# TABLE OF CONTENTS

## HYPERBARIC OXYGEN THERAPY

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A Retrospective Multicenter Review Evaluating the Safety of Utilizing Fiberglass Total Contact Casts in Hyperbaric Oxygen Chambers.</td>
<td>02</td>
</tr>
<tr>
<td>ORAL PRESENTATION: Saturday, September 9</td>
<td>7:50 AM – 8:00 AM</td>
</tr>
<tr>
<td>2. Pilot Study Investigating Use of a Exudate Management Dressing Under Compression for the Treatment of Venous Leg Ulcers</td>
<td>03</td>
</tr>
<tr>
<td>ORAL PRESENTATION: Saturday, September 9</td>
<td>1:50 PM – 2:00 PM</td>
</tr>
<tr>
<td>3. Graft Incorporation and Microangiogenesis Evaluation via Fluorescence Angiography Following Application of an Acellularized Dermal Matrix.</td>
<td>05</td>
</tr>
<tr>
<td>ORAL PRESENTATION: Friday, September 8</td>
<td>7:50 AM – 8:00 AM</td>
</tr>
<tr>
<td>4. Non-Uremic Calciphylaxis Wound: A Case Study</td>
<td>06</td>
</tr>
<tr>
<td>ORAL PRESENTATION: Friday, September 8</td>
<td>1:50 PM – 2:00 PM</td>
</tr>
<tr>
<td>5. Guidelines to Harmonize Wound Management Across Settings and Specialties</td>
<td>08</td>
</tr>
<tr>
<td>6. The Effects of Hypothyroidism on Lymphedema and Wound Healing: A Case Study</td>
<td>09</td>
</tr>
<tr>
<td>7. Terminal Tissue Injuries in Medical Intensive Care Unit: Prevalence Data Collection</td>
<td>10</td>
</tr>
<tr>
<td>8. Pressure Injury Prevention Begins in the Emergency Room</td>
<td>12</td>
</tr>
<tr>
<td>9. Operating Room Driven Prevention</td>
<td>13</td>
</tr>
<tr>
<td>10. EBP-Evidenced Based Practice Leads Way for Change in Practice</td>
<td>14</td>
</tr>
<tr>
<td>11. Get Back to Living with Help from a Personal NPWT Device</td>
<td>15</td>
</tr>
<tr>
<td>12. Case Series: A Prospective, Single-Center Controlled Clinical Study of A Purified Collagen Matrix With Polyhexamethylenebiguanide On Non-Healing Pressure Injuries</td>
<td>16</td>
</tr>
<tr>
<td>13. Traditional Total Contact Cast Versus a Roll-On Alternative in the Treatment of a Diabetic Foot Ulcer: A Case Study</td>
<td>17</td>
</tr>
<tr>
<td>14. Retrospective Review: Gender Differences in diabetic ulcer prevalence amongst a Wound Healing Center (WHC) Population</td>
<td>18</td>
</tr>
<tr>
<td>15. Hypoperfusion and Wound Healing: Another Dimension for the Wound Assessment</td>
<td>20</td>
</tr>
<tr>
<td>16. Elastic Compression Therapy Appears to Enhance Regenerative Healing</td>
<td>22</td>
</tr>
<tr>
<td>17. Wound Edge Epiboly Responds to Elastic Compression Therapy</td>
<td>23</td>
</tr>
</tbody>
</table>

## LIMB SALVAGE

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. Heterotrophic Ossification in a Diabetic Foot: A Case Report</td>
<td>24</td>
</tr>
</tbody>
</table>
ABSTRACT 1

A Retrospective Multicenter Review Evaluating the Safety of Utilizing Fiberglass Total Contact Casts in Hyperbaric Oxygen Chambers.

Author(s): Sneha Patel DPM; Randall Eldridge DPM; Chris Hood DPM; Jeffrey Lehrman, DPM, FASPS, MAPWCA; Rhonda Cornell, DPM

Affiliations(s): Crozer Keystone Health System, Prospect Park, PA, USA

Category: Hyperbaric Oxygen Therapy

Background: Fiberglass total contact casts (TCC) have historically been acknowledged as the gold standard for offloading neuropathic foot wounds.1,2 Hyperbaric oxygen therapy (HBOT) has also been utilized to aid wound healing and is a modality frequently utilized by wound care practitioners as part of a multi-modal approach. However, little is known about the safety of using fiberglass TCCs in HBOT chambers.

Some wound care physicians do hesitate to utilize fiberglass TCCs in HBOT chambers even though there have been no reports of combustible events associated with the use of fiberglass TCCs in HBOT chambers. This study looked at the safety of simultaneous use of total contact casting and hyperbaric oxygen therapy in the treatment of diabetic foot ulcers. We also list the protocols utilized at our wound care centers for total contact casting in conjunction with hyperbaric oxygen therapy to provide insight regarding the use of both modalities concomitantly.

Method: A multicenter retrospective review was conducted on 15 diabetic patients with a total of 179 HBOT dives, recording all adverse events including those related and unrelated to the total contact cast. All patients were treated at a Center for Wound Healing and Hyperbaric Medicine, either Crozer Chester Medical Center (CCMC) or Delaware Country Memorial Hospital (DCMH).

Result: Five adverse events were recorded following 179 total HBOT dives while utilizing a fiberglass TCC. These events included 2 episodes of hypoglycemia, 1 episode of abdominal pain, and 2 episodes of shortness of breath with diaphoresis. No adverse events were directly associated with the use of a fiberglass TCC for any of the patients.

