Surgical Intervention in Fournier’s Gangrene: One Regional Burn Center’s Experience

Friday, November 4
4:00 - 4:15 pm

Author and Co-authors:
Claus Brandigi, MD¹; R. Fred Mullins, MD²; Becca Coley, BSN, RN¹; Katie Lovesy, BSN, RN¹; Callie Carter, PA-C¹; Preethy Kuriakose, PA-C¹; Patricia S. Graham³; Jessica L. Adams³; Benjamin Carmel³
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Objectives:
Upon completion of the lecture, attendees should be better prepared to:
▪ Discuss Fournier’s Gangrene and its prevalence in a burn center
▪ Describe treatment/management options for patients with Fournier’s Gangrene

Abstract:
Introduction: Fournier’s Gangrene (FG) is a surgical emergency characterized by a progressive necrotizing infection of the external genitalia and/or surrounding area. Tissue ischemia is the main pathogenetic factor of FG and is usually characterized by progressive necrosis secondary to thrombotic occlusion of small subcutaneous vessels and the development of gangrene. It is often caused by polymicrobial infections of both aerobic and anaerobic bacteria, the most common being E. coli.

Fournier’s Gangrene is not prevalent in most hospitals; it accounts for only 0.02% of hospital admissions. The rate of occurrence in males is 1.6/100,000, more commonly of those ages 50-79 (3.3/100,000), and with most being in the southern region of the United States (1.9/100,000). It is more likely to occur in those with diabetes, alcoholics, or those who are immunocompromised. Mortality rates have been widely reported with estimates of 7.5% to as high as 75%.

Treatment of FG consists primarily of wide excision to healthy tissue and broad spectrum antibiotics. Then, antibiotics are tailored to cover offending pathogens. Hyperbaric oxygen may be used as an adjunct. Reconstruction options range from orchiectomy to neoscrotum creation from thigh flap. Scrotal debridement is necessary in many cases, leaving options open such as creating a neo-scrotum with adjacent thigh tissue, split-thickness skin grafts (STSGs), creating a subcutaneous thigh pocket, or abdominal implantation followed by testicular cancer surveillance. Our first reconstruction option, if available, is to create at testicular thigh pouch. This is a fairly simple technique and has proven to be very comfortable and functional for a patient.

Methods: We reviewed nineteen male necrotizing fasciitis (NF) cases from the years 2014 to 2016 at a single burn center for confirmed diagnosis of FG and subsequent surgical management.

Results: Of the nineteen cases reviewed, one case was neither confirmed NF nor FG and therefore was excluded from the initial dataset. Upon further review, 12 (67%) received a confirmed diagnosis of FG. Of these 12, 8 (67%) received a procedure to create a subcutaneous thigh pocket or were “tucked” for testicular preservation. After initial excision and debridement, 6 of 12 (50%) patients went on to receive STSGs for closure, with some patients receiving both STSG and subcutaneous thigh pocket.

Conclusion: Fournier’s Gangrene is not a common infection seen in hospitals and a burn center may not be the first treatment facility that comes to mind in regards to treating these serious infections. However, patients with FG referred to a regional burn center may benefit from the center’s expertise and multidisciplinary approach to treating life threatening necrotizing soft tissue infections.
Disclosure:

Claus Brandigi - No Relevant Financial Relationships to Disclose
R. Fred Mullins - No Relevant Financial Relationships to Disclose
Becca Coley - No Relevant Financial Relationships to Disclose
Katie Lovesy - No Relevant Financial Relationships to Disclose
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Jessica L. Adams - No Relevant Financial Relationships to Disclose
Benjamin Carmel - No Relevant Financial Relationships to Disclose
Six Months Experience with the Use of Hyaluronic Acid Based Bilayer Matrix in the Management of Full-thickness Burns and Wounds

**Author and Co-authors:**
Steven A. Kahn, MD; Alicia Lintner, CRNP-BC; Ashley Greer, PA-C; Carly Leahey, PA-C; Scott Patterson, DO
Arnold Luterman Regional Burn Center, University of South Alabama, Mobile, AL

