EPUAP 2014

17th Annual Meeting of the European Pressure Ulcer Advisory Panel

27 -29 August 2014 · Stockholm, Sweden

PRESSURE ULCERS FROM BIRTH TO DEATH

Prevention, Treatment and Rehabilitation

PROGRAMME AND ABSTRACT BOOK

EUROPEAN PRESSURE ULCER ADVISORY PANEL

SÅRSJUKSKÖTERSKOR I SVERIGE

Organised by the European Pressure Ulcer Advisory Panel in cooperation with the Swedish Association of Tissue Viability Nurses SSiS and Sophiahemmet University

SOPHIA HEMMET UNIVERSITY

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CONTENT

DEAR PARTICIPANTS,

Finally, after a year of intense planning, the 17th conference of EPUAP is about to take off. It is a thrilling and challenging experience.

I would like to sincerely thank everyone involved in the planning of this event; Codan Consulting – the company who organized the conference, the Swedish organizing committee, SSiS, Visit Stockholm, Stockholm County Council, the City of Stockholm and Sophiahemmet University. We also thank the companies, sponsors and exhibitors for their valuable support.

We hope you will enjoy our beautiful city, the "Venice of the North", of which we will try to give you some glimpses in the social programme.

Most importantly, we hope that you will enjoy the scientific programme, carefully planned by the Scientific Committee of EPUAP. We think this is one of the most interesting and exciting programmes which we have ever presented at an EPUAP conference.

The programme is a mixture of key lectures, free paper sessions, symposia, workshops and poster sessions addressing the main theme of the conference Pressure Ulcers from Birth to Death – Prevention, Treatment and Rehabilitation.

This year the conference has attracted more than 500 participants from 32 countries all over the world, which is a new record for EPUAP!

So, we wish you a real good time in Stockholm, returning to your respective country inspired and more knowledgeable and ready to take on the big challenge of providing an even better prevention and care of persons at risk of, or with manifest pressure ulcers.

Prof. Christina Lindholm
Chair of the EPUAP 2014 Annual Meeting

Prof. Amit Gefen
President of EPUAP

Prof. Dimitri Beeckman
Chair of the Scientific Committee

Susanne Dufva
President SsiS

Carina Bååth *Eila Sterner* *Lena Karlsson* *Madeleine Stenius* *Lena Gunningberg* *BrittLouise Andersson* *Ammi Hommel*

About EPUAP

The "European Pressure Ulcer Advisory Panel" was created in London in December 1996 to lead and support all European countries in the efforts to prevent and treat pressure ulcers. At its inaugural meeting in London in December 1996, which included experts from many European countries, the group of over twenty agreed their mission statement and the initial Executive Board and Trustees.

The mission statement reads: "To provide the relief of persons suffering from or at risk of pressure ulcers, in particular through research and the education of the public and by influencing pressure ulcer policy in all European countries towards an adequate patient centred and cost effective pressure ulcer care." A very important activity for the EPUAP is our annual conference. These meetings are aimed at bringing together clinical care practitioners, researchers and people from industry, to discuss the current status of the problem in Europe and the world and to discuss new developments in pressure ulcer prevention, treatment and care.

About Swedish Society of Wound Care Nurses SSiS

SSiS is a professional organization under the umbrella of the Swedish Nursing Society.

The aim is to work on a nation based level to improve wound management in Sweden.

The Society is also official partner to different authorities concerning wound related questions.

SSiS has 350 members. The Council consist of both academically qualified and clinically active nurses.

Every year SSiS organizes a conference on different themes, attracting approximately 200 nurses. Next conference will be in April 2015 in Stockholm with the theme "wound management and technology".

This years close cooperation with and support of the EPUAP conference is a welcome event for SSiS, providing international contacts and extended educational options.

We welcome speakers and participants from all over the globe to this truly inspiring conference.

WEDNESDAY 27.08.2014 PROGRAMME

	Registration area	
08:00	Registration, badge and bag collection - Registration area	
08:00 - 09:30	Morning coffee & tea - registration and exhibition area	
	Auditorium / Left side	
09:30 - 10:15	**Opening Ceremony** in the Auditorium Left Side, *Chairs: Christina Lindholm, Dimitri Beeckman*	
	Opening festivity: Traditional Swedish horn blowing, *Jan Johansson*	
	Opening of the conference by *Barbro Westerholm*, member of the Swedish House of Parliament	
	From off - piste to off - load: a patient experience, *Ronny Persson*	
	Opening by the President and the local organiser, *Amit Gefen, Christina Lindholm*	
10:15 - 12:00	**Key sessions**, *Chairs: Christina Lindholm, Dimitri Beeckman*	
	The skin in a gender perspective, *Åsa Boström*	
	Pressure ulcers in neonates and a paediatric population, *Guido Ciprandi*	
	Pressure ulcers in palliative care patients, *Christina Lindholm*	
	Pressure ulcers after surgery, *Ami Hommel*	
	Reconstructive surgerny of pressure ulcers, *Jakob Lagergren*	
	Pressure ulcers in a rehabilitation unit, *Claes Hultling*	
	Geriatric experiences in the prevention of pressure ulcers, *Dag Salaj*	
12:00 - 13:15	*Lunch break and exhibition viewing*	
	Auditorium / Left side	**Auditorium / Right side**
13:15 - 14:45	**Key lectures,** *Chairs: Michael Clark, Jan Kottner*	**13:15 - 14:15 Industry Workshop**
	Risk factors in context; from conceptual framework to risk assessment in practice, *Jane Nixon*	
	The effect of sustained loads on cells and tissues, *Cees Oomens*	
	Contoured foam cushions in spinal cord injury care: Cinderella's shoe does not fit anymore!, *Amit Gefen*	
	Microclimate, *Dan Bader*	
	Nutrition and pressure ulcers, *Jos Schols*	
14:45 - 15:30	*Coffee break and exhibition viewing*	
15:30 - 16:00	**EPUAP Initiatives Key lectures**, *Chairs: Amit Gefen, Jeannie Donnely*	**15:30 - 17:00 Industry Satellite Symposium**
	Launch of the 2014 International Guideline for Pressure Ulcer Prevention and Management, *Lisette Schoonhoven*	
	PuClas3 show, *Dimitri Beeckman*	
	Stop Pressure Ulcer Day, *Zita Kis Dadara*	
16:00 - 17:00	**Free paper session 1: Pressure Ulcers in Trauma and ICU Patients,** *Chairs: Marco Romanelli, Guido Ciprandi*	
	Pressure ulcer prevention in critical ill neonates and infants, *Anne-Barbara Schluër*	
	Pressure Ulcers and Pain Due to the Extrication Collar and Headblocks in Trauma Patients, *Wietske Ham*	
	A prospective cohort study of the clinical effectiveness of multi-layer soft silicone dressings in the prevention of heel pressure ulcers in trauma and critically ill patients, *Nick Santamaria*	
	The Impact of a 5-Layered Silicone Bordered Foam Dressing on Intensive Care Unit (ICU) Patients' Sacral Pressure Ulcer Incidence: A Randomized Clinical Trial, *Peggy Kalowes*	
17:00 - 17:30	Official opening of the exhibition and refreshments (in the exhibition area)	
19:00	Welcome reception at the Stockholm City Hall, Nobel Prize Hall	

		08:00
		08:00 - 09:30
		09:30 - 10:15
		10:15 - 12:00
Bergsmannen	**Spelbomskan**	
		13:15 - 14:45
		14:45 - 15:30
		15:30 - 16:00
Free paper session 2: Pressure Ulcers in Older Persons, *Chairs: Cees Oomens, Hilde Heyman*	**Free paper session 3:** Tailoring of care: one size doesn't fit all, *Chairs: Geert Vanwalleghem, Elia Ricci*	16:00 - 17:00
Higher mortality if admitted with a pressure ulcer to a nursing home – Results of a cohort study, *Nils Lahmann*	Can a multi-faceted intervention affect pressure ulcer prevention?, *Eva Sving*	
Pressure ulcers on a static air mattress: incidence and risk factors, *Brecht Serraes*	Clinical Unit Microsystem Pressure Ulcer Prediction and Prevention, *Nancy Donaldson*	
A randomised control trial into the impact of prescribed seating in pressure ulcer prevention for nursing home residents, *Olivia McVey*	Head, Shoulders, Hips and Heels A Multi-Modal Approach to the Reduction of Pressure Ulcers in Infants, Children and Young People, *Sarah Kipss*	
A clinical evaluation of a specifically designed alternating support surface device for achieving the 30 degree tilt in older individuals at risk of pressure ulcer development, *Zena Moore*	Can real-time feedback of interface pressure optimise adequate repositioning in bed?, *Lena Gunningberg*	
		17:00 - 17:30
		19:00

See the industry satellite symposia and workshops at page 91

Thursday 28.08.2014 PROGRAMME

	Registration area	
08:00	Registration, badge and bag collection – Registration area	
	Auditorium / Left side	**Auditorium / Right side**
08:00 - 09:00	**Free paper session 4: Pressure Ulcers: Learning from the Lab and Applying to the Patient**, *Chairs: Jos Schols, Lena Gunningberg*	
	Buttock pressure management of able-bodied people seated on a rigid surface for two hours, *Olivier Chenu*	
	Evaluating the Sensitivity of Actimetry to detect Postural Changes in Seated Individuals, *Peter Worsley*	**08:30 - 09:30 Industry Satellite Symposium**
	Does the calcaneus morphology have an influence on the risk of posterior heel ulcer?, *Vincent Luboz*	
	Simulation and Discussion of the Microclimate in Heel Protector Boots, *Evan Call*	
09:00 - 10:00	**Key lectures**, *Chairs: Dan Bader, Jose Verdu Soriano*	
	The skin in a lifepan perspective, *Jan Kottner*	
	Recent health economic data from a systematic review of international literature, *Dimitri Beeckman*	
	Neglect - shame or blame, *Agnetha Folestad*	
10:00 - 10:45	*Coffee break and exhibition viewing*	**10:00 - 11:00 Industry Workshop**
10:45 - 11:45	**EPUAP Experienced and Novice Investigator Awards 2014**, Introduction to the Awards by the Chair of the Scientific Committee, *Dimitri Beeckman*	
	Experienced Investigator Award: Wound healing from past to future: What can we learn from history?, *Christina Lindholm*	
	Lactic acid bacterial symbionts in honeybees – an unknown key to honey´s antimicrobial and therapeutic activities, *Alejandra Vásquez*	
	Novice Investigator Award: Pressure ulcer care: the Netherlands vs. Germany 0 - 1, *Esther Meesterberends*	
11:45 - 13:15	*Lunch break and exhibition viewing*	
12:45 - 13:15	**Annual General Meeting of the EPUAP**	
13:15 - 14:15	**Session for physiotherapists / occupational therapists**, *Chair: Richard Goossens*	**Free paper session 7: Biomechanics and Etiology**, *Chairs: Lena Gunningberg, Jos Schols*
	The five why's about seating, *Milja Vaitilo*	Self-Propagation of Cell Death in Muscle Tissue via Myoglobin Release: A Computational Model of Mechano-Chemical Interplay in Deep Tissue Injury (DTI), *Lisa Tucker-Kellogg*
	Position changes - why, when and how often, *Ulrika Kallman*	The Role of Mathematics in Ulcer Development and Wound Healing, *Fred Vermolen*
	Cognition and compliance with pressure ulcer prevention, *Dorothy Riedel*	A novel MR compatible indentation setup to study the etiology of pressure ulcers and related deep tissue injury, *Jules Nelissen*
	Characterization of walk and seating in young adults with spina bifida; Challenges and possibilities, *Martina Bendt*	Discrimination between diabetic patients with and without diabetic foot ulcer based on testing the cutaneous microcirculation in response to low pressure, *Dominique Sigaudo – Roussel*

		08:00
Bergsmannen	**Spelbomskan**	
Free paper session 5: Innovative Approaches for Risk Assessment, *Chairs: Hilde Heyman, Geert Vanwalleghem*	**Free paper session 6: Pressure Ulcer Research and Basic Science**, *Chairs: Zita Kis Dadara, Lenche Neloska*	08:00 - 09:00
Pressure ulcer prevalence and prevention practices – a comparison between formal risk assessment and assessment using clinical judgement alone, *Zena Moore*	PRESSURE 2 Trial: Considerations on the design of the trial and the decision making process at the interim analyses, *Sarah Brown*	
Improving the risk assessment of pressure ulcer by nurses for elderly with psychiatric disorder a pilot project, *Florence Bassin*	The Effect of a Bacteria and Fungi Binding Mesh Dressing on the Bacterial Load of Pressure Ulcers Treated with Negative Pressure Wound Therapy (NPWT), a Pilot Study, *Marino Ciliberti*	
Is pain a predictor of Category 2 pressure ulcers? Analysis of skin site level data from the PURPOSE Pain Cohort Study, *Isabelle Smith*	Numerical Study of different Types of Supporting Structures regarding the Prevention of Deep Tissue Injuries, *Alexander Siefert*	
Early pressure ulcer prevention and Intervention for patients undergoing fasttrack surgery, *Brigitte Skovgaard*	A clinical comparative study on 940, 808 and 658 nm laser therapy in pressure ulcer healing: early and long term results, *Jakub Taradaj*	
09:30 - 10:30 Industry Workshop		09:00 - 10:00
		10:00 - 10:45
		10:45 - 11:45
	11:00 - 12:30 Industry Workshop	
		11:45 - 13:15
		12:45 - 13:15
Workshop: The implementation of the 2014 pressure ulcer guidelines in clinical practice, *Lisette Schoonhoven*	**Workshop:** Pressure Ulcer Classification: PuClas3, *Dimitri Beeckman*	13:15 - 14:15

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Thursday 28.08.2014 PROGRAMME

	Auditorium / Left side	Auditorium / Right side
14:15 - 15:15	**EWMA - EPUAP Session,** *Chair: Jane Nixon*	**14:15 - 15:45 Industry Satellite Symposium**
	EWMA: Working together for better wound care education in Europe, *Salla Seppänen*	
	EPUAP: Integrating pressure ulcer prevention and management in educational curricula: current status, views and joint initiatives, *Trudie Young*	
	EWMA: EWMA Managing wounds as a team document, *Zena Moore*	
15:15 - 16:00	Coffee break and exhibition viewing	
16:00 - 17:15	**Key lectures**, *Chairs: Nihls Lahman, Jakub Tarafaj*	**16:00 - 17:00 Industry Workshop**
	SSiS scholarship	
	Telemedicine in pressure ulcer prevention and management, *Rolf Jelnes*	
	The National Register of Wounds, RiksSar (RUT), *Ruth Öien*	
	Swedish National Prevalence Study Initiative 2009 - 2014, *Agneta Andersson*	
	Mobile pressure ulcer team, *Karin Hagqvist and Mona Johansson*	
19:30	Conference Dinner, Solliden Restaurant	

Bergsmannen	Spelbomskan	
Free paper session 8: Patient Safety, Quality of Care and Policy (1), *Chairs: Lena Gunningberg, Lisette Schoonhoven*	**14:15 - 15:30 Student free papers session: Clinical and Applied Science**, *Chairs: Lenche Neloska, Marco Romanelli*	14:15 - 15:15
Home-care wound care – a EWMA document, *Sebastian Probst*	Patients and nurses experiences of using the 30 degree tilt for the prevention of pressure ulcers, *Urmila Victor*	
What Percentage of Hospital-Acquired Grade 3 and 4 Pressure Ulcers are Avoidable?, *Fiona Downie*	Evidence-based skin care at a university hospital in Germany - *Andrea Lichterfeld*	
Do patient safety culture items affect pressure ulcer prevalence in a sample of Norwegian hospitals?, *Ida Marie Bredesen*	RNs knowledge of PU risk factors and prevention in internal medicine of a University Hospital In Iceland, *Iris Gísladóttir & Arna Pórðardóttir*	
	Pressure Ulcers due to Stroke patients receiving Percutaneous Endoscopic Gastrostomy, *Gunnel Wärn Hede*	
	Role of Braden scale scoring as a prognostic tool for pressure ulcers, *Kumar Madhaver*	
		15:15 - 16:00
16:00 - 17:15 Student free papers session: Basic Science, *Chairs: Zita Kis Dadara, Jeannie Donnelly*	**16:00 - 17:00 Workshop: Pressure Ulcer Prevention Pathways (PUPPS)**: Active Monitoring Model of Care Incorporating PURPOSE T', *Susanne Coleman*	16:00 - 17:15
Heel Ulcers: Simulations of Injurious Tissue Loads and Remedial Local Drug Delivery, *Rinat Friedman*		
Changes in topography and structural properties of healthy aged skin after loading, *Gabor Dobos*		
The quest for smart materials to protect the fragile skin: Computational modeling of how shear and microclimate influence skin that rubs against clothing, incontinence pads, diapers etc., *Mor Ben-or Frank*		
Development of biomarkers for the Wound Fluid RT-PCR method to detect critically colonised and infected wounds, *Mayumi Asada*		
Biomechanical simulation of the Charcot neuroarthropathic foot with plantar ulcer, *Antoine Perrier*		
		19:30

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Friday 29.08.2014 PROGRAMME

	Registration area	
08:00	Registration, badge and bag collection - Registration area	
	Auditorium / Left side	**Auditorium / Right side**
09:00- 10:00	**Key lectures**, *Chairs: Jane Nixon, Jeannie Donnely*	**Free papers session 9: Pressure Ulcer Epidemiology**, *Chairs: Lisette Schoonhoven, Geert Vanwalleghem*
	International initiatives and experiences, *Terence Ryan*	Pressure Ulcers in Iceland prevalence, seriousness and prevention, *Guðbjörg Pálsdóttir*
	Pressure ulcers: an African initiative, *Katarzyna Trok*	The effect of a simple three-step pressure relieving strategy for preventing pressure ulcers: an explorative longitudinal study from 2002-2011, *Martin van Leen*
	Pressure ulcers in the darkly pigmented skin, *Madeleine Stenius*	Suspected Deep Tissue Injury on Heels of Nursing Home Residents: Development and Evolution within 16 weeks, *Barbara Bates-Jensen*
		Pressure Ulcer Prevalence 2011-2014: Data from the International Pressure Ulcer PrevalenceTM Survey, *Charlie Lachenbruch*
10:00 - 10:45	*Coffee break and exhibition viewing*	
10:45 - 12:00	**Clinical case discussions: interactive session**, *Chairs: Michael Clark, Marco Romanelli*	
	Pressure ulcers in the amputation stump and how they can be avoided, *Anton Johannesson*	
	Pressure ulcers in the paediatric population, *Guido Ciprandi*	
	A multidisciplinary approach to prevention and treatment of pressure ulcers in palliative care, *Lenche Neloska*	
	Successful management of a non-healing pressure ulcer for an immuno-compromised child with a bacteria binding gel dressing, *Anna Sahlqvist*	
12:00 - 12:30	**Presentation of EPUAP 2015 Gent, Belgium,** *Dimitri Beeckman, Geert Vanwalleghem, Hilde Heyman*	
	Closing of the conference, *Amit Gefen*	

		08:00
Bergsmannen	**Spelbomskan**	
09:00 - 10:30 Workshop: Debridement: Why - When - When not? *Carolyn Wyndham - White*	**Free paper session 10: Patient Safety, Quality of Care and Policy (2)**, *Chairs: Michael Clark, Marco Romanelli*	09:00- 10:00
	Cost analysis and effects of one of the first outpatient wound clinics in the Netherlands, *Armand Rondas*	
	Nurses' attitudes and perceived barriers to pressure ulcer prevention, *Ahmad Tubaishat*	
	Knowledge among ICU nurses about pressure ulcers prevention, *Maria Hansbo*	
	Patients with pressure ulcers – from prevention through treatment to healing – results from the national quality registries RUT (Registry of Ulcer Treatment) and Senior alert, *Ruth Öien*	
		10:00 - 10:45
		10:45 - 12:00
		12:00 - 12:30

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SCIENTIFIC WORKSHOPS

EPUAP WORKSHOP:

The implementation of the 2014 pressure ulcer guidelines in clinical practice

Implementation of guidelines in clinical practice requires a systematic approach. This approach should target relevant barriers and facilitators for use of the guidelines.This workshop will focus on the identification of these barriers and facilitators and the development of a matching implementation strategy.

Speaker:	Lisette Schoonhoven
Date:	28 August 2014
Time:	13:15 – 14:15
Meeting room:	Bergsmannen

EPUAP WORKSHOP:

Pressure Ulcer Classification: PuClas3

The new PuClas version includes an update of the classification system according to the latest international guideline, an updated terminology for incontinence- associated dermatitis, high quality photographs, an assessment module for basic level and advance level, and a separate assessment module including cases and photographs.

Speaker:	Dimitri Beeckman
Date:	28 August 2014
Time:	13:15 – 14:15
Meeting room:	Spelbomskan

WORKSHOP:

Pressure Ulcer Prevention Pathways (PUPPS): Active Monitoring Model of Care Incorporating PURPOSE T'

The NIHR PURPOSE Programme of research, highlighted the limitations of pressure ulcer risk assessment practice and the standard 'assess, plan, implement and evaluate' model of care (Nixon et al. Submitted). This prompted the development of a new evidenced-based risk assessment framework - PURPOSE T and an active monitoring model of care incorporating primary and secondary Pressure Ulcer Prevention Pathways (PUPPs). The workshop will present the new Risk Assessment Framework PURPOSE T and allow delegates to practice using the tool. PUPPs will also be introduced.

Speakers:	Susanne Coleman
Date:	28 August 2014
Time:	16:00 – 17:00
Meeting room:	Spelbomskan

DEBRIDEMENT WORKSHOP:

Why – When – When not?

Participants will gain knowledge about wound evaluation, the goals of debridement (when and why), limits, dangers, and related measures. Attendees will be able to practice sharp debridement and learn the necessary practical skills.

Speaker:	Carolyn Wyndham - White
Date:	29 August 2014
Time:	09:00 – 10:30
Meeting room:	Bergsmannen

25th Conference of the
European Wound Management Association

EWMA 2015

LONDON·UK

13-15 MAY 2015

WOUND CARE – SHAPING THE FUTURE

A PATIENT, PROFESSIONAL, PROVIDER AND PAYER PERSPECTIVE

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20th November 2014

STOP PRESSURE ULCER DAY

one GOAL Worldwide

How can you get involved?

- Host educational activities on prevention and treatment of pressure ulcers
- Organise awareness raising events to share information about pressure ulcers
- Reach out to your local community to inform them about pressure ulcers
- Make policy makers aware about pressure ulcers

Download support material for free at: www.epuap.org

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Oral presentations overview

*(**Bold** = presenting author)*

1 Pressure ulcer prevention in critical ill neonates and infants
Schluër Anne-Barbara, *Degenhardt Johanna*

2 Pressure Ulcers and Pain Due to the Extrication Collar and Headblocks in Trauma Patients
Ham Wietske H.W., *Schoonhoven Lisette, Leenen Luke P.H., Schuurmans Marieke J.*

3 A prospective cohort study of the clinical effectiveness of multi-layer soft silicone dressings in the prevention of heel pressure ulcers in trauma and critically ill patients
Santamaria Nick, *Gerdtz Marie, Liu Wei, DeVincentis Stephanie, Ng Wei Ai*

4 The Impact of a 5-Layered Silicone Bordered Foam Dressing on Intensive Care Unit (ICU) Patients' Sacral Pressure Ulcer Incidence: A Randomized Clinical Trial
Kalowes Peggy, *Messina Valerie, Li Melanie, Carlson Carole, Lukaszka Diana*

5 Higher mortality if admitted with a pressure ulcer to a nursing home – Results of a cohort study
Lahmann Nils

6 Pressure ulcers on a static air mattress: incidence and risk factors
Serraes Brecht, *Schoonhoven Lisette, Beeckman Dimitri*

7 A randomised control trial into the impact of prescribed seating in pressure ulcer prevention for nursing home residents
McVey Olivia, *Tierney Martina, Casey Jackie, Daly Orlagh, Martin Suzanne*

8 A clinical evaluation of a specifically designed alternating support surface device for achieving the 30 degree tilt in older individuals at risk of pressure ulcer development
Moore Zena, *Urmila, Victor*

9 Can a multi-faceted intervention affect pressure ulcer prevention?
Sving Eva, *Högman Marieann, Mamhidir Anna-Greta, Gunningberg Lena*

10 Clinical Unit Microsystem Pressure Ulcer Prediction and Prevention
Donaldson Nancy, *Aydin Carolyn, Stotts Nancy, Fridman Moshe, Browne Storer Diane*

11 Head, Shoulders, Hips and Heels A Multi-Modal Approach to the Reduction of Pressure Ulcers in Infants, Children and Young People
Kipss Sarah Jane, *Maxwell Jan*

12 Can real-time feedback of interface pressure optimise adequate repositioning in bed?
Gunningberg Lena, *Carli Cheryl*

13 Buttock pressure management of able-bodied people seated on a rigid surface for two hours
Chenu Olivier, *Payan Yohan, Moreau-Gaudry Alexandre, Diot Bruno, Cannard Francis, Vuillerme Nicolas*

14 Evaluating the Sensitivity of Actimetry to detect Postural Changes in Seated Individuals
Worsley Peter, *Webb Sally, Bader Dan L.*

15 Does the calcaneus morphology have an influence on the risk of posterior heel ulcer?
Luboz Vincent, Perrier A., *Bucki M., Diot B., Cannard F., Vuillerme N., Payan Y.*

16 Simulation and Discussion of the Microclimate in Heel Protector Boots
Call Evan, *Oberg Craig, Bill Brian, McLean Chad, Drennan Joseph W.*

17 Pressure ulcer prevalence and prevention practices – a comparison between formal risk assessment and assessment using clinical judgement alone
Moore Zena, *Johansen Edda, van Etten Menno, Strapp Helen*

18 Improving the risk assessment of pressure ulcer by nurses for elderly with psychiatric disorder a pilot project
Bassin Florence, *Queiros Alcina, Djamel Moad, Charbonneau Lucie, Séchet Véronique*

19 Is pain a predictor of Category 2 pressure ulcers? Analysis of skin site level data from the PURPOSE Pain Cohort Study
Smith Isabelle, *Brown Sarah, McGinnis Elizabeth, Stubbs Nikki, Nixon Jane*

20 "Early pressure ulcer prevention and Intervention for patients undergoing fast-track surgery"
Skovgaard Brigitte Brask, *Appelt Henriette Djuurhus*

21 PRESSURE 2 Trial: Considerations on the design of the trial and the decision making process at the interim analyses
Brown Sarah, *Smith Isabelle, Hulme Claire, Nixon Jane*

22 The Effect of a Bacteria and Fungi Binding Mesh Dressing on the Bacterial Load of Pressure Ulcers Treated with Negative Pressure Wound Therapy (NPWT), a Pilot Study
Ciliberti Marino

23 Numerical Study of different Types of Supporting Structures regarding the Prevention of Deep Tissue Injuries
Siefert Alexander, *Hofmann-Rösener Monika, Lachenbruch Charlie*

24 A clinical comparative study on 940, 808 and 658 nm laser therapy in pressure ulcer healing: early and long term results
Taradaj Jakub, *Polak Anna, Halski Tomasz*

25 "Self-Propagation of Cell Death in Muscle Tissue via Myoglobin Release: A Computational Model of Mechano-Chemical Interplay in Deep Tissue Injury (DTI)"
Tucker-Kellogg Lisa, *Gefen Amit*

26 The Role of Mathematics in Ulcer Development and Wound Healing
Vermolen Fred, *Gefen Amit*

27 A novel MR compatible indentation setup to study the etiology of pressure ulcers and related deep tissue injury
Nelissen Jules, *Traa Willeke, Nicolay Klaas, Strijkers Gustav, Oomens Cees*

28 Discrimination between diabetic patients with and without diabetic foot ulcer based on testing the cutaneous microcirculation in response to low pressure
Vouillarmet Julien, *Josset-Lamaugarny A., Viart-Ferber Ch, Sigaudo-Roussel D.*

29 Home-care wound care – a EWMA document
Probst Sebastian, *Seppänen Salla, Gerber Veronika, Rimdeika Rytis, Hopkins Alison, Gethin Georgina*

30 What Percentage of Hospital-Acquired Grade 3 and 4 Pressure Ulcers are Avoidable?
Downie Fiona, *Sandoz Heidi, Pauline Gilroy, Royall Dawn, Davies Sarah*

31 Do patient safety culture items affect pressure ulcer prevalence in a sample of Norwegian hospitals?
Bredesen Ida Marie, *Bjøro Karen L. K., Gunningberg Lena, Hofoss Dag*

32 RNs knowledge of PU risk factors and prevention in internal medicine of a University Hospital In Iceland
Gísladóttir Iris, *Þórðardóttir Arna*

33 Patients and nurses experiences of using the 30 degree tilt for the prevention of pressure ulcers
Urmila Victor, *Moore Zena*

34 Evidence-based skin care at a university hospital in Germany
Lichterfeld Andrea, *Hauss Armin, Sauber Christian, Blume-Peytavi Ulrike, Kottner Jan*

35 Pressure Ulcers due to Stroke patients receiving Percutaneous Endoscopic Gastrostomy
Hede Gunnel Wärn, Faxen-Irving Gerd, Ekman Sirkka-Liisa, Crisby Milita, Ebbeskog Britt

36 Role of Braden scale scoring as a prognostic tool for pressure ulcers
Madhavan Kumar, *Singhal Maneesh, Ranjan Piyush, Sagar Sushma, Garg Kavita*

37 Heel Ulcers: Simulations of Injurious Tissue Loads and Remedial Local Drug Delivery
Friedman Rinat, *Haimy Ayelet, Shabshin Nogah, Zilberman Meital, Gefen Amit*

38 Changes in topography and structural properties of healthy aged skin after loading
Dobos Gabor, *Richter Claudia, Trojahn Carina, Blume-Peytavi Ulrike, Gefen Amit, Kottner Jan*

39 The quest for smart materials to protect the fragile skin: Computational modeling of how shear and microclimate influence skin that rubs against clothing, incontinence pads, diapers etc.
Ben-Or Frank Mor, *Limbert Georges, Fader Mandy, Kottner Jan, Gefen Amit*

40 Development of biomarkers for the Wound Fluid RT-PCR method to detect critically colonised and infected wounds
Asada Mayumi, *Nakagami Gojiro, Tochiori Ayaka, Sugama Junko, Sanada Hiromi*

41 Biomechanical simulation of the Charcot neuroarthropathic foot with plantar ulcer
Perrier Antoine, *Vuillerme N., Luboz V., Bucki M., Diot B., Cannard F., Havan G., Payan Y.*

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Pressure ulcer prevention in critical ill neonates and infants

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Introduction

There is greater awareness that paediatric patients in certain health care settings are at high risk of developing pressure ulcers. In different care settings, such as paediatric intensive care units (PICUs) and according to different risk factors, such as medical devices, different pressure ulcer prevalence rates have been published [1, 2]. Pressure ulcer prevalence rates in neonates and infants vary from 11% to 61.5% [3,4]. Risk factors for hospitalized neonates and infants include a PICU stay and mechanical ventilation support. Thus, critically ill patients of younger age are at very high risk of developing pressure ulcers [5,6]. Therefore the aim of this study was to implement specific prevention strategies to decrease pressure ulcer risk in neonates and infants treated on a PICU.

Methods

In 2013 a longitudinal study was conducted in a Swiss PICU setting including all neonates and infants in critical life conditions admitted to a PICU which needed mechanical ventilation support. All neonates and infants where assessed every 12 hours if they had (1) any mechanical ventilation support, (2) any other device which can cause pressure in the face aera, and (3) if they developed a pressure ulcer (including category). The assessment was performed in all patients until 48 hours post discharge from PICU or until death of a patient.
Mechanical ventilation support devices included tracheal tubes, continuous positive airways pressure masks (with and without prongs), masks, nasal tubes and tracheostomy.
After a first phase lasting 4 month, a new fixation strategy to secure tracheal tubes and underpadding any masks was implemented.

Results

In 2013 a total of 245 neonates and infants with the need for mechanical ventilation support where assessed.
In the first study phase the incidence of pressure ulcer (incl. category 1) was 44%.
After implementing the specific prevention strategies with underpadding any masks and a new fixation technique to secure tracheal tubes the incidence decreased to 25%.

Discussion

Incidence rate for pressure ulcer development in neonates and infants in a PICU setting are high. This is in line with previous published incidence rates in these setting [5,6]. Ventilation support devices such as CPAP or mechanical ventilation increased the risk of pressure ulcers.
Neonates and infants with congenital heart defects and after cardio-surgery procedures where the patients most at risk for pressure ulcer development.
With an easy to apply, but adapted to the study population, intervention the pressure ulcer incidence in the study group decreased.

Clinical relevance

The prevention of pressure ulcers in this patient group must start early to avoid any further harm to their highly vulnerable skin. Therefore these children need evidence based and appropriate preventive measures to decrease their pressure ulcer risk. Under-padding, careful fixation and positioning of medical devices, especially ventilation support devices, in these highly vulnerable patients are mandatory and easy to apply to decrease the risk of pressure ulcers.

Acknowledgements

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Conflict of Interest

None.

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Pressure Ulcers and Pain Due to the Extrication Collar and Headblocks in Trauma Patients

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Introduction

At the scene of an accident, every trauma patient with suspected spine injury is immobilized with a backboard, and extrication collar combined with headblocks, and transported to the emergency department (ED) for evaluation and treatment. The backboard is used as transportation device, and should ideally be removed before initial assessment in the ED.(1) Spinal immobilization should further be continued by straight alignment of the spine and supine body position. The cervical spine remains immobilized with an extrication collar combined with headblocks until injury is diagnosed or ruled out, i.e. the cervical spine is 'cleared'. It is known that immobilizing devices cause pain and increase pressure ulcer (PU) risk. (2) However, pain, as well as the development, clinical symptoms and evolution of PU related to the use of the extrication collar and headblocks, have not been described. The purpose of this study was to gain insight into PUs and pain from the extrication collar combined with lateral headblocks in trauma patients admitted to the ED for evaluation and treatment of acute traumatic injuries.

Methods

Prospective data of 342 consecutive adult trauma patients admitted to the ED after acute trauma were collected from January 2013 until December 2013. Trained ED nurses assessed pain intensity and condition of the skin related with pressure areas for erythema, PU and indentation marks at the moment the extrication collar and headblocks were removed or changed. Pressure areas were defined as: chin, occiput, clavicles, back, chest and ears.

Results

The 342 trauma patients were in an extrication collar and headblocks for an average of 137.7 minutes (Range (R) 10-845, Standard Deviation (SD) 95.30), until cervical spine clearance. Seventy-one (20.8%) patients reported moderate pain (NRS 4-6) and 111 (32.5%) severe pain (NRS 7-10) on pressure areas. In approximately half of the patients who reported moderate or severe pain, pain was located at the occiput. 268 (78.3%) patients developed a PU of which 75.4% was category 1, and 2.9% category 2. 205 (59.9%) had more than 1 PU site. The majority of the PUs were located on the back, chest and shoulders of the patients (113, 135, and 118 times, respectively). 218 patients developed indentation marks; 125 (36.5%) had mild and 93 (28.1%) had severe indentation marks. 126 (36.9%) patients had more than one indented site. The majority of the indentation marks were located at the chest, back, and shoulders (71, 90, and 111 times, respectively).

Discussion

This was the first prospective study on PU and pain from extrication collars and headblocks in trauma patients with suspected cervical spine injury. The use of multiple data collectors in our study can lead to information bias, however, the interrater reliability prior and during the study was MKappa 0.58 and Kappa 0.85 respectively. A considerable number of trauma patients developed a category 1 or 2 PU, severe indentation marks and experienced severe pain while in an extrication collar and headblocks.

Clinical relevance

The current practice of cervical immobilization in case of suspected cervical spine injury should be evaluated. First, the procedure of cervical spine clearance should be optimized in order to minimize time in the extrication collar and headblocks. Second, during cervical spine immobilization, the number of trauma patients with PU, indentation marks and pain could be reduced by reconsidering the design and materials that are currently used to immobilize the cervical spine.

Acknowledgements

We appreciate the help of ED staff and all ED nurses from the Emergency Department of the University Medical Center Utrecht. Without their support and enthusiasm, this study would not have been possible.

Conflict of Interest

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3

Proceedings of the 17th Annual European Pressure Ulcer Meeting
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A prospective cohort study of the clinical effectiveness of multi-layer soft silicone dressings in the prevention of heel pressure ulcers in trauma and critically ill patients

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Introduction

Preventing pressure ulcers (PU) in critically ill patients is challenging for clinicians due to a multiplicity of physiological and environmental factors. We have previously demonstrated that the the use of prophylactic soft silicone multi-layer dressing can significantly reduce the incidence of sacral and heel PUs in this group of patients [1]. The mechanisms underpinning the protective effectiveness of these dressings are believed to relate to their multi-layer construction modifying pressure, friction, shear forces and the management of microclimate.

Methods

We conducted a 10-month prospective cohort study with a historical control cohort (n=221) from a recent ICU project [1] as a comparator. A total of 191 critically ill and trauma patients were enrolled into the study in the ED. Each patient had a soft silicone multi-layer dressing applied to each heel in ED on admission and maintained in place throughout their ICU stay. The heels were inspected daily by a member of the research team and dressings were replaced every three days or if they became dislodged. All patients were cared for on the same low air loss beds throughout their stay in ICU. The end point for the study was the incidence rate of heel pressure ulcers. Analysis was based on intention to treat and multiple regression and survival analysis of time to PU development.

Results

Table 1: Patient characteristics and outcomes

	Intervention Cohort N = 191 Mean (SD)	Control Cohort N= 221 Mean (SD)
Age	54 (19.7)	56 (20.5)
Male/Female	123/67	132/82
MAP (mmHg)	91 (21.8)	93 (22.7)
Temp (C)	36.0 (1.8)	36.2 (1.6)
SpO_2 %	97	98
HR (BPM)	96 (25.9)	95 (26.6)
Braden	11 (2.9)	12 (3.9)
APACHE II	18.9	19.5
Length of stay(Hrs)		
ED	6.7 (5.2)	6.4 (4.6)
OR	4.5 (3.9)	5.2 (4.2)
ICU	107 (122.6)	86 (100)
Pressure Ulcers (%)	0 (0)	19 (8.5)

Discussion

Whilst patients in our intervention and control cohorts were similar on key demographic and physiological factors (Table 1), the intervention cohort had a longer length of stay in ICU which could be considered as a greater risk for these patients of developing a PU. Our finding that the intervention group did not develop any heel PUs over the course of the study suggests that the dressings are a viable protective intervention for this group of critically ill patients.

We believe that further research is required to better elucidate the protective mechanisms of these multi-layer silicone dressings. Additionally it is not clear at present if other dressings comprising different construction and/or formulations of silicone provide similar protective performance.

Clinical relevance

The findings of this study highlight and support our earlier work on the clinical effectiveness of multilayer soft silicone dressings in preventing PUs in critically ill patients. These dressings appear to effectively reduce pressure, friction and shear forces at the heel.

Acknowledgements

We are indebted to the nurses from the ED and ICU at the Royal Melbourne Hospital for their assistance with this research.

Conflict of Interest

Nil

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Cost analysis and effects of one of the first outpatient wound clinics in the Netherlands

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Introduction

The burden of treating chronic wounds is growing rapidly due to an ageing population and a sharp rise in the incidence of diabetes and obesity worldwide [1-4]. At any time almost 1% of the world's population suffers from chronic wounds, with associated costs accounting for more than 2-4% of health care expenses [5]. The economic and effectiveness evidence of wound care community clinics in the UK encouraged us to perform a cost-analysis of one of the first outpatient community wound care clinic in the Netherlands.

Methods

This study involved a cost analysis based on an observational cohort study with a 1-year pre- and a 1-year post-admission comparison of costs. Patients were included when they first consulted the outpatient wound care clinic. They were all health insured by one health care insurance company Cooperation VGZ. A standard six-step procedure for performing cost studies was used to calculate the costs [6-8]. Given the skewed cost data non-parametric bootstrapping was used to test for statistical differences.

Results

172 patients were included in this study. The difference in wound care related costs between the year before and after admission to the wound clinic resulted in a reduction of €2,621 per patient in the base case analysis. The categories 'general practitioner', 'hospital care', 'mental healthcare' and 'patient transport' scored lower after admission to the wound clinic.

Discussion

In this study only the reimbursement data of patients of one health insurance company and specifically only those made under the Dutch Health Insurance Act were available. Because of its observational design it is not possible to conclude on the plausible causality of the introduction of an outpatient wound clinic versus noticeable changes in reimbursement costs in the year post admission. Nevertheless this study is a first attempt of a cost analysis of an equipped (outpatient) wound clinic as an innovative way of responding to the increasing number of chronic wounds in the Netherlands. The calculations show that savings in wound care are possible.

Clinical relevance

The emergence of outpatient wound centres reflects the increasing incidence and prevalence of chronic wounds as well as the costs to the health care systems these patients represent. Except for the attention paid at the wound care quality it is essential to establish a financially viable enterprise [9-12].

Conflict of Interest

First author AALM Rondas, PhD student at the Maastricht University is working at the outpatient wound clinic as physician.
The research data were though provided externally by Cooperation VGZ and checked by the academic co-authors.

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Higher mortality if admitted with a pressure ulcer to a nursing home – Results of a cohort study

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Introduction

Pressure ulcers (PUs) are chronic wounds that mostly occur in critically ill or frail patients as those usually suffer from multiple risk factors, e.g. impaired mobility or disturbed perfusion. Hospital-acquired PUs have been found to be related to increased mortality. While the prevalence of pressure ulcers on hospital admission among nursing home residents transferred to the hospital is known to be high, there is a lack of evidence regarding the prevalence on admission to a nursing home and how it does affect mortality. The aim of this study is to compare the mortality of nursing home resident with and without pressure ulcers on admission, whether or not individuals who have been admitted to a nursing

Methods

307 nursing home residents in 11 nursing homes in Berlin were enrolled in a cohort study. Detailed information about the methodology can be found open at Meesterberends et al. (1). Study nurses examined individuals according to a standardized study protocol once a week for 3 months after residents' admission to the nursing homes. After that the residents was visited every 6 month for 2.5 years. Kaplan-Meier Analysis and Cox Proportional Hazard will be used. For statistical significance an alpha of < 0.05 % (two-sided) was chosen.

Results

Mean age was 83.4 (sd 9.2) years, 69.4 % were female. The mean Braden Score on admission was 18.1 (sd. 3.8). The prevalence of PU on admission was 15.3 % (n=47)
Figure 1 shoes the survival curve of the Kaplan Meier analysis. Mean average survival in days after admission of residents without pressure ulcers was 592,6, whilst in residents with pressure ulcers it was 360,8. The log-rank Chi^2 value was 14.7 (df=1), indicating highly statistical significance. Table 1 shows the results of the cox proportional hazard regression. Controlled for age, sex and mean Braden Score the hazard ratio was 1.8 (95 CI 1.1 – 2.8)

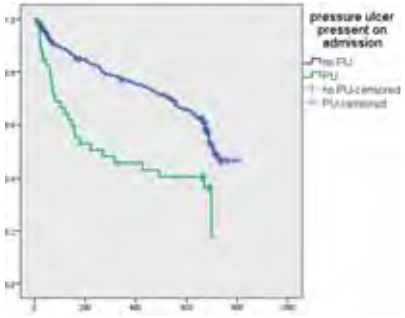

Figure1 Kaplan Meier Curve

Table 1 Cox regression Hazard ratio

	HR	Lower 95%	Upper 95 %
Braden Score	0.93	0.88	0.98
age	1.04	1.01	1.06
male sex	1.28	0.86	1.92
PU on Admission	**1.75**	**1.09**	**2.81**

Discussion

The strong bivariate association between pressure ulcer prevalence on admission was still present after controlling for age, gender and Braden Score. When present on admission to a nursing home, residents with PU average survival time was only one year in comparison to those without PU to more than 1.6 years, which corresponds to the results of the multivariate analysis of an Hazard ratio of 1.8.

Clinical relevance

Pressure ulcers have a high impact on mortality in nursing home residents

Conflict of Interest None

1. Meesterberends E, Halfens RJ, Heinze C, Lohrmann C, Schols JM. Pressure ulcer incidence in Dutch and German nursing homes: design of a prospective multicenter cohort study. BMC Nurs. 2011;10:8. Epub 2011/04/30.

Pressure ulcers on a static air mattress: incidence and risk factors

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Introduction

Pressure ulcers (PU) have a major impact on patients, caregivers and society. Prevention is essential to reduce this impact. There is still considerable uncertainty about the effectiveness of various preventive strategies. The aim of this study was to investigate PU incidence when using a low-tech constant low pressure air mattress.

Methods

A multi-centre prospective cohort study was performed in Belgium nursing homes. The outcome of this study was defined as incidence of PU category II-IV.
Data were collected in a convenience sample of six nursing homes in Belgium. A consecutive sample of 176 residents was included based on following inclusion/exclusion criteria: (1) being bedbound (> 8 hours in bed) and/or chair-bound, (2) a Braden score <18 and / or Category I PU, (3) aged > 65 years, (4) weight <139 kg (mattress specification). Residents were excluded if (1) the expected length of stay was <2 weeks (2) they received palliative care (3) there was a "do not resuscitate code" (4) there was a medical contraindication, or (5) there was category II-IV PU present. Data were collected over a 30 day period.
The device under study was the Repose® mattress overlay (Frontier Medical, UK). This mattress is a combination of two urethane membranes. The inner membrane is inflated and provides static pressure redistribution throughout tubular cells, which form along the length of the overlay. The second membrane is formed from a multidirectional stretch, vapor permeable and strong material. The combination of the two membranes provides pressure redistribution. The length of the mattress is 1780mm and the width is 770mm.
Prior to the study, all nurses attended a theoretical training on (1) PU prevention (pathology, classification, the use of the Braden scale for risk assessment), (2) an introduction to the study aims and protocol, (3) and the use of the data collection instrument. Clinical observations were performed according to the validated procedure by the European Pressure Ulcer Advisory Panel. Pressure ulcers were categorized according to the 2009 EPUAP/NPUAP classification system.
A standardized 4 hourly repositioning protocol was applied for all resident in this study. Besides, a standardized protocol for prevention in the chair was applied (Repose® Cushion combined with 2-3 hourly repositioning). The Repose® Wedge was used to relieve pressure at the heel. Daily skin assessments were performed by the ward nurses (qualified nurses and nursing assistants under the supervision of a qualified nurse), in the morning. Study completion was defined as: (1) development of a pressure ulcer Category II–IV, (2) 30 days of follow- up, (3) transfer to a non-participating ward, (4) death or (5) withdrawal of the initial consent to participate.
For the quality of the study, the inter-rater reliability of the observations of the skin at the pressure areas and the Braden Scores were monitored by the researcher.

Results

The mean age of the residents was 87 years (SD= 6.96 years) and the mean Braden score was 14 (SD= 2.52).
Of 176 residents that started, 144 were completed the study. There was a drop out of 35 residents reported as started palliative care (n= 1), transfer to a non-participating ward (n= 4), medical contraindication (n= 5), deceased (n= 7), voluntary withdrawal (n= 15). On study completion, pressure ulcer incidence (Cat. II-IV) was 4.8% (n=9). In total, 6 residents developed a Category II PU (3.4%) and 3 residents developed a Category III PU (1.6%). No PU Category IV was found. Further results will be completed by August 2014. Baseline data will be compare between the group that developed PU and non-PU to identify risk factors. The inter-observer reliability will be calculated.

Discussion

Methodological issues should be considered when interpreting the results of this study. Further research should focus on the effectiveness of static air mattress.

Clinical relevance

This descriptive study focused on the prevention of PU with Static air mattress, cushion and/or heell wedge in nursing home settings.

Acknowledgements

This review is a part of my thesis to obtain the degree of master of science in Nursing and Midwifery from Ghent University. Special thanks go to my supervisor of this project, Dimitri Beeckman for his valuable expertise and advice related to this discipline.

Conflict of Interest

EPUAP Annual Conference 2014 Stockholm, Sweden.

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Title: A randomised control trial into the impact of prescribed seating in pressure ulcer prevention for nursing home residents

Introduction

While guidance is available on most aspects of pressure ulcer prevention and management, there has been little discussion of how to specifically address these issues in patients who are seated for long periods. When pressure ulcer prevention and management are discussed, the specific issues most often addressed relate to the use of pressure-redistributing beds and mattresses, risk assessment, patient repositioning and local management of established pressure ulcers.
However, some important topics are often overlooked. For example, the role of seating in both pressure ulcer prevention and management has been neglected. This research investigates the effectiveness of specialist seating provision within a nursing home environment and how it has the potential to impact positively on the health and wellbeing of residents and their caregivers. It will identify the key principles of correct positioning, seating and positioning and the influence this can have on the pressure ulcer incidence of older people.

Methods

(1) To identify the postural issues within seating that is evident in nursing homes.
(2) To understand the impact of a poor sitting posture for residents in nursing homes.
(3) To highlight the effect that sitting postures can have on the residents' care giver.
(4) To identify the contribution of a seating assessment and provision of the prescribed seating equipment in reducing pressure ulcers.

A mixed methods design was ethically approved and employed. Participants were recruited from three nursing homes and randomly allocated to one of two groups. The control group continued to use their existing seating while the intervention group was provided with seating tailored to their individual needs. The participants were then observed for pressure care amongst other variables.

Results

This research study clearly demonstrated that prescribed seating following personalised assessment can contribute to a reduction in pressure ulcer incidence and postural correction, increased saturated oxygen levels, functional ability and social interaction.

