The Duration of Effectiveness of Mafenide Acetate Solution After Reconstitution

Saturday, November 5
10:00 - 10:15 am

Author and Co-authors:
Ashkan Afshari, MD, Resident¹; Steven A. Kahn, MD; Lyly Nguyen, MD¹; Amy Montgomery, BS¹; Takashi Shinha, MD¹; Charles Stratton, MD¹; Blair Summitt, MD¹
¹Vanderbilt University Medical Center, Nashville, TN; ²University of South Alabama, Mobile, AL

Objectives:
Upon completion of the lecture, attendees should be better prepared to:
- Describe the duration of effectiveness of mafenide acetate after reconstitution
- Consider utilizing mafenide acetate solution beyond 48 hours after reconstitution

Abstract:
Introduction: Mafenide acetate is an effective but costly antimicrobial solution used for burn wounds. The package insert instructs the user to discard unused solution within 48 hours of opening. The purpose of this study is to evaluate the antimicrobial activity of mafenide acetate beyond 48 hours after reconstitution, to possibly reduce cost by eliminating product waste.

Methods: S. aureus and P. aeruginosa isolates were used to seed Mueller-Hinton agar plates at 0.5 McFarland standard. Filter paper disks were then saturated with 5% mafenide acetate at 0, 2, 7, and 14 days after reconstitution, while the control group consisted of unsaturated dry filter paper. Disks were then placed on the seeded agar plates and incubated for 24 hours at 37°C. After incubation, the zone of inhibition around each plate was measured. A zone of inhibition of 2mm or greater was indicative of susceptibility. Reconstituted mafenide was stored at 4°C during the study duration.

Results: The control group demonstrated no zone of inhibition for both S. aureus and P. aeruginosa. Five percent mafenide acetate remained efficacious, with a >2mm zone for both organisms at 0, 2, 7, and 14 days post mafenide acetate reconstitution (See attached table). Conclusion: This in vitro study demonstrates that the antimicrobial activity of mafenide acetate remains present for at least 14 days after reconstitution. Unused mafenide may not need to be discarded at 48 hours after opening if stored properly. Reducing wasted product has the potential to translate into cost savings. The duration of mafenide acetate’s antimicrobial activity needs to be further studied in a clinical setting.

<table>
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<th>Days after reconstitution</th>
<th>S. aureus</th>
<th>P. aeruginosa</th>
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<tbody>
<tr>
<td>0</td>
<td>6</td>
<td>8</td>
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<tr>
<td>2</td>
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Disclosure:
Ashkan Afshari - No Relevant Financial Relationships to Disclose
Steven A. Kahn - No Relevant Financial Relationships to Disclose
Lyly Nguyen - No Relevant Financial Relationships to Disclose
Amy Montgomery - No Relevant Financial Relationships to Disclose
Takashi Shinha - No Relevant Financial Relationships to Disclose
Charles Stratton - No Relevant Financial Relationships to Disclose
Blair Summitt - No Relevant Financial Relationships to Disclose
Care for Vesicant Injuries - Not Just Historic Footnotes

Saturday, November 5
10:15 - 10:30 am

Author and Co-authors:

Todd Bierman, MD, Resident¹; Thomas Holcombe²; Scott Patterson, DO¹; Alicia Lintner, CRNP-BC¹; Jon Simmons, MD¹; Sidney Brevard, MD¹; Steven Kahn, MD¹

¹Naval Medical Center, Portsmouth VA; ²Arnold Luterman Regional Burn Center, University of South Alabama, Mobile, AL

Objectives:
Upon completion of the lecture, attendees should be better prepared to:
- Identify the features of vesicant injuries
- Demonstrate the management of these injuries
- Recognize these injuries as unique from chemical injuries

Abstract:
Introduction: Vesicant injuries are challenging because they are relatively rare, literature is sparse, and they can be mistaken for a chemical burn. Incorrectly diagnosing these injuries may be problematic, as the two entities are different.

Methods: This is a case report of a 20 year old college student who presented one week after suffering burns to both hands while disposing of “waste chemicals” in the local university chemistry lab. He stated that the chemicals eroded through his gloves. Three days later, he developed pruritis, and later blisters appeared. At presentation, he complained of worsening pain at the injury site. He provided a list of chemicals, which included 2,4,6trichloropyrimadine, a known vesicant substance. The initial wounds appeared superficial. His blisters were left intact and treated with a topical antimicrobial therapy. On follow up five days later, the wounds were still painful and appeared to be deeper, concerning for full thickness that might require excision. Daily dressing changes at home and close follow up in outpatient wound care was continued, and in another 48 hours, the wounds showed signs of healing. They ultimately healed in two weeks without operative intervention and minimal scarring.