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

- Describe the role of HA matrix for full thickness burns and chronic wounds

**Abstract:**
Introduction: Management of full-thickness burns and soft tissue defects are particularly challenging when exposed tendon, muscle, vessels, and bone complicate timely wound closure. Various biologic dermal substitutes have been utilized to accelerate wound healing, restore function, cover avascular structures, and minimize scarring. One downside of dermal templates in the literature is that they require anywhere from 24 weeks before skin grafting. Hyaluronic acid (HA) based matrices have more recently been developed for the same purpose. HA functions as a dermal replacement, laying a scaffold for fibroblast formation, capillary network integration, granulation tissue formation, and reepithelization or skin grafting. The purpose of this study is to review a series of patients with full-thickness burns and wounds managed with a bilayer silicone-hyaluronic acid based matrix.

Methods: This study was a retrospective case series of patients over a 6 month period with full thickness burn wounds or deep soft tissue defects treated with an HA based matrix. All patients were initially treated with surgical excision of devitalized tissue until healthy tissue was reached. Patients were treated with 12 applications of HA, with or without a negative pressure wound dressing. Wounds were evaluated at a minimum of twice weekly intervals for progression of wound healing and need for repeat application. Data points collected included demographics, comorbidities, time to incorporation of HA, time to grafting, time to healing, and graft take.

Results: Nine patients with 12 distinct wounds treated with HA were included in the study. There were six males and three females with a median age of 58.5 years. Six patients had comorbidities that interfere with wound healing. Wound locations included wrist, shin, face, thumb, and foot; with a wound size ranging from 2-107 sq. cm (median 28 sq cm). Wound etiologies included 8 burn wounds, 2 wounds from necrotizing infection, 1 arterial ulcer, and 1 cocaine induced skin necrosis. Six of the eight burn wounds had avascular structures exposed in the wound beds. Negative pressure was placed over the HA matrix for 8 wounds. Median time to complete incorporation of HA and readiness for a skin graft was 11 days. Autografting was performed at a median day 14 (when applicable), and wounds were healed at a median of 19.5 days after application of HA. Two face wounds and one shin wound epithelialized without a graft; while 8 wounds were treated with STSG, and one with FTSG. There were no infections and median graft take was 98% at 7 days. The patient with cocaine induced vasculitis had graft loss at two week follow up.

Conclusions: Preliminary data suggests that use of hyaluronic acid based matrices is a safe and speedy method to facilitate wound closure and reconstruction of deep wounds with exposed avascular structures. The patients in this study healed their wounds and
were ready for a skin graft much sooner than expected compared to previous literature that utilized other dermal templates. Further, prospective studies are warranted to determine the effect of HA on scarring.

**Disclosure:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Role/Relationship</th>
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<tbody>
<tr>
<td>Steven A. Kahn</td>
<td>Speaker: Medline</td>
</tr>
<tr>
<td>Alicia Lintner</td>
<td>Consultant: Medline</td>
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<td>Ashley Greer</td>
<td>No Relevant Financial Relationships to Disclose</td>
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<td>Carly Leahey</td>
<td>No Relevant Financial Relationships to Disclose</td>
</tr>
<tr>
<td>Scott Patterson</td>
<td>No Relevant Financial Relationships to Disclose</td>
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An Update to the 10-Year Longitudinal Study Utilizing Acellular Dermal Matrices in Full Thickness Burn Wounds: Simultaneous Application of Skin Graft and Matrix Application

Friday, November 4
4:45 - 5:00 pm

Author and Co-authors: Tracee Short, MD¹; Christina Sharon, MD²; Keira Murphy³, MD; Liz Spreen, RN¹; Dhaval Adhvaryu, MD¹; Jeff Littleton, MD¹
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Objectives:
Upon completion of the lecture, attendees should be better prepared to:
▪ Understand how this application is different from other dermal repair technologies
▪ Describe treatment regimen used
▪ Recognize the selected wounds that benefit from the single stage technique

Abstract:
The purpose of this presentation is to review our clinical experience utilizing a treatment strategy developed at our center, which simultaneously addresses the dermal defect and the need for epithelial coverage. This strategy utilizes a fetal bovine acellular dermal matrix (FBADM; PriMatrix, Integra) to generate new dermal tissue in a tangentially excised burn wound. The wounds are autografted with a split thickness skin graft that varied from 1:6:1 meshed application. Since 2011, approximately 20 patients with clinically assessed full thickness wounds have been managed per this treatment strategy. Histological analysis confirmed that the dermal tissue generated with FBADM can be re-epithelialized by surviving epidermal elements in a supposed full thickness wound.