Seven of the intervention participants who had red skin areas at the beginning of the trial no longer presented with these at the end of the 12 week trial period. One participant in the control group developed a pressure ulcer in their existing seating while one red skin area that presented at the beginning of the 12 week trial no longer presented at the end of the 12 week trial period. Seventeen of the intervention group participants were found to have increased saturated oxygen levels over the 12 week trial. One of the intervention group participants maintained their initial results and none of the intervention participants were recorded to have decreased saturated oxygen levels. Nine of the control participants experienced decreased oxygen saturation levels while continuing to use their existing seating which had not been individually tailored to their needs.
Many of the caregivers reported that the provision of a suitable seating system made it much easier to feed the residents particularly when using the tilt in space feature on the chairs, as well as some reporting that they noticed an increase in social interaction when using the chairs. Overall, many of the caregivers reported the experience of having individualised seating for their patients was a positive one both for the patients and the caregivers.

Discussion

The provision of individualised seating is often required as people age. Individualised seating means identifying the person's body contours, joint range of motion, orientation in space, postural skills and providing a seating system that best positions and supports the person for comfort and function. This research highlights the very real value in maintaining a person centre approach to seating provision. It clearly highlights that the needs of each patient are different and require individualised evaluation to provide appropriate clinical guidance for the ordering recommendations of an appropriate static chair (Engstrom, 2002). Some of the key findings indicate that the provision of an individually assessed seating system to an elder within a long term care environment improves skin integrity, reduces the risk and incidence of pressure ulcers and can improve quality of life factors and ease of completing ADL's.
.
Current expenditure by the NHS in the UK on pressure sores is £2.1bn annually (Bennett, 2004). This equates to approximately £10,500 per sore. The evidence suggests that correct seating provision is instrumental in depleting this cost by preventing sores through investment in chairs before sores develop. As the average retail price of a chair is £1800 across all seating companies, there is an 82.9% potential saving

A clinical evaluation of a specifically designed alternating support surface device for achieving the 30 degree tilt in older individuals at risk of pressure ulcer development

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Introduction

Pressure ulcers are a common and debilitating concern arising due to unrelieved pressure and shearing forces. Therefore, pressure ulcers are largely seen in those with activity and mobility problems[1]. Although any one of any age could develop a pressure ulcer should their condition be sufficiently poor, pressure ulcers are more common in the older population. Indeed, it is this population that shows the greatest propensity for mobility and activity problems[1]. For those who cannot reposition themselves, they will require assistance in order to redistribute pressure and shear[2]. The EPUAP/NPUAP guidelines state that repositioning should be undertaken using the 30 degree tilt[2]. However, achieving planned goals in repositioning can be challenging in a climate of reduced staffing combined with increased demand due to poor nurse/patient ratios[1]. Advances in technology have seen a change in the type of equipment available for pressure ulcer prevention. One such advancement is a pressure redistribution alternating support surface with an additional modality which moves the patient into the 30 degree tilt position. This clinical evaluation aimed to determine patient and staff acceptance of this device specifically among older individuals at risk of pressure ulcer development.

Methods

This clinical evaluation took place in a Health Service Executive long stay nursing home setting in Ireland, from April – May 2014. Approval to undertake the evaluation was granted by the hospital's clinical governance team. Participants were included if they were at risk of pressure ulcer development, using the activity and mobility components of the Braden scale; consented to be nursed on the positioning support surface and had no medical condition that would preclude the use of the 30 degree tilt. The patient was nursed on the device and repositioned every 3 hours; follow up was for a period of 2 weeks. Daily skin assessments were undertaken by the tissue viability nurse. The primary outcome of interest was the ability of the device to maintain the individual in a 30 degree tilt. The secondary outcomes of interest were: patient comfort, patient acceptability, staff acceptability and pressure ulcer development

Results

Twenty patients participated in the evaluation, 11 men and 9 women with a mean age 85.3 years (SD 9.9 years). Of the participants, 50% were completely immobile, whilst 50% had very limited activity; furthermore, 30% were bedfast, whereas, 70% were chairfast. Scores for all outcomes were recorded between 1-10, with 1 being the worst score and 10 being the best. The following are the results:

1. Ability of the device to maintain the individual in a 30 degree tilt: Mean 8.5 (mode 9; SD 1.5; min 5, max 10)
2. Patient comfort: Mean 8.10 (mode 9, SD 1.4; min 5, max 10)
3. Patient acceptability: Mean 8.56 (mode 10. SD 1.4; min 5, max 10)
4. Staff acceptability: Mean 8.15 (mode 8. SD 1.3; min 5, max 10)

Other comments received included, two patients preferred their original bed, and, in three patients with contractures, it was difficult to centre them in the bed. Over the evaluation period no patient developed a pressure ulcer of grade 2-4.

Discussion

Overall, the device maintained the individual in the 30 degree tilt. Furthermore, the device was comfortable for the individual and was acceptable to both patients and staff. Bearing in mind the importance of repositioning using the 30 degree tilt as a component of pressure ulcer prevention, this device has potential to contribute to achieving goals of care. However, for those with contractures the mattress may not be suitable due to difficulties in centering the individual in the bed.

Clinical relevance

This device positioned individuals at risk of pressure ulcer development into the 30 degree tilt in a safe and acceptable manner. The indication for use of the mattress is specifically for those who are immobile and thus cannot reposition themselves independently.

Acknowledgements

The authors acknowledge the contribution of the staff and patients to this clinical evaluation.

Conflict of Interest

The repositioning devices were supplied by Meditec Medical, Ireland.

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Can a multi-faceted intervention affect pressure ulcer prevention?

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Introduction

Pressure ulcers cause substantial health burdens for patients [1] and has shown to be common in hospital settings [2]. Even though evidence-based guidelines are available pressure ulcer prevention is lacking [3]. Thus far, there is insufficient knowledge concerning how to successfully implement evidence-based care [4]. The aim of the study was to evaluate whether a multi-faceted, unit-tailored intervention using evidence-based pressure ulcer prevention affects the performance of pressure ulcer prevention.

Methods

A quasi-experimental, pre- and post-test design (Fig. 1) was used at five hospital unit. The intervention was based on the PARIHS framework [5]; a) a multi-professional team supported the units, b) one-day training to the nurses, c) repeated quality measurements were conducted by a contact nurse at the unit and the team nurse, d) feed-back of results the same day to first-line managers.
In the pre- and post-test evaluation, an established methodology [2] was used.

1	Pre	Intervention		Post				
2		Pre	Intervention		Post			
3			Pre	Intervention		Post		
4				Pre	Intervention		Post	
5					Pre	Intervention		Post
Jan2012	◄							June 2013 ►

Fig. 1: *Design and inclusion of the units.*

Results

In total 506 patients participated, out of which 105 were at-risk patients (21 %). There were no differences between the pre- and post-test groups regarding gender, age, days at the hospital and days at the unit. Almost 100 % of the patients had pressure-reducing mattresses. Table 1 presents prevention activities for patients at risk.

Table 1: *Pressure ulcer prevention for patient at risk*

		Pre-test (n=53)	Post-test (n=52)	p-value
Prevention activities		n (%)	n (%)	
Patient with prevention		15 (29)	27 (41)	0.027
Number of prevention per patient	1	35 (69)	24 (46)	0.011
	2	11 (22)	14 (27)	
	3	3 (5.9)	9 (17)	
	4	1 (2.0)	1 (1.9)	
	5	0	3 (5.8)	

Discussions

The findings showed that the multi-faceted unit-tailored intervention had an effect on pressure ulcer prevention. Repeated quality measurements together with rapid feed-back of results to the contact nurse and first-line managers, were seen as essential in the intervention. The results from the quality measurements could be discussed in relation to the patients whom they knew. Feed-back of results is also one factor of importance for successful implementation [5]. The PARIHS framework was useful in identifying areas of importance for implementation and when planning and evaluating the intervention. However, the study also showed that quality improvement still is needed.

Clinical relevance

Having an evaluation plan and providing rapid and continuous feedback of results of nursing care may increase possibilities for successful implementation of evidence-based care. When a facilitator is used, it is important to specify this role.

Acknowledgements

We appreciate the help of financial support from the Centre for Research & Development, Uppsala University/County Council of Gävleborg and Uppsala-Örebro Regional Research Council in Sweden.

Conflict of Interest

None

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Clinical Unit Microsystem Pressure Ulcer Prediction and Prevention

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Introduction

In an effort to understand how characteristics of the clinical microsystem impact hospital acquired pressure ulcer (HAPU) prevention, this study modeled the predictive strength of unit/patient characteristics, nurse workload, nurse expertise, and HAPU preventive clinical processes of care on unit level prevalence of hospital acquired pressure ulcers (HAPUs).

Methods

The investigation used a prospective cross-sectional design. Standardized pressure ulcer prevalence data were submitted in 2009-10 by 789 medical-surgical units drawn from 215 hospitals participating in the Collaborative Alliance for Nursing Outcomes (CALNOC) nursing quality benchmarking registry [1] Using unit-level data, HAPUs were modeled using Poisson regression with zero-inflation (due to low prevalence of HAPUs) with significant covariates as predictors. Clarke and Donaldson's conceptual model (2008) was used to guide this study [2].

Figure 1 Adapted from- Clarke, S. and Donaldson, NE. (2008). *Nurse Staf f ing and Patient Care Quality and Saf ety. In Hughes, RG (Editor). Patient Saf ety & Quality: An Evidenced Handbook f or Nurses. AHRQ Publication No. 07-00151. Rockville, M D: Agency f or Health Care Research & Quality*

Conflict of Interest

The co-authors serve as volunteers, paid personnel, and/or consultants under the terms of contractual agreements with CALNOC. Dr. Donaldson is currently a member of the CALNOC Board of Directors.

Results

In a sample with <3% HAPUs, fewer HAPUs were predicted by a combination of unit/patient characteristics (shorter length of stay, fewer patients at-risk, fewer male patients), RN workload (more hours of care, greater patient [bed] turnover), RN expertise (more years of experience, fewer contract staff hours), and clinical processes (more risk assessment completed).

Discussion

Unit/patient characteristics were potent HAPU predictors, yet generally are not modifiable. RN workload, nurse expertise, and processes of care (risk assessment/interventions) are significant predictors that can be modified to reduce HAPU. Further research is indicated to test these findings in a population with higher HAPU prevalence.

Clinical relevance

Understanding how characteristics of clinical unit microsystems vary within and between units and how these differences may impact crucial processes of care and resulting HAPU development is key to elimination of HAPU.

Acknowledgements

This study was funded, in part, by grants from the Gordon and Betty Moore Foundation, Betty Irene Moore Nursing Initiative and the Robert Wood Johnson Foundation, Interdisciplinary Nursing Quality Research Initiative. The contribution of Mary Foley PhD, RN, FAAN, CALNOC INQRI Study Coordinator, is gratefully acknowledged.

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♫♫♫ Head, Shoulders, Hips and Heels ♫♫♫ A Multi-Modal Approach to the Reduction of Pressure Ulcers in Infants, Children and Young People

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Introduction

Pressure ulcers are not commonly associated with very young babies and children. However, they do occur within paediatric practice and children continue to be vulnerable to this type of skin injury and the resultant pain and discomfort. The UK National Institute of Health and Clinical Excellence (2005) [1] identify individuals at 'extremes of age' as at risk of developing pressure ulcers. In April 2014 the first national guidelines in the UK for the Prevention of Pressure Ulcers in Neonates, Infants, Children and Young People were published (NICE, 2014) [2]

Great Ormond Street Hospital for Children NHS Foundation Trust (GOSH) is an acute specialist trust in London, providing a full range of specialist paediatric health services. An increase in the number of pressure ulcers was identified in early 2012. A large scale improvement project was initiated. During 2012-2013 the average rate of reported hospital acquired pressure ulcers fell 33%. During 2013-2014 we reduced the number of hospital-acquired grade 3 pressure ulcers from seven to three.

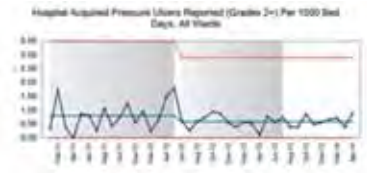
Methods

The Pressure Ulcer Prevention and Management team was formed. Operationally, the team members provide a responsive service to the wards. A new Clinical Educator joined the team and worked closely with the pre-existing Tissue Viability Nurse to seek innovative solutions, utilise improvement methodology and implement sustainable change across the organisation. A multi-professional group formed to oversee the teaching, to analyse the Trust wide incidence data and to design targeted interventions.

Following in-depth analysis of the pressure ulcer data, six work streams were developed and implemented:-

- A creative publicity campaign for staff
- Launch of the Glamorgan Paediatric Risk Assessment Tool
- Introduction of a Paediatric SSKIN Care bundle
- Investment in new prevention technologies such as new dermal pads (Aderma®) and specialist beds
- New interactive teaching programme for staff
- A new Root Cause Analysis (RCA) tool adopted by the Risk Management team

Results



Discussion

There have been significant changes in practice as a result of each intervention. Nurses have reported a shift in practice and have a new confidence in their role towards the prevention of pressure ulcers and the early implementation of prevention strategies.

The Glamorgan Paediatric Risk Assessment Tool and the GOSH Paediatric SSKIN care bundle, based upon the SKIN process tool developed by Ascension Health [3] ensures children's skin integrity is checked and documented daily.

Clinical relevance

Infants, children and young people in hospital are risk of developing pressure ulcers causing concern in children with serious co-morbidities. However, our interventions have resulted in smaller and less severe pressure ulcers and a reduction in overall incidence.

Conflict of Interest

There are no conflicts of interest

Acknowledgements

We appreciate the help of staff at Great Ormond Street Hospital for Children NHS Foundation Trust (GOSH)

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Can real-time feedback of interface pressure optimise adequate repositioning in bed?

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Introduction

The use of pressure-reducing mattresses and the timely repositioning of patients is the most effective intervention for preventing pressure ulcers.[1,2] However, knowledge of this is inadequate among many nurses in hospital settings.[3]
An innovative pressure-sensing mattress overlay attached to a monitor (MAP™) claims to provide real-time feedback for nurses and patients about which parts of the body are most exposed to potentially damaging pressure. (Fig 1.)
The aim of this study was to investigate how well registered nurses (RN) and assistant nurses (AS) position bed-ridden patients with regard to pressure ulcer reduction and if the MAP™ could provide staff with a pedagogic tool to optimise repositioning and thereby concretise the link between theoretical knowledge and practice.

Methods

A quantitative study was performed using a descriptive, comparative design. Both RN, (N=19) and AN, (N=33) were recruited to the study. Two volunteers, over the age of 70 and with normal body mass index, played the role of patients. The pressure-sensing overlays were placed on Optimal 5 zone mattresses and each was covered with a sheet. RN and AN worked in pairs, and were instructed to place the "patient" in the best pressure-reducing position, first without viewing the monitor and then again after feedback. The "patients" were instructed to be passive while the nurses laid them in both the supine and lateral positions, giving 4 positions per pair.

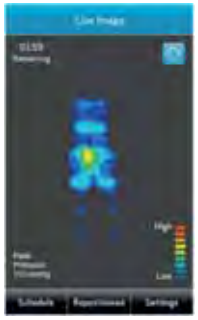

Fig. 1: Monitor of the MAP™

Results

Thirty nursing pairs conducted in total 120 position-ings. Data from the positioning and repositioning of the female "patient" is shown in Table 1. Similar results were found for the male.

Table 1: *Peak pressure, number of interventions and comfort*

	Female 60 kg		
	Without feedback	With feedback	p-value
Left side			
Mean peak pressure (mmHg) Min-max	47,5 37-67	43.2 37-52	0,001
Number interventions	4,1	4,6	0,002
Comfort	9,1	9,4	0,084
Back			
Mean peak pressure (mmHg) Min-max	39,2 29-49	37.7 29-43	0,021
Number interventions	4,1	4,6	0,001
Comfort	8,7	9,5	<0,001

Discussion

The resulting mean peak pressures varied considerably between pairs but lessened after feedback. We observed that feedback generated more discussion and reasoning about how best to reposition the "patient" and the nurses became more resourceful, diverging from their normal routines and testing other ways to reduce pressure. The nurses reported an increased awareness of the importance of small adjustments in positioning for improving pressure reduction. The "patients" reported their comfort as good in all positions but even better after feedback.

Clinical relevance

Real-time feedback of pressure points could be a useful educational tool for both nursing staff and nursing students.

Acknowledgements

We appreciate the help of Kristen Thurman, PT, CWS, Wellsense, USA for the loan of MAP™

Conflict of Interest

None

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Buttock pressure management of able-bodied people seated on a rigid surface for two hours

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Introduction

It is now well known that deep pressure ulcers are due to excessive pressure intensity (leading to soft tissues internal strains above 50 % for some minutes) and prolonged compression (leading to internal strains above 20 % for about two hours) [1]. Paraplegic people particularly suffers from pressure ulcers in the buttock area because of the inactivity of their leg muscles that make them a lot thiner and fragile [2] and because of the sensory dysfunctions that unable them to perceive warning signals thus keeping a risky situation by not moving enough. This paper aims at better understanding why able-bodied individuals put in quite extreme conditions (i.e seated for 2 hours long on a rigid surface) do not get pressure ulcers.

Methods

Thirty young healthy subjects agreed to stay seated on a rigid surface during two hours while watching a movie. The buttocks/seat interface pressures were recorded at 10 Hz by a Vista Medical pressure mapping system (Orthotest). Subjects were asked to move (e.g. change their postures, release high pressures, …) only if necessary. The study was conducted by the CIC-IT and CIC at the Grenoble University Hospital and was approved by an ethics committee (CPP Sud-Est).

Results

The first results focus on the global bi-dimensional Pressure x Time curves.
Figure 1 shows, for different levels of pressure, the maximum durations they were hold.

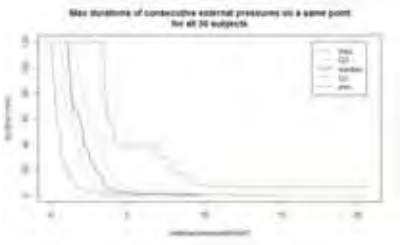

Fig. 1: *For a given level of pressure (x axis), the curve indicates the longest time one region of the buttock maintains that pressure (y axis). Black (resp. blue, cyan, orange, red) plot is the median (resp. min, 1st quartile, 3rd quartile, max) of data computed for the whole 30 subjects.*

Discussion

The experiment presented here aimed at observing the behaviors of young able-bodied subjects seated on a rigid surface for a duration of 2 hours, theoretically sufficient to cause pressure ulcers [1].

Figure 1 shows a very thin interquartile range, indicating that most of the subjects seem to have similar tissue tolerance. To compare this result with the thresholds found by Loerakker et al. [1], internal stresses and strains should be used instead of external pressures. Such a computation of internal stress and strain from external pressure is possible [3] but needs the elaboration of a person-specific biomechanical model based on medical imaging exams.

Clinical relevance

This study aims at understanding the prevention strategies of able-bodied people and estimating the dangerous thresholds of Pressure among Time.

Acknowledgements

We appreciate the help of the staff of the CIC, the CIC-IT, and we would like to thank the volunteers.

Conflict of Interest

Some authors are involved with the TexiSense Company (http://www.texisense.com/home_en).

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Evaluating the Sensitivity of Actimetry to detect Postural Changes in Seated Individuals

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Introduction

Changes in posture and mobility are two key strategies in the prevention of pressure ulcers (PUs). Objectively measuring movement is therefore an important factor to identify individuals at risk of PUs. The evolution of accelerometers has now created technology that can monitor movement over prolonged periods (in excess of 10 hours) and data can be collected remotely [1]. Indeed, an initial study has been performed on patients at risk of developing pressure ulcers as part of a risk assessment [2]. However, there is need to assess the accuracy and sensitivity of these accelerometers to measure movements in individual in lying and seated postures. Accordingly, a study was designed to classify movement changes in a leisure chair using accelerometers.

Methods

Twelve healthy participants were recruited (mean age= 24.4 years (SD 1.6 years), weight= 75.1 kg (SD 11.8kg), height= 179.3cm (SD 9.7cm)). Each participant was required to sit for a 90 minute period and adopt a series of standardized postures (optimal, slump, right lean) in a leisure chair. Each posture was maintained for a total of five minutes and repeated twice in random order. Accelerometer data sampled at 60Hz were collected using a Shimmer Sensor (Figure 1a) strapped to the sternum throughout the test session (Figure 1b).

a b

Fig. 1: *(a) shimmer accelerometer. (b) The experimental setup in the leisure chair during right lean.*

Sagittal plane (A-P) and frontal plane (M-L) data from the accelerometer were analyzed in Matlab (Mathworks, USA). The angular movement about each plane was analyzed for each posture and the root mean squared (RMS) values calculated during the five minute postures. A threshold value for movement detection was established to estimate the accuracy of classification for the slump and right lean postures.

Results

Table 1 describes the change in trunk angle relative to optimal posture measured using the accelerometer. The largest deviation from optimal for the sagittal (A-P) trunk angle was slump (-29.1^0) and for frontal (M-L) trunk angle was right lean (-21.2^0).

Table 1*: Descriptive statistics for accelerometer data*

	slump		right lean	
	Median	IQR	Median	IQR
A-P (deg)	29.1	19.6	2.5	10.1
M-L (deg)	0.5	22.2	21.2	17.8

(RMS= root mean squared) (IQR=Inter quartile range)

A 20° threshold value for changes in trunk angle relative to optimal posture was selected for analysis. Using this threshold, an accuracy of 71% and 67% detection of postural change was identified for slump and right lean conditions, respectively.

Discussion

Present findings suggest that accelerometery can be used to distinguish movement between seated postures in a leisure chair with of accuracy of between 67-71%. These values need to be increased to justify the time and expense needed to implement the systems in a clinical environment. However, the use of accelerometers to objectively monitor seated patients at risk of pressure ulcers remains a potentially valuable tool with further research and validation.

Clinical relevance

Accelerometers have the potential to monitor patients at risk of pressure ulcers. This study has provided preliminary data regarding the accuracy of the device to monitor the seated individual.

Acknowledgements

Thanks to ACCORA for supplying the leisure chair.

Conflict of Interest - none

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15

Does the calcaneus morphology have an influence on the risk of posterior heel ulcer?

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Introduction

Pressure ulcers (PU) affect almost half of the patients in reanimation or geriatric units. Forty percent of those PU are posterior heel ulcers. The main suspected causes are the excessive pressure intensity (leading to internal strains above 50 % for about 10 minutes) and prolonged compression (leading to internal strains above 20 % for about two hours) [1]. Prevention through daily examination lacks efficiency because of the nature of these deep tissue injuries resulting from internal strains. When visual symptoms appear it is often too late for PU prevention. It is consequently crucial to monitor the internal strains. But is there a difference in terms of strain from a patient to another because of the difference in their calcaneus shape?

Methods

To answer this question, a lower leg Finite Element (FE) model was elaborated based on a previous foot model [2]. This new model represents the soft tissues of the lower leg as four different sub-domains each modelled using a Neo Hookean material with Young moduli and Poisson ratios of 200 kPa and 0.495 for the skin, 30 kPa and 0.49 for the fat, 1 GPa and 0.495 for the Achilles tendon, and 60 kPa and 0.495 for the muscles [3], Fig. 1. Bones are modelled as rigid solids, 18 different shapes of calcanei are simulated. This leg model rests on a FE model of a cushion with three compartments of varying stiffnesses: under the calf, the Achilles tendon, and behind the heel.

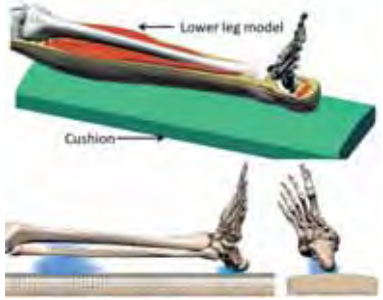

Fig. 1: *Top: the four types of materials defining the lower leg FE model: skin (only one layer of elements around the leg), muscles (in red), fat (in yellow), and Achilles tendon. Bottom: clusters of the nodes with VM strains above 20 % with a stiff cushion below the heel and a soft cushion elsewhere. The maximum VM strain (57 %, in red) is located under the heel, at the interface between fat and calcaneus.*

Results

Table 1 shows the summary of all the FE simulations for the 18 lower legs under gravity. To measure the PU risk, the volumes of the largest clusters with contiguous nodes with VM strains over 20 % or 50 % are observed during simulations.

Table 1: *Average of the volume, in cm^3, of the largest cluster of nodes with a VM strain above 20 % and 50 %, and their deviation in %.*

Cushions' configurations	Stiff calf Soft Achilles Soft heel	Stiff heel Soft Achilles Soft calf	all stiff	Very stiff heel Soft Achilles Soft calf
Mean cluster vol. . over 20 % in cm^3	0.836 [+/- 0.0%]	0.479 [+/- 23.8%]	0.209 [+/- 3.2%]	1.826 [+/- 16.8%]
Mean cluster vol. over 50 % in cm^3	-	-	-	0.020 [+/- 152.0%]

Discussion

The influence of the calcaneus' morphology is clearly demonstrated by the cluster volumes with deviations of 23.8 % and 16.8 % in the simulations with stiffer stiff cushions below the heel of the 18 models. The same morphology was used for those models in the proximal section which explains the low deviation (0 and 3.2 %) below the calf. Additionally, this lower leg FE model could be used to identify the cushions' stiffness minimizing the ulceration risk for each individual over time: a very stiff cushion below the heel leads to a cluster volume of 0.02 cm^3 that could create a PU in less than 10 minutes, while a softer cushion avoids creating any cluster with internal strains over 50 %: in that case, the risk of PU creation is around two hours [1]. Moreover, the largest cluster can be located with the simulations: it is at the interface between the calcaneus and the fat layer when the cushion is stiffer under the heel, Fig. 1, therefore increasing the risk of PU when maintained for a long time.

Clinical relevance

This study quantitatively proves that the calcaneus shape has a strong impact on the risk of PU creation.

Conflict of Interest

Some authors are involved with the TexiSense Company (http://www.texisense.com/home_en).

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Simulation and Discussion of the Microclimate in Heel Protector Boots

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Introduction

Heel protector boots protect the integrity of the at-risk heel tissue by redistributing pressure and reducing friction and shear; however, tissue integrity is greatly influenced by the microclimate at the tissue-protector boot interface. Because elevated skin temperature is associated with increased metabolic demand of 6% to 13% per degree Celsius, it is reasonable to conclude that tissue susceptibility to injury is increased, particularly when both nutrient supply and metabolite removal are reduced by loading[1].

- High temperatures stress tissues by increasing metabolic demand and induce sweating response, leading to an accumulation of moisture.
- Moisture trapped at the skin increases friction and lowers the breaking strength of skin.

In addition to pressure, friction, and shear reduction, the temperature and moisture permeability of these devices should be considered when choosing an appropriate heel protector boot in the clinical setting.

Methods

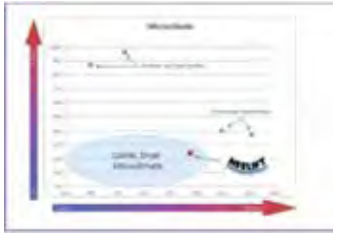
The purpose of this experiment was to simulate, measure, and compare the microclimate at the boot-patient interface by applying a heated indenter, modified to release water vapor, to the internal surface of six commercially available heel protector boots.

Fig. 1: *The experimental setup.*

Two samples of three different styles of boot construction were tested: open-celled ventilated foam, air bladder, and pillow. The microclimate was continuously monitored via temperature and humidity sensors.

Results

As described by Gefen[2], a support surface's permeability to humidity and perspiration has a much greater effect on tissue integrity than skin temperature. Although the air bladder boots were the coolest, the open-celled foam boots were more permeable to moisture, demonstrating that the microclimate inside these boots is better suited for protecting tissue integrity than less moisture permeable constructions.



Discussion

The air bladder style boots remained cooler than the pillow and open-celled foam constructions by approximately 4-6°C and 2-3°C, respectively. The open-celled foam trapped less humidity (was more permeable) than the air bladder and pillow constructions by approximately 50% RH and 10% RH, respectively.

Clinical relevance

Briefly summarize the clinical relevance of your work here (1-2 sentences).

Conflict of Interest

Independent lab research funded by DM Systems Inc.

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Pressure ulcer prevalence and prevention practices – a comparison between formal risk assessment and assessment using clinical judgement alone

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Introduction

Use of a risk assessment scale is recommended in international pressure ulcer prevention guidelines. Yet it is evident that there are challenges in their use. Within many health-care settings, PU risk assessment is an integral component of PU prevention policy. Conversely, in other settings, formal risk assessment is not conducted; indeed, many clinical staff are unaware of risk assessment tools currently available[1]. This disparity provides the opportunity to explore whether there are differences in how patients are risk assessed, either formally or informally, and how this impacts on the provision of prevention strategies and subsequent PU prevalence and incidence rates. An example of two such health-care settings are Norway (limited use of formal structured risk assessment) and the Republic of Ireland (routine use of formal structured risk assessment). Therefore, these two countries were chosen as the sites for research exploring the use and impact of formal structured PU risk assessment.

Methods

This study explored whether the risk assessment method (structured versus clinical judgment) influences pressure ulcer prevalence or prevention strategies. A cross section survey design was employed with use of a pre-designed data collection instrument. Following ethical approval and consent, data were gathered from 180 patients in 2 acute care settings, 59 in Norway (clinical judgment) and 121 in Ireland (structured risk assessment). Data collected were analysed using SPSS. Data were at nominal and ordinal level therefore, in the main, simple descriptive statistics were conducted, outlining the demographic profile of the participants, risk status, pressure ulcer prevalence and prevention strategies employed. Inferential statistics were employed only as appropriate. Pressure ulcers were graded according to the EPUAP pressure ulcer grading system, and all grades 1-4 were included. Pressure ulcer prevalence was calculated as the number of persons with a pressure ulcer divided by the number of persons assessed.

Results

49% of patients were male, 50% female with the majority (46%) aged 70-99 years of age. Prevalence was 54% (Norway) and 11% (Ireland). In Norway, the majority of pressure ulcers (69%) were grade 1, whereas in Ireland the majority (50%) was grade 2. Only 8% of patients in Norway were risk assessed on admission compared with 85% in Ireland. Norway had no dynamic mattresses in use, in Ireland 27 were used with the majority (44%) for high risk individuals. Four pressure redistribution cushions were in use in Norway and eleven in Ireland. Of those at risk of pressure ulcer development, 15% in Norway and 56% in Ireland had a documented repositioning care plan for when in bed, and 0% in Norway and 13% in Ireland for when seated on a chair.

Discussion

There were inconsistencies in approach to pressure ulcer risk assessment and prevention across the 2 clinical settings. Prevalence rates differed however, mainly relating to grade 1 pressure ulcer damage. Even though formal risk assessment is well established in Ireland, this is not necessarily followed up with appropriated pressure ulcer prevention. Thus, the method of risk assessment does not seem to influence subsequent care planning, questioning the role of formal risk assessment; however despite this risk assessment does put a focus on an important clinical problem.

Clinical relevance

Whether risk assessment is undertaken using a formal risk assessment tool, or using clinical judgement alone, does not seem to influence the subsequent care provided to patient for pressure ulcer prevention, neither does it seem to influence pressure ulcer prevalence. It is evident from this study that risk assessment practice need to be revisited to ensure that it is providing meaningful information for practice and patient care.

Acknowledgements

This work is partly funded by a research grant from the Norwegian Nurses Organisation (NNO's) (Norsk Sykepleierforbund NSF) in 2012. The authors have no conflict of interest to declare.

Conflict of Interest

The authors have no conflicts of interest to declare.

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Improving the risk assessment of pressure ulcer by nurses for elderly with psychiatric disorder a pilot project

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Introduction

In 2013, the annual prevalence of pressure ulcer in the Department of Psychiatry at the advanced age at University Hospital in Lausanne was at 23.3% (n=67), 50% of participants did not benefit from systematic preventive measures as established in the program created by the expert pressure ulcer prevention group called in French "*Objectif Zéro Escarre*" (OZE). The healthcare team has difficulties to establish the risk assessment by using the Braden scale and assess the skin. Manager care has request the intervention of OZE to support the implementation of best practice and to establish specific recommendations for elderly patients with psychiatric disorders.

Methods

A participatory consultation approach was used to explore the problematic, a focus group was performed (1). The tool used for the animation of the focus group was "*Mindmapping*" (2). Two nurses assistants and four registered nurses participated. A clinical nurse specialist (CNS) of OZE guided the interaction. Two questions were identified.

1. What is the patient profile identified at risk of pressure ulcer in psychiatry advanced age?
2. What are your main facilities and difficulties in the risk assessment and the implementation of preventive measures?

All participants identified three keys words, classified by themes. At the end of the focus group, a photography of each *mindmapping* was taken. The CNS compared the result of the literature. The CNS have presented the analysis to the focus group and approved the validity of that analysis. Finally, the CNS has proposed some recommendations to improve risk assessment and prevention plan for PU.

Results

The results of the first question of focus group identified the same answers than the physiopathology process of pressure ulcer and the risk factors.

The Table 1 shows the results of the second question.

Table 1 *:Result focus groups by themes question no "2*

Facilities	Difficulties	No consensus
trust with patient	aggressiveness depressed psychotic symptoms	Schema of mobilization

Material access	Skin assessment	Continuity of plan care
	Knowledge of patient PU risk	
	Knowledge of healthcare provider	
	No priority of plan care	
	Access of EBN	

Discussion

The risk factor of PU in psychiatry advanced age is similar as the literature but the impact of the psychological disorder is not described. The Braden scale need to be used to support the clinical judgment and integrated the psychological dimension in the risk assessment (3,4) Strategies for skin evaluation could be tested through different situations of care like patient empowerment and nursing therapeutics. The healthcare team needs some training on risk assessment, preventive interventions and planning continuity of care. Further research need to be made to explore the impact of psychological disorder and risk of PU.

Clinical relevance

The purpose of this project is to improve the risk assessment and established pressure ulcer prevention to elderly person with psychological disorders.

Acknowledgements

We appreciate the help of direction of care of CHUV and nurses who participated at the focus group.

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Is pain a predictor of Category 2 pressure ulcers? Analysis of skin site level data from the PURPOSE Pain Cohort Study

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Introduction

Pain is an important symptom which aids the diagnosis of many conditions. A systematic review of health related quality of life in patients with pressure ulcers (PU), identified that patients' reports of localised skin pain associated with early PU development are ignored [1, 2, 3]. This study was a prospective cohort study that explored the role of pain as an early predictor of Category≥2 PU development. Whilst the primary analysis was presented at EPUAP 2013, this abstract presents the skin site level analysis compared with patient level analyses and illustrates why both methods should be considered.

Methods

We conducted a prospective cohort study with 30 days follow-up, in 26 acute and community NHS Trusts involving patients at high-risk of PU development. High-risk was defined operationally as having one or more of the following characteristics: Braden bedfast/chairfast AND completely immobile/very limited mobility; localised skin pain on any pressure area skin site; Category 1 PU on any pressure area skin site. There were 13 pre-specified skin sites assessed for each patient, including the buttocks, sacrum and heels (Figure 1).

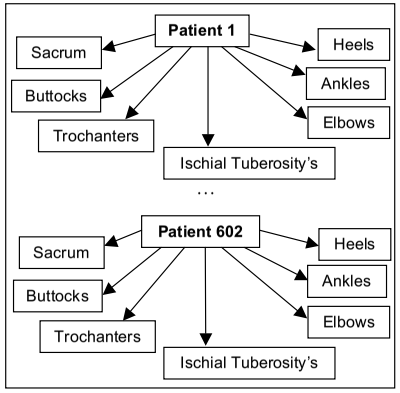

Figure 1 Skin site level data structure

We used full stepwise variable selection and a multilevel logistic regression model to assess whether pain is a risk factor for developing a category≥2 PU at the same skin site after adjusting for between patient variation.

Results

There were 602 patients with a combined total of 7,863 potential skin sites assessed, of these 7483 (95.2%) were evaluable in the analysis (i.e. all skin sites observed as being healthy, altered or category 1 at baseline with at least one follow up assessment). Overall 223 (3.0%) evaluable skin sites developed a category ≥2 PU, and the incidence was higher for skin sites with pain at baseline at 10.3% compared to skin sites with no pain at baseline at 1.7%. The final multilevel logistic regression model on the development of a category ≥2 PU at a skin site level included two variables; skin status which consisted of two levels: skin alterations (OR 4.65, 95% CI (3.01, 7.18), p<0.0001) and category 1 PU (OR 17.30, 95% CI (11.09 , 27.00), p<0.0001) and; the presence of pain on a healthy, altered or category 1 skin site (OR 2.25, 95% CI (1.53, 3.29), p<0.0001) .

Discussion

This is the first risk factor study to explore the relationship between localised skin pain on a pressure area skin site and category≥2 PU development on the same skin site.

Replication studies are required, and skin site level analyses should be considered in addition to patient level analyses.

Clinical relevance

The assessment and response to pain on PU free skin sites may be an important part of PU prevention and should be a clinical priority.

Acknowledgements

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Conflict of Interest

None Declared

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Early pressure ulcer prevention and Intervention for patients undergoing fast-track surgery

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Introduction

National prevalence studies show that patients are in high risk of developing pressure ulcers during their in-hospital stay resulting in serious complications in terms of established quality of life, prolonged bed stay, risk of infections, need for subsequent nursing and medical treatment, increased mortality and economical burden [1,2]. Having enrolled a Quality Improvement and Patient Safety Program, Elective Surgery Centre, Silkeborg Regional Hospital, decided to focus on early pressure ulcer prevention and intervention.

Objectives: Identifying early pressure ulcer prevention and intervention for patients undergoing Fast-track surgery in order to reduce in-hospital stay pressure ulcer.

Methods

We carried out a retrospective study of 44 patients. All subjects were identified on Safety Cross Calendar in the period of December 2012 to August 2013.

The main question behind the study was: Where and how did the damage of pressure ulcers occur within the individual patient pathway?
Clinical measurement criteria where: Diagnoses, Body Mass Index (BMI), category of pressure ulcer [3], temperature under surgery <36, individualized risk factor, where was the pressure ulcer placed on the body and what was documented as reason for the pressure ulcer damage.
Additional measurement criteria as to on-going nursing intervention where: Which nursing treatment was used, was the ulcer minimized, was the condition of the patient followed up and monitored after hospital discharge?.

Results

44 patients had 54 pressure ulcers in category I and II [3]. There were two pivotal findings with clinical relevancy:
1) 8 out of 16 patients who underwent Open Reduction Internal Fixation (ORIF) of Hip Fracture had pressure ulcers on heels and os sacrum. All subjects had a BMI < 25, before surgery, 5 patients had intense pain providing optimal repositioning.
2) 10 out of 10 patients who underwent Lumbar Spinal Fusion Surgery had post operative pressure ulcers in the forehead. 8 out of 10 patients with BMIs > 25 were positioned in Wilson frame and the surgery time lasted more than two hours.

Conclusion

It is feasible to reduce pressure ulcers on heels and os sacrum by training the clinical staff by systematic use of easy slide in order to ensure easy and carefully repositionering. Friction reducing tools as well as accurate use of the hospital beds function may also help preventing friction in connection with transferring the immobilized patient. Communication of pressure ulcer development, risk assessment, skin inspection results and treatments should be consistent.

More Spine Fusion research of the link between BMIs > 25 and development of pressure ulcers in the forehead (category I and II) is needed to identify early pressure ulcer prevention and intervention. As for now, our patient safety strategy to reduce pressure ulcers in the forehead is: Move patient's head every hour to the extent possible, change patient's head position by tilting operating table a few degrees when it is in the Trendelenburg.

Clinical relevance

Persistent focus on auditering, quality assurance and development promotes partnership working between the Multidisciplinary Team and between our Wards, in order to facilitate safe effective, well documented, timely patient care.

Acknowledgements

We appreciate the help of the staff in our 3 wards (K1, K2 and Patient Hotel) that made audits possible by recording on Safty Cross Calendar every day all year round.
We also appreciate the help from Harboe Foundation who have made it possible to submit this abstract.

Conflict of Interest

None

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PRESSURE 2 Trial: Considerations on the design of the trial and the decision making process at the interim analyses

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Introduction

Alternating Pressure Mattresses (APM) and High Specification Foam (HSF) mattresses are used routinely in clinical practice, however APMs are considered, by some, to be the superior mattress despite the lack of high level evidence to support their use in the prevention of pressure ulcers (PUs) in high risk patient populations[1].

PRESSURE 2 is a multicentre, randomised, double triangular group sequential, parallel group trial involving up to 2954 patients, comparing HSF and APM in high risk acutely ill patients for the prevention of new PUs. The primary endpoint is time to developing a new Category 2 or above PU from randomisation to 30 days post treatment phase (maximum 90 days).

Whilst the overall trial was presented at EPUAP 2013, this abstract presents methodological considerations on the design and the decision making process at the interim analyses.

Methods

Whilst the group sequential trial design increases the maximum sample size required compared to a conventional fixed sample size design, it provides an efficient design as the stopping rules allow for early stopping by demonstrating effectiveness of either mattress or futility of the trial. The use of an early primary endpoint allows information to assess early stopping to be available in a timely fashion.

Considerations in the design of the group sequential trial included the criteria for early stopping and the number and spacing of planned interim analyses.

Statistical stopping boundaries provide guidance to the independent Data Monitoring Committee on stopping the trial early, however further considerations include the safety profile of each intervention, the economic evaluation and also the availability of information external to the trial.

Results

Two interim analyses are planned at coherent cut points. The first interim analysis is to be conducted after 300 patients have developed a Category 2 or above PU, corresponding to the minimum number of events required for the economic evaluation. The second interim analysis, after 445 patients have developed a Category 2 or above PU, corresponds to the number of expected events required to stop the trial early for futility.

Figure 1 provides a summary of the planned decision making process at each interim analysis.

Fig. 1: *Decision making process at interim analyses*

Discussion

The design and decision making process at the interim analyses allows for all the available clinical, economic and safety data as well as information external to the trial to be considered in the decision on whether to stop the trial early and thereby inform future clinical practice.

Clinical relevance

The design maximises the potential for evidence to be available to guide clinical practice earlier than in a conventional trial design.

Acknowledgements

This presentation presents independent research funded by the National Institute for Health Research (NIHR) under its Health Technology Assessment Programme (11/36/33). The views expressed in this presentation are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health

Conflict of Interest

None

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The Effect of a Bacteria and Fungi Binding Mesh Dressing on the Bacterial Load of Pressure Ulcers Treated with Negative Pressure Wound Therapy (NPWT), a Pilot Study

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Introduction

A pressure ulcer (PU) is a localised injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear forces and/or friction. Studies developed by the SIC (Statistical Organization on Italian Healthcare) established that approximately two million people suffer from pressure sores and this number may increase as the ageing population increases. Prevention is certainly the best approach in PU management; however, once these chronic wounds are present they represent an increased burden for patients and healthcare systems. Thus, it is essential to find cost-effective ways to manage the most severe categories of PU.

Chronic wounds are colonised by a polymicrobial flora. The role of bacteria in wounds depends on their concentration, species composition, and host response. Low concentrations of microbes are considered normal and are not believed to inhibit healing; however, critical colonisation and infection are associated with a significant delay in wound healing.[1]

The clinical benefits of Negative Pressure Wound Therapy (NPWT) are now well recognised. NPWT has become a common method used for treating wounds of different aetiologies.[2] Over the previous ten years, published articles studying the role of NPWT on the bioburden of chronic wounds have provided contradictory results [2, 3, 4, 5, 6].
It is understood that the wound filler may influence the effects of NPWT on wound healing. Foam and gauze are the most frequently used wound fillers for NPWT. Glass and Nanchahal [7] published the results of a literature review on NPWT. They concluded from the available evidence that foam and gauze transmit Negative Pressure efficiently, that there is no clear evidence to favour either dressing, or that there is insufficient evidence to credit NPWT with reduced bacterial wound colonisation. All studies published to date, which report the effect of NPWT on wound microbiology, have been conducted using non-antimicrobial wound filler materials.

Methods: An observational non-comparative single centre study conducted on patients presenting with Pressure Ulcers Category III or IV and receiving homecare, who were considered suitable for the centre's standard treatment with NPWT. No patient showed signs of local wound or systemic infection in the seven days before inclusion in the study, nor received local or systemic antibiotics. Each patient was observed for seven days and received NPWT at -80mm Hg pressure with the BFBM dressing as Wound Contact Layer (WCL). Wound biopsies were performed at Day 0 (B0) (at enrolment) before the application of NPWT, then after 48 hours (B1) and then at the end of the seven day observation period (B7). Samples of the BFBM dressing were examined for the bacterial load at 48 hours (D1) and at seven days (D7) respectively. The primary endpoint was the change in the bacterial load of the wounds. The bacterial load was quantified in colony forming units (CFU/ml) and the species recorded.

Results

50 patients in total were enrolled with no withdrawals. No device related adverse events were reported. One patient died of multiple co-morbidities. 43 (86%) of the pressure ulcers were on the sacrum. At B0 (enrolment) three groups of wounds were identified by degree of bacterial colonisation; Group A (28%)with negative biopsy results and (18%) with bacterial loads from 10^2 and 5 x 10^3 CFU/ml, Group B (18%) 10^4 – 10^5 CFU/ml and Group C with $\geq 10^6$ CFU/ml. The analysis of variance (ANOVA) did not show any significant difference in bacterial load for Group A over the study period. Statistically significant differences were present for Group B at B1 and B7 (p=0.04 and p=0.0067) and for Group C at B1 and B7 (p <0.00001). There was no significant difference found between the bacterial loads of the dressing samples at D1 and D7 (p=0.823). The most prevalent organisms isolated at B0 were *P. aeruginosa* (30%), *E. coli* (26%), *S. aureus* (13%) and *Proteus spp.* (10%). The

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Numerical Study of different Types of Supporting Structures regarding the Prevention of Deep Tissue Injuries

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Introduction

Measurements of the pressure distribution are an indicator for the risk of pressure ulcers. But a comprehensive assessment especially for deep tissue injuries is only possible in combination with information about the internal stress and strain state [1]. An enhancement of experimental studies is possible by the application of the finite element method (FEM) [2], [3]. Thereby the benefits of supporting structures with respect to the mechanical loading can be investigated and evaluated by non-measurable quantities in a much more detailed way.
Additionally the simulation has the advantage, that the loading due to patient is reproducible. Consequently the differences in the results are only related to the design and the properties of the supporting structures enabling finally a more precise comparison.

Methods

In the carried out project two different designs of bed systems have been investigated (a foam mattress and a continuous low pressure air mattress with additional kinematic features).
The loading was presented by the human body model CASIMIR [4]. The comparison of both systems was carried out with two typical bed adjustments:

- Flat and
- Inclination of headrest about 30°

For both mattress types a detailed FE model is generated based on design data.

Fig. 1: *The FE model for low pressure mattress.*

The properties of foams, bladders and cover materials have been identified via data of compression and tension tests.
The simulation takes into account all nonlinearities due to changing contact between mattress and human body and due to material properties. The investigation is divided into two steps: 1. Gravity load (flat) and 2. Alignment of headrest.

Results

For each step the pressure distribution (normal and shear) at the surface of the mattress and the internal tissue state in the area of the sacrum are evaluated.

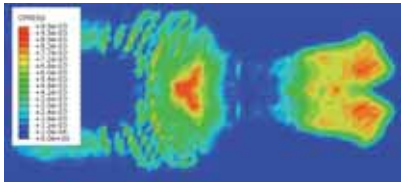

Fig. 2: *Example of pressure distribution for flat posture.*

Further the movement of the human body model is determined while aligning the headrest to evaluate the benefit due to additional kinematic feature.

Discussion

For all setups it could be observed that the internal loading state of the tissue is higher than the values of the pressure distribution.
Comparing both supporting systems for the flat posture the continuous low pressure air system shows benefits with respect to the maximum pressure values.
Finally it could be observed that the additional kinematic system prevents greater movements of the patient. For the patient this should in reality lead to the prevention of uncomfortable postures, to a reduction of shear forces and for the hospital staff the number of readjustments will most probably be decreased.

Clinical relevance

The assessment of the risk for deep tissue injuries only by the pressure distribution is limited as the internal tissue state is not considered.

Conflict of Interest

There were no conflicts of interest.

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A clinical comparative study on 940, 808 and 658 nm laser therapy in pressure ulcer healing: early and long term results

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Introduction

Laser therapy has been used to accelerate wound healing since the late 1960s, but its results are still controversial. The aim of the clinical study was to compare the efficacy of laser therapy (at different wavelengths: 940, 808 and 658 nm) for treating pressure ulcers. The primary endpoint in this trial included both the percentage reduction of the ulcer surface area and the percentage of completely healed wounds after one month of therapy (ulcer healing rate). The secondary end-point was the ulcer healing rate at the follow-up evaluation (3 and 6 months after the end of the study).

Methods

In total, 72 patients with stage II and III pressure ulcers received laser therapy once daily, 5 times per week for 1 month using a (GaAlAs) diode laser with a maximum output power of 50 mW and continuous radiation emission. Three separate wavelengths were used for the laser treatment: 940 nm (group I), 808 nm (group II) and 658 nm (group III). An average dose of 4 J/cm^2 was applied. In group IV, a placebo was applied in the same manner, but the laser device was turned off during treatment sessions (only an applicator was turned on to scan ulcers using non-coherent red visible light). The laser therapy (also placebo) in all comparative groups lasted one month. Three and six months after the therapy, all patients were reviewed (to compare the final healing rates in the groups). During this time, the participants only received routine treatment, including daily simple dressings with sterile gauze after wound cleaning with a 0.9% physiologic solution and use of 1% hydrophilic silver sulfadiazine cream.

Results

The observed groups were homogenous in all participant characteristics. After one month of therapy, the healing rate (number percentage of completely healed ulcers) was the highest in group III – 47.05% or 8/17 patients. A significantly worse rate was found in the other groups – only 11.11% or 2/18 patients in each group. Similar results were found in the follow-up analyses. The analysis of the changes of the percentage ulcer area also confirmed that laser irradiation at a wavelength of 658 nm is the most efficient for wound healing. The wavelengths of 940 and 808 nm appeared to be much less effective and were not better than the placebo.