Conclusion: Utilizing a fiberglass TCC while a patient also undergoes HBOT was noted to be a safe practice in this retrospective review conducted at our wound care facilities. In a practice setting that utilizes advanced modalities for wound healing, it may be in the patients’ best interest to use TCC in conjunction with HBOT to expedite wound healing and promote limb salvage. The use of TCC in HBO chambers did not yield any adverse events directly related to the use of the TCC and should be considered if indicated.

References:
ABSTRACT 2

Pilot Study Investigating Use of a Exudate Management Dressing Under Compression for the Treatment of Venous Leg Ulcers

Author(s): Lucian G. Vlad, MD; Candace L. Farrar, RN, BSN; Hengameh Barzkar, MS; Ivo A. Pestana, MD; Joseph A. Molnar, MD, PhD

Affiliations(s): Wake Forrest School of Medicine, Winston-Salem, NC, USA

Category: Wound Healing

Background: Venous leg ulcers (VLU’s) are, in general, exudative wounds that require compression therapy to address the increased venous hypertension. Dressing choice for these patients is extremely important as they must be kept on the wound surface for several days under the compression wraps, and they must be able to absorb the exudate and maintain moisture balance at the wound interface. The purpose of this pilot study is to describe the outcomes of VLU treatment with TRITEC Silver in combination with compression. Specifically, TRITEC Silver wound dressings are a silver based antimicrobial contact layer with a unique exudate management technology.

Method: This is a 10 patient, IRB-approved, single site, open label, non-randomized, non-comparative, prospective pilot study to evaluate the study dressings used under compression for the management of VLUs. Each week, the circumference of the calf and the wound measurements were recorded. The primary objective was the rate of wound closure, based on wound measurements using digital planimetry. Secondary objectives were also examined including: pain, odor, periwound skin condition, edema, and exudate amount. Following the collection of data and photographs, the study dressing was applied and covered with ABD pads (to act as a secondary absorptive layer) and compression. The dressing was to be left on for 7 days between weekly visits. The subjects were followed for a minimum of 4 weeks, but could have been followed for as long as 12 weeks dependent upon wound progression. A patient completed the study if he was healed, or if the clinician considered a different dressing a better option; as usually a near completely healed wound does not need absorptive dressings.

Result: Wound surface measurements obtained using digital planimetry were plotted and rate of closure percent was calculated. One patient completed trial before 4 weeks. On average, at 4 weeks a 68% reduction in wound surface was noticed. Average reduction was 0.15 sq cm/day.

In Graph 1 the wound volume progression over time is displayed. Patients were asked to numerically rate wound pain: 4 patients had decrease pain, 6 had similar levels. Subjective assessment (scale 1-10) of exudate, periwound skin, ease of use (application and removal) and odor was favorable and rated highly by the clinicians (9 and 10).
Conclusion: The AFM exudate management technology in conjunction with multi-layer compression therapy was found to be a useful strategy, as outlined by the calculated rate of closure. The application, management, and removal of the dressing had positive clinical outcomes and good tolerability from both clinical and patient perspective.

TRITEC Silver and AFM are affiliated with Milliken Healthcare Products, LLC and their patented portfolio of moisture management technologies.
ABSTRACT 3

Graft Incorporation and Microangiogenesis Evaluation via Fluorescence Angiography Following Application of an Acellularized Dermal Matrix.

Author(s): Jared Gremillion, DPM; Tyson Green, DPM, FACFAS; Matthew McCabe, MS, DPM

Affiliations(s): Christus St. Patrick Hospital/Imperial Health, Lake Charles, LA, USA

Category: Wound Healing

Background: To evaluate the incorporation of an acellular dermal matrix graft by evaluating vascularization in a noninvasive manner via fluorescence angiography.

Once a biological graft has been applied, it begins to incorporate and interact with the host bed by forming a vascular network. This process is known as inosculation. The graft begins to turn pink as the vascular flow is restored to the graft. There are several theories of which to discern how this process occurs, whether the vascular ingrowth is due to host vessels, the formation of new vessels, or a combination of the two. While this remains a topic of debate, all can be thoroughly evaluated via fluorescence angiography.

Acellular dermal matrix (ADM) grafts have risen in popularity over the previous decade both with increasing brands/types of grafts and also their indications. Very limited research has been performed evaluating the exact level of vascularization within these grafts once applied. To do so previously, the applied-grafts had to be sectioned, stained, and then evaluated under a microscope at various time intervals for new lumen growth. With today’s technology of fluorescence angiography, one can evaluate vascular growth not only more accurately but also, and some would argue more importantly, in a noninvasive manner.

Method: This study details the case of a 39-year-old African American male who contracted necrotizing fasciitis from an infected boil on his right anterior lower leg. After debridement of all nonviable tissue and eradication of the infection, an impressive defect remained totaling 195 cm². Due to the patient having no comorbidities and large granular wound bed, he was a prime candidate for this study. A preoperative fluorescence angiography scan was performed and then an ADM graft was applied intraoperatively using the preferred technique as described by the manufacturer. Fluorescence angiography studies were then performed at serial intervals (7d, 14d, 21d, and 42d) to evaluate for vascular incorporation of the graft. The degree of vascular ingrowth was determined based on the date at which the post-application study ingress and maximal point of intensity rates reached that of the pre-application.

Result: At day 7 the graft had completely incorporated and at day 21 fully vascularized.