Generally wounds that do not spontaneously re-epithelialize in 23 weeks skin grafting is performed over the generated tissue. With this technique, outcomes demonstrate that the continued regeneration of dermal elements happens beneath the closed epithelial level. No significant delay in treatment occurs, as skin grafting subsequent to FBADM application is our standard of care for deep partial thickness and full thickness burn wounds. At long term follow up, excellent functional and cosmetic outcomes have been observed.

Disclosure:
Tracee Short - No Relevant Financial Relationships to Disclose
Christina Sharon - No Relevant Financial Relationships to Disclose
Keira Murphy - No Relevant Financial Relationships to Disclose
Liz Spreen - No Relevant Financial Relationships to Disclose
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Effective Treatment of Radiation Therapy Burns Using Dehydrated Human Amnion/Chorion Membrane (dHACM)

Author and Co-authors:
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Objectives:
Upon completion of the lecture, attendees should be better prepared to:
▪ Describe radiation dermatitis in the radiotherapy setting
▪ Describe dehydrated irradiated human amnion/chorion membrane (dHACM) allograft
▪ Share a case experience using dHACM on Grade 4 radiation dermatitis

Abstract:
Introduction: Radiation dermatitis is one of the most common side effects of radiotherapy for cancer, affecting approximately 95% of patients receiving radiotherapy (RT). Acute radiation dermatitis (RD) is a common effect of RT, usually occurring within 90 days of exposure. Signs of acute radiation skin reactions are blistering and ulcerations of the skin, delays in treatment, and diminished aesthetic appearance. If the damaged skin is not properly managed timely, it could hinder RT, thus negatively impacting cancer control and prognosis. The reaction is usually noticeable within 1-4 weeks after starting radiation treatment and can persist during the radiation treatment period.

Treatment of Grade 2-3 RD consists of a number of topical applications, normal saline compresses, sitz bath, antibacterial creams, hydrogels and hydrocolloid dressings. A Grade 4 RD presentation consisting of skin necrosis or ulceration of full thickness dermis is more complex and may require debridement and skin grafting.

Human amniotic membrane is a material for use as an allograft in wound management. The material of the amniotic membrane is unique in that it facilitates the healing process to promote regenerative healing while simultaneously reducing scar formation. Human amnion has been used for many years as a temporary biological wound dressing for partial thickness burns. Advantages of human amnion treatment include pain relief, ease of use, prevention of infection, and accelerated wound healing. The amniotic membrane allograft will incorporate into the wound bed within 1 to 2 weeks of application, and an improvement in the wound margins and depth is noticeable within 2 to 3 weeks.

Treatment of radiation induced RD with a dehydrated irradiated Human Amnion/Chorion Membrane (dHACM) allograft is emerging as a new way to treat this type of burn. dHACM allograft is a minimally manipulated, dehydrated, nonviable cellular amniotic membrane allograft that preserves and delivers multiple extracellular matrix proteins, growth factors, cytokines, and other specialty proteins present in amniotic tissue to help regenerate soft tissue.

Methods: We present a single patient case study of a 72 year old male patient with RD to the throat area treated with dHACM.

Results: A 72 year old male patient with a past medical history of throat cancer, status post RT to the throat presented to the emergency department with complaints of moderate to severe painful swallowing and dysphagia. Physical exam revealed partial thickness radiation burns to the right and left throat region (Grade 4). The patient was referred to the burn service and underwent surgical debridement with placement of dHACM to the right and left throat. The patient was subsequently discharged, returned to his home out of state, and reported well
epithelized skin with good cosmesis.

Conclusion: The use of dHACM was a clinical success in this case. Overall clinical observations included good cosmetic result with no complications related to application and healing. Results of this case study encourage and support further use of dHACM as treatment in RD.