Discussion

Laser therapy has been suggested to be a promising treatment option for sport injuries, musculoskeletal disorders, neurological problems and open wounds. We only found a few well–documented reports (unfortunately with strongly critical remarks) in the literature about pressure ulcer management [1, 2, 3]. The results of our study showed that the wavelength of the laser beam is extremely important during the wound-healing process (and perhaps this is one reason for the many controversies). In this trial, we found no evidence that justifies using laser therapy at wavelengths of 940 and 808 nm as an adjuvant to the future consensus pressure ulcer treatment. However, in our opinion the wavelength of 658 nm is interesting, and its use yielded in promising clinical results. We cannot agree with a general statement that laser therapy does not accelerate the healing process because the correct parameter settings (wavelength, dose, and method of application) must still be demonstrated in the literature. Researchers still do not know all of the physical processes that occur at the cell or tissue level after laser irradiation.
We conclude that laser therapy at a wavelength of 658 nm appeared to be effective for healing pressure ulcers. The wavelengths of 808 and 940 nm did not have any effect in our study. Future *in vitro*, animal and clinical studies are necessary.

Clinical relevance

We believe that this study will be helpful in preparing the future NPUAP/EPUAP updates of the international guidelines for the prevention and treatment of pressure ulcers.

Authors declare no conflict of interest

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Self-Propagation of Cell Death in Muscle Tissue via Myoglobin Release: A Computational Model of Mechano-Chemical Interplay in Deep Tissue Injury (DTI)

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Introduction

Deep tissue injuries (DTI) have a dangerous potential for rapid deterioration. Muscle necrosis releases the heme-containing protein myoglobin [1], which can cause toxic levels of oxidative stress, unless the myoglobin is packaged intracellularly within a specialized antioxidant environment [2]. Extracellular myoglobin is known to cause cell death when concentrated, for example in kidney tissue during clearance from circulation after muscle injury. Not yet studied is the potential for extracellular myoglobin to damage muscle tissue during DTI. This question is particularly relevant for a context of mechanical deformation, firstly, because myoglobin could accumulate extracellularly due to myotube rupture or pressure-induced plasma membrane permeability [3], and secondly, because oxidative stress causes membrane peroxidation [4] and facilitates the mechanical rupture of membranes [5]. In this work we use computational modeling to simulate a potential role for extracellular myoglobin in inducing oxidative stress, loss of membrane integrity, and extracellular release of additional myoglobin. Our theoretical results illustrate a catastrophic feedback loop of self-perpetuating death in muscle cells, due to the combination of oxidation and deformation.

Methods

A computational model of muscle injury dynamics simulated biochemical factors and cell state over time. Fig.1 depicts the injurious effects included in the model. In addition, for each injurious effect, the model had a homeostatic counter-effect (not shown) such as antioxidants to resolve oxidative stress. Because quantitative measurements are currently not available (and sometimes not feasible with present technology) for many of the phenomena in question, we developed a dimensionless qualitative model as a first step in this research. The purpose of qualitative modeling is, at this stage, to explore which parameters can influence the balance between recovery and self-propagation of cell and tissue damage.

Results

After deformation was applied to the muscle tissue, time-course simulations showed a variable time of latency, with gradual accumulation of non-lethal cell stress, followed by an 'explosive' increase in cell death. When the simulation was repeated with stronger homeostatic counter-effects and faster recovery processes, the system converged to a viable steady-state with low levels of cell death maintained over arbitrarily long durations of deformation. The outcomes of the simulations were particularly sensitive to the rate of membrane repair.

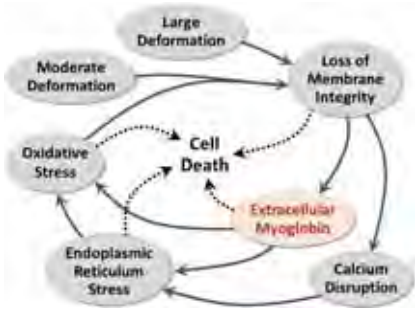

Fig. 1: *Chief effects in the computational model.*

Discussion

Computational modeling considered a small number of influences on DTI, as the previous literature had focused mostly on the biomechanics of tissues and cells, and less on the interplay with impaired cellular function. Future work should consider that ischemia can lower pH, which augments the toxicity of extracellular myoglobin [6]; reperfusion can produce peroxides [7], which accelerate myoglobin production of superoxide [6]; and infection can introduce LPS (endotoxin), which may exacerbate globin toxicity [8].

Clinical relevance

If oxidative mechanisms are driving muscle tissue death during DTI, then treatment might be improved by developing dressings that release antioxidants locally. Laboratory testing complemented by additional modeling work will be our next step in this regard.

Conflicts of Interest: None.

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The Role of Mathematics in Ulcer Development and Wound Healing

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Introduction

Wound development and wound healing are important medical problems and intimately related biological processes. Much of today's understanding of these processes is based on experimental observations in clinical and in vitro settings. However, in order to gain better understanding of the biological mechanisms and of the interplay between the various factors and variables which are involved in wound development and healing, it is crucially important to convert biological hypotheses into quantitave relations and data. The quantitative relations often arise in terms of mathematical equations (partial differential equations) or stochastic (random) processes. The combination of all the quantitave relations defines the mathematical problem to be solved or analyzed by the use of rigorous mathematical techniques. The (representation of the) solution to the mathematical problem defines the mathematical model. These models allow to simulate, and hence to visualize, key biological processes like ulcer development or wound healing on a computer and herewith the consequences of the biological hypotheses can be validated if experimental observations are available. This validation step may confirm the mathematical modeling and hence the biological hypotheses, or indicate that a revision of the model and biological hypotheses is needed, see Figure 1 for a schematic. In this presentation we will describe several types of models for various biological processes regarding formation of pressure ulcers and wound healing.

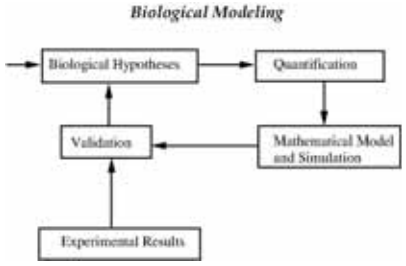

Fig 1: The feedback loop between mathematical modeling, experimental results and hypothesis building.

Methods

The methods that we present are based on mathematical principles such as stochastic processes and partial differential equations, which arise from conservation principles. A class of models that we will consider is cell-based, where cell division, death and differentiation are treated as random processes to model angiogenesis (vascularization), wound healing and contraction. Next to the cell-based models, finite element methods are used to solve the resulting equations for mechanical strains and stresses in the models for pressure ulcer development. A mathematical model for ulcer development is constructed where microclimate factors are taken into account as well.

Results

We will present some movies visualizing development and healing of wounds which have been constructed using the various modeling principles, where cell-based models show migration and deformation of individual cells in conjunction with wound healing, contraction and the function of the immune system. Further, various results of finite element simulations are shown for the development of pressure ulcers. The models also permit to quantify the sensitivity of the simulation results with respect to input data.

Discussion

All the modeling is based on biological hypotheses and the solution of mathematical problems. Therefore errors may arise as a result of an oversimplification of reality and of so-called truncation errors of mathematical solution methods that arise from the use of a finite resolution. The biological mechanisms are complicated, e.g. as a result of the interaction between various cell types, biochemicals and the mechanical environment. However an adequate mathematical model should pick the most important key-relations that determine the kinetics. This complexity will also be illustrated in the presentation.

Clinical relevance

The work can be used to visualize and quantify biological mechanisms underlying clinically relevant processes which are related to development of pressure ulcers and wound healing. Further, hypothesis quantification and validation may lead to increased understanding and to improved treatment.

Conflict of Interest

Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

A novel MR compatible indentation setup to study the etiology of pressure ulcers and related deep tissue injury

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Introduction

The aim of this study was to design, build and test a new Magnetic Resonance (MR) compatible indentor for research on the etiology of pressure ulcer related deep tissue injury in the tibialis anterior (TA) skeletal muscle in a Sprague-Dawley (SD) rat model. The indentation setup was built as technical improvement of the previously used setup [1,2].

Methods

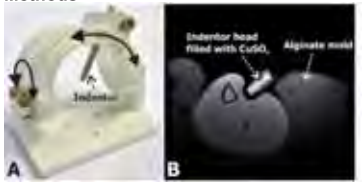

***Fig. 1: A.** MR compatible indentation device. **B.** Indentation of TA muscle.*

MR compatible indentor: The indentation device, shown in Fig. 1A, consists of a holder with a rotatable half arch, on which the indentor can be moved to allow flexible positioning.
Rat model: 7-week-old SD rats (♀, 152-220 gram, n=10) were used. The rat leg was placed in the MR compatible indentation setup. Indentation of the TA muscle, for a period of 2 h, took place inside the MR scanner (Fig 1B).
In vivo MRI: Skeletal muscle injury and physiological changes were assessed with T2 mapping, and angiography protocols. All measurements were performed pre, during and up to 2 h after indentation.

Results

In Fig. 2 T2 maps pre, during and after indentation of the TA muscle are shown. Increased values compared to pre and during indentation were observed in the T2 map after 1 h of indentation. The T2 enhancement seems highly structured.

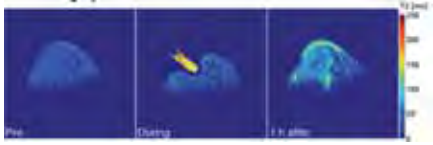

***Fig. 2:** Quantitative T2 maps of pre, during and after indentation.*

***Fig. 3:** Angiograms of pre, during and after indentation.*

Fig. 3 shows angiograms of the blood vessels in the rat leg pre, during and 2 h after indentation. Application of a load to the TA muscle with the indentor resulted in a collapse of a main supplying vessel, whereas several smaller vessels became visible, which could indicate a compensatory mechanism in collateral vessels to account for loss of blood supply. After load release more small vessels became visible, indicative for a hyperemic effect.

Conclusion

A new Magnetic Resonance (MR) compatible indentor was successfully designed, built, and tested. After application of the indentor to TA muscle inside the MRI scanner, increased contrast was observed on T2 maps as a result of increased intracellular and extracellular free water. The possible causes of the increased water density are pathological features associated with deep tissue injury such as inflammation, oedema and haemorrhage. Angiography revealed a collapse of larger blood supplying vessels and a hyperemic effect after load release. We expect that the use of this novel device will provide new insights in the etiology of pressure ulcer related deep tissue injury.

Clinical relevance

(Pre) clinical scientists interested in pressure ulcer research, skeletal muscle damage and musculoskeletal MRI.

Acknowledgements

This research was supported by the Dutch Technology Foundation STW, the Applied Science Division of NWO, and the Technology Program of the Ministry of Economic Affairs.

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Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

Discrimination between diabetic patients with and without diabetic foot ulcer based on testing the cutaneous microcirculation in response to low pressure

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Introduction

Predicting the occurrence of diabetic foot ulcer (DFU) is still limited, it is important to validate a new test that would help in preventing and / or limiting cutaneous lesions highly disabling for patients.
Our team is behind the discovery of the Pressure-Induced Vasodilation first observed in healthy subjects after local application of a gradual pressure on the skin leading to cutaneous vasodilation at the application of pressure. This gain in blood flow delays the onset of ischemia. Over the past five years we have shown that in pathological conditions (eg diabetes), PIV was absent and could not protect anymore the skin in response to external pressure in humans but also in rodents. Moreover the combination of peripheral vascular and nerve alteration makes a diabetic patient particularly susceptible to foot ulceration.
The objective of the study was to demonstrate the impact of neuropathy on the cutaneous microcirculation under low pressure in T2D patients with DFU and without DFU.

Methods

The study protocol was approved by the hospital's medical ethics committee and written consent was obtained from all participants after detailed information was given. The study was performed in T2D patients (50-70 year-old) with DFU (26 patients) and without (26 patients) taking into account the neuropathy score and taking into account lidocain effect. Lidocain, a local anaesthetic will inhibit cutaneous nerve fibers on the site of the measurement.
We assessed the microvascular response to low pressure with and without lidocain close to the foot. The slope of each response will be extracted and then the difference between slopes with and without lidocaine will be calculated for each individual.
Cutaneous vascular responses to acetylcholine (Ach) and sodium nitroprusside were also measured to inform on maximal vasodilation
NDS and NSS scores were evaluated to inform on neuropathy and nerve sensitivities (mechanical and thermal) were assessed before and after lidocain application to inform on nerve capacities.

Results

As expected the microvascular response to low pressure in both T2D groups was reduced. However, the slope of the microvascular decrease was different from the two groups of patients with a greater disparity for the T2D DFU patients (Fig 1).

Figure 1: *Influence of small nerve fibers in the skin vascular response to pressure*

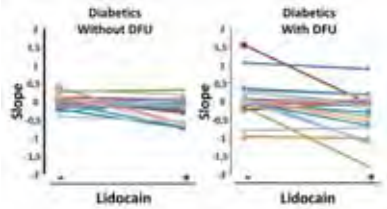
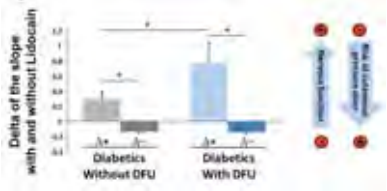


Figure 2: *Nervous reservoir assessment*



Discussion

Within each group lidocain could either worsen or not the slope revealing presence or absence of nerve contribution, respectively (Fig 2). The negative residual slope difference (Δ-) (slope without lidocain – slope with lidocain) was correlated with a high NDS score revealing severe neuropathy whereas the positive residual slope difference (Δ+) was not.

Regarding the vascular response no major differences were observed and it remains to determine a threshold value below which the response is considered at risk.

Clinical relevance

It remains to determine the outcome of each sub groups (Δ+ vs Δ-) in terms of DFU incidence in the T2D patients and in terms of DFU healing capacities/delay in T2D DFU patients.

Acknowledgements

We appreciate the help of Region Rhône-Alpes and ARC2 for funding the study.

Conflict of Interest: none

Home-care wound care – a EWMA document

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Introduction

The aim of this presentation is to give an overview of how wound care is carried out within home care setting as well as to demonstrate what recommendations should be taken into the consideration while developing or evaluating wound care in home care settings.

Taking care of patients with a chronic wound in the home care setting is challenging as Europe has gone through a dramatic shift in the location of service delivery from hospital towards home care settings. As a consequence, more wound-patients with complex pathological comorbidities are being treated at home. Therefore, health care professionals have to acquire skills and knowledge how to manage wounds in the home care setting as there is substantial need for pressure ulcer and chronic wound treatment in home care setting.

Methods

Based on literature reviews in combination with expert opinions from across sectors and areas of expertise a document was elaborated to give an overview of the main current approaches to the organisation of wound care within home-care settings, to identify possible barriers, challenges and opportunities for providing modern, cost-efficient, interdisciplinary wound care. The document has been developed in an intersectoral collaboration across European countries and organisations between the Tissue Viability Society (UK), Initiative Chronische Wunden (Germany), HomeCare Europe and EWMA. Thus, the focus is interdisciplinary and not tied to a specific health care system.

Results

To be able to manage and educate patients, a set of minimum education level and competences as well as wound management techniques and the use of advanced wound care products should be available.

A list of recommended product types, devices and materials will be presented

Discussion

Describing recommendations and raising a debate of how to manage non-healing wounds including pressure ulcers at home is of crucial importance for healthcare professionals, - providers, companies and policy makers as there is a tendency in home care of going towards employment of non-registered nurses.

The document underlines the importance, scope, and level of the appropriate skills and gives recommendations for the interdisciplinary set-up required for wound care in the home-care setting.

Clinical relevance

This document should raise awareness of how to manage wounds at home to health care professionals, providers, patients, informal carers, industry and policy makers.

Acknowledgements

G. Bon, HomeCare Europe; Z. Kis Dadara, EPUAP

Conflict of Interest

The document is supported by an unrestricted grant from BSN Medical, Convatec, Ferris/Polymem, Flen Pharma, KCI, Lohmann & Rauscher, Nutricia and Welcare.

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What Percentage of Hospital-Acquired Grade 3 and 4 Pressure Ulcers are Avoidable?

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Introduction

Following the 2012 "Stop the Pressure" campaign in the NHS Midlands and East Region (1), 5 acute Trusts were able to collate their data regarding their hospital-acquired grade 3 and 4 pressure ulcers (PU). This process facilitated the determination of how many of these pressure ulcers were actually avoidable.

Methods

With the introduction of targets to reduce avoidable PUs (2), there was a focus on having uniformity in how PUs were reported and validated by organisations. All five UK hospitals reporting in this paper utilised the following methodology to determine the avoidability status of a PU acquired within their organisation: incident form completed; tissue viability nurse (TVN) confirms and validates the PU grade; root cause analysis (RCA) commenced by the area's senior nurse; decision made regarding the avoidability or unavoidability of the PU, this being made in conjunction with the senior nurse and TVN, with executive sign off; RCA forwarded to the commissioners for scrutiny.

Results

Table 1: Avoidable/unavoidable status of hospital acquired grade 3 and 4 PU (3)

Discussion

The figures presented here clearly identify that over a one year period, collectively across 5 acute UK NHS hospitals with a total of 2991 – 3187 (seasonal fluctuations) beds between them, following a standardised review process, only 43% of all the full thickness pressure damage (grade 3 & 4) sustained were avoidable; this is less than half of the nationally accepted figure that 95% of PUs are avoidable. In addition, it is believed that this reported figure (43%) is still possibly higher than the actual true number, as it has been highlighted that a small proportion of avoidable pressure damage would have been deemed clinically unavoidable, but for the lack of evidenced care delivery documentation being in place.

Clinical relevance

It may be expected that as clinical acuity of patients increases (4) and with the continued improvements in PU preventative care/strategies and education that the number of PUs deemed avoidable will change. The authors hypothesise, therefore, that there will be an increasing trend of unavoidable pressure damage being reported.

Acknowledgements

We appreciate the help of following for the value of their contribution: Dianne Brett, Lead Tissue Viability Clinical Nurse Specialist; Philippa Clark, Tissue Viability Nurse; Cath Peak, Tissue Viability Clinical Nurse Specialist; Janice Rossiter, Tissue Viability Nurse Specialist; Carole Young, Tissue Viability Nurse Specialist.

Conflict of Interest
Nil

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Do patient safety culture items affect pressure ulcer prevalence in a sample of Norwegian hospitals?

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Introduction

Patient safety culture, staffing, and other organizational factors may affect pressure ulcer (PU) development. However, research findings are inconsistent [1,2]. The aim of this study was to investigate the effect of patient safety culture on the odds of hospital acquired PU (HAPU) in a Norwegian data set.

Methods

We utilized data from two cross-sectional studies collected in 2012. Study 1 investigated PU prevalence. An adjusted version of The European Pressure Ulcer Advisory Panel's (EPUAP) methodology [3] was used. HAPU in this study was defined as PUs not documented at hospital admission based on health personnel's admission notes in patient records. PU was assessed as no ulcer or category I-IV [4]. Study 2 was a part of a national patient safety campaign [5]. The study investigated patient safety culture using three items from the Safety Attitudes Questionnaire (SAQ): safety climate, teamwork and perception of management.
The study includes 84 somatic hospital wards from a sample of hospitals in one region in Norway and a total of 1056 patients ≥18 years. Ward mean scores for the three items were used to predict HAPU odds.
The intraclass correlation (ICC) (ward variance/ward + patient variance ($\pi^2/3$)) was used to investigate the distribution of the variance of HAPU across levels. A two-level logistic regression model was applied.

Results

The ICC of the empty two-level logistic regression model was .21. This could indicate that organizational factors may affect HAPU prevalence. However, none of the patient safety culture items were significant predictors of HAPU (Table 1). But ICC at ward level was still almost 17.5%.

Table 1: *The logistic multilevel regression model with HAPU and patient safety culture items.*

	Model 1	
	OR	95% CI
Safety climate	0.97	0.88-1.07
Teamwork	0.95	0.86-1.04
Perception of management	1.04	0.98-1.10

Discussion

None of the patient safety culture items were significant for development of HAPUs in our adjusted model. Our results confirm those of Ausserhofer et al. for patient safety climate [2]. Still, the ICC at ward level was high and significant in the adjusted model. This could indicate that organizational factors not investigated in this study may have an impact, e.g. other items of SAQ questionnaire, the ward type, preventive measures, patient-to-nurse ratio, seniority of staff, staff attitude and knowledge towards PUs, or patient characteristics. Further research is needed.

Conclusion

The patient safety culture items had no effect on HAPU development in our study.

Acknowledgements

We appreciate the help of the data collectors and coordinators at each participating hospital. Thanks for funding to Oslo University Hospital, The Norwegian Nurses Organization, University of Oslo and Sophies Minde Ortopedi AS.

Conflict of Interest

None

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RNs knowledge of PU risk factors and prevention

in internal medicine of Landspitali University Hospital

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Introduction

Pressure ulcers in hospitals are common and can be difficult to treat. They can lead to decrease in patient's quality of life and increase healthcare system expenses. Studies indicate that the best treatment for PUs is a powerful prevention strategy and healthcare worker vigilance. To ensure that these indications can be followed, healthcare workers must be knowledgeable about PU risk factors and how to prevent them on a daily basis. The objective of this study was to answer the following

1. What is the status of RNs knowledge in the internal medicine department of Landspitali when it comes to PU risk factors and prevention

2. Is there a relationship between type of ward and knowledge?

3. Is there a relationship between clinical experience, age and status of knowledge?

Methods

This was a descriptive study. The population of the study was all nurses currently employed in the internal medicine department of Landspitali University hospital with valid employee e-mail addresses (N=293). Questionnaires were developed by the authors using a modified version of the PUQ-2003 questionnaire and current EPUAP/NPUAP guidelines and the authors' own clinical experience. The validity of the questionnaire was determined by face validity. The cut-off point for sufficient status of knowledge was set at 70%. Reliability was determined via Cronbach's alpha (α=0,701). Three questions were removed from the list for statistical analysis due to suspicion of translation error or wording. 293 RNs in 16 wards of the hospital received the questionnaire and were given 3 weeks to respond.

Results

32,7% of the 293 RNs responded (n=96)

Table 1: *RNs Status of knowledge*

Status of Knowledge	n (%)
70% and over	57 (59,4)
Less than 70%	39 (40,6)

Table 2: *Scoring 70% and over by age*

Age	n (%)
35 and younger	16 (47,1)
36-50	20 (55,6)
51 and older	22 (84,6)

Table 3: *Scoring 70% and over by type of ward*

Ward	n (%)
Rehabilitation/Geriatrics/Hospice	23 (67,6)
Acute internal medicine	32 (53,3)

Table 4: *Scoring 70% and over by clinical experience*

Work experience	n (%)
10 years or less	19 (47,5)
11 years or more	38 (67,8)

Discussion

Despite the low cut-off point determining sufficient status of knowledge only a third of the participants received the needed number of correct answers to score 70% or higher on the questionnaire. This is cause for some concern and indicates that further research may be warranted into the cause of this lack of knowledge. Among the participants, those aged 51 and older had higher scores than younger nurses. The study also showed that 16 years or longer clinical experience reflected higher scores. Type of ward appeared to have an impact on questionnaire outcome but was statistically insignificant (*p=0,176*). Years of clinical experience (*p=0,045*) and biological age (*p=0,01*) seemed to effect status of knowledge. These findings suggest that clinical experience and biological age are determining factors for RNs knowledge of PU risk factors and prevention.

Clinical relevance

RNs are at the front line of PU prevention because of their proximity to patients. Therefore it is important for them to maintain a certain level of knowledge.

Acknowledgements

We appreciate the help of the staff of Landspitali.

Conflict of Interest

No conflict of interest.

References

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PATIENTS AND NURSES EXPERIENCES OF USING THE 30 DEGREE TILT FOR THE PREVENTION OF PRESSURE ULCERS

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Introduction

International & national best practice advocates the use of repositioning as an integral component of pressure ulcer prevention strategies [1]. The findings of study of Moore *et al* suggest that 30 degree tilt technique used 3 hourly at night reduced the occurrence of pressure ulcers by 85%[2]. However the study did not elicit patient & staff nurses experiences of the repositioning technique, which is important to ensure that therapies offered are acceptable to those for whom the therapies are intended. Therefore this study explored the experiences of patients & staff nurses using the 30 degree tilt repositioning technique for the prevention of pressure ulcers.

Methods

A Qualitative descriptive research method was employed.

Sampling:
Patient Selection: Purposive sampling was employed to select all patients who meet the inclusion criteria.
Nurses Selection: Convenience sampling was used to select those willing to participate in focus group interviews.
Data Collection:
For the focus group with the staff nurses, semi structured questioning was employed.
For the one to one interviews with the patients, semi structured questioning was employed.
Ethical Approval:
Ethical approval was received from the University Research Ethics Committee. All four ethical principles were followed to ensure no harm will come to the participants.
Data analysis: Descriptive thematic analysis was conducted using Colaizzi's frame work (1978). Data were transcribed verbatim.

Results

The two main overarching themes that emerged from the focus group and the in-depth interviews were:

1. Theoretical application: Under this theme two sub themes emerged
    a. Prevention
    b. Treatment
2. Practical application: under this theme two sub themes emerged
    a. Advantages
    b. Challenges

Discussion

The study findings suggest that both the patient and nurse participants understood the benefits of using the 30° repositioning technique, in that it relieved pain and promoted comfort, further, for those with existing ulcers some were reduced in size and some healed. The nurse participants found the 30° lateral repositioning was easy and quick to perform. However, a few staff nurses found that three hourly turns disturbed patients sleep at night and that a few agitated patients would not co-operate with repositioning. The patients in the study clearly understood the benefits of repositioning. Indeed, Some participants showed enthusiasm by assisting with repositioning where possible. However, some participants in the study, although they appreciated the overall importance of repositioning, failed to recognise the benefits of it for them.

Clinical relevance

Patients' and staff generally understand the importance of repositioning for pressure ulcer prevention and felt it to be acceptable in terms of both eh prevention and treatment of pressure ulcers. Involving patients, where possible, in decision-making and educating them about their health needs will contribute to enhancing outcomes in the prevention of pressure ulcers..

Acknowledgements

The author is grateful to Professor Zena Moore for the guidance and continued support. The author is Thankful to Ms. Fiona Cleary, DON & Dr. Seamus O'Dea, MD for providing the opportunity and fellow students of my group and colleagues for sharing ideas.

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Evidence-based skin care at the university hospital Charité

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Introduction

At the university hospital Charité hundreds of patients receive daily routine skin care including washing, showering, bathing with or without the use of skin cleansers. Additionally various leave-on products are used including lotions, oils or creams. These personal hygiene and skin care activities are integral parts of nursing, but there is little-known about the benefits, costs and clinical efficacy of skin care in the hospital setting. The promotion of skin health is important especially in bedridden and immobile persons. The aims of our project are to assess and to evaluate skin care interventions and products at the Charité hospital and to develop an evidence-based clinical algorithm to improve the quality of skin care. The project is divided into three subprojects. All over the counter rinse-off and leave-on products were considered. Here we report the results of the first subproject.

Methods

Skin care products available at the Charité were identified via the pharmacy and the purchasing department. Consumption and costs per ward were calculated and quantitatively described. During a smaller qualitative research part semi-structured interviews on 13 wards were conducted.

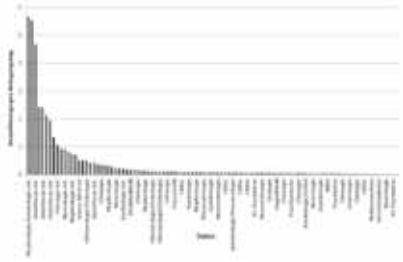
Results

At the Charité 84 skin care products were identified. The three most frequently used products in the year 2012 were Octenisan® hand wash gloves, Bepanthen® Wound- and Healing Ointment and Bübchen® children care bath on 102 included wards. Product consumption was highest on intensive care units (Fig. 2). Overall there was a large heterogeneity in product consumption.

Fig. 1: *Storage cabinet with skin care products*

The interviews revealed similar views and perceptions regarding skin care. Personal beliefs play major roles for clinical decision making. Above all nurses identified the need for guidance for skin care product selection and use.

Fig. 2: *Quantity of used products per patient day*



Discussion

Results indicate large variations in product use and skin care strategies. The choice of skin care products seems to be strongly related to the preferences, experiences and competencies of the individuals. At the same time there is limited evidence about the effects and efficacy of preventive skin care and product performance in the hospital setting [1, 2].

Clinical relevance

Evidence based skin care ensures skin integrity and health. However the broad variations in skin care practice reveal the uncertainties of best care practice and may indicate quality issues.

Acknowledgements

This project is supported by the Charité Foundation, the Clinical Research Center for Hair and Skin Science and the Clinical Quality- and Riskmanagement of the Charité.

Conflict of Interest

None

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Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

Pressure Ulcers due to Stroke patients receiving Percutaneous Endoscopic Gastrostomy

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Introduction

Stroke, one of the most common diseases in Sweden, affects around 26000 residents annually [1]. When stroke leads to neurological dysphagia it is recommended to provide the patient with enteral nutrition (EN) to improve nutritional status. Due to European guidelines [2] Percutaneous Endoscopic Gastrostomy (PEG) is preferable to nasogastric tube feeding when the patient needs nutritional support for a longer period of time. Complications after inserting PEG vary; early complications are reported in between 3-38% of the patients and late complications between 20–28% [3,4,5]. Studies show that elderly patients suffer from malnutrition when admitted to hospital with an increase during the stay [6,7]. Studies also illuminate the relationship between malnutrition and increased mortality [8]. The aim of the study was to retrospectively examine indications, complications and survival of patients receiving a PEG and to study to what extent nutritional status were reported.

Methods

Data was collected from patient records for patients admitted to hospital from January 2006 to December 2009. A total of 161 records were audited for patients that received a PEG during a four-year period at one university hospital and at one local hospital in an urban area in Sweden. Collected data included: age, gender, length of stay, eating difficulties, indication for inserting PEG, body length, body weight, BMI, unintentional weight loss, complications during hospital stay e.g. pressure ulcer.

Results

Of the 161 patients, 92 were women and 69 were males with mean age of 82 years (range 65-98) and 86% of the patients were older than 75 years. Mean length of stay was 34 days (range 8-216 days), Table 1.

Table 1: *Characteristics of patients, n=161(%)*

	Women	Men	All
Age			
65-74	7(4,4)	15(9,3)	22(13,7)
75-84	38(23,6)	31(19,3)	69(42,9)
≥ 85	47(29,2)	23(14,3)	70(43,5)
Living status at admission			
No information	1(0,6)	0	1(0,6)
Private accommodation	68(42,2)	52(32,3)	120(74,5)
Elderly care unit	22(13,7)	14(8,7)	36(22,4)
Dementia care unit	1(0,6)	3(1,9)	4(2,5)

Preliminary results show that complications due to PEG insertion were reported in 45% of the cases, 31% of these had one complication reported and 14 % had more than one complication (range 2-6) reported.

A total number of 116 pressure ulcers (PU) occurred in 81 patients, 38 women and 43 men. Thirty patients had more than one PU, one patient had PU within all four categories I-IV. In age group ≥ 85 years 37 patients developed PU, in age group 75-84 years 31 patients developed PU and in age group 65-74 years 13 patients developed PU.

Clinical relevance

This study shows that complications must be identified early after PEG insertion thus giving a chance of being treated.

Conflict of Interest

The authors have no conflict of interest to declare.

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Stockholm, Sweden

Role of Braden Scale Scoring as a Prognostic Tool for Pressure Ulcers

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Introduction

Pressure ulcers are multifactorial, prevalent, easy to develop and yet preventable morbidity. Pressure ulcers are often resistant to therapy. Traditionally we have used Braden scale as a tool to screen patients into high-risk groups based on 6 subscales. We felt the need for a scale that could predict the prognosis of pressure ulcers. We decided to test the validity of Braden scale as a tool to predict the prognosis of pressure ulcers.

Methods

With this background in mind, a prospective observational study was started, under which we observed all the patients admitted to our neurosurgical ward over a period of 3 years. We observed 3114 patients for development of pressure ulcers. All these patients underwent Braden scale scoring upon admission by qualified nursing staff. Among these patients, 297 developed pressure ulcers and were monitored further for 1 year. An association was sought for between the Braden scale score of these patients and the progress of pressure ulcers (classified as better, worse or healed) at 1 month, 2 months and 1 year. These observations were carried out in ward or follow up OPD. This was done on the basis of serial measurement of dimensions of the pressure ulcer and depending upon the type of granulation tissue present at the base of the ulcer. All our patients received optimal care as per established protocol and the study did not interfere with the same.

A master chart was prepared using MS excel software and the Braden scale of each of these patients, who developed a pressure ulcer was entered in it along with the status of their ulcers after 1 month, 2 months and 1 year. Kruskal Wallis equality of populations rank tests, Pearson chi square test and Fischer's exact test were the statistical tests used. p value < 0.05 was considered as significant. Statistical analysis was carried out using STATA 13. Ethical guidelines as those laid out by the ethics committee at AIIMS were strictly adhered to.

Results

Total number of patients observed- 3114(N)
Patients who developed pressure ulcers- 297(n)
Prevalence- 95.4 per 1000 patients
We analyzed our results and a statistically significant association was found between Braden scale scoring at admission and prognosis of pressure ulcers at all the 3 checkpoints (1 month, 2 months and 1 year- p value <0.05).

Discussion

Pressure ulcers can become a nightmare for caregivers and patients if not prevented, especially in neurotrauma setting. The annual direct cost of treating facility acquired pressure ulcers ranges from $400,000 to $700,000 per year for hospitals as per the International Pressure Ulcer Prevalence Survey 2010. Further their prevalence rates are high though this may vary depending upon the setting. There are numerous studies and a recent Cochrane review [1], which have evaluated Braden scale with varying results. However there is no single study, which has evaluated Braden scale as a prognostic tool and ours, is the first to do so. We conclude that this relatively new role for Braden scale should be explored in clinical setting. While further studies and higher level of evidence may be needed before its universal acceptance, Braden scale's role as a prognostic tool should not be ignored.

Clinical relevance

Braden scale can be assessed as a prognostic tool for pressure ulcers in clinical setting.

Acknowledgements

We appreciate the help of our nursing staff and residents who were involved in day to day care of our patients.

Conflict of Interest- none declared

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Heel Ulcers: Simulations of Injurious Tissue Loads and Remedial Local Drug Delivery

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Introduction

The heel is one of the two most common sites for pressure ulcers [1]. Heel ulcers (HUs) are formed when soft tissues are deformed for extended periods between the calcaneus and a support, causing structural damage and possibly pain [2]. Using a patient-specific three-dimensional (3D) finite element (FE) heel model with a pre-existing ulcer, we evaluated the internal tissue stress conditions that led to the formation of the HU in this case. We then modeled local drug delivery from over the wound bed area and inwards to the tissues, by means of a drug eluting dressing. The drugs considered for this patient-specific simulation were ibuprofen (IB; analgesic and swelling-reducing) and gentamicin (GM; a wide-range antibiotics) [3,4].

Methods

A 3D FE model of the right heel of a 72 years-old male (bodyweight, BW=95kg) who demonstrated a deep HU in an MRI scan was developed (Fig 1a). The tissues included in the model were the calcaneal bone, subcutaneous fat, insertion of the Achilles tendon, and skin. Tissue mechanical properties were all adopted from literature. To simulate the pre-injury anatomy, the HU was virtually removed and replaced with non-ulcerated tissues. The heel was then loaded by downward displacing the superior surface of the calcaneus to simulate foot weight (in the range of 1-3%BW; Fig. 1b) which was verified by calculating resulting posterior heel interface pressures. The simulations were developed and meshed using Simpleware ScanIP (ver. 6) and solved using FEBio (University of Utah). Outcome measures at this stage were the magnitudes and distributions of effective (von Mises) stresses in the soft tissues. Next, the injury was considered again, a debridement was simulated, and drug dispersion in the wound bed was modeled in an off-loaded position (Fig. 3a). For this purpose, a tightly-overlaying dressing was placed on the wound cavity and surrounding area. Drug concentrations in the tissues over time were governed by Fick's 2nd-law of diffusion in 3D. COMSOL Multiphysics (ver. 4.4) was used to model the discharge of IB and GM (separately) from the dressing, based on empirically determined release profiles (Fig. 3b) [4]. Using the Mackie-Meares theory [5], diffusion coefficients (D) were calculated for IB (D=658 μm^2/s) and GM (D=364 μm^2/s).

Results

Our modeling predicted HU injury thresholds of 15-23 kPa in skin, and 11-35 kPa in fat, upon a support with elastic modulus of 80kPa (Fig. 2). Drug diffusion lines and concentration differences are depicted in Fig. 3.

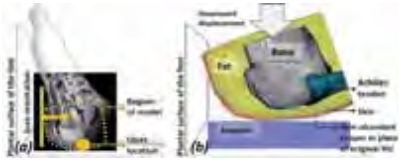

Fig. 1: *–Scan orientation, region of interest and HU location (a), model components and applied displacement (b).*

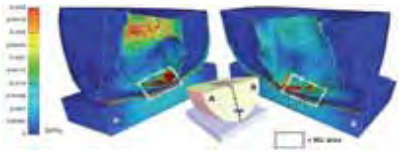

Fig. 2: *The effective stress distribution causing the injury. The calcaneus was made transparent for presentation only.*

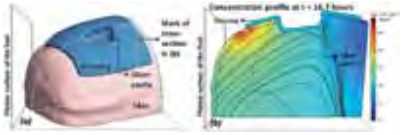

Fig. 3: *Diagram of gentamicin concentration at a cross-section marked in (a), 17 hours after placing the dressing (b).*

Discussion

We present, for the first time, a case study of HU which was used for back-calculating injury thresholds in terms of effective tissue stresses. We further demonstrate the usefulness of computational modeling in treatment planning, in the emerging field of drug eluting dressings.

Clinical relevance

We show the potential of patient-specific modeling in risk assessment and treatment planning of HUs.

Conflict of Interest
None.

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Changes in topography and structural properties of healthy aged skin after loading

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Introduction

Pressure ulcers (PUs) and incontinence-associated dermatitis (IAD) are common skin disorders in elderly immobilized patients. Mechanical loading, particularly shear plays a major role in the pathogenesis. Age-related increases in skin roughness [1] and stiffness [2] are believed to enhance the susceptibility to damage in this vulnerable population [3]. The aim of this explorative study was to quantify possible changes in skin topography and structural properties following standardized loading regimes in healthy aged subjects.

Methods

Twenty skin-healthy female subjects were recruited. The study was approved by the institutional ethics committee. Subjects were asked to maintain standardized lying postures in supine position on a standard hospital mattress with standard lining, while wearing standard hospital night shirts. Measurements of skin topography and structural stiffness properties were conducted before and immediately after 90 and 150 minutes of continuous loading. Measurements have been conducted on the areas of the sacrum, heels and upper back where PUs/IAD often develop.

Results

Fig. 1: *Example images of skin surface before and after loading.*

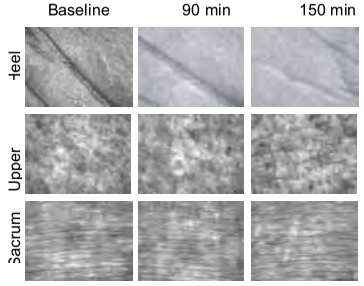
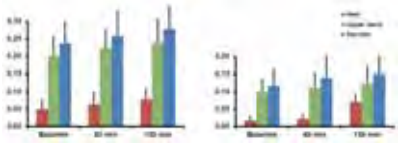


Table 1: *Skin topography: roughness parameter Rz.*

	Baseline	90 min	150 min
Heel, mean (SD)	61.6 (19.3)	54.0 (19.1)	51.6 (19.2)
Upper back, mean (SD)	53.5 (10.7)	53.6 (13.1)	57.2 (13.7)
Sacrum, mean (SD)	44.1 (13.8)	44.6 (13.3)	44.8 (12.1)

Fig. 2: *Total structural extensibility (left) and elastic deformation of the skin (right) before and after loading (units are mm).*



Discussion

In the current study we demonstrated that after loading in a clinical simulation of immobility, skin roughness remained unchanged at the upper and lower back, but showed a decrease at the heels.
The structural extensibility and elastic deformation of the skin increased at all the three tested areas after 90 and 150 minutes of bodyweight loading on a standard hospital mattress, that is, overall, the skin was experiencing growing deformation levels under the sustained loading over the time course.
Both the changes in roughness and structural deformation were most remarkable at the heels. This might be explained by two anatomic differences, firstly the stratum corneum is about 10 times thicker there compared to other skin areas, and secondly heel skin generally lacks supporting fatty tissues between the skin and the bony prominences. These differences between behaviors of the skin areas under loading could indicate different pathogenic pathways to onset and development of PUs/IAD.

Clinical relevance

Understanding the aforementioned anatomical-site-dependent differences between structural skin behaviors under and post loading should support development of technologies for preventing PUs/IAD e,g, in textiles and support surfaces.

Acknowledgements

We thank Annette Andruck, the CRC study team and the volunteers for conducting and for participation in the study.
Conflict of Interest: none.

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The quest for smart materials to protect the fragile skin: Computational modeling of how shear and microclimate influence skin that rubs against clothing, incontinence pads, diapers etc.

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Introduction

Increasing evidence exist that the skin-clothing, or, more generally, any skin-material (e.g. skin-incontinence pad or skin-diaper) frictional properties and the microclimate, which together constitute the local thermo-mechanical conditions within and around skin tissues, strongly influence the susceptibility of skin to lesions. Lesions may include blistering, skin tearing and incontinence-associated dermatitis - if urine and/or faeces are present. All of these play a role in development of superficial pressure ulcers (SPUs). During hospitalization, changes in microclimate parameters, particularly local skin temperature and moisture contents, but also exposure to urine and stool, affect frictional properties between the skin and clothing/materials as well as the skin's stiffness and strength properties, which makes skin more susceptible to deformation damage [1,2]. In addition, while repositioning, caregivers may apply large shear forces that can cause mechanical failure of the already vulnerable skin. For skin tissues that have been subjected to disuse-related or age-related changes [3] which cause loss of tissue mass, stiffness and structural strength (including less dermal-epidermal interlocking; DEI), and which are further exposed to the aforementioned conditions, protection by "smart hospital clothing" or other technological concepts can be considered. However, development of such friction-reducing technologies requires standard, objective and quantitative tools to evaluate efficacy. Here we provide a computational modeling framework to study skin-clothing/material mechanical and thermal interactions, e.g. due to friction, skin/ambient temperatures, humidity and support permeability in isolation or in combination, using multiphysics finite element (FE) analysis.

Methods

The modeling considers a volume of interest containing the tissue layers (Fig. 1) of the *stratum corneum*, *epidermis* and *dermis* (including the dermal-epidermal junctions; DEJs) and *subcutaneous fat*. Shear strains and thermal energies were calculated to indicate extents of mechanical and heat loads – pointing to risk levels for tissue breakdown e.g. while clothing is rubbing against the skin in a frictional sliding condition (relevant to blistering as a pathway to SPUs). The constitutive laws for the *stratum corneum*, *epidermis*, *dermis* and *fat* were each set as hyperelastic neo-Hookean, and the clothing was linear elastic. Dimensions and mechanical properties for the tissue layers were all adopted from literature [4].

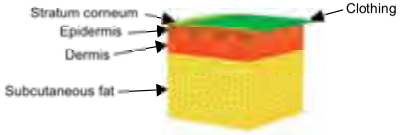

Fig. 1: *The tissue layers and clothing/material in the model.*

Results

Example distributions of shear strains and thermal energies while the skin is rubbing against a piece of clothing are shown in Fig. 2, which depicts that mechanical (left frame) and thermal loading (right frame) both concentrate at the DEJs and hence, the modeling identifies these interfaces as potential failure sites.

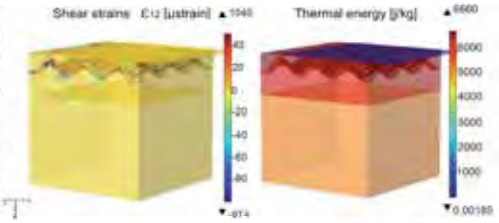

Fig. 2: *Calculated distributions of shear strains (left frame) and thermal energies (right frame) in the layers of the skin.*

Discussion

Using multiphysics FE modeling, mechanical and thermal effects of frictional and microclimate conditions and their interactions can be determined. The shear strains concentrated at the DEJs (Fig. 2), which points to the role of DEI in preventing skin breakdown, particularly those occurring through a "friction blister" pathway. Clinically, it is commonly accepted that adequately structured DEJs protect against blistering damage, and that friction blisters do occur in the stratum spinosum of the epidermis. The modeling supports that, and further provides the means to address research questions related to changes or damage to the DEI. The finding that mechanical and thermal loads concentrate in the DEJs should hence be a start point for research on skin breakdown in disuse and aging. The present modeling is suitable for testing e.g. concepts of smart, low-friction clothing, incontinence pads/diapers, consequences of exposure to urine and faeces including the influence of enzymatic activities on the stiffness and strength of the skin layers, effectiveness of skin cleansing, efficacy of friction-reducing creams/lotions etc.

Clinical relevance

Smart clothing/materials to minimize SPUs are considered; modeling was conducted to facilitate the design of such new medical technologies.

Conflict of Interest: None

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Development of biomarkers for the Wound Fluid RT-PCR method to detect critically colonised and infected wounds

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Introduction

Bacterial identification is insufficient for diagnosing chronic wound infection because all open wounds contain bacteria. Moreover, a relatively new concept of bacteria-related wound status "critical colonisation" manifests as delayed healing without overt clinical signs and symptoms, therefore invalidating diagnosis by clinical observations. Thus, it is imperative to develop a rapid, accurate and objective method to detect only problematic statuses caused by the presence of bacteria (critical colonisation and infection) that are in need of immediate clinical interventions. We previously developed the Wound Fluid RT-PCR method to discriminate wound statuses using gene expression analysis of cells in rat wound fluids [1]. The purpose of this study was to develop biomarkers of critically colonised and infected wounds in humans by applying this method.

Methods

To identify marker genes for distinguishing critically colonised and infected wounds from those with other statuses, we narrowed down candidate marker genes using rat wound models. The models were designed to manifest four distinct wound statuses according to the infection continuum: control, colonisation, critical colonisation and infection [2]. Briefly, we created full-thickness wounds on the flank region of male Sprague-Dawley rats and inoculated different concentrations of *Pseudomonas aeruginosa*. Wounds were covered with polyurethane film dressings and wound fluids were collected. RNA was extracted from cells obtained from post-wounding day 6 wound fluids and subjected to gene expression profiling by DNA microarray to generate lists of promising genes. Eleven patients with pressure ulcers were entered into this study. Wound statuses were judged retrospectively with sequential observations and divided into the normal healing, critical colonisation and infection groups. We collected used gauze from these patients containing wound fluid and extracted RNA. The expression levels of the listed genes were evaluated in each group by real-time RT-PCR.

Results

A total of 550 candidate marker genes were identified that expressed a less than 1.5-fold change in the colonisation group compared with the control, a more than 2.0-fold change in the critical colonisation group and a more than 10-fold change in the infection group by the DNA microarray data. Of the 20 tested candidate marker genes from the top of the list, expression of *NPPB*, *ITGB6*, *CPNE4*, *EML5* and *ITSN1* were detected in the all critically colonised and infected wounds (7/7 samples) but not detected in the normal healing wounds (0/4 samples) in human wound fluid samples. *CPEB1* expression was detected in 6/7 critically colonised and infected samples and 0/4 normal healing samples (**Table 1**). The genes *NPPB*, *ITGB6*, *CPNE4*, *EML5* and *ITSN1* had 100% sensitivity and 100% specificity for detection of critical colonisation or infection.

Table 1: *Diagnostic accuracy of the marker genes*

Group	*NPPB*	*ITGB6*	*CPNE4*	*CPEB1*	*EML5*	*ITSN1*
Sensitivity	100%	100%	100%	85%	100%	100%
Specificity	100%	100%	100%	100%	100%	100%

Discussion

We have identified a number of marker genes that can distinguish normal healing and critical colonisation in clinical settings by the presence or absence of their expression using the Wound Fluid RT-PCR method.

- This method enables us to investigate gene expressions at the wound site without pooling exudate and to assess wound status effectively.
- This study shows the possibility of using these markers clinically even for wounds with polymicrobial infections.
- Further mechanistic research for these marker genes in the context of wound infection may lead us to an understanding of pathophysiology of critical colonisation.

Clinical relevance

We anticipate these biomarkers will be applied to future clinical settings in the form of a handy diagnostic kit that can diagnose critical colonisation on the spot. It is supposed to be non-invasive, prompt and more accurate than conventional biomarkers for infection.

Acknowledgements

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Conflict of Interest
The author declares no conflicts of interest.

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Biomechanical simulation of the Charcot neuroarthropathic foot with plantar ulcer.

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Introduction

Diabetic patients with long-term diabetes are mainly affected by peripheral neuropathy. This lack of sensitivity induces a destructive process affecting joints and bony structures which can lead to the Charcot neuropathic osteoarthropathy (CNO). The CNO results in dramatic deformities and dysfunctional foot and ankle complex. For 15 to 43% of the patients, joints are damaged in the tarso-metatarsal zone leading to a mid-foot breakdown. This situation is described as type 2 CNO in Sanders classification [1]. The destruction and osteo-synthesis create deformities and cause luxations. The gait and stance are modified and overloads occur because of overpressures below the bony prominences. As the neuropathy makes the region insensitive to pain foot ulcers can appear. The principal suspected causes are excessive compression intensity (leading to internal strains above 50% for about 10 minutes) and duration (leading to internal strains above 20% for about two hours) [2]. Currently, there is no way to prevent foot ulcer resulting from the foot anatomy reconfiguration induced by CNO.

