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OCTOBER 21– 23, 2021
NATIONAL CONFERENCE

When a Wound Swab Makes All the Difference: A Case of *Shewanella putrefaciens* Necrotizing Wound Infection Following Saltwater Exposure

Lauren Wolfe RN, MClSc-WH, NSWOC, CWOCN, Clayton MacDonald MUDr, FRCPC, D(ABMM), Brian Ellis PhD, Jan Hajek MD, FRCPC

Ask questions! Swab judiciously! Carefully adjust antibiotics and topical wound management according to the clinical context.

Statement of Clinical Problem

The interpretation of bacterial cultures from a superficial wound swab is often difficult and superficial cultures from a chronic wound are often misleading. We present a case highlighting the role of wound cultures in a patient with a non-resolving wound infection following salt water exposure.

Case Presentation - Background

76-year-old man with a history of venous stasis and remote left ankle fracture; very active (hiking, cycling, paddling).

Mid-August 2020, scraped his left calf against a log; a superficial abrasion. Over the next few days, his activities included saltwater exposure.

He developed tenderness, erythema, and the wound failed to heal in the following two weeks. He was prescribed a topical antibiotic.

Despite topical therapy, his condition worsened. He returned to hospital and was diagnosed with cellulitis and probable wound infection. He was treated with cefazolin and cephalexin to target *Streptococcus* and *Staphylococcus* (MSSA), the most common causes of skin and soft tissue infections. There was some improvement, but the inflammatory changes persisted, and small ulceration at the initial injury failed to heal.

A wound swab isolated Pseudomonas species, but it was interpreted as a probable colonizer of the wound.

Late-September 2020 developed a relatively acute worsening of his left lower leg with the development of a hemorrhagic bulla (large blister). He returned to hospital, feeling unwell with severe pain. An aspirate of the bulla was sent for culture; he started ciprofloxacin plus ceftriaxone and was admitted for further management.

C&S swab results

August 31: Wound Swab: Gram stain = No WBC, 4+ GNB, 4+ GPC
- Culture = Heavy growth Coliforms; Moderate growth Normal skin flora

September 23: Wound Swab: Gram stain = 2+ WBC, No bacteria seen
- Culture = Light growth *Pseudomonas species*

September 27: Aspirate of Blister/Abscess: Gram stain = 4+ WBC, No bacteria seen
- Culture = ***Shewanella putrefaciens***
  - Resistant to cefazolin and cephalexin
  - Sensitive to ceftriaxone, ciprofloxacin, and TMP/SMX

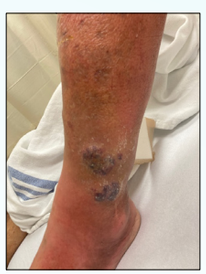
September 27: Blood cultures = negative

Acknowledgement

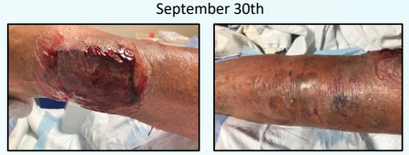
We would like to thank our microbiologist Dr. Clayton Macdonald for his assistance with this patient's care and poster presentation

Healing trajectory and dressing selection

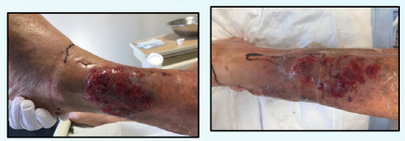
September 27th



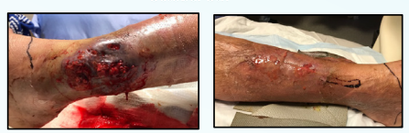
September 30th



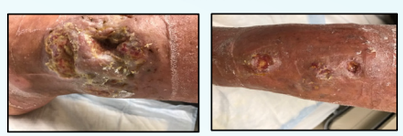
October 2nd



October 5th



October 20th



Hospital management

He was hospitalized for 10 days.

Antibiotics: ceftriaxone and ciprofloxacin in hospital.

Multidisciplinary Care:
Internal medicine, Infectious diseases, Plastic surgery and Wound Care Clinician

Wound Assessment:
He underwent bedside debridement.
Severe pain was managed with hydromorphone and sublingual sufentanil

Assessments with each dressing change due to ever changing wound bed.
Exudate: Copious seropurulent/serosanguinous.
Signs of infection: Erythema, exudate, induration, pain

Dressings were based upon the wound assessment.
- Antimicrobial transfer dressing and a highly absorbent outer wicking cover layer

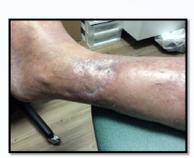
Following debridement and two weeks of antibiotics, there was a reduction in pain, and compression therapy was introduced in the community.

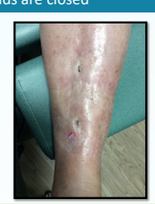
Community management

- Localized signs of infection and venous insufficiency
  - Gentian violet and methylene blue dressing with light compression 20-30mmHg
- Delayed wound healing and continued necrotic tissue
  - A biofilm disrupter
  - Compression wrap, 30-40mmHg compression

On wound closure, he was measured for compression stockings to allow for continued wound healing.

December 30th Wounds are closed





Discussion

Shewanella are environmental bacteria found in fish and marine waters (>15°C). Two species are associated with human infection *S. putrefaciens* and *S. algae*.

Shewanella bacteria are very similar to *Pseudomonas* and without definitive species identification may be misreported as *Pseudomonas* species.

Shewanella are intrinsically resistant to 1st and 2nd generation cephalosporins and typically treated with 3rd generation cephalosporin, carbapenem, TMP-SMX, or quinolone.

Infections due to *S. putrefaciens* are rare, but skin and soft tissue infections (SSTIs) following saltwater exposure have been well described. *S. putrefaciens* has been isolated in clinical samples at our health region serving a population of 1.5 million people only 25 times in the last 15 years.

Conclusion

Skin and soft tissue infections related to water exposure often can be complicated by organisms unique to these environments. It is important to recognize that while gram negative bacteria can often be colonizers of chronic wounds the clinical context needs to be carefully considered.

Although *Pseudomonas aeruginosa* and other gram-negative bacteria are usually representative of colonizing flora in immunocompetent persons with non-healing wounds, the presence of *Shewanella putrefaciens*, like *Vibrio vulnificans*, is a red flag and typically pathogenic. Earlier recognition of *Shewanella putrefaciens*, bacteria associated with wound infections particularly in persons with prior fish or trauma and water exposure, can help guide appropriate antibiotic therapy

Treatment involves both targeted antibiotic treatment, debridement of necrotic tissue, and management of complicating risk factors – which in our patients' case was venous stasis and decreased calf muscle pump due to a previous ankle fracture.

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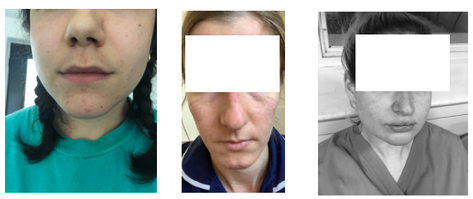
Impact of personal protective equipment use on Canadian Healthcare Professionals

Kimberly LeBlanc PhD RN NSWOC WOCC (C), FCAN; Kevin Y. Woo, PhD RN NSWOC WOCC (C); Dr. Lorne Wiesenfeld MD, FRCP(C); Julia Bresnai-Harris BScN, RN, NSWOC, TVN; Corey Heerschap MScCH(WPC), BScN, RN, NSWOC, WOCC(C), PhD (student); Britney Butt BScN, RN, MClSc-WH, NSWOC, WOCC(C); Valérie Chaplain MScN, RN, NSWOC, WOCC(C); Samantha Wiesenfeld (Student Nurse)

Introduction

Since the onset of the COVID-19 pandemic, skin conditions mainly related to the use of personal protective equipment (PPE) and frequent skin cleansing have emerged including pressure injuries, contact dermatitis, itching, and hives related to pressure. The purpose of this cross-sectional study is to explore the frequency and duration of PPE use and to gain a better understanding of the impact prolonged PPE use has on the skin integrity of by Canadian nurses and physicians.



Research questions

To date, this is the first study of its kind in Canada. The primary purpose of the proposed study is to explore the impact of personal protective equipment use on Canadian healthcare professionals

Research Questions

1. What types of PPE related skin injury are Canadian healthcare professionals experiencing?

What is the prevalence of PPE related skin injuries among Canadian healthcare professionals?

Research design

- Cross-sectional survey design.
- Anonymous, self-administered via a survey web link
- Pre-determined samples size = 384 participants
- Actual sample size= 712
- Ethical approval from the Queen's Health Sciences Research Ethics Board

Results

Q9 - What if any of the following issues have you experienced related to use of a mask or face protector/shield or head cover (surgical cap)? select all that apply

Answer		%	Count
A.	Acne (new or worsening)	11.33%	395
B.	Itch (face, eyelids, lips)	8.58%	299
C.	Dry skin	8.01%	279
D.	Redness	7.83%	273
E.	Sore Skin	6.77%	236
F.	Rash	4.59%	160
G.	Increased pore size	4.53%	158
H.	Pressure injuries	2.07%	72
R.	Runny nose, sneezing	9.87%	344
S.	Problem with breathing, shortness of breath, tightness of chest	4.19%	146
T.	Moisture Associated Skin Damage	1.41%	49
U.	Soreness behind the ears	13.06%	455
V.	Panic attack	0.89%	31
W.	Feeling claustrophobic when wearing face cover PPE	3.76%	131

Q13 - What if any of the following skin integrity issues have you experienced related to use of gloves? select all that apply

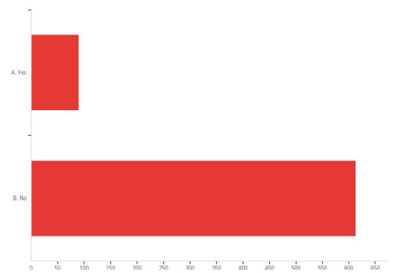
Answer		%	Count
A.	Dry skin	24.75%	404
B.	Redness	13.73%	224
C.	Dry skin	12.99%	212
D.	Itch	12.25%	200
E.	Broken Skin	9.50%	155
F.	Rash	7.23%	118
G.	Dermatitis	5.09%	83
H.	Broken Skin	3.31%	54
I.	Bleeding	2.57%	42

Q17 - What if any of the following skin integrity issues have you experienced related to use of a gown? select all that apply

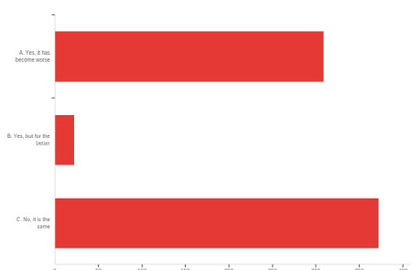
Answer	%	Count
A. Itching	6.15%	42
B. Moisture associated skin damage to abdominal folds, inframammary, axilla, groin	5.56%	38
C. Feeling claustrophobic when wearing PPE Gown	4.54%	31
D. Acne (new or worsening, not located on the face)	3.22%	22
E. Dry skin	2.34%	16
F. Itch	1.90%	13
G. Rash	1.02%	7

Results

Q18 - Have alterations to skin integrity related to the use of PPE impacted your ability to work?



Q21 - Has your mental well-being changed since wearing face coverings?



Key Points

- 6-11% of participants reported skin issues such as acne, itching, dry skin, redness or sore skin related to wearing a face mask
- 3.76% reported feeling claustrophobic when wearing face cover
- 25% of participants stated that they experience dry skin on the hands related to gloves, however 50% stated that they did not moisturize their hands on a regular basis
- 43.95% of participants reported that their mental well-being became worst since wearing facial coverings

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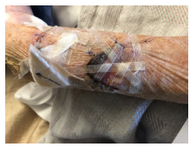
A randomized controlled pragmatic study to evaluate the use of silicone dressings for the treatment of skin tears

Kimberly LeBlanc PhD RN NSWOC WOCC (C); Kevin Y. Woo, PhD RN NSWOC WOCC (C)

Introduction

Maintaining skin integrity is espoused by several international authorities as a benchmark for patient safety and quality of care. One of the most common causes of skin breakdown is skin tears (STs) defined as "wounds caused by shear, friction, and/or blunt force resulting in separation of skin layers" (LeBlanc et al., 2011).



Several prevalence studies conducted in LTC settings indicate evidence of ST among 10-54% of their residents (Everett & Powell, 1998; McErlean, Sandison, Muir, Hutchinson, & Humphreys, 2004; Santamaria, 2009).

Careful selection of dressings with an atraumatic and non-adherent wound contact layer, such as silicone, has been documented to limit skin damage/trauma with dressing removal and to minimize pain at dressing changes (Woo & Smith, 2014). Silicone coatings consist of chains of hydrophobic polymers with alternate molecules of silicone and oxygen. Compared to other adhesives, the silicone coatings produce a lower surface tension combined with a more extensive contact interface.

In a comparative study, Matsumara et al. (2012) evaluated eight commonly used wound care products with adhesives (soft silicon, hydrocolloid, polyurethane, and acrylic adhesives) and their potential effect on the epidermis in 10 normal volunteer subjects. Dressings that incorporated soft silicone technology were less likely to cause skin stripping and removal of stratum corneum than other tested material.

Research questions

To date, this is the first study to evaluate the use of soft silicone dressings to promote healing of skin tears. The primary purpose of the proposed study is to compare the effectiveness of a soft silicone dressings for the healing of skin tears with local best practices that do not include soft silicone dressings.

Research Questions

1.Is there a difference in the proportion of complete healing between soft silicone dressings and non-soft silicone dressings for treatment of skin tears?

2.Is there a difference in healing rates between soft silicone dressings and non-soft silicone dressings for treatment of skin tears?

Research design

•A prospective, pragmatic randomized controlled trial.
•Participants were randomized, using a computer based randomization program, blinded to the researcher.
•Randomization were conducted on the unit level within the participating long-term care facilities.
•Duration: 3-week (complete healing was anticipated with 7 to 21 day period for the majority of skin tears)

Inclusion Criteria	Exclusion Criteria
• Resident of participating LTC facilities • Presence of a skin tear • all types of skin tears • All levels of exudate	• Factors that may compromise wound healing: • medical condition • previous wound treatment • non-compliance • infection

Intervention and comparison

Treatment group:
•Depending on the type of skin tears and potential exudate produced by the wound, an appropriate form of silicone dressing was used.
•Meiptel One dressing will be used for Type 1 and Type 2 skin tears where exudate is expected to be minimal.
•Mepilex® Border Flex will be used for exudative Type 2 and Type 3.

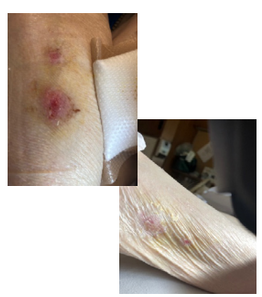
Control group:
•Non-adherent non-silicone dressing
•Alldress

Table 1: ISTPA skin tears classification system

Measurement

Weekly measurement of wound sizes: the longest wound length and wound width dimensions that were perpendicular to each other to provide the estimation of wound surface areas.

Proportionate changes in mean surface area over the 3-week period were calculated to provide healing rates.
•All subjects were evaluated at week 0, week 1 and week 3 (i.e., at the end of the study)
•Photography of the wounds.
•Pain : NRS or Pain Assessment in Advanced Dementia (PAINAD) scale
•Adverse events



Results

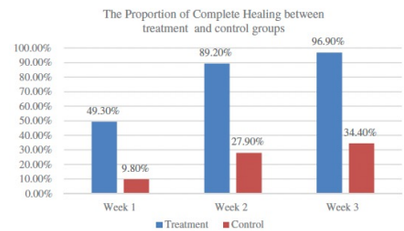
•A nonprobability convenience sampling = 126 individuals
- Male = 56 (44.4%)
- Female = 70 (55.6%)
- Mean age = 82.9 (+/- 8) years; (45-102 yo)

•Setting: long-term care facility and complex continuing care hospital in Ottawa and Toronto

Treatment	Frequency	Percent
Alldress	45	35.7
Mepilex (Flex)	55	43.7
Mepitel 1	17	13.5
Nonadherent (Telfa)	9	7.1
Total	126	100.0

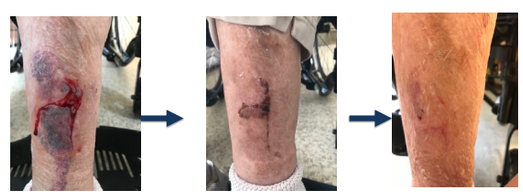
Skin Tear classification	Frequency	Percent
Type 1	16	12.7
Type 2	55	43.7
Type 3	55	43.7
Total	126	100.0

Results and conclusion



Skin Tear Healing Times

			Mean	
			95% Confidence Interval	
Group Assignment	Estimate Days	Std. Error	Lower Bound	Upper Bound
Control	21.73	1.02	19.74	23.72
Treatment	11.06	0.59	9.90	12.22
Overall	16.21	0.75	14.75	17.67



Results of this study suggest silicone dressings are superior to nonadherent dressing for the treatment of skin tears.

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Effectiveness of an educational website for improving undergraduate nursing knowledge about pressure injuries: a quasi-experimental study

Bernardes, R. M. (RN, Ph.D.)[1]; Rabeh, S. A. N. (RN, Ph.D.)[2]; Caliri, M.H.L. (RN, Ph.D.)[2]; Pieper, B. (RN, Ph.D.)[3]; Costa, I.G (RN, NSWOC, Ph.D.)[4]

[1]Professor, Estácio University Center of Ribeirão Preto, Brazil; [2]Professor, School of Nursing of Ribeirão Preto - University of São Paulo, Brazil; [3]Professor, Wayne State University, United State; [4]Assistant Professor, School of Nursing, Lakehead University, Canada

Introduction

- Studies have identified that while nursing students have some knowledge about pressure injuries (PI), they mention erroneous and outdated intervention their daily practice.
- Thus, highlighting the need to promote continue education in order to improve and encourage adherence to updated knowledge, technologies and available and current therapies.(1,2)
- For this situation to be changed, it is essential to use teaching strategies that favor the dissemination and implementation of National and International clinical guidelines for the prevention and management of pressure injuries.(1)

Objectives

- To evaluate the effectiveness of using an Educational Website to improve the knowledge of nursing students related to pressure injuries by comparing the average of pre and post tests and determine the level of satisfaction with the knowledge acquired.

Methodology

- Quasi-experimental study with quantitative analysis.
- A total of 51 4th year students of undergraduate nursing programs from 10 public or private Brazilian universities participated in this study.
- To assess students' knowledge, the Pressure Ulcer Knowledge Test Caliri-Pieper questionnaire was used with 41 questions about pressure injury assessment and classification and 12 questions about pressure injury management from the Pieper-Zulkowski Pressure Ulcer Knowledge Test, both validated in Brazil.(3,4)
- Students' satisfaction were assessed by a questionnaire developed regarding the topics covered.
- The content of the educational website was organized into teaching modules, validated by specialists and offered as an extension course at a distance.
- The students participated in a pre-test and post-test to compare the effectiveness of the tool by means of knowledge and satisfaction averages.
- For comparisons between the averages of knowledge and satisfaction of paired samples, the t-Student test. The level of statistical significance was set at P <.05.

Findings

Figure 1 - Website with educational content: www.eerp.usp.br/feridascronicas/

- Age ranged from 21 to 48 year-old, with a mean of 28.8 years (SD + - 7.8). Regarding gender, 42 (82.3%) were women and 9 (17.7%) were men. Thirty-eight students (74.5%) were from public universities and 13 (25.5%) from private universities.

Table 1 - Average of the percentages of correct answers to the questions in the pre and post-test (n = 51)

	Average percentage of correct answers for the questions		
	Pre-test	Post-test	
Test domain area	Average (SD)	Average (SD)	p*
Evaluation and classification of PI	75.98 (+-12,71)	94.36(+-8.03)	<0,01
PI prevention	75.7 (+-8,67)	95.66(+-7.1)	<0,01
PI management	66.99 (+-11,9)	78.27(+-18.26)	<0,01
Total score on the test	73.77(+-7,57)	91.53(+-8,42)	<0,01

Table 2 - Performance of participants from public and private universities in the pre and post-test of knowledge, according to the test domain areas.

	Public U	Private U	
Domain area of pre-test questions	Average (SD)	Average (SD)	p*
Evaluation and classification of PI	77,30 (+-11,93)	72,12 (+-14,57)	0,263
PI prevention	73,92 (+-8,35)	80,89 (+-7,66)	0,011
PI management	64,91 (+-12,58)	73,08 (+-6,93)	0,006
Domain area of post-test questions			
Evaluation and classification of PI	93,42 (+-8,59)	97,12 (+-5,48)	0,082
PI prevention	95,53 (+-7,41)	96,04 (+-6,35)	0,816
PI management	75,22 (+-18,43)	87,18 (+-15,07)	0,028

Table 3 - Comparison of student satisfaction with knowledge before and after the intervention.

	Before	After	
Student satisfaction	Average (SD)	Average (SD)	p*
All	70,78 (+-29,82)	93,92 (+-20,89)	<0,01
Public Universities	73,55 (+-29,57)	92,11 (+-23,95)	0,001
Private Universities	62,69 (+-30,25)	99,23 (+-2,77)	0,001

Discussion

- The evaluation of nursing students' knowledge about pressure injuries allows educators to implement strategies aimed at improving the specific dimensions on the topic and improving the opportunity to provide care to patients during clinical practice.(2)
- Courses aimed at increasing students' knowledge and confidence about prevention and management of pressure injuries, are extremely necessary for the preparation of future nurses to be able to implement safe and quality care to their patients.(5,6)
- Distance education strategies, in addition to being an innovative and widely accessible form, have their efficiency proved by numerous research. It also has the potential to prepare a large number of individuals on issues related to pressure.(6)
- The measurement of knowledge scores before and after the educational intervention must be considered to determine whether the knowledge deficits are corrected(7) and whether the learning objectives have been achieved.

Conclusions

- The knowledge of nursing students about pressure injuries can be improved with appropriate educational strategies and resources such as online tools.
- Increasing satisfaction can improve motivation and self-confidence. Thus, it is expected that the uptake of knowledge will improve patient safety and quality care, hence decreasing the incidence of pressure ulcer and its poor outcomes (e.g., infection, hospitalization and death).
- This study has the potential to inform curriculum development and clinical practice. By including education strategies that are innovative and meaningful in the nursing program will contribute to better prepare future nurses to implement patient safety and quality of care.

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Partner Institutions:

"It Was Just a tiny hole": Patients' voices and perceptions about health-seeking behaviours at the onset of a diabetic foot ulcer

Costa, I.G (RN, NSWOC, Ph.D.)[1]; Camargo-Plaza, P. (RN, Ph.D.)[2]
Assistant Professor, School of Nursing, Lakehead University1, Canada; Associate Professor, School of Nursing, Queen's University2, Canada

Introduction

- Foot ulceration should be properly treated at its onset to avoid further damage and ulcer deterioration. [1]
- Delay in all stages of the care pathways including at the early stage (onset) of DFU can result in undesired outcomes such as impaired healing, infection, hospitalization, and amputation
- The risks of ulcer deterioration could be minimized by the implementation of preventive measures and earlier referral to a certified wound care specialist. [2]

Aim

- To examine patients' voices and perception of the factors influencing their health-seeking behaviours at the onset of a diabetic foot ulcer

Methodology

- A constructivist grounded theory, informed by Charmaz [3], was used to guide the study design. Theoretical sampling and intensive semi-structured interviews were conducted with 30 individuals with DFU. Data was collected in a wound care clinic in southeastern Ontario, Canada, between April and August of 2017.
- Data analysis was conducted alongside data collection in a cyclic research process (Figure 1).

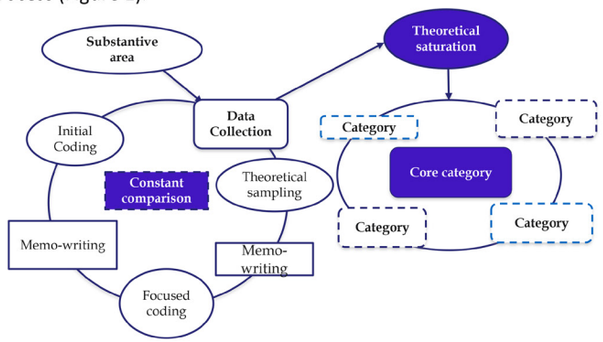

Figure 1 – Diagram representing data collection and analysis

Results and Discussion

- The communality among the 30 participants pointed out to personal and professional factors that led to delay in seeking appropriate help. Through analyzing the data two categories of factors emerged and are listed in Figure 2.

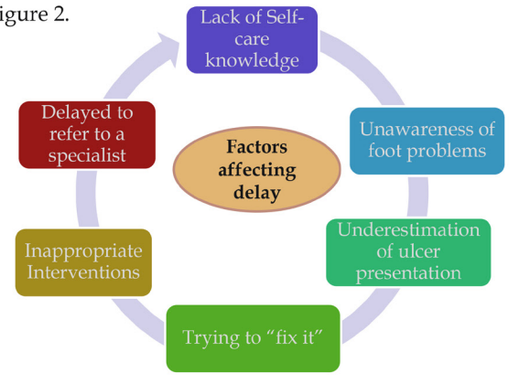

Figure 2 – Theoretical model representing the factors affecting delay in health-seeking behavior

- The findings of this qualitative study revealed the reasons why patients delay to seek help and healthcare professionals delay to refer them to a wound care specialist at the onset of DFU (Table 1).