Disclosure: Laura M. Velcu - No Relevant Financial Relationships to Disclose
Michael M. Van Vliet - No Relevant Financial Relationships to Disclose
R. Fred Mullins - No Relevant Financial Relationships to Disclose
Patricia S. Graham - No Relevant Financial Relationships to Disclose
Jessica L. Adams - No Relevant Financial Relationships to Disclose
Benjamin Carmel - No Relevant Financial Relationships to Disclose
Clinical Results from Treatment of Deep Partial-Thickness Burns with Cryopreserved Allogeneic Human Skin Substitute Tissue
Support Progression to Phase III Study

B. Lynn Allen-Hoffmann, PhD1; James H. Holmes IV, MD2; Michael J. Schurr, MD3; Lee D. Faucher, MD4; Kevin N. Foster, MD5; Steven E. Wolf, MD6; Booker T. King, MD7; Mary A. Lokuta, PhD1; Allen R. Comer, PhD1; Kelly F. Barbeau, BA1; Stuart T. Mohoney, BS1
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2Wake Forest School of Medicine, Winston-Salem, NC
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Upon completion of the lecture, attendees should be better prepared to:
• Understand information about a cryopreserved, allogeneic human skin substitute developed for the treatment of deep thermal burns
• Understand how results from a clinical trial using this skin substitute tissue to treat deep partial thickness burns support and inform the design of a phase III clinical trial

Introduction: Like full thickness burns, deep partial-thickness (DPT) thermal burns are typically excised and autografted to prevent delayed wound healing and scarring. Treatment of severe burns with autograft requires the harvest of healthy donor skin, creating a donor site wound susceptible to infection, pain, and scarring. An effective therapeutic that both closes burn wounds and reduces or eliminates donor site wounds would greatly enhance burn management and patient quality of life. We developed a cryopreserved, living, full-thickness, allogeneic human skin substitute providing wound coverage and barrier function, as well as sustained expression of wound healing factors. We present results of a completed clinical trial evaluating the safety and efficacy of treatment of DPT burns with the skin substitute tissue as an alternative to surgical harvest of donor sites and autografting.

Methods: A multicenter, dose escalation clinical trial was performed to examine the safety and efficacy of the skin substitute tissue to promote DPT burn healing. Enrolled subjects had 3-49% total body surface area (TBSA) burns, with two comparable DPT burn sites randomized to receive autograft or skin substitute tissue. Two donor sites, one for each treatment area, were prospectively identified. Subjects in the first two 10 subject cohorts were treated with skin substitute tissue that had been stored under refrigeration, at dosages of up to 220 cm2 and 440 cm2, respectively. Subjects in the third cohort were treated with up to 440 cm2 of human skin substitute that was cryopreserved. Primary endpoints were the percentage of the treatment area requiring autografting by day 28, and wound closure at three months. Other assessments included safety, immunological responses, cosmesis, donor site pain, and persistence of allogeneic DNA at month three.

Results: None of the DPT burns treated with the skin substitute tissue required autografting through day 28. Complete wound closure of the skin substitute tissue treatment site was observed in 27 of the 28 per-protocol subjects by three months posttreatment, and these sites remained closed throughout the 12 month follow up period. Performance of the cryopreserved tissue matched that of refrigerated tissue. Since the donor sites prospectively identified for the skin substitute tissue treatment sites were not harvested, they showed better cosmesis and reduced pain compared to donor sites harvested for the control autograft treatment. For all cohorts, no safety signals were noted and no allogeneic DNA from the skin substitute tissue was detected after three months.
Conclusions: Clinical trial outcomes demonstrated that one application of the skin substitute tissue can promote healing of DPT burns by autologous tissue regeneration, resulting in wound closure with reduced donor site harvest and associated pain and cosmetic impact. Together with the increased shelf life afforded by cryopreservation, this skin substitute tissue provides an effective, readily available alternative to autograft that promises to improve the medical management of DPT burns, particularly for children, the elderly, and those lacking sufficient donor skin. Results of this trial informed the design of a phase III registration study for the treatment of DPT burns with this skin substitute tissue.