Methods

To explore this issue, a Type 2 CNO foot was reconstructed using the CT-Scan modality and the corresponding biomechanical finite element (FE) model was created. This model includes bones as rigid bodies and represents the soft tissues of the foot as two different sub-domains each modeled using a Neo Hookean material with Young moduli and Poisson ratios of 200 kPa and 0.495 for the skin, 40 kPa and 0.49 for the fat/muscles tissues. The sole of the foot model is put in contact with a virtual horizontal pedobarographic platform.

The Charcot patient was asked to perform a static standing acquisition of plantar pressures using a Zebris platform. The collected pressures were applied on the FE foot sole in order to compute internal strains. Then, the foot model including gravity and contact with the virtual pedobarographic platform was used to simulate a standing position. The corresponding sole pressure (SSPP: standing simulated plantar pressure) and internal strains thus computed can therefore be respectively compared with the measured standing plantar pressures (MSPP) and with the internal strains simulated from the MSPP boundary conditions.

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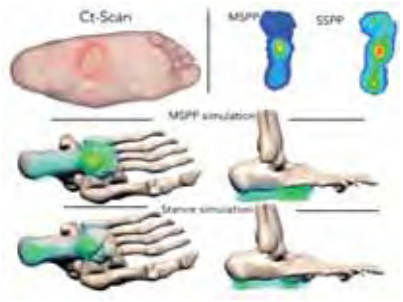
Results

The volumes and location of the largest clusters with contiguous nodes with Von Mises (VM) strains over 20% or 50% are similar (errors<5%) between measured pressure applied and static simulations. The simulated peak pressure value is also close to the one measured with the patient in weight bearing position. (Table 1) Fig 1.

Table 1: *Volume, in cm^3, of the largest cluster of nodes with a VM strain above 20% and 50%, the peak plantar pressure and their deviation in %.*

Conditions	MSPP	SSPP	Deviation
Mean cluster volume with strains over 20 % in mm^3	1.92E^{-01}	1.84E^{-01}	4.16%
Mean cluster volume with strains over 50 % in mm^3	4.76E^{-02}	4.70E^{-02}	1.26%
Peak Plantar pressure in N/cm^2	20	19.62	1.90%

Fig. 1: *Top: CT-Scan, MSPP and SSPP maps. Middle: MSPP applied: strains clusters. Low: Weight bearing simulation: strains clusters*



Discussion

The FE model of the type 2 CNO is able to predict, in weight bearing position, the location and the proportion of the Von Mises Strains in the soft tissue of the diabetic foot. The location is similar to the real plantar ulcer for this patient and the plantar pressure values are in accordance with the measurements. Indeed, a peak pressure value of 19.6N/cm^2 is simulated in regard of the cuboid bone, which happens to be the actual location of the ulcer.

Conflict of Interest

Some authors are involved with the TexiSense Company (http://www.texisense.com/home_en).

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Pressure Ulcers in Landspitali University Hospital in Iceland, prevalence, seriousness and prevention

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Introduction

The aim was to study: a) the prevalence, seriousness and site of pressure ulcers among inpatients on a specific day, b) risk factors among patients with pressure ulcers, c) preventive measures, types of under lays and planned repositioning intervals at Landspitali University Hospital. The aim was also to compare these results to a prevalence study made in May, 2008 in Landspitali.

Methods

This was a descriptive cross sectional study. The population was inpatients, 18 years and older, at Landspitali on April 17th, 2013. Excluded were maternity and psychiatric units. The European Pressure Ulcers Advisory Panel's (EPUAP's) study sheet was used.

Results

The sample was 52% (n=227) of admitted patients. Pressure ulcer prevalence was 19.5% (n=44). Pressure ulcers grade 1 were 36% (n=16), grade 2 32% (n=14), grade 3 23% (n=10) and grade 4 9% (n=4). Eight patients had two pressure ulcers, three had three ulcers and one had four ulcers, totally 61 ulcers. These results are almost the same as in 2008 with prevalence 21.5%.

The most common sites of ulcer were on sacrum (n=23), heels (n=9), tuberosities ischii (n=9). Patients at risk according to the Braden scale (<18 points) were 48% (n=108). Eleven patients at risk and two of them suffering from pressure ulcers were lying on standard sponge mattresses and four patients without risk were lying on air-mattresses. Three planned turning schemes were found.

Discussion

Prevalence of pressure ulcers was rather high compared to other studies. Prevention of pressure ulcers seemed to be inconsequent, as the use of under lays was not always determined by the risk of the patients and too few turning schedules were found compared to the number of patients at risk. The use of electronic health records was beneath expectations.

Clinical relevance: Hospital authorities have shown interest in the rather disappointing results and have decided to increase financial input to fight pressure ulcers in Landspitali.

Acknowledgements: We are greatful for the help of our co-workers in collecting data for the study. We also appreciate the support from The Icelandic Nurse´s Association, The Icelandic Wound Healing Society and Landspitali University Hospital who all supported the study with a research grant.

Conflict of Interest: None

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The effect of a simple three-step pressure relieving strategy for preventing pressure ulcers: an explorative longitudinal study from 2002-2011

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Objective:
Pressure ulcers (PUs) still form an important and distressing problem in Dutch nursing homes. Pressure ulcer prevention protocols are generally based on current guidelines. We developed an alternative three-step protocol to help prevent pressure ulcers. We calculated in this study the effects of this new three-step protocol on the prevalence of pressure ulcers in patients at risk of developing PUs in the Avoord nursing homes in Etten-Leur/Zundert (Netherlands). In addition, the protocol's general cost effects were explored.

Method:
Data on the prevalence of pressure ulcers and the use of preventive measures were derived from the annual independent National Prevalence Measurement of Care Problems of Maastricht University (LPZ). This annual measurement was implemented in 1998 and measures care problems such as the prevalence of PUs and related preventive measures. Data on patients at risk of developing PUs at the Avoord nursing homes in Etten-Leur/Zundert (Netherlands) were analyzed and compared with national data between 2002 and 2011.

Results:
The introduction of the three-step protocol resulted in a significant reduction of the nosocomial prevalence of category 2 to 4 pressure ulcers. The prevalence was reduced from 8.7% to 0.5% during the first year and remained stable at about 2% throughout the rest of the study period. The prevalence at national level also decreased during this period, but not as much and was still significantly higher in 2011.

The use of alternated systems decreased to almost 1%. Use of static air mattresses showed an almost linear rise in the Avoord nursing homes from the start of the implementation of the protocol, while the trend for both types of mattresses remained stable on a national level. Introducing the static air mattress instead of the more expensive alternating mattresses helped to reduce the mean daily costs of mattresses at the Avoord nursing homes by over 70% compared to national figures. The workload of the nursing staff decreased as well thanks to the reduction of repositioning.

Conclusion:
The introduction of the three-step protocol showed to be effective. The prevalence of PUs and the mean daily costs were reduced to and have been sustained at a significantly low level.

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Suspected Deep Tissue Injury on Heels of Nursing Home Residents: Development and Evolution within 16 weeks

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Introduction

Heels are more prone to deep tissue injuries (DTIs) than other anatomical locations.[1,2] Heel DTIs are more prevalent among elders but have not been widely studied within this group. Historically, DTIs were placed in the same category with Stage I pressure ulcers (PUs) [4], but in 2007 the National Pressure Ulcer Advisory Panel (NPUAP) recognized DTIs as a separate entity.[5] Detection is difficult but critical for viable tissue rescue. Detection is focused on observation of skin discoloration (for which little evidence of effectiveness exists) that occurs when damage has already progressed within tissues. The time of injury precedes DTI from 3 to 5 days opening the door for a biophysical measure of early damage.[6]. Initial reports suggested DTI severity progressed aggressively; 73% deteriorated into full thickness PUs.[7] Recent studies found many DTIs remain stable or resolve. [8,9] Research is needed on heel DTIs because of the clinical problem that DTI presents and the faulty existing detection methods.

Methods

In a large nursing home (NH) study (N=417), visual assessments and sub-epidermal moisture (SEM) were obtained weekly for up to 16 weeks. From this cohort, we identified participants with a DTI on either heel (33 participants with 40 DTIs; 8% prevalence). SEM was measured with surface electrical capacitance and a dermal phase meter, higher readings indicate greater SEM (range 0-70). Visual assessment was rated as normal, erythema, stage I PU, DTI, and stage II+ PU.

Results

Participants with heel DTI had a mean age of 75.3 (SD 15.1) years, were 70% female, 24% non-Hispanic white, 21% Hispanic, 48% African American, at PU risk (mean Braden Scale score =14.1, SD 2.8); functionally dependent (U.S Minimum Data Set (MDS) mean bed mobility score 2.9, SD 1.2; transfer score 3.4, SD 0.9; both range 1-4). Length of NH stay ranged from 5 months to 4 years (1 person was newly admitted) Heel DTI incidence was 5% (21 participants with 24 DTIs); another 16 DTI (from 14 participants) were present at baseline. Photographs and visual assessments over time were used to describe the natural history of each heel DTI. Of the 40 DTIs, 20% resolved to erythema or normal skin; 25% progressed to full thickness PUs; 55% persisted during study (followed up to 16 weeks; mean weeks follow-up=12.9, SD 4.1). SEM was higher for resolved DTIs compared to DTIs that progressed or persisted (29.0 vs 27.6 and 25.4, respectively). Researchers observed PU prevention for all participants with DTIs: bed support surfaces (61%), heel protectors (64%), pillows for off-loading (91%). Mean SEM was elevated the week prior to observation of DTI, compared to contralateral heel (29.1 vs 27.9 for right heel DTI, 30.4 vs 28.2 for left heel DTI).

Discussion

Fewer DTIs progressed to full thickness PUs than previously reported. Many DTI persisted in spite of consistent standard prevention efforts provided. SEM detection of DTI prior to observation on the skin surface has promise for identifying early damage and predicting progression. This would allow more aggressive intervention earlier in the course of the damage. DTIs that developed late in the study might resolve if observed past the 16 week study period.

Clinical relevance

Not all heel DTIs progress to severe PUs. Efforts to identify DTIs that resolve versus DTIs that progress is needed. SEM detection of DTI damage prior to observation on the skin surface has promise for identifying early damage and predicting progression, allowing more aggressive intervention earlier in the course of the damage.

Acknowledgements

5RO1NR10736-2 **Conflict of Interest:** None

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Pressure Ulcer Prevalence 2011-2014: Data from the International Pressure Ulcer Prevalence™ Survey

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Introduction

There has been a generalized focus in pressure ulcer prevention efforts across many national healthcare systems. A large number of guidelines and protocols have been established for PU prevention and treatment. The International Pressure Ulcer Prevalence™ Survey has collected data on pressure ulcer prevalence since 1989, and currently surveys over 100,000 patients each year in order to evaluate ongoing progress toward a reduction in pressure ulcer prevalence. Participating countries for the 2014 survey include the United States, Canada, Australia, Lebanon, Philippines, Saudi Arabia, Turkey and the United Arab Emirates. This report will serve as a follow up to a previous report [1] and provide summary data of overall pressure ulcer prevalence (OP) and facility acquired pressure ulcer prevalence (FAP) data from 2011-2014 limited to the US and Canada.

Methods

As part of quality improvement efforts, participating facilities perform prevalence surveys in their facilities during a pre-determined 24 hour period within a pre-selected 2 to 3 day window (this year the survey was conducted 18-20 Feb, 2014). The types of facilities included in the survey include acute care, long-term care or nursing homes, long-term acute care hospitals, and rehabilitation facilities.

While the goal of the survey is to assess all admitted patients in a facility, 100% patient inclusion is not mandated for participation. Sites sign up on the sponsor's website and receive study materials consisting of data collection forms, educational materials and general instructions. Facilities then receive a detailed report demonstrating individual progress and aggregate data are summarized for trends. Overall prevalence (OP) is defined as the number of patients who have pressure ulcers/total patients surveyed. Facility acquired pressure ulcer prevalence (FAP) is defined as those patients who did not have ulcers documented on admission to the facility/surveyed patients. Only aggregate data is publically reported and no protected health information is collected during the survey.

Results

Data from 2011-2014 surveys included 414,384 patients, (see Table 1). The majority of the data (~94%) was from the US and Canada. Overall, OP has slightly declined ranging from 11.2% in 2011 to ~10% in 2013/2014. US OP decreased from 10.8% in 2011 to 9.6/9.7% in 2013/2014. Canadian OP is higher decreasing from 19.4% in 2011 to 15.8% in 2013 and up again to 17.4% in 2014, however, there were significantly fewer patients in this data set. FAP has decreased in US participating facilities from 4.3% to 3.2%-3.4% in 2013/2014 while Canadian facilities' FAP was 12.5% decreasing to 10.6/10.9% in 2013/2014.

Table 1: PU Prevalence data 2011-2014

All Participants	# of Facilities	Total # of Pts	OP	FAP	OP (excl Stg I)	FAP (excl Stg I)
2011	832	104,557	11.2%	4.7%	8.4%	3.1%
2012	885	104,915	10.1%	4.1%	7.7%	2.7%
2013	980	103,429	10.0%	3.7%	7.7%	2.5%
2014	1010	104,480	10.2%	3.9%	8.1%	2.9%
US Data						
2011	882	81,724	10.8%	4.3%	8.2%	2.9%
2012	831	80,769	9.3%	3.5%	7.5%	2.4%
2013	880	91,097	9.6%	3.2%	7.6%	2.3%
2014	917	91,145	9.7%	3.4%	7.9%	2.5%
Canadian Data						
2011	37	6,080	19.4%	12.5%	12.5%	7.0%
2012	37	4,755	19.5%	12.5%	11.9%	7.1%
2013	50	5,538	15.8%	10.6%	10.1%	6.1%
2014	58	6,005	17.4%	10.9%	11.4%	6.5%

Discussion

Pressure ulcers are costly and lead to deleterious changes in patient's quality of life and physical condition. Hospital quality drivers in the US (Joint Commission Accreditation, IHI, AHRQ, and others) and reimbursement entities (CMS) have placed a significant emphasis on decreasing pressure ulcers beginning in 2006, when facilities began preparing for changes in reimbursement and quality reporting (2005 US OP was 15.2% and FAP was 7.3%) [1]. The decreases in prevalence since that time may demonstrate that a reduction in PUs is possible, but requires time and significant effort to affect change.

Conflict of Interest: The authors are employees of Hill-Rom.

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Cost analysis and effects of one of the first outpatient wound clinics in the Netherlands

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Introduction

The burden of treating chronic wounds is growing rapidly due to an ageing population and a sharp rise in the incidence of diabetes and obesity worldwide [1-4]. At any time almost 1% of the world's population suffers from chronic wounds, with associated costs accounting for more than 2-4% of health care expenses [5]. The economic and effectiveness evidence of wound care community clinics in the UK encouraged us to perform a cost-analysis of one of the first outpatient community wound care clinic in the Netherlands.

Methods

This study involved a cost analysis based on an observational cohort study with a 1-year pre- and a 1-year post-admission comparison of costs. Patients were included when they first consulted the outpatient wound care clinic. They were all health insured by one health care insurance company Cooperation VGZ. A standard six-step procedure for performing cost studies was used to calculate the costs [6-8]. Given the skewed cost data non-parametric bootstrapping was used to test for statistical differences.

Results

172 patients were included in this study. The difference in wound care related costs between the year before and after admission to the wound clinic resulted in a reduction of €2,621 per patient in the base case analysis. The categories 'general practitioner', 'hospital care', 'mental healthcare' and 'patient transport' scored lower after admission to the wound clinic.

Discussion

In this study only the reimbursement data of patients of one health insurance company and specifically only those made under the Dutch Health Insurance Act were available. Because of its observational design it is not possible to conclude on the plausible causality of the introduction of an outpatient wound clinic versus noticeable changes in reimbursement costs in the year post admission. Nevertheless this study is a first attempt of a cost analysis of an equipped (outpatient) wound clinic as an innovative way of responding to the increasing number of chronic wounds in the Netherlands. The calculations show that savings in wound care are possible.

Clinical relevance

The emergence of outpatient wound centres reflects the increasing incidence and prevalence of chronic wounds as well as the costs to the health care systems these patients represent. Except for the attention paid at the wound care quality it is essential to establish a financially viable enterprise [9-12].

Conflict of interest

First author AALM Rondas, PhD student at the Maastricht University is working at the outpatient wound clinic as physician.
The research data were though provided externally by Cooperation VGZ and checked by the academic co-authors.

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EUROPEAN PRESSURE ULCER ADVISORY PANEL

NURSES' ATTITUDES AND PERCEIVED BARRIERS TO PRESSURE ULCER PREVENTION IN JORDAN

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Introduction

Pressure ulcers are common problem in different clinical settings. The sum of prevention modalities organized in the form of protocols is a key point for effective prevention. A number of these pressure ulcer prevention protocols have been reported in literature. The actual application of these protocols depends on the nurses' desire to perform these interventions and on the existing barriers to this practice. In Jordan evidence regarding nurses' attitudes and practice is lacking.

The purpose of this study is to explore Jordanian nurses' attitudes toward the prevention of pressure ulcers, and to identify the barriers that exist to pressure ulcers prevention as perceived by the participant nurses.

Methods

Across-sectional multi-centre study was undertaken in four hospitals in Jordan. The registered and practical nurses working at these sites were requested to complete a self-administered questionnaire.

Results

The participant nurses hold positive attitudes regarding pressure ulcers prevention (Mean=3.91). The only factor that seems to have an effect on the positive attitude was the experience of the participants (X2(2, n=227) = 6.38, P=0.041). The positive attitude was enhanced with increased number of years of experience. Several barriers to good practice were reported by the participants, including: lack of staff (86.2%), time (83.6%), and patient conditions (68.6%).

Discussion

Findings of this study suggest that positive attitudes are not enough to change the practice. Several barriers need to be resolved first if effective prevention is to be provided. This should form a reference dataset that needs to be addressed in the tissue viability field in Jordan, which is still in its infancy.

Conflict of Interest
None to declare

Knowledge among ICU nurses about pressure ulcers prevention

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Introduction

Most pressure ulcers are avoidable. However, the prevalence of pressure ulcer in Intensive Care Unit (ICU) remains unacceptably high 16.8 % [1]. Despite the importance of PU prevention and development of international evidence-based guidelines, several studies have demonstrated various levels of nurses' knowledge of risk assessment and PU prevention. The aim of the study was to describe the knowledge among nurses about preventing pressure ulcer and compliance to guidelines.

Methods

In total, 100 nurses from one intensive care unit in the middle of Sweden participated. Data was collected September 2013 to October 2013 where the participants completed the Swedish version of the original Pressure Ulcer Knowledge Assessment Tool (PUKAT) [2]. The PUKAT has been translated into Swedish and recently been used in a study by Gunningberg et al, 2013 [3]. Mean knowledge score of ≥ 60% was satisfactory.

Results

The mean knowledge for the sample was 62.3%. One fourth (27.2%) of the nurses knew that lack of oxygen causes pressure ulcers. 18.4 % knew that supine position- side 30° lateral position- reduces pressure risk the most. Likewise, 54.5% of the nurses completed a skin assessment on the patients' skin suit. Furthermore, 14.9 % of the nurses used European Pressure Ulcer Advisory Panel (EPUAP) classification from category 1-4, when assessing pressure ulcers. Among the nurses 55% knew about the guidelines.

Discussion

There is a knowledge deficit in pressure ulcers prevention among ICU nurses in Sweden. This study provides an insight into ICU nurses knowledge about pressure ulcers prevention and compliance to guidelines. A major educational campaign needs to be undertaken. Emphasis should be on understanding the etiology of ulcers and developing of PU.

Clinical relevance

The findings underscore the importance of continuing PU prevention education for ICU nurses. Nursing leadership in the health care settings has a significant task to emphasize the core elements in patient care.

Acknowledgements

To all nurses who participated.

Conflict of Interest
None

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Patients with pressure ulcers – from prevention through treatment to healing – results from the national quality registries RUT (Registry of Ulcer Treatment) and Senior alert

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Introduction

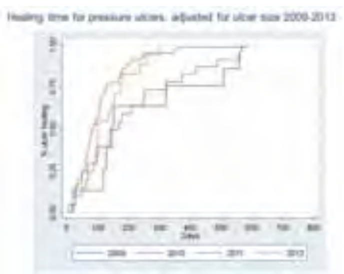
To follow patients with pressure ulcers from prevention through treatment to healing or clinical negative event by using the two Swedish national quality registries on pressure ulcers: Senior Alert for prevention and RUT (the Registry of Ulcer Treatment) for data on healing.

Methods

By using a common IT platform at UCR (Uppsala Clinical Research Centre) results from the two registries are used to follow patients with pressure ulcers to show the impact of prevention on healing time and the patients' well-being and Health Related Quality of Life (HRQoL).

Results

In May 2014 there were 2283 patients registered in RUT, i.e. almost 10% of all patients with hard-to-heal ulcers in Sweden.
The median age for all patients with hard-to-heal ulcers was 81 years compared with 73 years for patients with pressure ulcers.
For all ulcers, women constituted 60% compared to 45% for patients with pressure ulcers.
The median ulcer size for all ulcers was 3.25 cm² compared with 10.7 cm² for pressure ulcers.
Median healing time was 146 days in 2009 compared with 71 days in 2013 for all ulcers and 92 days in 2014 for pressure ulcers.
Antibiotic treatment was reduced from 71% in 2009 to 22.4% in 2013.



In Senior Alert there were over 500 000 registrations concerning prevention for pressure ulcers but only 12% developed a pressure ulcer.

Discussion

The healthcare system requires information on the burden of care in order to inform decisions on the needs of the population and the allocation of resources. Cooperation between the two registries on prevention and treatment of patients with pressure ulcers whether the patient is older, in palliative care or a younger patient with neurological diseases, can give a more complete picture of pressure ulcer care nationally.
The registries are used daily and nationwide in Sweden [1,2] covering every level in the healthcare system such as primary care, community care, hospital care, wound healing centres and private caregivers.
Focusing not only on healing but largely on the patients' HRQoL, the registries can give supplementary information on the situation of these patients.
Together the registries demonstrate the potential for improved wound management while using national quality registries for structured ulcer care.

Clinical relevance

To use the resources of national quality registries which focus on prevention, treatment and continuity of care, is a warranty for a more efficient and cost-effective wound management nationally while focusing on the patients' well-being.

Acknowledgements

We appreciate the help of the steering groups of RUT and Senior Alert.

Conflict of Interest
None

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Lactic acid bacterial symbionts in honeybees – an unknown key to honey´s antimicrobial and therapeutic activities

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Introduction

Today, due to the misuse of antibiotics and emerging antibiotic resistant pathogens, we are facing a new era of searching for alternative tools against infectious diseases. Chronic wounds are subjects for intensive research efforts due to the bacteria's ability to sustain antibiotic treatment and maintain chronic infections by biofilm production. Antibiotic resistant bacteria in wounds caused by frequent use of antibiotics are a threat to the Health Care Sector and now, researchers are searching for new antimicrobial weapons in natural products and unexplored ecological niches for alternative tools against infections. Symbionts in an ecological niche that are already shaped to defend their host by producing bioactive compounds are a relatively unexploited option. Less than a decade ago we discovered a large un-explored bacterial microbiota of Lactic acid Bacteria in symbiosis with honeybee's, located in the honey stomach and key players in honey production [1]. Our hypothesis that these novel LAB with their active bio-products could be the reason for why honey has been regarded as an antimicrobial agent through human history.

Methods

We conducted varying analyses in order to characterize LAB's bioactive metabolites. To check the LAB's antimicrobial activities we performed Dual Culture Overlay assays against wound pathogens.

Results

The Overlay assays (Table 1) display that all tested pathogens from clinical human wounds were inhibited by antimicrobial compounds diffusing from each of the 13 LAB originating from honeybees and when the 13 LAB were grown together. The results show that the different LAB strains produce different bioactive metabolites of varying inhibitory effects against the pathogens. These include; lactic-, acetic and formic-acids, benzene, 3-OH Fatty acids (anti yeast), hydrogen peroxide, etc. [2].

Table 1. Dual culture overlay assays with LAB strains of bee origin against clinical isolates of pathogenic wound bacteria and yeast. The diameters of the inhibition zones are displayed in millimeters. Antibiotics commonly used against the same pathogens are depicted as controls.

LAB strain[A]	*Serratia narcescens* NJ19 5c	*Staphylococcus areus* FJ02	*Klebsiella aerogenes* Clmp R	*Citrobacter Freundii* CR01 5A	*Staphylococcus areus* 74022 PR	*Staphylococcus areus* CR01	*Pseudomonas aeruginosa* LE08	*Enterobacter cloacae* JSB 5B	MRSA clinical isolate 18	*Klebsiella oxytoca* JSB 5B	*Escherischia coli* V517	*Candida albicans*	*Enterococcus f aecalis* E12 VRE	*Acinetobacter* A23 Z32524
L. kunkeei Fhon2	$^{S}42$	ND	$^{S}24$	*32	$^{S}31$	ND	$^{B}30$	$^{S}38$	33	ND	$^{B}40$	*20	$^{S}31$	$^{S}55$
Lactobacillus Fhon13	$^{S}8$	ND	*10	*18	$^{S}20$	ND	0	0	18	ND	*12	0	$^{S}14$	13
Lactobacillus Hma2	$^{S}9$	ND	*9	*10	0	ND	$^{B}10$	5	$^{B}9$	ND	*7	0	0	0
Lactobacillus Hma8	18	ND	*9	$^{B}15$	$^{S}19$	ND	0	$^{S}17$	16	ND	$^{B}12$	0	8	$^{S}18$
Lactobacillus Bma5	$^{S}11$	ND	$^{B}10$	*18	*13	ND	0	$^{S}11$	$^{B}6$	ND	$^{B}12$	0	0	6
Lactobacillus Biut2	$^{S}7$	ND	*7	*8	$^{B}16$	ND	0	7	$^{S}12$	ND	$^{B}10$	0	0	$^{B}12$
Lactobacillus Hma11	0	ND	0	0	0	ND	0	0	0	ND	0	0	0	0
Lactobacillus Bin4	$^{S}39$	ND	$^{S}26$	*32	$^{B}22$	ND	$^{S}29$	$^{S}29$	$^{B}32$	ND	$^{B}30$	*20	21	$^{S}40$
Lactobacillus Hon2	0	ND	0	0	0	ND	0	0	0	ND	0	0	0	0
Bif idobacterium Bin2	$^{S}18$	ND	$^{S}15$	$^{B}13$	$^{S}9$	ND	*10	$^{S}21$	0	ND	$^{B}19$	*8	10	$^{S}15$
Bif idobacterium Bin7	22	ND	$^{S}17$	*22	$^{B}14$	ND	$^{B}15$	$^{S}24$	$^{S}15$	ND	$^{B}28$	*12	13	$^{S}21$
Bif idobacterium Hma3	$^{S}26$	ND	$^{B}16$	*18	$^{B}15$	ND	$^{B}16$	21	19	ND	$^{B}20$	*8	$^{S}15$	$^{S}22$
Bif idobacterium Bma6	0	ND	0	*6	$^{S}9$	ND	0	0	0	ND	0	0	0	0
[G] **All together**	$^{S}40$	$^{S}42$	$^{S}40$	$^{B}31$	28	$^{B}39$	$^{B}33$	$^{S}40$	$^{S}32$	$^{B}36$	$^{B}39$	*12	25	$^{S}32$
Antibiotics	V	V / F	Cx	Cl	F	V / F	Cn / C	Cn	V / F		A		A	C
	9	19 / 29	28	$^{S}19$	$^{B}29$	19 / 29	19 / *31	$^{S}21$	23 / $^{S}29$		0		19	0

Discussion and perspectives

The fact of finding new treatments in wound management is already one of the most important tasks in today's clinical and biochemical research. Although clinical reports have shown positive results when using honey in wound management, the application of honey dressings still gives a low confidence for its use in therapeutic treatment in wound management. However, we have discovered a unique LAB microbiota in the honey producing tract of the honeybee given, for the first time, an explanation to the before unknown factors contributing to honey's antimicrobial properties [1]. In this study we could confirmed that LAB symbionts are responsible for many of the antibacterial and therapeutic properties of honey. This is one of the most important steps forward in the understanding of the clinical effects of honey in wound management. The explanation model will take honey in combination with its viable and standardized amount of LAB into a much wider clinical use.

Conflict of Interest
The LAB strains used in these studies have been submitted to patent applications by T.C. Olofsson and A. Vásquez.

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Poster presentations overview

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P1

Use of "Collost"("Salvecoll") Preparation in Complex Treatment of Decubitus Ulcer, Degree IV.

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Introduction
Radical surgical treatment of decubitus ulcer, degree IV remains a very difficult problem as only 50-75 % of decubitus ulcer is healed by the primary intension, percentage of postoperation complications is high [1,2].Search for preparations that are implanted intrasurgically and are totally biodegenerating, hypoallergenic and have a considerable effect of stimulation of regeneration and reparation is actively being carried out in the world."Collost" ("Salvecoll") preparation almost perfectly fits fulfiling of these tasks, that is why it has been used in the complex surgical treatment of patients with decubitus ulcer, degree IV.

Methods.
13 patients with decubitus ulcer, degree IV were treated with "Collost" preparation: 7 patients with decubitus ulcer in the area of the sacral bone, 3 patients had it in the area of the ischial tuberosity, and 3 patients- in greater trochanter. These patients were included into the main group (MG). 15 patients with the same pathology were included into the comparison group (CG).Patients of both groups had almost the same age, main and concurrent diseases, duration term of decubitus ulcer, local and general treatment, almost the same number of males and females. In MG it was a three-staged surgery, in CG-a two-staged one. The first operation in both groups was a maximum radical necrectomy (including osteonecrectomy).In the second stage of operation (proliferation stage) "Collost" was used for temporal closure of tissue defect (by a 50x60 mm membrane, having 1.5 mm thickness, 7 % or 15 % gel, powder) in MG. Preparation amount was determined individually and depended on the tissue defect size. Microinjections of gel into the margins and bottom of the wound were done, then the wound surface was impregnated by the powder. The final stage was the complete closure of the wound defect by membranes, having the sizes of the wound. Membranes were fixed to the cutis margins of the wound by single stitches along the perimeter, and in case of need they were stitched to each other. In postoperation period bandaging was performed on average once within 5 days, applied napkins were moistened by means of fluid solution of antiseptic. Stitches were removed in 3-5 weeks after maximum or complete biodegeneration of the membrane. After the first operation management of patients in CG was conservative and usual [2].The final closure of the wound defect in both groups was performed either by means of the secondary stitching (SS) or autografting (AG).

Results.
In MG the results of complex hospital surgical treatment were good in all 13 patients (100 %)-wound defects were totally healed without forming rough scars. In CG wound defects were totally closed only in 9 out of 15 patients, in 4 patients wound defect sizes became 1.6 times less, in 2 patients-1.2 times less.There were cases of wound reinfectioning and superinfectioning after necrectomy, i.e. 60 % of good results and 40 % of satisfactory results. The process of granulation tissue formation and marginal epithelization on the background of "Collost" biodegeneration was activated in patients of MG, and it made possible to the wound get ready for AG or SS earlier. Time duration of getting ready for SS in MG was 35.0 +-4.8 days, in CG-61.2 +-9.1 days.

Discussion.
Obtained good results in all 13 patients of MG and in 9 out of 15 patients in CG (60 %) made it possible perspective including of "Collost" into the complex of surgical treatment of patients with decubitus ulcer, degree IV. Nevertheless, the little number of treated patients, absence of data about relapse in a year after treatment do not allow us to carry out a serious comparative analysis, using data from other clinics, also having not a great experience of "Collost" use in treatment of mentioned above category of patients. There is a necessity to carry out further multicentre investigation with "Collost" use for this pathology.

Clinical relevans.
"Collost" use in complex surgical treatment of patients with decubitus ulcer, degree IV considerably (1.75 times faster) reduced time duration of wound getting ready for SS or AG due to activated process of granulation tissue formation and marginal epithelization. It made possible achieving of good results in all the patients of MG-a total healing of decubitus ulcer and relapse absence within the first year after treatment.

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Conflict of Interests.
There is no conflict of interests among the authors of the abstract.

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P2

Material science for pressure redistributing seat cushions & mattresses

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Introduction
Pressure Ulcers (PU's) are painful, problematic, yet largely preventable wounds. Indeed, research undertaken at several trusts in the UK shows that use of a few simple measures almost reduces the incidence of PU's to zero. One of these measures is to be acutely aware of what support surface the patient is sitting or lying on, as such awareness facilitates the choice of the most appropriate surface.

Aims
The goal of pressure ulcer prevention is to reduce tissue deformation, to let the deformation occur in the material, not in the human body. In the newer understanding of PU etiology time is considered to be a major factor. There are diverse materials employed in the numerous versions of support surfaces currently available. This presentation will endeavour to combine the newest understanding of the causes of pressure ulcers with how materials in the support surfaces react to these factors. Fundamentally, the aim is to enhance understanding of how these support surfaces can contribute to pressure ulcer prevention.

Concept under consideration
When soft tissues are squeezed between a bony prominence and a support surface, the soft tissue will inevitably be compromised. Understanding what material the support surfaces is made of and how these materials react to a load (pressure and shear) in addition to heat/humidity makes the choice of the most appropriate surface easier. A material with hydrostatic properties, where the fluid is being dispersed, has better enveloping qualities and thus better pressure ulcer preventative qualities when compared to materials with a high resilience. Furthermore, materials which reduce a buildup of heat and humidity have better preventative qualities than those without this ability. However, regardless of the material in the support surface one choses, a frequent turning regimen and steps outlined in the SSKIN bundle are also important preventive measurements against the development of pressure ulcers.

Clinical relevance
The key considerations in selecting the correct mattress or cushion are: how well the material envelopes the body, the response of the material to being loaded and the effect that these factors have on the skin microclimate. Furthermore, use of all the appropriate interventions, as outlined in the SKIN bundle, should also be considered in order to ensure success in prevention strategies.

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Conflict of Interest
The author is employed as a wheelchair seating and mobility consultant at ETAC.

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Therapeutic management of extensive pressure ulcer affecting occipital and parietal bone

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Introduction

A female patient of 81 years, in good health condition, living on her own in a house suffered a stroke in 2001, and in 2010 she was diagnosed with an inoperable brain tumour (meningeoma).

Methods

Apart from occasional memory loss and short term nausea she had no difficulties and could take care of herself. Following a visit she paid to her relatives in December 2013 she suddenly lost consciousness, fell and was left lying on a stone floor until her relatives found her after two days. She developed an extensive pressure ulcer in the location between her shoulder blades and the occipital and parietal bone in the scull, accompanied by loss of hair, skin, and subcutaneous tissue up to the bone in the area of 10x12 cm.
After two months of hospitalisation at the Department of Neurology her general condition has been stabilised, she communicates, but her mobility is limited.

Results

The pressure ulcer between her shoulder blades heals quite effectively, the manifestations on the cranium are stagnant, the pressure ulcer shows callous margins, and the bone is coloured dark brown to black. Since March 2014 the therapy included gel preparations, and we also have commenced stem cell therapy with a very good effect.

Discussion

The application of stem cells harvested from adipose tissue with growth factors processed using bioengineering technologies can deliver he most progressive effects without any undesired effects. Adipose cells (ASCs) are multipotent, thus an ideal source material in the field of regenerative medicine. The final effect of application includes the formation of new skin cells, improved appearance of existing wrinkles, improved skin elasticity due to the synthesis of collagen, elastin, and other ECM components (extracellular matrix – proteins and saccharides).

Clinical relevance

The method is quite costly and technically challenging, and requires perfect cooperation and coordination between the expert, the laboratory, and the patient, but it brings excellent final results. The method is very comfortable for the patients. The paper documents the topical therapeutic approach applied as well as the final effects achieved in the patients treated.

Conflict of Interest

There is no conflict of interest in connection with this presentation.

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Pressure Ulcer Prevention – A toolkit for Healthcare professionals to ensure success

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Introduction

In 2009, the hospital pressure ulcer (PU) prevalence of category 1 to 4 was 19.2%. The prevention interventions were not always done by healthcare givers and not in adequacy with the latest best practices. An institutional program called "Objectif Zéro Escarre" (OZE) has been developed and implemented in the hospital. Primaries goals of the program were updating professional's knowledge regarding pressure ulcers prevention, establishing best practice guidelines and reducing the annual PU prevalence. In 2012, the prevalence is lower (12.2%) but shows that the prevention interventions are not well documented and the guidelines are not always adopted in practice. To guarantee long term effect on PU prevalence and to ensure continued awareness of PU prevention by all healthcare professionals, which clinical and management tools are needed to confirm that all at risk patients benefit from adequate interventions?

Methods

A literature review was made using PUBMED and *Google Scholar*. The keywords ***nursing supervision, guidelines adherence, pressure ulcer*** and ***incentive plan*** were selected separately and in combination. Six articles out of 32 were analyzed. They were chosen for their strength of evidence. The data collected was used to establish a list of the most reliable interventions in reducing pressure ulcer prevalence. Minimum required actions have been gathered in a toolkit in order to ensure the application of hospital's PU prevention guidelines for all at-risk patients

Results

Minimal required interventions toolkit [1-2-3-4-5-6]

1. Professional's responsibilities clarification
2. Monitoring and clinical management
   a. Risk assessment
   b. Relief support surfaces
   c. EBP-Posters and handouts
   d. Clinical documentation
   e. Patient/family empowerment
3. Professional knowledge and training
4. PU Champions
5. Performance of nursing care indicators and communication

Discussion

The professionals' non-adherence to PU guidelines may affect the quality of care provided to the patient and lead to pressure ulcer development. The Lausanne's University Hospital administration has made the program OZE a priority in its institutional action plan. Since 2009, the annual prevalence has been reduced. This reduction is probably due to the great effort done by the managers and healthcare professionals. The literature shows that it is a great challenge to support the effort needed throughout the time. This toolkit may be an answer to assure best practice in pressure ulcer prevention and quality care to every at risk patient hospitalized in our institution.

Clinical relevance

A prevention program needs continuous attention, monitoring and adjustment to ensure long term awareness and good practice.

Acknowledgements

We appreciate the help of the Hospital Nursing Administration and healthcare professionals.

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P5

Treatment of pressure ulcers in children with impaired central neuroregulation

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Introduction

One of the hardest and most frequent complications after spinal cord injury is pressure ulcers of soft tissues. The proportion of children patients with pressure ulcers is 19,5-27,4 % of the total number of children with spinal cord pathology of various origins. Septic condition in this group of patients develops in 4% of cases. Decubitus lesions make difficult rehabilitation activities, and they can be the cause of postponing surgery operations.

Methods

In our clinical center we applied novel method for treatment of local trophic complications in children with spinal cord injury with using sterile collagen material “Collost” (Russia), it also known as “Salvecoll” in EU. We applied two forms of the preparation – membrane and gel.

Before “Collost” application we conducted necrectomy, excision of callous edges of the wound and marginal excision of the bone. Decubitus completely purified from fibrin and nonviable tissue for translating the local process from necrotic-inflammatory condition to inflammatory-regenerator. It should be note that we did not set out to completely debridement of the wound. We had to be sure that there was no contamination of Pseudomonas aeruginosa. The persistention of other kinds of microflora was not a contraindication to “Collost" application.

Dressings were conducted depending on the wound repair potential but not more than one time in 5-7 days. Effective application of “Collost” need of regular maintaining a moist environment, so we regularly irrigated the dressing.

Results

During the treatment with “Collost” (“Salvecoll”) the period of wound healing was ranged from 21 to 48 days. In all clinical cases there was formed full soft tissue without scar in the zone of biomaterial application. We did not observe any complications associated with “Collost”.

Discussion

Analysis of the results showed high efficacy of "Collost" (“Salvecoll”) in terms of the rate of wound healing and forming of new full soft tissue. So this fact indicated the perspective of this collagen biomaterial application in surgical practice.

P6

The Effect of a Silicone Border Foam Dressing For Prevention of Pressure Ulcers and Incontinence Associated Dermatitis in Intensive Care Unit Patients

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Introduction

Clinical practice guidelines from the EPUAP and NPUAP summarize current evidence that strongly suggests increased risk of sacral pressure ulcer (PU) formation from shear force and sustained pressure when the HOB is elevated.[1] Unfortunately, there is a clinical conflict of interest for ventilated ICU patients who is recommended to prevent pneumonia. Meanwhile, the etiology of incontinence associated dermatitis (IAD) differs from PU, but IAD and PU often coexists.[2] The skin affected by incontinence is less tolerant to pressure, friction, and shear.[3] The purpose of this study was to evaluate if application of a silicone border foam dressing to the sacral and coccygeal areas, would help to decrease PU occurrence and IAD score among patients at risk in the ICU, as compared to standard PU preventative care.

Methods

Data were collected using a non-randomized comparison cohort study. Subjects and Settings: 102 patients (>40 years of age) with a Braden scale score of 16 or less who were admitted to two ICUs at the Samsung Medical Center in Seoul participated in the study. Instruments: PU development was determined based on the guidelines of EPUAP and NPUAP. IAD was measured using the Incontinence Associated Dermatitis and its severity instrument (IADS).[4] 52 subjects were assigned to the experimental group (standard PU preventive care routine plus application of the silicone border foam dressing), and 50 subjects were assigned to the control group (standard PU preventive care alone). The number of patients that developed PU in the experimental group was compared with that from the control group using the χ^2-test (Table 1). The IADS score of the experiment group was measured and compared with those of the control group using an independent t-test (Table 2). Logistic regression was carried out to analyze the relationship between the IADS score and pressure ulcer development (Table 3).

Results

Both the incidence of PU development and IADS scores were significantly lower (χ^2=21.722, p<.001 and t=2.166, p<.033, respectively) in patients assigned to the experimental group as compared to those in the control group. The incidence of pressure development significantly increased as the IADS score increased (OR=1.900, CI=1.237–2.917). A logistic regression analysis revealed that pressure ulcer development was related to IADS score (p=.003) and that the risk of developing a pressure increased 1.9 fold for every one-point increase in IADS score.

Table 1. Effect of a Silicone border foam dressing on PU occurrence

N=102

Variables	Total n(%)	Control (n=50) n(%)	Experimental (n=52) n(%)	p-value
Developed PUs				
Yes	26 (26%)	23 (46%)	3 (6%)	
Stage 1	18 (18%)	17 (34%)	1 (2%)	
Stage 2	7 (7%)	6 (12%)	1 (2%)	
Deep tissue injury	1 (1%)	0 (0%)	1 (2%)	< .001
No	76 (74%)	27 (54%)	49 (94%)	
Intact	61 (61%)	27 (54%)	34 (65%)	
Blanching erythema	15 (15%)	0 (0%)	15 (29%)	

Table 2. Incontinence Associated Dermatitis and its Severity Scores

n= 47

Variables	Total n(%)	Control (n=23) Mean(SD)	Experimental (n=24) Mean(SD)	p-value
IADS score	0.89 ± 1.28	0.04 ± 0.75		< .033

Table 3. Relationship Between IADS score and PU Occurrence

N= 102

	B	SE	p-value	OR	95% CI for OR
Constant	-1.643	.321	< .001	0.193	
IADS Score	.642	.218	.003	1.900	(1.237, 2.917)

Discussion

We hypothesize that this difference is at least partly attributable to protection afforded by the dressing to the sacrum and the gluteal fold along the coccyx. Additional research is needed to confirm this hypothesis. Results of this study revealed an association between PU occurrence and IADS score. Although the etiology of IAD clearly differs from that of pressure ulceration, the conditions often coexist. Additional research is needed to further clarify the nature of this relationship.

Clinical relevance

Use of a silicone border foam dressing application was found to reduce the occurrence of PU and IADS scores in a group of critically ill patients.

Acknowledgements

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Conflict of Interest : None

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Telemedicine; a pressure sore project- Patient communication all the way home

The use of new technology as a communication channel to replace long travelling, travel expenses and time, is common in many workplaces. Video conferencing has long been used in both companies, but also private. Today, the opportunities to communicate are almost endless, regardless of the distances.

Norway is a country with scattered settlements. That leads to travelling over long distances, which at times can make it difficult to provide good healthcare support.
For many years, Sunnaas Rehabilitation Hospital has focused on implementation of telemedicine as a way to communicate with patients, colleagues and partners. This to facilitate necessary healthcare to all in need of it. This eventually ended up in what today is called " The Sunnaas model". We will give a presentation of this Model.

Sunnaas Rehabilitation Hospital has a nation –wide responsibility for patients with spinal cord injuries, among others.
In 2012 two pilot projects started, using telemedicine in the form of video conferencing, as an offer in the outpatient treatment of patients with spinal cord injury and pressure ulcers, and in the monitoring of aphasia patients. We will give a presentation where we focus on the results from the group with pressure ulcers. We used recommendations from the Norwegian Center for Integrated Care and Telemedicine, and we cooperated with the University of Oslo in the preparations for the pilot project.

We wanted to offer equal treatment to all patients, regardless of residence and geographical obstacles. We wanted to clarify if possible for patients with spinal cord injury and pressure ulcers to be followed up at home in a safe, predictable and responsible manner rather than to put them in hospital. In addition, we wanted to improve interaction with homecare nursing in the way that we offered organized training in the care of pressure ulcers, and also invited the caretakers to call or send messages when they needs assistance.
We also established close cooperation with the Plastic Surgery department at Oslo University hospital, for the possibility to quickly implement “the right treatment to the right patient at the right time”, aiming the patients to go back to habitual activity and participation in home, work and society.

During 2012, seven patients were followed up in the project. Patients and their local caregivers were interviewed about the experience of participating in the project. The feedback gave us the opportunity to facilitate the treatment. Wound healing were registered, we made socioeconomic calculations, and we revealed staffing needs to offer such an outpatient healthcare, both in specialist- and in primary healthcare. We will give a presentation with some of the results from this pilot project.

We also created/ designed an e -learning course for use in primary healthcare. Parts of this course will be presented.

The results from the pilot project are good, both in terms of healing of pressure ulcers, cooperation with primary health care, and what comes to socioeconomic health savings. We will present some of this savings. The programme is now implemented in ordinary outpatient activity at Sunnaas rehabilitation hospital, but a problem, however, is the earnings to the hospital.

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Surveillance and prevention: a contact-free monitoring solution

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Introduction

Caring for patients with low mobility, at risk of pressure sores, generally elders with high comorbidity, it means increase prevention activities; but if patients have already developed bedsores, then we need to survey carefully, to avoid new lesions and to manage the situation at our best. This is often not possible due to lack of human resources and too heavy workloads. In this context, it becomes very useful to have a technological support that can really help caregivers to improve patients management, allowing a deeper focus on mobilization and vital signs[1].

Methods

We started a study of a technological device that would allow easier management of the patient with bedsores (or at risk of developing). It’s a computerized device that can guarantee prevention of adverse events with contact-free continuous monitoring of Heart Rate, Respiratory Rate and Motion, without ever touching the patient; in the event of a change in a patient’s status, the system alerts caregivers at the Central Display Station (CDS), on large screens in prominent locations and on handheld devices. The system has been developed specifically for inpatients who needs to be monitored frequently.

Fig. 1: *On the left the screen with general data; on the right the one with motion data.*

As you can see in figure 1, there’s a monitor to show all data collected by the device; there’s also an app that turns a mobile into a real-time alert/reminder handheld device, specifically developed for on-duty caregivers. Our aim is to demonstrate the real effectiveness and usefulness of the device, not only in hospital units, but also at home, to improve the quality of care by relatives and to allow effective surveillance and prevention[2]. The target is to follow patients at home for three-six months, evaluating the skin status, the caregivers management and the preventive efficacy.

Results

The study is still ongoing, but the preliminary results are really impressive. We can confirm a lower level of stress among caregivers because if something happens there’s a system that help you to prevent and to intervene quickly, if necessary. We noted an higher level of assistance, a very low incidence of bedsores, an improvement in wound management and a better quality of life for patients, caregivers and relatives.

Discussion

The ability to use technological devices for the prevention and surveillance of patients with pressure ulcers (or at risk of developing) opens new scenarios of care: reducing workload to caregivers means a better quality of care, a reduction of the risk of "burnout syndrome"[3] and, therefore, improve the patients’ quality of life. It’s also very significant that patients at home can be managed better by relatives that show to be less anxious: they “feel safe and helped” and can be “transformed” into real caregivers.
There’s another feature to be highlighted: an important cost saving due to less ICU days, lower incidence of bedsores and “burnout syndrome”, better home management that reduces forced hospitalization[4].

Clinical relevance

Easy management, improvement of quality of life for patients and caregivers, prevention and surveillance, cost saving: we think that the clinical relevance of our work is that we are demonstrating it’s possible to achieve all these targets.

Acknowledgements

We appreciate the help of EarlySense (Israel) and Moss (Italy) that provided the devices.

Conflict of Interest
None

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P9

Feeding without harm: preventing gastrostomy tube related Hospital Acquired Pressure Ulcers

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Introduction

One third of all Hospital Acquired Pressure Ulcers (HAPUs) are medical device related pressure ulcers (MDRPUs) [1]. Patients with a medical device are 2.4 times more likely to develop a pressure ulcer of any kind [2]. If MDRPUs were prevented the overall incidence and prevalence rates of hospital acquired pressure ulcers would be significantly reduced. At Stanford Hospital and Clinics, wound and ostomy nurses noticed an upward trend in the incidence of gastrostomy tube (G-tube) related MDRPUs (Fig. 1). A gap exsited between best practices and actual nursing practice. During 2011 three ICU patients developed multiple full thickness G-tube MDRPUs; ICU RNs practice indicated an absence of care standardization. Following a comprehensive review of the literature, an updated protocol regarding caring for G-tubes was developed.