Conclusion: The present study placed the several advantages of fluorescence angiography on display. Not only were the vascular components of graft incorporation able to be precisely determined, but also, it was done so in a noninvasive manner, which has not been able to be performed to date to our knowledge.
ABSTRACT 4

Non-Uremic Calciphylaxis Wound: A Case Study

Author(s): David Troung, DPM, MS¹; Kathya Zinszer, DPM, MPH, FAPWCA²

Affiliations(s): Geisinger Community Medical Center, Scranton, PA, USA¹; Geisinger Medical Center, Danville, PA, USA²

Category: Wound Healing

Background: The objective is to understand non-uremic calciphylaxis etiologies and current treatment trends. The purpose is to evaluate a new treatment option for non-uremic calciphylaxis wounds.

Calciphylaxis is a rare and fatal disease that affects the subcutaneous layer of the skin. It is a calcification vasculopathy induced by a metastatic process that cause occlusion of small blood vessels. People who are diagnosed with calciphylaxis have a mortality rate of 52% within one year, and the rate increases to 81% with sepsis being the leading cause of death. Uremic calciphylaxis and the known effective treatments are well documented in the literature. Unfortunately, there is no known effective treatment for non-uremic calciphylaxis. Most of the current treatments of non-uremic calciphylaxis are derived from uremic calciphylaxis treatment protocols. This case study represents and details the successful treatment of a patient suffering from non-uremic calciphylaxis.

Method: A case study outlines the treatment of a 75-year-old female who presented with painful, chronic, non-healing wounds on her right lower extremity. Various conservative treatment methods have failed for this patient. A Skin biopsy confirmed calciphylaxis, and the patient was successfully treated with 4 treatments of pamidronate infusions and local wound care.

Result: The patient right lower extremity ulcers were persistently necrotic and painful with erythematous skin margin and a skin biopsy confirmed calciphylaxis. The patient has no history of renal or other autoimmune disease and the Rheumatology workup was unyielding. The Hematology/oncology workup showed a monoclonal IgG kappa gammopathy. Given the clinical, biochemical, and histopathological findings, it was determined that the patient has non-uremic calciphylaxis. The patient was then scheduled with the infusion center, and received four treatments of pamidronate infusion along with local wound care. Her wounds improved with each infusion and eventually resolved. She was discharged with a knee-high compression stocking and hasn’t experienced a recurrence since then.

Conclusion: Non-uremic calciphylaxis wounds represent a rare pathology and are difficult to treat. Given the rarity of the disease, literature is limited. However, there have been case reports of resolution of NUC with sodium thiosulfate infusion. This case represents NUC wounds successfully resolved with pamidronate infusions and no relapse at approximately 6 months post treatment.
References:
ABSTRACT 5

Guidelines to Harmonize Wound Management Across Settings and Specialties

Author(s): L.L. Bolton, PhD; S. Girolami, RN, BSN, CWOCN; L. Corbett, APRN, MSN, CWOCN; K. Couch, MS, CRNP, CWS; L. Gould, MD, PhD; S. Zakhary, MD; C. Davey, MD; K. LaForet, RN, MCISc, IIWCC; K. Napier, RN, BScN, CETN, MCISc-WH; D. Merkle, APRN, CWOCN, PhD; L. Lavery, DPM, MPH; L. Cowan, PhD, FNP-BC, CWS

Affiliations(s): Rutgers Robert Wood Johnson Medical School, Metuchen, NJ, USA

Category: Wound Healing

Background: Consistent wound care across settings by collaborating members of interdisciplinary teams improves consistency and quality of patient and wound outcomes. The International Consolidated Guideline Task Force (ICGTF) develops patient-centered guidelines that channel evidence-based principles from all related organizations’ guidelines to serve interdisciplinary wound care teams. These guidelines and related implementation tools are designed to harmonize wound care team interactions and serve patients and professionals across all settings and specialties. We describe the ICGTF guideline development process and how it improves quality of wound care guidelines by replacing consensus with formal content validation of recommendation relevance.

Method: Using published standardized processes the Association for the Advancement of Wound Care Guideline Task Force collaborated with the Wound Healing Society and Canadian Association for Enterostomal Therapy in updating the ICGTF Venous and Pressure Ulcer Guidelines. Independent multidisciplinary respondents completed an online survey, formally content validating each recommendation’s clinical relevance and rating its strength (benefit-to-harm ratio) using recognized standards. MEDLINE database literature reviews identified up to 5 best available references supporting each recommendation based on recognized evidence standards.

Result: Guidelines were designed using Institute of Medicine, AHRQ, GRADE and AGREE principles for developing high quality guidelines. All recommendations included in each final guideline are clinically relevant (Content Validity Index at least 0.75) and/or supported by the highest level of evidence. Implementation tools are illustrated, including evidence tables, checklists, algorithms, professional pocket guides and patient brochures designed to involve patients as active participants in guideline-consistent team care.

Conclusion: ICGTF guidelines span specialties and settings to serve interdisciplinary wound teams encouraging appropriate diagnosis, prevention, timely referral and treatment in harmony with current specialty source guidelines. All interested wound organizations are invited to collaborate with the ICGTF encouraging all wound professionals to appreciate each other’s value, while highlighting value of each related specialty guideline.
ABSTRACT 6

The Effects of Hypothyroidism on Lymphedema and Wound Healing: A Case Study

Author(s): Erin Fazzari, PT, MPT, CLT, CWS; Brittany Chervino, PT, DPT, CLT-LANA, WCC

Affiliations(s): Good Shepherd Penn Partners Penn Therapy and Fitness at University City, Philadelphia, PA, USA

Category: Wound Healing

Background: This poster is a case study to illustrate the effects of untreated hypothyroidism on edema associated with stage III lymphedema and a secondary sequelae of chronic wounds. The endocrine system is a complex system that is connected to all of the body's physiological processes. The literature discusses that low thyroid hormone, as seen in hypothyroidism, has a significant influence on kidney function leading to fluid retention with the decrease of renal blood flow and glomerular filtration rate. This decreases sensitivity to adrenergic stimulus, renin release, angiotension II and impairs the renin angiotension aldosterone System (RAAS) activity.