Disclosure:
B. Lynn Allen-Hoffmann - Stratatech: CEO
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Steven E. Wolf - No Relevant Financial Relationships to Disclose
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Mary A. Lokuta - Stratatech: Employee
Allen R. Comer - Stratatech: Employee
Kelly F. Barbeau - Stratatech: Employee
Stuart T. Mohoney - Stratatech: Employee
Introduction: The presence of inhalation injury continues to be a significant source of morbidity and mortality causing 10,000 deaths annually in the United States. It has been noted to increase mortality by as much as 20%, even in the absence of cutaneous burns. 1 Hallmarks of inhalation injury include airway obstruction from cast formation, bronchospasm, and transvascular fluid flux. 2 This results in decreased lung compliance, increased ventilation perfusion mismatch, and increase in dead space ventilation. 3 The onset of respiratory failure has been seen up to 48 hours after smoke exposure. Management protocols vary by institution but include serial bronchoscopies, nebulized anticoagulants, and bronchodilators.

There have been few advances in the treatment of inhalation injury with refractory hypoxemia. Inhaled nitric oxide (iNO), an inhaled vasodilator, has been shown in small case series to improve ventilation/perfusion mismatch and to reduce pulmonary hypertension. 4 Aerosolized epoprostenol also promotes pulmonary vasodilation and has anti-inflammatory and antiplatelet properties. A single case report demonstrated improved oxygenation with use of inhaled prostaglandin during high frequency ventilation in a patient with inhalation injury.5 Inhaled prostaglandins ($200 per day) are a less expensive alternative to iNO ($3,000 per day). We sought to review our experience with both vasodilators in managing refractory hypoxemia in patients with inhalation injury.

Methods: This was a retrospective chart review that included all adult patients admitted to the burn ICU between 1/1/2012/ 1/2016 with documented inhalation injury who underwent treatment with inhaled nitric oxide or aerosolized epoprostenol. A total of 36 charts were reviewed with n=18 in the inhaled nitric oxide treatment group and n=18 in the aerosolized epoprostenol group. Statistical analysis was performed to include means, standard deviations, Fischer's exact test, ANOVA and Kaplan-Meier survival curves. The primary endpoint was to determine changes in PaO2:FiO2 ratios following initiation of either vasodilator; secondary endpoints included mortality, duration of mechanical ventilation, ICU length of stay as well as a cost analysis of both agents.

Results: The patient population in the inhaled nitric oxide and aerosolized epoprostenol groups was similar at baseline with the exception of a larger total body surface area burns in the inhaled nitric oxide group( Table 1). Baseline PaO2:FiO2 ratios indicated moderate hypoxemia in both treatment groups (119±54 in the epoprostenol group; 143±73 in the nitric oxide group). PaO2/FiO2 ratios increased after agent initiation in both groups, with the largest, statistically significant increase seen at the 48 hr mark post initiation (263 in the epoprostenol group; 252 in the nitric oxide group); however, there were no differences in the PaO2/FiO2 ratio change between both groups. There was a 55.6% mortality in the epoprostenol group, compared to a 72.2% mortality in nitric oxide (p=0.80). Mean ICU length of stay was 33 ± 24.7 days for the aerosolized epoprostenol group and 45 ± 42.3 days for the inhaled nitric oxide group. Mean duration of therapy was 11.5 days ± 9.9 in the aerosolized epoprostenol group and 6.3 ± 3.5 days in the inhaled nitric oxide group. The mean duration of therapy per day represents a cost of...
18,900 for the inhaled nitric oxide therapy and a mean cost of 2,300 for the aerosolized epoprostenol therapy.

Conclusions: Based on our results, epoprostenol improved oxygenation by increasing PaO2:FiO2 ratios similar to nitric oxide effects, improving hypoxemia severity from moderate to mild. Epoprostenol is a clinically feasible, more cost effective salvage therapy for inhalation injury with refractory hypoxemia.

References
5. Allan, PF, Codispoti CA, Womble, S. Inhaled Prostacyclin in Combination With High Frequency Percussive Ventilation. JBCR. 2010; 31:347352.