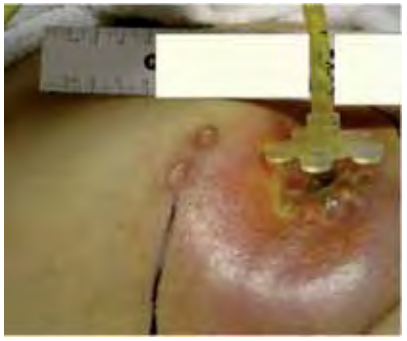

Fig. 1: *G-tube related pressure ulcers of the abdomen.*

Methods

A standardized protocol requiring the G-tube bumper to be unsutured and dressed only with thin foam was developed, thus eliminating the use of bulky gauze dressing under the bumper. After a pre-test, education on the newly developed evidence based G-tube care protocol was delivered to ICU nurses via staff in-services. To assess the effectiveness of knowledge transfer, a post-test was included in the training experience. A secondary review of MDRPUs quality reports was also completed to better understand the occurrence of G-tube related HAPUs.

Results

Table 1: *Number of patients with G-tube HAPUs*

Group	Number of patients	Pressure ulcers
Pre intervention (2011)	3	10
Post intervention (2013)	1	1

On average, participants knowledge related to G-tube care was lower on the pre-test (M=11.47, SE=.332) compared to the post-test (M=14.56, SE=.172). The difference was statistically significant t(154)=-8.94, p<.05. The results indicate a significant change in knowledge on average after participants received the G-tube pressure ulcer prevention in-service training. Identical pre and post tests were administered consisting of eight questions with a total possible score of 16, total sample size N=81 (pre-test n=75, post-test n= 81). The data was analyzed using a t-test. Additional observations were: the absence of California Department of Public Health reportable G-tube related HAPUs in 2012.

Discussion

Nursing education about the G-tube care was deemed effective and expanded hospital wide. The development and implementation of an evidence based G-tube protocol led to the reduction of G-tube HAPUs. Ongoing monitoring identified one full thickness G-tube related HAPU in 2013 indicating the need for ongoing education and surveillance.

Clinical relevance

A statewide collection and analysis of adverse event data demonstrated that the lack of understanding regarding device care was a causative factor in 63% of MDRPUs [2]. This evidence based practice project demonstrated that the implementation of standardized best practices and focused education led to a reduction in G-tube related HAPUs.

Acknowledgements

We appreciate the help of Anne M. Klevay, RN, MSN, PMHCNS-BC, EBP Coach, Lynn M. Forsey, RN, PhD, EBP Program Director, Nurse Scientist.

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P10

Wound-Conditioning in Pressure Ulcer Patients: Negative Pressure Wound Therapy and Octenidine-containing Wound Irrigation Solution – *in-vitro* Results and Clinical Outcome

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Introduction
In pressure ulcer patients reduced resistance against germs and the proximity to the anogenital region promote the rate of wound infections. The surgical standard is a two-step procedure: debridement plus antiseptic wound conditioning and defect-coverage with a local flap.

Methods
We present the successful treatment of male paraplegic patients suffering from gluteal pressure ulcer carried out according to the following schema: surgical debridement in general anesthesia, taking swabs and bone biopsies, installation of a NPWT system (V.A.Culta™) in combination with an octenidine-containing (octenilin®) wound irrigation solution. After 6 days the NPWT system was removed, swabs were taken again and the defect was closed with a posterior thigh flap. Furthermore, the antiseptic efficacy of the octenilin® wound irrigation solution and other commercially available irrigation solutions were examined by *in vitro* tests simulating real conditions.

Results
Swabs prior to installation of NPWT system presented germs associated with wound infections, whereas no germs were detected afterwards. No wound healing disorders were noticed in follow-up examinations. Regarding *in vitro* tests, a sufficient bactericidal effect on the spiked MRSA strain and the accompanying flora was achieved both after 0.5 and 2 minutes of exposure to the octenidine-containing wound irrigation solution.

Discussion
A broad-spectrum of antimicrobial efficacy was proved for octenilin® wound irrigation solution within a short contact time in a clinically relevant situation. The combination of an antiseptic, octenidine containing, wound irrigation solution and NPWT during wound conditioning is a secure therapy contributing to reduce the complication rate after surgery of pressure ulcer patients.

Clinical Relevance
NPWT and octenilin® wound irrigation solution offers the advantage of very short contact time required of the antiseptic of less than three minutes in the clinical everyday. Thus, the tightness of the NPWT system is improved significantly after instillation.

Predictive validity of four risk assessment scales for prediction of pressure ulcer development in a hospital setting

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Introduction

The prevention of pressure ulcer formation is an important aspect of nursing care, and the identification of patients who require preventive measures is a key issue. Various risk assessment scales have been developed since the early 1960's and all of the scales have claimed to have acceptable ability to identify patients at risk of pressure ulcer development. However, changes in health hospital care such as an older patient population and shorter hospital stay motivate continuous and repeated examination of the predictive validity of these instruments. The aim of this study was therefore to determine the predictive validity of four risk assessment scales. Two of the scales are commonly used in Sweden (modified Norton and RAPS) [1, 2] and two are used worldwide (Norton and Braden scale) [3, 4].

Methods

This cross-sectional descriptive study was conducted in a hospital in southern Sweden. Out of 412 patients (≥18 years) admitted to medical, surgical, orthopedic, oncology and rehabilitation wards, a total of 346 patients participated in the study. Data were collected using the Swedish version of the European Pressure Ulcer Advisory Panel minimum data set [5], the Norton-, Modified Norton-, Braden- and the RAPS scales. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the four risk assessment scales were calculated at various cut off points, including the recommended cut off for each scale. To define the prognostic validity of the scales the area under curve (AUC) was calculated.

Results

Fifty-six of the 346 patients were found to have at least one pressure ulcer, yielding a prevalence rate of 16.2 %. The RAPS scale reached best balance between sensitivity and specificity at recommended cut-off level (≤ 29p), followed by the Braden scale and the Norton scale at recommended cut-off levels of ≤ 18 versus ≤ 16 points respectively (Table 1). The modified Norton scale also reached an acceptable balance between sensitivity and specificity, but at the cut-off level of ≤ 23 points, which is a higher cut-off level than recommended. At these cut off levels, which show the best balance between sensitivity and specificity, the PPV ranged from 32.5% to 35.1% among the scales and NPV ranged from 93.6% and 94.4%. Acceptable AUC was reached for all scales.

Table 1: *Summary of the most important data*

Group	Cut off	Sensitivity	Specificity
Modified Norton scale [1]	23	77.8%	68.4%
RAPS scale [2]	29	77.8%	69.9%
Norton scale [3]	16	74.5%	70.6%
Braden scale [4]	18	74.5%	73.7%

Discussion

The results both supports and contradicts previously recommended cut-off levels. Regarding the modified Norton scale a cut of level of ≤ 20 is recommended in the Swedish Handbook for Healthcare. Based upon the reasoning that higher sensitivity is preferable to higher specificity, this study indicates that the cut off level should be as high as 23 for the modified Norton scale. The effect of preventive measures could be the reason why the PPV of the scales was not very high.

Clinical relevance

These study results could be used as a basis for discussion concerning the current recommended cut-off level of the modified Norton scale and if it should be reconsidered.

Acknowledgements

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Conflict of Interest
No conflict of interest has been declared by the authors

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Peroperative pressure ulcers – A unknown phenomenon?

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Introduction

Pressure ulcers are a unwanted complication, that may lead to painful after-treatments. Pressure ulcers are a highly prioritized area in hospital settings in Denmark. There are a number of different policies in the area, frequent prevalence studies and the National "Patient Safety" Hospital. Peroperative patients have among other things very limited possibilities for repositioning, and lack of sensorial perception. Anesthetics can cause significant changes in patient hemodynamic status and skin perfusion, which makes these patients in sever risk of developing pressure ulcers during operation.

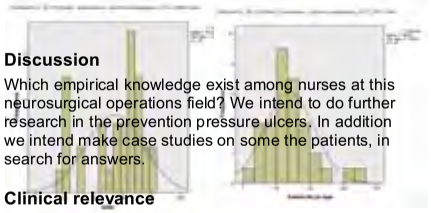
Methods

39 patients participated in this prevalence study. (N=39). A special record was made for data collection in this study and a creation of a database was made. We collected among other things data on Body Mass Index, age, position during surgery, positioning equipment during surgery, and time on the operation field. For statistical analysis was used SPSS version 19.

Results

The prevalence study showed that non of the 39 per-operative patients developed pressure ulcers during surgery. Our study revealed, that anesthetist- or operation nurses in the Neuroanesthetic operation field often uses more than two different types of positioning equipm Fig 1 g surgery to prevent Fig 2 lcers.

The mean age was 54,53 (16-82) (fig 1) and the mean time on the operation table was 138,62 minutes (30-329) (fig 2).



Discussion

Which empirical knowledge exist among nurses at this neurosurgical operations field? We intend to do further research in the prevention pressure ulcers. In addition we intend make case studies on some the patients, in search for answers.

Clinical relevance

The Nurses in the Neurosurgical operations field may hold significant knowledge in preventing pressure ulcers. A knowledge that maybe can used in other hospital settings also, in the prevention of pressure ulcers.

Acknowledgements

We appreciate the help of NeuroAnaesthesiologic and Neurosurgical Department at the Danish National Hospital.

Conflict of Interest: None

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P13

Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

Correlation between electronically generated nurse feedback and the frequency of position changes

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Introduction

A key item in pressure ulcer guidelines and protocols is the limitation of the time a patient stays in one position. To achieve that, most protocols advise repositioning of patients every 3 hours.

A recently introduced sensor-based device (Mobility Monitor, compliant concept) is able to measure the time intervals between position changes of patients. It can be connected to the nurse call and allows to set a warning if a patient did not change position for a certain time (2, 3 or 4 hours), indicating the nurse the need to perform a repositioning of the specific patient.

The aim of our research was to determine whether the use of the Mobility Monitor effectively helps nurses to reduce the maximum time a patient stays in one position.

Methods

In order to establish a baseline, the device was used for two weeks without being linked to the nurse call system to record the frequency of patients' turning intervals, and without giving nurses access to the information provided by the Mobility Monitor. Then the device was linked to the nurse call system

Two groups of patients are selected. With patients in the control group, the device is placed for three days without being linked to the nurse call, measuring the patients' mobility which allows calculating the median time and the maximum time spent in one position. With patients in the intervention group, the device is placed for three days while being linked to the nurse call, measuring the patients' mobility which allows calculating the median time and the maximum time spent in one position. A total of three devices was in use.

Results

Data collection is ongoing until end of May 2014. Results will be presented at the EPUAP conference 2014.

Clinical relevance

Position changing every 3 hours on a routinely basis is a labor intensive method of preventing pressure ulcers. Much effort has to be made to keep nurses motivated to act according to the protocols.

This device could offer a solution by letting the nurse know which patient needs her care and which patient does not at this time. This could lead to a significant reduction in ineffective allocation of nurse time and an increase in patients who receive appropriate p.u. preventive care

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P14

Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

Incidence of Pressure Ulcers in Patients with Acute Spinal Cord Injury

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Introduction

Starting from 1996 all patients with spinal cord injuries (SCI) in the County of Stockholm have been included in a dedicated spinal rehabilitation program at the Dept. of Neurology, Karolinska University Hospital. Spinal cord injury patients are especially vulnerable to develop pressure ulcers due to loss of sensory functions and inability to change position, which may lead to suffering for patients and delayed rehabilitation. [2] In addition pressure ulcers are the most common "preventable" cause of hospitalization among SCI patients. [1]
The aim of this study was to evaluate incidence and risk factors to develop pressure ulcers, such as delays in admission to the spinal unit and number of units the patient passes before admission.

Methods

Descriptive retrospective study with clinical journal review for all patients included in rehab chain for SCI 2010-2013. Information included age, gender, level and of completeness of injury, localization and grade of pressure ulcer at admission, comorbidity, body mass index, time to admission to the spinal unit and number of units passed before admission.

Results

Out of a total of 198 SCI patients, 28 patients had pressure ulcer at admission, of which 11 came directly from ICU.

Table 1: Spinal cord injured patients admitted to R 18 for rehabilitation/year (blue).

Discussion

In this single center study of pressure ulcers at admission to the spinal unit we find an incidence of 11-22%. It was unexpected that such a high proportion of patients with pressure ulcer was admitted directly from the ICU, where staffing is much higher than for ordinary wards.

Clinical relevance

Pressure ulcer can be considered a failure of health care, since it can be prevented. Our findings underscore the need of instructing hospital units, including ICUs, caring for SCI patients. Preventive measures are likely to be cost effective and also result in reduced suffering among SCI patients.

Acknowledgements

Conflict of Interest

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Defeating IAD with technomolecular silver

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Introduction

The main components of a clinical situation called IAD (Incontinence Associated Dermatitis) are maceration, compression and skin senile degeneration: when the maceration due to poor control of incontinence is complicated, the IAD is its direct result. This situation is not easy to manage, especially from the preventive point of view or in its early stage of development; in fact, in these cases, the normal activities of preventing the onset of pressure sores are not specifically indicated, even if the IAD is, in any case, a form of bedsore[1]. It therefore becomes essential to be able to work to prevent the change from a simple excoriation to a real chronic lesion. The aim of the work is to demonstrate that it is possible to intervene at an early stage to avoid that IAD turn into necrotic lesion.

Methods

We enrolled 100 over seventyfive patients with incontinence, diaper holders 24 hours a day, with initial signs of IAD. The protocol, in addition to the normal hygiene procedures, consisted of a therapeutic treatment with a molecular technology spray powder containing anionic silicon dioxide as a carrier of a complex of ionic silver, with a covalent bond, and chlorexidine ($SiO_2^- Ag^+$ Chlorexidine); dressing change every time the patient needed to be washed and to change the diaper (also used as secondary dressing). The observation time was two weeks; after this period we evaluated IAD evolution, inflammation signs and pain (Numerical Rating Scale)[2].

Results

Figure 1: *Pain Trend*

We had no worsening (necrotic evolution), no infection signs, no pain increasing; in all patients we had complete healing within two weeks. No allergies. In figure 1 you can see the pain trend: in 21 patients we had the complete disappearance of pain.

Discussion

The results and the statistically significant numbers obtained demonstrate that this type of treatment is particularly effective, and thus indicated in the treatment of Incontinence Associated Dermatitis. This product can control optimally both the bacterial balance and, especially, the moisture balance; the synergistic actions of absorption and antisepsis allow to obtain successful treatments.
"Take home messages":

- complete healing in all patients
- no necrotic evolution
- no infections
- no allergies
- improvement of patients' quality of life

Clinical relevance

The clinical relevance of this work is the demonstration that a very "easy to use" treatment can prevent the onset of skin complications due to incontinence.

Acknowledgements

We appreciate the help of Pharmaday that provided the product for all patients.

Conflict of Interest
None

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The EPUAP Annual Conference 2014 Stockholm, Sweden

Do we do correctly all for the prevention of pressure sores?

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Introduction

Applied for EPUAP´s call to joint the „STOP Decubitus Day" and Faculty hospital Pilsen supports this event. The prevention of pressure ulcers (dekubitus) is nothing new for us and it is also one of our long-term priorities in nursing care. In 2013 we have done 73rd prevalence investigation of pressure ulcers since 1994.

We are involved in national data collection of pressure ulcers statistics, see www.nrc.cz [1, 3] The results of the incidence of pressure ulcers in our hospital can be compared with reference data. Quality indicator is the number of pressure ulcers that occur in hospital patients at risk. Although we can not completely stop the incidence of pressure ulcers, we are still looking for new ways to prevent them and to treat them.

Presentation is aimed at comparing the results of the occurrence of pressure ulcers in our hospital to the results of other hospitals in the Czech Republic. Further information on the activities of Head Nurse of the Ministry of Health and the role of the Czech Association of Nurses and last but not least nursing management in visibility STOP of pressure sores.

Methods

To use benchmarking application software with remote access, data are collected by prevalence every three months. Comparing the results of occurrence of PU in our hospital to the results of other surveyed hospitals in the Czech Republic (n-10).

We organize regular educational events:
Symposium on decubitus two times per year Certified course, where the nurses are gaining greater competence in the area of prevention and treatment of pressure ulcers and chronic wounds two times per year Conferences with the Czech Association of Nurses.
Our nurses regulary publishe in professional magazines [4,5].

Considerable amounts are devoted by our hospital management, to the prevention of pressure ulcers in equipment on bed stations: antidecubitus mattresses, lifting equipment, tools, materials.

We will continue in our activities and focus more on the general public in the fight against decubitus.

On the 21st November 2013, in collaboration with the students of medical school, we presented to the public how to care about the risk patiens. We used also EPUAP´s layouts in the Czech language and prepared our own layouts.

The public was also informed about the importance of the prevention of pressure ulcers and about the importance of nutrition according to the pressure ulcers prevention. The public was informed about this nutritional care in the local radio. Our nutritional therapists presented and joined live broadcasting.

Results

The incidence of pressure ulcers in the Czech Republic is moving down from 5,46 % to 3,40 % and in our Hospital long-term progression is from 4,1 % to 4,6 %, depending on the mixture of patients. *Fig. 1 – 3.* According to the modified Norton´s scale there is a long-term appearance of high-risk patients at the University Hospital Pilsen has been from 17 % to 18 %, our goal is to provide the care of these patients to prevent the development of pressure ulcers. *Fig. 4.*
The number of patients admitted to the hospital suffering from pressure ulcers is in between 30 % to 41 %. *Fig.5 – 6.*

Fig. 1: Total number of patients having PU within surveyed hospitals in Czech Republic

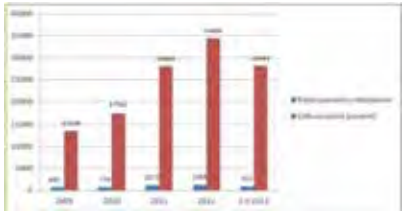
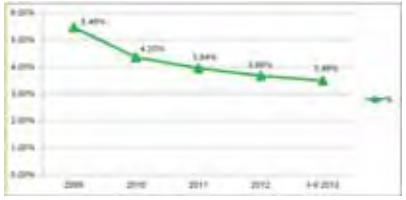


Fig. 2: The proportion of patients with PU hospitalized in surveyed hospitals.



PI7

Pressure Ulcer Prevalence Survey – an eye opener!

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Introduction

Because of a national initiative on prevention of pressure ulcers, a prevalence survey was done in December 2012 at all of the hospitals included within the Capital Region of Denmark. The survey was intended as a baseline for a prospective effort of zero tolerance of pressure ulcers.

Prior to results of the prevalence survey, the Department of Orthopaedic Surgery at Gentofte University Hospital had the perception, that following knee or hip replacement, self-reliant patients did not have pressure ulcers and that daily monitoring was unnecessary. However, the result of the prevalence survey indicated that 24% of our patients did, in fact, have pressure ulcers on their elbows. The general prevalence at Gentofte Hospital was 39%.

Methods

In light of the results of the regional prevalence survey, Gentofte Hospital's management decided that all departments must implement a daily pressure ulcer screening, conduct a count of pressure ulcers and lastly document these results in a pressure ulcer calendar that was developed for this purpose. It also became mandatory to report these results on a monthly basis to the hospital's Quality Assurance Department. Hospital management reassigned a nurse for 3 months. This nurse was responsible for assisting all departments with implementation of written procedures for facilitating preventive measures, for bedside teaching of nursing staff, and for extracting weekly data from the pressure ulcer calendar.

Our department compiled a procedure for prevention and treatment of elbow pressure ulcers. This included a strategy for informing patients preoperatively on how to prevent these elbow sores. To keep focus on pressure ulcer prevention, a hospital-wide audit was done in October 2013 as a precursor for the regional follow-up in December 2013.

Results

The results of the regional follow-up survey in December 2013 indicated that the occurrence of elbow pressure ulcers at our department had decreased to 8%.

Discussion

Prevention of elbow pressure ulcers remains a continuing challenge for the Department of Orthopaedic Surgery as our goal for 2015 is that no patients have elbow pressure ulcers. Therefore additional preventive measures are necessary since elbow sores continue to occur regularly, despite the focus on pressure ulcer prevention at regional, at hospital, and specifically, at the departmental level.

As a result of this, our department has set up a working group focusing on prevention of elbow pressure sores through patient involvement. The group is planning an project including: a preoperative survey of patients' knowledge of elbow pressure ulcers, a nurse evaluation of the communication strategy "teach back", preparation of an instructional video as well as development of a patient flyer including photos and finally a follow-up measurement of the combined efforts.

Clinical relevance

Prevention of pressure ulcers related to self-reliant orthopaedic patients is necessary due to the fact that postoperative infection may result in longer hospitalization and unnecessary suffering for patients.

Conflict of Interest

No conflicts of interest.

PI8

Decision making in mattress choice: a new tool suggestion

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Introduction

Attending patients with very serious problems, often terminals, unfortunately means come into contact with the reality of pressure sores; for this reason, it becomes essential to be prepared to deal with the event, not only from a purely medical point of view, and therefore therapeutic / pharmacological, but also from the care that begins with prevention.
Our ambitious target is to be able to combine an effective preventive program to a valid therapeutic one, if the lesions are already present, optimizing and rationalizing the use of technological surfaces, improving the quality of life of the patients, reducing the workload of caregivers and developing a decision-making process.

Methods

The choice of an antidecubitus surface should be based on accurate assessments and take into account the matress/overlay characteristics in terms of patient comfort, ease of management for the caregiver, cost-effectiveness and, of course, in terms of preventive and curative efficacy. We therefore analyzed the state of the skin at risk (or the pressure ulcer, if present) and the score of the Braden[1] scale to have a basic indication; we mostly evaluated the ability of spontaneous mobility of the patient which has a so preponderant influence in the choice of the surface[2]: a fully immobilized patient can't have any benefit from a self compensating surface that depends from the position variations ! We then considered the nutritional status, the skin humidity and comorbidity, giving scores: the target was to obtain a numerical data that could guide us in choosing the most effective surface.

Results

In table 1 we show a schema for a basic choice. The results we had using this decision-making system are quite interesting because no patients developed new lesions and most of them improved their bedsore. In many cases we achieved complete healing.

Table 1: *Basic Decision Making in Mattress Choice*

STAGE	BRADEN ≥13	BRADEN <13
Stage 0 "Blanchable" Erythema	Standard Foam Silicon Cave Fiber Slow Memory Foam	Thermodynamic Foam Interconnected Air Cells Low Pressure Overlay
Stage 1 "Non-Blanchable" Erythema	Thermodynamic Foam Interconnected Air Cells (reservoir)	Low Pressure Overlay Alternating Low Pressure
Stage 2 Partial Thickness	Interconnected Air Cells (reservoir) Low Pressure Overlay	Alternating Low Pressure
Stage 3 Full Thickness Skin Loss	Alternating Low Pressure Interactive Compensation	Dynamic Floatation Airloss
Stage 4 Full Thickness Tissue Loss	Dynamic Floatation Interactive Compensation Airloss	Interactive Compensation Airloss Dynamic Low Pressure (4:1)

As you can see, in this table we included the Stage 0, according with the works of Linda Russel[3]; she demonstrated the relevance of this situation and the successful intervention when we start to treat patients just in this situation.

Discussion

We agree that the most important data we had is that all those patients that couldn't use the right surface (based on the suggestion of our schema) developed a new bedsore. According with the results we achieved, we implemented this tool with the items we already talked about; so, it's possible to have a numerical value that can indicate the right choice.

Clinical relevance

We think that this work may be useful in our daily job: if we have the possibility to choose the right surface, we can manage patients in the best way. And that's all we hope.

Conflict of Interest

None

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Modeling the Economic Impact of Pressure Ulcer Prevention with the SEM Scanner

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Introduction

Bruin Biometrics has developed a budget impact model (BIM) to estimate the cost savings attributable to an intervention incorporating the SEM Scanner into a PU prevention protocol. In the United Kingdom, pressure ulcer (PU) care costs the healthcare system £2.1 billion per year [1]; cost estiamtes are similar in Germany (€1.4 billion) [2] and the Netherlands (up to $2.8 billion) [3]. Many countries reimburse only a fraction of the costs of treating pressure ulcers. As a result, there is a signficant burden on healthcare systems to minimize PU incidence or experience financial losses due to unreimbursed expenses. Studies of PU prevention programs have demonstrated a 40-50% reduction in PU prevalence rates with intervention [4], but the realized savings of such programs vary dependent upon the cost of implementing the intervention and the care settings.

Model Variables

Based on published literature, the budget impact model assumes the following by country:

- Annual PU incidence and prevalence
- % of PUs that are hospital acquired
- Average patient length of stay (LOS)
- Average cost of one hospital day
- Reduction in PU incidence with intervention

These values are a weighted-average across PU Stages I-IV and can be modified from country-specific to hospital- or setting-specific if values are known.

User modifiable values (default values):

- Number of wards included in the model (3)
- Number of admissions per ward per year (25)
- Number of SEM Scanners deployed per ward (2)
- Time to perform visual skin assessment (4 min.)
- Time to collect SEM Scanner readings (8 min.)
- Number of assessments per day (2)

A net increase in nursing time and a capital expense associated with SEM Scanner deployment were included in the model.

Results

Table 1 presents the model assumptions, specifically an assumed 40% reduction in number of PUs, and the results, specifically the pre- and post-intervention losses (defined as cost of treatment minus reimbursement for

Results (con't)

treatment), the number of beds made available by decreasing LOS, and the total savings after accounting for the cost of deploying the SEM Scanner as an adjunct within a PU prevention protocol.

Table 1: *With 40% PU Reduction, Impact on Costs*

	UK	Belgium	Germany
PU incidence (%)	5.43	5.3	6.7
PU prevalence (%)	10.2	12.1	11.0
% of PU hospital acquired	59	59	26.3
Average LOS (days)	7.4	7.6	7.7
Average cost of one hospital day	£250	€410.8	€523
% reduction in # of PUs per year	40	40	40
# of beds made available	1	2	3
Pre-intervention loss (£/€ '000)	(185)	(765)	(882)
Post-intervention loss (£/€ '000)	(5.3)	(82)	81
Savings with intervention (£/€ '000)	179.7	683	963

Discussion

The most desirable healthcare interventions are those that increase quality of care and lower costs. In all cases of SEM Scanner deployment modeled, the care setting experienced cost savings, even with a default 40% reduction in the weighted average number of pressure ulcers and hypothetical cost increases of SEM Scanner deployment. To date, two separate studies using the SEM Scanner have, anecdotally, observed a reduction in PU incidence during the period of study due to increased awareness of PU prevention. The Germany model showed a modest excess reimbursement as a result of the deployment.

Clinical relevance

Decreasing pressure ulcer incidence is achievable and will result in significant cost savings. The SEM Scanner is well positioned to aid in this achievement.

Acknowledgements

We appreciate the assistance of K. Boodts, J. Höhne, O. Raddunz, and O. Rasit of Deloitte Consulting in developing this model.

Conflict of Interest

None.

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Practical Use of the SEM Scanner in Diverse Clinical Settings

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Introduction

Implementation science is the study of the uptake of evidence-based healthcare technologies and involves assessment workflow with and without the technology. Bruin Biometrics has prepared clinical scenarios to understand the potential impact of the SEM Scanner on workflow and pressure ulcer (PU) detection.

Methods

These scenarios present possible clinical workflows with the SEM Scanner as an adjunct to standard of care interventions for PU detection.

Scenario 1. Inpatient Hospital

Day 1. Mr. W. is a 70-year-old male with right-sided paralysis that began 3 hours prior to admission. The admitting MD performed history, physical exam, and confirmed a neurological infarct following MRI. MD requested skin assessment from wound care nursing specialist (WCN). Braden Scale of 10 suggested high risk for loss of tissue integrity. WCN requested skin assessments each shift including SEM Scanner readings on all vulnerable sites with special attention to bilateral heels and sacrum. WCN advised nursing staff to place him on a pressure reduction mattress, elevate heels, repositon every 2 hours, and monitor for changes in skin integrity with each repositioning.
Day 2. MD and nursing monitored his neurological status every 2 hours; results indicated Mr. W. was neurologically stable with persistent right-sided paralysis. Skin examination including SEM Scanner readings performed and documented in patient record, with no change in SEM readings from Day 1. Physical Therapy (PT) performed evaluation, noted he was a very high fall risk and recommended 24-hour care and 2 hours of physical and occupational therapy per day.
Day 3. Mr. W. visited by MD and nursing. Vital signs, neuro status and skin examination including SEM Scanner readings performed and documented in patient record; no change in SEM readings. Mr. W. remained stable, and was transferred to a skilled nursing facility. Recommendations were to continue currrent observation status, skin monitoring with the SEM Scanner on admission and twice daily due to his high risk of skin breakdown. They were also to continue the pressure reduction mattress and addition of a pressure reduction chair pad when up in chair.

Scenario 2. Skilled Nursing Facility

Day 4. Mr. W. [Scenario 1] was admitted to the skilled nursing facility. At admission, he was found to have Braden Scale of 10. SEM Scanner readings were performed and recorded in patient record. He was

Scenario 2. Skilled Nursing Facility (con't)

placed on a pressure reduction mattress and scheduled for turning/repositioning and skin monitoring every 2 hours. WCN scheduled SEM readings every 12 hours and with any change in skin integrity.
Day 5. Mr. W. was visited by WCN and PT; vital signs, neuro status, and skin examination including SEM Scanner readings were performed. Previous SEM readings werw evaluated. WCN noted that readings 2cm and 4cm left of the sacral bony prominence were elevated compared to prior day and compared to readings from right of the bony prominence. WCN implemented further PU intervention protocols for sacrum based on clinical judgement, Braden Scale, visual assessment, and SEM Scanner readings.
Days 6-9. Mr. W. was visited by WCN and PT; vital signs, neuro status, and skin examination including SEM Scanner readings were performed and documented in patient record. Readings in the sacral region remained elevated at 2cm and 4cm left of sacral bony prominence though no skin discoloration apparent. SEM Scanner used on other regions were unremarkable. Nursing staff advised to continue pressure ulcer intervention protocol for sacrum.
Day 10. Mr. W. was visited by WCN and PT. Neurological evaluation revealed minimal improvement in his mobility; vital signs remained stable. SEM Scanner readings performed and documented in patient record. Braden score of 12 suggested risk for PU development, but improvement with mobility after discharge from the hospital. SEM Scanner readings at 2cm and 4cm left of sacral bony prominence were no longer elevated compared to other regions or readings from Day 4. No skin discoloration apparent. Nursing staff advised to monitor sacrum and other vulnerable areas with visual assessment and SEM Scanner, and he was allowed increased activities out of bed, utilizing the pressure reduction chair pad.
Day 11, onward. Mr. W. is visited regularly by WCN, with evaluation and management of the patient's skin reviewed with nursing staff, PT and his physician. SEM Scanner readings are used daily, in accordance with the skilled nursing facility's skin assessment protocol.

Clinical relevance

As demonstrated here, the SEM Scanner can be used (1) on admission, (2) discharge, and (3) throughout the length of stay as determined by the healthcare practitioners responsible for patient care.

Conflict of Interest

SR, KJ, MB, MB are employees or contractors of BBI. PC is the study coordinator for a study funded by BBI.

P21

Usability and Reliability of the SEM Scanner

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Introduction

The Bruin Biometrics (BBI) SEM Scanner Model 200 (Fig. 1) is a battery operated, portable, handheld device that provides biometric information to a physician or health care professional that can be utilized as an adjunct to the current standard of care for the detection of pressure induced tissue damage. Current standard of care for pressure ulcer (PU) prevention includes risk assessment tools (Waterlow, Norton, Braden scales) and visual inspection. Both forms of assessment are subjective, dependent on the skill of the assessor, and may have issues with one or more measures of predictive validity such as sensitivity, specificity, and reliability [1-3]. During device development, BBI conducted usability and reliability studies in clinical and human subjects.

***Fig 1**. The SEM Scanner.*

Methods

Usability Study of the SEM Scanner. Participants included 22 nurses, nursing students, and nursing faculty. Each participant was given 10 minutes to read the device Instructions for Use (IFU) and then was asked to perform readings at 3 different anatomical sites on a patient mannequin. A trained, unobtrusive observer noted correct and incorrect usage of the device. Upon completion of the procedure, each participant completed a survey assessing 9 domains of usability on a 5-point scale and was invited to give feedback in a one-on-one interview.

Reliability Study of the SEM Scanner. Operators included 3 persons trained in using the SEM Scanner; participants included 31 ambulatory volunteers. Each participant remained in a supine position for 15 minutes prior to collection of SEM Scanner readings. Each operator collected 3 readings using 3 separate devices at 4 anatomical locations on each participant for a total of 108 readings per participant. Intraclass correlation coefficient (ICC), an estimate of how similar measurements collected by different operators or devices are to each other, was calculated for operators and devices in SAS 9.3 (SAS Institute Cary, NC).

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Results

Usability Study. 20 of 22 (91%) participants successfully used the device within 10 minutes of reading the IFU.

***Table 1:** Findings from Usability Survey*

Domain	Avg Response
IFU clarity	4.35
IFU completeness	4.40
Device comfort	4.35
Screen layout and visibility	4.75
Pressure indicator bar	4.60
Ease of cleaning	4.75

Reliability Study. The SEM Scanner was reliable and measurements were repeatable across devices and operators.

***Table 2:** Findings from Reliability Study*

Anatomical Site	ICC By Operator	ICC By Device
Sternum	0.95	0.95
Sacrum	0.86	0.86
Left heel	0.81	0.81
Right heel	0.82	0.82

Discussion

The SEM Scanner rates highly for ease of use and has demonstrated above 80% reliability. Upon learning about the SEM Scanner, health care practitioners immediately understand the potential for significant clinical impact of the device on PU detection. A clinical impact model has been developed and suggests potential reduction in PU incidence with SEM Scanner readings (1) on admission, (2) discharge, and (3) throughout length of stay.

Clinical relevance

The SEM Scanner can be utilized in diverse clinical settings with minimal investment in training to existing staff and will provide reliable assessment of pressure induced tissue damage irrespective of the clinician performing the assessment.

Acknowledgements

We wish to acknowledge the UCLA School of Nursing for use of their Simulation Lab. The SEM Scanner is a non-significant risk device under clinical investigational use in the United States.

Conflict of Interest

Both studies presented here were sponsor-investigator led studies funded by Bruin Biometrics, LLC.

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SEM Scanner Readings to Assess Pressure Induced Tissue Damage

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Introduction

Bruin Biomentrics (BBI) has developed an easy to use device for use as an adjunct to standard of care for the assessment of pressure ulcers (PUs). Under clinical investigational device use in the United States, we have used the SEM Scanner in two clinical studies to assess sacral and heel regions in persons affected and unaffected by PUs. New, portable tools used for early detection of pressure ulcers are essential if prevention is to be possible.

Methods

Affected Subjects Study. Participants were recruited from nursing homes or assisted living facilities in Virginia Beach, VA, USA and Los Angeles, CA, USA. Enrolled subjects were ≥ 18 years of age, had a Stage I PU or suspected deep tissue injury (DTI), and were free of physical limitations or contra-indications preventing assessments and readings. Each identified PU or DTI was assessed visually and with the investigational device. SEM Scanner readings were collected at the center of the wound and at 16 points around the wound (Fig 1). Demographics, medical history, Braden and Waterlow scores were collected. Analyses presented for the Affected Subjects Study are based on interim data, enrollment is ongoing.

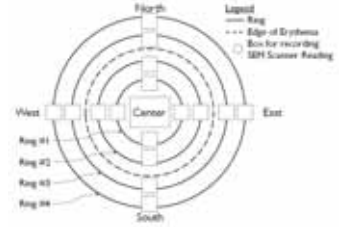

***Figure 1.** SEM Scanner Wound Mapping Technique*

Unaffected Subjects Study. Participants were recruited from a pain specialty clinic in Virginia Beach, VA, USA. Enrolled subjects were ≥ 55 years of age, were free of physical limitations or contra-indications preventing readings, not currently using corticosteroids, and free of rheumatoid arthritis, gout, or autoimmune disease. SEM Scanner readings were collected at the center of the sacrum and left or right heel and at a subset of the 16 points of Fig 1 (7 for sacrum and 4 for heels). Demographics and medical history were collected.

Statistical Analysis. Ordinary least squares regression for testing differences in means was implemented in SAS 9.4 (SAS Institute Cary, NC). All study subjects provided informed consent.

Results

***Table 1:** Demographics of Study Subjects*

	Affected Subjects	Unaffected Subjects
# Subjects	46	50
% Male	47.8	50.0
Average Age (SD)	82 (13.4)	67 (7.3)
% Caucasian	78.3	78.0
# Heel PU/DTI	35	n.a.
# Sacrum PU/DTI	13	n.a.

SEM readings at the center of wounds on the sacrum are significantly lower ($p<0.001$) and SEM readings at the periphery of wounds on the sacrum are significantly higher ($p<0.001$) than SEM readings from the same anatomical region that is unaffected by a PU.

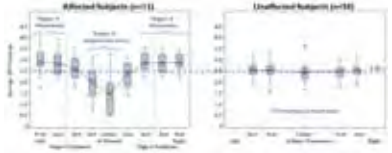

***Figure. 2** SEM Scanner Readings for Affected and Unaffected Sacrum*

Similar patterns are seen for PU/DTI wounds on heels albeit SEM Scanner values are lower for heels than for sacrum in affected and unaffected subjects.

Discussion

The SEM Scanner provides a tool for assessment of tissue viability and wound status. Consistent with a model of inflammation followed by tissue damage, SEM Scanner values are lowest at the center of the PU wound and are highest at and beyond the edge of erythema.

Clinical relevance

SEM Scanner readings performed (1) on admission, (2) discharge, and (3) during length of stay can provide an objective means of supporting pressure ulcer assessment in the clinical setting.

Acknowledgements

We wish to acknowledge F. Turner, MD; A. Touch, MD; and P. Crawford, MSN, NP for assistance with these studies.

Conflict of Interest

These studies were funded and sponsored by Bruin Biometrics.

Effectiveness of the implementation of evidence-based recommendations for pressure ulcer prevention in hospitals - a systematic review

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Introduction
For more than ten years, evidence-based guidelines have been available for pressure ulcer (PU) prevention. But epidemiological data show a significant number of patients at risk who do not receive adequate preventive measures, indicating poor implementation of guideline recommendations [1,2]. Therefore, this review aimed to investigate the effectiveness of strategies for implementation of evidence-based recommendations for PU prevention in hospitals.

Methods
DESIGN: Systematic review with structured narrative synthesis of the data. SELECTION CRITERIA: We included randomised controlled trials (RCTs) and prospective, non-randomised controlled studies, reporting the effect of implementation of evidence-based prevention recommendations on the PU incidence in acute hospitals (published in German or English). DATA SOURCES: Electronic search in three databases (Medline, Cochrane Library, CINAHL) covering the period from January 2000 to May 2013, and bibliographies of retrieved studies. STUDY QUALITY: Study quality was assessed regarding risk of bias, statistical imprecision and the reproducibility of reported implementation strategies. Selection of eligible studies, data extraction, and critical appraisal were performed by two independent reviewers. SYNTHESIS: The characteristics of the implementation strategies were summarised using the framework of process evaluation by May [3] and cross-mapped with the studies' results, stratified for the trial quality.

Results
We included five studies (1 cluster-RCT, 4 non-randomised studies). In all studies, the implementation strategies comprised several components, with combining guideline recommendations in prevention bundles, staff education, monitoring and feedback activities, and local PU prevention champions most frequently applied. In general, strategies varied greatly, e.g. with respect to content, intensity, and duration of activities or target groups. In terms of risk of bias and statistical uncertainty, the study quality of all non-randomised trials was assessed as very low, while the cluster-RCT showed moderate quality. The reproducibility of reported interventions appeared as either moderate (2 studies) or very low (3 studies). All non-randomised trials reported a reduction of PU incidence. The cluster-RCT revealed no between-group difference in the PU incidence post implementation.

Discussion
Despite the majority of studies showing a benefit, results must be interpreted with caution. Given the existing limitations in quantity and quality of available trials, we were not able to reliably assess the impact of implementation of evidence-based recommendations for PU prevention on the PU incidence in hospital patients and to identify likely reasons for success or failure. In future trials, implementation strategies should be chosen based on the most appropriate theoretical and empirical evidence. Components like reward systems for staff empowerment or supply of devices were rarely included in the evaluated strategies, but may be potentially important.

Clinical relevance
Based on our systematic review, the clinical impact of implementation of evidence-based recommendations for PU prevention in acute hospital patients remains unclear. In clinical practice, activities striving for better preventive care should be complemented with robust process and outcome evaluation.

Conflict of Interest
There are no conflicts of interest.

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Successful management of a non-healing pressure ulcer for an immuno-compromised child with a bacteria binding gel dressing

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Introduction
A 2-year-old girl with Acute Lymphoblastic Leukemia (ALL) developed a grade 4 pressure ulcer in the right gluteal sulcus after six months of chemotherapy treatment. The wound was managed with wound gel and adhesive secondary dressings according to local clinical practice. Surgical debridement of necrotic tissue was performed on two occasions with minimal improvement noted. After 20 days of management the wound was still about 2.5 cm in diameter (Fig. 1). Meanwhile, the patient suffered from two episodes of febrile neutropenia requiring IV antibiotics. Also advanced antimicrobial dressings including silver based preparations were used with little improvement.

Methods
The management with a bacteria binding gel dressing began just over a month after the first visit to the wound clinic. The gel dressing was covered with moisture preserving polyurethane dressing. The dressing was changed twice weekly by the patient's mother, who photo-documented the healing process.

Results
At the dressing change after 7 days a notable improvement had occurred (Fig 2). After 13 days of treatment, the wound was further improved and healing of the wound occurred over time while chemotherapy treatment was ongoing.

Fig 1. *Wound before start of management with the gel dressing.*

Fig 2. *Wound status after 7 days with the gel dressing.*

Discussion
The patient in this case report was an immunocompromised toddler thus making the choice of dressing paramount. The purpose of the dressing was to protect the wound from infection without interfering with healing while maintaining a good moisture balance. Location of the wound within the diaper boundary and in combination with a compromised immune system increased the likelihood of wound contamination. This was a reason alone to protect the wound from infection.

In this case a bacterial binding gel dressing was used to protect the wound against microorganisms. The mode of action of the dressing is based on hydrophobic interaction and is not dependent on the release of chemicals into the wound bed [1].

An important factor for good wound healing is that the moisture balance is maintained [2]. After debridement of the necrotic tissue a wound cavity was formed which was filled with the gel dressing. As the gel is combined with a dressing the gel is kept in place.

The patient was managed at home with regular visits to the hospital to verify the state of the wound status. The dressing was easy to apply and remove both at the hospital and in the home environment. The gel did not cause pain and the dressing did not stick to the wound bed which may cause pain at dressing change.

Clinical relevance
This case report indicates that a bacteria binding gel dressing can add value in the treatment of a non-healing pressure ulcer in an immunocompromised child.

Acknowledgements
We appreciate the help of the mother of the child with continuous report on progress and pictures.

Conflict of Interest
There is no conflict of interest regarding the material discussed in the case report.

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Proceedings of the 17th Annual European Pressure Ulcer Meeting
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Therapeutic hypothermia and pressure ulcer risk

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Introduction

Recent NPUAP-EPUAP [1] guideline on pressure ulcers (PU) highlights oxygen consumption and temperature among the risk factors of pressure ulcer development. Both hypothermia [2] and fever [3] have indicated as risk factors, which is somewhat conflicting since the oxygen consumption increases or decreases about 13 %, when the body temperature changes with one degree Celsius [3]. We examined whether therapeutic hypothermia predisposes for pressure ulcer development.

Methods

During 2010-2012 totally 4899 adult patients were treated in a large, mixed intensive care unit (ICU) and 364 patients (incidence 7.6%) of them developed a pressure ulcer. Patients with pressure ulcer exclusively in the nose caused by a non-invasive ventilation mask were excluded from the analysis.

To investigate the relationship of hypothermia and PU risk we examined retrospectively the development of PUs among adult patients with induced therapeutic hypothermia (N=59) with a target temperature of 33°C [4] over the three years in this mixed ICU population.

Results

74.6 % (44) of the patients were transferred to wards as recovering. 12 (incidence 20.3 %) out of the 59 therapeutic hypothermia patients developed a pressure ulcer during their intensive care period. The location of pressure ulcer was not recorded in 8 patients, two had a pressure ulcer in sacrum and 2 in the heels.

Discussion

Hypothermia reduces the oxygen requirements of the tissues considerably which together with the use of dynamic mattresses aimed at maximum protection against PUs should decrease the risk of pressure ulcer development [1]. When assessing the PU risk issues in the past medical history and the prior cardiopulmonary resuscitation needs to be considered as predisposing factors for PU development. Furthermore, the total immobility with deep sedation and prolonged intensive care together with stiffening (reduced elastic modulus) of the tissues due to hypothermia will increase the pressure ulcer risk [1, 2, 5]. In this ICU population, the extremely high risk group of intensive care patients for PU development i.e. Jackson/Cubbin score ≤29 [2,5], where the therapeutic hypothermia patients also belong to, the incidence of pressure ulcers is about 12 % [5]. Furthermore, within these intensive care patients we can identify subpopulations of patients whose PU risk is more than 40 %. Thus based on the incidence figure of the pressure ulcers in the therapeutic hypothermia group, it is questionable, whether hypothermia forms a major risk factor for pressure ulcer development.

Clinical relevance

Patients treated with therapeutic hypothermia belong to the high risk group developing a PU for several reasons and has to be treated accordingly. Still hypothermia itself is not necessarily independent risk factor for PU development.

Acknowledgements

The study has been supported by grants from the author's Department, the Finnish Wound Care Society and the Finnish Society of Intensive Care Medicine.

Conflict of Interest

Esa Soppi is the chairman of board of Carital group manufacturing and marketing globally mattresses for pressure ulcer prevention and treatment.

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Sequential Organ Failure Assessment as a Predictor of Pressure Ulcer Risk in Intensive Care Patients

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Introduction

More than 450 different risk factors for pressure ulcer development were recently identified [1]. Many of these risk factors are derived from common basis but dealt or interpreted differently in various risk scales. The Sequential Organ Failure Assessment (SOFA) score takes into account in addition to respiratory and hemodynamic variables also renal hepatic and hematological disorders as well as the Glasgow Coma score (GCS) [2]. Manzano et al (2010) [3] identified first-day respiratory SOFA and fourth-day cardiovascular SOFA subcategories as possible risk factors for PU development. Furthermore, Glasgow Coma score have been indicated as a possible risk factor [1]. This abstract reports the significance of the SOFA scale on pressure ulcer development in a cohort of more than 4700 ICU patients.

Methods

The data were retrospectively collected from the clinical database of a large mixed intensive care unit (ICU) consisting the whole adult patient cohorts (about 1630/yr) from years 2010-2012 [4]. The first day SOFA scores were used to predict the PU risk. The patients with PU at admission (N=115) as well as those from whom all data point were not available were excluded from analysis.

Results

357 out of 4782 patients during their ICU stay developed a pressure ulcer, a PU incidence 7.5%. The higher the SOFA score the more patients developed a PU (P<0.0001, logistic regression). A SOFA score ≥12 group consisted of 7.1% of all patients but that group included 18.5% of all PU patients. Only the thrombocyte count and bilirubin concentration were not significantly associated with PU development (P=0.2817 and P=0.0707, respectively).

Discussion

Previously only limited evidence have been available of the association of SOFA score or its subcategories to the development of pressure ulcer in intensive care [1, 3]. The Jackson/Cubbin (J/C) risk scale which has been shown to perform best among risk scales for intensive care patients [4, 5] contains respiratory and hemodynamic variables. Even though they are presented in J/C scale differently from that of SOFA the results are concordant. It seems that large patient materials are needed to show, excluded or confirm previously suggested associations of SOFA and PU development [1, 3]. The results confirm and indicate that the first day respiratory and cardiovascular SOFA subcategories have a predictive value for the pressure ulcer development in the ICU setting.

Clinical relevance

Respiratory and cardiovascular SOFA subcategories together with other variables may improve the prediction of pressure ulcer development in ICU patients.

Acknowledgements

The study has been supported by grants from the author's Department, the Finnish Wound Care Society and the Finnish Society of Intensive Care Medicine.

Conflict of Interest

Esa Soppi is the chairman of board of Carital group, manufacturing and marketing globally mattresses for pressure ulcer prevention and treatment.

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Vital Skin Predictor – a measurement tool to quantify temperature and humidity at the interface between wheelchair cushion and buttocks

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Introduction

Pressure distribution, sitting balance, temperature and humidity are important factors in the prevention of pressure ulcers. Temperature and humidity determine the microclimate between cushion surface and buttocks. Ferguson-Pell states that too little attention is paid to microclimate [1], one reason being that it is very difficult to quantify objectively. More knowledge about this microclimate may aid in the choice of cushion type and may aid in raising patients' awareness regarding the importance of the aforementioned parameters. The aim of this study was 1. to develop a system to measure temperature and relative humidity at the cushion / buttocks interface (CBI), and 2. to assess potential differences in microclimate changes over time, in healthy volunteers who sat on three types of cushions.

Methods

The Vital Skin Predictor (VSP) measurement mat, developed by Adelante, consisted of 7 calibrated sensors (STH75, Sensirion). 6 placed in a permeable fabric (sedelogic.com) and 1 measuring room climate. Ten healthy subjects participated in the study (table 1). They sat on the VSP quietly for 45 minutes behind a PC. All wore trousers of identical fabric. The difference was calculated between the relative humidity measured in the room and the mean value of relative humidity measured by the 6 sensors in the VSP, averaged over the last five minutes of the 45 minute measurement.
The three cushion types used were:

- Basic wheelchair cushion (Handicare) (basic)
- CulsanaMedicalSeat with permeable cover (Culsana) (CMS)
- CulsanaMedicalSeat with PU cover (Culsana) (PU)

Statistical analysis included Wilcoxon signed-rank tests.

Table 1: *Description of the participant group (mean ± sd)*

Number	Age [years]	Weight [kg]	Height [m]
10 (3 male)	39.3 ± 14.9	71.5 ± 10.5	1.71 ± 0.04

Results

Figure 1 shows an example of time series of the measurements from one participant. Figure 2 shows boxplots of the difference in relative humidity for all 3 cushion types. Temperature at the CBI did not differ significantly between the three cushions types.