Conclusions: Vesicant injuries, though common during World Wars I and II, are quite uncommon today; however, given modern day threats such as terrorism, recognizing and appropriately treating these injuries is necessary for healthcare providers. Treatment should start with decontamination and removal of residue at the scene. This includes removing articles of clothing or jewelry, as well as washing exposed areas, including hair and skin, with soap and water. Residue not removed can result in deeper injury, can be spread to additional body parts, and can cause injury to civilians and healthcare providers. After decontamination, transfer to a facility equipped to care for vesicant injuries is appropriate. Any pulmonary involvement can be treated supportively with supplemental oxygen, CPAP, or mechanical ventilation, depending on severity of injury. Resuscitation is often unnecessary, as these wounds do not result in large fluid losses and shifts like thermal burns—therefore, resuscitation per burn therapy formulas is unnecessary and may be harmful. Large skin blisters (>12 cm) should be unroofed, and all denuded areas should be irrigated several times a day with water and dressed with a topical antimicrobial. Eyes are can also be involved, and should be thoroughly irrigated and treated with topical antibiotics and lubrication. Close follow up is recommended, as these may require excision and grafting, though this is largely dependent on the agent and amount of exposure.

Disclosure:

Todd Bierman- No Relevant Financial Relationships to Disclose
Thomas Holcombe- No Relevant Financial Relationships to Disclose
Scott Patterson- No Relevant Financial Relationships to Disclose
Alicia Lintner- No Relevant Financial Relationships to Disclose
Jon Simmons- No Relevant Financial Relationships to Disclose
Sidney Brevard- No Relevant Financial Relationships to Disclose
Steven Kahn- No Relevant Financial Relationships to Disclose
First-in-Human Use of a Novel Photoplethysmography Imaging Device to Investigate Blood Flow in the Microcirculation of Burn Wounds

Saturday, November 5
10:30 - 10:45 am

Author and Co-authors: Konstantinos Chouliaras, MD, Resident¹, Jeffrey E. Carter, MD¹; James H. Holmes, IV, MD¹; John J. Squiers, MD²; Kristy Piepenbrok, MD³; Jeffrey Thatcher, PhD³; J. Michael DiMaio, MD²
¹Wake Forest University, Winston-Salem, NC; ²Baylor Research Institute, Dallas, TX; ³Spectral, Dallas, TX

Objectives: Upon completion of the lecture, attendees should be better prepared to:
- Identify technology currently in development that can assist in assessing burn wound severity aiding providers to determine appropriate burn care

Background: The DeepView Wound Imaging System is an experimental device that utilizes photoplethysmography imaging technology to detect pulsatile blood flow in the microcirculation. We aimed to characterize our center’s initial experience with the implementation of our device to study burn wounds in the clinic, the intensive care unit, the hydrotherapy room, and the operating room.

Methods: Patients with acute and chronic burn wounds were consented for imaging studies under an IRB approved investigational protocol. Wound imaging was performed using the portable DeepView Wound Imaging System throughout the burn center with burn surgeons and wound care nurses simultaneous assessing the burn depth.

Results: A total of 12 burn victims underwent imaging procedures during the study period. Images were collected from a variety of anatomic locations including the face, neck, thorax, abdomen, back, limbs, and hands. The portability and maneuverability of the device allowed for easy and rapid transportation throughout the medical center. The device was capable of performing imaging studies intraoperatively without disrupting the sterile field or significantly prolonging operative time. Photoplethysmography detection of microcirculatory blood flow correlated with our clinical assessment of burn wounds: minimal blood flow was detected in deep partial thickness and full thickness burns, whereas blood flow could be detected in surrounding areas of healthy tissue.

Conclusion: The DeepView Wound Imaging System was implemented into the clinical workflow of our burn center with minimal disruption. Burn wounds of all depths and in a wide variety of anatomic locations were imaged. Preliminary analysis of the photoplethysmography blood flow images suggests that the system has the potential to provide data that will facilitate clinical management of burn victims

Disclosure:
Konstantinos Chouliaras- No Relevant Financial Relationships to Disclose
Jeffrey E. Carter – Advisor Panel: Acetia; Speaker: Integra Lifesciences; Stock: PermeaDerm
James H. Holmes - Stock: Abbott Labs; AbbVie; Eli Lilly; RegenMed Therapeutics; PermeaDerm
John J. Squiers – Salary: Spectral
Kristy Piepenbrok – Salary: Spectral
Jeffrey Thatcher – Salary: Spectral
Michael DiMaio Salary: Spectral
### Author and Co-authors:
**Daniel Freno, MD, Resident, Steven Kahn, MD; Scott Patterson, DO**
University of South Alabama, Arnold Luterman Regional Burn Center, Mobile, AL