Table 1: Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Nitric Oxide (n=18)</th>
<th>Inhaled epoprostenol(N=18)</th>
<th>P-Value</th>
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<tr>
<td>Gender: Male n(%)</td>
<td>12 (70.6)</td>
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<td>Age, median(IQR)</td>
<td>34.0 (26.3)</td>
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<td>Burn Size, median (IQR)</td>
<td>52.5 (49.8)</td>
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<td>Mechanical ventilation, median days (IQR)</td>
<td>41.0 (28.0)</td>
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<td>Paralytic used, n (%)</td>
<td>18 (100)</td>
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<td>Diuretic used, n (%)</td>
<td>16 (88.9)</td>
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<td>Pneumonia, n (%)</td>
<td>13 (72.2)</td>
<td>11 (61.1)</td>
<td>0.7247</td>
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</tbody>
</table>

Disclosure: Rachael Williams - No Relevant Financial Relationships to Disclose
Rita Gayed - No Relevant Financial Relationships to Disclose
Walter Ingram - No Relevant Financial Relationships to Disclose
Juvonda Hodge - No Relevant Financial Relationships to Disclose
Sebastian Perez - No Relevant Financial Relationships to Disclose
Exploring Post-traumatic Stress Disorder (PTSD) in Healthcare Professionals Working in a Regional Burn Center

Friday, November 4
5:45 - 6:00 pm

Author and Co-authors:

<table>
<thead>
<tr>
<th>Author and Co-authors:</th>
<th>Maria J. Rivell, MD(^1), R. Fred Mullins, MD(^2); Kimberly M. Linticum, ACNP-BC(^1); Jennifer Hardy Casella, AGACNP(^1); Melissa Bailey, PA-C(^1); Jane Echols, RN, BSN(^1); Jillian L. Begin, MSN, RN, CNL, CEN(^1); Patricia S. Graham(^3); Cara C. Joseph(^3); Jessica L. Adams(^3)</th>
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| \(^1\)Joseph M. Still Burn Center, Doctors Hospital, Augusta, GA | \(^2\)Joseph M. Still Burn Center at Doctors Hospital and Burn and Reconstructive Centers of America, Augusta, GA
\(^3\)Joseph M. Still Research Foundation, Augusta, GA |

Objectives:

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

- Discuss PTSD in healthcare professionals
- Discuss correlations, if any, of PTSD of healthcare professional’s ICU settings to healthcare professionals in Burn Intensive Care Unit settings

Abstract:

Introduction: Post-traumatic stress disorder (PTSD) is prevalent in the healthcare arena. Leading experts have contributed to peer reviewed scientific journals with research focusing on PTSD experienced by healthcare professionals working in intensive care unit settings. PTSD is described as long lasting emotional sequelae that stem from traumatic experiences. This condition is often associated with war veterans and in that context, referred to as “Shell Shock” or “Battle Field Syndrome”, but it can affect victims of any severe trauma or experience. Recent publications purport that various healthcare professionals caring for patients in intensive care settings suffer from various symptoms of PTSD, including but not limited to, anxiety, hopelessness, and chronic depression. In light of this, it could be theorized that healthcare professionals in burn critical care and subacute units at a Regional Burn Center, may also suffer from the same symptoms associated with the disorder.

Healthcare professionals in our burn center may face profound and complex emotional challenges when treating patients with severe burns and traumatic injuries. In addition to patient care, these professionals also interact with patient families who are simultaneously experiencing their own emotional reactions. For burn patients and their families, the road to recovery can be very long and sometimes, despite a truly exceptional team effort, the outcome is not the best or the patient dies. Given the recent research in this area, we suggest that PTSD among healthcare professionals working with burn patients warrants further exploration.

Methods: We will conduct a scientific literature review to explore the concept of PTSD experienced by healthcare professionals in intensive care settings. Following synthesis and analysis of the existing research, we will seek to ascertain what aspects, if any, apply to healthcare professionals in a burn intensive care unit setting. Findings of the literature review will be complemented by discussions with key individuals of our burn care leadership team, the attending burn psychiatrist, and other individuals as deemed appropriate to determine the application of findings to our center and explore intervention opportunities.

Conclusion: Recent publications on the effects of PTSD in intensive care units serves as a solid platform for analysis as it relates to the disorder in healthcare professionals working in burn critical care and subacute units. We hope, through this endeavor, to impart on the burn care community about the effects, if any, of Post-traumatic stress disorder on healthcare professionals in the burn care setting.
Disclosure:

Maria J. Rivell - No Relevant Financial Relationships to Disclose
R. Fred Mullins - No Relevant Financial Relationships to Disclose
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