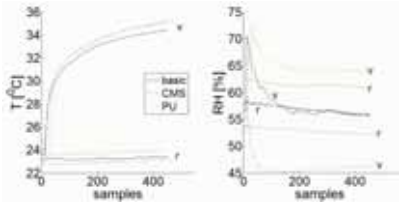

Fig. 1: *Example of time series temperature (T) and relative humidity (RH) of room (r) and VSP mat (v)*

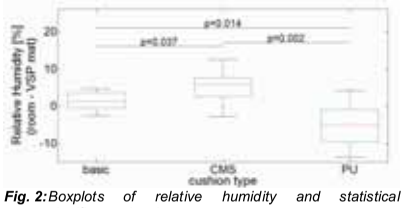

Fig. 2: *Boxplots of relative humidity and statistical significance levels*

Discussion

The VSP proved to be mechanically robust (wear-and-tear) and electronically stable. The VSP is able to differentiate between cushion types regarding microclimate aspects, i.e. regarding relative humidity. Of the three cushion types compared, CMS proved to be the best in regulating the microclimate at the CBI.

Clinical relevance

Results indicate that the VSP may provide valuable information as to prescription and evaluation of cushions, thereby optimising pressure sore prevention regimes.

Acknowledgements

We appreciate the help of R. Doon, Culsana BV, and J. Stokkermans, Sedelogic, the Netherlands

Conflict of Interest
Non declared

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Methods and results of the James Lind Alliance Pressure Ulcer Priority Setting Partnership

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Introduction

The role of people with chronic, complex wounds in wounds research is usually limited to, *"being objects of study and beneficiaries of research results"* [1] The James Lind Alliance Pressure Ulcer Priority Setting Partnership (JLAPUP) was initiated by the National Institute for Health (NIHR) Wounds Research for Patient Benefit (WRPB) programme grant for applied research [2]. The primary objective was to bring service users/patients, carers and health professionals together to identify and prioritize the top ten uncertainties, or 'unanswered questions', about the effects of pressure ulcer interventions that they agree are the most important. A second objective was to investigate methodology for patient and public involvement in research priority setting in wound care. Pressure ulceration was chosen because pressure ulcers were the most common complex wound type found in the WRPB prevalence study and because pressure ulcers are a high priority for the UK National Health Service (NHS). The prevention of pressure ulcers is included in domain 5 of the NHS outcomes framework 2014/15 [3].

Methods

We adopted a mixed methods, participatory research framework to this priority setting work. There is no gold standard method for health research topic identification and priority setting and reporting in this area is predominantly descriptive rather than evaluative [4, 5]. JLAPUP was conducted in close collaboration with the James Lind Alliance (JLA) which was established in 2004 to bring together patients, carers and clinicians together in Priority Setting Partnerships (PSPs) to identify and prioritize uncertainties about the effects of treatment. While our methods were informed by the emergent JLA approach, we were also influenced by other approaches and in particular the Dialogue Model, another framework for research agenda setting, which includes both consultative and deliberative methods and allows for emergent and flexible design. A protocol was developed which outlined a six phase process comprising exploration, initiation, consultation, collation, prioritization, integration, reporting and evaluation. This was followed under the guidance of the JLAPUP steering group.

Results

An existing, reliable answer in the research literature was found for only one of the 690 intervention uncertainties submitted in the process. 61% of research questions generated focused on prevention as an investigative outcome and 32% focused on healing. Genuine uncertainties are published on NHS Evidence in the UK Database of Uncertainties about the Effects of Treatments (DUETs). The top twelve uncertainties chosen in the deliberative process are at http://www.jlapressureulcerpartnership.co.uk/

Discussion

The JLAPUP process revealed the extent of research uncertainty about pressure ulcer treatment and prevention. In addition to the effectiveness of treatment and prevention interventions, stakeholders also placed high priority on research concerned with aetiology, diagnosis, prognosis and other aspects of care. In keeping with previous PSPs, JLAPUP prioritized questions about the effectiveness and harmonization of NHS service models and the best means of supporting patient and family self care within those models. JLAPUP faced the particular challenges posed in developing patient and public involvement work with those affected by chronic wounds who are often elderly, immobile, unrepresented and unwell, many of whom are living with concurrent long term conditions. Participants in the process were generally younger and more likely to be living at home than the pressure ulcer population as a whole. People in more formal care settings (including people in nursing homes and hospital in-patients) were under-represented compared to the pressure ulcer population as a whole. These omissions may be offset to some extent by the inclusion of uncertainties from health professionals and carers for these groups.

Clinical relevance

The JLAPUP process revealed that some strongly held beliefs about pressure ulcer care are actually big research uncertainties.

Acknowledgements

We appreciate the help of all of the partners and all those who submitted their experiences and uncertainties to the process.

Conflict of Interest

None

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MRI and 3D FEA based investigation of Deep Tissue Injury in Rat Tibialis Anterior Muscle

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Introduction

Deep tissue injury (DTI) is a type of pressure ulcer developing due to loading of soft tissue e.g. near bony prominences. Often injury remains internal and undetectable until severe and external wounds develop, highlighting the need for improved early detection of and insight into the onset of DTI. To this end animal experiments and dedicated finite element analysis (FEA) can be performed [1]. In this study a novel magnetic resonance imaging (MRI) compatible experimental set-up is used, enabling mechanical loading of the tibialis anterior muscle (TA) of a rat during 3D MRI [2]. The MRI methods combined with custom 3D FEA allow for evaluation of in-vivo damage and loading metrics during DTI development.

Methods

7-week-old Sprague-Dawley rats (♀, 152-220g, n=10) were secured in the MRI compatible set-up and subjected to 2h indentation of the TA. A 7.0T Bruker small animal scanner was used to perform MRI measurements pre-, during- and post-indentation. Anatomy and geometry was recorded using T1-weighted MRI while indentation induced physiological changes, potentially including damage, where assessed with T2-mapping. Animal specific 3D FEA models were generated based on segmentation of the T1-data (using the GIBBON MATLAB Toolbox [3]). FEBio (1.6.0) was used to simulate indentation by prescribing indentor motion, and soft tissue was modelled as uncoupled Ogden hyperelastic. Local strain energy density (SED) served as a summary metric of deformation. Quantitative T2-maps were obtained by voxel-wise MRI signal fitting. Preliminary analysis was performed on two subjects comparing SED and T2-maps.

Results

In **Fig-1 A-B-C** T2-maps of the TA muscle are shown pre-, during- and post-indentation, respectively. Significantly increased T2-values (ROI-based analysis, paired t-test, $p<0.001$) were observed post-indentation as compared to pre- and during-indentation. The T2-enhancement was highly structured and edema was present between muscle and skin. **Fig-1 D** shows a schematic representation and boundary conditions of the 3D FEA. **Fig-1 E** shows that the SED was maximal at the indentation site. **Fig-1 F** shows an axial SED slice corresponding to those in **Fig-1 A-B-C**. A comparison of **C** and **F** shows that regions of high SED values and raised T2 values visually colocalize.

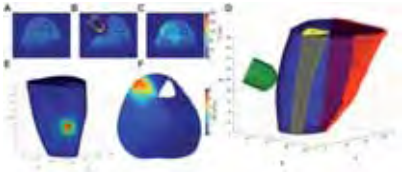

Fig. 1: A B C: *Quantitative T2 maps [ms] of TA skeletal muscle pre (**A**), during (**B**), and after (**C**) indentation. **D**: Schematic representation of the FEA model, in blue the meshed soft tissue model, in green the indentor prior to indentation, in yellow the bone nodes with a prescribed displacement due to indentation, in red the selected skin surface nodes which were modeled as rigid due to contact with the cast used for fixation of the leg. **E**: The SED results [kPa] of the entire leg are shown. **F**: Axial cross section of the SED which corresponds to the slice in C.*

Discussion

The development of DTI is indicated by local tissue T2-enhancement. T2-enhancement is caused by an increase in intra- and extracellular free water. Possible causes for this increase are pathological features associated with DTI such as inflammation and oedema. Visual comparison between the FEA results and T2-maps show that high SED values colocalized with elevated T2 values, and thus damaged tissue. Future work focusses on the further analysis of the 3D MRI T2 and FEA derived damage metrics.

Clinical relevance

The combination of MRI and FEA provides insight into the effects of mechanical loading on the development of deep tissue injury. This insight can be used to optimize treatment strategies.

Acknowledgements

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Conflict of Interest

No conflict of interest.

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Surfaces for Health – Reducing pressure ulcers using surface technology

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Introduction

The onset of a pressure ulcer, superficial or deep, is multifactorial although it seems clear that sustained mechanical loading is the primary cause. [1], [2] The influence of shear/friction on the development of pressure ulcers has been acknowledged for a long time. Dinsdale (1974) found that the combination of pressure and shear could reduce the threshold value for the development of pressure ulcers by a factor of 10.[3] The images in figure 1 underline the importance of taking shear into account. The figure illustrates the calculated stress distribution inside a spherically shaped deforming body sliding over a flat surface. This results in a shear force parallel to the surface that depends on the friction coefficient. In the almost friction-free situation (figure 1 a) the maximum stress found inside the tissue is relatively low and is located at a short distance from the surface interface. With increasing static friction coefficient (figures 1b and c), the overall stress-level increases significantly and the location of the maximal stress moves to the surface of the skin.[4] In addition to the increased mechanical stresses within the tissues, shear forces can cause blocking of the capillaries and thus minimize blood flow and local oxygen levels as well as separate the layers of the skin and damage the stratum corneum.[5]

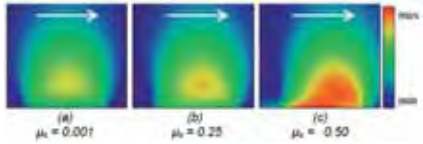

Fig. 1: *Sub-surface stress in contact with increasing static friction coefficient (μ_s)*

Therefore, the focus of the multidisciplinary "Surface for Health" research program is on the contact and friction behavior of the human skin in relation to the development of pressure ulcers. This research project is a cooperation between tribologists, rehabilitation clinicians, biomechanical and biomedical engineers.

The aim of the project is threefold:

1) Development and experimental validation of a model that describes skin-surface interaction, including the effects of surface textures and local environmental conditions.
2) Developing a method to measure tissue damage and irritation as a result of shear.
3) Assessing the sensitivity of skin to shear.

Methods

The proposed approach is to develop computer models describing the interaction between skin and a supporting surface. These models will be used to quantify normal and shear stresses and the strains inside the tissue as a function of the contact properties and the environmental conditions. In-vitro and in-vivo experiments will be performed to validate these models.
Subsequently, the irritation and damage mechanisms in the skin and the underlying tissue that result from the stresses in the contact area will be described. The use of biomarkers as a measure for skin irritation/injury will be further explored, with particular focus on the influence of shear loads.
Lastly, the load and load-ability of the skin will be assessed in-vivo, using Laser Doppler flowmetry and White light Photospectromety to measure the perfusion and oxygenation of the tissue up to a maximum measurement depth of 10 mm.

Clinical relevance

This project aims to get more insight into the role of shear in the development of pressure ulcers, and the relation between load and the load ability of the skin in respect to shear and skin properties. This knowledge can be used in the clinic to early detect patients at risk of developing pressure ulcers based on their skin characteristics and eventually develop materials that reduce the effect of shear on the skin.

Acknowledgements

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Conflict of Interest

There are no conflicts of interest reported.

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Preventing Heel Blisters in Orthopaedic Patients who have spinal anaesthesia

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Introduction

This is a multiple Orthopaedic patient innovation that positively impacts on a change in a particular care group. The study is to determine if the application of a five layer silicone dressing when used prophylactically would reduce the incidence of the development of a grade 2 heel blister, where shear and friction are causative factors post operatively in acute trauma patients who undergo spinal anaesthesia.

Methods

All patients who present on the unit over a 3 month period with fractured neck of femur and are selected for spinal anaesthesia repair will be included in the study. Subject to consent they will have a five layer silicone heel dressing applied immediately post operatively. The heel skin will be monitored for signs of non blanching erythema daily and the dressing will be removed after 72 hours post operation or when the patient is mobilizing out of bed.

Patients with known vascular disease or with existing tissue damage related to pressure, shear or friction will be excluded from participating in the study. Usual preventative care delivery will be continued throughout the study with the addition of the silicon dressing application.

Previous data has been collected on incidence of post operative heel blister damage following spinal anaesthesia and this will be utilized as a baseline in order to determine decrease in incidences.

Data will be collected on age, sex, surgery performed, Waterlow Risk Assessment score, any skin damage identified on admission, type of trauma, period of time prior to hospital admission.

Discussion

The prevention of hospital acquired pressure ulcers in all patients remains a critical challenge once all known preventative strategies have been utilized. Whilst generic strategies such as pressure reducing foam mattresses and dynamic pressure relief mattresses, the incorporation of rounding's, positional movement, nutritional correction, etc all play a significant part in preventing such events. It is argued that there is a requirement to also recognize that deeper analysis into the specific causative factors of pressure area damage which are specialist to the patient and/or the patients presenting condition should also be addressed. The incorporation of the five layer silicone dressing into the context whereby the patient has an enforced deficit of sensory perception could then be widened to incorporate those patients who have a disease related deficit such as new stroke patients, elderly patients and diabetic patients, who have degrees of peripheral neuropathy and are often unaware of the sensory deficit, may also benefit from such preventative measures.

Data collection will demonstrate if a fall in incidence occurs when analyzed against previous comparable period data. Recommendations for a wider study to be undertaken will include patients who have sensory deficit and this will be made once the initial data collection is completed and preliminary conclusions can be derived.

Clinical Relevance

The hypothesis for testing is that the application of a five layer silicone dressing within the principles discussed by the Santa Maria study can be applied in a setting where moisture is not a key factor but where sensory deficit results in shear and friction being a principle causative factor, will result in a decrease from previous acknowledged data statistics.

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SYSTEMATIC IMPROVEMENT OF PRESSURE ULCER PREVENTION

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Introduction

When the Kalmar County Council first conducted a prevalence study of pressure ulcers, the prevalence of 19 percent of patients affected was reported, i.e. every fifth patient had pressure ulcers! To implement a change soon became imperative. An interdisciplinary group was set up, with focus on systematic improvement. The objective was thus to achieve an annual reduction of pressure ulcers by 20 %, beginning in 2012, and to eventually achieve Vision Zero.

Methods

Methods:

- Mapping of pressure ulcer prevalence in each ward (2008 -)
- Consensus regarding common materials and procedures:
  - Preventive methods (repositioning schedule, pressure-relieving equipment, right mattress etc.)
  - Education programs
  - Prevention plans
- Follow-ups after each prevalence study and annually
- Follow-ups on risk and skin assessments
- Establishment of skin-care teams

Results

In 2014 the Kalmar County Council reached a prevalence of 5.4 percent, the lowest reported prevalence in all the County Councils of Sweden.

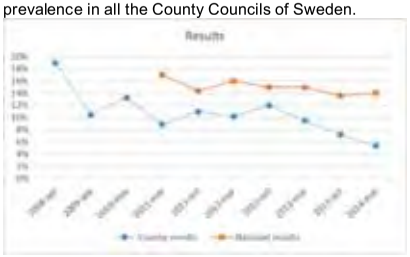

Table 1: *Prevalence studies 2008-2014*

Note: The results include all reported pressure ulcers, even ulcers that were known when the patient was admitted to hospital.

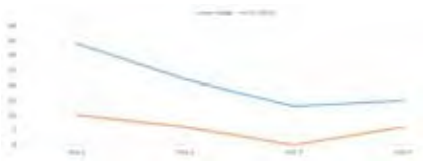

Table 2: *Categories/stages of pressure ulcers 2008 vs 2014*

Discussion

During the course of this project, the team has met a few challenges:

- Is it ethically correct to fully involve patients at life´s end?
- Is it possible to reach Vision Zero?

Clinical relevance

Pressure ulcers increases the number of days spent in hospital, depleting budgets by 70 000 SEK/patient, but above all – pressure ulcers results in increased suffering for each patient.

Conflict of Interest
None.

P33

Mepilex Border Sacrum dressing use for pressure ulcers prevention in period of open heart surgery and in ICU

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Introduction

Pressure ulcers prevention is more than ten times cheaper than treatment. By using modern technologies and diagnostic methods during open heart surgery, nowadays it is possible to make surgeries for high risk patients. According to that, there is a possibility to get pressure ulcers during the surgery. It is important to assess the risk of obtaining a pressure ulcer for each patient, and to prevent to pressure ulcers before surgery as most of them can be prevented. One of the actions in pressure ulcers prevention is using suitable dressing which maintains skin entirety. To prevent pressure ulcers effecitively, Mepilex Border Sacrum dressing was used for patients before open heart surgery artifical blood condition.

Aim. To evaluate Safetac technology dressing Mepilex Border Sacrum effect on maintaining skin entirety (pressure ulcers prevention) for patients during open heart surgery and in ICU.

Methods

Clinical observation in which took part 16 patients. Main patient selection criterias: Mechanical lung ventilation (16); repetitive surgery (4); long surgery (13); unstable hemodynamic (13); obesity (4). Each of selected patients were estimated. Estimation included evaluation of skin eternity and risk of pressure ulcers from Braden scale before putting on dressing in surgery room, in ICU and before patients were moved to the clinical heart surgery department. Duration of surgery was from 2 to 11 hours. Average age of patients:65 years. For one patient the dressing was used after surgery in ICU with an intention to prevent PU. During surgery one patient got 2nd stage PU in sacrum area outside of the borders of dressing.

Results

From all selected 16 patients, everyone maintained skin entirety by using Mepilex Border sacrum dressing, 1st stage pressure ulcers healed in 17 hours and 2nd stage pressure ulcers healed fully in 19 days. Period of using one dressing was 3-7 days. Total usage of dressings: 19, average usage time of one dressing: 1, 5 days (7max).

Conclusions

Safetac® technology Mepilex Border Sacrum dressings efficiency was convincingly proved in clinical practise, using for patients with prolonged immobility. If started using Mepilex Border Sacrum at the righ time for prevention it is possible to fully maintain skin eternity during surgery and recovery period in intensive care unit.

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P34

The prevention of sorrorigenic wounds in intensive care

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Introduction

Some wounds may be caused by the negative effects and activities of nurses and their care. Adverse effects include: prolonged pressure on the skin and tissue; pressure of the equipment, friction, moisture, devices for monitoring vital signs, inappropriate fixation, allergy to patch or disinfectants; restraints; frequent rebandaging of wounds; insufficient/incorrect application of a protective film on the predilection sites; inappropriately selected therapeutic material for healing; inappropriate use of anti-decubitus aids or prone position [1, 2]. The formation of wounds is caused because of the focus on life-saving and so neglected skin care is common in intensive care units.

Methods

A questionnaire survey (22 items) was carried out among nurses working in the largest Faculty hospital in the South Moravian region (Czech Republic). Statistical analyses was made with using the Kruskal-Wallis and Wilcoxon test (significance level 0.5).

Results

The survey was completed by 149 acute care nurses (working at anesthesiology – AN or ICU) with a response rate of 86.7%. The average age of respondents was 31 years. Average duration of working experience was 9 years. Most of the nurses graduated from secondary school for nurses (40.94%). Only a few had an academic degree (BSc. 20.13%; MSc. 9.4%). Half of the respondents worked in AN (47.65%) and a half at ICU (52.35%). Almost all interviewees marked down pressure ulcers (84.56%) as sorrorigenic wounds In addition, they marked down hematoma (38.26%), excoriation 29.53% and moist lesions in 28.86%. Abrasion of the skin were marked down in 24.16%. A total of 12 respondents (8.05%) were not able to identify sorrorigenic wounds. The most common cause of wounds was reported as being inadequate nursing care (81.21% respondents) and as the most common local cause of sorrorigenic wounds pressure (80.54%), moisture (77.18%) and intrusive manipulation (72.48%) were marked down. The use of derivative ointments was more common at ICU than at AN. Despite this almost half of the respondents (45.64%) rated their competences as good, 33.56% as very good, 10.07% as sufficient and 7.38% as excellent and only 3.36% as inadequate. The average mark grade of subjective competence assessment was 2.68 (on a 1 to 5 point scale). Subjective evaluation of knowledge was similar. Most nurses (48.99%) considered their knowledge as good, 27.52% as very good, 16.78% as satisfactory and 3.36% evaluated their knowledge as excellent and/or inadequate. The average grade was 2.89.

Discussion

Nurses in our sample evaluated themselves as relatively qualified yet gave lower self-evaluation ratings to the level of their knowledge. In spite of feeling qualified only 16.11 % said they are always accepted by physicians in wound prevention and only 6.05% is accepted in wounds treatment. Doctors accept them above all in the assessment of wounds 59.73%. We have found that nurses from AN feels better accepted by physicians (p≤0.00). This is consistent with findings in other sources [1, 2]. It is confirmed also in McCluskey´s study, which indicates ambivalent findings. On one hand, it admits that nurses do not have sufficient knowledge but conversely, if nurses do have the knowledge, it is often not accepted by physicians [3]. We have verified that nurses' knowledge depends on the type of workplace P = 0.02. Nurses from AN showed better knowledge in their objective evaluation. Nurses from AN also are more likely to perform dressing changes with a specialist nurse at any time of day, while nurses in the ICU often perform dressing changes with a doctor during morning hygiene care (p≤0.00).

Clinical relevance

Acute care nurses from our sample have a sound knowledge of wound prevention, but it appears that many of them do not use the recommended clinical guidelines pertaining to wound care. Because it is important for nurses to be able to detect early symptoms of wound formation and possible complications it is necessary to plan treatment precisely according to current clinical guidelines. Knowledge about the risk of possible interventions has to be improved for intensive (acute) care nurses and physicians should accept better the knowledge and skills of their nurses.

Acknowledgements

We appreciate the help of nurses from The Brno Faculty Hospital.

Conflict of Interest – no conflict of interests

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Pressure ulcer prevention – Why don't we start from the beginning?

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Introduction

Extensive research tells us that pressure ulcer prevention does make a change and early actions are encouraged. International and national clinical guidelines have been developed. However, we also know that these guidelines are not always used in everyday practice [1]. Furthermore, clinical guidelines often exclude the care provided at more complex settings as for example the emergency department and ambulance contexts. Why don't we start from the beginning of the acute care delivery chain?

A randomized controlled trial (RCT) has been undertaken to test the effect of heel pressure ulcer prevention boots. The purpose of this presentation is to describe methodology, and strengths and barriers when conducting a RCT across the acute care delivery chain.

Methods

The RCT involved ambulance stations, emergency departments and wards at two county councils in Sweden (Fig. 1). A total of 183 patients participated in the study. Study-specific protocols were developed to cover the care processes in the entire acute care delivery chain, from inclusion in the ambulance to discharge from a hospital ward.

Fig. 1: *The participating settings in the acute care delivery chain.*

Results

Information about incidence of pressure ulcer, risk assessment as well as patients´ perspective of comfort was gathered. Data collection is completed and data analysis in progress.

Discussion

Interventions focusing on the entire care process, from the pre-hospital care, admission via the emergency department and to discharge should be encouraged in respect to safety and quality requirements to improve the patient care.

Our study shows that it is possible and of importance to carrying out RCTs across the acute care delivery chain. Although the intervention was easy to apply, the implementation to the contexts was more complicated. During the planning stage and the data collection several challenges were raised; such as organizational changes, logistic issues, number of health professionals involved and staff unfamiliar with research procedures. This study was resource- and time-consuming.

Clinical relevance

Patient care must be safe and based on the best possible evidence. This is a responsibility for all health care staff caring for patients across the acute care delivery chain. Thus, undertaking RCTs in clinical care is important to facilitate research based care and to support research utilization.

Acknowledgements

A grateful thank you to Etac for providing Heelift and to all study nurses for the help with data collection.

Conflict of Interest
None

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Marjolin Ulcer; Arising in A Pressure Sore with Acute Malignant Transformation

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Introduction

Marjolin ulcer refers to a rare malignancy that arises from chronic non healing wounds or cutaneous scars. This most commonly occurs in burn wounds, but has been reported in many other types of non healing wounds[1]. The development of malignancy tends to be slow, usually takes time of 25 to 50 years[1]. Marjolin ulcer tends to be more aggressive than other types of skin cancer and metastatic rate has been documented much higher[1].

Methods

Thirty four-years-old male with a history of paraplegia had been referred for management of pressure sore. He had underwent surgery with V-Y advancement flap 17-years ago. Two years prior to presentation, he noticed the onset of ulceration again. The fungating mass with central ulceration was located over previous surgical scar in midline of sacral area, measuring approximately 5 x 6 cm (Fig. 1). The scar presented itself with a relatively normal appearance.

Fig. 1: *The pressure sore was located over previous surgical scar in midline of sacral area.*

Fig. 2: *There has been no evidence of recurrence of cancer or ulceration at 6-month follow-up examination*

Results

Punch biopsy was done which revealed well-differentiated SCC. Bilateral lymph nodes were palpated, and we checked pelvic CT and PET, which showed suspicious bilateral lymph node metastasis. The patient received wide excision and bilateral lymphadenectomy. The resultant defect was covered with superior gluteal artery perforator propeller flap. The final pathology report described a Marjolin ulcer, characterized by well-differentiated SCC. No evidence of recurrence of cancer or ulceration was found at the 6-month follow-up examination (Fig. 2).

Discussion

We present a case of Marjolin ulcer which quickly transformed to a malignancy within only 2 years. The previous scar presented itself with a relatively benign appearance, different from what could be seen in a typical Marjolin ulcer. Therefore, scar itself does not seem to be a direct cause of Marjolin ulcer in this case. However, the scar was located on midline of sacral area where suffer from repeated friction, shearing and pressure. We assumed that decreased vascularity and weakened epithelium of scar combined with repeated trauma due to midline location quickened malignant transformation. We managed it with perforator propeller flap, and successfully covered the defect with normal skin which is distant from the surgical scar.

Clinical relevance

We report a case of Marjolin ulcer which degenerated within only 2 years, successfully treated with perforator propeller flap.

Acknowledgements

We certify that there is no conflict of interest.

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P37

Facial Pressure Ulcer due to The Senstaken-Blackemore Tube Securing Helmet

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Introduction

Pressure ulcers are a serious complication and major cause of morbidity in critically ill patients. In most cases, pressure ulcers develop over bony prominences such as the sacrum and greater trochanter. However, in cases where a medical device itself produces the pressure, the pressure ulcers may develop in an unusual area where it may be difficult to detect. In the present report, we described a case of an atypical facial pressure ulcer associated with Sengstaken-Blakemore(SB) tube use in order to raise awareness of this rare complication among clinicians.

Methods

Fifty-nine-year-old female with alcoholic liver cirrhosis visited emergency department due to massive hematemesis. On physical examination, the initial blood pressure was 60/40 mmHg, pulse rate was 106/minute, and respiratory rate was 34/minute. To prevent further bleeding, SB tube was inserted and it was secured to helmet. When the helmet and tube were removed after 3 days, about 14 x 3 cm sized full thickness skin necrosis was noticed in her forehead(Fig. 1).

Fig. 1: *A full thickness skin necrosis, approximately 14 × 3 cm in size, on the forehead.*

Results

We decided to perform debridement and local skin flap coverage after the patient recovered. In spite of intensive care, she died of hepatic failure 17 days after consultation.

Discussion

Although medical devices produce relatively low pressure, it can be an exceptional cause of pressure ulcer in critically ill patient who is vulnerable to tissue ischemia. Not only pressure, but also the change of microclimate by humidity and heating between device and skin is a major cause of medical device-related (MDR) pressure ulcer[1,2]. In addition, aggressive fluid therapy to correct hemodynamic instability can induce localized edema and skin stretching[3]. It makes skin to be fragile to external stimulation and pressure. Therefore, in case of improper fitting of medical device, friction force or shearing force can be induced between device and skin, making the wound deteriorated. Although a few cases of MDR pressure ulcers caused by cervical collars, pulse oximetry equipment, and ventilation masks, have been reported[1], the development of forehead skin necrosis due to SB tube use has not been reported. Forehead skin is susceptible to external pressure because the subcutaneous tissue is relatively thin and the frontal bone is prominent. To prevent this disastrous condition, physicians should check whether padding is sufficient and gentle pressure is evenly distributed on entire surface. Also, the frequent skin inspection is required to see whether any injury is developed and position of medical device is maintained well.

Clinical relevance

The purpose of this presentation is to report a rare cause of MDR pressure ulcer to alarming the clinician the significance of it.

Acknowledgements

We certify that there is no conflict of interest.

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P38

Dual process theory and nurses' pressure ulcer related decision making

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Introduction

Consistent delivery of safe high quality health care relies on nurses' ability to make appropriate judgements and decisions about the treatment of patients. Nurses have to make a number of judgements and decisions in pressure ulcer prevention and management (1). Studies (2-4) have identified that nurses find it challenging to distinguish between different grades of pressure ulcers and between pressure ulcers and moisture lesions. Incorrect judgements about the state of a patient's skin of pressure ulcer can lead to the implementation of inappropriate or ineffective measures (1-3). Nurses play a pivotal role in pressure ulcer prevention and management, so understanding how they make judgements and decisions is integral to improving the quality and safety of the skin care patients receive (5-7).

Dual process theory of decision making

Recent developments in decision making theory have contended that there are two distinct ways of thinking (system 1 and system 2) that people use to make judgements and decisions in what is known as dual process theory (8, 9). When, where and in what balance system 1 and system 2 are used is an active subject of research in many domains of application.

Fig. 1: *Key characteristics of system 1 and system 2 thinking*

System 1	System 2
Unconscious / intuitive	Conscious / reflective
Fast Parallel, high capacity	Slow Serial, limited capacity
Hard to influence through education	Responsive to education
Associative and/or heuristic-based	Deductive, rule-based

Discussion

Studies (10, 11) which underpin the dual process theory indicate that experts have an enhanced intuitive process for decision making that is underpinned by pattern recognition, which allows them to decide the best course of action with the experiential information stored in their memory. Experts develop their expertise through practice and reflection on experience; which results in a higher level of expert heuristic or intuitive decision making in contrast to the more emotional intuitive decision making of novices (10, 12).

Clinical relevance

The dual process theory appears to account for some of the findings about the shortcomings of nurses' pressure ulcer related decision making in different studies (1, 2). It may be prudent to put in place measures such as clinical decision support systems or decision making aids (13, 14) to enable nurses to consistently make more appropriate decisions about pressure ulcers.

No conflict of interest

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Soft-tissue complication during early treatment of children with congenital clubfoot: prevention and management

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Introduction

Serial casting in children with congenital clubfoot is a standard protocol for management of this severe orthopaedic disorder. Casting starts usually immediately after birth of the child and clinicians are facing with numerous problems, depending on the specific skin and soft tissue condition of the newborns, inevitable pressure during casting and severity of the deformity.

Aim

To assess the risk of soft-tissue damage during early treatment of children with congenital clubfoot in order to avoid possible complication.

Material and method. In consequential series of 100 children with congenital clubfoot (135 feet) we assessed the number of soft-tissue complications. Three groups were determined depending on severity of the damage: 1) skin irritation; 2)pressure sore; 2) ulcer. The square of the damage and duration of healing process were assessed also. Correlations of the incidence of complication with age of the child, severity of initial deformity, and details of treatment protocol were estimated.

Results

The incidence and severity of soft-tissue damage during early treatment of children with congenital clubfoot has positive correlation with severity of the initial deformity. We could not found dependence of the incidence of soft-tissue damage with the age of the child. Ulcers were more common for children younger 6 months. In children, treated by the method of Ignacio Ponseti provides less complications in terms of soft-tissue lesions.

Conclusions

Soft-tissue damage during early treatment of children with congenital clubfoot is rather common complication. Severity of the initial deformity is estimated as the most important prerequisite for the following soft-tissue lesion. Age before 3 months does not alleviate the risk of the lesion. Thorough casting in accordance with current principles (Ponseti) and the usage of contemporary materials helps in prevention of severe complications.

Cardiopulmonary resuscitation (CPR) - function of air mattresses is useless? - A manikin study

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Introduction

There is a huge variation between the properties of different mattresses, ranging from static foam to dynamic air mattresses, and which may behave differently in case of cardiopulmonary resuscitation (CPR) [1,2]. Air mattresses in acute care units are expected to be equipped with a CPR system to enable a rapid deflation of the air mattress to allow CPR to be carried out. A part of the continuously functioning air mattresses are so called open systems which are required to be deflated at the initiation of CPR according to manufacturers' instructions, while others are closed systems not necessarily requiring deflation. However, it is not known whether the use of a CPR function of the air mattresses really has an effect on the stability and effectiveness of CPR. Therefore, we examined the functionality and performance of different type of mattresses during CPR [1,2].

Methods

In this study we examined the performance of a higher specification foam mattress and two dynamic air mattresses which modes of function are totally different (Carital® Optima, thickness 13 cm, closed system, optimally adjusting to optimum irrespective of patient's weight, body shape, and position by the intelligent control unit) and Nimbus® 3, thickness 21,5 cm, alternating system, pump functioning 24/7; an open system) during the experimental CPR. A patient simulator manikin (SimMan 3G, weight about 40 kg) was used as a resuscitation target.
Air mattresses were examined during their normal functional modes as well as when the CPR-valve was opened at the initiation of experimental CPR. The results were compared to situations where the manikin was placed on hard floor and on a higher specification foam. To get more information about the resuscitation efficiency and functionality of various mattress types a pressure sensitive mat was placed between the manikin and surface in each resuscitation session (FSA-mat, with 2048 pressure sensors, Vista Medical).

Results

The results show that the mean compression frequencies and compression depths were not substantially different between various surfaces or settings of air mattresses or when the CPR-valve was opened at the start of CPR (Table). On the foam or Carital mattress the stability was comparable to the hard surface (VAS-scale). When the thickness of the air mattress increased the stability and efficiency (hands-on time) of resuscitation procedure seemed to deteriorate. At the same time the resuscitating nurses expressed that the strenousity of the CPR increased. The results with the pressure sensitive mat point to interesting potential differences between various surfaces which apparently result from the functional differences between the mattresses.

Table: Efficacy of experimental CPR

	Flat hard floor	A higher specification foam mattress	Carital Optima	Carital Optima with CRP opened	Nimbus 3 comfort soft, alternating mode	Nimbus 3 soft comfort, alternating mode with CPR opened
Compression frequency /min (SD)	120.7 (11.3)	109.9 (8.3)	109.3 (8.6)	108.0 (5.1)	106.4 (9.9)	104.6 (5.6)
Compression depth, mm (SD)	45.8 (5.3)	43.4 (8.3)	45.5 (6.9)	41.6 (10.5)	47.5 (7.1)	47.0 (5.8)
Hands-on time % at 120s (SD)	96.4 (0.9)	96.6 (0.5)	96.0 (1.1)	95.8 (1.1)	71.3 (14.8)	70.5 (7.7)
Stability, VAS mm (SD)	100 (-)	82.7 (10.2)	71.2 (18.7)	65.5 (19.1)	40.2 (24.1)	71.3 (20.2)

Discussion

The use of CPR-valve seemed not to be necessary to achieve adequate stability and effectiveness of resuscitation in the case of the air mattresses used. Hard plate may not be needed to be placed between the patients and a higher specification foam mattress. It is still possible that the use of the CPR-valve can increase the stability, effectiveness and efficiency of resuscitation if the thickness of the mattress increases above 20-25 cm and if the CPR is carried out in bed.

Clinical relevance

The results highlight potential differences between various types of mattresses in association with CPR. Current requirements on deflation of air mattresses are based on opinions, not on research.

Conflict of Interest

Esa Soppi is a chairman of the Board of the Carital Group.

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What is a higher specification foam mattress?

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Introduction

Current guidelines state that a higher specification foam mattress is more effective in pressure ulcer (PU) prevention than a conventional foam mattress [1]. The guideline, however, does not specifically define what is a higher specification foam mattress. In different occasions the quality of foam mattresses are attributed to various criteria, such as the thickness of the foam, number of foam layers, density of the foam, its subjective softness or hardness, its viscoelasticity or results from interface pressure measurements, etc.
Still, none of these properties as such have proved to be significant, since they are partly subjective or have little to do with the functionality of the mattress to prevent the PU development. The evidence defining what is a higher specification for mattress is scarce and with conflicting results [2].
To our knowledge there are no single study involving foam mattresses that would highlight more than two specifications of polyurethane foams which make the interpretation and comparison of the study results extremely difficult. To improve the situation it would be beneficial to agree on how the specify different foams and foam mattresses. We want to share our combined close to 100 years of experience in polyurethane foam production, of working with foam manufacturers, research on mattress development, mattress manufacturing and pressure ulcer research.

Results

Table: The key properties for higher specification foam mattresses.

Specifications	Foam layer on the bottom	Foam layer on the top	Middle layer(s)	Note(s)
The main functionalities of the foams	Immersion control; supports the body and prevents bottoming out	Envelopment; capability to deform around and encompass the contour of the body	Improves immersion control and prevents bottoming out in heavy patients.	Middle layer is needed for patients weighting > 100 kgs
Type of the foam	High resiliency (HR) foam	Viscoelastic foam	HR/ Viscoelastic/ Other	A huge number of various soft foams are available
Ball rebound (%)	> 50	< 20	According to the desired function	A measure of resilience
Density (kg/m³)	> 40	> 50	> 40	The more dense the more durable
CLD hardness at 40% (kPa)	4 - 5	1 – 2,5	HR: 4 - 5 Viscoelastic 2 - 3	Main measure of the immersion control
Progressive hardness i.e. SAG-index	2,7 – 3,1	< 2,4	According to the desired function	SAG-index = IFD at 65% / IFD at 25%
Tensile strength (kPa)	> 80	> 80	> 80	Describes the durability of the foam
Elongation at break (%)	> 115	> 115	> 115	Describes the durability of the foam
Layer thickness (cm)	Minimum 8	Minimum 4-5	According to the desired function	Layers must be clued together since it enhances the durability

A higher specification foam mattress needs to have at least two layers; high resilience foam on the bottom and viscoelastic foam on the top. However, the specifications of different foam grades needs to be clearly defined. Table summarizes the main features for higher specification foam mattresses. At least the six main features listed in the table should be available from each grade of the foam used in any mattress. Furthermore, the production tolerance of the foam grades should be tight; ±10% from batch to batch.

Discussion

A higher specification foam mattress needs to fulfill three central functional user specifications: 1) it needs to possess good pressure relieving properties and 2) the patient is able to change his or her position, 3) it is easy for the nursing staff to change the patient's position or move the patient. Thus the mattress needs to have good pressure reduction properties and prevent the development of high pressure peaks. Simultaneously the mattress needs to support the body well and be comfortable. Currently all of these properties are impossible to achieve by using only one type of polyurethane foam as proposed by the largest study comparing conventional and a "prototype" of a higher specification foam mattress [3]. On the other hand a foam mattress with multiple layers is not automatically a higher specification foam mattress. Furthermore, the mattress cover has a major impact on the functionality of mattress including its microclimate properties. Thus, a higher specification foam mattress needs a cover which properties are also clearly defined.

Clinical relevance

Clear specifications for foams and mattresses help to judge their suitability for different use in clinical settings No clinical trials should be published without clearly specifying the foam grades used in the mattresses.

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Carital® Neo, a Unique Mattress Solution for NICU and PICU

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Introduction

Pressure ulcers (PUs) are an avoidable problem with a great personal, institutional and social impact. Although PUs are usually linked to elderly population children and neonates cared in intensive care units (ICUs) that are immobile are at high risk of developing PUs related with the sleeping and resting surfaces.
There are numerous mattress solutions available to prevent PU development in adult ICUs. Dynamic air mattresses are most effective of which the Carital® Optima dynamic air mattress system adjusting automatically and always optimally to minimum pressure irrespective of patient's weight and body shape, and which is the parent for Carital® Neo mattress system that has been shown to be highly effective in prevention of development of pressure ulcers in extremely sick patients in ICU setting [1].

Methods

Carital® Neo possesses the same ingenious, physiological properties as its parent but is meant for patients weighting from 500 g to 6 kg [2]. It offers maximal protection (extremely low interface pressures) against skin injury as shown in a manikin study (Table). It utilized a pressure sensitive mat (Vista Medical) between the surfaces and the manikin (Fig). This is linked with great physical and clinical stability of the patients allowing care of patients who cannot be repositioned, are mechanically ventilated and have numerous catheterizations, like ECMO patients. The results from two pediatric ICUs are reviewed.

Fig: *A neonatal manikin, weight 2030 g on hard surface.*

Results

Carital range of products has been in use in several PICUs with excellent results [3]. Children (N=30) at PU risk only one (3.3%) (CI 95%: 0.08 – 17.2%) developed a nondevice-related PU (P=0.021). No adverse events occurred. Historical incidence was 20 % in the same unit during the previous years without Carital products.

PICU in Royal Children's Hospital (RCH) is one of the largest users of Carital products (Optima, Juve and Neo) over the last years in the world. More than 1500 infants and children of all medical and surgical pediatric subspecialties are admitted to the PICU yearly. The unit has a high acuity, with 70 % of admissions requiring intubation and mechanical ventilation. The PICU in RCH is the largest neonatal and pediatric ECMO center in Australia. Approximately 30 ECMO, and 5-10 centrifugal ventricular assist device procedures are carried out yearly and about 50 % of the patients are neonates. Still the hospital's quality of care reports [4] indicate very low numbers of pressure injuries i.e. about 5 / year meaning an incidence below 1 %. Interface pressure and contact area values on Neo are 20-30 % less than those compared to hard surface (Table).

Table: *Summary of the manikin study results*

Discussion and Clinical relevance

We assume that Carital mattresses have contributed to these excellent results observed in the PICUs. The relative differences in interfaces pressure and contact area changes are almost equal from hard surface to foam and from foam to Carital Neo. The products offer great pressure relief, coupled with optimal immersion and envelopment control together with unique stability necessary for therapy of vulnerable patients, such as spinal or unstable fractures and ECMO.

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Pressure ulcer : teaching the mechanical basics over 6 years

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Introduction

4 posters are proposed (1 for each main hard site: sacrum, heel, ischium, greater trochanter).
Goals:

- Teaching the mechanical basics which should be taught to those whose vocation is the health care of pressure ulcers patients.
- Eradicate the false notion of fate and stress the notion of pressure [1] [2], shear [3] [4], and friction [5] on the main hard bony sites [6].
- Point out that the concern about the dressing's choice is not enough, for the best dressing in the world cannot heal a pressure ulcer if it continues to undergo pressure, shear, and friction forces.

Methods

- Quote and describe one by one the most common trigger situations for each main bony site, and propose the resulting preventive and curative measures.
- Summarize 24 years of practice in the pressure ulcer field.
- Highlight the practical side of the issues with diagrams and drawings.

Results

Targeted persons, from January 2003 to March 2013 (break from February 2009 to December 2012):

- Students → nurses: 780
  → nurse aids: 540
  → nurses + nurse aids trainees with institutionalized disabled persons: 96

- Certified → hospital nurses + nurse aids 55
  → nurses school in Switzerland: 28
  → doctors (general practitioners):15
  → physical therapists: 9

TOTAL: 1523

Discussion

- The students received this teaching with enthusiasm, since everything is new for them.
- Most of qualified nurses are unaware of this basic practical teaching about the mechanics of these trigger situations, although they have the overall theoretical knowledge of pressure ulcers; they often confuse sacrum with ischium.
- Physicians are taught very little about pressure ulcers practice in their training, and yet they don't attend teaching sessions in a hospital setting (lack of interest or time?).
- Information on pressure ulcers is so abundant that many professionals don't know how to differenciate between priorities, details, useless actions, and harmful actions.
- The qualified nurses know very well how to select the dressing and how to manage promoting conditions such as maceration and malnutrition. But many trigger situations are unknown or neglected.

Clinical relevance

A maximum number of patients will be impacted if an accurate, simple, logical, and mechanical teaching of the basics is widely spread among the care providers. The patient participation as well as that of his family is of the utmost importance in the healing process.

Acknowledgements

We appreciate the help of the patients who forced us to reflect due to their particular situations.

Conflict of Interest

None.

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Electrical Stimulation for Pressure Ulcer Treatment in People with Spinal Cord Injuries: A Meta Analysis and Systematic Review

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Introduction

Pressure ulcer (PU) is one of the most common secondary complications following a spinal cord injury (SCI). Electrical stimulation (ES) can confer benefit to pressure ulcer treatment in SCI[1,2]. However, to date, the clinical guidelines regarding the use of ES for PU healing in SCI remain limited. This systematic review was therefore conducted to identify the updated evidence, and to critically appraise and Meta-analyze the research evidence on ES for PU treatment in spinal cord injuries.

Methods

Review was limited to peer-reviewed studies published in English from 1970 to 2014. A Free-text and keyword/MESH terms search of five databases (Medline, CINAHL, EMBASE, PsycINFO and the Cochrane Central Register of Controlled Trials), in addition to manual searches of other resources and retrieved articles was undertaken on 3rd March 2014. Studies included randomized controlled trials (RCTs), non-randomized prospective controlled trials. Target population included adults with SCI. Interventions of any type of ES were accepted. Any outcome measuring the effectiveness of PU treatment was included. Methodological quality was evaluated using established instruments by two independent reviewers.

Results

Eleven studies applied ES for PU treatment in SCI were identified, one case series and two case reports were excluded, remaining eight controlled studies were included in this review. Within the eight studies, 5/8 studies were RCTs, 2/5 had Jadad score of 3 or greater that was considered as good quality; other three studies were prospective non-RCTs. ES was delivered through surface electrodes in all studies. Pooled analysis of prospective Non-RCT showed a significant higher healing rate (% healing per day) with ES in (mean difference 0.78, 95% CI 0.32-1.25) (Figure 1), but not in pooled analysis of RCTs (mean difference -0.07, 95% CI -0.82-0.96) (Figure 2).

Fig.1 Healing rate in pooled analysis of non-RCTs

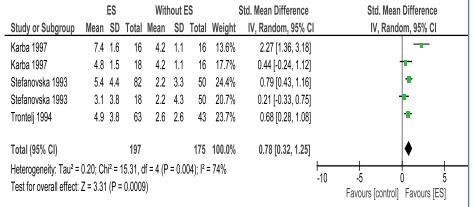
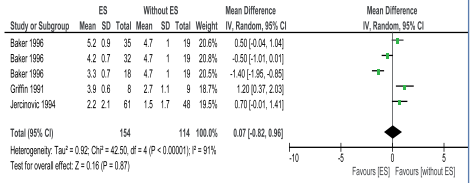


Fig.2 Healing rate in pooled analysis of RCTs



Discussion

The methodological quality of studies included in this review was poor. Although a significant effect of ES on enhancement of PU healing is shown in non-RCTs. There is no significant beneficial effect of ES on PU healing in pooled analysis of RCTs. Future research is suggested to improve study design, standardize ES parameters and conduct more rigorous large sample sized randomised controlled trials.

Clinical relevance

Meta-analysis showed that ES improves PU healing rate in non-RCTs, but not in level I evidence (RCTs).

Reference

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Acknowledgment

We would like to thank Mr Paul Howell, a clinical librarian for helping online literature databases search.

Conflicts of interest

No

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To prevent and treat pressure ulcers through a holistic approach and team work

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Introduction

Rehab Station Stockholm conducts medical rehabilitation for people with spinal cord injuries, orthopedic injuries, stroke, MS, and general neurology outpatient and inpatient form.
Our patients have a major risk of developing pressure ulcers due to paralysis, muscle atrophy, bone decalcification and sensory loss.

Our goal is to help our patients;
- Prevent and avoid pressure ulcers (PU)
- Healing - as soon as possible
- Prevent complications and recurrences after a pressure ulcer flap surgery.

Methods

Through a team effort with a holistic point of view, we can prevent, heal and stop pressure ulcers.
You need to engage and educate the patient in the wound healing process in order to understand the cause-effect for a faster and long-lasting result.

To heal deep pressure ulcers on the sitting area, it´s necessary to offload lying in bed and this may last for several years. There is a major risk to become apathetic and lose the spark of life because of the isolation and lack of activity due to pressure ulcers. A flap surgery may then be the only way out, but complications after surgery and recurrence, and new pressure ulcers are reported to be as high as 30-40%. In cooperation with the plastic surgeons at the Karolinska University Hospital, we have designed a rehabilitation programme after flap surgery for pressure ulcers in paralyzed patients.

Results

A methodical 3-year follow-up of the plastic surgery patients shows that our program has improved the situation tremendously when only 4% received postoperative complications and these were in addition lighter than before and it showed a low incidence of new or recurrent ulcers (11%) None (0%) have had infection.

We can see that patients and assistants react faster than before and can then stop the progression of the wound before it goes too far. Team work around the pressure ulcer patients is of great importance, not only to change the dressing!

To prevent, heal wounds quickly is both economically and save years of suffering for those affected.

Discussion

Early treatment of pressure ulcers with specific knowledge of the patient group is considered too expensive but it would avoid several operations and prevent years of suffering. If the patient is admitted in hospital in the early stages, the pressure ulcer often heal faster because it is easier to structure pressure relief routines in healthcare than in their home. Procurement, lack of knowledge and money can prevent the patient from receiving the right dressings and technical aids. Preventing pressure ulcers cost significantly less than pressure ulcers, both in healing terms of money and personal suffering. Despite the fact that as much as 50-95% of these pressure ulcers could be prevented, people still dying because of pressure ulcers.

Clinical relevance

Our Stockholm chain of care with guidelines for treatment after a flap surgery is so successful that centralization should be considered for persons with spinal cord injuries

Conflict of Interest
None

P49

A course in the holistic approach to healing pressure ulcers in persons with SCI

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Introduction

Pressure ulcers are a major complication (95%) after an spinal cord injury (SCI).
At the Rehabilitation Station Stockholm (RSS) we educate patients how important it is to learn how to avoid and treat pressure ulcers (PU).
Many patients are admitted to RSS in our specific wound care programs where they are treated by the whole rehabilitation team. Many district nurses do not have sufficient knowledge of SCI. This makes it difficult to get a holistic view of the situation. An admission and/or custom made review is nesserary to get an overview and to plan treatment.