### Objectives:
- Recognize that routine nasolaryngoscopy is not necessary in the evaluation for potential upper airway injury in patients presenting with facial burns
- Describe the situation in which selective use of nasolaryngoscopy might prove beneficial

### Abstract:
#### Background:
Upper airway injuries can be fatal in burn patients if not recognized, which causes a significant amount of anxiety for physicians providing initial assessment of burn patients. Early elective intubation is often performed; however, some providers employ nasolaryngoscopy for patients presenting with facial burns or signs/symptoms of upper airway injury in order to assess the need for intubation. Evidence is currently lacking about the utility of nasolaryngoscopy as an adjuvant assessment during evaluation of potential upper airway burn injuries. The objective of this study was to determine if nasolaryngoscopy provides additional information to the history and physical in making the decision to electively intubate patients with facial burns.

#### Methods:
This study was a retrospective analysis of all patients who underwent fiberoptic nasolaryngoscopy after facial burn injury to evaluate for upper airway injury associated with burns over a 2 year period at a regional burn center. During this time period, all patients who presented with facial burns, soot, or carbonaceous sputum underwent nasolaryngoscopy to look for upper airway injury regardless of mechanism of injury. Patients intubated prior to arrival were excluded from the study. Patients were considered to have signs/symptoms of airway injury (symptomatic) if they presented with dyspnea, tachypnea, hypoxia, or obvious burns to buccal mucosa. Procedure notes were used to determine if supraglottic/glottic injury (erythema or edema) was present on nasolaryngoscopy. Presence of pathologic changes and whether they led to intubation were evaluated in the asymptomatic and the symptomatic groups of patients.

#### Results:
Only 10/210 (5%) of patients included in the study were intubated after nasolaryngoscopy. 188 patients were asymptomatic, and 58 (31%) of this group had either erythema or edema, and only 2 asymptomatic patients were intubated (1%). These patients were both extubated within two days. None of the 130 asymptomatic patients with negative nasolaryngoscopy were intubated. 22 patients were symptomatic upon presentation, 8 of these had a negative laryngoscopy, and only 1 was intubated. Of the 14 with pathological changes on laryngoscopy, only 7 (50%) were intubated.

#### Conclusions:
This study showed disparity between signs and symptoms of airway injury and nasolaryngoscopy findings. Asymptomatic patients showed pathologic changes in 30% of scopes, but this finding only changed management 1% of the time. Furthermore, the two patients in this group were extubated quickly, suggesting they may have been suitable for observation without intubation. These results indicate that the presence of erythema or edema is of questionable clinical significance in asymptomatic patients and nasolaryngoscopy is of limited benefit in this group. Only 50% of the symptomatic patients with airway injury evident on nasolaryngoscopy were actually intubated, also bringing into question the significance of the pathologic changes in this group. However, negative nasolaryngoscopy may have had some benefit in preventing intubation in a few, select symptomatic patients. This study suggests that a thorough history and physical is the best tool to identify patients at higher risk of upper airway injury who need intubation, but this should be further studied in prospective trials to determine the definitive role of nasolaryngoscopy.
Disclosure:
Daniel Freno - No Relevant Financial Relationships to Disclose
Steven Kahn - No Relevant Financial Relationships to Disclose
Scott Patterson - No Relevant Financial Relationships to Disclose
14 Year Review: Characterization and Prevalence of Isolated Head and Neck Burns

Saturday, November 5
11:00 - 11:15 am

Author and Co-authors:
Travis Hamilton, DMD, MD, Resident; Walter Ingram, MD; Yuvonda Hodge, MD; Shelly Abramowicz, DMD, MPH; Rachael Williams, MD
Grady Health System Burn Center, Atlanta, GA

Objectives:
Upon completion of the lecture, attendees should be better prepared to:
• Describe and discuss patient demographics and mechanisms associated with head and neck burns

Abstract:
Statement of Problem: There is limited data in Oral and Maxillofacial Surgery (OMFS) literature characterizing head and neck burns in the United States.

Purpose: To report prevalence of isolated head and neck burns and associated sequelae and to assess patient outcomes useful in facial burn management.