Factors	Patients' Voices and Perceptions
Associated to the Individuals	- Through my diabetic education, they don't mention ulcers (lack of knowledge) - I thought it was just a cut, 'cause it was very little, but it wouldn't heal. (Unawareness) - It was tiny, tiny little black spot (underestimation) - I put a, uh, one of those little bunion plasters on my little toe (Trying to fix it)
Associated to healthcare providers	- For a long time, they didn't know what it was and tried to treat it with different things (Inappropriate intervention) - After he tried different things, about thee months letter I was referred to this wound care clinic (Delayed to refer to a specialist)

Table 1. Factors affecting health-seeing behavior at the onset of DFU

- The reasons for delay in health-seeking behavior reflect the limited knowledge and unawareness of the patients with diabetes about foot problems and underestimation of foot ulcer presentation leading to inappropriate self-management actions by participants.
- On the other hand, the lack of knowledge from healthcare providers about the initial stage of DFU led to misdiagnosis and inappropriate interventions to meet patients need within the care pathway.
- Despite national and international guidelines highlighting the importance of early detection and referral to a wound care specialist be a key to prevent LEA. [4, 5]

Implications

- These findings have important implications for clinical practice, healthcare professional's education (e.g., nurses, physicians, chiropractors) and future research that focus on factors preventing healing and barriers to get on the right care pathway
- The is a need to improve the healthcare systema navigation and communication among the interdisciplinary team to ensure that patients are seen by the right specialist at the right time.
- Ultimately, this study call for the need to educate patients and healthcare providers to identify the early DFU presentation and take immediate and appropriate actions before it is too late.

References

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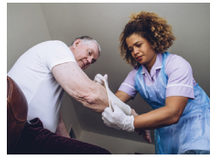
INTER-PROFESSIONAL VIRTUAL WOUND CARE

Impact in an Integrated Health Care System during COVID-19

Background and Purpose

Home and Community Care Support Services has a focused mandate to deliver local health care services such as home and community care, access to community services and long-term care home placement across Ontario. Home and Community Care Support Services Central East is committed to providing high quality, evidence-based nursing care to approximately 15, 000 patients with wounds per year in the community, and is one of the largest and fastest growing regions in Ontario.

An area of over 16,673 km²



The COVID-19 pandemic posed a challenge for our wound care patients in the community as face-to-face access to experts and specialists was limited. High-risk wound patients, the same older, comorbid population most susceptible to COVID-19, risked exposure to infection by travelling to clinics, medical appointments or other community healthcare settings. A Wound Care Inter-professional Team was implemented in response to these challenges and risks.

Method

The Wound Care Inter-professional team draws upon clinical experience and other expertise across sectors to collaborate, strategize and provide recommendations and treatment options on clinically complex or non-healing wounds. This team, with patients at the centre, works together to provide virtual and face-to-face wound care consultations, ensuring patients throughout our region continue to receive seamless, evidence-based, high quality wound care during a global pandemic.

Home and Community Care Support Services Central East
1-800-263-3877 | healthcareathome.ca/centraleast

West	North East	Central

• Scarborough Health Network
  • *Chief of Plastic Surgery*
  • *Advanced Practice Nurse*
  • *Nurse Practitioner*
• Scarborough Centre for Healthy Communities
• Four Contracted Nursing Service Provider Organizations
• Two Contracted Nursing Clinics
• Home and Community Care Support Services Central East Wound Resource NSWOC
	• Peterborough Regional Health Centre
	  • *Advanced Practice Nurse*
	• Ross Memorial Hospital
	  • *Advanced Practice Nurses*
	• Five Contracted Nursing Service Provider Organizations
	• Four Contracted Nursing Clinics
	• Home and Community Care Support Services Central East Wound Resource NSWOC
		• Lakeridge Health Corporation
		  • *Infectious Diseases Physician Specialist*
		  • *Nurse Practitioner*
		• Glazier Medical Centre
		  • *Chiropodist*
		• Mission United (Support for Poverty Relief)
		  • *Nurse Practitioner*
		  • *Registered Nurse*
		  • *Primary Care Outreach Paramedic*
		• Five Contracted Nursing Service Provider Organizations
		• Two Contracted Nursing Clinics
		• Home and Community Care Support Services Central East Wound Resource NSWOC

Front-line community nurses drive the Inter-professional Team with their leadership and wound expertise. The collaboration, innovation and support provided by all members of the team empowers and strengthens the capacity of these nurse wound care champions, helping to enhance their knowledge, judgement and treatment decisions.

As a participant in the Telewound Care Canada initiative, the Wound Care Inter-professional Team utilizes Swift Medical's Skin & Wound App to conduct virtual wound consultations. High quality, scientifically calibrated wound images, paired with standardized assessments enables virtual wound collaboration and consultation among members of the Wound Care Inter-professional Team. This initiative is made possible by funding received through the Federal government's Digital Technology Supercluster.

Home and Community Care Support Services Central East wound experts

Contracted nursing service provider organization wound champions

Health care system partners

The goals of the Wound Care Inter-professional Team:

- Improved wound outcomes
- Decreased length of stay on home care nursing services
- Improved patient/caregiver satisfaction and quality of life
- Decreased emergency department and unscheduled health care visits

Statistics Since Project Go-live January 2021

248	355	1,092	145	15
Patients	Unique Wounds	Evaluations Competed	Wound Resource NSWOC Care Coordinator Consults	System Partner Consults

Results | Patient Impact

Patient Survey Results:

92% — **Satisfied or Very Satisfied** with the Wound Care IPT program

83% — **Agree or Strongly Agree** that Wound Care IPT has improved their quality of life

75% — **Agree or Strongly Agree** that they were able to better manage their health

Clinician Survey Results:

Clinician survey aimed at front-line users of the Swift Skin and Wound App:

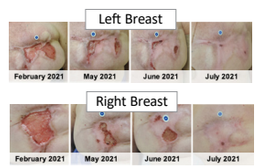
100% — **Agree or Strongly Agree** the solution is intuitive and easy to use.

90% — **Agree or Strongly Agree** the solution helps me follow changing wound progress over time.

85% — **Agree or Strongly Agree** the solution helps me make better and faster patient care decisions.

Patient Story

One of our patients spent 5 years with non-closing wounds after undergoing bilateral breast reconstruction post partial mastectomy. This patient was referred to the Wound Care Inter-professional Team in January 2021, team members consulted together, and a new wound care treatment was recommended. Within six months of being referred to the Inter-professional Team, the patient's wounds have closed, greatly improving the patient's quality of life.



"I spent 5 years treating this wound and nothing was helping. Once I was referred to the Inter-professional team I couldn't believe how fast my wound improved and now it's almost healed, it's amazing and I'm so thankful" - Wound Care Patient

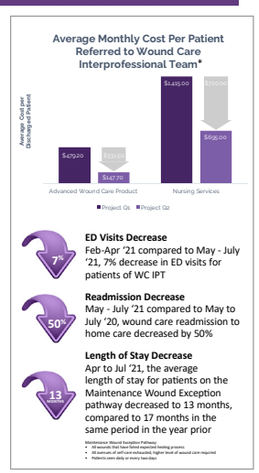
Conclusions

While the global pandemic had many negative impacts, it allowed for opportunities for growth, innovation and creative virtual wound solutions which have further enhanced the delivery of health care. The global COVID-19 pandemic lent itself to a dark time of uncertainty with extreme risk to the health care system and potential consequences for wound care patients.

Implemented a new model of patient partnered wound care leveraging the Inter-professional Team and digital wound solution, which resulted in better patient engagement and improved quality of life for 100% of our patients

Unified vision and dedication to best practice, evidence based, and high quality wound care

Increased collaboration and networking amongst our health system partners



Feasibility of a 20-minute Fast-walk in Individuals with Diabetic Peripheral Neuropathy Wearing an Offloading Boot and a Shoe Balancer: Preliminary Results

Nikolas Beauchesne[1], Yassin Andoulsi[1], Alice Wagenaar[1], Magali Brousseau-Foley[1,2], Gabriel Moisan[1], Vincent Cantin[1], Virginie Blanchette[1,3]

[1]Département des sciences de l'activité physique, Université du Québec à Trois-Rivières (UQTR), Trois-Rivières, Canada;

[2]Centre intégré universitaire de santé et de services sociaux de la Mauricie et Centre-du-Québec (CIUSSS-MCQ), Trois-Rivières, QC, Canada;

[3]Centre de recherche du Centre intégré de santé et services sociaux de Chaudière-Appalaches (CISSS-CA), Lévis, Canada

Background

- Diabetic peripheral neuropathy (DPN) affects 28% of individuals with diabetes[1].
- This condition is 11,2 times more likely to lead to a diabetic foot ulcers (DFU)[2].
- Offloading is an important part of DFU management and physical activity (PA) prevents complications but can be difficult to introduce because of the increased mechanical stress[3].
- Including non-weight-bearing activity in DFU management plan might ↓ wound size without negative consequences[4,5].
- Sedentary behavior is an independent predictor of DFU development, it is important to gather knowledge and develop tools to get the DPN population moving[5].

Aim

Principal objective :
Identify spatiotemporal gait pattern changes during a 20-minute fast walk in individuals with diabetic peripheral neuropathy (DPN) while wearing an offloading boot and a contralateral shoe balancer.

Secondary objectives :
1) Compare gait patterns between walking conditions
2) Compare gait patterns between DPN and control group
3) Verify feasibility of the intervention in this population.

Hypothesis :
The activity is feasible and does not cause harmful gait pattern changes. DFU risk is not increased in the DPN population while using an offloading device and contralateral shoe balancer.

Figure 1. Offloading boot and contralateral shoe balancer

Methods

Design : Descriptive comparative study (Figure 2).
Sample size : We are expecting to reach the statistically relevant (p=0.9) sample size of n=32 by December 2021 to complete the data collection.
Inclusion criteria : 35 to 70 yo, Presence of DPN for Group A (10g Semmes-Weinstein Monofilament and 128Hz Tuning fork).
Exclusion criteria : <1-year DFU history, Cardiac medical history, Peripheral arterial disease (Monophasic Doppler waveforms), Charcot neuroarthropathy.
Data collection : Demographics, foot types and deformities, activity level (IPAQ)[6], gait parameters (e.g., cycle duration, cadence, stride length, stride velocity, double support percentage) and qualitative feedback from participants.

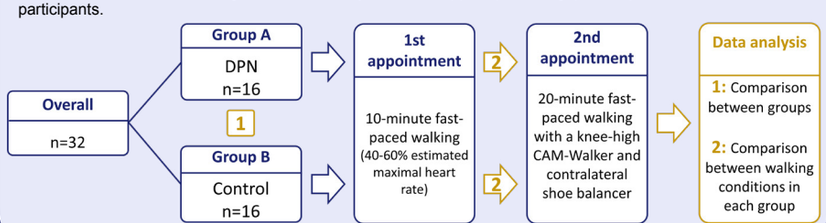


Figure 2. Experimental summary

Preliminary results

	Age	Sex ratio	IPAQ Score[6]		
	Mean (±SD)	M/F	Low	Medium	High
Group A (n=8)	64.1 (±7.3)	1	2	3	3
Group B (n=5)	54.5 (±15.9)	1.5	1	1	3

Table 1. Participants' characteristics

92% of patients reported the activity to be feasible in a daily context

«Impact on hips is much less with contralateral elevation»*

Figure 3. Data collection example during the 2nd appointment

***Acquired from participants' feedback**

Preliminary Analysis

1
- Walking speed : ↓ 20% in Group A
- Double-stance % : ↓ 10% in Group B
- Minimal toe clearance : ↓ 43% in group B

2
- Walking speed : ↓14%
- Asymmetry : ↑ 121%
- Double-stance % : Comparable
- Minimal toe clearance : ↑ 28%

- Asymmetry in gait parameters ↑ and walking speed ↓ with the use of the offloading boot and contralateral shoe balancer (compared to the participants' own shoes);
- Comparable changes in gait patterns for both groups, but accentuated for the DPN population;
- No pain was reported, and participants stated that fast walking is feasible with the provided devices.

Implications

- Keeping individuals with DPN active while using an offloading device (e.g., active Charcot, foot ulcer) is a highly relevant issue. These preliminary results show that a 20-minute pressure-protected weight-bearing physical activity intervention, which is consistent with the 150 minutes per week of PA recommended by Diabetes Canada, is feasible[7].
- Plantar pressures will be investigated in the next phase of the study along with the development of an intervention program.

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Contact : nikolas.Beauchesne@uqtr.ca

An Interprofessional Collaboration to Reduce Pressure Injuries in Intensive Care Unit Patients

Timothy Burgess PT, Leslie Richards RN, Charlene Arko RN, Olayinka Babalola RN, Sherry Campbell RN, Shawna Chapman RN, Erin Hawthorne RD, Shannon Hill Longo PT, Shelley Hynes RN, Jennifer Marra RN, Marjorie Nguyen RN, Amy Wong RD
Lakeridge Health

Aim

A quality improvement initiative guided by RNAO's Best Practice Guidelines focused on reducing the number of pressure injuries occurring to patients and improving knowledge and management of pressure injuries amongst intensive care unit staff through increased awareness and discussion.

Background

Lakeridge Health is a multi-site organization consisting of 5 sites in Durham Region, Ontario. The Lakeridge Health Oshawa site contains a level 3 Intensive Care Unit (ICU) with an adult medical/surgical patient population.

Methods

Over the course of 5 months, an interprofessional team consisting of management, nursing staff, dietitians and physiotherapists met weekly to discuss all patients in the ICU that had an identified pressure injury. Morning rounds referred to as "Wound Care Wednesday" lasted for approximately 15 minutes. Discussion was fostered through the use of a document developed to allow nursing staff to identify wound location, stage, mobility status, relevant consults entered and wound dressing concerns (figure 1). Additional strategies such as a "proning kits" (figure 2) and ensuring all patients had a wedge support system for turning were utilized. Relevant staff education and wound care management strategies were disseminated to all staff based on trends identified in the discussions and data collection.

Interventions

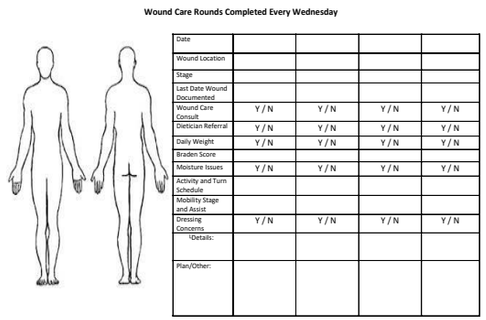


Figure 1. Template used by nursing staff to identify wound concerns to be communicated at rounds.

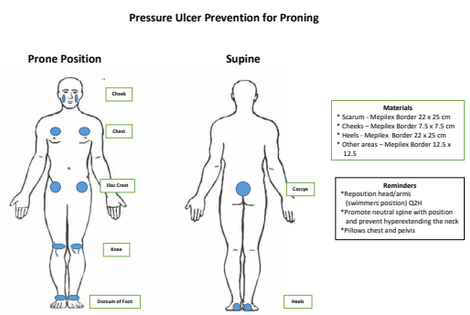
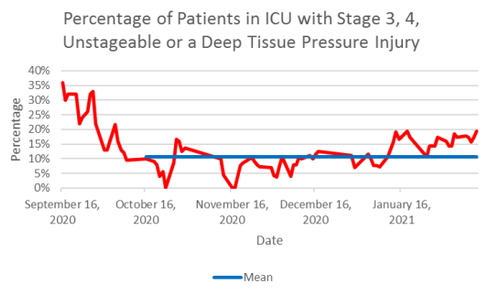


Figure 2. Diagram included in "proning kit" to assist staff with identifying prominent skin breakdown locations and sites for preventative dressings prior to prone positioning patients.

Results



Findings

It was determined that the average number of patients with a pressure injury documented as a stage 3, 4, unstageable or deep tissue injury decreased from 22% to a monthly average of 11% despite an increase in the daily average number of admitted patients from 22-28.

Implications

Utilizing the RNAO's BPG for Assessment and Management of Pressure injuries for the Interprofessional Team, discussion and review of the stage of pressure injury occurrence amongst frontline clinicians and with the support of management led to the early identification of pressure injury trends. We believe consistent and routine discussion was instrumental in the success achieved.

Contact

Timothy Burgess
Lakeridge Health
1 Hospital Court, Oshawa, On
L1G 2B9
tburgess@lh.ca
905-576-8711

Leslie Richards
Lakeridge Health
1 Hospital Court, Oshawa, On
L1G 2B9
lesrichards@lh.ca
905-244-3917

References

Registered Nurses' Association of Ontario, (2016). *Assessment and Management of Pressure Injuries for the Interprofessional Team.* Toronto

"This work is part of the BPSO® designation program, funded by the Government of Ontario. For more information about the RNAO BPSO® Designation please visit www.RNAO.ca/bpg/bpso."

ChristianaCare

Combination Therapies Accelerate Acute Surgical Wound Healing

Kathy E. Gallagher, DNP, APRN-FNP, WCC, CWS, FACCWS; Jessie Powell APRN-FNP-C;
John Getchell RN; Peter J. Mallow PhD; Luis Cardenas DO, PhD

MAGNET RECOGNIZED
AMERICAN NURSES CREDENTIALING CENTER

INTRODUCTION

Historically, rudimentary, and single-product dressings have been applied to treat even complicated acute surgical wounds with varying efficacy. Alternatively, an acute surgical wound service (ASWS) often incorporates a combined advanced wound therapy approach. The objective of our case review series was to assess if healing rates were correlated with utilization of unique combination therapies.

METHODOLOGY

An ongoing observational, prospective analysis was performed, reviewing patients with complex acute surgical or traumatic wounds from their inpatient admission through their outpatient course until wounds were healed. Systematic assessments were standardized employing a variation of T.I.M.E. (tissue, infection /inflammation, moisture balance, edge/periwound)[1], but including an "S" for wound size and social considerations, at every patient encounter. Key outcomes included wound progression determinations and measurements, tracking individualized treatment regimens, time to healing, and healthcare utilization metrics.

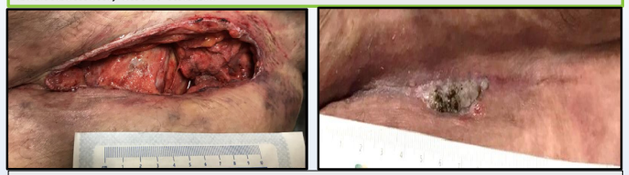
TRADEMARKED ITEMS

*Vashe® Wound Solution, Urgo Medical North America, Fort Worth, Texas, USA
˚Aquacel® Ag Extra™, ᵛDuoDerm®, ConvaTec, Inc., Bridgewater, NJ, USA
‡Allevyn◊ Life, Smith & Nephew, Inc., Fort Worth, Texas, USA
ᵸAdaptic™, ‡Promogran Prisma™, ᴱTegaderm™, 3M Health Care, St. Paul, MN, USA
ᵡMediHoney®, Integra LifeSciences, Princeton, NJ, USA
ǂMepilex®, Mölnlycke Health Care, Gothenburg, Sweden

DISCLOSURES

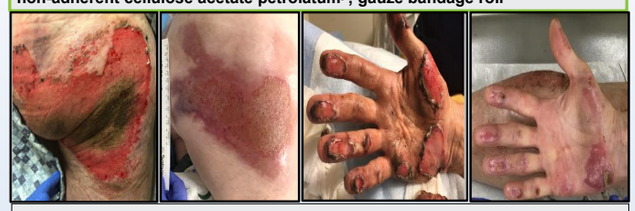
This work was produced with support from Urgo Medical North America.

Case study #1
Patient: 66-year-old male with multiple comorbidities
Mechanism of Injury: ran over by lawnmower
Sustained: Complex Left lower quadrant/left groin full thickness wound
Initial size: 17x6x8, tunneling ~5cm @ 9 o'clock and ~3cm @3 o'clock, undermining 1-2cm to entire wound
Time to healing: 78 days
Combination of therapies used: HAPWOC* via NPWT instillation, HAPWOC* gauze soak, hydrofiber impregnated with silver°, collagen/oxidized regenerated cellulose with silverǂ, non-adherent foamǂ, hydrocolloidᵛ, sharp debridement, silver nitrate



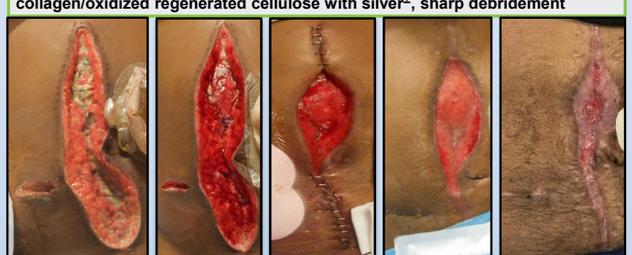
5/21/21 7/15/21

Case study #2
Patient: 66-year-old male with no significant PMH
Mechanism of injury: Struck by automobile while riding his bike
Sustained: Extensive body wide partial and full-thickness road rash
Initial size:
Right palm: (Proximal) 4.5x4.5x0.1cm, (Distal) 1.2x1.2x0.1cm, (Thenar) 3x3x0.1 cm
Right second finger: 2x1.5x0.1cm Right third finger: 2x1x0.1cm
Right fourth finger: 2.5x1.0x1cm Right fifth finger: 1x0.7x0.1cm
Right buttock/Upper posterior thigh: 25x21x0.1cm
Time to healing: 30 days for hand, 51 days for posterior thigh/buttock
Combination of therapies used: HAPWOC*, hydrofiber impregnated with silver°, transparent filmᴱ, medical grade honey sheetsᵡ, bacitracin ointment, non-adherent cellulose acetate petrolatumᵸ, gauze bandage roll



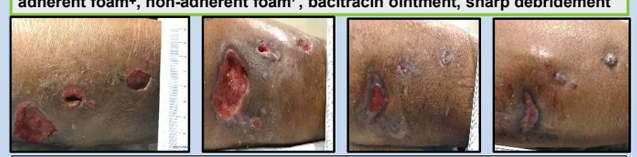
6/11/21 7/1/21 6/11/21 7/1/21

Case study #3
Patient: 33-year-old male
Mechanism of injury: GSW to abdomen requiring emergent surgery
Sustained: Abscess of postoperative abdominal wall incision
Initial size: Midline: 20x6x3.5cm, RLQ: 1x3.5x1.5cm, tunneling ~2cm @ 3 o'clock
Time to healing: 22 days for RLQ, 76 days for midline
Combination of therapies used: HAPWOC* via NPWT instillation, HAPWOC* gauze soak, hydrofiber impregnated with silver°, non-adherent foam‡, collagen/oxidized regenerated cellulose with silverǂ, sharp debridement



6/29/21 *7/1/21 7/6/21 7/23/21 9/9/21
*1st dressing change

Case study #4
Patient: 79-year-old female
Mechanism of injury: Dog attack
Sustained: multiple dog bites bilateral lower extremities
Initial size:
Proximal calf: 4.8x6x1.6cm, tunneling into mid-calf wound @ 5 o'clock
Mid-right calf: 1.8x1x1cm with tunneling into proximal wound @10 o'clock
Mid-left calf: 1.5x1.5x0.3cm
Distal calf: 1.8x1.3x0.6cm
Days to healing: 48 days for distal, 68 days for middle
Combination of therapies used: HAPWOC*, hydrofiber impregnated with silver°, collagen/oxidized regenerated cellulose with silverǂ, silver nitrate, non-adherent foam‡, non-adherent foamǂ, bacitracin ointment, sharp debridement



4/19/21 4/29/21 5/27/21 7/1/21

FINDINGS / RESULTS

Since inception, 17 patients who had single or multiple complex acute wounds of various etiologies have healed. Treatments were reevaluated at each visit and modified according to wound assessment. All wounds were managed with hypochlorous acid preserved wound cleanser* (HAPWOC), as gauze soaks or via negative pressure instillation therapy, in combination with one or more of the following: silver alginates, collagen products, medical grade honey, and foam dressings. Healing was observed in 54 wounds with a median healing time of 19.48 days. Factors associated with delayed wound healing included comorbidities, continued tobacco use, and inability to obtain correct supplies. No adverse events were noted with any of the therapies utilized.

IMPLICATIONS / APPLICATIONS

Early consultation, within 3.93 days, to wound specialists and utilizing a combination therapy approach, including HAPWOC in addition to other agents, have been found to shorten healing time and associated healthcare utilization in the clinical experience of this ASWS. The decrease in frequency of dressing changes and reduced follow-up in the outpatient clinic and home care settings resulted in a cost savings and expected increase in patient satisfaction.

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Email: Kathy.e.gallagher@gmail.com with any questions

Photobiomodulation therapy in the Treatment of Peristomal Dermatitis in Infants

AUTHORS: Juliana Balbinot Reis Girondi, Gabriela Beims Gapski, Milena Ronise Calgari, Julia Grisard de Bem, Lúcia Nazareth Amante

Objectives

To report a case of peristomal dermatitis in an infant treated with Photobiomodulation.

Methods

Single case study of an infant born at 38 weeks with a diagnosis of type II ileal atresia, submitted in August 2020, to enterectomy with resection of 10 cm of the intestine and enteroanastomosis. Then he presented surgical complications and adhesions, performing a new Enterectomy with removal of 25 cm of the intestine and making an ileostomy. In November she presented a retracted ileostomy (10mm), functioning with peristomal dermatitis (50 cm^2) extending to the right thigh and dorsal region. A crying child, irritated at the slightest touch, disturbed sleep, low water and food intake. Two laser photobiomodulation sessions were performed at an interval of seven days. Energy dose of 1J/point of red light (660nm) and infrared (808nm) were used simultaneously, spot application (in the first session eight points applied and in the second three), exposure time of 10 seconds, irradiance 10 J/cm^2. Adopted local care: skin hygiene with neutral pH soap, application of hydrocolloid powder and skin protector spray, leveling the stoma with hydrocolloid paste after each collector change.

Results

On the first day of LLLT, the infant had improved sleep, absence of crying and irritability. The next day she accepted breastfeeding and nutritional supplements; protruding stoma with regression of hyperemia and area (40 cm^2). With two LLLT sessions associated with the recommended nursing care, in 12 days there was healing of the peristomal dermatitis.