Method: CASE Study: The patient is a 46 African-American female with a complex medical history including: gastric bypass surgery, 100lb weight-loss with elective excess skin removal, complicated by necrotizing fasciitis, sepsis, and ventilator- dependent respiratory failure. The patient had debridement of necrosed areas and developed long standing chronic wounds for over 2 years, and secondary stage III bilateral lower extremity (LE) lymphedema. The patient was treated with standard local wound care, complete decongestive therapy (CDT) – the gold standard of care for lymphedema - and diuretics. These treatments over a 10-month period had minimal effect on wound healing, edema volume increased by 29.7% in the LLE and 36.7% in the R LE, and the patient had a weight gain of 100lbs.

Result: In March 2017, the patient was diagnosed with hypothyroidism and treated with levothyroxine and diuretics. Standard CDT and local wound care regimens were continued. In 4 months, the patient's weight returned to her weight at the start of care, overall 100lb weight loss from her maximum weight, volume reduction of the LLE was 22.8%, RLE 24.7%, and 99% closure of chronic wounds.

Conclusion: Decreased thyroid function should be investigated when there is an occurrence of recalcitrant edema reduction with patient adherence to CDT.
ABSTRACT 7

Terminal Tissue Injuries in Medical Intensive Care Unit: Prevalence Data Collection

Author(s): Elissa Harmon, RN, DNP; Janet Limone RN, MSN; Kathleen Boyle, RN, BSN; James Hazlett, RN, MSNc; Amy Buttaro, RN, BSN

Affiliations(s): Thomas Jefferson University Hospitals, Philadelphia, PA, USA

Category: Wound Healing

Background: To identify population in the Medical Intensive Care Unit (MICU) with unavoidable pressure injuries. To have MICU patients with terminal tissue injuries removed from National Database of Nursing Quality Indicators (NDNQI) data inclusion process. A trend was noted regarding the presence of pressure injuries during the monthly scheduled skin assessments as related to MICU patients approaching end of life. The MICU population consists of complex critically ill patients. A commonly noted complication is end organ damage and / or failure. As part of the institution’s assessment of nursing sensitive measures to improve quality of patient care; pressure ulcer prevalence is done on a monthly basis. An unbiased group of registered nurses are assigned to physically examine the population of each designated patient unit on a particular day. Their findings are reported and checked by our certified wound, ostomy & continence (WOCN) nursing team.

Method: A year-long retrospective chart review process was used to identify patients with terminal tissue injuries who were included in our prevalence data collection. A pressure injury was defined by the National Pressure Ulcer Advisory Panel (NPUAP) in 2015 as a, “localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear”. In 2016, the NPUAP replaced the terminology of pressure ulcer with pressure injury in the classification of skin/tissue damage. Although, pressure injuries are considered by the Joint Commission (2016) to be preventable events; the timeline proximity of pressure injury concurrence to patient expiration prompted a retrospective chart review to identify those patients with end of life skin changes when skin prevalence was surveyed.

Result: The concept of end of life deteriorating skin changes has been studied most prominently by Karen Lou Kennedy (1989) as Kennedy Terminal Ulcers (KTU) and later by Trombley - Brennan as Terminal Tissue Injuries (TB-TTI) and the consensus statement from the expert panel (2009) regarding the Skin At Life’s End (S.C.A.L.E.). Also of note was work done by Dr. Jeffrey Levine (2016); “identified skin failure as an event whereby skin and underlying tissues die due to hypoperfusion that occurs concurrent with dysfunction or failure of other organ systems”.

Conclusion: Given the presence of multi organ failure; the supposition was made that many of the pressure injuries identified in the MICU patients on the day of prevalence assessments were not preventable.
References:


ABSTRACT 8

Pressure Injury Prevention Begins in the Emergency Room

Author(s): Jackie Bender, RN, BSN; Dina Kenyon, RN, BSN; Connie Johnson, MSN, RN, WCC, OMS, LLE, DWC; Sandi Mariani, MSN, RN-BC

Affiliations(s): University Medical Center of Princeton, Plainsboro, NJ, USA

Category: Wound Healing

Background: The first destination for many critically ill patients is the Emergency Department. With skin being the largest organ, we must protect it. We sought to provide the ED staff RNs with criteria to apply Mepilex for prevention and reduction of Stage 1 Pressure Injury in certain patient populations.

Method: In services and education on proper application and autonomy of the RNs to apply the Mepilex products was initiated. Developing the criteria of application was essential for the RN driven prevention. Crite ria for automation application of Mepilex products for prevention in the ED: Patient age greater than 70; Braden Score 18 or less; History of Pressure Injury; Admission diagnosis of Sepsis, Cardiac, Respiratory, Immobility fractures (Hip, femur), CVA/TIA, failure to thrive; and at the discretion of the RN.

Result: Results from the study had a positive impact on patient reduction of Stage 1 Pressure Injury. In September 2016, 73 patients with suspected Stage 1 Pressure Injury resolved within 8 hours of inpatient admission. Continuous RN education and concurrent chart review of selected patient population continues to support the positive impact.