Materials and Methods: A retrospective cross-sectional study was conducted at Grady Memorial Hospital, a major metropolitan burn referral center. Data of patients admitted with a primary diagnosis of head and neck from 2000 to 2014 was reviewed. Demographic (age, gender), burn (mechanism, depth, total body surface area), airway and respiratory management (intubation, tracheostomy, ventilator days), surgical (procedure, timing), and outcomes (length of stay, mortality) details were recorded.

Results: There were 205 patients with head and neck burns who met inclusion criteria. The majority of burns occurred in males (66%) with mean age of 40 years (range, 2 months to 88 years). The majority of burns were accidental (n=196, 96%) and caused by (flame (n=136, 66%). The superficial partial thickness burn was the most frequently reported depth (n=165, 80%). The average total body surface area was 3%. Patients were intubated (n=29, 14%) and required tracheotomy (n=9, 4%). After intubation, patients averaged 7.5 days on the ventilator (range, 1 to 85 days). Mean length of stay was 4.4 days (range 1 to 112 days). Surgical management in the operating room was required for 25 (12%) patients. Inhalation injury was the most common associated injury, occurring in 32 (16%) patients and had a 22% mortality rate. Overall mortality was 2%.

Conclusions: Superficial partial thickness head and neck burns were more common in males, older than 55 years. Most head and neck burns were accidental and the most frequent mechanism was flame. The majority of head and neck burns are managed outside of the operating room via local wound debridement and dressing changes. Due to an increased risk and mortality of inhalation injury, airway protection and respiratory management are critical considerations of head and neck burn management.

References
Disclosure:
Travis Hamilton - No Relevant Financial Relationships to Disclose
Walter Ingram - No Relevant Financial Relationships to Disclose
Yuvonda Hodge - No Relevant Financial Relationships to Disclose
Shelly Abramowicz - No Relevant Financial Relationships to Disclose
Rachael Williams - No Relevant Financial Relationships to Disclose
AUTHOR AND CO-AUTHORS: Duane Wang, MD, Resident; Lesley Wong, MD; Daniel H. Stewart, MD
University of Kentucky, Lexington, KY

OBJECTIVES: Upon completion of the lecture, attendees should be better prepared to:
- Recognize the importance of post burn skin surveillance for the development of malignant lesions even in the acute setting less than 12 months after injury
- Discuss the pathophysiology of the conversion of burn scars to malignant lesions

ABSTRACT:

INTRODUCTION: Skin cancer arising in previously injured skin has been termed a “Marjolin’s Ulcer,” with the malignancy typically occurring many years after the injury. A skin cancer that develops in a scar within 12 months of the injury has been termed an “acute” Marjolin’s ulcer. We describe two patients who presented with multiple synchronous skin cancers in areas of relatively minor burns within 23 months of the injury.

METHODS: The charts of two patients were reviewed. A systematic review of the literature was performed.

RESULTS:
Case 1: A 64 year old male sustained a 12% TBSA partial thickness flame burn involving his face, arms and legs while burning brush with gasoline. The burns healed with topical wound therapy. Two months later he presented with rapidly growing ulcerated lesions on this right forearm and left knee in areas of healed burns. These were excised and pathology returned as well differentiated squamous cell cancer with negative margins. The patient had no history of previous skin cancer and reported no lesions at the time of the burn. A full body exam by Dermatology did not reveal any other suspicious lesions.

Case 2: A 66 year old female sustained 4% TBSA partial thickness grease burn to her lower legs. The burns healed with topical wound therapy. 3 months later she presented with five rapidly growing ulcerated lesions on her left anterior leg in an area of healed burn. These were excised and pathology returned as well differentiated squamous cell cancer with negative margins and solar elastosis with actinic changes. She had a past history of skin cancers but was closely followed by Dermatology and did not have any suspicious lesions on her legs at the time of the burn injury.

DISCUSSION: Less than 20 cases of acute Marjolin’s ulcers after a burn injury are reported in the literature and these have all been instances of single lesions. Some additional cases are reported as acute Marjolin’s ulcers, but the etiology is unknown. There is no consensus in the literature regarding differences between acute and chronic Marjolin’s ulcers. Presumptive mechanisms for malignant transformation include prolonged inflammation and hyperplasia resulting in DNA mutations, ionizing radiation damage to DNA in oncogenes and/or tumor suppressor genes, lymphatic obstruction and ischemia leading to localized immune suppression (“immunocompromised district”), ultraviolet light damage to Langerhans cells with loss of local immune response, and carcinogenic stimulus of a preexisting premalignant lesion or occult malignancy.