Implications

Peristoma dermatitis is recurrent in ostomy patients. In the reported case, adjuvant treatment with LLLT provided tissue repair by cell photobiomodulation causing mitotic stimulation in epithelial cells, mitochondrial energy synthesis, inhibition of cell apoptosis, promotion of local microcirculation, collagen synthesis and reorganization, reduction of inflammatory cytokines, pain reduction and sensitivity.

Contacts: Juliana.balbinot@ufsc.br

Debridement: Canadian Best Practice Recommendations for Nurses

Developed by: Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC)

Kevin Y. Woo, PhD, RN, NSWOC, WOCC(C), FAPWCA
Nancy E. Parslow, RN, MClSc-WH, NSWOC, WOCC(C)
Erin M. Rajhathy, RN, BScN, MClSc-WH, NSWOC, WOCC(C)
Valérie Chaplain, RN, BScN, NSWOC, WOCC(C),
Mary C. Hill, RN, BScN, MN, NSWOC, WOCC(C)

Why do we need Debridement Best Practice Recommendations for Nurses?

Debridement can lead to patient harm when performed inappropriately. Negative outcomes include bleeding, loss of function, and even death.

The purpose of these evidence-informed best practice recommendations (BPR) is to answer the following questions to promote safe clinical practice and optimize patient outcomes. Questions include:

Who should be responsible for debridement? What preparation is required for nurses to be competent in performing debridement? What are the scopes of practice for the various categories of nurses to initiate and perform debridement? What are the regulatory requirements for wound debridement for nurses practicing in Canada?

Background

Optimal wound management requires i) meticulous assessment and treatment of the underlying cause, ii) understanding of patient's experience to identify meaningful patient goals and values, and iii) implementation of appropriate local wound care. There are four essential components for local wound care including debridement of devitalized tissue, control of infection (bioburden)/ prolonged inflammation, moisture balance, and treatment of non-advancing wound edges (known as edge effect)[1].

What is debridement?

Debridement can be defined as the removal of unhealthy tissue, biofilm, foreign debris, and residual material from dressings. Debridement is a necessary step to prepare a clean wound bed and promote healing.

Why debridement?

Debridement involves various modalities to remove necrotic or devitalized tissue, hyperkeratotic epidermis, and other undesirable materials that impede wound healing. Potential benefits of debridement may include the following:

- Reduction of bacterial sequestrum and risk of infection
- Reduction of pain from excessive inflammation
- Removal of foreign debris that may perpetuate an inflammatory response
- Removal of dysfunctional senescent cells that lack normal cellular functions
- Evacuation and drainage of an abscess
- Elimination of the source of odor
- Proper determination of the wound depth and tissue types
- Restoration of a healthy wound base and edges for granulation
- Overall promotion of wound healing

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Six common methods of debridement were discussed within this BPR. The choice of debridement method is dependent on the amount of necrotic tissue, urgency, infection risk, pain, resources or expertise available, and patient preference.

1. ***Autolytic debridement*** involves creating a moist wound environment promoting the body's natural processes involving phagocytic cells and endogenous enzymes (matrix metalloproteinases) to remove non-viable tissue.
2. ***Mechanical debridement*** requires mechanical force. The use of wet to dry dressings and irrigation are common forms of mechanical debridement.
3. ***Enzymatic and chemical debridement*** uses exogenous agents such as proteolytic enzymes, to accelerate the debridement process.
4. ***Biological debridement*** or maggot debridement therapy (MDT), also known as larval therapy or therapeutic myiasis, involves the inoculation of sterile fly larvae into wounds.
5. ***Conservative sharp debridement (CSWD)*** involves the use of sharp instruments to remove slough or necrotic tissue above the level of viable tissue without causing bleeding.
6. ***Surgical debridement*** involves the application of sharp instruments often into viable tissue, usually performed in the operating room, by a surgeon. This debridement method will usually create bleeding and may not always be feasible due to pain, bleeding and potential cost

Methods

Under the leadership of Nurses Specialize in Wound Ostomy and Continence Canada , a group of expert nurses were brought together to systematically examine a broad range of evidence using a scoping review process following the methodological framework proposed by Arksey and O'Malley (2005)[2]. The search included 10 databases and other websites where guidelines or practice documents may be posted. Keywords and phrases included various forms of debridement and nursing standards and scope of practice for nursing designations in Canada. Best available evidence was synthesized and developed into best practice recommendations. Following a modified Delphi process, the expert group engaged in several rounds of discussion to modify these recommendations until over 80% agreement was achieved for all recommendations. An interprofessional peer review provided feedback which was considered prior to finalizing the BPR.

Implications for practice

All forms of debridement pose a clinical risk resulting in potential patient harm and complications.[3]

Standardization of scope of practice requirements and consistent debridement practices are essential to promote wound healing, minimize adverse events, and prevent patient harm related to debridement. There is a need for national debridement competencies and a competency-based debridement education and preceptorship program for nurses to obtain the specialized knowledge, skills, and critical thinking to become competent to initiate, and perform debridement.[3]

This BPR delineates scope of practice requirements and provides directions for government bodies and organizations to standardize nursing practice for all methods of debridement. Dissemination and implementation of this BPR across all Canadian healthcare sectors will support patient safety related to debridement.

NURSES SPECIALIZED IN WOUND, OSTOMY AND CONTINENCE CANADA
INFIRMIÈRES SPÉCIALISÉES EN PLAIES, STOMIES ET CONTINENCE CANADA

Summary of Recommendations

Recommendation 1: Scope of Practice (Level of Evidence IV-V)
All classes of nurses must work within the controls of federal and provincial/territorial legislation, regulatory bodies, organizational policies and individual competency. This includes accountability and having the knowledge, skills, judgement and authority to perform all methods of debridement.

Recommendation 2: Organizational Recommendations (Level of Evidence IV-V)
Employers/organizations should ensure all policies and procedures, or operational resources related to debridement including the type/method of debridement each class of nurse is authorized to initiate and/or perform, including the specific level of education, training (including mentorship), and experience required to perform the method of debridement.

Recommendation 3: Prior to Initiation of Debridement (Level of Evidence IV-V)
Prior to initiating any method of debridement, the nurse must fully understand the indications for the different types of debridement and level of knowledge and skill required to perform each one. This includes knowing their own limitations and when to consult the interprofessional team and how to mitigate and manage potential adverse events.

Recommendation 4: Education and Preceptorship (Level of Evidence IIb, IV-V)
Prior to initiating or performing debridement, successful completion of a recognized wound management program and an additional competency-based debridement module is highly recommended. Although all methods of debridement carry clinical risk, mandatory preceptorship is recommended for CSWD.

Recommendation 5: Patient Assessment (Level of Evidence III-V)
Prior to initiation of debridement, the nurse must conduct and know how to interpret findings of a comprehensive patient assessment.

Recommendation 6: Wound Assessment (Level of Evidence IV-V)
In addition to the comprehensive patient assessment, a comprehensive wound and periwound skin assessment using a validated assessment tool is recommended to assist the nurse to identify the wound etiology, stage/categorize/grade the wound, and identify barriers to healing.

Recommendation 7: Environmental Assessment (Level of Evidence IV-V)
Asses the patient's environment to ensure the setting is safe to perform the debridement modality. Prior to the initiation of CSWD, resources and personnel must be available to manage potential adverse event.

Recommendation 8: Wound Healing Goals (Level of Evidence IV-V)
Prior to the initiation of any method of debridement, it is essential to establish realistic goals that align with the patient's goals including concerns and cultural traditions and the goals for wound healing.

Recommendation 9: Informed Consent (Level of Evidence V)
Informed consent should include legal and ethical considerations, organizational requirements, and should be obtained for all forms of debridement. The method used to obtain informed consent and the patient's response must be documented in the patient's record.

Recommendation 10: Product Knowledge (Level of Evidence V)
Nurses must be knowledgeable about wound care products and therapies used both above and below the dermis before using them in practice as many promote or enhance autolytic debridement.

Recommendation 11: Reassessment (Level of Evidence IV-V)
Regular reassessment of the patient and the wound is imperative to evaluate outcomes.

Recommendation 12: Cost-Effectiveness (Level of Evidence IV-V)
Ensure all associated costs are considered before selecting the method of debridement. This includes costs for the healthcare system, the employer or organization, the nurse, the patient and significant other.

*View **Debridement: Canadian Best Practice Recommendations for Nurses***
www.nswoc.ca/debridement

A quick reference guide (QRG) was developed to guide nurses decisions regarding the requirements to safely initiate, direct and perform debridement.

View the Quick Reference guide:
http://nswoc.ca/wp-content/uploads/2021/09/Debridement-BPR-Quick-Reference-Guide-copyrighted.pdf

How A Change in Practice in a Nurse-led Wound Clinic Improved Venous Leg Ulcer Healing Outcomes

Holly Murray BNSc RN WOCN NSWOC WOCC(C)

Background:

Venous Leg Ulcers Impact to the Healthcare System

Venous leg ulceration (VLU) affects up to 3% of the population worldwide and accounts for 60–80% of all cases of ulceration. These ulcers can end up becoming challenging chronic wounds, with up to 30% remaining unhealed even after a year of care and up to 70% recurring within a year. This can pose a negative impact on the patient's perceived quality of life and can cause the clinician frustration with applying interventions that end up unsuccessful. Spectrum Health Care nurse-led wound clinic within the Mississauga Halton region makes every effort to apply best practice (wound bed preparation, assessment of infection, and appropriate compression therapy based on Ankle-Brachial Pressure Index (ABPI)) to care for VLUs and understands that adjunctive therapy also has a place in the care of these complex wounds. When a muscle pump activator (MPA) was introduced and made available for access by the Mississauga Halton Local Health Integration Network (LHIN) in 2017, Spectrum clinicians began to include the device in the care planning of patients with VLUs.[1,2,3] The geko™ device, a muscle pump activator, utilizes an innovative mechanism of non-invasive neuromuscular electrostimulation.

Aim:

To share how a change in practice within an Ontario nurse-led community wound clinic resulted in improved outcomes for patients living with VLUs.

Method:

Prior to this evaluation clients with VLUs were provided with best practices and required 30 days of standard care before adding the Muscle Pump Activator (MPA.) For this evaluation patients with VLUs had MPA devices added to the treatment plan as soon as possible following admission. Wound measurements were documented pre MPA utilizing standard of care (SoC) and then with MPA and SoC. Common metrics for assessing the healing rate of wounds such as percentage area reduction introduce bias depending on wound size.

Linear advance of the wound margin (wound area/perimeter) (WMA) has been favoured by other researchers as a metric for the healing rate of VLUs[5] because it removes wound size bias.

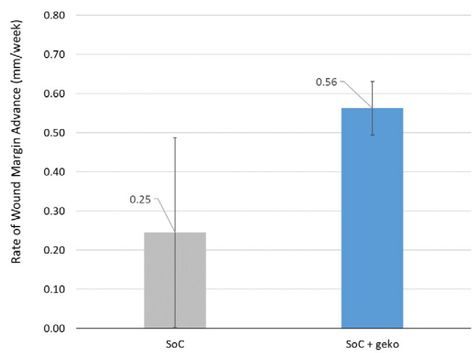
In this analysis the linear advance of the wound margin (WMA) was used to highlight the effect of SoC healing rates and SoC + MPA healing rates, of the 18 patient VLU wound measurements included in this review.

Results:

Prior to initiation of MPA the average time to close a wound in Mississauga Halton LHIN was 15 weeks with an MPA initiation time of 14.3 weeks[3.] In this evaluation the average time to closure was 6.7 weeks with an MPA initiation time of 3.8 weeks[4.] This is a decrease of 55% in the time to wound closure.

The graph shows that when MPA was added to SoC the rate of closure increased compared to SoC alone. Results observed occurred with SoC (optimal compression) and MPA application as soon as possible.

The Effect on Rate of Wound Margin Advance of Adding the geko™ device to Standard Care (N=18)



Implications for Practice:

The positive results influenced how patients with venous leg ulcers are managed. These faster healing times allowed patients to be discharged from service earlier. It was noted some patients that stopped using the MPA before the wounds closed, still showed a decrease in wound size however, further study is needed. MPA is now initiated at baseline assessment in conjunction with standard of care.

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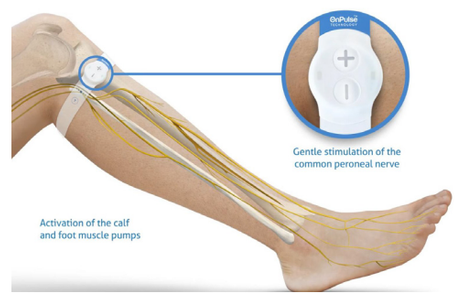


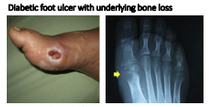
The effect of antibiotic loaded calcium sulfate beads on bacterial growth from infected diabetic foot ulcer tissue – an *in-vitro* analysis

Julie Fletcher[1], Rob Porter[2], Sean Aiken[3], Craig Delury[3] and Stephen Michell[1]

1. Biosciences, University of Exeter, Stocker Road, Exeter, EX4 4QD
2. Royal Devon and Exeter NHS Foundation Trust, Barrack Road, Exeter, EX2 5DW
3. Biocomposites Ltd., Keele Science Park, Keele, Staffordshire, ST5 5NL

Introduction: Diabetic foot infection (DFI) is the main reason for diabetes-related hospitalisation and is a major cause of diabetes-related amputation. In England for the period 2014-2017 there were 26,378 lower limb amputations related to diabetes, equivalent to 169 per week (1). Infections are often polymicrobial with a succession of species observed as the disease progresses (2). **Aim:** This study investigates the effect of antibiotic loaded calcium sulfate beads on the *in-vitro* growth of bacteria retrieved from tissue taken from diabetic foot infections. **Method:** Patients were recruited from the Macleod Diabetes and Endocrine Centre at the Royal Devon and Exeter Hospital. Debrided tissue was homogenised and spread over the surface of Columbia blood agar and fastidious anaerobe agar. Calcium sulfate beads containing a combination of vancomycin and gentamicin (500mg/240mg per 10cc respectively) were then placed on the surface of the agar. Plates were incubated aerobically or anaerobically as appropriate with zones of inhibition recorded at 1 and 4 days. **Findings:** Beads containing vancomycin and gentamicin were able to inhibit bacterial growth from all tissue homogenates tested, with zone diameters ranging from 12 – 40 mm. **Applications:** Local release of antibiotics could have the benefit of achieving high local concentrations within poorly vascularised tissue which may inhibit bacterial growth at the wound site. By improving treatment of diabetic foot infections, it may be possible to prevent amputation, maintain mobility and conserve quality of life.

Diabetic foot ulcer with underlying bone loss



Uçkay *et al.* (2015) Int J Infect Dis. **40**, 81-91

Effect of antibiotic beads on bacterial growth from patient tissue homogenates

Patient selection
Patients were recruited from the Macleod Diabetes and Endocrine Centre at the Royal Devon and Exeter Hospital. Inclusion in the study was based on clinical recognition of an infected diabetic foot ulcer (DFU) requiring wound debridement. Spare tissue was collected following informed consent.

Bead preparation
5 cc (10 g) of synthetic recrystallized calcium sulfate hemi-hydrate (Stimulan® Rapid Cure, Biocomposites, Staffordshire, UK) was mixed with vancomycin (250 mg) and 3 ml gentamicin solution (40 mg/ml) and pressed into hemispherical cavities with a 6 mm diameter and allowed to set.

Figure 1. Stimulan® Rapid Cure

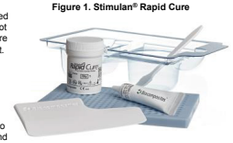


Figure 2. Incubation of tissue homogenates with antibiotic loaded beads

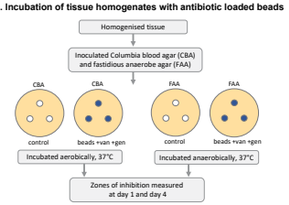


Figure 3. Effect of beads containing vancomycin and gentamicin on tissue homogenates

a) Tissue homogenate 8 CBA aerobic
b) Tissue homogenate16 FAA anaerobic
c) Tissue homogenate 10 CBA aerobic

Table 1. Zones of inhibition of microbial growth for tissue homogenates

	Zone of inhibition diameter (mm)															
Tissue homogenate number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CBA aerobic (day 4)	NG	NG	25	29	NG	6	NG	30	24	16	30	40	23	32	25	24
FAA anaerobic (day 4)	31	NG	21	24	35	29	NG	24	19	16	27	30	19	27	15	18

NG = no growth

- Stimulan® beads containing vancomycin and gentamicin had an inhibitory effect on bacterial growth from all tissue homogenates where growth was obtained (Table 1).
- Often differential ZOI could be observed with some species present in a sample being inhibited to a greater extent than others (Fig. 3a).
- The smallest ZOI diameter observed was for DFU 10 (Fig. 3c).
- For DFU 6 a clear zone of inhibition could be observed on anaerobic plates, however colonies were present on the aerobic plates which grew in contact with the antibiotic containing beads. On Gram stain these colonies were noted to be yeasts.

References

1. www.diabetes.org.uk/about_us/news/lower-limb-amputations
2. Clokie *et al.* (2017) Diabet Med: **34**, 305-315

Antimicrobial susceptibility testing and effect of antibiotic beads on patient isolates

Strain isolation
Tissue homogenates were plated onto a range of selective and non-selective agar. Colonies were sub-cultured and identified by MALDI-TOF mass spectrometry (Vitek). Isolates representing 40 different species were identified. Presented here are the results for a group of *Enterococcus* spp. obtained from different patients.

Figure 4. Antimicrobial susceptibility testing and bead screening of isolates

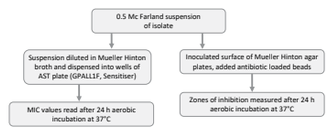


Table 2. MICs and zones of inhibition for isolates

Strain (patient number:isolate)	MIC (mg/L)		Zone of inhibition diameter (mm)			
	vancomycin	gentamicin	Control beads	Beads +van	Beads +gen	Beads +van +gen
E. faecalis 4.6	0.5 = S	>500 = R	6	23	6	23
E. faecalis 8.4	1.0 = S	8 = S	6	22	19	23
E. faecalis 8.21	1.0 = S	8 = S	6	23	19	22
E. faecalis 9.9	32 = R	>500 = R	6	24	6	24
E. faecium 10.6	>32 = R	>500 = R	6	12	6	15
E. faecium 10.15	>32 = R	8 = S	6	12	27	28

Breakpoints for *Enterococcus* spp. vancomycin S ≤ 4, R > 4; gentamicin (high-level aminoglycoside resistance) S ≤ 128, R > 128 (EUCAST Clinical Breakpoint Tables v. 9.0)

- 3 isolates demonstrated resistance to vancomycin (MIC >4 mg/L).
- 3 isolates demonstrated high level aminoglycoside resistance with an MIC for gentamicin of >500 mg/L.
- Isolate 9.9 and 10.6 demonstrated resistance to both vancomycin and gentamicin.
- Vancomycin was delivered at a concentration high enough to produce a ZOI for isolate 9.9 (van R and gen R) equivalent to ZOI obtained with susceptible isolates (Fig. 5/Table 2).

Figure 5. Effect of beads containing vancomycin and gentamicin on isolate 9.9

a) *E. faecalis* 9.9 beads +van
b) *E. faecalis* 9.9 beads +gen
c) *E. faecalis* 9.9 beads +van +gen

Summary

Stimulan® Rapid Cure beads loaded with vancomycin and gentamicin were able to:

- Inhibit bacterial growth from tissue taken from infected DFU harbouring mixed communities.
- Inhibit the growth of *Enterococcus* spp. including strains with vancomycin and gentamicin resistance.

Application of antibiotic loaded beads to infected DFUs could facilitate clearance of bacterial infection and improve wound outcomes. Further work is required to confirm *in-vitro* findings clinically.

Acknowledgments

This work was undertaken as part of a Daphne Jackson Trust Fellowship. The project was supported by a financial award from Biocomposites. We are grateful to the Diabetes Podiatry team (RD&E) for their assistance in obtaining samples and to the Microbiology Department (RD&E) for their ongoing collaboration. Samples were provided through the RD&E Tissue Bank, part of the NIHR Exeter Clinical Research Facility.

ROSS MEMORIAL HOSPITAL
Kawartha Lakes

Pushing through the 'Pressure' During the Pandemic

Jennifer Maunder, RN, BScN, ENC(c)[1]
[1]*Ross Memorial Hospital, Lindsay, Ontario*

OBJECTIVE

This study aimed to decrease the prevalence of HAPI's, stage 2 and higher by 30% and IAD by 50%. Additional goals included decreasing bed rentals by 50% and increased staff knowledge of PI's and IAD.

CONCLUSION

The medical unit has reduced HAPI's by 86% and IAD by 100%. Bed rentals reduced from $49,497.00 to $0.

Bed rentals reduced from $49,497.00 to $0.

The Medical Knowledge acquisition was adopted, and patients were spared undue suffering and complications from developing HAPI's or IAD.

INTRODUCTION

Incontinence-Associated Dermatitis (IAD) And Hospital-Acquired Pressure Injury (HAPI)

- HAPI and IAD are risks for hospitalized patients, with IAD being under reported yet linked to the development of HAPI's[1,2]
  - The prevalence of IAD is underreported and estimated to range from 7.0% to 50.0%.[1]
  - The prevalence of HAPI is Canada is not widely reported but a 2004 nationally-funded study reported and the mean (95% confidence interval) proportion of HAPI prevalence in acute care facilities is 25.1 (23.8–26.3).[2]
  - IAD is an independent risk factor for HAPI development[3]
- HAPI are associated with pain, infection, and increased mortality and length of stay[3]
  - One study reported that HAPI are associated with increased risk for sepsis and infections, and may lead to increased mortality[4]
- Despite prior efforts, Ross Memorial Hospital wanted to improve IAD and HAPI prevention efforts in order to protect patients.

METHODS

Clinical Setting

- This quality improvement (QI) initiative took place on a 36-bed medical unit, which was identified as having the highest incidence of HAPI and IAD on a baseline audit within the midsize community hospital
  - The baseline audit found 14 HAPIs on 9 patients, with 5 stage II and higher, and 5 cases of IAD in 15 incontinence patients

Quality Improvement Initiative

- During the COVID-19 pandemic, in December 2020, the Medical unit implemented bundled approach to HAPI and IAD prevention
  - All mattresses were replaced with gel therapeutic surfaces[a] with low air loss
  - The following items were removed and standardized as follows:
    - Disposable incontinence pads,[b] and prepackaged bathing and barrier cloths[c]
  - The following items were removed and standardized as follows:
    - Brown soaker pad (replaced with microclimate body pad)
    - Bath basins (replaced with disposable cloths)
    - Multi-step incontinence care (replaced with 3% dimethicone impregnated barrier wipes)

Eduction

- Staff were re-educated on turning, positioning, skin assessment documentation, and empowered to employ the bundled approach to HAPI and IAD prevention

Metrics

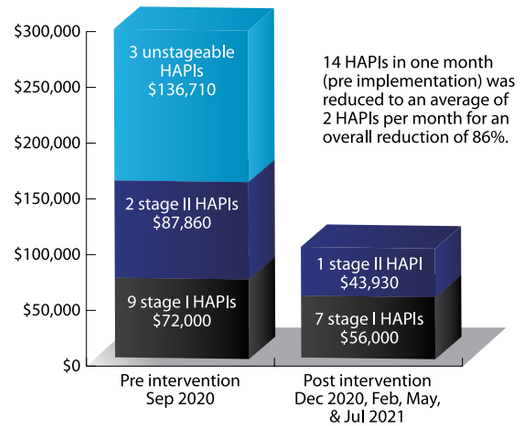
- Post-implementation bi-monthly audits were conducted on surface use, HAPIs, and IAD incidence, and documentation

[a]IsoFlex® Low Air Loss Mattresses & Low Air Loss Pumps (Stryker Corporation, Kalamazoo, MI)
[b]Microclimate Pad (Stryker Corporation, Cary, IL)
[c]Comfort Shield® Barrier Cream Cloths (Stryker Corporation, Cary, IL)

RESULTS

This QI initiative resulted in decreased IAD and HAPI.

Figure 1:



Results of the QI Initiative

- The medical unit has reduced HAPIs by 86% and IAD by 100%
- Bed rentals reduced from $49,497.00 to 0

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ACKNOWLEDGEMENTS AND DISCLOSURES

Poster development was supported by Sage Products, a division of Stryker Corporation. The authors maintained total editorial control of poster content.

NORTHUMBERLAND HILLS HOSPITAL

Empowering Nurses to Reduce the Prevalence of Hospital Acquired Pressure Injuries

Laura Eakins, RN, BScN[1]; Elizabeth Davis, RN, MSN[1]
[1]*Northumberland Hills Hospital, Cobourg, Ontario, Canada*

OBJECTIVE

Our goal was to reduce our rate of HAPI Stage 2 and above by empowering nurses with strategies they could implement in real time at the point of care.

CONCLUSION

Empowering nurses at the point of care to act on the results of risk assessment is an effective strategy to prevent pressure injuries.

The estimated quantified reduction overall was $777,780.

INTRODUCTION

Burden of Hospital-Acquired Pressure Injury (HAPI)

- HAPI is one of the most common hospital acquired conditions.
  - HAPI incidence ranges widely from 0% to 72.5% across clinical settings and between countries.[1]
  - One Canadian hospital estimated the percentage of patients with intensive care unit (ICU) and non-ICU HAPI[2]:
    - In 2017, 10% (10/33) of pressure injury were non-ICU HAPI and 45% (18/45) were HAPI in the ICU.
- Increased prevalence of pressure injury is directly correlated with an increase in health resource utilization and excess costs:
  - Canadian health care costs are estimated higher in HAPI patients ($C44,000 to 90,000) vs non-HAPI ($C11,000 to 18,500)[3,4]
  - A hospital stay associated with HAPI may be extended by approximately 4.3 days[2,5]
  - The risk for hospital readmission increases as HAPI risk increases[6]

METHODS

Clinical Setting

- Northumberland Hills Hospital is a 112-bed community hospital.
  - The hospital serves a patient population significantly older than the provincial average, including incontinent patients at higher risk for skin breakdown.