Conclusion: The 5 layered self-adherent soft silicone bordered foam dressing was key to: Reducing the incidence of ED-related pressure injuries from 18% to less than 1 % over a 4-month period and the resolution of Stage 1 pressure injuries within 24 hours when the dressing was used for treatment. Resolution of pain improved patient satisfaction. Prevention of further damage is key to both patient satisfaction and hospital reimbursement for pressure injury treatment. The quick resolution of this patient safety issue is one indication that our pressure injury prevention program, led by our Skin Integrity Team operates in continual quality improvement mode.

References:
ABSTRACT 9

Operating Room Driven Prevention

Author(s): H. Winter, RN; H. Brogan, RN, CRNA; J. Bousenberry, RN; C. Johnson, MSN, RN; N. Montecer, MSN, RN, CNOR; Dr. Bridget Ruscito

Affiliations(s): University Medical Center of Princeton, Plainsboro, NJ, USA

Category: Wound Healing

Background: During the patient’s surgical experience, the largest organ being patient skin must be protected from injury. Due to an increase in awareness regarding tissue injuries by the nursing staff, a significant increase in awareness led to an increase in documentation of pressure injuries in the operating room. Especially for the patients in the Prone position.

Method: The use of Mepilex has been implemented in operating room by Nursing and Anesthesia staff as a collaborative effort. Mepilex is placed on the foreheads of Prone patients, and Sacrum of supine patients for periods over an hour or more. In addition, the use of foam cushions on bony prominences has increased as well for surgical periods of and hour or more. Foam cushions were suggested to staff to be transported with the patient to the Recovery room rather than being discarded in the surgical suite.

We sought to provide the perioperative staff, as well as ASC, with a variety of skills training stations during skills fair. Positioning our patients in varying positions such as Supine, Prone, Lithotomy and Lateral positions were covered using posters, and interactive positioning aides for our staff.

A positioning competency was created with behavioral objectives for each.

Staff was able to verbalize and return demonstrates the use of positioning aides as well as safety measures taken to protect our patients from injury.

Poster boards were also created for visuals describing potential nerve injuries in each of these positions and ways to prevent them.

Result: Results from the skills fair has had a positive impact on the reduction of stage 1 Pressure injuries for the patients in Prone position.

Conclusion: Prevention and management of Stage 1 pressure injuries by the collaborative effort of Anesthesia & OR staff has resulted in a positive outcome maintaining patient skin integrity.

References:
ABSTRACT 10

EBP-Evidenced Based Practice Leads Way for Change in Practice

Author(s): J. Ryan, RN, BC; J Ventura, RN; A. Savacool, RN; C. Johnson, MSN, RN

Affiliations(s): University Medical Center of Princeton, Plainsboro, NJ, USA

Category: Wound Healing

Background: While situations may require specific expertise to assess & provide treatment for patients that require tubes for feeding, drainage, even decompression of the gastrointestinal system, urinary system, accessory organs, & the respiratory system. Often wound/ostomy staff is consulted to assist & manage care of such patients. One policy was created to cover all.

Method: Change in anything is difficult for everyone, much less nurses who have set routines, or have been performing one task for years. Such as “swoosh” test. Creating a document according to EBP to cover all tubes and drains was a huge undertaking. One major change in practice was removing swoosh test from facility practice & creating a new procedure, “change in practice”, based on current EBP.

Result: Continued education & educational modules were some of the means used to educate all nurses regarding change in practice. There was no resistance from the newer graduating nurses as they are currently being taught to utilize pH strip testing in lieu of “swish” test. Whereas the more seasoned nurse can be challenging. Although it is considered a reasonably safe procedure, placement of a NG tube does carry a risk of serious and potentially fatal complications. Despite acknowledgement that an abdominal radiograph is the ‘gold standard’, other methods of verifying placement location are widely used and have varying success rates. Based on this knowledge, it was important to explore and institute a uniformed approach to practice. The most recent evidence based research suggests the use of pH strips when verifying tube placement is the best way to provide effective, safe, and efficient patient care.

Conclusion: Continuing to provide optimal patient care that is EBP may require change in practice along the way. Multiple forms of educational means are often necessary to reach all staff members.

References:
4. www.npsa.nhs.uk/advice
5. Reducing the harm caused by misplaced nasogastric feeding tubes Interim advice for healthcare staff – February 2005
ABSTRACT 11

Get Back to Living with Help from a Personal NPWT Device

Author(s): Peg Manochi, BSN, RN, CWCN; Stacy Stevenson, RN, WCC

Affiliations(s): Medela, Inc, Cherry Hill, NJ, USA

Category: Wound Healing

Background: The treatment of chronic wounds is a billion dollar industry. We spend upwards of $25 billion a year treating them.1 The challenges for patients suffering from chronic wounds after discharge from the hospital are many. Returning to a productive life poses unique challenges that involve mobility, cost control and maintaining dignity all while continuing to keep the wound on a healing trajectory and preventing costly complications and readmissions.

Method: This patient presented with a Stage 4, mid-thoracic pressure injury measuring 5.8cm X 2.1x 1.1cm with circumferential undermining after a long hospital stay for acute MI, cardiogenic shock, ventilator-dependent respiratory failure, acute renal failure, hemorrhagic shock, serratia and citrobacter pneumonia requiring the use of extracorporeal membrane oxygenation (ECMO) therapy in ICU for 38 days. Advanced wound care dressings were ineffective in healing the wound. A portable, personal NPWT device was implemented upon discharge to home. The patient also required a defibrillator vest that exerted pressure on the wound site.