Methods

Rehab Station Academy has designed custom made coursers in the user's home. It's important to get the user, their relatives and helpers to understand cause and effect of wound healing, to accive a positive result that endures. We (Occupational Theraphist/ Assistant nurse) check the daily routines, lifestyle and wound care. Advice and support is given continuously during healing process by phone / email. Patients living in Stockholm are also followed up in the Spinalis outpatient clinic.

Results

Wound healing is normally rapid with our hospitalised patients as our holistic approach includes not only dressing changes but also pressure relief, correct tools and suitable nutrition.

Discussion

Our specialized experience and knowledge of pressure ulcers, rehabilitation of SCI and technical aids makes it possible to help the persons even in their home. The review and education in cooperation with user, family and staff is a successful combination for wound healing.

Clinical relevance

With this holistic method, we see faster wound healing which can prevent years of suffering, this is also socioeconomically very positive.

Conflict of Interest
None

Results of the WMW project: PU Quiz in accordance with the 2nd world wide Stop Pressure Ulcer Day

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Introduction

The association Wound-Management-Vienna decided to take part in the 2nd Stop Pressure Ulcer Day on November 21st 2013. A multi-center event was planned. Due to this reason 2 standardized questionnaires for healthcare professionals and non-healthcare professionals were developed. The interview was conducted by executive committee members and regular members of the association. To receive representative information cooperation was initiated with the hospital Göttlicher Heiland, the Geriatriezentrum Baumgarten and the office of the GP Dr. Michael Mraz. The aim of the event was to get information about the basic knowledge in pressure ulcer in both groups.

Methods

For each group 10 multiple choice questions, based on the EPUAP factsheet 2013[1] and the EPUAP patient guide 2013[2], were designed. Each question had 3 answer possibilities, but only one was correct. Demographic characteristics like sex, age and profession of the participant were collected. The aim of the project was to get at least 100 forms of each group to reach an average sample. The analysis was carried out numerally.

Results

219 healthcare professionals and 131 non-healthcare professionals completed the questionnaires. The evaluation showed that 17,35% (38) healthcare professionals and 36,64% (48) non-healthcare professionals answered all 10 questions correctly. Although there were two different questionnaires; we discovered that the healthcare professional, not differs in the level of knowledge but they stick to old doctrines.

The other interesting point was that they did not use their intuition in contrast to the non-healthcare professionals.
Due to these results we will show for each group which questions had the most frequently wrong answers.

Discussion

Summarizing the results it could be necessary for the healthcare professionals to develop and revise information about instruments of diagnosis and the different possibilities which trigger a pressure ulcer. In relation to the non-healthcare professionals it would be useful to point out more the risk-factors for developing a pressure ulcer.

Clinical relevance

For our association with its characteristic feature of patient empowerment and education for persons dealing with a non-healing wound the results showed us the possible way for our future activities concerning knowledge transfer and understanding.
Finally we would like to repeat the interviews in Austria to get the information if there is a difference in the various parts of Austria.

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http://www.epuap.org/wp-content/uploads/2012/05/EPUAP_Patient_Guide_A4_2013.pdf

Template for the EPUAP Annual Conference 2014 Stockholm, Sweden

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Titel: No pressure in C-ICU!

Introduction

The central Intensive Care Unit 96 at Sahlgrenska University Hospital in Gothenburg is the largest intensive care unit in Sweden treating about 2000 patients a year. C-ICU is a mixed medical and surgical intensive care unit that treats mainly adults but also children from the age of 4 months. The unit has competency in medicine, surgery, nursing and medical technology which involves specialist areas like trauma, transplantation, neurotrauma, vascular/plastic/tumour surgery, sepsis, organ failure, intoxications, cardiac arrests and cranioplastic surgery in children.

Background

In 2011, C-ICU participated in a national study that measured and identified pressure ulcers. The result showed that several of our patients had signs of pressure damage and therefore had an increased risk of developing a pressure ulcer.

Aim

Earlier detection of pressure damage and preventing pressure ulcers with improved routines and guidelines.

Methods

We monitored pressure sensitive areas in all patients every month during 2012. We used the pressure ulcer classification tool used by European Pressure Ulcer Advisory Panel (EPUAP) which divides the pressure ulcers into 4 different grades.

Pressure ulcer grading

Stage/grade pressure description ulcer damage

1. Non-blanching erythema of intact skin
2. Full-thickness wound, which involves the epidermis, dermis or both
3. Full-thickness wound, which involves the epidermis, dermis, subcutaneous tissue and the superficial fascia
4. Full-thickness wound, which involves the epidermis, dermis, subcutaneous tissue and the deep fascia

The results of the study were presented to the rest of the staff through verbal presentation and were posted on the noticeboard.
We are also providing teaching to the staff in C-ICU and have developed new clinical practice guidelines for preventing pressure ulcers.
Registered nurses and enrolled nurses shall inspect and record the status of the patient´s skin to increase awareness in changes in the condition of the skin and observe early signs of pressure damage. The status should be recorded by a registered or enrolled nurse in the patient´s medical records.

Results and continued work

Regular monitoring shows that we follow the new guidelines and that the incidence of pressure ulcers has dropped to zero since we commenced the monitoring. The awareness of how to prevent pressure damage has increased. We continue to monitor the incidence of pressure damage in our unit twice a year for quality assurance.

Dimitri.Beeckman@UGent.be, also copying C.W.J.Oomens@tue.nl before the closing date of **30th April, 2014**.

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Dressings & Topical Agents for Preventing Pressure Ulcers – A Cochrane Review

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Introduction
Pressure ulcers, which are localised injury to the skin, or underlying tissue or both, occur when people are unable to reposition themselves, to relieve pressure on bony prominences. Pressure ulcers are often difficult to heal, painful and impact negatively on the individual's quality of life. The cost implications of pressure ulcer treatment are considerable, compounding the challenges in providing cost effective, efficient health services. Efforts to prevent the development of pressure ulcers have focused on nutritional support, pressure redistributing devices, turning regimes and the application of various topical agents and dressings designed to maintain healthy skin, relieve pressure and prevent shearing forces. Although products aimed at preventing pressure ulcers are widely used, it remains unclear which, if any, of these approaches are effective in preventing the development of pressure ulcers.

Methods
A Cochrane Systematic review was to evaluate the effects of dressings and topical agents on the prevention of pressure ulcers, in people of any age without existing pressure ulcers, but considered to be at risk of developing a pressure ulcer, in any healthcare setting. In February 2013 we searched the relevant electronic databases to identify reports of relevant randomised clinical trials. We included RCTs evaluating the use of dressings, topical agents, or topical agents with dressings, compared with a different dressing, topical agent, or combined topical agent and dressing, or no intervention or standard care, with the aim of preventing the development of a pressure ulcer. We assessed trials for their appropriateness for inclusion and for their risk of bias. This was done by two review authors working independently, using pre-determined inclusion and quality criteria.

Results
Five trials (940 participants) of unclear or high risk of bias compared a topical agent with a placebo. Four trials randomised by individual and one trial randomised by cluster. When results from the five trials were combined, the risk ratio (RR) was 0.78 (95% CI 0.47 to 1.31; P value 0.35) indicating no overall beneficial effect of the topical agents. When the cluster randomised trial was omitted from the analysis, use of topical agents reduced the pressure ulcer incidence by 36%; RR 0.64 (95% CI 0.49 to 0.83; P value 0.0008). Four trials (561 participants) all of which were of high or unclear risk of bias showed that dressings applied over bony prominences reduced pressure ulcer incidence RR 0.21 (95% CI 0.09 to 0.51; P value 0.0006).

Discussion
There is insufficient evidence from RCTs to support or refute the use of topical agents applied over bony prominences to prevent pressure ulcers. Although the incidence of pressure ulcers was reduced when dressings were used to protect the skin, results were compromised by the low quality of the included trials. These trials contained substantial risk of bias and clinical heterogeneity (variations in populations and interventions); consequently, results should be interpreted as inconclusive. Further well designed trials addressing important clinical, quality of life and economic outcomes are justified, based on the incidence of the problem and the high costs associated with pressure ulcer management.

Clinical relevance
The evidence base for use of topical agents and dressings to prevent pressure ulcers is limited, despite the wide use of these interventions. Further trials are justified, based on the incidence of the problem and the high costs associated with pressure ulcer management.

Acknowledgements
The authors would like to acknowledge the contribution of the referees (David Brienza, Carol Dealey, Rachel Richardson, Durhane Wong-Rieger), the Wounds Group editors (Marian Brady, David Margolis, Gill Worthy) and copy editor Jenny Bellorini.

Conflict of Interest
The authors have no conflicts of interest to declare.

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P53

Tissue Oximeter Measures Increased Perfusion to Areas of Vacuum-Assisted Wound Closure

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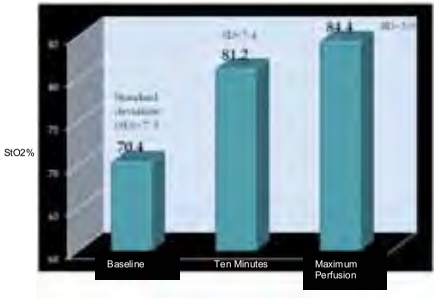
Introduction
The tissues of many acute and chronic wounds are deficient in oxygen. It has been theorized that closure of these wounds is enhanced by increased perfusion to the tissue surrounding the wound. Vacuum Assisted Closure devices induce negative pressure suction, allowing edematous fluid to be sufficiently removed; thus, inducing vasodilation and greater cell proliferation. The ViOptix™ Tissue Oximeter is a technological device that assesses blood flow to a particular part of the body by measuring the hemoglobin saturation ratio via infrared light. This device can help to assess perfusion to a particular part of the body. The objective of our work was to determine whether or not the Wound VAC does, indeed, increase blood flow by measuring changes in perfusion with the Tissue Oximeter

Methods
The Tissue Oximeter sensor was placed on the same area of 5 individuals' arms and the baseline hemoglobin saturation was measured.
A vacuum-assisted closuredevice sponge was then placed, turned on, and 125mmHg of pressure was applied. Changes in perfusion, as indicated by the Tissue Oximeter, were recorded.

Fig. 1: *The experimental setup.*

Results
All five individuals demonstrated an increase in their hemoglobin saturation with the use of the Wound VAC, as indicated by the ViOptix Tissue Oximeter.

Table 1. Average Perfusion Values



Discussion
This study demonstrates that the Wound VAC does increase perfusion to the area of the body to which it is applied. Moreover, it further demonstrates the use of the hemoglobin oxygenation ratio in the assessment of blood flow.

Further studies can be done to examine changes in perfusion in smokers versus non-smokers and in individuals who are actually undergoing Wound VAC therapy.

Clinical relevance
Our work demonstrates that vacuum-assisted closure increases blood flow to the area to which it is applied.

Acknowledgements
We appreciate the help of the staff of Winthrop University Hospital.

Conflict of Interest
None

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STOP Pressure Ulcer Day Activities in Turkey

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A pressure ulcers (PUs) is localized injury to the skin and underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear (1).

In the studies conducted for the determining, the prevalence and incidence of PUs in Turkey, operation-related PU was determined to be 54.8%, it was determined to be 14.3% and 20.56% in intensive care units, and 8.1% and 8.3% in point-prevalence studies (2,3,4,5,6).Even though PU can be mostly prevented, it constitutes a problem for the individual, healthcare system, and economy of the country (7,8).

The scope of the Stop Pressure Ulcer Day on November 21st 2013, with the contributions of the European Pressure Ulcer Advisory Panel, some events were organized by the Turkish Wound, Ostomy and Incontinence Nurses Society with the participation of 49 hospitals in 7 provinces in Turkey. Within this scope, "STOP Pressure Ulcer Day" posters were hung in hospitals, patients and their families were distributed EPUAP Patient Guide "How can you help to stop pressure ulcers, and a meeting was held by nurses at the hospital." The information poster titled EPUAP Factsheet "Pressure ulcers: just the facts!" was presented to the hospital administration and distributed to all the clinical areas for the nurses.
As a result this activity had meant to us very enjoyable and productive experience.

Acknowledgements

We appreciate the help of Wound Ostomy and Incontinence Nurses in Turkey.

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Analysis of pressure ulcer healing data from clinical evaluations of a next-generation antimicrobial dressing

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Introduction

A majority of chronic wounds are known to contain biofilm[1,2]. A next-generation antimicrobial dressing (NGAD; AQUACEL Ag+ dressings) has been designed to manage biofilm, in addition to excess exudate and infection[3]. The aim of this study is to analyze pressure ulcer (PU) healing data collected from clinical product evaluations of NGAD.

Methods

11 clinical evaluations of NGAD were conducted on PU across Europe and in Canada, using the dressing in standard protocols of care, for up 5 weeks on non-healing PU that were infected or at risk of infection. Data on PU dimensions before, after, and in some cases throughout, the study durations were analyzed to track wound progression. Infection status, suspicion of biofilm, and wound images were also recorded throughout.

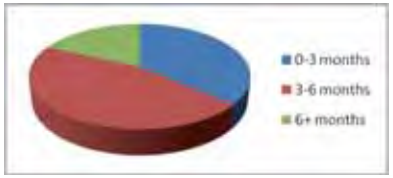

Fig. 1: *Baseline PU duration.*

Results

The majority of PU were at least 3 months in age (Fig. 1) and had been subject to a variety of unsuccessful prior treatments. 10/11 (91%) of PU of various ages and prior treatments were shown to reduce in dimensions, over NGAD treatment times ranging from 2 to 5 weeks (Fig. 2). The average reduction in wound size was 66% over an average treatment time of 3.5 weeks. 4/11 (36%) of PU were completely healed using NGAD (Fig. 2). In a majority of cases, clinical signs of infection or infection risk (including suspected biofilm) were resolved. Only one PU did not reduce in size but this wound was reported to be healthier after 5 weeks of NGAD than at start of the evaluation.

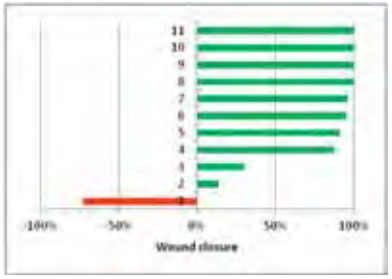

Fig. 2: *Wound closure data.*

Discussion

NGAD demonstrated clinical effectiveness by improving healing and resolving infection in PU that had previously been challenging to heal. This clinical efficacy can be explained by the anti-biofilm efficacy of NGAD demonstrated in controlled *in vivo* studies which showed correlation between biofilm removal and increased granulation tissue formation and epithelialization[3]. NGAD may therefore be an effective dressing for PU and other wounds that are infected or at risk of infection, where biofilm is likely to be a factor.

Clinical relevance

NGAD is the first dressing to manage three key local barriers to wound healing – excess exudate, infection and the recently-acknowledged barrier, biofilm. In protocols of care, the dressing contributes considerably to improvement towards healing of challenging PU that were infected or at risk of infection, where biofilm is a likely factor.

Acknowledgements

We appreciate the help of the patients and clinicians who took part in the clinical evaluations.

Conflict of Interest

P56

Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

A congenital neural tube closure defects and pressure ulcer

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Summary

A congenital neural tube closure defects' children, who live in the special institue (Wheelchair Repair Primary School, Secondary School, Uniform Methodology Institute of Special Education and Student Home). I examine, how many pressure ulcers occur at 1997-to 2012 of the spina bifida's children. (1. Table)

I would like the pick-up somebody, who borned with meningomyelocele. She lives in the countryside, far away this shool. She's 28 years old now, and lived in the school at 1994 to 2004. She used this method since 1995. She had a decubitus, just once. She lives independent, and she has job now. She's an examle for everybody, how to live full of life.

	Shunt	Wellcher	Independent movie	Pressure ulcers	Independent catheterezation	Catheterization with help	Use diaper
Boy	12	8	6	3	10	2	11
Girl	12	9	5	4	8	3	12
All	24head	17 head	11 head	7 head	18 head	5 head	23 head

This numbers are very low-down, becouse they use the Clean Intermittent Self-Catheterization (CISC). This method is simply and quick to learn. Six times a day do that. This children's quality of life, mobility, independece and improvement. The special institution, where live the students, arrived from all over the country.

This is important for us, how may to help provides for physically disabled people. The main role is the prevention, and early detection. An other essential project, the education for parents and children.

1997

2014

P57

Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

Electrostimulation Wound Healing and Tissue Regeneration

M. Ciliberti[1],

[1]C.A.R.T. (Wound Care Centre ASL NAPOLI 3 SUD) District 56

Introduction

Wound treatment with woundEL® is a highly effective, synergetic combination of approved moist, hydro-active wound treatment combined with controlled, low frequency LVMPC impulses.
EStim is already listed inside the EPUAP/NPUAP treatment guidelines for pressure ulcers. In fact, it is the only therapy ranked with the highest possible level of recommendation with regards to the evidence available.
In this context we can state that contemporary clinical studies are missing which describe how to a)implement the guidelines and b)how this compares at a cellular level with NPWT and c)how to measure therapeutic outcome in daily practice and d)to find a modality of treatment that fits an ambulatory care.

The device's polarity is set according to the condition of the wound. DC Pulses flow from the woundEL electrical stimulation device onto the wound through the dressing electrode and are then transferred back to the device through the dispersing electrode.

The pulses then cause the following cell and tissue reactions in the wound and the surrounding skin (depending on the selected polarity):

- Acceleration of the migration of cells that are important for wound healing, such as: macrophages, leukocytes, fibroblasts, ceratinocytes, etc.
- Increase and acceleration in the proliferation of tissue cells important for wound healing, such as: granulation tissue, epithelial tissue, capillary blood vessels, peripheral cutaneous nerves, etc.
- Increase in cellular ATP-, DNA-, and protein synthesis
- Reduction in the number of bacteria in the wound due to the bacteriostatic effect of the pH value changes which the current causes.
- Reduction of accompanying wound oedema

Reduction of accompanying wound pain

AIM

The aim is to judge the introduction of the treatment protocol of pressure ulcers and the use of an electric stimulation.

METHODS

In this context we have considered the device application over 50 patients affected by pressure ulcers.

The therapy has been carried out for 3 weeks, following the protocol.

The wound evolution was documented with qualitative controls.

The indicators of quality under exam were the wound bed and healing process.

A wound biopsy was executed, to evaluate the healing process during the treatment with electro stimulation .

In some cases it was possible to compare histologically the wound treated with negative pressure wound therapy and the one treated with electro stimulation.

Results

The results ,obtained by considering the evaluation forms , are :

- the improvement of wound aspect was made on 44 patients over 50;
- the wound healing process advanced over 90% cases
- the histological comparisons between pressure ulcers treated with negative pressure and the ones with electro stimulation demonstrate

that the healing process was halted after 4 weeks of treatment of NPWT, while it continues if treated with electro stimulation.

Conflict of Interest There were no external sources of funding for this study. The authors have no conflicts of interest to declare.

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Evaluating the effectiveness of a new Lateral Turning System to aid Patient Repositioning using Dynamic Interface Pressure Mapping

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Introduction

Repositioning of patients who are at risk of pressure ulcers is paramount in any preventative or treatment plan, in conjunction with pressure redistribution/relieving surfaces, skin care and nutritional support. The quality of off-loading areas subjected to high pressure will undoubtlly vary among health care professionals dependant on their experience and skill. Difficulties may arise when patients are not clinically stable enough to be physically moved, non-concordant with a repositioning plan and/or distressed when moved due to pain or dementia. This evaluation demonstrated the effectiveness of using a new lateral turning system in comparison to physical repositioning by using dynamic interface pressure mapping..

Methods

An alternating dynamic pressure therapy full mattress replacement system was placed on the lateral turning system with the continuous bedside pressure mapping system placed on top of the mattress underneath the bed sheet. The evaluation was carried out with the consent of a patient who had been assessed as very high risk of developing a pressure ulcer (Waterlow score of 27)(1) who was already been nursed on the alternating mattress replacement system.

Continuous pressure mapping was performed for 12 hours, broken into 2 segments of 6 hours: the first segment was mapped with nursing staff repositioning the patient on a 2 hourly basis with the lateral turning system not in use. The second segment was with the lateral turning system set to reposition the patient to a 30degree tilt every hour without nursing staff having to physically reposition the patient.

Device under study
The lateral turning system under evaluation was the ToTo® (GenieCare) and the mattress replacement system was Trio II (Sidhil Doherty)

.

Results

Peak pressures were noted on the patients' spine, sacrum and shoulder intermittently during the period of being repositioned by nursing staff with peak pressures of 97mmgh in the hip and shoulder after 2 hours.
Whilst using the lateral turning system lower pressures were noted in the spine, sacrum and shoulder areas, the lowest being 5mmgh with a peak pressure of 40mmgh.

The volunteer patient reported that she found her position in bed was more comfortable with the lateral turning system than when staff were repositioning her.

Discussion

Effective patient repositioning undoubtedly plays an important role in minimizing pressure in bedbound patients, however in practice some nurses are more skilled at this than others.

Dependent upon an individual patient it may take between 2 – 4 nurses to reposition them to reduce the risk of pressure damage, and then it will depend on the skills of these nurses as to how effective the offloading of pressure would be.

With the lateral repositioning system the patient was effectively placed into a 30degree tilt position which they found comfortable and reduced the workload of the nursing staff without compromising patient care. However the author does advocate that if this system is used nursing staff should still perform regular skin assessments to identify early signs of skin damage.

Clinical relevance

The Toto® is an effective alternative to physical repositioning of patients who are immobile and/or bedbound.

Acknowledgements

I appreciate the help of Sidhil Doherty who kindly provided the pressure mapping system.

Conflict of Interest
No conflict of Interest

References

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Pressure mapping on OR table and post op

Maria Amnell, Etac AB, Sweden
Eila Sterner Karolinska Sjukhuset, Sweden, Bart Van der Heyden, Belgium

Introduction

During spring 2011, we performed pressure mapping in surgery resembling conditions on ORT and directly thereafter on hospital bed with standard hospital mattress and hospital beds with ROHO Dry Floatation overlay.

During surgery, orthopedic patients are positioned and can remain in the same position for hours. By performing pressure mapping, document redness and interviewing the test persons we obtained information that we have analyzed.

Methods

2 test persons
A: Woman 59 years, 52 kg, 167 cm
B: Woman 55 years, 70 kg, 168 cm
Both were fasting since 24.00 the night before and dressed in hospital shirts
We used two different ORT, one with regular foam and one visco elastic foam.
Positions ORT: Supine for 2 hours. Lateral with fixations for hip and arm for 1 hour. Test person A used Warm cloth.
"Postop":Transfer to hospital bed. Supine position for 1 hour.Hospital standard mattress and ROHO Dry Floatation overlay.
Continuously pressure mapping was performed on all surfaces:
Recording of pressure distribution and intensity on exposed skin areas. Focus on how rapidly the pressure intensity and distribution developed.
Documentation of persistent redness.
Documenation oft the test person´s own pain experience

Results

On ORT:
Max pressure over the exposed area developed rapidly.
Positioning alterations in hip and knee angles had no effect on the exposed areas in the lateral position.
We saw high pressure that didn´t result in redness and vice versa.
Redness due to the same pressure intensity but on different body parts had different appearance.
On the ORTs max pressure and pressure distribution developed within a few minutes.
On the standard mattress the pressure raised slower than on ORT.
The heels showed high pressure on the hospital bed.
The ROHO DFO gave out standing pressure distribution and largest contact area.

The heels were extremely exposed on ORT and standard mattress:
ORT: (Heels) After 1 minute the peak pressure was 160 mmHg and rapidly raised to 220 mmHg.
On standard mattress: (Heels) After 10 minutes the pressure on the heels reached 140 mmHg and continued to raised up to 220 mmHg within the hour.
On ROHO Dry Floatation overlay the heel pressure was constantly under 50 mmHG

Discussion

Our test persons had no intrinsic risk factors. They developed persistent redness and pain.
We used the viscoelastic foam ORT only for the lateral position and can therefore not compare the foam quality. But none of the table´s foam had sufficient pressure distribution qualities.
We see our results as an indicator and hopefully a motivator for coming larger studies, which hopefully can lead to improved clinical implementations regarding pressure care during and directly after surgery also for patient´s that may not be considered as risk patients.

Conflict of Interest
We have looked at these studies and our findings did not conflict with their result:
Interface pressure measurement during surgery, a comparison of four operating table surfaces.
B.P.J.A. Keller, J Overbeeke, Chr van der Werken, Jan 2006.
Preventing pressure ulcers, an evaluation of four operating-table mattresses.
Tom DeFloor, De Schuijmer JD, Aug 2000
Pressure mapping of Therapeutic bed surfaces: Clincal evidence. Nov 2010
Sarah Thorne, Katrine Sauvé, Christine Yacoub, Paulette Guitard, November 2009

Clinical relevance

When these results were presented for the orthopedic surgery unit, it became very obvious how exposed the heels are. This has resulted in a coming study for heel pressure protection before, during and after surgery that will start during 2014.

Acknowledgements

Eila Sterner, R.N, MD doctor, Karolinska Sjukhuset
Bart Van der Heyden, independent PT, clinical consultant, Belgium
Besides our two brave test persons; A and B, Eila, Bart and myself would like to thank you Kai and Eva who assisted us during the whole procedure.

P60

Can Pressure Mapping Facilitate Patients and Carers in Their Decision Making with Regards to Repositioning and Pressure Ulcer Prevention in the Community Setting

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Introduction

XSENSOR® ForeSite™ PT Patient Turn System (ForeSite PT System) is intended for monitoring in-bed activity and care delivery for patients susceptible to pressure ulcers in all care settings.

The ForeSite PT System consists of a fitted mattress cover embedded with thousands of sensor cells that continuously measures the patient's body surface pressures and a touch screen computer that displays a turn timer and pressure information. It helps to identify areas of the body that have been under sustained pressure. The turn timer allows clinicians, carers and patients to better understand and manage a patient's turn schedule and repositioning regime.

This project focuses attention onto the community dweller, and explores the use of pressure mapping in a setting where care provision is much less frequent than in the more studied hospital setting and where the ability to monitor patient activity is often reliant on unskilled carers[1]. The objectives of the study are; whether the development of pressure ulcers can be reduced following use of the ForeSite PT System; is the product useful in facilitating patient decision-making in determining specific positions that should be avoided; to look at the ease of use and user acceptability and comfort of the product.

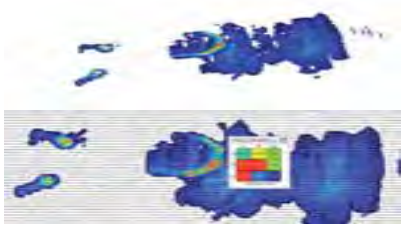
Methods

Patients were recruited for the study who were identified as being at high risk of developing pressure ulcers and who were referred to the tissue viability service. The patients comprised of those who either were refusing or reluctant to use equipment or where current equipment was not effective for reasons such as dissatisfaction and discomfort [2].

Results

The early results indicate that patients are very responsive to the images on the pressure monitor; requesting to be turned in line with the turn clock, becoming more concordant with repositioning regimes and shifting position in line with the pressure indicators. Pressure ulcers are healing or improving as clinicians and carers also respond to the images on the monitor. Pressure that would not have been identified is being captured through the mapping; Figure 1 demonstrates a bedpan placed under a patient for a period of 55 mins with pressures of >200mmHg in the contact area and the heels.

Fig. 1: *Pressure monitor Images*



Discussion

The mapping images appear to facilitate individualised care. Although it is recognised that interface pressures do not provide the full picture with regards to the amount of pressure exerted on muscle tissue and deformation of cells which result in deep tissue injury[3][4], they do provide insight into areas that are at high pressure and thus require a change in position. It is not possible via MRI to determine a patient's normal lifestyle only the effect of low tissue tolerance at a given time. Therefore through this technology, the monitoring of interface pressures in the patients home will allow a patient to adjust their positions according to their own interface pressures.

Clinical relevance

The use of the pressure mapping device provides valuable insight into patient activity in the community with the potential to enable vulnerable adults to be more empowered in terms of the management of their conditions. By observing the colour changes produced by the pressure variances, patients can then make real time decisions around pressure relief and position change that make a difference to their pressure risk.

Acknowledgements

We appreciate the help of the patients, care givers, XSENSOR and SUMED for their continued support.

Conflict of Interest

Project supported by XSENSOR and SUMED

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P61

Comparison of Pressure Area Index (PAI) achieved on pressure reducing mattresses as part of the introduction of a new CLP mattress system

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Introduction

Patient support surfaces for over 25 years have been compared using interface pressure measurements; these studies have measured either;

1. For alternating pressure mattresses (ALT) the Pressure Relief Index (PRI) defined as the period over a set time (i.e. one complete mattress cycle) at a given reference point that pressures are below relevant thresholds (5,10, 20 & 30mmHg).
2. For constant low pressure mattresses (CLP) the Pressure Area Index (PAI) is calculated. This is defined as the number of sensors reading below relevant thresholds as a percentage of all the load bearing sensors.

This evaluation of the seven mattresses was performed in order to gather baseline PAI data of the mattresses to compare with two new CLP mattress systems developed for the Multicare Critical Care Bed.

Methods

The nine mattresses were placed on a Multicare Critical Care Bed and tested in two lying positions, position 1. Supine, and position 2. Profiled at 30 degrees with knees gatched. The profiled and knee gatched position was achieved using the auto contour feature of the bed frame. The FSA (Forced Sensor Array) bed mat from Vista Medical was placed directly onto the mattress. Both mattress and sensor mat were set up as per manufacturer's instructions.
An 83Kg manikin was positioned on the mattress for 15 minutes to allow for adjustments, then for a further 15 minutes whilst measurements of the contact pressures were recorded every 5 seconds.
The focus of the evaluation was to analyse and report on the Pressure Area Index (PAI) at selected points of time during the 15 minutes of data recording. The pressures were recorded and analysed using the FSA software and were also exported to an Excel spread sheet for further analysis.

The manikin in the supine position, the head was flat to the mattress with no pillow, arms by the side of the torso with elbows down and thumbs up, heels were placed at shoulder width apart with the legs straight. In the profile position the arms were placed across the lower abdomen with the legs bending to contour with the knee gatch.

Results

Mattress	Pressure	PAI Supine	PAI Profiled
1	<30mmHg	85.3%	83.7%
	<10mmHg	41.7%	38.2%
Symbioso 200	<30mmHg	75.6%	63.9%
	<10mmHg	35.2%	27.6%
Symbioso 100	<30mmHg	88.0%	79.9%
	<10mmHg	44.7%	38.4%
4	<30mmHg	85.4%	75.1%
	<10mmHg	38.3%	29.3%
5	<30mmHg	73.1%	73.4%
	<10mmHg	35.7%	28.8%
6	<30mmHg	78.3%	69.8%
	<10mmHg	35.9%	28.4%
7	<30mmHg	79.8%	88.6%
	<10mmHg	37.5%	37.5%
8	<30mmHg	81.5%	69.9%
	<10mmHg	33.6%	30.6%
9	<30mmHg	73.5%	53.8%
	<10mmHg	29.9%	25.7%

Table 1: *Pressure Area Index (PAI) at 15minutes*

Discussion

The manikin used was an attempt to maintain stability of factors in weight and shape for repeatability during testing, not always possible with human subjects. However the manikin does not mould and conform to the mattress shape as a human subject would.

From the results obtained it is difficult to claim superiority of one mattress over another, however for the purpose of this testing the results show that the Symbioso 200 and 100 mattresses are comparible with other mattresses in the Pressure Area Index achieved.

Clinical relevance

Pressure Area Index is only one factor in the assessment of the performance of a mattress and does not provide any indication of clinical outcome, further testing and evaluation design need to be considered before being able to identify a superior product.

Conflict of Interest
Author received a consultancy fee from Linet UK.

Using the latest technology support surface and patient monitoring in an adult critical care to optimise outcomes in pressure ulcer prevention.

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Introduction

The reported incidence of pressure ulcers in the Critical Care settings is low, figures given range from 14.3% in one hospital [1] and 38% - 124% in a literature review in 2008 [2].
The cost of treating pressure ulcers, estimated at between £1000 for a Category One to £10,000 for a Category Four [3]. The impact these figures have on the financial burden to healthcare is significant and continues to be a focus for targeted prevention strategies.
The University Hospital Bristol Adult Critical Care Unit with 20 ICU/HDU beds (13 level 3 and 7 level 2) introduced new technologies within the normal package of care for patients at high risk of pressure ulcer development.
1. Virtuoso Series 2 Mattress providing two modes of operation, alternating or constant low pressure support.
2. Used the Innovian Clinical Information System as part of the 'intentional rounding' protocol to optimise appropriate care and interventions.

Methods

Over the 6-month period the Virtuoso Series 2 mattress was evaluated on a rolling programme throughout the unit.
Critical Care Unit staff were provided with a product specific evaluation form made up of seven sections to complete during and following their use of the mattress with each patient.
Trust pressure ulcer incidence reporting continued unchanged as per policy and guidelines.
Data was analysed using the statistical analysis package SPSS Base.

Results

51 patients (31 male, 19 female) completed the evaluation, mean age of 62.77 years (range 24 - 93yrs), length of stay 2 – 61 days (mean 8.12 days).

Forty six (46) patients were immobile, 37/46 were recorded as being ventilated (32/37 sedated) needing maximum assistance for repositioning.

74.5% (n=38) patients were assessed as high/very high risk of pressure ulcer development.

17 patients had tissue damage, (n= 13 Cat.1, n=3 Cat.2, n=1 Cat.3) 15 of which had developed prior to admission to the unit. All patients were reported to be healing or healed whilst on the Virtuoso (n=5 healing, n=12 healed).

87.5% (n= 42/48 responses) found the mattress to be acceptable.

95.9% (n=47/49 responses) found that the mattress met their expectations in the management of patients, and in the prevention and management of pressure ulcers.

Discussion

Prior to commencing the project the average monthly incidence of pressure ulcers was 7-9% with high numbers of category 2 and 3 pressure ulcers. In the six months the incidence reduced to <2% and has continued to remain at this level following the mattress data collection period.

Month	Incidence %
1	4%
2	1%
3	2%
4	1%
5	1%
6	1%
7	1%
8	Zero
9	Zero

Table 1: *Unit pressure ulcer incidence figures*

Clinical relevance

The Virtuoso mattress system is safe and effective in optimising outcomes in the management of critically care patients, coupled with effective nursing and care rounding packages optimised healing and prevented very high risk patients from developing pressure ulcers.

Conflict of Interest
Author[1] received a consultancy fee from Linet UK.

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A Comparison of the Ability of Collagen/ORC and Other Biomaterials to Reduce Protease Activity.

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Introduction

Chronic wounds have been reported to have elevated levels of Proteases that contribute to their delayed or non-healing status. It has also been postulated that reducing the protease levels in such wounds, will move the wound healing process from a stalled state, towards wound closure.

In the past decade many dressings and therapies have become available that claim to reduce the level of both Matrix Metalloproteases (MMP) and Serine protease in chronic wounds. These products use a diverse range of biomaterials and achieve their protease reducing activity through various mechanisms such as electrostatic binding, metal chelation, pH and acting as a sacrificial substrate for MMPs within the wound environment.

In this study we compared the ability of different biomaterial based dressings to inactivate proteases that are elevated in chronic wounds

Methods

In vitro fluorogenic substrate assays were used to determine the effect of different biomaterials to reduce both MMP and Elastase protease activities. The Protease activity levels used in the assays were comparable with those measured in chronic wound fluid.

Results

Each of the test materials demonstrated a level of MMP and Elastase inactivation; however, there were significant differences in the rate and degree of protease inactivation that was observed. A blend of collagen/Oxidised Regenerated cellulose was found to be the most effective material at reducing levels of both MMPs and Elastase.

Discussion

This study suggests that in wounds with elevated protease activity, dressings containing Collagen/ORC are more effective than those containing other biomaterials.

Conflict of Interest

All abstract authors are employees of Systagenix. This study was funded by Systagenix

P64

Pressure ulcer study in Satakunta Central Hospital in Finland

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Introduction

Pressure ulcer prevalence is estimated at 5-25 % of adult Finnish patients. Pressure ulcers (PU) cause considerable financial burden to the societies not to mention the increased stress, pain, reduced quality of life and anxiety for all involved. Most pressure ulcers develop during the first week of treatment and the risk is greatly increased if patient is elderly, unable to move or suffers from malnutrition or has reduced sense of pain. Satakunta Central Hospital has prioritized pressure ulcers as one of main development projects aiming at establishing leg ulcer care policy to minimize their genesis. The aim of the study was to determine the present number and grades/staging of pressure ulcers and to perform risk assessment to consented adult patients on study day.

Methods

Consented adult in-hospital patients were assessed clinically by an authorized nurse specialist and the whole skin was examined. Pressure ulcers were graded using NPUAP/EPUAP guidelines for pressure ulcer staging and Braden risk assessment tool was used. Demographic data was collected from patient files.

Results

236 patients in 13 wards were treated in hospital on the study day and 229 patients (97 %) were consented. Overall pressure ulcer prevalence was 8, 7 % (20 patients). Category/Stage I was most prominent, in 14 patients, Category/Stage II was detected on 4 patients, Category/Stage III on 1 patient and 1 patient had an unclassified PU. Ulcers were situated on heels in 8 patients, were sacral in 7 patients, scapular in 2 and 2 were on hip and 1 in pelvic area. Braden risk was extremely high in 1, 4 % (4 patients), high in 17 % (39 patients), medium in 26 % (60 patients) and low in 55 % of patients. Most pressure ulcers (55 %) were found on patients treated in surgical wards in our hospital. Hospital treatment length was less than 4 days in 48 % with 4 PUs and 4-7 days in 30 % with 5 PUs and over 7 days in 22 % with 11 PUs, respectively.

Discussion

Preventing pressure ulcers should be concerned as a major multidisciplinary concern in health care. They can be regarded as adverse events in the co-operation and skills of the entire health care team. Although most, but not all, pressure ulcers can be prevented [1], effort should be put on intensive and sustained staff education and careful and constant patient monitoring and full patient information recording [2] .In Finland pressure ulcers prevention has not evolved in the past 10 years and prevalence ratios have remained relatively unchanged [3]. Real development and implementation procedures leading to pressure ulcer prevention and treatment excellence and, thus higher quality of care are actively being implemented in Satakunta Central Hospital.

Clinical relevance

Only adequate acknowledgement of pressure ulcer problem in health care settings can lead to key preventive practices. This study is will further lead our focus on developing preventive methods and daily routines for all in- hospital patients to prevent pressure ulcers.

Acknowledgements

The study was funded by the Satakunta Hospital District and the Hospital District of Southwest Finland.

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Standardized patient-centered bedside handover for improve continuity of patient care

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Introduction

In 2010, Stockholm county council started a prevention project conducted under the name of TUFF. This is an abbreviation of pressure ulcer (T), malnutrition (U) and prevention of fall (FF). Health care professional from acute hospitals and nursing homes begin to work in TUFF teams.

Today the rate of patient turnover is increasing with shorter length of stay in the acute hospitals. This situation can lead to decreasing of risk assessments due to less time for each patient. It can affect the communication with other staff members and quality of documentation in the electronic health care record because the computer is not always available near the patient. It can be time consuming and affect the outcome for the patients.

Pressure ulcer is still a problem for the health care. We do several of point prevalence surveys and follow-ups, we do risk assessments and still we have this problem with pressure ulcers. Why not involve the patient and spouses in prevention of pressure ulcers? Maybe increased involvement and participation of the patient will be the key to reduce suffering of pressure ulcers. Today's technology with the use of smart phones, and hand held computers may optimize the adoption of measures and follow ups, to facilitate the documentation/communications and reporting to quality registers, and to involve the patient in their own care.

In nursing care it is important with patients' participation and engagement. This "shared decision-making" may significant improve adherence and this is an important part of the philosophy of "patient-centeredness" [1] [2]. It is important to have a balance between comprehensiveness and efficiency in the data collection of patients' health.

Handover at the bedside saves time, ensuring accurate identification of patient with information and to put a face to the name, allows asking questions and gives an opportunity to begin patient assessments. Most importantly, bedside handover allows participation by patients, careers and family members which enables them to be better informed about their care plan, could enhance effectiveness of follow up of prevention taken and improve patient safety.

The primary purpose of handover bedside communication is to provide accurate, up-to-date information about the patient's care, treatment, use of services, current condition and any predictable changes to health during hospital stay. A second purpose is to involve and increase the patients' "shared decision-making" in their own care and treatment [3].

The aim of this project is to create a demo of a hand held computer application used bedside - for documentation of relevant risk assessments (in step 1 -pressure ulcer prevention) and information needed to improve patient safety together with the patient / spouses. The use of this hand held computer may also be a support for the nurses decisions to choose the appropriate prevention for the patient and keep them free from complications as pressure ulcers [4].

Clinical relevance

Access to information anywhere and at anytime, can greatly benefit nursing practice. Care plans, outcomes and agreements between patients and nurses is easy to follow and update bedside.

Acknowledgements

I appreciate all help and supervise from my two colleges: Margareta Skog at Karolinska University Hospital and Inger Rising at Stockholm county council.

Conflict of Interest Non

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Biophotonics: a novel approach to the treatment of wounds

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Introduction

Chronic wounds particularly pressure ulcers are a challenge to treat and may subsist despite multiple wound treatment modalities. Phototherapy has traditionally been used to treat skin conditions and is also now being considered for tissue repair applications [1,2,3]. KLOX Technologies has devised a new biophotonic system based on light for wound healing.

Methods

The KLOX biophotonic system is comprised of a multi-LED light and a photoconverter gel (fig 1) containing a fluorescent chromophore. The multi-LED light emits narrowband light at a peak wavelength well suited for activating the chromophore in the gel. Once activated, the chromophore fluoresces to illuminate the wound with a broader wavelength of light spanning blue, green, yellow and orange wavelengths.

Fig. 1: *Pre-Activated gel, Activated Gel, Post-Activated gel (Left to Right).*

In an effort to further understand the clinical impact and relevance of this novel technology on wounds, we undertook in vitro and in vivo studies which are summarized in Fig.2.

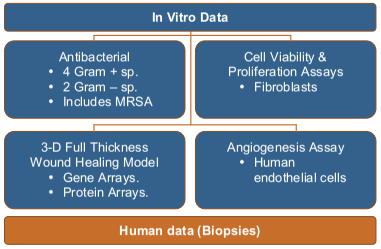

Fig 2. *Summary of* in vitro and in vivo studies

Results

Key findings from the in vitro and vivo studies include:

- Bacteriostatic/bactericidal effect.
- No negative effect on fibroblast or keratinocyte viability.
- Angiogenic effect seen in cells isolated from diabetic patients.
- Growth factor modulation (favorable to wound healing).
- No cytotoxicity and excellent safety profile.
- Modulation of protein secretion and gene expression involved in the early phase of wound healing in a 3D human skin model.
- Collagen synthesis.

In addition anecdotal observations and results from clinical trials in Canada have shown unresponsive chronic wounds to proceed to heal, some in an accelerated manner.

Discussion

The *in vitro* and *in vivo* studies together with the clinical data have indicated the potential of KLOX's biophotonic therapy to make a significant positive impact on wounds. Further clinical trials are currently being planned.

Clinical relevance

A quick, easy to use, effective therapy aimed to treat both pressure ulcers and hard to heal wounds could be a very important addition to clinical practitioner's armamentarium.

Acknowledgements

None

Conflict of Interest

All authors are employees of KLOX Technologies

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Objective evaluation by reflectance spectrophotometry can be of clinical value

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Introduction

Patient with hip fracture are a fragile group of patients for several of complications due to surgery [1][2]. Pressure ulcers are a common complication to hip fracture surgery. The sacral area is one of the most commonly affected areas in immobile patients lying on supine position before and after hip surgery. Early detection of category 1 pressure ulcers is essential for the prevention of more severe pressure ulcers. Today observation and light skin pressure is state of the art to separate blanching erythema from non-blanching, but this assessment is subjective and is depending on knowledge and practice. The purpose of the present study was to investigate if a digital medical device (reflectance spectrophotometer) can be of help to assess early changes on the skin in the sacral area of patients undergoing hip fracture surgery [3],[4].

Methods

A narrow-band reflectance spectrophotometry was used in order to detect early redness on the skin (Derma Spectrometer). Seventy-eight patients with hip fractures were followed daily, from the first day post surgery and to a maximum of five days. The sacral area was assessed independently by two nurses. After ocular skin assessment and blanching/ non blanching test the skin was measured by a reflectance spectrophotometer. Each day the assessment started with point 1-8, and the same turn was repeated a total of three times (fig 1). The reference point at the hip is placed opposite to the fracture side, not exposed to any pressure, was also measured three times each measuring days.

Fig 1

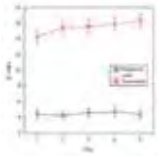

Fig 2

Results

Change of the Erythema index over time was analyzed using a mixed linear model [5]. For the assessments using reflectance spectrophotometer measurements, the results showed a significant change over time for the mean value of the Erythema index across the 8 points in the sacral area ($p<0.001$).

Post hoc contrasts showed significantly higher Erythema index values from Day 2 to Day 5 compared to Day 1 ($p=0.015$, 0.002, $p<0.001$ and $p<0.001$ respectively). The reference point on the hip (which was not exposed to pressure) did not show any significant changes during the measurement period ($p=0.32$) (Fig 2)

Discussion

This clinical study, which has followed patients throughout the entire admission using a medical device assessing redness in the skin has the potential to offer an objective measurement. The ability to distinguish between reactive hyperaemia and blanching/non-blanching erythema is difficult but important. An increased Erythema index may indicate that the skin has been affected by pressure and should be protected for new periods of pressure [6]. This technique is simple to use for register minor changes and can be a help for the nurses to choose rapid individual prevention. Though more studies are needed for investigate other vulnerable areas, e.g. heels [7].

Clinical relevance

Early detection of tissue affected (before visible category 1 pressure ulcers) is a crucial factor for prevention of more serious pressure ulcers damages.

Acknowledgements

I appreciate all help from my three supervisors; Professor, RN Björn Fossum, Professor, RN Christina Lindholm and Professor, MD André Stark who make it possible for me to complete my thesis.

Conflict of Interest Non

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Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

Reliability and Predictive Validity of Braden Scale in Turkish Intensive Care Patients

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Introduction

It is important to determine high risky patients for developing of pressure ulcers at intensive care units by using a valid measurement tool. In Turkey, there have been no studies that have tested the Braden Scale, which is the mostly used measurement tool, for reliability, predictive validity and established cutoff points for assessing risk specific to intensive care units. The purpose of this study was to: (a) establish the reliability and predictive validity of the Braden Scale (BS) in intensive care units' patients; and (b) determine the critical cutoff point for patient risk.

Methods

The sample was 422 patients with a mean age of 59 (SD=16) years at 50 intensive care units (ICUs) of 21 hospitals, located in Istanbul, Turkey. Reliability was based on internal consistency and item-total correlation. Internal consistency was assessed by Cronbach's coefficient; item-total correlation was assessed by Pearson correlation coefficients. Predictive validity was measured by using sensitivity, specificity, positive predictive value, and negative predictive value.

Results

The Cronbach's alpha value was 0.82 for the overall scale, Corrected item-total correlation coefficients ranged between 0.72 to 0.84 for the subscales (Table 1). BS scores were significantly lower in those who developed ulcers than in those who did not develop ulcers. In patients with and without pressure ulcers, the least difference was observed in moisture dimension scores. Overall, the critical cutoff score for predicting risk was 14 and the best sensitivity and specificity balance was obtained with this cutoff score (Table 2).

Table 1: *Corrected item–total scale correlation*

Subscales	Corrected item-total correlation
Sensory perception	0.75
Moisture	0.84
Activity	0.80
Mobility	0.72
Nutrition	0.82
Friction&Shear	0.75

Table 2: *Sensitivity and specificity values at different cutoff points*

Cut-off Point	Sensitivity (%)	Specificity (%)	Predictive Value Positive (%)	Predictive Value Negative (%)
≤18	100	27	47	100
≤17	96	31	48	92
≤16	95	40	51	92
≤15	93	46	53	91
≤14	86	52	87	85
≤13	79	55	54	80
≤12	69	63	55	75

Discussion

The reliability analysis yielded highly satisfactory results. The Cronbach's alpha coefficient for the total instrument was higher than 0.80 indicating that very acceptable internal consistency. Item-total correlations exceeded the accepted standard which was >0.20. BS scores were significantly lower in patients with pressure ulcers than in those without ulcers showing that its usefulness in predicting pressure ulcers. By means of moisture dimension, there was a least differences between patients with and without pressure ulcers. In ICUs, urinary catheterization may be necessary for preventing activity and maintaining absolute bed rest as well as for problems such as urinary incontinence. In such situations, problems occur in evaluating the moisture subscale and the discriminating function of the dimension becomes limited. On the other hand, in some studies, it was reported that the activity and nutrition subscales did not provide sufficient evaluation in ICUs patients [1]. The BS demonstrated usefulness in predicting pressure ulcer development on ICUs when using a cutoff score of 14. Studies continue in order to determine the cut-off point of the BS in ICUs [2].

Clinical relevance

The satisfactory results we obtained prove that BS will be suitable instrument for use to determine risky patients for pressure ulcers in ICUs. Additionally, the BS can be used in the evaluation of the effectiveness of nursing interventions to decrease pressure ulcers incidence.

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Proceedings of the 17th Annual European Pressure Ulcer Meeting
Stockholm, Sweden

Prevalence of Pressure Ulcers in Intensive Care Unit Patients in Turkey

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Introduction

Pressure ulcers, which have varying incidence rates from country to country and from institution to institution are one of the important health problems. Intensive care units (ICUs) is seen risky places for developing pressure ulcers. However there was no study that has investigated pressure ulcers prevalence among a representative sample in ICUs in Turkey. The purpose of this study was to evaluate the prevalence of pressure ulcers among adult intensive care patients.