CONCLUSION: We are unaware of previous reports of multiple synchronous acute Marjolin’s ulcers. These cases add to the body literature regarding acute Marjolin’s ulcers occurring in a burn injury and highlight the need to be vigilant in diagnosing and treating new onset skin lesions and performing a full body exam.
<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Duane Wang</td>
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<td>Lesley Wong</td>
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<td>Daniel H. Stewart</td>
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# Treatment of an Iatrogenic Tracheo-Cutaneous Fistula in a Burn Victim

**Author and Co-authors:**

Katherine M. Huber, MD, Resident; Alicia Billington, MD, PhD; Kimberly Maynell, ARNP-C; Loryn Taylor, ARNP-C; C. Wayne Cruse, MD

University of South Florida, Tampa General Hospital Regional Burn Center, Tampa, FL

**Objectives:**

Upon completion of the lecture, attendees should be better prepared to:

- Recognize factors that may lead to tracheocutaneous fistula in a burn patient and describe appropriate treatment options based on characteristics of the TCF.

**Abstract:**

**Introduction:** Tracheo-cutaneous fistula (TCF) is a problem often experienced after decannulation of a long-term tracheostomy that can lead to significant morbidity. We describe an interesting presentation of TCF in a burn victim and offer a conservative treatment option in place of more complex reconstruction.

**Methods:** A 65 year old woman presented with symptomatic hypertrophic burn scar contractures of the anterior neck several months after undergoing excision and grafting of full thickness grease burns to the neck and chest. Notably, she had history of tracheostomy placement at the time of initial burn with subsequent uneventful decannulation. She underwent excision of hypertrophic burn scar to the neck with staged placement of bilayer wound matrix and split thickness skin grafting. Postoperatively she was noted to have billowing of the graft with phonation and respiration attributable to a TCF which prevented graft adherence. The graft was debrided and local wound care was performed for several weeks followed by re-grafting.

**Results:** As of 9 months postoperatively, fistula closure was maintained with good functional and aesthetic outcome.

**Conclusion:** Conservative management of an iatrogenic TCF in a burn patient results in adequate soft tissue coverage for subsequent successful skin grafting and epithelialization. This method affords minimal morbidity to the patient and is a viable alternative to more elaborate flap reconstruction.

**Disclosure:**

Katherine M. Huber - No Relevant Financial Relationships to Disclose
Alicia Billington - No Relevant Financial Relationships to Disclose
Kimberly Maynell - No Relevant Financial Relationships to Disclose
Loryn Taylor - No Relevant Financial Relationships to Disclose
C. Wayne Cruse, MD - No Relevant Financial Relationships to Disclose
# Initial Experience with ReCell for Face Burns

**Author and Co-authors:** Lindsay Allred, MD, Resident; Jeffrey Carter, MD; James Holmes, MD; Joseph Molnar, MD, PhD
Wake Forest University Baptist Medical Center, Winston-Salem, NC

**Objectives:**
Upon completion of the lecture, attendees should be better prepared to:
- Discuss the ReCell system and its safety concerns in the coverage of facial burn injuries

**Abstract:**

**Introduction:** Severe facial burn injuries frequently require split thickness skin grafts (STSGs) to provide permanent coverage of burn wounds. Cosmetic and functional results can be variable with STSG to the face. As an alternative to STSG, non-cultured autologous cell suspension technique has been used under investigational protocol to close wounds not located on the face or neck. We present pictures of adult and pediatric burn patients treated with ReCell derived autologous cell suspension for coverage of their facial burns.

**Methods:** ReCell is an investigational device used intra-operatively to generate a non-cultured, autologous cell suspension that is currently limited by US federal law to investigational use. We obtained approval to use the ReCell system for compassionate use for these patients all of which sustained burn injuries >49% of their total body surface area. This case series describes our results from using autologous cell suspension on facial burn injuries.

**Results:** Non-cultured autologous cell suspension created by the ReCell system can be used effectively in facial burn injuries to expand donor site skin elements and aid in expeditious wound coverage. Wound bed assessment and judicious wound care are necessary for optimal outcomes.

**Conclusion:** Non-cultured autologous cell suspension can be used in facial burn injuries to help close massive burn wounds and minimize donor site morbidity. Functional and aesthetic outcomes require further research and long-term follow-up but initial results are reassuring and were associated with reduced hospital stay and early wound closure with minimal donor site morbidity.

**Disclosure:**
Lindsay Allred - No Relevant Financial Relationships to Disclose
Jeffrey Carter – Advisor Panel: Acelity; Speaker: Integra Lifesciences; Stock: PermeaDerm
James Holmes - Stock: Abbott Labs, AbbVie, Eli Lilly, RegenMed Therapeutics, PermeaDerm
Joseph Molnar – Consultant: Integra Life Sciences