Result: The wound healed in a short amount of time with no complications. The unique challenges of the defibrillator vest and the NPWT device were dealt with expertly by the home care nurse and the wound care nurse.

Conclusion: By implementing the use of a portable, personal NPWT device the patient was able to return to a productive, rewarding life and maintain ADL. Home care nurses and the wound care nurse from the medical device company collaborated to trouble shoot, educate and follow up on his progress and solve any issues his unique circumstance presented. The patient is grateful to be alive and celebrate the "best Father's Day ever" without a wound!

References:
ABSTRACT 12

Case Series: A Prospective, Single-Center Controlled Clinical Study of A Purified Collagen Matrix With Polyhexamethylenebiguanide On Non-Healing Pressure Injuries

Author(s): Oropallo, Alisha, MD\textsuperscript{1,2}; Kaplan, Sally, RN, CCRC\textsuperscript{1}; Baksh, Farisha, BS\textsuperscript{1}; Nicastro, Jeffrey, MD\textsuperscript{1,2}; Coppa, Gene, MD\textsuperscript{1,2}; Caprioli, Russell, DPM\textsuperscript{1}; Haight, John, DPM\textsuperscript{3}; Pliskin, Michael, DPM\textsuperscript{3}; Ferguson, Raymond, DPM\textsuperscript{3}

Affiliations(s): Department of Surgery, Northwell Health System, Comprehensive Wound Care Healing Center and Hyperbarics, Lake Success, NY, USA\textsuperscript{1}
Hofstra-Northwell Health System School of Medicine, Hempstead, NY, USA\textsuperscript{2}
Department of Podiatry, Northwell Health System, Comprehensive Wound Care Healing Center and Hyperbarics, Lake Success, NY, USA\textsuperscript{3}

Category: Wound Healing

Background: It is well established that many variables including the products used for the management and treatment of various wounds can affect the rate and extent of healing.

Method: This was a prospective, 12-week study from a large outpatient institution that specializes in the treatment of patients with diverse wound types. This case series explored the effects of a purified collagen matrix with polyhexamethylenebiguanide (PCMP; PuraPly AM™ Organogenesis: Canton, MA) for the management of non-healing pressure injuries, regardless of anatomical location. Key exclusion criteria included patients with sensitivity to porcine materials or polyhexamethylenebiguanide, patients with third degree burns, and/or those receiving concurrent treatment with other topical antimicrobials or skin substitute products. Wounds were evaluated weekly for size, wound closure, and signs of infection; debridement was performed as needed.

Result: Twelve patients with a pressure injury (n=12) were enrolled in the study. At baseline, wound sizes ranged from 0.1 to 327.8 cm\textsuperscript{2} and at week 12, there was a mean decrease in wound size of 28.2 cm\textsuperscript{2}. At study follow-up, five wounds completely healed and four reduced in size by ≥80%. Overall, nine wounds decreased in size by >40% by week 4, and from baseline to week 12, the size of two wounds remained unchanged and one increased slightly. None of the patients showed any signs of complications or infections throughout the course of the study.

Conclusion: This case series, evaluating PCMP use for the management of non-healing pressure injuries, demonstrated better wound outcomes (surface area, size, wound closure, etc.) overall which may be suggestive of a potential benefit to the wound healing process. These results need to be further substantiated in well-designed studies with a larger sample of patients.
ABSTRACT 13

Traditional Total Contact Cast Versus a Roll-On Alternative in the Treatment of a Diabetic Foot Ulcer: A Case Study

Author(s): Sarah M. Shipley DPM; Jeffrey D. Lehrman DPM, FASPS, FACFAS, MAPWCA

Affiliations(s): Crozer-Keystone Health System Podiatric Surgical Resident, Upland, PA, USA

Category: Wound Healing

Background: Demonstrate the benefit of an evidence-based treatment plan for a diabetic foot ulcer (DFU) with traditional total contact casting (TCC) after failure to heal with a roll-on casting alternative. The Purpose is to reinforce the importance of evidenced-based medicine to heal chronic DFUs thereby preventing limb threatening complications.

Method: A 71-year-old diabetic male with a plantar midfoot DFU was treated for fourteen months, including eight applications of a roll-on type casting device and four applications of cellular and/or tissue based products for wounds (CTP). After failure to heal, the treatment plan was changed to a traditional TCC combined with CTPs in an attempt to increase the chances of healing. The patient was followed until wound closure.

Result: The size of the patient’s DFU at the start of the traditional TCC treatment was 4cm². After three TCCs over 3 weeks, the wound area reduced 65% to 1.4cm². The wound healed at eleven weeks after ten applications of the traditional TCC and eight applications of CTPs, without any complications. Offloading with TCC is the gold standard for neuropathic DFUs.1 If a DFU does not reduce in area by 53% after four weeks of treatment, it is a negative predictor of healing at twelve weeks.3 In a small case series comparing the traditional TCC and the roll-on alternative, DFU healing in traditional casts occurred in under half the time it took to heal in the roll-on alternative.2 Similarly our patient healed after switching to the traditional TCC.

Conclusion: Once the treatment plan was altered to the traditional TCC, positive predictors for healing were noted. While the roll-on casting system may have a faster application, the traditional TCC has been shown to be more effective and was again in this case study. The extra time it takes to apply a traditional TCC could be the difference between healing a DFU and costing the patient their limb or life.