Quality Improvement Initiative

- Following initial data collection, our intervention began with creation of a dedicated nurse educator role with a focus on skin health.
  - We implemented quarterly prevalence audits focusing on HAPI Stage 2 and above (September 2020, December 2020, March 2021, and June 2021)
  - Our educator coached staff to complete the Braden Scale risk assessment within 24 hours of admission and every 24 hours thereafter.
  - Resources were made available at the point of care to guide interventions based on the patient's Braden sub scores.
- We focused on risk assessment, encouraging a dietitian consult for patients with malnutrition and consistent application of a barrier cream for patients with incontinence
- We audited documentation to ensure an admission skin assessment was recorded, to prevent pre-existing injuries from affecting our HAPI scores.

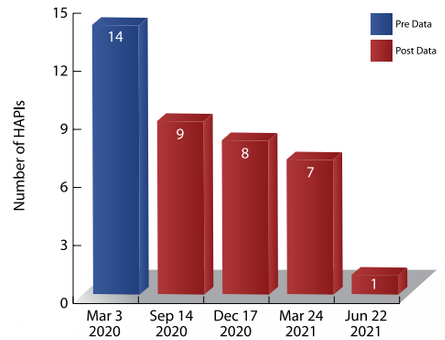
Intervention

- As part of our bundled approach, we replaced 40 foam surfaces on a pilot unit with gel therapeutic surfaces* and replaced pillows with protective heel boots** throughout the hospital.

*ComfortGel™ Support Surface (Stryker Corporation, Kalamazoo, MI)
**Prevalon® Heel Protector II (Stryker Corporation, Cary, IL)

RESULTS

This QI initiative resulted in an overall 93% reduction in stage II & above HAPIs.



Results of the QI Initiative

- Quarterly prevalence audits revealed a sustained decrease in stage II and above as follows:
  - 10.98% (September 2020), 9.09% (December 2020), 7.14% (March 2021), and 1.3% (June 2021)

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ACKNOWLEDGEMENTS AND DISCLOSURES

Poster development was supported by Sage Products, a division of Stryker Corporation. The authors maintained total editorial control of poster content.

Virtual Home Care Navigation for Chronic Complex Wounds during COVID-19

Helen Arputhanathan MSc, BScN, RN, IIWCC, NSWOC; Jane Hyde, BScN, RN, IIWCC, NSWOC, WOCC(C); R Gary Sibbald, MD. M.Ed., D.SC (Hon), FRCPC (Med,Derm)

Home and Community Care Support Services, Waterloo Wellington; WoundPedia and ECHO Wound Program

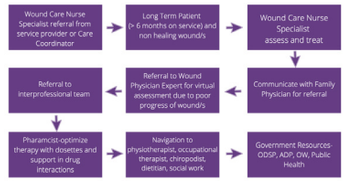
Project Aim

To virtually navigate an interprofessional home care team assessment and treatment for patients with chronic complex wounds during COVID-19

Interprofessional Team

Eligibility

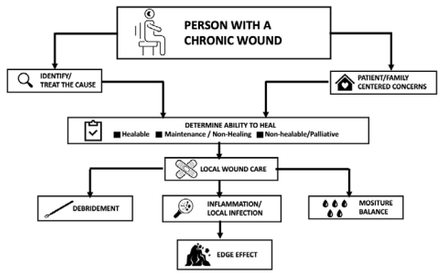
- Patients who completed a wound clinical pathway without wound closure.
- Palliative patients with complex wounds.
- Patients without a diagnosis or best practice care.



Referral Process

Wound Bed Preparation

2021



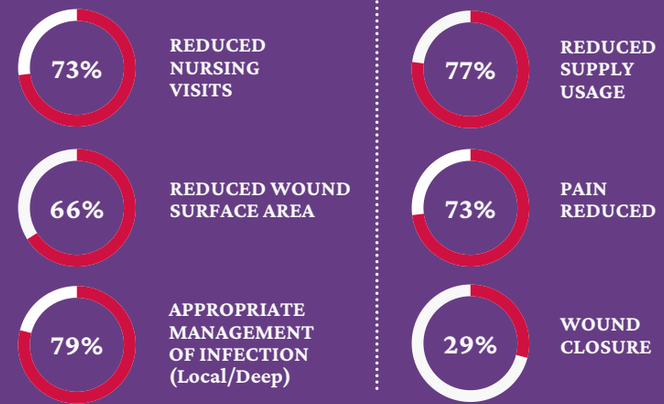
- **Manage the cause with interprofessional consultation** (blood supply, co-factors impacting healing)
- **Address patient centered concerns** (pain, activities daily living, circle of care)
- **Determine healability** (Healable, Maintenance or Non-healable)
- **Optimize local wound care** (debridement, infection, moisture management)
- **Evaluate outcomes** (healing, re-assessment, utilization of adjunctive therapies)

Lessons Learned for Practice

1. Used validated tools to identify and treat wound cause, comorbidities, surgical history, skin characteristics, nutrition and medications
2. Optimized resource management through use of electronic records
3. Reviewed healability, activities of daily living and symptom goals
4. Identified interprofessional team members to maintain and manage skin integrity and to optimize patient's overall health and well being
5. Implementation of evidence-informed holistic plan of care focused on optimizing local wound environment, selecting appropriate dressings and potential use of adjunctive therapy
6. Evaluation of outcomes to determine whether goals of care have been met, adjust treatment and support prevention to reduce the risk of recurrence

Results

Since April 2020, forty eight patients on service between 2012 and 2021 were referred to the Home and Community Care Support Services (HCCSS) Wound Care Nurse Specialist for holistic virtual assessment and treatment.



Overall Outcome

Wound bed preparation is an excellent tool to ensure effective management of persons with wounds. This project validated the use of wound bed preparation and collaboration with the interprofessional team, benefiting both patients and the health care system overall.

HOME AND COMMUNITY CARE SUPPORT SERVICES
Waterloo Wellington

WATERLOO WELLINGTON INTEGRATED WOUND CARE PROGRAM

WoundPedia

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The Feasibility of a Social Media-based Self-management Program for Patient Prevention of Diabetic Foot Ulcers in Canada: Preliminary Findings

Helen N. Obilor, MSc. (Nursing), RN, PhD Candidate; Kevin Woo, PhD
Queen's University, Kingston, Ontario, Canada

Introduction

- The incidence of diabetic foot ulcers (DFU) is anticipated to increase due to the impact of the COVID-19 pandemic on the healthcare system (1).
- However, available foot self-management education programs for people with diabetes (PWD) are mostly face-to-face and limited in sustaining patients' adherence to foot self-care recommendations (2).
- Social media is a potential health tool that could facilitate continuous education of PWD during the COVID-19 pandemic (3).

Objective

- To evaluate the feasibility of social media as an alternative method to engage PWD in DFU prevention.

Methods

- This feasibility study utilized Brewin and Bradley's partially randomized preference trial design – experimental and control group.
- Participants in the experimental group accessed the study intervention alongside their usual care, while the control received only usual care.
- The study outcomes were participants' intervention acceptance rate and efficacy (mean change in baseline and 3-month post-intervention self-reported footcare-related variables, e.g., foot self-care adherence.
- Data collection approaches include online surveys and telephone interviews.

Eligibility criteria

- Persons with diabetes aged 18 years or over
- Own or be willing to create a Facebook account
- Have access to the internet, computer/smartphone and email
- Speak and write in the English language

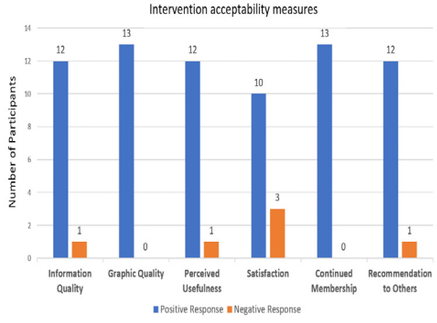
Intervention

- The intervention is a peer-led diabetic foot self-management support program, implemented through a private Facebook group.
- The development of the Intervention was underpinned by Social Cognitive Theory with education content structured based Wounds Canada Healthy Feet, and You Program (3).
- Participants' engagement involved 2-3 daily posts in text, videos, photos, polls, and weblinks for three months.

Methods

- A total of 32 PWD residents in 8 provinces in Canada participated in the study (AB, BC, NL, NS, ON, PE, QC, and NT).
- Twenty-six participants had Type I DM, and six had Type II DM.
- Most of the participants were adults aged 50 years and over (n=30), ranging: 24 – 77 years.
- At baseline, 62.5% of the participants had a moderate DFUs' risk level and poor adherence to foot self-care recommendations.
- Twenty-three participants enrolled in the experimental and nine in the control group.

Intervention acceptability measures



Intervention acceptance mean score was 83.08 and greater than cut-off point of > 70%; SD= 9.93; range = 64 – 99.

Preliminary efficacy of the study intervention

Outcome Variables		Intervention (n=12) (Mean ±SD)	Control (n=7) (Mean ±SD)	t-test	p
Foot self-care Efficacy:	Baseline	89.17 ± 8.78	78.81 ± 19.43	1.33	0.22
	Post-Int.	88.67 ± 10.94	77.62 ± 14.56	1.79	0.09
Foot Self-care Adherence:	Baseline	68.01 ± 12.47	62.89 ± 14.37	0.82	0.43
	Post-Int.	79.08 ± 11.94	57.47 ± 14.46	3.37	*0.004
Communication with HCP:	Baseline	51.11 ± 24.84	52.38 ± 32.07	-0.10	0.92
	Post-Int.	58.67 ± 33.96	51.43 ± 29.74	0.45	0.65
Community Res. Awareness:	Baseline	8.00 ± 1.91	7.23 ± 1.60	0.83	0.42
	Post-Int.	8.60 ± 1.78	8.57 ± 0 .98	0.38	0.97
Perceived Foot Health Status:	Baseline	60.83 ± 15.64	65.71 ± 18.13	-0.62	0.54
	Post-Int.	71.00 ± 13.70	65.71 ± 13.97	0.78	0.45
Physical Health Status:	Baseline	47.10 ± 9.75	47.11 ± 9.65	-0.00	0.10
	Post-Int.	49.07 ± 9.04	45.17 ± 10.97	0.80	0.44
Mental Health Status:	Baseline	44.15 ± 12.62	48.89 ± 12.86	-0.79	0.44
	Post-Int.	42.33 ± 11.10	50.86 ± 10.86	-1.50	0.16

Note: Post-Int. = Post intervention at 3 months; df at baseline = 17 and post-Int. = 15

The intervention led to significant improvement in participants' adherence to foot self-care recommendations (p=0.01)a

The key themes from the qualitative data on participants' experience of the study intervention are increased awareness of DFUs as a severe health problem, taking personal responsibility for foot health, and desire for continuity of study intervention.

Conclusions

- The preliminary result showed that a social media-based DFU prevention program is feasible, acceptable and could improve patients' diabetic foot-related outcomes.
- The continuity of the study intervention is demanded. Therefore, integrating social media in patients' DFU prevention programs could ensure PWD continuous access to programs across Canada during and beyond the COVID-19 pandemic.
- The overall study finding will expand the knowledge of the feasibility of social media in engaging PWD in DFU prevention and serve as the foundation for future trials.

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Acknowledgments

We thank Dr. Joan Tranmer, Dr. Rosemary Wilsom, Mariam Botros, Olena Veryha, Tom Weisz, and Heather Ibbetson for their contribution, and Queen's Ban Righ Centre for funding the participants' recruitment social media Ad.

Exploring the footcare and footwear practices of persons living with type 2 diabetes and their spousal influences – A research proposal for a qualitative descriptive inquiry

Student Researchers: Jahnke D, Noland I, Velasco J, & Williams T
Research Supervisor: Kuhnke JL.
Masters of Clinical Science in Wound Healing (MCISc-WH) School of Graduate and Postdoctoral Studies Western

Introduction

- Diabetes-related complications incur high-cost to the health care system, affecting mortality and quality of life.
- Diabetes Canada reports direct healthcare cost of $3.8 billion in 2020, rising to $4.9 billion by the year 2030[1].
- An integrated footcare approach can prevent up to 75% of foot ulcer[2], yet many people with type 2 diabetes mellitus (T2DM) do not engage in preventative footcare.
- An understanding of how adults care for their feet and choose footwear needs to be explored.

Research Objectives

The purpose of this research proposal is to explore the footcare and footwear practices of people with T2DM focusing on illness beliefs, self-efficacy, depression, and spousal influence on self-care decisions.

Literature Review

Self-efficacy

"Perceived self-efficacy is an important factor for successful performance of self management and a fundamentally required skill to perform it."[3]

Illness beliefs

" Many patients with T2DM do not seem to perceive their conditions to be serious and postpone lifestyle changes until diabetes-related complications occur."[4]

Depression

Diabetes and depression are often associated co-morbid conditions, with a depression incidence of 20-40% in persons with T2DM.[5]

Spousal Influence

"Spouses' attitude and behaviour influenced the patients' own. This would suggest that engaging spouses/significant others in foot care behaviour education may improve foot care behaviour and clinical and psychosocial outcomes."[6]

"Action cues indicated that participants who received recommendations from family, friends or health professionals were 5.27 times more likely to perform daily foot exams."[7]

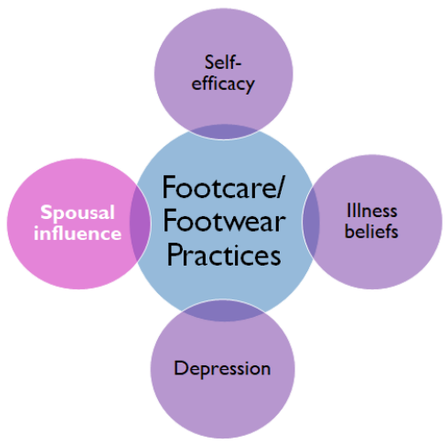

Figure 1. Literature Review Themes

Methods

The study will utilize a qualitative descriptive research method

Inclusion Criteria:

- Adults 18+ years with T2DM with spouse/partner
- Without foot ulceration(s)

Data Collection:

- Four people with T2DM and their spouses/partners
- Semi- structured 1:2 interview based upon pre-determined questions to guide the discussion
- Interviews will be audiotaped through in-person, phone, or virtual session
- Data will be recorded and transcribed verbatim

Data Analysis

Data analysis will be completed using thematic analysis, defined as "a method for identifying themes and patterns of meaning across a dataset."[8]

Clinical Relevance

The study findings will:

- Contribute to understanding participants' decisions around preventative footcare and footwear based on self-efficacy, illness beliefs, depression, and spousal support.
- Provide an understanding of why and how people with diabetes and their spouses engage in footcare and footwear practices leading to individualized, effective education strategies improving clinical outcomes.
- Results will potentially influence the design and delivery of educational programs for people with T2DM and their spouses.
- Contribute to the identification of the indirect cost associated with caring for someone with T2DM including loss of productivity of the spouse.
- Assist spouses with gaining recognition as care providers by government and healthcare agencies.

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Disclaimer: This document was produced as part of Western University Faculty of Health Sciences, Master of Clinical Science, Advanced Health Care Practice, Supervised Research Experience course PT9630 for 2020-2021 during the Covid-19 pandemic.

Cost-Effectiveness of Hypochlorous Acid Preserved Wound Cleanser (HAPWOC)* versus Saline Irrigation in Conjunction with Ultrasonic Debridement for Complex Wounds

Peter Mallow, Ph.D; Debashish Chakravarthy, Ph.D

Xavier University, Cincinnati, OH

Vashe Wound Solution, Urgo Medical North America, Fort Worth, Texas

Introduction

Wound Bed Preparation (WBP) has been a holistic and structured approach to determine which wounds are healable and best practices to consider during treatment. (Sibbald, 2021) For healable complex wounds, WBP promotes debridement as a means to promote healing and decrease the time reepithelization. A key element of WBP is physical removal of necrotic tissue. In addition to the removal of necrotic tissue, a key benefit of debridement is the removal of bacterial laden tissue. (Robson, 2012; Robson 2001). For those complex wounds that can be definitively closed with primary closure techniques involving grafts, approximations, or pedicle flaps, the quality of the WBP is of paramount importance. Failures of such primary closures of severely complex wounds have enormous negative consequences for the patient and the healthcare system.

One approach to debridement is the use of low-frequency ultrasound. This approach combines mechanical and sharp debridement with irrigation and has been shown to disperse biofilms and decrease time to healing. (Suzuki, 2009; Chang, 2017) Saline is typically used as for irrigation with low-frequency ultrasound; however, saline does not possess anti-bacterial preservative properties. (Kataoka, 2020; Hiebert, 2016) Hypochlorous acid preserved wound cleanser (HAPWOC) has been shown to mechanically reduce bacteria levels and to be non-cytotoxic and non-irritating to the wound. (Alberto, 2020) A recent prospective clinical study found low-frequency ultrasound debridement with HAPWOC to be more effective than saline for complex wounds with the primary clinical outcome being the number of wounds that were deemed successfully closed 7-10 days after definitive surgery 7 days post ultrasound debridement. (Hiebert, 2016) However, the value of low-frequency ultrasound debridement with HAPWOC for complex wounds given its added cost is unknown. Thus, the objective of this study was to determine the cost-effectiveness of HAPWOC compared to saline for use in ultrasonic debridement of complex wounds. The specific context was closure success or failure following definitive closure via surgical techniques following wound bed preparation.

Methods

Study Population

The study population consisted of 17 adult patients with complex stage 3 or 4 wounds of multiple etiologies A full description of the study population and treatment procedures was published by Hiebert and Robson (2016). The patients were randomly assigned to receive HAPWOC (9) or saline irrigation (8) during their low-frequency ultrasonic mechanical debridement procedure. All patients were evaluated on days 1, 7, and 14 post-procedure for wound healing and the presence of wound-related complications.

Modeling Strategy & Verification

A patient-level microsimulation model was developed to assess the cost-effectiveness of using HAPWOC versus saline irrigation for the treatment of complex wounds (Figure 1). The model effectiveness measure used was avoidance of a wound-related complication at 14 days post-debridement procedure. The cost measures included the additional cost of HAPWOC for the debridement procedure. All other care was the same; thus, the costs were the same. The perspective of the model was the US health system and all costs were reported in 2021 USD. The primary outcome was the incremental cost effectiveness ratio (ICER). The ICER was calculated with the following formula:

$$ICER = (C_{saline} - C_{HAPWOC}) / (Comp._{saline} - Comp._{HAPWOC})$$

Where: C_{HAPWOC} & C_{saline} were the summation of the total costs for HAPWOC and saline, respectively; $Comp._{HAPWOC}$ & $Comp._{saline}$ were the summation of the postoperative complications of HAPWOC and saline, respectively. The number needed to treat (NNT) indicates the number of patients that need to be treated with HAPWOC to avoid one wound-related complication. Lower NNT results are indicative of a more effective treatment. The NNT was calculated using the following formula:

$$NNT = 1 / (P_{HAPWOC} - P_{saline})$$

Where: P_{HAPWOC} & P_{saline} were the probability of a wound-related complication for HAPWOC and saline cohorts, respectively. The cost per NNT was calculated by multiplying the incremental cost of HAPWOC by the NNT. The benefits of the NNT and cost per NNT are its: ability to be easily understood, straightforward calculation, and it is less sensitive to event rates in the control group (saline). Modeling strategies followed recommended practices by the International Society of Pharmacoeconomics and Outcomes Research and the Society of Medical Decision Making (Roberts, 2012; Siebert, 2012). The model was developed using Treeage Software (Williamstown, MA). The base case results were verified through the development of identical model in Excel (Microsoft, Redmond, WA).

Parameter Estimates

The clinical and utilization data were obtained from a single-center prospective study previously published (Hiebert, 2016). All patients followed the same treatment protocol with the exception of the HAPWOC cohort, who received HAPWOC irrigation rather than saline. Wound complications were assessed at 1-, 7-, and 14-days post debridement. The presence of complication at any time was used to inform the overall complication rate for both cohorts. The incremental cost of HAPWOC was the only difference in utilization between cohorts. The cost of HAPWOC was the total cost of materials per the application of irrigation during the debridement procedure and provided by a manufacturer. Table 1 lists the key model inputs and their values used in the model.

Sensitivity Analysis

One-way deterministic and probabilistic sensitivity analyses were performed to gauge the reliability and robustness of the results of the ICER to changes in model input parameters. The one-way sensitivity analysis varied key model parameters one-by-one and recalculated the ICER each time. The probabilistic sensitivity analysis used a Monte-Carlo approach to recalculate the ICER over 10,000 simulated patient trials. All parameters were varied +/- 25% from the base case value to derive the sensitivity range.

Results

Table 2 reports the results of the CEA for HAPWOC versus saline irrigation. In the base case model, HAPWOC had an ICER of $90.85 per wound-related complication avoided. This means that compared to saline, one would be expected to spend $90.85 to avoid one additional wound-related complication with HAPWOC. The incremental expected cost was $49.97 and 55% decreased probability of a wound-related complication for the HAPWOC cohort. For any one patient, there would be an incremental cost of nearly $50 and a corresponding decreased probability of avoiding a wound-related complication of 55%. Another way to illustrate the cost-effectiveness was the NNT. The NNT to avoid one wound-related complication was two (Table 3) indicating that for every two patients treated with HAPWOC, one wound-related complication would be avoided. The cost per NNT was $99.94 which indicated that for less than $100 in additional expected treatment costs over two patients, one expensive wound-related complication will be avoided. One-way sensitivity analysis revealed the ICER to be most sensitive to the number of units of HAPWOC used during the debridement and the cost of HAPWOC (Figure 2). The probabilistic sensitivity analysis revealed that all 10,000 simulated patient trials fell below a willingness-to-pay threshold of $100 per wound-related complication avoided (Figure 3). Specifically, Figure 4 illustrates the cost at which HAPWOC becomes cost-effective ($90.85) relative to saline. This leads to the conclusion that assuming one is willing to pay $91 or more to avoid a single wound-related complication for a patient that matched the patients reported in this study, HAPWOC was the preferred irrigation modality.

Discussion

Assessing cost-effectiveness when effects are measured in natural units – complications avoided - requires an assessment of the willingness-to-pay to avoid one complication. Stated another way, was the expected cost of using HAPWOC less than the expected cost of a wound-related complication? A recent study of wound complications estimated the cost range between $366 for a minor venous wound complication to $7,308 for a diabetic foot ulcer complication. (Nussbaum, 2018) This is a conservative estimate as a full failure and necrosis of a pedicle flap is bound to cost much more. Therefore, the ICER of $90.85 found in this study would be considered highly cost-effective and was robust to sensitivity analysis at any cost of a complication below $300.

Using clinical data from Hiebert and Robson (2016), one can extrapolate the total expected savings of using HAPWOC. Among all 17 patients the total additional costs were $850 for HAPWOC. The total expected costs of wound-related complications conservatively ranged from $1,830 to $36,540. Thus, the total savings to the healthcare system would range from $980 to $35,690 if HAPWOC was used in conjunction with low-frequency ultrasound debridement for all 17 patients.

The use of cost-effectiveness analyses provides a common framework for comparing medical interventions for wound care. Healthcare decision makers have scarce resources and must maximize the outcomes gained relative to the costs incurred. This study adds to the growing body of literature indicating HAPWOC is a cost-effective and clinically beneficial adjunct for the treatment of complex wounds. (Ma, 2014; Niezgoda, 2010 Selkon, 2006; Wang 2007)

In the context of other wound care modalities, the use of HAPWOC appeared to be provide a better value for patients with serious and complex wounds. HAPWOC was found to have a favorable ICER compared to the use of enhanced nursing best practices to avoid wound-related issues (HAPWOC ICER $91 vs. Enhanced Nursing ICER of $2,142). (Padula, 2019) Becaplermin gel was found to have an ICER of $298 per pressure injury avoided. (Gilligan, 2018) Whereas, the use of digital subtraction angiography for all diabetic-foot ulcers had an ICER of $75,824. (Barshes, 2016)

Limitations

This study has several limitations that must be noted. First, the results are based on a small study of complex wound patients seeking treatment at a single center. As such the results may not be generalizable to other wound care centers following different treatment protocols. Second, the clinical study used a broad definition of wound-related complication, ranging from minor to major. A conservative approach to assessing the cost-effectiveness was employed to mitigate this limitation. If the composition of complications were more likely to be major the results of this study would be stronger for HAPWOC. Third, clinical study used in this analysis only followed patients for 14 days with respect to any wound-related complication. Despite these limitations, these results provide insight into the type of irrigation used during a mechanical debridement procedure for complex wounds. A relatively minor cost of adding HAPWOC was shown to provide substantial value with respect to avoiding the high probability of an expensive wound-related complication when using saline for irrigation.

Conclusion

HAPWOC was expected to be a cost-effective strategy for the treatment of complex wounds during low-frequency ultrasonic mechanical debridement. Assuming a willingness-to-pay of $100 or more to avoid a wound-related complication, HAPWOC was the preferred irrigation modality in the treatment of complex wounds that were closed definitively using wound bed preparation techniques to allow the surgical closure to be adopted. Estimated healthcare system savings among the 17 patients ranged from $980 to $35,690. The adoption of HAPWOC should be considered a value-added adjunct to low-frequency ultrasound debridement of complex wounds.