Methods

The risk of pressure ulcer in 422 patients at 50 ICUs of 21 hospitals, located in Istanbul, was determined by using the Braden Scale. Subsequently, patients who had pressure ulcers were evaluated by means of ulcer/s' localization and size, presence of exuda, situation of surrounded tissues and ulcer/s' phase according to the classification system recommended by EPUAP. Before the study, permissions from the management of hospitals and ethical approval by Local Ethics Committee were obtained.

Results

The prevalence of pressure ulcers in intensive care patients was 39.8% (n=168) (Fig 1). Patients who were hospitalized at Chronic ICUs had more pressure ulcers (Fig 2).

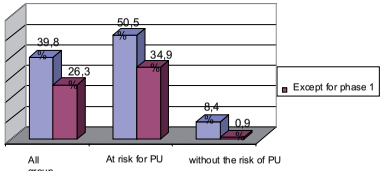

Fig.1: *Prevalence of pressure ulcers in ICUs patients.*

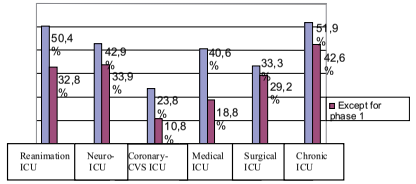

Fig. 2: *The prevalence of PU according to different ICU*

The mean number of ulcers was 2.0 (SD=1.2) and the mean ulcer size was 63.0 mm (SD=26.4 mm). One third of the ulcers were in the sacral area and the majority of ulcers were in the first phase (Table 1).

Table 1: *Characteristics of pressure ulcers*

Locations	n (%)	Phase	n (%)
Sacrum	111 (33,7)	Phase1	151 (45,8
Heels	97 (29,4)	Phase2	131 (39,7)
İschium	40 (12)	Phase3	38 (11,5)
Trochanter	28 (8,5)	Phase4	10 (3)
Malleolus	18 (5,4)		
Ear	16 (4,9)		
Other	20 (6,1)		

Discussion

In our study, the prevalence of pressure ulcers were higher than indicated rates in the literature [1, 2]. Three possible explanation can be done for this finding. First, this result may be due to insufficient preventive patient care. Second, since the most important parameter for evaluating quality of nursing care in ICUs is pressure ulcers, the rate of pressure ulcers might be underestimated in previous studies if the researcher was employed at the institution or if data was obtained according to the declaration of the employee rather than a valid measurement tool. In the current study, researchers were not employed the institution where study was done. Moreover a valid tool which is Braden Scale was used to examine pressure ulcer Risk. The strongest possibility for the higher pressure ulcers prevalence in our study is poor preventative nursing care. In our study, the most diagnosed ulcer was phase 1. In some studies, phase 2 ulcers ranked first [1]; however, it is more difficult to diagnose ulcers in the phase 1 and the evaluation can be subjective. Pressure ulcers were mostly located on the sacral area showing that patients were lying in supine position for long duration without relieving pressure. In our research, prevalence of pressure ulcer was the highest at the Chronic-CVS ICUs where duration of hospitalization is the longest. It is expected result because risk of pressure ulcers increases as the duration of hospitalization increases.

Clinical relevance

The prevalence of pressure ulcers in ICUs are quite high. The more effective precautions should be taken.

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Instrument measuring of the competence "risk assessment of pressure ulcer" applicable to simulation of clinical practice: process validation

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Introduction

The clinical decision involving the best available practice presupposes the exercise of the competences. The evidences contained of the guideline of National Pressure Ulcer Advisory Panel (NPUAP) and Europen Pressure Ulcer Advisory Panel (EPUAP) may result in structuring of competences to health professionals with safety and quality training. Competencies involve the articulation of a set of knowledge, skills and attitudes [1]. The competence development are pointed as process and outcome positive of clinical simulation strategy. The aim of this study was to construct and validate the contents of the measuring instrument of the components knowledges, skills and attitudes of the competence "risk assessment for pressure ulcers" applicable to teaching strategy by simulation.

Methods

This This methodological study was developed in stages. The first: elaboration and validation of the construct (theoretical framework) on the knowledge, skills and attitudes of the competence "risk assessment for pressure ulcers". The second: development of pilot instrument subjected to semantic analysis and content validation. The elaboration of the construct occurred from the analysis of knowing (knowledge); knowing-doing (skills); and wanting to act, knowing-acting, and ability to act (attitudes) based on conceptions of Le Boterf (2003), considering the recommendations for risk assessment the NPUAP / EPUAP (2009) . For the attitudes was used the concept of critical thinking established by Delphi report Facione (1990). Were identified 37 items to knowledge, 29 items to skills; 34 items to attitudes, totaling 100. The construct was subjected to content validation by a committee of five experts. The construct was subjected to content validation by a committee of five experts. The trial was expressed by degrees of pertinence. The instrument for measuring competence was developed from the validated construct and subjected to semantic analysis (brainstorming with groups formed by 4 nursing undergraduate students and 4 newly qualified nurses). Finaly was content validation by six experts committee. The instrument consisted of the 32 statements that allow the verification of level to agreement: knowledge(14),skills (8) and attitudes (10).

Results

The construct and instrument for measuring competence exhibited reliability (80 to 100 % of pertinence). The instrument was validated with response scale of five points ranging from none (1) to extremely (5). The scores follow the variation interval of the Likert scale. To Knowledge (min / max = 14 /70); Ability to (min / max = 8/40) ; For attitudes (min / max = 10 /50) . The higher the score in each component, the higher the level of the combination of knowledge, skills and attitudes to exercise of the competencea.

Discussion

Studies suggest that development of competences is the main result of the simulation strategy. However, there are few educational constructed and validated instruments capable of measuring the exercise of competences [2] [3] [4]. Of the 37 operational items of knowledge constructed, 33 items were considered pertinent and two changed. After classification by type of knowledge, 15 items suffered textual revision and one was added, resulting in 38 items. Of the 29 items about Skills, 27 were considered pertinent. The classifications by type of knowing-doing resulted in the amendment of four items, a reclassification and other one discarded, leaving 28. Of the 34 items about Attitudes, 33 were considered very pertinent and one was discarded. The content validity of the construct consolidated 99 of 100 items appreciated. The validated construct gave support to development of the instrument of the competence which consisted of the combination by knowledge evidence-based. Psychometric procedures for the instrument will be test in future studies.

Clinical relevance

The instrument is applicable to simulation strategy for the development of competence "risk assessment for pressure ulcers".

Acknowledgements

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No conflicts of interest to declare

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Detecting Subclinical Pressure Induced Tissue Damage among Nursing Home Residents with Subepidermal Moisture (SEM) Measures: Preliminary Findings

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Introduction

Pressure ulcers (PUs) are classified by the level of *visible* tissue damage, where stage I PUs exhibit non-blanchable redness on intact skin, deep tissue injuries (DTI) show maroon or purple skin discoloration, stage II PUs are partial thickness ulcers, and stage III-IV and unstageable ulcers involve full thickness damage.[1] Stage I PUs account for up to 47% of all PUs in the elderly, many of which progress to more severe ulcers.[2,3]. Skin discoloration indicates underlying tissue damage has already occurred. *Detection of subclinical pressure induced tissue damage* can allow for viable tissue rescue preventing stage I PUs and DTI. In pilot studies, we showed that subepidermal moisture (SEM) or water content in skin and tissues as measured using surface electrical capacitance, is related to skin damage among nursing home (NH) residents and SEM increased (e.g., more edema, inflammation) when no visible damage was observed but stage I or greater PU was visible one week later. The purpose of this descriptive cohort panel study is to describe SEM as a method of detecting of early pressure induced tissue damage among NH residents.

Methods

The University of California, Los Angeles, Human Subject Protection Committee approved the protocol. Research staff obtained written informed consent to participate from residents or designated proxies for those unable to provide consent. 417 NH residents from 19 NHs in California participated in the study. Visual skin assessments and SEM were obtained weekly for up to 16 weeks. SEM was measured with surface electrical capacitance and a dermal phase meter, higher readings indicate greater SEM (range 0-70). Visual assessment was rated as normal, erythema, stage I PU, DTI, and stage II+ PU.

Results

NHs were reflective of U.S. NHs with a range across quality of care ratings: Poor 17%; Below average 22%; Average 33% Above average 6%; Superior 22%.

Participants had a mean age of 76.7 (SD=14.5) years, were 58% female, 37% non-Hispanic white, 21% Hispanic, 29% African American, 12% Asian American, with mean Braden Scale score =15.6, SD 3.2; functionally dependent (U.S Minimum Data Set (MDS) mean bed mobility score 2.7, SD 1.2; transfer score 3.1, SD 1.0; range 1-4). Mean length of stay was 1.6 years (25% of participants were newly admitted during study). Incidence all PU stages & DTI over 16 weeks=46%; Stage II+ PU= 23%; DTI only=7%; and Stage I PU only=33%.

Mean SEM for skin condition at Sacrum: No damage 40.7; Erythema 42; Stage I 44.1 (only 1 sacral DTI observed). SEM was higher the week prior to observed erythema/stage I PU compared to SEM taken concurrently and to normal readings: ***42.51 (SD 7.65)*** versus ***41.45 (SD 9.54)*** and ***40.96 (SD 7.74)***, respectively.

Mean SEM for skin condition at L Heel: No Damage 28.8; Erythema 30.6; Stage I 30.5; DTI 27.6. (findings similar for R Heel)

Preliminary generalized ordered logistic regressions--(STATA SE 11) controlling for Braden Scale risk, clustering, with robust standard error, using SEM one week prior to observed damage (N=4081 obs) found both Sacral and Heel sites statistically significant. ***Sacral site-OR 1.016 Std Err, .008 P=0.046 95% CI 1.001--1.032; R Heel site- OR 1.022 Std Err, .008 P=0.004 95% CI 1.007—1.038.***

Discussion

SEM is moderately related to subsequent pressure induced skin and tissue damage. This approach can allow research to focus on pre-stage I pressure damage or subclinical disease. More work is needed to understand inter- and intra-person variation in SEM.

Clinical relevance

SEM may be useful as a method of detecting pressure induced damage across anatomic locations earlier than visual assessment. Use of biophysical measures such as SEM would allow for earlier more aggressive interventions and provide more objective assessment data. SEM shows promise for improving the quality of PU care.

Acknowledgements

NINR #5R01NR10736-2 **Conflict of Interest—none**

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P72

The use of DACC technology in two patients under Negative Wound Pressure Therapy - A new approach.

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Introduction

Negative Wound Pressure Therapy (NWPT)[1] is a well documented and successful therapy in the management of recalcitrant, non healing pressure ulcers, cavity and surgical wounds.

Cutimed Sorbact® is a unique range of antimicrobial wound dressings that promote the natural wound healing process by a unique mode of action that works without a chemically active agent in unclean, colonised and infected wounds. It uses the physical principle of hydrophobic interaction. The dressings are coated with a fatty acid derivative (DACC)[2] giving them their highly hydrophobic properties.

The author has had good results experience with NWPT and DACC technology. This trial has evolved from the mode of action of DACC and NWPT on healing rate and wound bed.

The Tissue Viability Team in City and Hackney community has evaluated the effectiveness of Cutimed Sorbact dressing under Negative Wound Pressure Therapy (NWPT). The Cutimed Sorbact has been trialed in the Trust to look at its versatility in terms of cost, quality and effectiveness as well as patient experience. A case study was undertaken involving two 74 year old females suffering from pressure ulcers for the past two months. They have been on a regime of various dressings to manage exudates for the past two months until they were referred to the Tissue Viability Service.

Methods

Two patients around the same age, suffering from pressure ulcers within City and Hackney were selected from the caseload of the Tissue Viability Service. Dressing selection and a holistic assessment[3] was carried out. The wounds presented were 80 sqcm, sloughy, smelly, warm to touch, redness to surrounding area as well as an increase in pain and exudates level. The wound showed no signs and symptoms of infection. It was noted that the two ladies became withdrawn and psychologically disturbed. They were socially isolated due to high exudates and smell when they go out of the house. It has been noted that they even restricted their grand children to visit them.

Nottingham Health related QOL scale[4] and pain score completed at each visit.

Both patients were placed on NWPT but only one had Cutimed Sorbact under the therapy.

Results

The use of the NWPT had kick- started the healing phase in both wounds and the wound healed after 6 weeks in Patient with DACC technology and the other one in 8 weeks. Staff and patient comments and views have been documented. Nottingham HRQoL and pain score show progression of score towards a better QOL and patient outcome and lesser pain from week to week.

N.B. The patient with the DACC and NWPT had longer wear time of the dressing, hence less nursing visit, hence less total dressing cost. This was possible due to the granulation not sticking to the DACC mesh while normally beyond 48 hours the granulation tissue attaches to the foam tissue.

Discussion

It is important to be able recognize the stage a wound is at in the healing phase and to know if a wound is not following the normal progression in healing. Identifying debris in the wound and knowing how best to deal with it are important aspects of wound management. Preserving viable tissue and structures within the wound bed will assist the healing process. Dressing selection and knowing the performance of a dressing is crucial to optimized healing. Cutimed Sorbact dressing promotes faster healing and improves patients' quality of life when used appropriately after a holistic assessment of the patient.

Clinical relevance

DACC technology dressing along with NWPT pumps is effective in term of rate of healing and dressing change as well as exudates management. It is also a good cost effective therapy in its totality of reduction in nursing time and improving quality of life.

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Conflict of Interest : None

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P73

Prevalence of pressure ulcers (PU) in a central hospital in Portugal

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Introduction

Pressure ulcers (PU) are a common problem to many countries of the world, in all levels of health care. This problem affects people of all ages and it's very expensive for the health budgets. The first step towards recognition of this serious health problem, is to go through epidemiological studies, to understand the real extent of the impact of PU. The literature shows prevalence's of Pressure Ulcers ranging from 1.8% to 56.2%, witch shows the huge amplitude between reality's.
The main aim of this study was to estimate the prevalence of pressure ulcers and characterize the patients admitted in Centro Hospitalar de S. João EPE.

Methods

Cross sectional, descriptive and quantitative study, conducted in Centro Hospitalar de S. João EPE on days 9,10 and 11 January 2013. Data collection was performed by the investigator and collaborators, The study population consists of all patients admitted to a central hospital in the city's Oporto, on days 9, 10 and 11 January 2013, except for the ER and Outpatient, totaling 1029 patients

Results

In the data collection period the hospital had 1105 beds, 1029 were occupied, resulting in a occupancy rate of 93.1%. From the 1029 inpatients in CHSJ, 342 had wounds, a prevalence rate of 33.2%, 140 patients had more than one wound and on average there was 1.85 injuries per patient. Form this wounds, the prevalence of PU was 20.3% (N=69). The classification of the pressure ulcers were assessed, and showing that 31,2% were category 1, and 26,6% category 4. The location of the PU were the coccix (56,3%) and the calcaneous.

Discussion

The prevalence rate is within the range found in literature. A disturbing fact is that most of the PU originates in the hospital, which may reflect the need of the institution to invest in prevention.

Clinical relevance

Institutional best practice policies for the prevention of PU associated with hospitalization should be encouraged. At a time when so much is said in preventing iatrogenic internment will not be also the pressure ulcer a iatrogenic disorder?

Acknowledgements

We appreciate the help of Nurses Arminda Costeira e Anabela Gomes

Conflict of Interest

None

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Increasing quality decreasing Incidence of PU in a ICU

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Introduction: Research in the area of the wounds has been growing, we have found that many professionals have investigated this issue that becomes increasingly prevalent (ALVES, P., 2012). In a hospital setting, 70% of chronic wounds, occur during the first weeks of hospitalization, and its prevalence reaches 45% in chronically ill and about 9% in the remaining patients (Delaunois et al., 1991). Studies in several countries, reported rates of incidence of 26.83% to 62.5% (SERPA et al, 2011) that are significantly higher than in Portugal with prevalence rates of pressure ulcers (PU) 16.6% at UCI.

Overall Objective: To determine the prevalence, incidence and risk of developing pressure ulcers, patients admitted to the PICU during the period 31 October 2012 to 31 October 2013
Specific objectives: Identify the prevalence and incidence of pressure ulcers in hospitalized patients in the P-ICU; Characterize the types of pressure ulcers (PU) in hospitalized patients in the P-ICU; Stratify the risk of PU development through the records of the Braden Scale;

Methods: Epidemiological study, retrospective focusing on the population of patients admitted to the ICU from 31 October 2012 to 31 October 2013. Data were obtained from the B-ICU program, which is in force for implementing patient records, getting registered all information concerning patients from admission to discharge. The data were further processed in SPSS and program analysis performed and the relationship between variables

Results

In the period from 31 October 2012 to 31 October 2013, were admited 509 patients of whom 89 had a PU, a prevalence of 17.5 %. The incidence of new UP occurred in 38 patients (7,5%). The average risk rating assigned by Braden was 11 points - high risk of developing pressure ulcers. The patients who developed PU, the average age of was 68 years and mode of 76 years. The youngest patient was 20 and the oldest 87. Related to the classification of PU found that the largest percentage (25 %) of the ulcers were category 4 . Also found that the ulcers Category 1 (16 %) were less frequent in the studied period . Were also identified UP mucosal representing 3 % and unclassified lesions that represent 10 % of PU. The average time for a patient develop a PU during the study period was 180 hours or 7.5 days, calculated by the introduction of diagnostic and / or attitude of nursing .

Conclusion

The values of incidence and prevalence are lower than in other European countries, however, is a worrying problem in intensive care units, as well as the increase in costs of hospitalization, prolongs it, and causes more suffering for the patients and family. It is one indicator of the quality of nursing care provided, it is necessary to explore the predisposing factors and proposals for prevention interventions.
Were some doubts about the consistency of ratings related to nutrition, where it proposes to introduce a range of nutritional screening.
As for records with different ratings in semantic terms is essential to assign a category when assigning a diagnosis of pressure ulcers. It is important to standardize the terminology records and internalization on the categorization of most current pressure ulcers..

Clinical relevance: This study's show the dimension of the problem and a way to justify the investment in prevention

Acknowledgements
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Conflict of Interest None

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Choose the "spaceship" for succeed with your goal!

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Introduction

One of the infectious ward at Karolinska University hospital has 22 beds. On this ward patients' with severe infections and skin disease are treated. The hospital stay is ~ 3-4 days for the patients with infectious diseases and ~ 7 days for the patients with skin diseases. When the patient needs hospital care they often needed ICU[1] care. After ICU episode the patient still is very ill and this can complicate the care, since the patient need a lot of monitoring and nursing care.

It is important to prevent pressure ulcers for patient safety. The human body is built for movement and one crucial factor for the prevention is pressure relief for patient who are bedridden and immobile [1] [2]. Science show that even low pressure on the same area under a long period of time can lead to tissue damage [3].

Methods

To investigate the effect of an active pressure ulcer redistribution mattress combined with a automatically lateral therapy bed for prevention and treatment of pressure ulcers. The frequency of the mattress cells movement cycle is 7.5 minutes. The cells "moving" from the foot to the head of the mattress. The bed has weight function and can be put in a lateral position to relieve pressure from vulnerable areas.

Results

Case 1 Man age 73, healthy and very long. At admission to the hospital (1 of December) he was septic and treated at ICU for over one month. During the ICU care period he got "clostridium difficile" and had severe IAD[2] problem. When arriving to the ward he had 15 at score of MNS[3] and he was very ill and affected of the infection. He was replaced on a standard foam mattress. After a few days the nurses found a pressure ulcer in the sacrum and he was put on the special mattress and bed. He recovered after ~ 60 days. He used the "Multicare" bed to discharge (3 of March). The MNS score was 22 at discharge. He needs hospital care some times after this episode and he asked especially after the bed because he felt the bed very comfortable and safe.

Case 2 Woman age 73, she had a severe skin disease. Her skin condition was very painful. At the admission (23 of March) she need care at ICU and got pressure ulcer during this care period. The ICU nurses categories the pressure ulcer to category 3 and the size was 2.8 cm placed between the buttocks. She has also a severe IAD problem. Risk assessment score was 17 and she got the "Multicare" bed at the ward. She felt the bed comfortable, and the mobilization from the bed was smooth. At discharge the 17 of April she had MNS score of 22 and free from pressure ulcer and IAD.

Discussion and clinical relevance

From the staffs point of view it is very important to have medical devices that help the staff with the nursing care. This "Multicare" bed is big, much bigger than a normal ward bed. It is very technical and at first sight staff describe the bed "like a big spaceship", with many buttons and many functions on the panel to keep in mind. After training and started using the "Multicare" bed they appreciated the bed's functionality even if it still looked like a "big spaceship". From the staff point of view this is important:
1. Easy to weight the patient - and stores the weight scores in bed memory.
2. The bed's lateral tilt can facilitate moving and mobilization of a patient. This reduces the physical strains and increases safety for the patient and the staff.
3. It is easier to making the bed, do daily hygiene and other nursing care tasks - collaboration with several people is not necessary, time consuming.
4. It is also important that all kind of care is conducted in an ethical and dignified manner for the patient.
5. And the comfort and patient safety is important.

Acknowledgements

We appreciate and thank Linet Sweden, for the opportunity to continue testing this "Multicare" bed.

Interest of conflict - non

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[1]ICU= Intensive care unit
[2]IAD = Incontinent associated dermatitis
[3]MNS is a modified version of Norton scale for risk assessment. Maximal score is 28 p, and from ≤20 and lower indicate pressure ulcer risk.

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Problematic Stage IV Pressure Ulcers on Heels closed with Polymeric Membrane Dressings

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Introduction

Heel pressure ulcers on extremely disabled patients tend to have marginal circulation and often become infected. Even with good compliance, which is rare, many heel pressure ulcers never close. This study highlights three patients who would not appropriately offload their heels: a 58-year-old man with severe Parkinson's, a combative 80-year-old man with Alzheimer's and a severely contracted 60 year old woman with Alzheimer's, all with 3-6 month old stage IV heel pressure ulcers acquired during hospitalization.

Methods

It was important for us to use a dressing that could easily be changed by the relatives at home. We chose to evaluate polymeric membrane dressings in regards to ease of use, cleansing and healing.
One patient's wound was sharp debrided. Polymeric membrane dressings moistened with a small amount of saline softened the eschar on the others. On one of the ulcers a silver version of the polymeric membrane dressings was used together with a charcoal dressing due to the odour. After initial debridement the polymeric membrane dressings were placed directly on each wound and replaced daily without rinsing or any other intervention. Later, dressing changes were performed every other day.

Results

The patient with Parkinson's did not tolerate a low air-loss bed. He would not wear heel protectors, perhaps due to the heat (no air conditioning). His previous dressings stuck painfully to his wound bed, but the polymeric membrane dressings were non-adherent and promoted steady wound healing. The 80 year old man with Alzheimer's was extremely aggressive when he became impatient, banging his heels on the bedrail. Dressing changes were quick, atraumatic and easy to perform, so his wife was able to do them without irritating him, allowing community nursing visits to decrease from daily to weekly. The 60 year old lady with Alzheimer's showed an improvement already after 2 days, after 2 weeks she no longer needed the silver version of the dressing. Her large cavity closed after 3,5 months. Both the other ulcers closed within nine months.

Discussion

The patient with Parkinson's did not tolerate a low air-loss bed. He would not wear heel protectors, perhaps due to the heat (no air conditioning). His previous dressings stuck painfully to his wound bed, but the polymeric membrane dressings were non-adherent and promoted steady wound healing. The 80 year old man with Alzheimer's was extremely aggressive when he became impatient, banging his heels on the bedrail. Dressing changes were quick, atraumatic and easy to perform, so his wife was able to do them without irritating him, allowing community nursing visits to decrease from daily to weekly. The 60 year old lady with Alzheimer's showed an improvement already after 2 days, after 2 weeks she no longer needed the silver version of the dressing. Her large cavity closed after 3,5 months. Both the other ulcers closed within nine months.

Clinical relevance

Choosing the correct dressing is extremely important in regards to healing and compliance.

Acknowledgements

We appreciate the help of Ruthie Winblad from Ferris Mfg. Corp who helped with the layout of the poster

Conflict of Interest NONE

P77

STOP ALL Pressure Ulcers:
Success Through Ownership, Prevention, Audit, Learning and Leadership

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Introduction

Pressure ulcers are complex wounds which can affect the skin as well as muscles, tendons and bones. They are painful lesions which threaten life and limb and they are expensive to treat. Whilst it is estimated that within the UK 412,000 people develop pressure damage per annum [1], the size of the problem within the BHSCT was relatively unknown. In addition, we did not have a clear view of contributing factors.

Methods

The Tissue Viability Nurse (TVN) Team worked with the Safety Improvement Team, Risk and Governance and front-line staff to develop additional fields within Datix® (a healthcare risk management, incident and adverse event reporting sorftware). This allowed us to validate, grade and theme reported pressure damage. The TVN team prospectively reviewed all pressure ulcer incidents that occurred from April 2012 until March 2013. This information provided base-line information on the number of pressure ulcers as well as an understanding of the cause. It allowed us to target education and resources in areas of need.

We encouraged teams to take an active part in a UK Safer Patient Network collaborative. This allowed front-line staff to learn from colleagues with expertise in Healthcare Improvement, with particular regard to introducing the SKIN™ Bundle* [2]. Regionally, we worked closely with the Public Health Agency and other Healthcare Trusts, sharing experience and influencing local standards.

We introduced the SKIN™ Bundle into all our acute adult inpatient wards and departments, utilising the concepts of local ownership of data (Safety Cross, Datix, monthly audit information), SKIN™ champions and small cycles of change. All areas received additional education, (SKIN™ workshops, one-one sessions) and resources, e.g. the SKIN™ Chart and the 'Think SKIN™' Poster. Frontline staff were asked to investigate every hospital acquired pressure ulcer (grade 2 and above) using a standardized short root cause analysis form. Learning was shared to reduce the likelihood of a similar problem arising.

*SKIN™ is an acronym for the basic themes underpinning pressure ulcer prevention: Skin checks and support surface, keep moving (repositioning), Incontinence/ Increased moisture management, Nutrition & hydration.

Results

Within the BHSCT, the reduction of Hospital acquired Pressure Ulcers is a primary driver for safety and quality. Every Trust acquired pressure ulcer (grade 2 and above) is investigated and learning shared. The reporting of Grade 2 pressure ulcers (superficial) has increased (in keeping with better vigilance, and understanding), however, the incidence of severe pressure damage has decreased (See Figure 1).

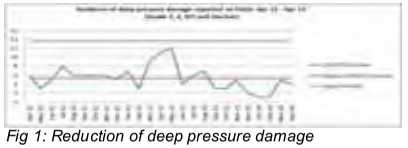

Fig 1: Reduction of deep pressure damage

Discussion

Practitioners are creating novel solutions to meet the needs of the patients and staff within their own departments. These include:

- An Alert Poster – This reminds staff that the patient is on the SKIN™ Bundle.
- Incorporation of the SKIN™ bundle into the major theatre care pathway
- Ward based Pressure Ulcer Groups, which have been pivotal in exploring issues through team supervision, newsletters, providing one-one feedback on problems noted and introducing novel solutions to device related ulcers.

Clinical relevance

The local ownership of data, along with 'high challenge and high support' will reduce the incidence of deep pressure damage. It will also help practitioners to understand local problems and create local solutions.

Acknowledgements

Thank you to all staff within the BHSCT who have embraced our campaign to STOP ALL avoidable pressure damage.

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Conflict of Interest: None

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SKIN Champions for Kids

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Introduction

Cerebral palsy (CP) is the commonest cause of physical disability in childhood. Children with CP may have problems with mobility resulting in contractures, poor nutrition, incontinence and are frequently reliant on orthotic appliances and wheelchairs. These are all risk factors for pressure ulcer development yet there is under-recognition of risk in this population. There appears to be lack of awareness amongst carers of relevant risk factors or the preventative measures that should be taken. Over the past four years in the UK there has been widespread adoption of the SKIN™ bundle developed at St Vincent's Medical Centre in Florida [1]. It has been fully implemented for adults in our organisation. The regional children's neurodisability team recognised there was an opportunity to pilot a children's version of the SKIN™ Bundle in a high risk group of children attending the tertiary service as outpatients.

The aim of the project was to ensure all at risk children had a SKIN™ assessment completed. The secondary aim was to provide appropriate education to carers.

Methods

The core team comprised a clinical nurse specialist, lead consultant, occupational therapist and physiotherapist. The project was developed in conjunction with the BHSCT Tissue Viability Nurse Specialists. The project commenced in January 2014 using improvement methodolgy including 3 PDSA cycles of the existing SKIN™ bundle templates. Implementation commenced in March 2014. A baseline carer questionnaire was undertaken to obtain information on current knowledge of risk factors for pressure damage in children.

Process Change:
S: Surfaces K: Keep moving I: Increased moisture/incontinence management N: Nutrition and hydration

All patients had the SKIN™ bundle assessment undertaken on admission. Carers were provided with verbal and written information on risk factors, prevention and treatment.

Process measure: all children with risk identified should be given information on prevention or referred on for treatment.

Balancing measures: increased reporting of pressure ulcers on DATIX® and nursing time taken to complete the bundle to be < 10 mins per patient.

Results

Pre-Assessment Carer questionnaire: 70% had never received any formal advice on caring for their child's skin. 50% of this group's children had experienced skin breakdown. Carers had poor knowledge of risk factors.

Completion of SKIN bundle

Two PDSA cycles were undertaken to develop an appropriate form.

Completion of the form fell to below 60 % owing to lack of awareness of the new process when a new staff member was working with the team.

A steady improvement occurred over the next two weeks.

A total of 14 children presented with active skin breakdown requiring outpatient treatment and advice from clinic staff. There was no reported increase in reporting to BHSCT Datix® system.

All assessments were completed in less than ten minutes.

Discussion

Carers are not well trained in the risk factors for skin breakdown in children with neurological disability. A simple information leaflet appears appropriate for raising awareness. The SKIN bundle was a quick and effective tool for use in the outpatient setting.

Clinical relevance

- A new process requires training and education of the team and updates if things change
- A bundle should be easy to administer with clear actions
- Skin breakdown in children with neurological disability is under recognised and under treated
- Carers can be empowered to act as skin champions using verbal and written information explaining risk factors and prevention techniques

Parental comments 'I will be more vigilant…reminded me what to look out for' and 'I will be more aware of moisture build up….and watch out for friction……I would know what to do…'

Acknowledgements

.

Conflict of Interest: None

References

[1] Gibbons, W. et al, Journal of Quality and Patient Safety. 32 (9):488-496

AUTHOR INDEX

GENERAL INFORMATION

Venue:Aula Magna
Aula Magna Stockholm University
Frescativägen 6
SE - 106 91 Stockholm
Sweden

EPUAP 2014 Conference Secretariat
Tel: +420 731 555 750
office@epuap.org

CONFERENCE HOURS

Tuesday 26 August

16:00 – 18:00	Pre-registration at conference venue

It is possible to upload oral presentations. More information will be available at the registration desk.

Wednesday 27 August

07:30 – 17:30	Registration
09:30 – 10:15	Opening ceremony
09:30 – 17:00	Scientific sessions
09:00 – 17:30	Commercial exhibition
17:00 – 17:30	Official opening of the exhibition (in the exhibition area)
19:00 – 20:30	Welcome reception at the Stockholm City Hall, Nobel Prize Hall

Thursday 28 August

07:30 – 17:15	Registration
08:00 – 17:15	Scientific sessions
08:30 – 17:10	Commercial exhibition
19:30 – 23:00	Conference dinner at Solliden Restaurant, Skansen

Friday 29 August

08:00 – 12:00	Registration
09:00 – 14:15	Scientific sessions
09:00 – 13:00	Commercial exhibition

TAXI

Taxi fares in Sweden are not regulated, which means that prices can vary significantly between companies. We recommend to use the following taxi companies: Taxi Stockholm (+46 8 15 00 00), Taxi 020 (+46 8 15 00 00) and Taxi Kurir (+46 8 30 00 00)

CERTIFICATES OF ATTENDANCE

All participants will received their certificate of attendance by email after the conference.

CME - CONTINUED MEDICAL EDUCATION

The 17th EPUAP Annual Meeting has been accredited by the European Accreditation Council for Continuing Medical Education (EACCME). The 17th Annual Meeting of the European Pressure Ulcer Advisory Panel is designated for a maximum of, or up to 14 European CME credits (ECMEC).

In order to obtain the CME credits, your attendance must be verified for each of the days that you wish to obtain the credits. In order to verify the attendance please go to the registration desk every day after 15 pm Wednesday and Thursday and after 10 pm on Friday. A certificate with your CME credits will be issued after the conference and it will be sent to you by email.

ENTITLEMENTS

Full conference registration:

- Final programme and abstract book
- Admission to the full conference programme, coffee breaks & buffet lunch
- Welcome reception on 27 August at Stockholm City Hall, Nobel Prize Hall

1-day registration:

- Admission to all sessions and symposia of the day, coffee break & buffet lunch.

CLOAKROOM

The cloakroom is located on the ground floor, near the entrance to the venue cafeteria. Please follow the signs. The cloakroom is unattended.

LUNCH AND COFFEE BREAKS

Lunch and coffee breaks will be served in the exhibition area and catering stations are located both on the ground floor and the gallery floor.

INFORMATION FOR SPEAKERS

Please bring your presentation to the technician in the meeting room at least 2 hours before your presentation. The technician will transfer the presentation into the conference server and make sure your presentation runs smoothly. We do not allow the use of personal laptops for presentations. Please bring your presentation on a memory stick. At the end of the conference, all presentations will be deleted so no copyright issues will arise.

Presentations taking place on 27 August in the morning can also be submitted on 26 August between 16:00 – 18:00 at the Aula Magna. Please ask the personnel at the registration desk.

MEETING ROOMS

Main Auditorium Left Side is located on the ground floor. The key lectures and free paper presentations will take place here.

Main Auditorium Right Side is located on the ground floor. The industry symposia and workshops, as well as free paper presentations will be held here.

The entrance to the main auditorium left side and right side is possible from both ground floor and gallery floor.

Bergsmannen is located above the Auditorium, on the 7th level. Free paper presentations and workshops will be held here.

Spelbomskan is located above the Auditorium, on the 7th level. Free paper presentations and workshops will be held here.

Kungstenen – Speakers' Room is located above the Auditorium on the 7th level.

EXHIBITION

The most imporatant companies in the field of pressure ulcer and wound management will present the latest products and developments in this field.

The exhibition is open during the conference programme. You can visit the exhibition during coffee and lunch breaks which will be served in the exhibition area. You can collect stamps from each exhibitor and win a free registration to the EPUAP 2015 Annual Meeting in Ghent, Belgium. Ask at the registration desk for the exhibition prize form.

The exhibition is located on the ground floor as well as on the gallery floor.

LANGUAGE

English

INTERNET AND WIFI

Free WiFi is available all through the venue. Access to WiFi will be possible based on it-access cards to be picked up at the registration desk.

POSTER AREA

The poster area is located on the Mezzanine Floor. Please follow the signage or ask the personnel at the registration desk for more information.

The posters should be set up on 27 August from 07:00 – 09:00. Equipment for setting up the posters will be provided at the registration desk upon request. Assistance will be available in the poster area during the time period mentioned above. There will be no formal presentations of paper posters. The conference secretariat takes no responsibility for damaged or left posters.

EPUAP INVESTIGATOR AWARDS 2014

The EPUAP Experienced and Novice Investigator Awards will be awarded by the President of EPUAP at the conference dinner held on 28 August at Solliden Restaurant.

BEST POSTER AND BEST ORAL PRESENTATION will be awarded by a panel of judges. The results will be announced after the conference and the award consists of a free hard copy of the updated guidelines for the prevention and treatment of pressure ulcer.

ABOUT STOCKHOLM

Stockholm, also known as the, Venice of the North', is strategically located on 14 islands on the coast in the south-east of Sweden. The city's oldest section is Gamla Stan (Old Town), located on the original small islands of the city's earliest settlements and still featuring the medieval street layout. Metro station in the old city is Gamla Stan (red and green line).

Stockholm is a compact yet cosmopolitan city with excellent flight connections and an efficient public transportation system. There are many reasons why Stockholm is the natural Capital of Scandinavia. One is that Stockholm is positioned at the heart of the region, and enjoys the benefits of a world-class transport infrastructure. Another is that Stockholm is the largest city in the largest country in Scandinavia. It is also where you find the most multinational companies, the largest stock market and, not least, the most visitors. People come to Stockholm for the food, the design and the music. Stockholm also offers a unique range of galleries and museums, and every year the eyes of the world are on Stockholm when the Nobel Prizes are awarded. Welcome to Stockholm – The Capital of Scandinavia.

SOCIAL EVENTS

WELCOME RECEPTION

The welcome reception is hosted by **Stockholm City Hall in the Nobel Prize Hall** and it is included in the registration fee. **Entrance is by invitation only. You will receive your invitation when you register to the conference.** It is necessary to confirm participation in advance.

The City Hall was designed by architect Ragnar Östberg in 1923. The building is beautifully situated on the waterfront in central Stockholm. It is mostly famous for the Nobel Prize festivities every year on 10 December.

Date: 27 August 2014
Time: 19.00 - 20.30

Stockholms stad

Conference Dinner

at Solliden Restaurant, Skansen

The Solliden Restaurant is located 10 minutes away from the city centre and offers a unique panoramic view of Stockholm. Skansen is known for its wild animals, culture and out-door exhibitions of Swedish cultural heritage.

Transportation to the conference dinner:
There will be free transportation to / from the conference dinner for all dinner guests. Meeting point: Mornington Hotel, Nybrogatan 53, Östermalm.
Pick up time: 19:00

Coaches will depart from the conference dinner between 22:30 and 23:30 and will take the guests to the city centre and to Mornington Hotel.

Date: 28 August 2014
Time: 19.30 - 23.00
Place: Solliden, Skansen
Price: € 100, limited number of seats

Live music & dance – Blåslaget will perform the best songs of ABBA.
Please don't forget to bring the dinner ticket.

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INDUSTRY SATELLITE
SYMPOSIA AND WORKSHOPS

Wednesday
27 August 2014

13:15 - 14:15 | Main Auditorium / right half

LINET WORKSHOP

Title:

Pressure Ulcer Prevention - Changing Techniques

Speaker: *Lorraine Demott* - Clinical Specialist (Moving and Handling)

15.30 - 17.00 | Main Auditorium / right half

NUTRICIA SATELLITE SYMPOSIUM

Title:

Pressure ulcer care without attention to nutrition is incomplete pressure ulcer care

Chair: *Prof Jos Schols* | **Speakers:** *Dr Emanuele Cereda, Dr Pearl Gumbs*

Thursday
28 August 2014

08.30 - 09.30 | Main Auditorium / right half

MÖLNLYCKE SATELLITE SYMPOSIUM

Title:

The impact of evidence on clinical practice: Protecting your patients

Chair: *Dr. Joyce Black* | **Speakers:** *Prof. Nick Santamaria, Dr. Peggy Kalowes, Prof. Amit Gefen*

09:30 -10.30 | Workshop room - Bergsmannen

LOHMANN & RAUSCHER WORKSHOP

Title:

Debrisoft - Active debridment

Speaker: *Prof. Christina Lindholm*

10.00 -11.00 | Main Auditorium - right half

ARJOHUNTLEIGH WORKSHOP

Title:

ArjoHuntleigh Interactive Workshop on Active Microclimate Management

Speakers: *Angel Delgado;* Global Clinical Development & Clinical Sciences, ArjoHuntleigh
Greg Olk; Senior Manager, Global Product Marketing, ArjoHuntleigh

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11:00 - 12:30 | Workshop room - Spelbomskan

SCA HYGIENE PRODUCTS AB

Title:

Incontinence and elderly skin – Aspects of Pressure Ulcers and Incontinence Associated Dermatitis

Speakers: *Sari Torniainen;* Commercial Training Manager, *Dr Shabira Abbas;* Senior Scientist,
Dr Maria Sköld; Associate Scientist

14.15 - 15.45 | Main Auditorium - right half

3M SATELLITE SYMPOSIUM

Title:

Pressure ulcers and Incontinence - Associated Dermatitis: the journey from the lab to the patient

Chair: *Prof. Dimitri Beeckman* | **Speakers:** *Prof. Amit Gefen, Dr. Jan Kottner, Mrs. Knibbe H. Msc*

16.00 - 17.00 | Workshop room - Bergsmannen

COMPLIANT CONCEPT WORKSHOP

Title:

Mobility Monitor – a versatile assistant for pressure ulcer prevention that measures your patient's mobility & supports your repositioning management"

Speaker: *Michael Sauter*

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journal of wound care

SPECIAL EPUAP SUBSCRIPTION OFFER – VISIT STAND 6B

Journal of Wound Care (JWC) is the leading source of tissue viability research and information. **JWC is essential reading for all specialists** who wish to enhance their practice and stay ahead of developments in wound management and tissue viability.

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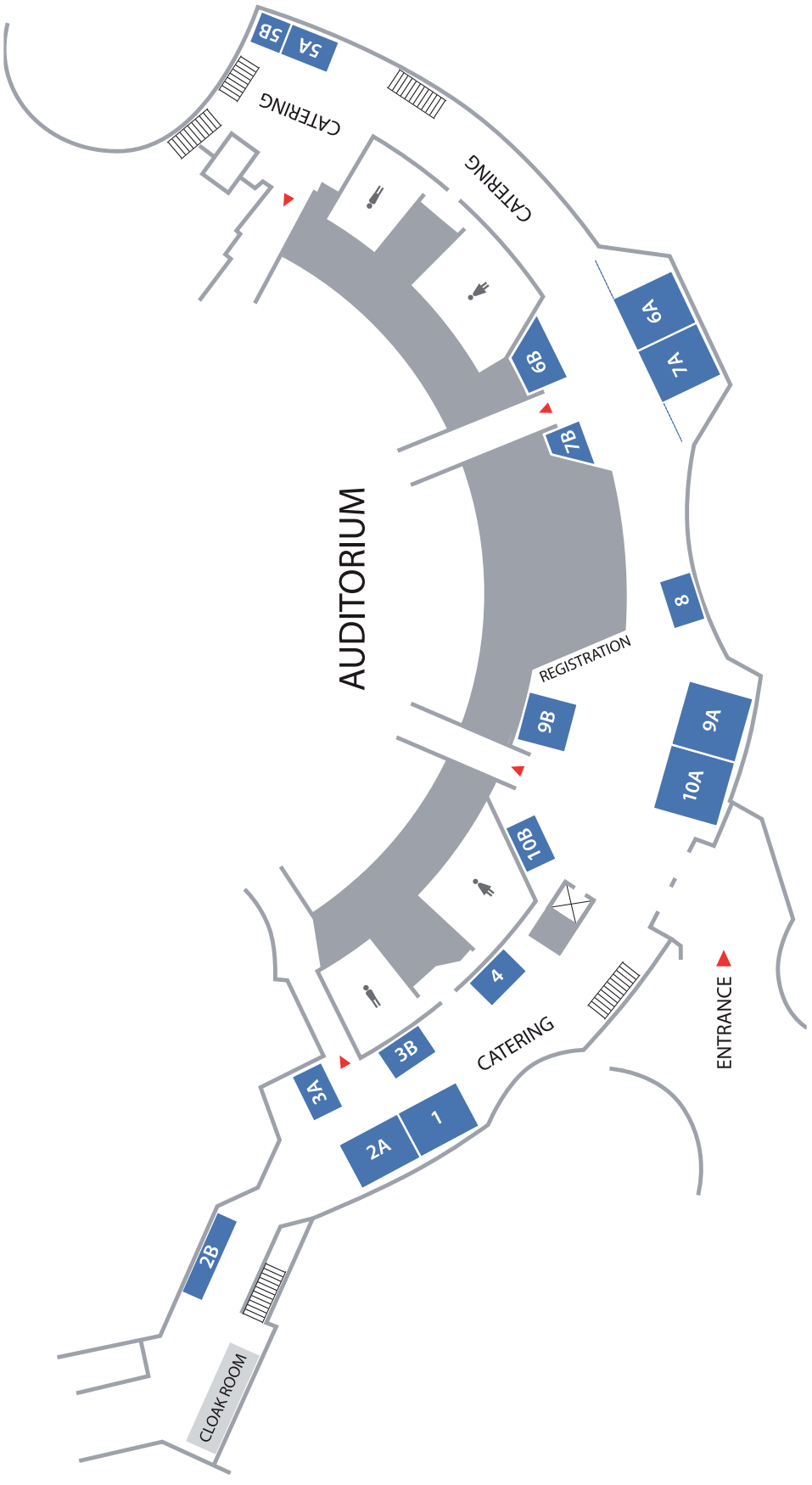

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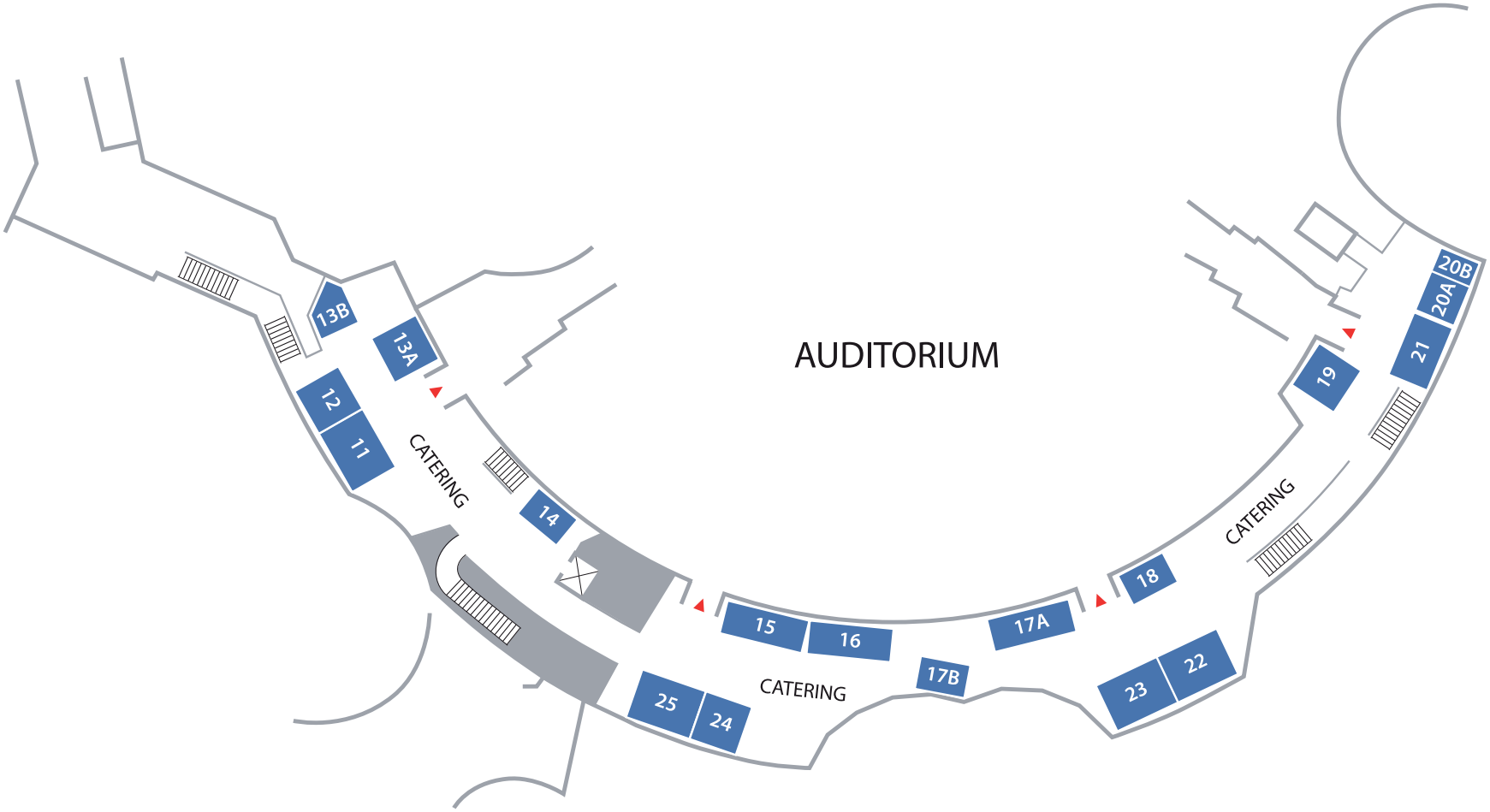
Carital Oy	**3A**	**Lohmann&Rauscher**	**1**	**Seatting Matters Ltd**	**2B**
Crawford	**4**	**Nutricia**	**9B**	**Stryker**	**2A**
Hill Rom	**7A**	**OneMed**	**5A**	**Vitri Medical AB**	**8**
Joerns	**9B**	**RikSar**	**5B**	**WUWHS**	**3B**
JWC	**6B**	**Sage Products**	**6A**		



GALLERY LEVEL

3M	15
Abigo	17A
ArjoHuntleigh	22&24
Bbraun	20A
BSN Medical	19
Care of Sweden	25
compliant concept	18
Convatec	14
ETAC	12
EWMA	17B
Invacare	13A
Jarven	21
Molnlycke	11
Polymem	16
Smith & Nephew	24
TVS	20B

EPUAP 2015

Putting the pressure in the heart of Europe

18th Annual Meeting of the European Pressure Ulcer Advisory Panel

16-18th September 2015 · Ghent · Belgium

Dates and information

Conference dates
16 – 18 September 2015

Venue site
Culture and Conference Center
Het Pand

EPUAP Industry Session
January 2015 (Ghent)

Abstract submission deadline
30 April 2015

Early registration deadline
15 June 2015

Programme

The main topics of the conference programme will be:

- the societal impact of pressure ulcers;
- health economics;
- how to put pressure ulcers more on the international agenda for healthcare;
- pressure ulcers and quality indicators;
- developing and evaluating local and national quality improvement projects;
- international collaboration in practice, research and education.

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