References:
2. Franklin C, Lehrman JD, Cornell R "A Retrospective Comparison of Healing Rates of Two Total Contact Cast Systems" Symposium on Advanced Wound Care (SAWC), Orlando, FL April, 2014
ABSTRACT 14

Retrospective Review: Gender Differences in diabetic ulcer prevalence amongst a Wound Healing Center (WHC) Population

Author(s): Robert Skerker, MD, FAPWCA; Melissa Marrero, MSN, RN, CWCN; Joyce Kucerovy, BSN, CMSRN

Affiliations(s): Morristown Wound Healing Center at Morristown Medical Center, Morristown, NJ, USA

Category: Wound Healing

Background: Analysis of a diabetic cohort within a wound healing center to gain a better understanding of population demographics. Diabetes, a burgeoning medical issue in our population is associated with significant morbidity and mortality. Diabetes affects 29.1 million Americans or 9.3% of population; 15% of population over 65 have diabetes. One major complication of diabetes is the diabetic foot ulcer which often represents a series of pathophysiological abnormalities including neuropathy, small blood vessel disease leading to ischemia, and bony architectural changes of the foot. Ten to 20% will go on to some type of amputation, which magnifies mortality rates. Treatment is difficult and the expense to the healthcare system is large. There is also a high recidivism rate. Diabetes affects males and females equally.

Method: The Morristown Wound Healing Center (WHC), performed a retrospective chart analysis (QI project) for all patients treated with new wounds in 2015 to gain a better understanding of population trends and wound types treated. Data collection was done by means of running a standard “wound type” report from within the EMR. Data analytics were used to match age and gender demographics to each wound within the cohort. A male gender predilection was noted in the diabetic wound cohort resulting in the expansion of this QI initiative to 4 other affiliated Wound Healing Centers (WHC).

Result: In 2015, the Morristown WHC treated 2432 total wounds, 278 of which were diabetic ulcers; 33 wounds in 16 females (11.9%) and 245 wounds in 92 males (88.1%) [p value < 0.001]. There was no statistically significant difference in mean or median age based on gender. Each of the other affiliated 4 WHC sites individual data showed similar findings. Pooled data from all 5 sites revealed: 1011 (11.2%) diabetic wounds amongst 9019 treated wounds. Females accounted for 280 wounds (27.7%) and 731 wounds (72.3%) were attributable to males; [p <0.001]. There was no difference in mean or median age between genders.

Conclusion: A preliminary review of the literature pertaining to diabetic wounds within a wound care setting does not support any known gender differences. An initial QI project showed data that suggested a significant male prevalence. This led to a retrospective review of the 2015 diabetic wound cohort at 5 affiliated Wound Care Centers. Each individual site supported the initial finding and the pooled data together continued to support the finding that male gender is a demographic variable that is statistically important in diabetic ulcers. Further research is recommended to confirm these diabetic ulcer prevalence findings and explore potential causality such as marital status, health care coverage, behavioral factors and health care literacy.

References:


ABSTRACT 15

Hypoperfusion and Wound Healing: Another Dimension for the Wound Assessment

Author(s): Wendy Smollock, MS, APRN, CWS; Paul Montenegro, MS, APRN, CWCN; Yuan He, MS; Amy Czenis, MS, APRN, CWS

Affiliations(s): Wound Healing Solutions, LLC, Barrington, NJ, USA

Category: Wound Healing

Background: Currently there is a paucity of quantitative measurements wound specialists have at their disposal to accurately describe the factors impacting wound healing outcomes. Furthermore, the analytic process used to establish the assessment framework within wound healing continues to be retrospective. We seek to describe how the effects of tissue perfusion impacts wound healing. Additionally, we seek to describe the threshold of perfusion necessary to support wound healing thereby guiding the clinician with an analytical process which can be used accurately and prospectively at the bedside. It was determined that a straightforward method to assess tissue perfusion is the Mean Arterial Pressure (MAP). The general consensus of the literature suggests a MAP of > 60mmhg is necessary to sustain organ viability but does that support the skin and wound healing? We chose the calculation of the MAP as a measure of the skin’s tissue perfusion.

Method: Participants were adults residing in a long-term care facility. Over a three-month observational period, vital signs taken prior to their weekly wound assessments. All participants had existing skin breakdown of various etiologies and various durations. Participants were not controlled for co-morbidities, blood sugar stability, race, age, sex or type of topical treatment used. All participants received general supportive interventions, including offloading, that met the standard of care for skin and wound management. Wound healing was assessed through both a visual analogue scale as well as an assessment of the change in wound surface area. This index was correlated to the individual’s MAP.

Result: Aggregate analyses of the data revealed a positive correlation (Pearson R) between the MAP and index of wound healing. A well-defined correlation between the MAP and stalled or poor wound healing was noted for all wound locations in this data set when MAP values were 80 or less.

R = 0.86  N=501; P<0.0001
**Conclusion:** Our data suggests that MAP values <80 can independently result in stalled or worsened wounds. We saw predictability of wounds stalling or declining related to the MAP, regardless of topical treatment or standard of care interventions. The data also suggests that remediating states of low perfusion should take precedence in making treatment decisions, as low perfusion will negatively affect wound healing regardless of other interventions. Our data will hopefully expand the utilization of the assessment of skin perfusion within standard wound assessments. Understanding the effects of intrinsic factors of wound healing can help shape a more accurate picture of underlying etiology and prognosis. In these cases, hypoperfusion ulceration may represent a more accurate label.