Table 1. Model Parameters

	Base	Low	High	Distribution	Reference
HAPWOC Cost/Unit	$50	$37.50	$62.50	Gamma	Urgo Medical, Inc.
HAPWOC Units/procedure	1	1	3	Uniform	Urgo Medical, Inc.
Complications					
HAPWOC	25%	18.75%	31.25%	Beta	Hiebert, 2016
Saline	80%	60.00%	100.00%	Beta	Hiebert, 2016

Table 2. CEA Model Results

	Cost	Inc. Cost	Effect	Inc. Effect	ICER
Saline	$0.00	-	0.20	-	-
HAPWOC	$49.97	$49.97	0.75	0.55	$90.85

The incremental cost-effectiveness ratio (ICER) represents the cost to avoid one-wound related complication using HAPWOC.

Figure 1. Model Diagram

The model diagram illustrates the decision of using HAPWOC or Saline as the irrigation modality with low-frequency ultrasonic debridement of a complex wound.

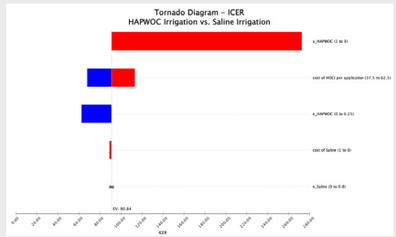
Table 3. NTT Results

	Cost
NNT	2
Cost per NNT	$99.94

The NNT is rounded up to the nearest whole number to reflect actual patients needed to treat to avoid one wound-related complication. The cost per NNT reflects the expected costs to avoid one wound-related complications.

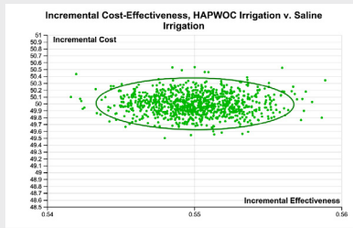
Tables and Figures

Figure 2. Tornado Diagram of One-Way Sensitivity Results



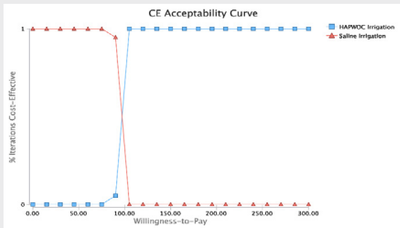
The tornado diagram is a visual representation of the one-way sensitivity analysis. The one-way sensitivity analysis assessed which model parameters were most important to the incremental cost-effectiveness (ICER) results. Shown, here the additional use of HAPWOC influenced the ICER the most.

Figure 3. Probabilistic Sensitivity Results



The scatter plot shows the results of 10,000 simulated patients. Parameter values were randomly assigned based upon the data contained in Table 1 to calculate the incremental cost and effectiveness of using HAPWOC.

Figure 4. Cost-Effectiveness Acceptability Curve



The acceptability curve shows the point at which HAPWOC becomes the preferred strategy ($90.85) based on the willingness-to-pay amount to avoid one wound-related complication. Assuming a wound-related complication costs $91 or more, HAPWOC would be the cost-effective irrigation adjunct for low-frequency ultrasound debridement.

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Efficacy & tolerance of a TLC-NOSF dressing in the local management of pressure ulcers: Results of a clinical study

Dr. Sylvie Meaume (Hôpital Rotshild, Paris), **Dr. Philippe Léger** (Clinique Pasteur, Toulouse), **Dr. Valérie Rethore** (CH, Lagny sur Marne), **Dr. Hervé Noury** (Centre Hélio-Marin, Berk sur Mer), **Dr. Serge Bohbot** (Laboratoires URGO)

INTRODUCTION

Numerous factors may contribute to the chronicity of pressure ulcers (PUs): cellular and systemic effects of aging, repeated ischemia–reperfusion injuries, local excess of Matrix Metalloproteinases (MMPs)[1]. Nano-Oligosaccharide Factor (NOSF, sucrose octasulfate) containing dressings or TLC-NOSF dressings are widely used in the management of chronic wounds, such as diabetic foot ulcers and leg ulcers. This dressing has been demonstrated through different RCTs and confirmed in current practice in large observational studies.[2,3,4]

AIM

The objective of this study was to assess the efficacy and tolerance of a TLC-NOSF impregnated dressing in the local management of pressure ulcers.

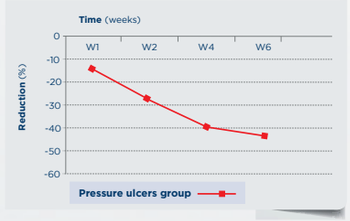
METHODS

This work presents the results of a prospective multicenter clinical trial. Inpatients or outpatients with a stage 3 PU, according to the EPUAP classification, and a wound area ranging from 3 to 50 cm2, without any dark necrosis plaque or local infection, were eligible to inclusion and treated with the evaluated dressing during a six-week period. Every week, clinical and planimetric evaluations were completed and photos of the wound were taken. The primary outcome was the Relative Wound Area Reduction (RWAR) at Week 6. Main secondary outcomes included wound closure rate, acceptability (ease of application and removal, conformability, pain at dressing change, odor and exudate management), and tolerance with occurrence of adverse events.

Population at inclusion: baseline caracteristics

	Study group (n=25)
Male	20 (80%)
Age (years) [min;max]	55.9317.4 [34;94]
BMI (kg/m²) [min;max]	22.634.4 [14.5;31.6]
Wound duration (months) [min;max]	2.532.4 [0.2;10.8]
Wound area (cm²) [min;max]	6.4135.65 [0.68;25.02]
Wound area covered by slough (%) [min;max]	22.4 3 20.4 [0 ; 80]

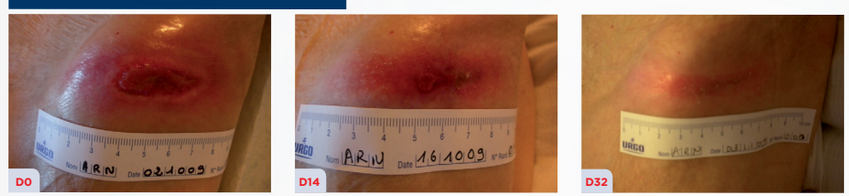
RWAR of pressure ulcers treated with TLC-NOSF dressing



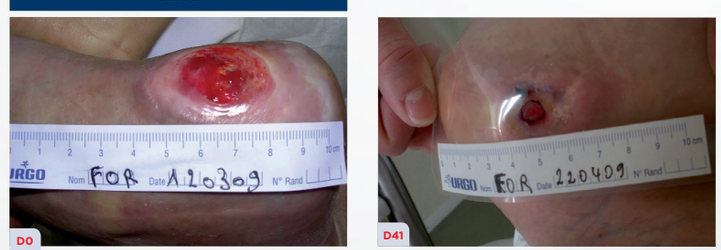
RESULTS

A total of 25 patients (age range: 24 to 84 years, 80% of male) have been included with pressure ulcers mainly located on sacral area (40%) and heel (28%). At baseline, the mean wound duration was 2.5 3 2.4 months and the mean wound area was 6.4 3 5.7 cm². By week six, the Relative Wound Area Reduction was 45.8% (median value). Complete healing occurred in 3 patients after a mean treatment time of 27 3 6 days and a dressing change every 2.4 days. An improvement of perilesional skin (94% healthy versus 67% at baseline) and a very good acceptability of the evaluated dressing were reported by healthcare professionals. Two local adverse events occurred under the tested dressing (hypergranulation). These two local adverse events triggered a pause of respectively 3 & 6 days in the treatment with TLC-NOSF dressing.

Case 1



Case 2



CONCLUSION

TLC-NOSF dressings seem to be very promising option for the local management of pressure ulcers, chronic wounds known to be of poor healing.

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Information Communication Technology Tools Utilized in Diabetic Foot Ulcers Prevention Programs: A Scoping Review

Helen N. Obilor, MSc. (Nursing), RN, PhD Candidate; Meshack Achore, MSc., PhD Candidate; Kevin Woo, PhD

Queen's University, Kingston, Ontario, Canada

Introduction

Globally, diabetic foot ulcers (DFUs) are severe complications of diabetes linked to excess disability and morbidity. Information communication tools (ICTs) have the potential to facilitate patient education and improve health outcomes (1). There is extensive evidence on the integration of ICT tools in most diabetes self-management education and support program components except for foot care (2). This review aimed to summarize existing evidence in the literature on how ICT tools have been utilized in health interventions to engage persons with diabetes in preventing DFUs.

Methods

This scoping review followed the six-stage methodological framework proposed by Arksey and O'Malley to map, review, and synthesize existing evidence (Figure 1).

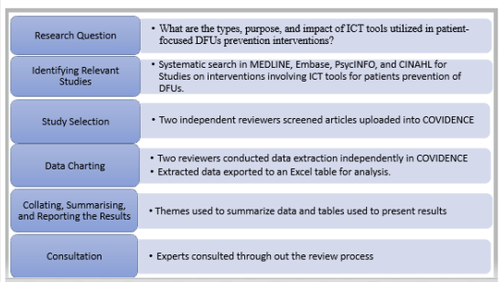

Figure 1: The Review steps based on Arksey and O'Malley's Scoping Review Framework

Results

The database search yielded a total of 312 citations that were screened and 17 articles with 1856 persons with diabetes and varied DFUs risk level in 9 countries (mostly the USA) included in the final review.

The intervention evaluated in the included studies were patient education, multidimensional foot health program, remote temperature monitoring and pressure-sensitive insole system.

A total of eleven ICT tools were utilized in the included studies to engage patients in the prevention of DFUs with phone and video as the most utilized devices (Figure 2).

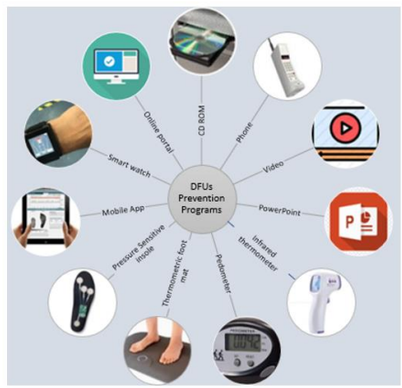

Fig 2: ICT TOOLS USED TO PROMOTE PATIENTS' ENGAGEMENT IN PREVENTION OF DFUs

The specific reasons for the ICT tools in the included studies were the presentation of educational information, follow-up reinforcement of patient education, patient counselling, self-monitoring, remote patient monitoring, self-care reminder, problem-solving, motivation, and communication.

Table 1: Assessed Diabetes Foot Care Outcomes and Intervention Effect Reported in the Included Studies

Lead author (year)	DFUs' Incidence	Foot Self-care behaviour	Foot Self-care Knowledge	Foot Self-care Efficacy	Foot skin conditions	Toenail conditions	Peripheral neuropathy	Peripheral Vasculopathy	Wearing Ideal footwear	Idea socks' Choice	Insole Adherence	Footcare information Recall
Abbott (2019)	■										□	
Adaramouch (2017)		■										
Banks (2020)												
Chen (2011)		■					■	■				
Fan (2013)					■	■						
Fan (2014)		■	■	■								
Fan (2014)									■	■		
Grady (2011)		■										
Gravely (2011)												□
Hassan (2017)		□	□									
Killeen (2020)												
Lavery (2007)	■											
Moradi (2019)		■	■									
Najafi (2017)	□										□	
Nguyen (2019)		■			□							
Ogrin, (2018)												
Woodbury (2013)		□	□									

NB: ■ = Outcome improved and statistically significant □ = Outcome improved but not statistically significant
□ = Outcome improvement could not be determined because of the study design

The included studies assessed varied diabetic foot care-related outcomes (Table 1), and 59% of the studies reported a significant improvement in patient outcomes.

Conclusions

This review provided an insight into the various types, purposes, and impacts of ICT tools used in patients' DFUs prevention programs.

The finding suggests that interventions involving one or more ICT tools are mostly associated with a reduction in recurrence of DFUs, improvement in self-care behaviour/cognition, and reduction of risk factors.

None of the reviewed studies utilized ICT tools such as email, interactive voice response systems, and social media that are currently prevalent for social interaction.

Most of the included studies were not designed to examine the direct impact of ICT tools on diabetic foot care-related outcomes and therefore caution the generalization of this review findings.

Therefore, future research studies should investigate the direct impact of the identified ICT tools on diabetic foot care-related outcomes and explore the feasibility of others not yet studied particularly social media.

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Acknowledgments

We appreciate Sandra Halliday and Dr. Christina Godfrey for their contributions.

Successful Limb Salvage Combining Revascularization Surgery with an Advanced Acellular Dermal Matrix (ADM) in Treating Multiple Non-Healing Diabetic Foot Ulcers

DALHOUSIE UNIVERSITY
FACULTY OF MEDICINE
FACULTY OF ENGINEERING
School of Biomedical Engineering

Humber River Hospital

Asem Saleh[1,2] and Paul F. Gratzer [3,4]

[1]Humber River Hospital, [2]North Toronto Vascular, [3]School of Biomedical Engineering, Dalhousie University, [4]Dept. of Surgery, Dalhousie University

Introduction

- The number of diabetics is projected to reach 439 million by 2030 or approximately 10% of the world's adult population.[1]
- Up to 25% of diabetics are expected to have non-healing foot ulcers with the success rate for wound closure with standard of care ranging from 35-50% and taking an average 8 - 9.5 weeks.[2,3]
- 85% of lower extremity amputations are preceded by a diabetic foot ulcer (DFU)[1,2] equating to a limb being amputated somewhere in the world every 20 seconds.[3,4]
- In Canada, the annual cost for treating non-healing DFU's is $500 million.[5]
- In addition to the economic burden of non-healing DFU's leading to amputation, few diseases have a higher mortality rate reaching 30 - 50% after 2 years.[6]
- Over 65% of diabetic foot ulcers have an ischemic component, making vascular surgery an essential component to limb preservation.[7]
- **Even with re-vascularization and best standard wound care practices, significant challenges remain in healing DFU's and avoiding amputations.**

Aim

- We report on a case of a diabetic patient with multiple non-healing necrotic lesions on both feet.
- Aggressive standard treatments and surgeries were performed without success.
- A combination of revascularization and a Canadian developed advanced Acellular Dermal Matrix (ADM) was then used on the right foot to try to save the limb.

Methods

- A 75 year old male, Insulin dependent diabetic (over 10 years) initially presented with multiple necrotic ulcers to both his feet.
- *Right foot:* 1st digit medial, lateral foot at base of 5th toe, and heel ulceration (all dry gangrene). *Left foot:* 1st digit toe, and two on the 4th digit. Extensive vascular disease required a bypass to the posterior tibial artery that eventually failed and a posterior pedal loop reconstruction was performed. Unfortunately, the left foot was subsequently amputated due to severe infection.
- The right foot stopped healing and surgery was performed to re-open the pedal loop. The patient was also sent for hyperbaric oxygen therapy (HBOT). Very slow healing and periods of regression occurred over the next 8 months. Vessel re-occlusion and re-opening occurred a total of 4 times. Wounds persisted along with recurrent superficial infections. After a final repair of the bypass artery, the three ulcers present received an application of a Canadian advanced ADM (decellularized human dermis) material (Figure 1).
- Following standard of care procedures, each wound was debrided to provide a bleeding wound bed. A piece of ADM was applied by sizing to approximately 2-3 mm past the margins of the ulcer with the dermal side in contact with the wound bed.
- A non-adherent dressing (e.g. Mepilex) was used to cover the graft, followed by dry gauze or retentive dressing.

Results

- After application of the ADM graft, the patient was instructed to offload the foot and was seen weekly for follow-up and wound dressing changes.
- After 1 week, all ulcers had good uptake and integration of the ADM graft. (Figures 2,3,4).
- The heal ulcer was found to close after 10 days (Figure 2) and the lateral ulcer closed after 3 weeks post-treatment (Figure 3). The medial ulcer slowly healed and then presented with a necrotic central area. After debridement, a second ADM graft was applied and the ulcer closed 4 weeks later (Figure 4).

Figure 1

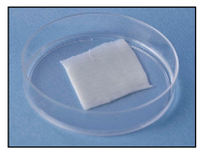
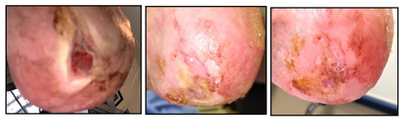
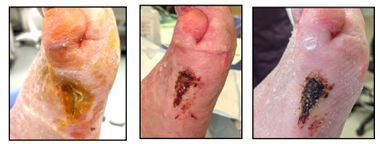


Figure 2



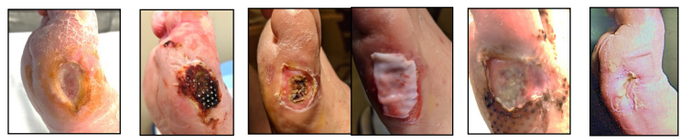
Treatment Day 1 week 2 weeks

Figure 3



Treatment Day 1 week 4 weeks

Figure 4



Treatment Day 1 week 3 weeks 4 weeks 28 weeks

Clinical Significance

- This difficult case illustrates that providing adequate blood flow to a limb in combination with offloading, debridement and HBOT may not be enough to promote healing.
- The use of this new ADM graft to treat non-healing ulcers may help to provide the missing elements required to promote successful DFU healing.

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Acknowledgements

Materials for the study were supplied by DeCell Technologies Inc.

Use of Standardized Treatment Protocols in Promoting Timely Management of Pressure Injuries

Joshua Moralejo, RN, BScN, MScCH: WPC, IIWCC-CAN

Background

During September-December 2019, about 373 referrals were received requesting initial and follow-up wound assessments (Humber River Hospital, 2019). Consults involve a formal wound assessment, patient and family discussion, treatment consideration and staff education. A consult may take about 30 minutes to complete or longer if extensive wounds or complex Negative Pressure Wound Therapy application is involved. Therefore, there can be potential delays in completing consults if an influx of referrals occurs. As per Figure 1, about 9% of the patient referrals received (n=34) were discharged before a wound consult was conducted.

Delays in wound consults can result in:
- Inappropriate and inconsistent local wound treatment which can impact wound outcomes and potentially affect length-of-stay (LOS); and/or
- Lack of updated discharge plans for wound management which can increase re-admission rates due to worsened wounds in the community.

Therefore, there is a need to have an interim process to support nurses in timely addressing the local wound needs of patients particularly involving Pressure Injuries which represented majority of the referrals (43%).

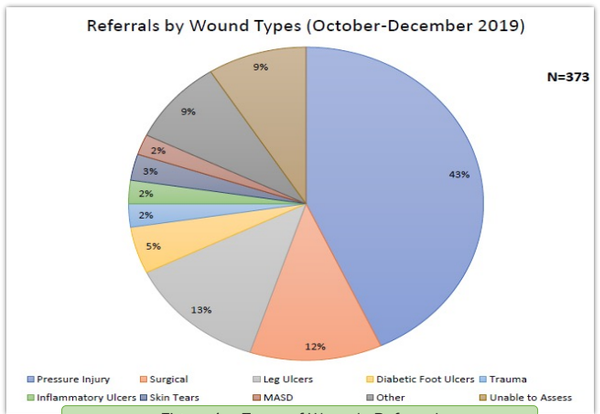


Figure 1 – Types of Wounds Referred

Aim

To establish a process that will support timely treatment of pressure injuries among patients with pending wound referrals. The goal has three main objectives:
- to enhance nursing knowledge on Pressure Injury Staging and Assessment,
- to develop evidence-based protocols, and
- to update relevant hospital policies, procedures and guidelines.

Procedure

The "Knowledge-to-Action" Framework was used to facilitate the planning and implementation of the project objectives (*Figure 2*). The *Knowledge Creation* component of the framework enabled the appraisal of the literature resulting in the development of the Pressure Injury Protocols (*Figure 3*). Various stakeholders (*including Plastic Surgeons & Frontline Nurses*) were engaged to provide their perspective of the established local treatment protocols (*Figure 4*).

Figure 2 – Knowledge-to-Action Cycle (Graham et al., 2006)

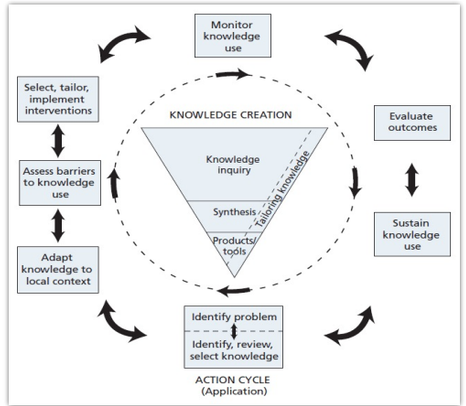
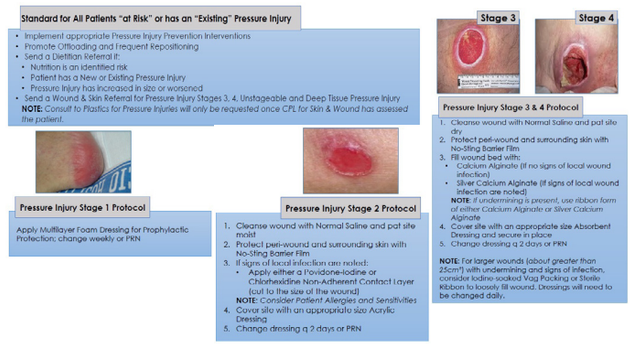


Figure 3 – Sample of the Pressure Injury Protocols



The *Knowledge Application* component of the framework enabled the identification of key implementation milestones (Figure 4). The standardized protocols were implemented in the Emergency Department, Adult Inpatient Medical/Surgical Units and the Reactivation Care Centres.

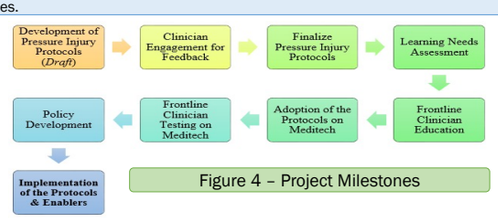
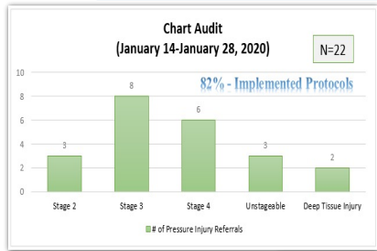
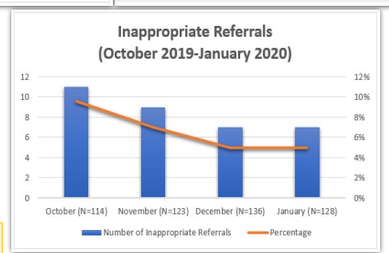


Figure 4 – Project Milestones

Results

Post-implementation of the standardized Pressure Injury Protocols and its associated strategies for practice change resulted in favourable outcomes. A random chart review of 22 medical/surgical patients indicated that 82% (18 of 22) have an appropriate Pressure Injury treatment in place prior to a formal consult by the Wound and Skin Clinician. Post-education learning needs assessment also indicated a 28.6% improvement in staff knowledge. A steady reduction in the number of inappropriate referrals was also noted. In particular, referrals to the Plastic Surgeons were streamlined by the implemented process mitigating inappropriate consultation to the service.





Implications

- Leveraging the use of standardized treatment protocols and supporting staff knowledge in wound assessment and management can minimize inadvertent delays in local wound treatment.
- The use of the "*Knowledge-to-Action Cycle*" provides an excellent framework for the adoption and integration of theoretical knowledge into clinical practice.
- Embedding protocols and clinical guidelines within Electronic Health Record Solutions can support accessibility and frontline clinical decision-making at the point-of-care.

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Maskwiomin: Re-discovery and Study of a Traditional Mi'kmaq Skin Remedy made from Birch Bark

Tuma Young[a], Audrey Walsh[b], Claudette Taylor[b], Raj Kalia[c], Matthias Bierenstiel*[,c]

[a]Department of Lnu, Social and Political Sciene, [b]Department of Nursing, [c]Department of Chemistry

Cape Breton University, Sydney, Nova Scotia, B1P 6L2, matthias_bierenstiel@cbu.ca

Background

Maskwiomin (maskwi = birch bark, omin = oil) is a traditional skin remedy by the L'nu people that serves as treatment for skin conditions. Bierenstiel and Young have worked with the Indigenous community of Membertou First Nation, Sydney, Nova Scotia for 8 years and re-discovered maskwiomin through recreation, stories, and empirical chemical research. The traditional can-over-can method in a campfire produces small amounts of the birch bark extract. A large can containing birch bark is exposed to heat from a wood fire that produces the viscous extract that drips through a hole in the bottom to a receptacle can. There is a high degree of variability as the fire conditions are difficult to reproduce.

Elder Danny Paul and *Matthias Bierenstiel* preparing birch bark-oil in a tradition way. campfire. The larger can (3.5 L) holding the birch bark is above a smaller receptacle can (0.5 L) that obtains the extract (not shown).

One of the stories that started this project, told by only two Elders of which one has since passed.

Anecdotal Story from 1920's in Cape Breton, Nova Scotia:

A new mother who had just started to breastfeed had a terrible, excessive eczema outbreak under her breasts and on her arms only shortly after giving birth, and therefore not able to feed her new born baby. The L'nu midwife then applied birch bark-oil on her skin for 2 days, and the eczema flare-up disappeared, allowing her to feed the newborn and ensure their survival.

How can we Solve the Problem of Reproducibility?

- Solution: Extractor unit developed that mimics campfire extraction process (commercial scale-up possibility)
- Extraction is improved for better yield and fewer side products.

Methodology

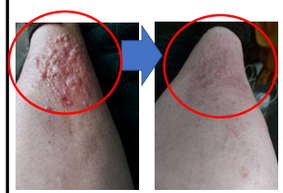
Synthesis of extract:

- Experimental series of extraction conditions

Bark extract analysis:

- GC-MS, UPLC-MS, FTIR, NMR
- Mass balance
- Biomedical testing (antibiotic, etc.)

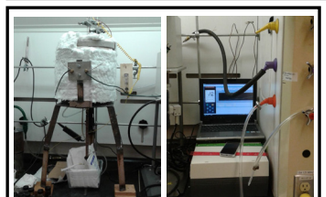
Anecdotal evidence /customer feedback:



Customer feedback: Blistering skin issue on back of calf **after 24 h** by applying birch bark extract cream twice.

- "Matthias! Have to tell you that I'm OBSESSED with maskwiomin. My eczema is basically gone and I haven't had to use my Rx cream (so no flare ups) since I bought the cream. Amazing. I also gave the sample to my Mum and she also loves it/has helped with some skin ailments in her house."
- "I ordered your products for my father, [..]. My dad has been made miserable by a flare-up of a skin rash/irritation and couldn't find any relief, which has been causing him a lot of sleepless nights. I spoke to him tonight to see if he's been using the cream and he loves it! He says it's the first time since he's had this condition that he has been able to rest, as the cream has helped better than anything else he has tried."
- "I just had to let you know that [my daughter] used the cream...lemongrass scent, on her arms last night. She has some keratosis pilaris on the back of each arm. She's had it since at least jr. high school, maybe longer. She was over this evening and I was AMAZED at how smooth and soft the skin now is. And that's just after one day!"
- **Selected other feedback with relief in 24 h to 48 h:** Acne outbreak, skin issue with diabetic foot under control after 5 days, poison ivy, psoriasis on scalp, burned hand with iron, blisters on toes, cracked skin on hands, itchy skin under new watch

Birch bark extract (maskwiomin) is a topical skin ointment that acts as a broadband spectrum antibiotic with the potential for much, much more…



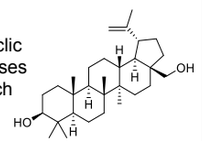
Laboratory-scale birch bark extractor with computer-assisted controls to mimic and enhance the traditional camfire method.

This CIHR funded project is in its **early stages**. We have received REB and Membertou Ethics Watch approval for collections of maskwiomin stories for qualitative screening of indications of the extract.

We believe that the birch bark extract is comparable to pine tar (*Australas J Dermatol.* **2017**, *58*(2): 80–85. (DOI: 10.1111/ajd.12427) which has **antibiotic, anti-inflammatory, analgesic, anti-itch** properties. Our extraction process is controlled and mild, and thus we believe we also do not generate carcinogenic compounds, which we have so far not found. Our bark extract is a complex mixture of over 200 compounds and we believe that this mixture makes the extract so effective for skin conditions. Our team lacking skin research specialists to bring our project to the next level. If you are interested to assist us, please contact: Matthias_Bierenstiel@cbu.ca

Hypothesis: Active Ingredient(s) in Birch Bark Extract are Derivatives of Betulin

- Betulin is a secondary metabolite, a pentacyclic terpenoid, and comprises approx. 25 wt% of birch bark.
- It has many important properties, including antibacterial, anti-cancer, anti-inflammatory, and antimicrobial properties.



The chemical structure of betulin.

Etuaptmumk, or 2-Eyed Seeing method

This project equally balances Indigenous knowledge and science, and involves working **with** the community. **Awakening of the Knowledge** is a pillar of the project to protect the stories and knowledge from loss by teaching the community the traditional methods. Science is assisting to understand the extract. Only careful analysis of stories allowed the development of lab-scale extractor. We believe that the divergent approach (holistic) with multi compounds in the extract brings the skin benefits as it contains compounds that are anti-inflammatory, anti-itch, analgesic, antibiotic – rather than just **one single chemical compound.**

Conflict of Interest Statement

As the co-founders, Bierenstiel and Young hold a financial stake in Maskwiomin company. They are working with Membertou First Nation as part of the ethical commercialization vision. The company is selling birch bark extract products (creams, ointment & soaps) since late 2020 as skincare cosmetics that a registered by Health Canada. Products are available locally by retailers and online at www.maskwiomin.myshopify.com

Acknowledgements

Funding for the project was provided and supported by:

- Cape Breton University
- Canadian Instituted of Health Research (Project Grant)
- Natural Sciences and Engineering Research Council of Canada (USRA)
- Collaborators in community and research collaborators at Dalhousie University
- Community of Membertou First Nation, Sydney, Nova Scotia

Saving Lower-Limbs: Introducing a New Vascular Wounds Pathway

Lynn Scholey[1] RKin, MSc, **Mike Setterfield**[1] MSc, **Christine Murphy**[2] PhD, RN, WOCC(C), **Ahmed Kayssi**[3] MD, MSc, MPH, FRCSC, CWSP
[1]CorHealth Ontario, Toronto, Ontario; [2]The Ottawa Hospital, Ottawa, Ontario; [3]Division of Vascular Surgery, University of Toronto, Toronto, Ontario

Aim

Vascular wounds can result in serious complications, including ongoing infection, amputation and death.[1] Best-practice evidence exists for the prevention and management of vascular wounds, albeit awareness is not yet widespread.[1,2] To increase awareness and as the foundation for a provincial Lower-Limb Preservation Strategy[3], CorHealth Ontario's Lower-Limb Preservation Advisory Committee collaborated with Wounds Canada to develop a practical system-level pathway for preventing and managing vascular wounds.

Procedure/Method

The development process involved:
- Review of existing provincial, national and international vascular wound guidelines, standards and best-practice recommendations
- An iterative process to develop Pathway content with Ontario vascular and wound experts
- A collaborative review and design process with Wounds Canada
- Endorsement of the Pathway by the Lower-Limb Preservation Advisory Committee and Wounds Canada experts

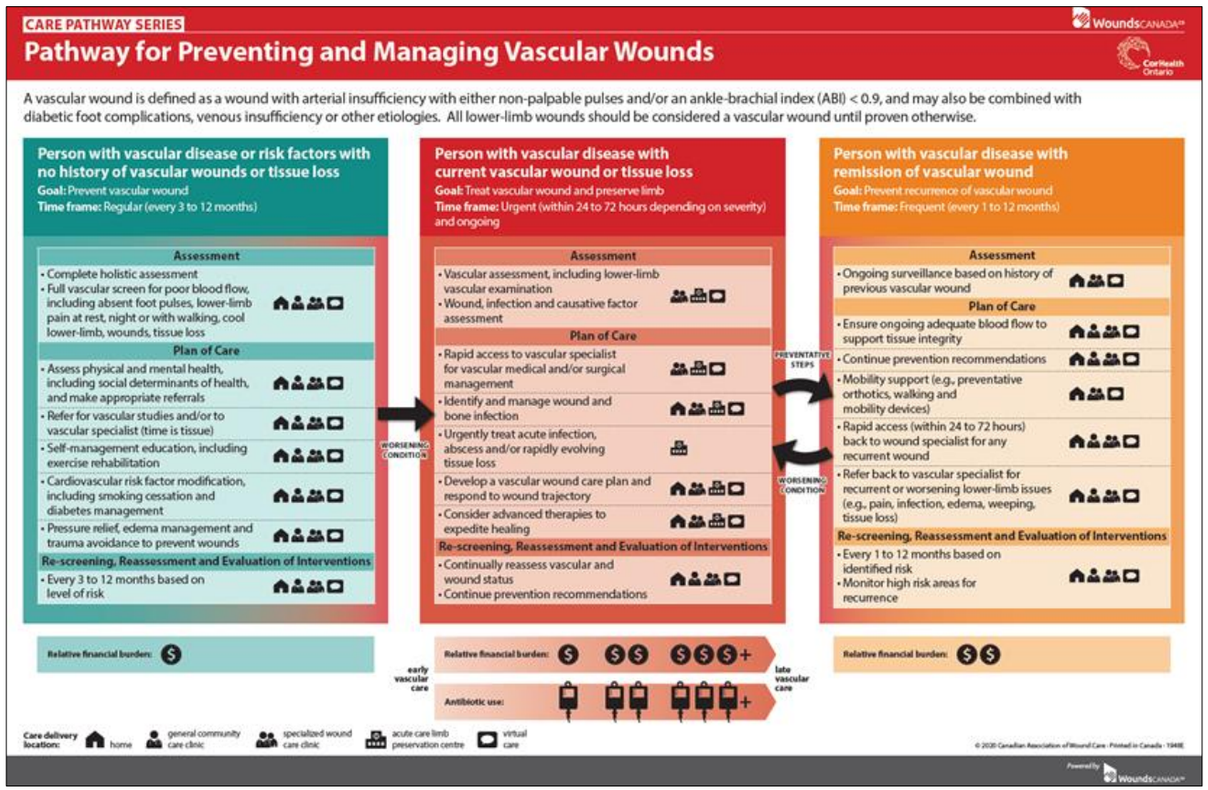
Findings/Results

The Pathway for Preventing and Managing Vascular Wounds is aligned with the Wounds Canada Best Practice Recommendations for the Prevention and Management of Peripheral Arterial Ulcers[1]. The Pathway highlights key care activities for evidence-informed best-practice vascular wound prevention and management in a practical one-page infographic. It defines a vascular wound and highlights the importance that every lower-limb wound should be considered a vascular wound until proven otherwise. The Pathway emphasizes the importance of regular preventative screening, patient education, early identification, timely assessment and best-practice treatment of a vascular wound (time is tissue).

For patients with vascular disease and/or risk factors, including diabetes, with no history of a vascular wound or tissue loss, key messages include:
- Regular vascular screening for poor blood flow (e.g., palpation of lower-limb pulses) and timely vascular assessment and referral to a vascular specialist as required
- A focus on prevention, including risk factor management, to minimize health care costs and maximize individual outcomes
- Self-management education for patients and families

For patients with vascular disease with a current vascular wound or tissue loss, key messages include:
- Urgent (within 24 to 72 hours depending on severity) access to a vascular and/or other lower-limb preservation specialist for medical and/or surgical management (time is tissue)
- Referral to a credentialled wound specialist for wound treatment and management
- Continuous reassessment of vascular and wound status

For patients with vascular disease with remission of a vascular wound, key messages include:
- Ongoing and frequent surveillance and monitoring of areas at high risk of recurrence
- Rapid access (within 24 to 72 hours) to a credentialled wound specialist for any recurrent wound
- Early referral back to a vascular and/or other lower-limb preservation specialist for recurrent or worsening lower-limb issues
- Continued risk factor management and prevention including mobility support, pressure relief and trauma avoidance



Implications/Applications

The Pathway provides a roadmap for use by lower-limb preservation organizations, administrators, and champions to inform and guide the development and delivery of vascular wound care services. When utilized, the Pathway, together with the Wounds Canada Best Practice Recommendations for the Prevention and Management of Peripheral Arterial Ulcers[1], provide guidance to optimize the delivery of best-practice vascular wound care, reduce health care costs and increase opportunities for desirable patient outcomes including reducing avoidable major lower-limb amputations.

Acknowledgements

CorHealth would like to gratefully acknowledge the contributions of the Ontario Lower-Limb Preservation Advisory Committee and Working Group who provided their valuable expertise and input, and the collaboration with Wounds Canada, to guide the development of this Pathway for Preventing and Managing Vascular Wounds.

For additional information, please visit
www.corhealthontario.ca
or contact: Mike Setterfield, Senior Strategist (Vascular), Mike.Setterfield@corhealthontario.ca

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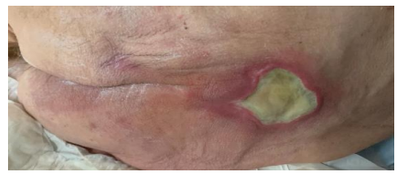
West Lincoln Memorial Hospital
HAMILTON HEALTH SCIENCES

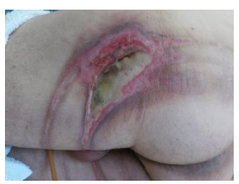
Sharing Success: Pressure Injury Prevalence and Incidence Reduction after Renewed Focus with Interdisciplinary Team

Stephanie Furtado[1 2 3 4 5], Rebecca Dyck[1 2 3], Debbie Mings[6 7 8 9]
[1]RN, [2]MClSc-WH, [3]BScN, [4]WOCC (C), [5]NSWOC, [6]IIWCC, [7]NP, [8]MHSc, [9]GNC(C)



INTRODUCTION

- Pressure injuries continue to be a challenge in all health care settings. The reduction of facility-acquired pressure injuries has become a priority across Canada in recent years. The Canadian national average prevalence of pressure injuries in health care settings is 26% (LeBlanc et al., 2019). It is critical for all health care settings to reduce pressure injuries, and prevalence and incidence (P&I) studies must be done to measure both the starting point and the trend over time.
- West Lincoln Memorial Hospital (WLMH) is a 55-bed community hospital in southern Ontario. It was founded in 1946, and joined the larger system of Hamilton Health Sciences (HHS) in 2014. At that time, it was identified that there was no wound nurse on site. In 2016, the site introduced the support of a Nurse Specialized in Wound Ostomy and Continence (NSWOC). WLMH already had an occupational therapist (OT), physical therapist (PT), and registered dietician (RD) on staff.

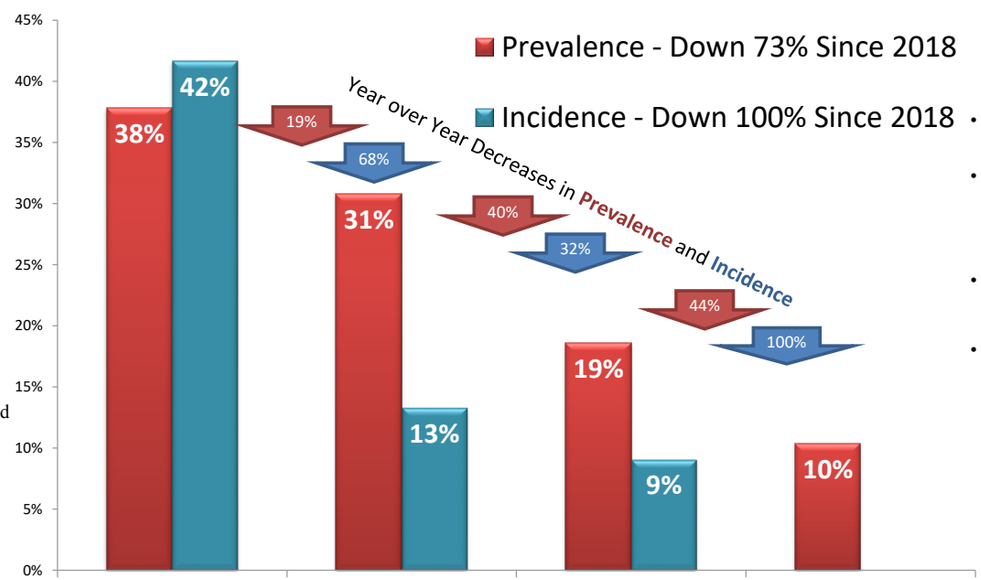


BACKGROUND AND METHODS

- P & I studies represent a point in time where data are collected to look at the trends over time. The occurrence of pressure injuries is being used as a quality of care indicator and as a strategy to review the effectiveness of the pressure injury prevention initiatives in place.
- Our ethics board determined that this study was exempt from requirements for individual written consent, as they are classified as quality improvement.
- For the prevalence study, a team of staff, including NSWOCs, examined every admitted patient on the study date for the presence of any pressure injury or deep tissue pressure injury. The staff then check the patient chart to determine whether the pressure injury was acquired in the facility or prior to admission.
- For the incidence study, which took place one week after the prevalence study, the team of staff re-assessed all patients from the previous week who were still admitted and did not already have a pressure injury.
- The initial P&I studies revealed a pressure injury prevalence of 56% with a one-week incidence of 40%. This far exceeded the Canadian average. The alarming data led to an increase in the frequency of P&I studies from biannually to annually, and the initiation of multiple collaborations and interventions to address the issue.

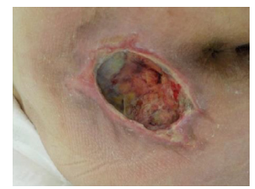
CHANGES TO PRACTICE AND RESULTS

- An interdisciplinary team formed in 2017/2018, including the NSWOC, OT, PT, manager, RD, and charge nurse.
- Education sessions began for staff nurses in the form of lunch-and-learns and teaching at the bedside.
- The NSWOC created education tools for staff in binders, and posters for the supply and medication rooms. After discussions with the OT, PT, charge nurses and management, we increased access to resources such as specialty mattresses, offloading devices and increased consults for the wider team to support patients who had pressure injuries.
- In 2019, our prevalence started to decline to 31% and incidence 13%.
- The NSWOC started to hold off site dinner teaching sessions for nurses. Allied health team members started to attend conferences, offsite educational events and connect with team members at other HHS hospitals.
- In 2020, our number dropped again to 19% and 9%.
- The medical director for WLMH started to hold meetings for nursing, management and allied health to discuss pressure injury prevention . We created a formalized pressure injury care plan and order set. The WLMH nurse educator led teaching with ward, ER, and ICU staff on the new order set. The medical director held a teaching sessions for physicians.
- Our most recent assessment showed a prevalence of 10% and incidence of 0%



ALLIED HEALTH TEAM ROLES

- The OT focus is to prevent pressure and shearing where possible. This is done with the recommendation of pressure- and shear-relieving interventions such as cushions, mattresses, appropriate lifters, promoting regular bed turning/offloading schedule as well as providing education regarding pressure redistribution techniques to staff.
- The RD focus is to develop and implement individualized nutrition care plans to ensure adequate daily caloric and protein requirements, addition of wound healing specific vitamin and mineral recommendations, along with adequate hydration status to ensure an optimal environment for wound healing.
- The PT focus is to promote and ensure ongoing mobility and ambulation.



DISCUSSION

- Since 2018, our team efforts have decreased our prevalence by 73% and our incidence by 100%
- While P&I assessments are just a snapshot in time, these results show a consistent trend over the past 3 years towards reduced pressure injuries after increased team-based interventions and full senior management support.

CONCLUSION

- The nursing and Allied Health team at WLMH remain committed to pressure injury prevention and management. Each member of the team brings a unique and complimentary role to the management plan.
- This work shows how with focused team-based interventions and administrative support, significant progress can be made to reduce pressure injuries.

REFERENCE

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Acknowledgements: Daniela Zagrodzki, Dawn Van Engelen, Andria Sanders, Mike Cass

Email questions to furtast@hhsc.ca

Photos used are of patients seen at WLMH by SF. Written consent provided for photo use

Poster #0041
WoundsCANADA
2021 National Conference

Hypervalent Complexes in Wound Infection and Healing

Carla Jehan Spina[a*], Vida Maksimoska[b], Carlie Goodall[c], Johanny Notarandrea-Alfonzo[a], Cezar Khursigara[c], Katalin Szaszi[b], Rod Precht[a]

[a] Exciton Pharma Corp, Toronto, ON, M5G 1L7
[b] University of Toronto, Keenan Research Institute, Toronto, ON, M5B 1W8
[c] University of Guelph, Guelph, ON, N1G 2W1

INTRODUCTION

Wound healing is a complex process, further complicated by infection. In recent years, hypervalent silver containing Ag(II) and Ag(III), have gained interest as topical antimicrobial agents due to their exceptional safety profile and potent planktonic and biofilm efficacy[1-3]. Iodine has also been recognized for its antimicrobial and antiviral properties for over 170 years[4,5]. Similar to silver, iodine has multiple oxidation states, in addition to a multitude of oxyiodides ranging in oxidation state from I(-I) to I(V), with low propensity for acquired resistance[5-7]. Although largely unexplored, it is theorized that the combination of these two elements to produce a ternary agent would have the potential to minimize resistance and enhance antimicrobial efficacy inclusive of antibiotic resistant pathogens.

AIM

This study investigates *in-vitro* antibacterial efficacy and mammalian epidermal cytotoxic response to a dual hypervalent chelate complex, tribasic silver bisperiodate (K_3AgBP) containing both silver Ag(III) and iodine I(VII) in hypervalent states. The efficacy of K_3AgBP against *S. aureus* biofilm and methicillin-resistant *S. aureus* (USA-300, MRSA), a serious pathogenic threat as defined by the Centre for Disease Control and Prevention, was determined. In addition, the propensity for a methicillin-susceptible *S. aureus* (MSSA, TCH959)strain to acquire resistance to K_3AgBP versus conventional antibiotics, was evaluated.

METHOD

Synthesis: Tripotassium silver bisperiodate of the general formula K_3AgBP (BP = $[IO_4(OH)_2]_2$) was prepared as previously described[8].

Antimicrobial Susceptibility: The antibacterial susceptibility to the K_3AgBP and traditional drugs were evaluated against clinical isolates of methicillin-susceptible (MSSA, TCH959) and resistant *Staphylococcus aureus* (USA-300, MRSA, TCH1516) versus a beta-lactam antibiotic, oxacillin, was determined.

Antibiofilm Efficacy: Biofilms of *S. aureus* (ATCC 6538) were established over a 72-hour time course, verified by scanning electron microscopy, within a three-dimensional matrix (gauze) with repeated daily 10^6 CFU/ml inoculation as per previously described methods[2]. The established biofilms were then exposed to K_3AgBP substrates at a concentration of 0.4 mg Ag/cm^2 over 6 hours. Negative control values represent the average of untreated control counts averaged over the equivalent exposure times.

Experimental Evolution of Resistance (EER): EER of MSSA was investigated for K3AgBP versus oxacillin: cultures were passaged daily in CAMHB containing known concentrations of each antimicrobial agent (doubling every 4 days from 1/8 up to 2x MIC_{90}) over a total of 20 days. Every second day, following daily CAMHB passage, MSSA MIC_{90} values were determined via optical density at 600 nm (OD600) for K_3AgBP vs. oxacillin according to CLSI guidelines.

Cytotoxicity: Epidermal keratinocyte (HaCaT) cells were grown to confluence, transferred to a 24-well plate, then left to incubate overnight at 37˚C to permit adhesion. The cells were subsequently rinsed and treated for 2hrs or 24hrs with K_3AgBP over a concentration range of 1 to 100 µM Ag. Following treatment, the cells were evaluated for metabolic activity via MTT, tetrazolium dye, assay. Cell viability was measured relative to untreated control.

RESULTS

The silver, Ag(III), bisperiodate, I(VII), chelate complex K_3AgBP is a neutral potassium salt with the formula $AgH_4(IO_6)_2K_3(H_2O)_4$. The *in-vitro* antibacterial susceptibilities of K_3AgBP versus a narrow-spectrum beta-lactam antibiotic, oxacillin, were determined against a *Staphylococcus aureus* TCH1516 and TCH959; two pediatric USA300 isolates from the Texas Children's Hospital in Houston. TCH1516 is a methicillin-resistant *S. aureus* (MRSA) strain and TCH959 is a methicillin-susceptible *S. aureus* (MSSA) strain. Susceptibility of the *S. aureus* strains to oxacillin, was significantly greater ($p < 0.001$) for MSSA than MRSA, with MIC_{90} values of 2.3 ± 0.0 µM and 300.2 ± 0.0 µM respectively, Fig. 1A. The antibacterial activity of K_3AgBP was found to be greater ($p < 0.001$) against MRSA with a MIC_{90} = 19.5 ± 0.0 µM versus MSSA with an MIC_{90} of 39.1 ± 0.0 µM. MSSA was more affected by the conventional antibiotic oxacillin than K_3AgBP, however K_3AgBP exhibited significantly greater ($p < 0.001$) antibacterial efficacy against the MRSA than oxacillin, Fig. 1A.

Within the EER study, a 16-fold increase in MIC_{90} value for oxacillin against MSSA, from 1.17 µM to 18.76 µM, was observed over the course of the 20-day exposure cycle as shown in Fig. 1B. No increase in the MIC_{90} value was observed for K_3AgBP-treated cultures over the same time frame as shown in Fig. 1B. On day 11 of EER study, a significant decrease ($P < 0.001$) in the optical density of MSSA exposed to K_3AgBP, at ½ MIC_{90}, was observed. By day 14, null optical density was observed for MSSA exposed to K_3AgBP; OD600 < 0.01 as shown in Fig. 1C. Enumeration of K_3AgBP-tretaed cultures on day 18 confirmed no viable cells remaining.

Established biofilm of *S. aureus* (ATCC 6538) were prepared as previously described; biofilm preparation methods outlined in Figure 2A. The establishment of *S. aureus* biofilm were readily disrupted and eradicated by K_3AgBP. Within 6 hours of treatment with K_3AgBP-coated non-woven dressings, a significant >99.9999% reduction ($p \leq 0.001$) of viable *S. aureus* biofilm was noted below limits of detection; log reduction of 6.72 ± 0.23 log CFU/ml as shown in Figure 2B.

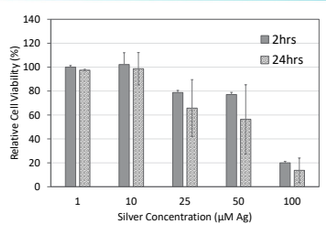

Figure 3. *In-vitro* cytotoxicity assay for epidermal (HaCaT) keratinocytes via an MTT Assay. Relative cell viability versus untreated control following exposure to K_3AgBP over various concentrations at either 2hrs or 24hrs treatment.

The *in-vitro* cell viability of human epidermal keratinocyte (HaCaT) cells was determined against K_3AgBP versus an untreated control over a relevant concentration range, as shown in Figure 3. Keratinocyte cell viability was determined following a 2-hour and a 24-hour K_3AgBP treatment period. There were no significant changes in the relative cellular metabolic activity of the keratinocytes between the 2 hour and 24-hour treatment period. At concentrations between 1 µM to 10 µM for K_3AgBP, no considerable loss in cell viability was observed. Between 10 µM and 50 µM, keratinocyte cell viability was maintained above 50% relative to untreated control over the treatment times reported.

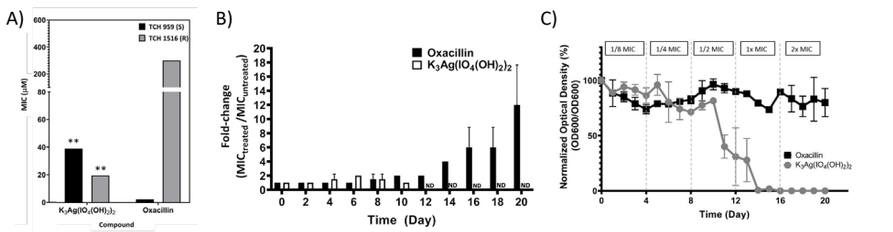

Figure 1. A) *Staphylococcus aureus* susceptibility of tripotassium silver (III) bisperiodate in parallel with drug controls expressed as the micromolar concentration for methicillin susceptible (USA300 TCH959) and methicillin resistant (USA300 TCH1516) strains. Significant differences between the hypervalent silver compound and the drug compound are denoted as ** for a P value of ≤ 0.001; B) Change in the MIC_{90} of MSSA (USA300_TCH959) cultures exposed to sub-inhibitory concentrations of oxacillin and $K_2Ag(IO_4(OH)_2)_2(H_2O)_4$, normalized to the MIC_{90} of untreated cultures which were cultured in parallel. MIC assays were completed every second day. ND: no data acquired due to lack of viable cells. C) Optical density (OD600nm) of MSSA (USA300_TCH959) cultures exposed to sub-inhibitory concentrations of $K_2Ag(IO_4(OH)_2)_2(H_2O)_4$ and oxacillin normalized to the OD_{600} of untreated cultures grown in parallel. Bacterial cultures were continually passaged in CAMHB containing increasing concentrations of antimicrobial (1/8, 1/4, 1/2, 1x and 2x MIC) over 20 days.

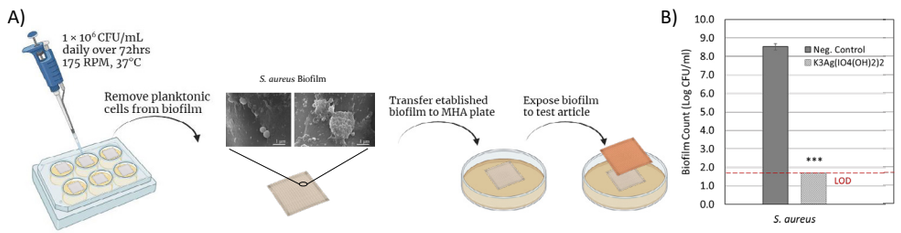

Figure 2. A) Established biofilm methodology and electron microscopy verification and subsequently determined; B) log reduction values of tripotassium silver (III) bisperiodate (K_3AgBP) against Gram-positive bacterium *Staphylococcus aureus* (ATCC 6538) established biofilm. Limit of detection (LOD) for quantification identified as dashed line. Results representing the average of triplicate data (n=3), error bars indicated represent standard deviations of the triplicate measurements. Asterisks *** indicates *P* value of ≤ 0.001 between K_3AgBP and negative untreated controls.

CONCLUSIONS

The development of novel topical antimicrobials, effective against drug-resistant strains of bacteria, is of considerable importance due to increasing concerns over antibiotic resistance. Herein, we describe a novel complex of tribasic silver bisperiodate containing Ag(III) and I(VII) demonstrating antibacterial efficacy against Gram-positive *S. aureus* including biofilm and methicillin-resistant clinical isolates (MRSA USA300), without eliciting acquired resistance over the course of prolonged treatment at sub-lethal, scaling concentrations. The current findings suggest that K_3AgBP may be a viable antimicrobial agent for the topical management of skin and wound infection, where: 1) K_3AgBP is an effective antimicrobial against MRSA/MSSA. 2) MSSA more readily acquires resistance to β-lactam antibiotic oxacillin. 3) K_2AgBP effectively disrupts *S. aureus* biofilm. 4) No significant loss in keratinocyte metabolic activity is observed up to 10 µM K_3AgBP. Further *in-vivo* studies are needed to verify *in-vitro* findings.

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ACKNOWLEDGEMENTS

Greg Wasney & the Core Facility for Structural and Biophysical Sciences, Hospital for Sick Children, Toronto, Ontario.

This work was supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) Collaborative Research and Development (CRD) grant with Dr. Cezar Khursigara University of Guleph (CRDPJ 501022-16), the Mitacs Accelerate grant with Dr. Katalin Szaszi at the University of Toronto (IT25932), and the Student Work Placement Program through BioTalent Canada (C2FJI-K565E-2REBV-JS3DH).

CONTACT INFORMATION

Carla Jehan Spina Ph.D., Director of Research & Development
Exciton Pharma Corp. , 101 College Street, Suite 200, Toronto, Ontario, M5G 1L7
cspina@excitonpharma.com, (o) 416-673-8135

Poster #0042
WoundsCANADA
2021 National Conference

A Novel Gel Matrix for Synchronous Delivery of O_2 & $Ag^{2+/3+}$: In-vitro & In-vivo Safety & Efficacy

Carla Jehan Spina[a*], Carlie Goodall[b], Vida Maksimoska[a], Johanny Notarandrea-Alfonzo[a], Rod Precht[a]

[a] Exciton Pharma Corp. Toronto, Ontario, Canada
[b] University of Guelph, Guelph, ON, N1G 2W1

INTRODUCTION

Wound healing in chronic complex wounds can be a lengthy, pain-filled process for patients, often impacting quality of life. Chronic, hard to treat, wounds can be a substantial financial burden on caregivers and health services worldwide. Oxygen has been recognized as a key component in wound healing, it has been shown to be crucial in vessel formation and tissue growth and regeneration[1]. As a result, many new wound care modalities are harnessing the potential of oxygen. Simultaneously, hypervalent silver, Ag(III), is known to promote wound healing[2] and are an effective antimicrobial agent, capable of antibiofilm activity[3,4]. It is proposed that a vehicle which may continuously afford both oxygen and hypervalent silver may be beneficial to a chronic wound environment.

AIM

Wound healing is a complex process, further complicated by infection. Heightened metabolic processes during healing result in an increased demand for oxygen while infection resolution poses distinct challenges. Achieving a harmonious balance between efficacy and healing is often accomplished with through a multitude of products and technologies. This study investigates the physiochemical properties of an Ag(II/III)-oxygen scaffold gel (AOSG). In parallel, exploring the *in-vitro* antibacterial and antibiofilm efficacy and *in-vivo* biocompatibility towards determining the potential application of AOSG in chronic wound care.

METHOD

Antimicrobial Efficacy: Seven-day planktonic bacterial reduction values for determined for AOSG against Gram-negative bacterium *Pseudomonas aeruginosa* (ATCC 9027) and Gram-positive bacterium *Staphylococcus aureus* (ATCC 6538). Test articles including negative controls were challenged daily with 1×10^6 CFU/mL inoculum for seven consecutive days. Bacterial reduction value of the test article was determined from the corresponding negative control.

Antibiofilm Efficacy: Gram-negative bacterium *Pseudomonas aeruginosa* (ATCC 9027) and Gram-positive bacterium *Staphylococcus aureus* (ATCC 6538) established biofilms were exposed to AOSG formulations over various treatment times. Biofilm reduction was determined from the corresponding negative control.

Silver & Oxygen Release: Silver release was determined in aqueous media over the course of 7 cumulative days wherein silver release was quantified via potentiometric titration. Oxygen release was determined over 7-days in aqueous or simulated media degassed under nitrogen gas ($N_{2(g)}$) at 21°C or 37°C. Continuous quantitation of oxygen was determined via ExTech Dissolved Oxygen meter over the specified time frame relative to an untreated control system.

In-vivo Biocompatibilty: AOSG *in-vivo* biocompatibility was determined via intracutaneous irritation rabbits, sensitization in guinea pigs, and sub-chronic IV injections in rats. Clinical observations, hematology and histopathology were reported.

RESULTS

Seven-day antimicrobial activity of AOSG was determined against both *S. aureus* and *P. aeruginosa* planktonic bacterial cultures, continuously challenged with 1×10^6 CFU/mL daily inoculum. Within 24 hours of treatment, the AOSG formulation effected a 5.63 ± 1.50 and 5.35 ± 1.45 log reduction in *S. aureus* and *P. aeruginosa* respectively. Over the course of the seven-day study, the efficacy of the AOSG gel increased to 6.77 ± 0.55 and 6.38 ± 1.44 log reduction for *S. aureus* and *P. aeruginosa,* respectively as shown in Fig. 1A and 1B. Negative control cultures were observed to support bacterial viability with average control counts of 8.58 ± 0.32 Log (CFU/ml) and 8.62 ± 0.31 Log (CFU/ml) for *S. aureus* and *P. aeruginosa,* respectively.

Anti-biofilm efficacy of the AOSG were determined in this study by treating established *S. aureus* and *P. aeruginosa* biofilms with the wound gel, relative to an untreated control. AOSG rapidly reduced viable P. *aeruginosa* biofilm by 7.05 ± 0.00 Log CFU/ml within 6 hours of exposure, sustaining this efficacy over the 24 h exposure time. A significant ($p < 0.001$) log reduction of *S. aureus* biofilm was also observed within 6 h of exposure to the AOSG, with an observed biofilm reduction of 6.61 ± 1.79 Log CFU/mL after a 24-hour exposure as shown in Fig. 1C and 1 D.

Physiochemical studies confirm a continuous $O_{2(g)}$ release from the AOSG. As observed in Fig. 1A, exposure to aqueous media triggers the release of oxygen within the wound gel, increasing up to 48 % within the first hour and > 180 % within 4 hours, corresponding with a solid-state conversion of $Ag_7NO_{11} \rightarrow AgO + O_{2(g)}$[5]. In parallel, a continuous release of activated silver (140 ± 16 ppm Ag/day) over 7 days was observed for the AOSG upon exposure to aqueous media as shown in Fig. 1B.

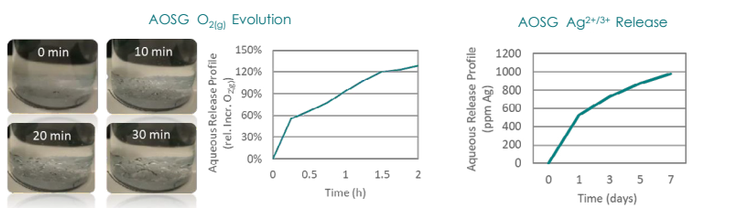

Figure 2. A) Gaseous oxygen release from AOSG wound gel upon exposure to aqueous media as determined by a dissolved oxygen meter probe. Oxygen evolution was measured relative to an untreated control system. Presented data reported as the average of a triplicate (n=3) experimental set. B) Silver release into aqueous media from AOSG wound gel as determined by potentiometric titration. Presented data reported as the average of a triplicate (n=3) experimental set.

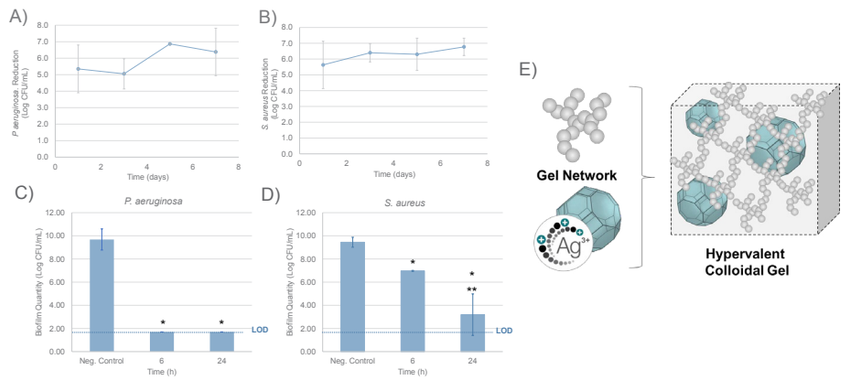

Figure 1. Seven-day bacterial reduction values for AOSG against A) Gram-negative bacterium Pseudomonas aeruginosa (ATCC 9027) and B) Gram-positive bacterium Staphylococcus aureus (ATCC 6538) in a planktonic state. Test articles including negative controls were challenged daily with 1 x 106 CFU/mL inoculum for seven consecutive days. Bacterial reduction value of the test article was determined from the corresponding negative control. Results representing the average of triplicate data (n = 3), error bars indicated represent standard deviations of the triplicate measurements. Biofilm log reduction values of for AOSG against C) Gram-negative bacterium Pseudomonas aeruginosa (ATCC 9027) and D) Gram-positive bacterium Staphylococcus aureus (ATCC 6538) established biofilm. Biofilms were grown over a 72 hours time course within a three-dimensional matrix substrate (gauze) with repeated daily 106 CFU/ml inoculation. The biofilms were then exposed to AOSG over various times. Negative control values represent the average of negative control counts averaged over all the exposure times. Limit of detection (LOD) for quantification identified as dashed line. Results representing the average of triplicate data (n=3), error bars indicated represent standard deviations of the triplicate measurements. Asterisks indicate significant differences between time points or negative controls, where * indicates a P value of < 0.001 between the evaluated time point and negative control and ** indicates a P value of ≤ 0.02 between the current and previous time point. E) Diagram representation of the three-dimensional gel network of AOSG.

The AOSG was evaluated *in-vivo* for allergenic potential or sensitizing capacity within a guinea pig model, for irritation and intracutaneously reactivity within in a rabbit model, for material-mediated pyrogenicity within a rabbit model, and for systemic toxicity including histopathology, clinical chemistry & hematology over sub-chronic parenteral exposure within a rat model. These *in-vivo* animal models demonstrated the AOSG gel to be non-irritating, non-sensitizing, nor did the gel elicit any signs or symptoms of systemic toxicity over sub-chronic exposure.

CONCLUSIONS

Wound healing necessitates heightened metabolic processes, the requirements for which include oxygen. Combating infection to facilitate healing processes poses additional challenges. Wherein the need to harmonize antimicrobial efficacy and wound healing do not always lend to a unified solution.

Novel technologies, such as the AOSG, aim to facilitate chronic wound healing by not only maintaining oxygen release profile into the wound environment but also affording antimicrobial effects higher oxidation states silver. Where the novel 3D gel matrix facilitates an active release upon exposure to aqueous media or a moist wound environment.

These studies suggest AOSG may reduce microbial load while affording a continuous release of oxygen to facilitate a non-toxic environment amenable to healing processes.

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ACKNOWLEDGEMENTS

Greg Wasney & the Core Facility for Structural and Biophysical Sciences, Hospital for Sick Children, Toronto, Ontario.

This work was supported by the Student Work Placement Program through BioTalent Canada (C2FJI-K565E-2REBV-JS3DH).

CONTACT INFORMATION

Carla Jehan Spina Ph.D.
Director of Research & Development
Exciton Pharma Corp. , 101 College Street, Suite 200, Toronto, Ontario, M5G 1L7
cspina@excitonpharma.com, (o) 416-673-8135

Sinai Health | Mount Sinai Hospital
Joseph & Wolf Lebovic Health Complex

BLOOMBERG
LAWRENCE S. BLOOMBERG FACULTY OF NURSING
UNIVERSITY OF TORONTO

Exploring validation of pressure injury diagnosis in administrative data vs NDNQI data collection as a reference standard

Laura Teague NP-Adult, PhD; Frances Bruno RN, MSc(A), PhD (c); Vincy Chan RN, MN, Monica Frecea RN, MScN, WOCC(C); Kun Lui BA, CHIMC;
William Mundle RN, MN, CMSN(C); Julie Tjan Thomas RN, MN, WOCC(C); Marlene Traille RN, MScN; Nely Amaral BScN, VAQS
Sinai Health, Toronto, Ontario Canada

Introduction

Pressure injuries (PI), are areas of injury to the skin and underlying tissue caused by external pressure, usually over a bony prominence.[7] In Ontario, Canada, modelled lifetime costs attributed to persons with PI requiring hospitalization are estimated to be $98,000 (Can).[3]
Accurate population-based methods to identify and monitor PI rates creates challenges for the measurement of PI outcomes when efforts are made to prevent and reduce PI over time.[1,2,5]

Objective

To compare PI classification from administrative data (Discharge Abstract Database - DAD) to a gold standard physical assessment and electronic medical record review.

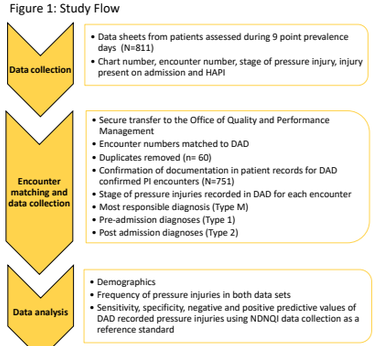
Design and Methods

This is a retrospective analysis of a pooled cross-sectional sample of 811 patients assessed across nine quarterly and consecutive standardized National Database of Nursing Quality Indicators (NDNQI) surveys from 2017-2019 at a tertiary care hospital in Toronto, CA.

Each point prevalence survey consisted of a single day survey using trained nurses who provided direct physical assessment of consenting patients and reviewed patient health records.

We compared International Classification of Disease Version 10 Canadian (ICD 10 CA) PI cases (L89 series) identified in the DAD against nurse-assessed PIs.[3] We identified PIs in the DAD that were type 1 (present on admission) and type 2 (hospital acquired). We also identified PIs that were present on admission and those PIs that were hospital acquired (HAPI).[3]

Figure 1: Study Flow



Results

Table 1 Demographics

Total number of patients N= 751	
Age (Years)	
Mean	70
Median	75
Gender n (%)	
Male	361 (48.1%)
Female	390 (51.9%)
Department	
Medicine	605 (80.6%)
ICU	102 (13.6%)
CCU	44 (5.8%)
Length of Stay (Days)	
Mean	45
Median	20

Table 2 Top ten most responsible diagnoses for patients admitted who had or developed PI

Most responsible diagnosis	Number of patients
Congestive heart failure	7
Delirium, unspecified	4
Pneumonitis due to food and vomit	4
Sepsis, unspecified	2
Acute respiratory failure, type I (hypoxic)	2
Acute respiratory failure, type II [hypercapnia]	2
Acute respiratory failure, type unspecified	2
Respiratory failure, unspecified, type I [hypoxic]	2
Stage IV pressure ulcer	2
Osteomyelitis, unspecified, ankle and foot	2

Table 3 NDNQI pressure injury frequencies

Total number of patients examined during NDNQI surveys	Frequency (%)
Total number of pressure injuries	111
Frequency of patients with at least one pressure injury	77 (10.3%)
Frequency of patients with hospital acquired pressure injury (any stage)	40 (5.3%)
Frequency of patients with hospital acquired injury, stage 2 or greater	38 (5.1%)

Table 4 DAD pressure ulcer frequencies N = 751

DAD record - ICD 10 CA Codes	Frequency (%)
L89.0-L89.9 pressure ulcer – any stage	51 (6.8%)
L89.1-L89.9 stage 2 or greater pressure ulcer	49 (6.5%)
Type 1 code : Hospital acquired pressure ulcer	31 (8.8%)
Type 2 code: Pressure ulcer present on admission	17 (2.3%)

Table 5 Sensitivity and specificity, positive predictive value (PPV) and negative predictive value (NPV) of stage 1,2,3,4, unstageable pressure ulcers compared to corresponding ICD 10 CA codes in DAD (Type M, 1 or 2)

Stage of ulcer	Sensitivity 95% CI	Specificity 95% CI	PPV 95% CI	NPV 95% CI
ANY stage of ulcer (type M, 1 or 2)	0.40 (95% CI 0.4,0.41)	0.97 (95% CI 0.96, 0.97)	0.61 (95% CI 0.60, 0.61)	0.93 (95% CI 0.93, 0.94)
Any stage ulcer type 2 (hospital acquired)	0.21 (95% CI 0.20, 0.21)	0.98 (95% CI 0.98, 0.99)	0.35 (95% CI 0.34, 0.36))	0.97 (95% CI 0.97, 0.97)

- Of the 751 participants, 361 (48.1%) were male with a median age of 75 years and median length of stay was 20 days
- In the NDNQI survey data, 77 patients (10.3%) had 111 PI. In the DAD, PI were recorded in 51 (6.8%) of the same patients
- The sensitivity and specificity of using the DAD to identify patients with PI was 0.4 (95% CI 0.4, 0.41), 0.97 (95% CI 0.96, 0.97) respectively
- The positive predictive value (PPV) and negative predictive value (NPV) of using the DAD to identify patients with PI was 0.61 (0.60, 0.61) and 0.92 (95% CI 0.93, 0.93) respectively
- The sensitivity and specificity of using the DAD to identify HAPI was 0.21 (95% CI 0.20, 0.21) and 0.98 (95% CI 0.98, 0.99) respectively
- The PPV and NPV of using the DAD to identify HAPI was 0.35 (95% CI 0.34-0.36) and 0.97 (95% CI 0.97, 0.97) respectively

Discussion

The results of this study suggest that a large proportion of PIs, both pre-existing and hospital acquired may not be captured in administrative data (DAD) routinely collected following our patient's general internal medicine and intensive care stay in hospital. These results are consistent with findings from other studies conducted in Canadian Health Care settings.[1,5]

We compared PIs in the NDNQI to the DAD records as well as stage 2 or greater with the DAD records. The greatest discrepancy in DAD was the hospital acquired rates of PI compared to PI rates recorded in the NDNQI.

We could not compare staging of PI from the NDNQI data to the ICD 10 CA codes in the DAD, as administrative codes are only recorded for stage 2 (L 89.1) or greater and for one PI only (highest stage). Given that there were 77 patients with 111 PI, there were many patients that had more than one PI.

The ICD 10 CA codes are not aligned with NPIAP PI definitions.[3,6] For example, deep tissue injury is not included in the list of definitions. This makes comparison of staging to codes even more difficult.

Conclusion

In this cohort study, use of administrative DAD demonstrated poor sensitivity and PPV, while specificity and NPV were acceptable. This study highlights the importance of consistency and accuracy of identifying PI in administrative data. Use of administrative data for quality assurance and improvement reporting or research activities could miss a large proportion of true positive patients. Standardized medical documentation, as well as review of nursing documentation by coders may improve the likelihood of PI being recorded in the DAD.

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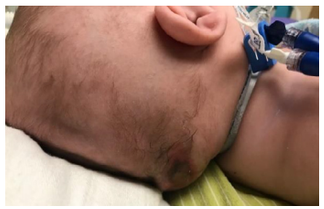
Prevalence Study of Skin Tears and Pressure Injuries in a Canadian Neonatal Intensive Care Unit

Stephanie Furtado[1 2 3 4 5], Tracy Dowds[1 2 3 4 5], Dr. Kimberly LeBlanc[1 3 4 5 6 7 8], Anna Palmieri[1 3 8], Dr. Kevin Woo[1 4 5 6 8]

[1]RN, [2]MClSc-WH, [3]BScN, [4] NSWOC, [5] WOCC (C), [6]PhD, [7]FCAN, [8]MN



INTRODUCTION

It is well documented that neonatal skin is at increased risk of skin breakdown due to the premature nature of the neonatal skin, and that the cohesion between the epidermal and dermal junction is decreased. At 24 weeks and younger, premature infants lack subcutaneous tissue meaning that their dermis sits directly on top of muscle. The subcutaneous layer starts to be developed at 26-29 weeks. At 30 weeks, the stratum corneum starts to develop and may be only 2-3 cell layers thick. Even at full term of 40 weeks, a neonate's skin is only about 60% of the thickness of adult skin (Baharestani, 2007). Neonates also have weak dermal-epidermal bonds (McCord & Levy, 2006). This predisposes this particular population to increased risk of skin injury.

There is limited knowledge pertaining to the scope of pressure injuries (PIs) and skin tears (ST) in the neonatal population. Most of our understanding on the extent of this issue comes from older prevalence studies, case reports, expert opinion, or anecdotal evidence. This demonstrates the need for a more current analysis of PI and ST burden so that we can understand the scope and impact in the neonatal population.

PURPOSE

The purpose of the proposed study is to: (1) assess the burden of ST and PI prevalence in a 72 bed (which includes 56 ICU beds and 16 Level 2 beds) Neonatal Intensive Care Unit (NICU) through a point prevalence study, and (2) explore correlational factors for ST/PI development.

METHODS

A point prevalence of pressure injuries and skin tears was completed prospectively on a single day, including all individuals who met the inclusion criteria the day of the study. Target population was a convenience sample of all admitted inpatients in NICU.

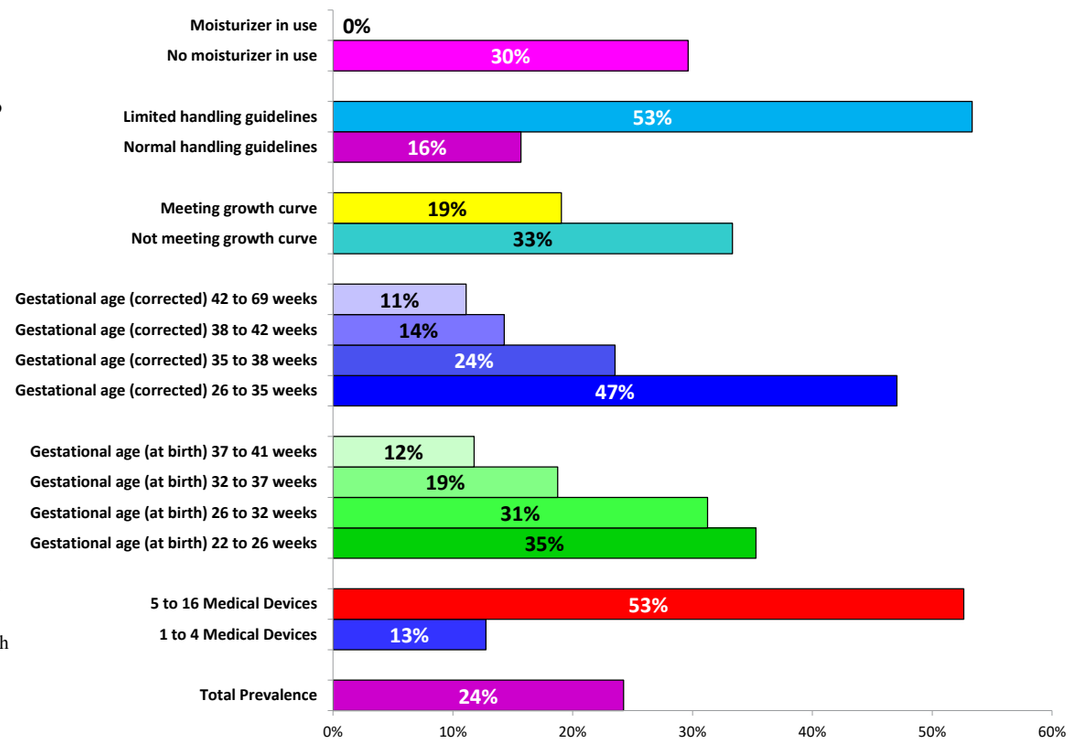
Data was collected at point of care onto an electronic spreadsheet at the bedside and included gestational age, corrected gestational age, meeting weight/growth goals, limited or normal handling guidelines, number of medical devices attached, adhesives in use on skin, moisturizer in use, number of pressure injuries or skin tears present, classification / level of pressure injury or skin tear, and medical device related skin injury.

A team of Registered Dietitians assessed each participant to determine if they met nutritional and growth-related goals. Criteria for meeting nutritional goals included meeting of growth targets and following growth charts. Growth targets were defined as weight gain of 15-20g/kg/day for less than 34 weeks gestation and less than 2 kg and 20-30 grams per day for over 34 weeks gestation and greater than 2 kg. Growth charts used were the Fenton or World Health Organization.

RESULTS

- 66 infants were assessed as part of the study as there were some empty beds at time of assessment
- PI prevalence was 24% and ST prevalence was 0%.
- 100% of PIs identified were found on the skin under a medical device.
- There were 27 PIs identified among 16 infants. 10 infants had 1 PI, 3 had 2 PIs, and 3 had 4 PIs.
- 25/27 of those injuries (92%) were Stage 1 PIs, 1/27 (4%) was a Stage 2 PI, and 1/27(4%) was a Deep Tissue PI.
- In our sample of neonates; 36% did not meet growth curve, 23% had limited handling guidelines, 18% had moisturizer in use, and 29% had 5 or more medical devices attached. For gestational age at birth and corrected, our sample in the chart below is grouped into quartiles, four quarters of more-or-less equal size.

Prevalence of Infants with at least one Pressure Injury by Correlational Factor



Email questions to furtast@hhsc.ca or dowds@hhsc.ca

DISCUSSION

At the time of the point prevalence no STs were observed. This could be related to a revised skin care policy that was released the year prior to the study date and had extensive staff teaching. The skin care policy highlights percentage of humidity for each age range, when to use moisturizer for very low birth weigh infants, bathing guidelines for timing of baths, and safe products to be used (e.g. pH balanced cleansers and NICU pharmacist approved barrier creams).

For PIs, unlike the adult setting, our data demonstrates that the overwhelming majority of Pis were determined to be related to medical devices. In the current study, it was found that 100% of PIs were related to pressure from medical devices. Almost all participants (97%) had adhesives in use. The presence of a PI was positively correlated with the following factors: low gestational age at birth and youngest age on the study date, lack of moisturizer application, having limited handling guidelines, not meeting weight gain goals, and having 5 or more medical devices attached.

Amongst those infants with at least one PI, having multiple PIs was positively correlated with limited handling, not meeting growth curve, and high gestational age at birth and corrected age. An infant is typically admitted to the NICU as a late preterm or term infant due to critical illness requiring increased medical and surgical interventions. For example, both infants on cooling blankets had multiple PIs.

CONCLUSION

PI's are a challenge in the neonate population. Most of the identified factors could not be modified, so prevention for those at greater risk is an important clinical consideration. Without an incidence of STs we cannot comment further on ST development, but with repeated assessments like this study we hope to see trends that can further guide clinical practice. Longitudinal studies will be needed to better understand the risks and clinical impact of PIs and STs in neonates.

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AKNOWLEDGEMENTS

Debbie Mings, Amanda Cappon, Madeline White, Melanie Amyotte, Ali McBryde and Christine Kalata

Photobiomodulation in the treatment of herpetic lesion: case study.

AUTHORS: Juliana Balbinot Reis Girondi, Felipe Duarte, Milena Ronise Calegari, Júlia Grisard de Bem, Carla do Rosario, Lúcia Nazareth Amante, Karina Meneguzzi

Objectives

to report a case of herpetic lesion treated with Photobiomodulation

Methods

Single case study, male, 65 years old for 13 years, being treated for an actinic keratotic lesion on the face and seborrhea. In April 2020, he was referred to an outpatient clinic for Herpes Zoster undergoing treatment for more than two months. Hypertensive for 20 years using antihypertensive drugs with stable pressure levels. Severe pain in the left face radiating to the eye and nose. Extensive lesions 100% covered by coagulation necrosis in the mental region, nasal and supralabial regions, with odor and seropurulent exudate, without measurement conditions. Wound hygiene was performed with a polyhexamethylene biguanide solution and instrumental debridement. Two laser photobiomodulation sessions were performed with an interval of seven days. In the first session, 2J energy dose / infrared light point (808 nm), spot application and infrared (808 nm) simultaneously, spot application, exposure time of 10 seconds, irradiance of 10 J / cm^2 (12 application points); secondary dressing with 10% papain. In the second session, dosimetry was maintained, but simultaneously red (660 nm) and infrared (10 application points) were used; secondary dressing with regenerating membrane. In all consultations, photographic records were taken.

Results

In the second session, 100% granulated wound with regular edges, adhered to the chin region. Absence of exudate, odor and significant pain regression. Total cure was achieved in 23 days, in addition to the self-reported improvement in the patient's self-esteem and quality of life.

Implications

Photobiomodulation stimulates fast and effective tissue healing(1,2). Its action provides pain control, modulation of inflammatory mediators, epithelial migration and cell proliferation, which interferes with collagen deposition, lesion retraction and contraction force. Thus, one can observe benefits to health services such as: cost reduction, infection prevention and reduced treatment time.

Contacts: juliana.balbinot@ufsc.br

Topical ozone therapy in the treatment of leukocytoclastic vasculitis

AUTHORS:Juliana Balbinot Reis Girondi, Felipe Duarte, Milena Ronise Calgari, Júlia Grisard de Bem, Lúcia Nazareth Amante, Luciara Fabiane Sebold, Carla do Rosario

Objectives

To report the treatment of a case of vasculitis with topical ozone therapy.

Methods

Case study of a 74-year-old woman with type II diabetes mellitus, systemic arterial hypertension, depression, history of allergy to diclofenac potassium and ceftriaxone. Eventual control of capillary blood glucose oscillating between 150-200 mg/dl. After several unsuccessful visits in health institutions, she was referred to a teaching hospital in southern Brazil, for treatment of leukocytoclastic vasculitis in lower limbs of unknown etiology(1). In the first consultation, May 2021, she presented intense pain and extensive lesions in the lower limbs, with the presence of purpura, necrosis, ruptured blisters, large amount of slough, odor and serous exudate. No conditions to measure the lesions by the extension and clinical status of the patient. Wound hygiene was performed with polyhexamethylene biguanide solution and instrumental debridement. Two sessions of topical ozone therapy for Bag were carried out weekly, at a dose of 90 mcg for 15 minutes. As a primary hydrofiber coating with silver and from the second service foam with adhesive-edged silver. Photographic records and planimetry were done in all appointments.

Results

In the second visit, the patient showed improvement in general condition, pain control, significant reduction in lesions, exudate and odor. Left limb with shallow wound, irregular edges adhered to malleolar region 4 x 3 cm (12 cm^2) bed with 95% granulation and 5% slough; right limb lesion on the dorsum of the foot with the same characteristics measuring 8.5 x 4 cm (34 cm^2), 100% granulated. In four weeks of care and two applications of ozone, he was discharged due to cure .

Implications

Ozone therapy as an adjuvant in the treatment of wounds, it provided antimicrobial action, increased angiogenesis , modulated the inflammatory process, decreased cellular oxidative stress, promoted analgesia and regulated cell metabolism(

Contacts: juliana.balbinot@ufsc.br

Urban Angel Diabetic Foot Care Pathway – A Preliminary Analysis

Muzammil H. Syed, Charles de Mestral, Abdelrahman Zamzam, Emily Harris, Ann-Marie McLaren, Suzanne Lu, Sreenath Rave, Mark Wheatcroft, Mohamad Qadura, Elisa Greco, Bertha Hughes, Robert Sargeant, Mohammed Al-Omran

Background

- Lower-limb amputation is a catastrophic complication of diabetes. Despite the seriousness of the complication, amputation prevention efforts are severely fragmented within this patient population. Therefore, we sought to develop a multidisciplinary foot care and amputation prevention pathway at St. Michael's Hospital.

Methods

1. Developed a foot care pathway that coordinates the expertise of chiropody, vascular surgery and general internal medicine (GIM)
2. Patients presenting to the emergency room (ER) with a diabetic foot ulcer (DFU) are triaged by chiropody during daytime hours and by the ER physician and medicine service after hours
3. Admission, if necessary, is under GIM with input from chiropody and vascular surgery and guaranteed within 1 working day of presentation.
4. Patients are treated via surgical management, nonsurgical management, or supportive management (figure 1).
5. To demonstrate the efficacy of this pathway, data is compared with DFU patient-level data obtained from the General Medicine Inpatient Initiative (GEMINI) database from 2010 and 2015 (n=557).

Results

- 57 unique patients (82 total visits)
- 48 males (84%)
- 16 readmissions within 30 days
- 67% surgical interventions vs 33% non-surgical

Table 1: Comparing the Efficacy of the Urban Angel Diabetic Foot Care Pathway with Data from the GEMINI Database

Metric (Median Days)	Urban Angel Diabetic Foot Care Pathway	GEMINI
Length of Hospital Stay	8.8	17.1
Admission to Chiropody Assessment	0.9	NA
Admission to Intervention	2.8	NA
Average Per Patient Cost (CAD)		
Surgical	$25,901	$45,035
Non-surgical	$9,279	$18,362

A chiropody-led, multidisciplinary diabetic foot ulcer pathway significantly reduces costs and expedites patient management and disposition planning

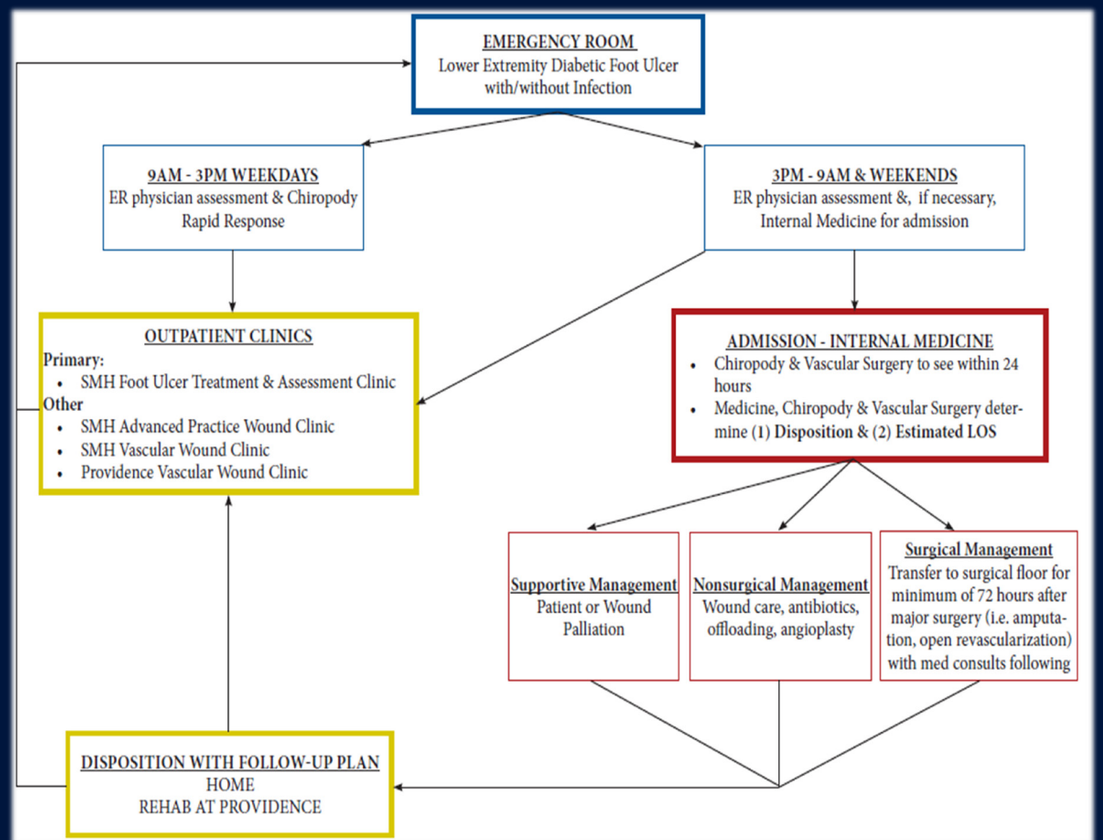

Figure 1: Urban Angel Diabetic Foot Care Pathway

Extra Tables & Figures

Table 2: Comparing Patient Disposition Data Between Urban Angel Diabetic Foot Care Pathway and the GEMINI Database

Disposition (# of patients)	Urban Angel Diabetic Foot Care Pathway	GEMINI
Rehab	22 (27%)	156 (28.0%)
Community Care Access Centre (CCAC)	0 (0%)	NA
Admitted to Another Hospital	0 (0%)	7 (1.3%)
Discharged Home	60 (73%)	358 (64.3%)

Conclusion

- A chiropody-led, multidisciplinary diabetic foot ulcer pathway significantly reduces costs and expedites patient management and disposition planning.

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Surgery UNIVERSITY OF TORONTO

ICD-10 DIAGNOSTIC CODING FOR IDENTIFYING HOSPITALIZATIONS RELATED TO A DIABETIC FOOT ULCER

St. Michael's Inspired Care. Inspiring Science.

Muzammil H. Syed, Mohammed Al-Omran, Jean Jacob-Brassard, Joel G. Ray, Mohamad A. Hussain, Muhammad Mamdani, Charles de Mestral

UNIVERSITY OF TORONTO

Division of Vascular Surgery, General Internal Medicine, and Data Science and Advanced Analytics, St. Michael's Hospital; Division of Vascular Surgery, Harvard University

Background

- Diabetic foot ulcers (DFUs) are a common complications of diabetes, with up to 26 million adults expected to develop DFUs annually.
- With an increasing number of diabetes-related amputations in Canada, there is a pressing need, to study the management and outcomes of DFUs
- While health administrative data are routinely utilized to study disease epidemiology, management, and outcomes, their usage is hindered by uncertainty in optimal coding approaches of Canadian International Classification of Diseases, 10th version (ICD-10) diagnostic codes that may identify a DFU

Objective

- To estimate the positive predictive value (PPV) of Canadian ICD-10 diagnostic coding for the identification of hospitalization related to a DFU

Methods

- Hospitalizations related to a neuropathic and/or ischemic DFU were identified from the Discharge Abstract Database (DAD) records of a single Canadian tertiary care hospital between April 1, 2002 and March 31, 2019.
- **Four Coding Approaches:**
  1) Most responsible diagnosis (MRDx) code for DFU with or without gangrene (**DSFUG group**)
  2) MRDx code for lower-limb osteomyelitis with a non-MRDx DSFUG code on the same DAD record (**osteomyelitis group**)

Methods Continued

- **Coding Approaches Continued:**
  3) MRDx code for lower-limb ulceration with a non-MRDx DSFUG code on the same DAD record (**LLU group**)
  4) MRDx code for lower-limb atherosclerotic gangrene with a non-MRDx DSFUG code on the same DAD record (**atherosclerosis group**)
- DAD records were independently compared by a masked-reviewer who manually-abstracted data from the entire hospital record (*reference standard*).
- **Data Analysis:** PPV and 95% confidence intervals (CIs) were generated
- **Subgroup Analysis:** PPV of DSFUG codes with and without mention of gangrene, as well as for type 2 diabetes versus type 1 and other diabetes

Results

Table 1. PPVs of ICD-10-CA diagnosis codes related to Diabetic Foot Ulceration or Gangrene in DAD records

DFU Code	# of DAD Records	PPV (%)
ALL RECORDS GROUP	390	88.5 (84.9 - 91.5)
DSFUG GROUP	300	90.0 (86.0 - 93.2)
OSTEOMYELTIS GROUP	50	82.0 (68.6 - 91.4)
LLU GROUP	33	84.9 (68.1 - 94.9)
ATHEROSCELORIS GROUP	7	85.7 (42.1 - 99.6)

Table 2. Subgroup Analysis of DSFUG codes, ascertaining the PPV with and without mention of gangrene, as well as for type 2 diabetes versus type 1 and other diabetes

DSFUG Code	# of DAD Records	PPV (%)
Codes Without Mention of Gangrene	134	88.8 (82.2 - 93.6)
Codes With Mention of Gangrene	166	90.9 (85.5 - 94.9)
Type 2 Diabetes Codes	280	90.7 (86.7 - 93.8)
Type 1 and Other Diabetes Codes	20	80.0 (56.3 - 94.3)

Summary & Implications

- The findings from this study suggests that hospitalization related to a neuropathic and/or ischemic DFU can be adequately identified from the DAD
- The specified coding algorithms can be used to study the management and outcomes of people hospitalized with a DFU in Ontario.

Acknowledgements

- This work was jointly funded by the Banting & Best Diabetes Centre-Novo Nordisk Graduate Studentships and the Canadian Institutes of Health Research (CIHR) Canada Graduate Scholarships Masters award.

Treatment of infected ulcers in people with diabetes mellitus with antimicrobial photodynamic therapy: Systematic review

Brandão, M.G.S.A. (RN, MSc)[1]; Moura, T. M. (RN, Ph.D.)[2]; Ximenes, M.A.M. (RN, MSc)[3]; Souza, C.B.L (RN, MSc)[1]; Rabeh, S.A.N. (RN, Ph.D.)[1] ; Costa, I.G (RN, NSWOC, Ph.D.)[4]

[1]School of Nursing of Ribeirão Preto - University of São Paulo, Brazil;[2]University of Integration of Afro-Brazilian Lusophony, Brazil; [3]Federal University of Ceará; Brazil; [4] School of Nursing, Lakehead University, Canada

Introduction

- Recent studies indicate that an adjuvant therapy that can favor the treatment and greater tissue repair of infected foot ulcers is Photodynamic Therapy (PDT).(1,2)
- PDT involves the topical application of a photosensitive compound to damaged tissues, followed by illumination with LASER or LED light, which, together with tissue oxygen, induces the formation of reactive oxygen species and production of a high local cytotoxic effect.(3)
- Due to its antimicrobial effects, PDT is considered an adjuvant therapy that can contribute to the treatment of infected ulcers, without inducing bacterial resistance.(4)

Objectives

- To identify in the literature the effectiveness of antimicrobial photodynamic therapy in the treatment of infected foot ulcers in people with diabetes mellitus.

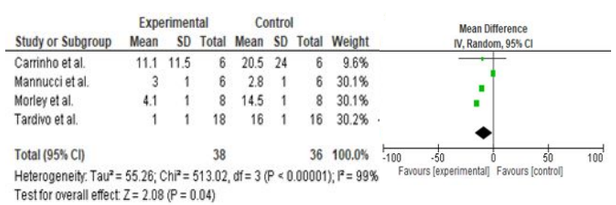
Methodology

- A systematic review carried out according to the methodological guidelines of the Joanna Briggs Institute (JBI).
- The review was registered in the database of the International Prospective Register of Systematic Reviews (PROSPERO), with registration number CRD42020214187.
- Searches in the Cochrane Library, Scopus, LILACS, PubMed, CINAHL, Web of Science, and EMBASE databases.
- Using MesH descriptors (Photochemotherapy, Diabetic Foot and Foot Ulcer) and DeCS (Photochemotherapy, Photodynamic Therapy, and Diabetic Foot) in association with the boolean operators AND and OR.
- The initial screening and selection of studies retrieved from the databases were carried out independently by two reviewers, using the Rayyan software.

Findings

- Four clinical trials were considered eligible; including 117 people aged 18 to 85 years, with a diagnosis of type 1 or type 2 diabetes mellitus and at least one-foot ulcer.
- Groups treated with photodynamic therapy were significantly better when compared to control groups that used topical dressings with collagenase and chloramphenicol (p=0.036), absorbent dressings (p<0.001) or dry dressings (p=0.002).
- People who received treatment with PDT showed significant improvements in terms of reducing the microbial load on the ulcer, with a decrease in colony-forming units soon after the first treatment session with PDT.
- The evolution in tissue repair of ulcers treated with PDT was remarkably better, with a significant reduction in the area of lesions and the ability to reduce the need for amputation by up to 35 times.
- For the three outcomes analyzed, the quality of evidence was considered moderate, with a clinically critical outcome (essential).
- In the meta-analysis, the intervention favored the experimental group, with a significant difference (p=0.04).

Graph 1. Meta-analysis for the outcome of tissue repair progress. Brazil, 2020.



Discussion

- From the analysis of the results of this study, there was a consensus regarding the superiority of PDT in the treatment of infected foot ulcers in people with DM, when compared with control groups that used topical dressings with collagenase and chloramphenicol, absorbent dressings, dry or petroleum jelly.(4-6)
- Studies consulted confirmed that PDT can be seen as a promising adjuvant approach for the inactivation of bacteria, especially in resistant bacterial biofilms.(2)
- Due to its multiple mechanism of action, low invasiveness and absence of significant side effects, PDT offers an interesting potential alternative to combat microbial resistance in infected ulcers.(3)

Conclusions

- The PDT is an adjuvant therapy that can substantially contribute to the healing process of infected foot ulcers in people with diabetes.
- In this study, PDT had positive implications for tissue repair, reduced microbial load on the ulcer and the need for non-traumatic amputations and improved quality of life.

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Partner Institutions:

Development of an educational video on the assessment of leprosy associated neuropathic ulcers

Souza, C.B.L (RN, MSc)[1]; Silva, P.G. (RN, MSc)[1]; Borges, A.A.(RN, Ph.D.)[2]; Brandão, M.G.S.A. (RN, MSc)[1]; Rabeh, S.A.N. (RN, Ph.D.)[1]; Costa, I.G (RN, NSWOC, Ph.D.)[3]
[1]School of Nursing of Ribeirão Preto - University of São Paulo, Brazil; [2]College Atenas, Passos, Brazil; [3]School of Nursing, Lakehead University, Canada

Introduction

- Leprosy is one of the biggest causes of neuropathic complications in the world. Among these are neuropathic ulcers, considered one of the most common causes of amputations, morbidity and mortality, a consequence of health care based on fragmented procedures with low resolution(1-6).
- Thus, the monitoring of neural function and guidelines for the prevention of physical disabilities and deformities resulting from the disease must be part of the periodic assessment of nurses (1,7).

Objectives

- To develop an educational video about the assessment and management of neuropathic ulcers associated with leprosy, to be made available to nurses.

Methodology

- The educational video was developed from a script and storyboard validated by nine experts on the subject and eight video experts, in addition to nine representatives of the target audience, who followed the recommendations of the Ministry of Health of Brazil and Wound, Ostomy and Continence Nurses. The nursing consultation for people with neuropathic ulcers associated with leprosy was approached, and the participation of volunteer actors (nurse and patient) was included. The video was divided into six thematic units: Presentation; Nursing reception and consultation; Clinical Nursing Assessment, Wound Assessment, and Closure. The scenario used for simulation and recording was a nursing officer in a Health Unit in Brazil. The process had the support of an audiovisual operator for the recording, creation of animations, image processing, sound, and video editing.

Findings

The educational video obtained a Content Validity Index higher than the recommended minimum (78%) and was considered valid.

Initially, the educational video had a duration of 16 minutes and 36 seconds, ending with 18 minutes and 32 seconds.

For the production, editing and finalization of the educational material, 42 hours of work were necessary, including 10 hours of rehearsals, organization of scenarios and recordings; 12 hours of meetings; and 20 hours of digital audio and video editing.

We sought to ensure access to educational material for people with visual and hearing disabilities, with the insertion of subtitles in the speeches, in addition to the narration of the procedures performed in times of absence of dialogue between the nurse and the user.

The language and clarity in the transmission of information were also carefully evaluated, in order to facilitate the understanding of the target audience.

It is noteworthy that, for the preparation, filming and editing of the educational material, there was no use of external funding, all expenses being the responsibility of the researcher, in addition to the guest actor and speaker having acted voluntarily and signed the Term of Consent for Authorization and dissemination of your images and voice.

The video is available at the following address: https://www.youtube.com/watch?v=IqZktIveAqY

Figury 1 - Video Scene: Evaluation for the management of neuropathic ulcer associated with leporsy.

Discussion

Simulation in the context of teaching and learning in Nursing, integrates the complexities of practical and theoretical learning with the opportunity for repetition, feedback, evaluation and reflection, an important factor in the development of the decision-making process by the nurse(8).

In the development of an educational video for peripheral venous puncture with a catheter, pointed out that the use of digital materials in the teaching-learning process with script and storyboard production enables the integration of specialists, making the process more qualified(9).

Conclusions

- Access to na educational video, available on digital platforms, will contribute to reaching the target audience, regardless of their geographic location and time, enabling nurses to update on the topic, with positive effects on the care provided to the person with leprosy.

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Partner Institutions:

FACULDADE ATENAS PASSOS

Lakehead UNIVERSITY School of Nursing