**References:**

ABSTRACT 16

Elastic Compression Therapy Appears to Enhance Regenerative Healing

Author(s): Martin J. Winkler, MD, FACS

Affiliations(s): Creighton University Bergan Mercy Hospital Advanced Wound Care Center, Omaha, NE, USA

Category: Wound Healing

Background: Edema is a treatable wound comorbidity and indications for elastic compression (EC) therapy are expanding. EC therapy for venous leg ulcers was pioneered by Moffatt, who feared an arterial tourniquet effect and advocated vascular testing. Limiting EC to limbs with ankle brachial index of >0.8 became a de novo standard however, little prospective data justifies withholding EC in wounds with arterial disease. In 2016, Brogan demonstrated that 1 hour of EC significantly increases skin perfusion.

Jacobs, in 2010, observed that pneumatic compression appears to enhance regenerative, i.e. stem cells precursors involved, healing. As we began to use EC liberally to heal ischemic wounds, we noticed the findings Jacobs described. Tamaia, using bioengineered mouse bone marrow transplantation model, demonstrated that five months after a split thickness skin graft, 85% of the epithelial cells in grafted skin are derived from bone marrow precursors. This case study asks, does elastic compression therapy enhance regenerative healing in chronic wounds?

Method: Photos document 5 full thickness mixed etiology wounds treated with EC therapy that demonstrate one of the three clinical signs of regeneration. Full thickness wound healing without scar, with fingerprints on palm and soles and with non-pigmented scar in dark skin.

Result: Photos of healed wounds with clinical signs of regenerative healing in 5 patients treated with EC for refractory leg ulcers are presented.

Conclusion: Anecdotal observations suggest that elastic compression* therapy, long required to heal venous leg ulcers, appears to have a regenerative mechanism.

(*EdemaWear® Compression Stockinet, Compression Dynamics LLC, Omaha, NE 68102)
ABSTRACT 17

Wound Edge Epiboly Responds to Elastic Compression Therapy

Author(s): Martin J. Winkler, MD, FACS

Affiliations(s): Creighton University Bergan Mercy Hospital Advanced Wound Care Center, Omaha, NE, USA

Category: Wound Healing

Background: Initial appearance of the wound edge betrays the multiple comorbid physiologic problems at work in a chronic wound and, importantly, guides our initial care of the wound. One example, early debridement of hyperkeratotic wound shoulders to create a flat wound couture is widely accepted. The role of edema control to treat epiboly is not widely understood.

Sibbald et al. established the importance of wound edge therapy as an integral part of wound bed preparation in an evidence level 5 review article in 2000. Recently Snyder and Fife include wound edge effects in the DIME paradigm (Devitalized Tissue, Inflammation, Moisture Balance and Edge Preparation), which is a Centers for Medicare and Medicaid (CMS) Physician Quality Reporting System (PQRS) measure.

This case series asks, does elastic compression therapy decrease wound epiboly?

Method: Photos document presentation, treatment and outcomes of ten lower extremity wounds of mixed etiology that had dramatic wound edge response to elastic textile compression.

Result: This non-controlled case series demonstrates that elastic textile compression therapy controls two DIME PQRS measures, wound moisture control and wound edge preparation.

Conclusion: Elastic textile* compression therapy appears to improve wound Edge epiboly and improve wound healing.

(*EdemaWear® fuzzy wale elastic compression textile, Compression Dynamics LLC, Omaha, NE 68102)
ABSTRACT 18

Heterotrophic Ossification in a Diabetic Foot: A Case Report

Author(s): Prashant H. Bhoola, DPM; Jeffrey D. Lehrman DPM, FASPS, FACFAS, MAPWCA

Affiliations(s): Crozer-Keystone Health System Podiatric Surgical Residency, Upland, PA, USA

Category: Limb Salvage

Background: Neuropathic ulcerations in the foot, especially in individuals with diabetes, have been widely discussed in our health care system. Despite it being a common finding, heterotrophic ossification is rarely discussed in the literature as a cause of neuropathic foot ulceration. Heterotrophic ossification is defined as “abnormal formation of mature, lamellar bone in the connective soft tissue” usually following trauma or surgical intervention. Most published studies focus on its formation after total hip arthroplasty.

Method: In our case study, a patient presented with plantar re-ulceration seven weeks status post transmetatarsal amputation, and despite three months of local wound care and proper offloading, the ulcer failed to heal. Radiographic evidence revealed Grade 3b heterotrophic ossification of all metatarsals. The unique characteristic found in our patient was the first and second metatarsals conjoined after the re-growth. Initial clinical and radiographical evaluations were subtle but after intraoperative inspection it was clear that re-ulceration was caused by the plantar pressure of the conjoined bones. Simple resection and percutaneous tendoachilles lengthening proved to be effective in healing of the ulcer.

Result: Our patient achieved full closure of the ulcer in seven weeks after the procedures combined with good patient compliance, non-weight bearing and local wound care which included a dialky carbamoyle-chloride contact layer, clostridial collagenase, and a dressing containing a combination of petrolatum and 3% Bismuth Tribromophenate, all used at different points in recovery.

Conclusion: In Boffeli et. al’s case series about 75% of patients developed re-ulcerations from heterotrophic ossification, with the majority having diabetic neuropathy and robust circulation. Preventive measures may include employing a two-stage surgical technique or single-dose radiation therapy. Overall, heterotrophic ossification is a concern for diabetics undergoing amputation and should be properly addressed to prevent re-ulceration and infection.

References: