Treating donor site pain in patients undergoing split-thickness skin grafting: A critical review and synthesis of clinical recommendations.

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Split-thickness skin grafting (STSG) is the most common reconstructive procedure in managing burn injuries. Harvesting split-thickness skin creates a new partial thickness wound referred to as the donor site. Pain at the donor site is reported to be one of the most distressing symptoms during the early post-operative period. Here, we a) identify strategies for managing donor site pain, b) assess the quality of individual studies and c) formulate evidence-based recommendations based on the amount and consistency of evidence. Our analysis revealed five distinct approaches to minimize donor site pain. These include: continuous subcutaneous local anesthetic infusion (3 studies), subcutaneous anesthetic injection (5 studies), topical agents (6 studies), non-pharmacological interventions (3 studies), and wound dressings (18 studies). Available RCTs typically evaluated pain on standardized scales (i.e. Visual analog scale, numerical rating scale), and compared the experimental group with standard care. Recommended treatments include: a) subcutaneous anesthetic injection of adrenaline–lidocaine, b) ice application, c) topical agents such as lidocaine and bupivacaine, and d) hydrocolloid- and polyurethane-based wound dressings accompanied with fibrin sealant. Methodologically sound RCTs examining the efficacy of modified tumescent solution, ropivacaine, plasma therapy, noncontact ultrasound, and morphine gels are lacking and should be a priority for future research.
Burn injuries resulting from illegal cannabis oil manufacturing: review of 12 cases and a synthesis of the literature to guide Canadian cannabis policy.

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Background: The increasing consideration of cannabis legalization in Canada and the US has motivated physicians to assess its prospective impact on the health care system. A particular concern within the burns community are injuries sustained as a result of the illegal manufacturing of cannabis oil. Cannabis oil is isolated from Cannabis sativa and Cannabis indica vegetation as a method to enhance its potency and involves highly flammable reagents.

Methods: We first synthesize clinical features unique to cannabis oil burn injuries from 5 published case series (4 from the US, 1 from New Zealand). We then expand this repertoire by analyzing 12 cannabis oil burn injuries treated over a 2-year review period at the Foothills Medical Centre in Alberta, Canada.

Results: 190 cases from 6 independent investigations converge in suggesting that cannabis oil burn patients (in comparison to all burn admissions): a) are younger, b) males are overrepresented, c) sustain a larger TBSA burns, d) require higher surgical management, and e) spend more time at the hospital.

Interpretation: Since Bell et al. found an increase in the frequency of cannabis oil burns following cannabis liberalization in Colorado, similar trends might recapitulate in Canada. To safeguard against this, we formulate a three-pronged approach to serve as an adjunct to cannabis liberalization policies. We recommend to: a) monitor national trends in cannabis oil burn injuries, b) educate the public and tertiary burn units about cannabis oil burns, and c) encourage regulation of cannabis oil production to reduce risk of injury.
A REVIEW OF OUR INITIAL EXPERIENCE USING EZYMATIC DEBRIDEMENT IN THE TREATMENT OF FULL THICKNESS BURNS

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Introduction: Nexobrid is a bromelain based enzymatic agent of plant origin licensed for use in the treatment of deep partial and full thickness burns. Nexobrid is capable of selectively removing burn eschar within 4 hours without the need for a general anaesthetic thereby providing a minimally invasive alternative to burn debridement. Our aim was to review the clinical effects/benefits of using this modality of treatment in our burn unit.

Method: We carried out a retrospective analysis of the case notes of nine patients undergoing Nexobrid treatment. We recorded information including: demographics, total body surface area affected, type of burn, burn depth, time to Nexobrid application, pain scores, anaesthesia given, need for surgical debridement following Nexobrid treatment, length of hospital stay, cost of treatment, time to healing and wound microbiology.

Results: In all our selected patients Nexobrid proved to an effective and safe treatment. In 8 of our patients it prevented further surgical debridement to the treated area. Additional benefits of Nexobrid included; a reduction in over debridement in anatomically challenging areas, minimal blood loss and potentially reduced hospital admissions.

Conclusion: We have found Nexobrid to be safe and effective in adequately debriding deep partial and full thickness burns. In our selected patients Nexobrid was found to reduce the need for surgical debridement under a general anaesthetic and its associated morbidities. Many have avoided skin grafting due to preservation of the dermis. The selected use of this product may significantly alter the acute management of full thickness burn injuries.
Objectives: Infections are one of the leading causes of morbidity and mortality among patients with burns. In our hospital we have different patient data registries which are concerned with different aspects of patient care but there was no specific registry focusing on the microbiological profile and antibiotic therapy for burn patients. We added a new module in our local burn patient database aiming to monitor changes in the bacteriological pattern and the development of multi-resistant bacteria during the care process, identify preventable infections, and to get an overview of the antibiotic treatment given to avoid using last choice drug whenever possible. We aim to describe the results of an infection registry for burn intensive care patients during 2 years in the national Burn Centre in Linkoping, Sweden.

Methods: All patients who required burn intensive care during 2015-2016 were prospectively recorded in the local database for burn care. The patients who required treatment with systemic antibiotics were registered in the specific infection module: microbial cultures; infection site; healthcare associated infections; the antibiotic treatment given. All recordings were included in the present study.

Results: Of the totally 63 patients recorded 39 (62%) were registered in the infection module, with 86 episodes of infection. The most common micro-organism was Staph. Aureus. Five patients have developed multi-resistant infections with psuedomonas bacteria during the first year. The most common antibiotic therapy was Piperacillin/Tazobactam, followed by Cefotaxime.

Conclusion: Computer based registry has proven to be a useful tool for surveillance of infection in the burn care setting.
Introduction/Objectives: Burns affect millions of people worldwide. Rapid wound closure is lifesaving. Unfortunately, large wounds exceed intrinsic wound-healing capacities and available coverage materials are insufficient, due to immunologic rejection and lack of cells. Mesenchymal stem cells (MSCs) promote wound healing, but their use is limited by lack of availability and invasive extraction methods. The aim of this study is to show that burned skin - which is excised routinely - contains functioning MSCs (burn derived MSCs; BD-MSCs) that can promote wound healing.

Methods: BD-MSCs were compared to umbilical cord (UC)-MSCs (n=3) in terms of key biological characteristics. Then, acellular skin-scaffolds (Integra®) were cellularized with BD-MSCs and applied onto murine punch wounds as well as onto excisional porcine wounds. Safety, granulation tissue formation and epithelialization were assessed during a 30-day period.

Results: We found no difference in key biological characteristics between BD- and UC-MSCs: mitochondrial function, proliferation, colony formation, cell cycle stage distribution, reactive oxygen species, the absence of tumor formation, and MHC I/II expression. Wound treatment with BD-MSCs improved wound healing by increasing epithelialization speed and granulation tissue formation. No adverse effects or safety concerns could be detected.

Conclusion: Severely burned skin contains healthy mesenchymal stem cells. Key biological functions are not altered by burn trauma. BD-MSCs can be incorporated into skin scaffolds and promote wound healing by accelerating granulation tissue formation as well as epithelialization.
Comparison of Two-Dimensional Methods Versus Three-Dimensional Scanning Systems in The Assessment of Total Body Surface Area Estimation in Burn Patients

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Purpose:
Accurate measurement of percent total body surface area (%TBSA) is crucial in the management of burn patients. %TBSA can be estimated using many methods, all of which are fairly inaccurate. Three-dimensional (3D) systems have been developed to improve TBSA estimation. The objective of this study was to compare the accuracy of %TBSA estimation by conventional methods against novel 3D methods.

Methodology:
This prospective cohort study included acute burn patients admitted in 2016. The staff burn surgeon determined %TBSA using conventional methods. In parallel, 3D %TBSA was determined using the BurnCase3D program. Wilcoxon Signed Rank test was used to determine differences between each %TBSA, with assessment of the influence of body mass index (BMI) and gender on accuracy.

Results:
Thirty-five patients were included in the study (6 female and 29 male). Average age was 47.5 years, with a median BMI of 26.6 kg/m2. %TBSA determined by BurnCase3D was statistically significantly different from conventional %TBSA assessment (p=0.007), with the 3D %TBSA being lower by 1.3%. BMI and gender did not impact %TBSA accuracy.

Conclusion:
BurnCase3D underestimated %TBSA by 1.3%, as compared to conventional methods. Although statistically significant, this is not clinically significant as it would have minimal impact on fluid resuscitation or on the decision to transfer to a burn center. 3D %TBSA evaluation systems are valid tools to estimate %TBSA, and should be considered to improve %TBSA estimation at centres with no available experienced burn staff surgeon.

Key Words: accuracy, 3D, burn size
Increased risk of long-term mortality among burn survivors: A population-based matched cohort study

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Introduction: The effect of sustaining a major burn injury on long-term life expectancy is poorly understood. We aimed to estimate long-term mortality following major burn injury compared to matched controls.

Methods: Using health administrative data, all adults who survived to discharge after major burn injury between 2003-2013 were matched to between 1 and 5 uninjured controls on age, sex, marginalization index, comorbidity score, presence of a major physical comorbidity, and presence of a major psychological comorbidity. The marginalization index accounts for residential instability, material deprivation, ethnic concentration, and dependency. The primary outcome was post-discharge all-cause mortality. Patients were followed until death or 2014, and censored at five years. Cumulative mortality estimates for all-cause mortality were estimated using the Kaplan-Meier method. Cox proportional hazards modeling was used to estimate the association of burn injury with mortality.

Results: 1965 burn survivors of mean age 44 (SD 17) years with median total body surface area burn of 15% (IQR 5-15) were matched to 8671 controls and followed for a median 1958 (IQR 934-2937) days. Five-year mortality was significantly greater among burn survivors (11 vs 4%, p <0.001), yielding a hazard ratio of 4.51 (95% CI 3.38-6.03). Burn survivors had increased mortality related to trauma (MRR 9.8, 95% CI 5-19) and mental illness (MRR 9.1, 95% CI 4-23).

Conclusions: Burn survivors have increased risk of late mortality. As future work characterizes the psychological and physiological sequelae of burn injury, burn follow-up should focus on injury prevention, mental healthcare, and detection and treatment of new disease.
BACKGROUND: Critical illness and acute traumatic injuries induce profound metabolic derangements secondary to the release of inflammatory mediators and the development of an abnormal “stress-induced” hormonal environment. The consequences of such hypermetabolic state are devastating, both acutely and in the long term. Several pharmacological interventions have been tested in an effort to halt the hypermetabolic state following thermal injury, trauma, and critical illness. Insulin, insulin growth factor 1, insulin growth factor binding protein 3, metformin, human growth hormone, thyroid hormones, testosterone, oxandrolone, and propranolol, among others, have been proposed to have anabolic or anti-catabolic effects. The aim of this broad analysis of pharmacological interventions is to raise awareness of treatment options to help mitigate these profound responses in the thermally injured and the critically ill.

METHODOLOGY: A PubMed search was conducted on the anabolic and anti-catabolic agents used in the critical care setting. Agents used for treating cancer cachexia and other muscle wasting disorders were included as potential novel treatment modalities.

RESULTS: One hundred and fifty-seven human studies published in English between 1999 and 2017 were included in this review.

DISCUSSION AND CONCLUSION: The rationale for the treatments, their indications, target patients and outcomes are discussed. A brief summary of the novel treatment strategies and their available evidence is also presented. Propranolol and oxandrolone have shown great promise but are not yet considered to be standard-of-care therapy. Further evidence is still needed to clarify their potential use for anabolic and anti-catabolic purposes.
Metformin exerts context-dependent effects on hepatic bioenergetics and AMPK signalling following thermal trauma in mice

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Objectives: The elderly are susceptible to poor outcomes after burns, due primarily to a scarcity of knowledge on the biomolecular effects of trauma in this population. Here, we investigated mitochondrial bioenergetics in the livers of adult and aged mice following a severe burn to characterize age-dependent differences and determine if metformin, an agent which limits stress-induced hyperglycemia, can provide benefits.

Methodology: Both 8 week and 50 week old C57BL/6 mice received a 30% TBSA scald burn. Select mice received daily injections post-burn of metformin (100 mg/kg). At day 7, mice were sacrificed and livers were collected for mitochondrial studies. Respirometry was performed on freshly isolated samples using a Seahorse XF96 analyzer, and these data were complemented by activity assays for electron transport chain complexes, Western blots for AMPK signalling and serum mitochondrial DNA analyses.

Results: At 7 days post-burn, adult bioenergetics were significantly higher than their sham counterparts. Aged mice, however, had lower respiration in the burned cohort compared to shams, implying that these mice fail to recover from burn trauma at the mitochondrial level. Metformin treatment appears to normalize both types of mitochondrial dysfunction.

Conclusion: It appears as though an underlying factor for the increased susceptibility of the elderly to trauma is a failure of bioenergetics to recover at the same rate as their adult counterparts. Interestingly, the administration of metformin in the aged cohort bolsters the recovery of mitochondria, despite it lowering the respiration rate in the adult population, thus normalizing bioenergetics post-burn.

Key words: Mitochondria; liver; ageing
A Surgical Device to Study the Efficacy of Bioengineered Skin Substitutes in Mice Wound Healing Models

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Due to the poor regenerative capacity of the adult mammalian skin, there is a need to develop effective skin substitutes for promoting skin regeneration after a severe wound. However, the complexity of skin biology has made it difficult to enable perfect regeneration of skin. Thus, animal models are used to test potential skin substitutes. Murine models are valuable but their healing process involves dermal contraction.

We have developed a device called a dome that is able to eliminate the contraction effect of rodent skin while simultaneously housing a bioengineered skin graft. The dome comes in two models, which enables researchers to evaluate the cells that contribute to wound healing from neighboring intact tissue during skin healing/regeneration. This protocol simplifies grafting of skin substitutes, eliminates the contraction effect of surrounding skin, and summarizes a simple method for animal surgery for wound healing and skin regeneration studies.
NLRP3 Inflammasome Knockout Improves Survival via Enhanced Immune and Inflammatory Responses

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Although sepsis in thermally injured patients represents the main contributor to post-burn mortality, effective treatments are presently absent and underlying mechanisms are essentially unknown. The NLRP3 inflammasome was recently shown to orchestrate inflammatory driven pathophysiology after burn. As the NLRP3 inflammasome is activated in the white adipose tissue of burn patients effecting downstream immune and inflammatory responses, we hypothesized that NLRP3 activation contributes to adverse outcomes in burn patients who become septic. To test our hypothesis, we utilized the two-hit model of burn plus Pseudomonas aeruginosa wound infection/sepsis in NLRP3 knockout mice. Confirming our hypothesis we found that NLRP3-/- mice had improved survival. However, we showed that improved survival in NLRP3 k.o. mice was characterized by greater infiltration of immune cells at the site of injury and better bacterial clearance. These robust populations were present acutely after infection and a better mobilization of immune response was attributed to survival. Lymphoid organs and liver all had increased macrophage and neutrophil expansions beyond the acute phase that occurred secondary to adipose tissue, suggesting its critical role in post-burn sepsis. Interestingly, ablation of NLRP3 in mice resulted in increased acute systemic inflammation, ER stress, apoptosis/pyroptosis in adipose tissue. In burn patients, we found that increased NLRP3 gene expression in adipose tissue beyond the acute phase determined sepsis outcomes. Our findings suggest that NLRP3 directly contributes to mortality in post-burn sepsis and ablation results in a tissue-specific responsiveness that improves survival by increasing immune mediators of inflammation in a compensatory non-persistent response.
Acute Kidney Injury after Severe Burn

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Background: AKI is a morbid complication after severe burn. We aim to examine the incidence, severity, and mortality of AKI after burn.

Methods: A retrospective study of adults with burn admitted to the Burn ICU from 2008-2015 was conducted. AKI was defined by SCr-KDIGO criteria. Onset of AKI ≤7 vs >7 days from admission was defined as early vs late AKI. Patient- and burn-specific characteristics among those with or without AKI were compared. Multivariable logistic regression with AKI as the independent variable and mortality as the dependent variable was utilized.

Results: 1040 patients with burn were included. Mean (SD) age was 48.9 (18.9), 70.5% were men and 16.4% black. Median total body surface area (TBSA) of burn was 16% (IQR: 6-29%). AKI was present in 617 (59%) patients, KDIGO stages: 1, 59.3%, 2, 20.3%, 3, 11.3%, 3D, 9.1%. Early AKI was present in 551/617 (89%). Patients with AKI had larger TBSA burn (median 20.5% vs 11.0%, p <0.001), received more mechanical ventilation days (median 2.0 vs 0.0, p <0.001), and stayed longer in the hospital (median 21.0 vs 10.0 days, p <0.001). Hospital mortality was higher in those with AKI vs without AKI: 19.7% vs 4% (p <0.001) and increased by each KDIGO stage (p trend <0.001). AKI was independently associated with hospital mortality (early AKI vs. no AKI: OR 8.69, 95% CI 4.20–18.0; late AKI vs. no AKI: 4.78, 1.61–14.15).

Conclusions: AKI occurs frequently after burn and portends increased mortality. Further investigation is warranted to examine AKI recovery patterns in burn survivors.
A study of patient satisfaction after erbium-yag laser resurfacing therapy for burn scar

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Background and Purpose/Objective:
Fractional laser therapy is a new treatment with potential benefit in the treatment of burn scars. We sought to determine patient satisfaction after burn scar treatment with the Erbium-Yag laser.

Methodology:
We performed a telephone survey of all patients who underwent fractional resurfacing of burn scars with the Erbium-Yag 2940 wavelength laser at Parkland Hospital from 01/01/2016 to 05/01/2017. Subjects were asked to rate their satisfaction with their scars’ post-treatment characteristics on a scale from 1 (completely unsatisfied) to 10 (completely satisfied). Subjects were also asked to assess their treatment response using the UNC 4P Scar Scale before and after treatment.

Results/Impact/Outcomes:
Sixty-four patients underwent 156 treatments. A survey response rate of 77% (49/64) was seen (age: 36.8±21 yrs; surface area treated= 435±326 cm2; 35% of burn scars were > 2 yrs old; mean scar age of 1.02±0.4 yrs). Overall, 46/49 (94%) of patients reported some degree of scar improvement post-treatment. Patient satisfaction scores were 8.3±2.3. Number of laser treatments included: 1 (31%), 2 (33%), 3 (18%), 4 (10%), >5 (8%). Treatment depth, scar age, and number of laser procedures were not significant predictors of satisfaction or UNC 4P Scar post scores. The paired t-test showed a significant reduction on each of the UNC 4P Scar scale items (pain, pruritus, pliability, paresthesia). One subject reported that she felt that the laser treatment made her scar worse (2%).

Conclusion and Discussion:
Burn patients treated with the erbium-Yag laser are highly satisfied with the changes in their burn scars.
Capnocytophagia canimorsus – a common zoonosis plastic surgeons should consider in dog or cat owners presenting with profound sepsis and purpura fulminans

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Capnocytophagia canimorsus (C.canimorsus) is a gram-negative bacilli present in the gingival flora of canine and feline species that was first identified in 1976. Although Pasteurella spp. are generally more well recognized in relation to animal bites, C.canimorsus is the second most common cause of infection and contact with canine or feline saliva or even close proximity with these animals can lead to severe sepsis in immunocompromised patients even without a breach to the skin. We present the case of a previously fit and well 51-year-old male who presented with disseminated intravascular coagulopathy, acute renal failure and widespread haemorrhagic bullae and skin necrosis. He was treated empirically with broad-spectrum antibiotics for sepsis of unknown origin for several days before slow growing gram-negative bacilli were seen in blood cultures. A more detailed social history carried out at this stage identified that the patient owned 7 dogs. C.canimorsus infection was therefore diagnosed and on commencement of targeted antibiotic therapy his sepsis improved whilst his purpura fulminans resolved with regular dressings by the burns department. Plastic surgeons should be aware of this organism and the potential for severe sepsis with significant skin involvement in patients exposed to domestic animals, even in cases without a breach of the skin. Early antibiotic therapy with a B-lactamase inhibitor should be trialed to improve the likelihood of a successful outcome.
Development of Modernized Frostbite Care in the Canada

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Background/Purpose: Frostbite care in Canada is not standardized. In many areas the approach has not moved beyond minimal care and awaiting demarcation prior to amputation. The Whitehorse General Hospital has developed a comprehensive protocol based on the best available evidence and modern guidelines. Since 2015 Frostbite patients presenting to the Whitehorse General Hospital have been treated with a comprehensive protocol which includes rapid rewarming, ibuprofen, aloe vera, and vasoactive agents (iloprost/tPA). All Grade 2 and 3 frostbite patients are treated with iloprost. Grade 4 patients are treated with iloprost and tPA.

Results/Outcomes: Our first two cases were published in the CMAJ. At present since 2015 eight patients with advanced frostbite have been treated with the protocol. Only one has required amputation.

Conclusion/Discussion: Using an aggressive protocol in a community setting is feasible and yields decreased amputation rates. There remain many unanswered questions regarding the optimal management of advanced frostbite injuries. To better understand the true incidence and outcomes a national frostbite registry and treatment protocol with the goal of optimizing care as measured by amputation rate is proposed.
The impact of time of mobilization after split thickness skin graft on wound healing – Systematic review and Meta-analysis

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Background
The aim is to summarize evidence for timing of mobilization after split thickness skin graft (STSG) to the upper (UE) and lower extremity (LE).

Methods
A systematic review and metaanalysis evaluating the impact of early (<POD3) versus late mobilisation (>POD4) after STSG in adult patients with wounds in the UE or LE was conducted. Randomized clinical trials and observational studies in any languages and published in any year were included. Outcomes evaluated were graft healing, presence of post-operative complications and length of stay in hospital.

Results
The search retrieved 4172 articles and 3064 remained after duplicate removal. Two independent reviewers screened citations, selecting 7 full texts for qualitative analysis and 5 full texts for quantitative analysis. Of these, two studies included burn patients. All wounds were in the LE. Odds of graft loss, of infection and of hematoma were respectively 0.55 (CI 0.12 – 2.54), 1.66 (CI 0.54 – 5.10) and 0.78 (CI 0.20-3.02) for early versus late mobilisation (n=2). Deconditioning was more common in late mobilisation group (n=3). Length of stay in hospital was shorter in the early mobilisation group, mean difference -2.14 days (CI -4.05 – -0.24) (n=3).

Conclusion
Wound healing and local complications were statistically similar between early versus late groups. Early mobilization prevented deconditioning and shortened length of stay in hospital. We conclude that early mobilization (<POD3) is the preferred strategy for patients treated with STSG to the LE. High quality studies are needed to evaluate the impact of mobilization on UE STSG.
Background: The HCMC Burn Unit in Minneapolis, MN experiences frigid winters with a high population density resulting in numerous frostbite injuries. Out of necessity, our center has become highly proficient in treating frostbite. Past developments have included thrombolytics, the Hennepin Frostbite Score, bone scans, LUNA studies, and hyperbaric oxygen (HBO) to improve outcomes in limb/digit salvage. This paper aims to outline the past developments, current modalities, and future directions for treatment severe frostbite injury at HCMC.

Methodology: Throughout the past 30 years, there has been a process of continuous ongoing research to establish our current treatment regimen which includes an initial bone scan, tPA, enoxaparin, and HBO. Our current study involves assessing the role of LUNA scans in assessment and predicting frostbite outcomes.

Results/Impact/Outcomes: Lytic therapy has been proven to significantly improve limb/digit salvage in frostbite. Recent study at HCMC has shown time of injury to time of tPA administration also predicts salvage. HBO has yet to yield significant impact though the sample sizes have been small. LUNA scans may prove predictive for amputation and have a role in replacing bone scans. Our recent winter’s salvage rate was 82.6%.

Conclusion/Discussion: Treatment of severe frostbite remains a moving target for improving outcomes. While lytic therapy has proven to have a substantial benefit, it has not been a panacea and many patients still require amputation. HBO may help wounds to heal by increasing oxygen tension in wounds. LUNA scans may allow for more rapid assessment of injury than a bone scan.
A Multi-Centre Comparison Of Nexobrid and Pawpaw for Enzymatic Debridement of Burns

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Early excision is the standard of care in burn treatment. Benefits include reduction in inflammatory burden, systemic inflammatory response and sepsis. Leading to improved healing and outcome. Surgical debridement is quick and effective. Early burns excision is critised, being traumatic, non-specific – leading to excision of healthy dermis, blood loss, dependent on costly specialist facility, subjecting the patient to anaesthesia. An alternative to surgery is enzymatic debridement. This method hasn't gained popularity reasons cited include, poor efficacy, pain, slowness, increasing infection risk. Enzymatic debridement has found renewed focus with the introduction of Nexobrid. This is an enzyme in an inert carrier forming a debriding gel dressing. The key agent is derived from Bromelain, a pineapple extract. A multi-centred RCT has shown Nexobrid to result in earlier eschar removal, reducing surgical excision, grafting, escharotomies with similar scar outcomes to SOC. In our experience, Nexobrid requires application under regional/general anaesthesia, has variable efficacy, often requiring subsequent eschar excision and grafting. It is reliant on in-patient specialist facilities, as such is costly. African hospitals have limited resources; there remains a role for traditional remedies. Papaya is used for enzymatic burns debridement. Pawpaw is proposed to work through proteolytic enzymes, chymopapain and papain, furthermore it has antimicrobial activity. It's used as a component of dressings, in children and adults, in the out-patient setting, by non-burns specialists. It doesn't require anaesthesia. We compare the use and outcomes of Pawpaw in Levy Mwanawasa University Hospital Zambia with Nexobrid used in St Andrew's Burns Unit, Broomfield Hospital, England.
The Management of Ocular involvement in Toxic Epidermal Necrolysis: Are We Blind to the Evidence?

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Erythema Multiform (EM), Steven-Johnson Syndrome (SJS) and Toxic Epidermal Necrolysis (TEN) lie on a spectrum of the same immune-mediated mucocutaneous disease. It has a mortality of up to 35% and survivors often suffer significant morbidity. Between 19%-75% experience chronic ocular disease. Ocular complications are probably the most significant for survivors. Acute ocular involvement is quoted between 24% - 100%. EM at the lower end, SJS and TEN individually quoted 81.3% and 66.7% respectively. Prompt recognition and appropriate management of the acute phase help mitigate the long-term sequelae. The spectrum of manifestations of acute ocular involvement range from localised conjunctival hyperaemia to inflammation and sloughing of the entire ocular surface, including the cornea, bulbar, tarsal conjunctiva and the eyelid margins with pseudomembranous or membranous conjunctivitis. Severe cases can lead to corneal blindness. Recent reviews have investigated the optimal treatment of the acute phase, using amniotic membrane transfer (AMT) as a successful adjunct in severe incidences. used with or as an alternative to conventional therapy (MT). It can prevent or reduce cicatricial ocular surface and lid margin abnormalities, indicators of long-term prognosis. Studies show that early AMT treatment improves outcomes compared to MT. Outcome parameters were BCVA, conjunctival scarring, symblepharon, trichiasis, and dry eyes. Despite promising results, patients experience disparity in treatment and outcomes; implementation of AMT is poor. Furthermore, ocular grading systems are rudimentary and difficult to use retrospectively. These elements need to be addressed to understand best use of AMT. We present the ocular outcomes in our centre over the last 5 years comparing to AMT.
Cold Sensitivity Postburn

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Introduction: Cold sensitivity is a common complaint after hand injuries but has not been documented after burn injuries. Based on burn survivors’ complaints, we believed this was a persistent complication postburn, therefore developed a cold sensitivity questionnaire (CSQ).

Methods: Seven self-reported cold sensitivity items were generated using the same response scale as the burn specific health scale-brief (BSHS-b). The CSQ was completed by 38 participants at baseline and 11 at follow up. Participants sustained 18.5±17.2% total body surface area burns, were 47.3±15.2 years old, 79% male and 108±58 days postburn at baseline and 267±136 days at follow up. Face validity and internal consistency were examined.

Results: Face validity was confirmed by demonstrating that there was no ceiling or floor effect for any items. The most problematic item “I have to protect myself more from the cold than before” was reported as “extremely” or “a lot” on 50.9% of the questionnaires. Cronbach’s alpha was 0.9589 indicating good internal consistency. At follow up the average BSHS-b score improved by 12.2%, however, the CSQ worsened by -2%.

Discussion: The vast majority of burn survivors reported an increase in cold sensitivity postburn that worsened with time. In total, 89% of burn survivors reported that they had to protect themselves more from the cold than before, and more frequently reported that they could not go out and do things in cold weather than in hot weather.

Conclusion: Cold sensitivity is an important issue for Canadian burn survivors, which currently is not being evaluated or treated.
Introduction: Burn patients receive enteral nutrition (EN)/tube feeding (TF) to meet increases metabolic requirements. Necrotizing Fasciitis (NF) is a soft tissue injury that is managed in a similar fashion as a burn injury, with debridement and grafting. However, limited data exists on the metabolic requirements of NF patients.

Methods: We conducted a prospective case series of 10 adult burn patients (6 male, 4 female) admitted to our centre. Data collected includes age, sex, body mass index, %TBSA, length of hospital stay, energy requirements from predictive equations and indirect calorimetry (IC) and number of procedures.

Results: Mean NF patient age was 49 yr and mean TBSA was 5%. NF patients had a mean of 4 surgeries and were in hospital for 36 days. Metabolic cart measurements were taken 15 ± 12 days from hospital admission. Mean measured caloric requirement was 1920 ± 390 kcal whereas predicted requirements were 1565 ± 247 kcal. Overall, measured caloric needs were 122 ± 14% of predicted requirements.

Conclusions: NF patients have elevated nutrition requirements that exceed that of predicted equations. We have shown that metabolic needs for NF patients are 122% in spite of a mean TBSA of 5%.

Applicability of Research to Practice: Although NF patients have small wounds, they have elevated nutritional requirements that need to be met to promote healing.
Accelerate Healing of Meshed graft by MeshFilling the Void Un-grafted Areas

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Rationale and hypothesis: The use of autologous meshed grafts saves lives of patients with large burn injuries. However, ungrafted areas remain open with a high chance of infection, fluid and heat loss and formation of devastating fishnet-like irregular scars. To overcome these difficulties, here, we hypothesize that a shelf ready multifunctional powdered reconstituteable liquid skin substitute referred as to MeshFill could be formulated to fill up void burn areas in a meshed graft. Methods: MeshFill, which made of collagen:GAG and glutaraldehyde crosslinked with PVA was prepared, lyophilized into powder, reconstituted into liquid and applied on mouse wounds, which have been splinted. The healing outcome was evaluated on day 7 and 14.
Results: The result showed a faster healing of wounds treated with MeshFill compared to control on day 7 and 14. The MeshFill treated wounds were fully epithelialized on day 14, while the controls remained wide open at this time. The faster healing seems to be due to a shorter wound healing inflammatory phase as the number of infiltrated CD45+ immune cells increased on day 7 and cleared before day 14. While there was a marked delay in appearance and clearance of infiltrated CD45+ cells in control wounds. Further, there was a markedly higher number of intracellular pro-collagen producing fibroblasts in MeshFill treated wounds compared to control.
Conclusion: These findings indicate that cells migrating from the wound edges into the MeshFill are viable and functional with the capacity to produce intracellular collagen and thereby shorten the healing time.
Use of a Lactic Acid based biodegradable skin substitute in 2nd degree burn care

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Several options are available for 2nd°burns temporary wound coverage to limit dressing frequency and accelerate healing. Infection and integration into the healing wounds have been major drawbacks, final outcome reports are scarce. The ideal treatment of 2nd°burns would 1-decrease pain, 2-limit dressing changes, 3-allow assessment of healing, 4-prevent infection, 5-accelerate healing, 6-improve long term outcome, 7-save treatment cost. This biodegradable skin substitute seems to fulfill 6 out of the 7 above mentioned requirements. This study was conducted as a retrospective chart review with IRB approval.

Over the past 3 years 169 patients received Suprathel®, a synthetic copolymer DL-lactide membrane, to their 2nd º burns. Wound bed preparation was achieved under anesthesia by dermabrasion. Suprathel® was applied after hemostasis. The wound bed was followed through the translucent Suprathel® and fat gauze layers. The dressing separated spontaneously after epithelialization.

94% of burns in this series healed without grafting. Infection rate was 2.4%. Time to epithelialization was accelerated compared to similar wounds receiving daily dressing changes and wounds placed in biobrane® or allograft (14 days). 10/169 wounds progressed to full thickness. No integration into wound beds was noted. Pain was rated at 1.7/10 throughout. Long term scarring was less than other 2nd degree burn series (6.5%).

Suprathel® for 2nd degree wounds offers a simple option with potential for better outcomes and less pain. Although lacking a control group, less frequent dressing changes, less pain medication and lower infection rate predict cost at least equivalent to current standard of care.
Long-term clinical outcomes of bilaminar skin grafts for large-sized burns: a case series

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Background
Skin coverage remains a significant hurdle in large-sized burns. Recent advances have allowed to grow Bilaminar Cultured Skin Autografts (BCSGs) from patients’ own limited donor sites. As the largest of three Canadian centers having employed this technique clinically, the aim of this study was to report long-term outcomes in patients with large-sized burns.

Methods
In total, nine patients received BCSGs from January 2010 to May 2015. Except one patient who deceased during hospital admission, all patients were contacted and four agreed to partake in the study. Patients were tested with the Vancouver Scar Scale (VSS), QuickDASH questionnaire and Burn Specific Health Scale (BSHS). Incisional biopsies of BCSGs were compared with patients’ autografts.

Results
From four patients, mean age was 40 years and mean TBSA was 70.3%. Score averaged 2.25 on the VSS, 29.5 on QuickDASH, 36/36 for psychosocial items and 63/84 for functional abilities on the BSHS. Compared with autografts, BCSGs demonstrated better pliability VSS and functional status. Biopsy specimens showed no evidence of malignancy or atypical changes, but multiple areas of hyperpigmentation.

Conclusion
This is the first report investigating the long-term outcome of a newly developed bilaminar cultured skin graft. BCSGs demonstrated comparable results with patients’ autografts, average functional outcomes on self-reported questionnaires and excellent psychological states. Substantial precaution given the extensive unexpected hyperpigmentation must be taken and a prospective randomized controlled study is underway.
The Murine model of the Effect of Amniotic Fluid Stem cells on the Wound Healing Process

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Background: Amniotic-fluid-derived stem cells and amniocytes have recently been determined to have wound healing effects, but their mechanism is not yet clearly understood. In this study, the effects of amniotic fluid stem cells and amniocytes on wound healing were investigated through animal experiments.

Methods: On the back of Sprague-Dawley rats, four circular full-thickness skin wounds 2 cm in diameter were created. The wounds were classified into the following four types: a control group using Tegaderm disc wound dressings and experimental groups using collagen discs, amniotic fluid stem cell discs, and amniocyte discs. The wounds were assessed through macroscopic histological examination and immunohistochemistry over a period of time.

Results: The amniotic fluid stem cell and amniocyte groups showed higher wound healing rates compared with the control group; histologically, the inflammatory cell invasion disappeared more quickly in these groups, and there was more significant angiogenesis. In particular, these groups had significant promotion of epithelial cell reproduction, collagen fiber formation, and angiogenesis during the initial 10 days of the wound healing process. The potency of transforming growth factor-β and fibronectin in the experimental group was much greater than that in the control group in the early stage of the wound healing process. (Fig.1) In later stages, however, no significant difference was observed.

Conclusions: The amniotic fluid stem cells and amniocytes were confirmed to have accelerated the inflammatory stage to contribute to an enhanced cure rate and shortened wound healing period. Therefore, they hold promise as wound treatment agents.
What are the provincial College of Physicians and Surgeons’ guidelines on smartphone clinical photography?

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The purpose of this review was to evaluate the completeness and accessibility of existing College of Physicians and Surgeons guidelines for use of smartphones to store and transmit patient information. Two independent reviewers assessed the guidelines for using a smartphone for clinical photography available on the 13 regulatory College of Physicians and Surgeons websites. Each college was scored using a previously determined ranking system on 6 specific categories: consent, transmission, storage, auditing capability, retention period and breach of information. Where no information was available on the website, each college was contacted individually by email and phone to further inquire about existing policies. Scoring system: 2 Information complete on website; 1 Information incomplete on website or only available by phone or email; 0 Information not available. Accessibility to the information was evaluated based on number of documents required to deliver the 6 categories of information. Existing Canadian College guidelines on clinical photography with a smartphone were difficult to access and incomplete for the majority of topics (5/6), with retention period having the most complete relevant information. Ten regulatory colleges contained some relevant information on their website. Only one college had guidelines available for all 6 categories. Seven colleges were missing guidelines on more than half of the six categories. An average of 2.4 documents per college (maximum 6) needed to be accessed in order to find recommendations. Provincial colleges across the country lack complete and readily accessible information to guide smartphone use for clinical photography. Concise national guidelines are needed.
Abstract ID: 50

Alternatively Activated Macrophages Drive Browning of White Adipose Tissue via IL-6 during Hypermetabolic States.

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Introduction: In hypermetabolic patients (e.g. burns, cancer) the browning of white adipose tissue (WAT) has presented substantial clinical challenges related to cachexia, atherosclerosis, and poor clinical outcomes. This phenomenon called 'browning' entails a process by which WAT converts into a fat burning engine. The mediators regulating this adverse switch in WAT is unknown. Methods: WAT and plasma were collected from both mice subjected to a 30% total body surface area (TBSA) burn injury and patients admitted to the Ross Tilley Burn Centre. WAT and serum collected were analyzed for browning markers and metabolic state via histology, gene expression, and resting energy expenditure (REE) assays. Results: Here, we show in rodents and humans that IL-6, a pro-inflammatory cytokine, is chronically up-regulated after burn, and that mice genetically deficient in IL-6 are protected against burn-induced browning and hypermetabolism. Administration of recombinant IL-6 alone induced browning and caused hypermetabolism. Chimera studies further elucidated the role of bone marrow derived IL-6, which induces browning via macrophage polarization and subsequent catecholamine secretion. Lastly, pharmacological inhibition of the IL-6 receptor attenuated browning and improved post-burn hypermetabolism. Conclusion: Our results identify IL-6 as a key mediator of browning during hypermetabolic states, and designate IL-6 as a promising target for hypermetabolism.
White adipose tissue browning: the heat is on the liver

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Introduction: A key characteristic of the hypermetabolic response post-burn is the development of hepatic steatosis, characterized by lipid accumulation in hepatocytes mediated by excessive lipolysis from adipose tissue. Recent studies have implicated browning, a phenomena where white adipose tissue (WAT) converts into a fat burning engine, resulting in cachexia and atherosclerosis. Despite this linkage between browning, burns, and metabolic dysfunction in the muscle and heart, mechanisms underlying hepatic steatosis and dysfunction post-burn injury are unknown. Methods: WAT and plasma were collected from both mice subjected to a 30% total body surface area (TBSA) burn injury and patients admitted to the Ross Tilley Burn Centre. WAT and serum collected were analyzed for browning markers, hepatic damage, and metabolic state via histology, gene expression, and resting energy expenditure (REE) assays. Results: In both burn patients and post-burn mice that expressed the browning gene UCP1, there were elevations in liver damage markers ALT and AST. Lipidomic profiling and analysis in burn-injured patients and mice revealed increased accumulation of saturated fatty acids (SFAs) linked to liver dysfunction, particularly pro-inflammatory palmitic acid. The last aspect of our studies was geared towards clinical applications, in which we targeted burn-induced browning. Neutralization of IL-6 the master regulator of burn-induced browning, inhibited adipose tissue browning, ameliorated hepatic steatosis and ER stress in burn-injured mice. Conclusion: Our findings link WAT browning to hepatic steatosis and unravel a comprehensive network of inter-tissue crosstalk that emerges during the hypermetabolic response to burn injury.
Reperfusion After Severe Frostbite: First Full Thickness Necrosis After Initial Successful Thrombolysis

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Background:
The commonest sites affected by frostbite injuries include fingers, toes, hands and feet. Factors determining the severity of cold injuries include, exposure to cold temperatures, wind chill factor and duration of exposure to cold.

Treatment options are limited; however, the novel method of thrombolysis could represent an efficient method addressing the issue of ischemia after rewarming.

Methodology:
We report the case of a 36 years old male who suffered from severe frostbite injuries to both feet with an estimated TBSA of 4%. The patient travelled by foot for 60 km, with an outside temperature of -10°C. Rewarming therapy commenced and on arrival to our institution, the decision was made to start thrombolysis. Thereafter, the feet recovered clinically up to the distal toes becoming pink with blisters. Pulses and saturation taken on every toe revealed normal values (98%). Thrombolysis ended 9 hours after its commencement due to accidental withdrawal of the catheter, but angiography showed adequate perfusion; thus, therapy was not continued.

Results:
Twelve hours after initiation of thrombolysis, pulses at the toes were lost. Subsequently developed progressive necrosis of the toes to mid-foot. The decision was made to amputate a month after initial injury and thrombolysis.

Discussion:
Thrombolysis is effective as it addresses the mechanism of frostbite ischemia. Although treatment was initially successful, the factors that may have led to that outcome included, treatment <24 hours, permanent tissue destruction due to freezing, despite reperfusion and irreversible intimal vascular injury.
Optimizing skin graft uptake and allowing mobilization for burns and necrotizing fasciitis wounds using a non-adherent contact layer dressing with negative pressure wound therapy

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Background-purpose:
Negative pressure wound therapy (NPWT) has been shown to have beneficial outcomes for the management of split thickness skin grafts (STSG) as it secures the graft in the post-operative period while allowing mobilization.1 An interface dressing may be used to prevent adherence of the NPWT foam to the graft.2 Skin graft loss may affect mobilization and increase length of stay. Early experience with the following dressings resulted in frequent adherence to the graft and occasional partial graft loss: low-adherent paraffin gauze, non-adherent petrolatum emulsion and low-adherent nanocrystalline silver. As a result of this initial experience, a non-adherent lipidocolloid contact layer dressing with silver was selected. The antimicrobial component of the dressing was desirable as these wounds, particularly burn injuries, may be higher risk of infection. The purpose of this clinical presentation is to describe the impact of using a lipidocolloid dressing on adherence to STSGs using photographic case studies.

Methodology
A convenience sample of 4 patients who received STSGs (2 thermal burns and 2 wounds associated with necrotizing fasciitis) were selected who had provided consent for digital photography. The lipidocolloid dressing was applied between the NPWT foam and the STSG for four days. Adherence to the STSG and graft uptake was visually assessed at dressing change.

Results
All 4 wounds managed with NPWT and the lipidocolloid dressing had 100% STSG uptake.

Conclusion
Use of a lipidocolloid dressing helps prevent adherence of the NPWT foam to the STSGs in burns and necrotizing fasciitis wounds.

KeyWords: NPWT-STSG-dressing adherence
Using Intra-arterial tPA for Severe Frostbite Cases

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Background:
Risk factors for frostbite injuries include homelessness, alcohol and/or drug abuse, mental illness and winter sports and activities. The mainstay treatment is rapid rewarming of the injured site using water at around 40°C. In cases of severe injuries with presence of necrosis, surgery is typically delayed to allow the necrotic tissues to demarcate, which allows amputating only devitalized tissues. The purpose of this study is to evaluate the effectiveness of intra-arterial tissue plasminogen activator (tPA) combined with nitrate to restore vascular supply to the injured and ischemic body parts after rewarming.

Methodology:
This is a single center, retrospective cohort study, where it is aimed to evaluate two groups of patients. The first group of patients were admitted between 2000-2006 and had received conventional treatment of frostbites. This group will be compared with another admitted between 2012-2017, who had received thrombolytic therapy in addition to conventional management after its standardized introduction in our therapeutic algorithm starting 2010.

Results:
It is hypothesized that the use of IA-tPA will improve vascular integrity of the injured body part and thus, will result in improved outcomes and reduced rates of morbidity and amputations.

Discussion:
There is considerable morbidity usually associated with frostbite injuries. This results from the necrotizing tissue, that may be complicated by infection and amputations usually resulting in longer hospital stay. In conclusion, the use of IA-tPA has shown to be the most beneficial therapeutic modality for severe cases of frostbites.
Heterotopic ossification (HO) is an uncommon but severe complication of burn injury, most often affecting the elbow joint. When present, HO can impair joint range of motion (ROM) and complicate efforts to prevent contracture. To date, there are limited quantitative studies evaluating the association between HO and contracture severity. The purpose of this study is to evaluate elbow ROM outcomes in patients with and without HO at discharge. Data was obtained from the Burn Model System National Database between 1994 and 2003. All patients over 18 years with an elbow contracture at acute discharge and radiological demonstration of HO were included. Elbow ROM was compared for those with and without HO. Contractures were reported as both mean absolute loss of ROM in degrees and relative percent loss of normal ROM. Elbow ROM were further examined by TBSA subgroups and compared between the HO and non-HO groups with a two-sample t-test. A p-value of < 0.05 was considered statistically significant. The database included 407 instances of elbow flexion or extension contracture at discharge of which 64 individuals had identified HO. Elbow extension exhibited similar contracture severity in both groups (28 degrees with HO vs. 25 degrees in non-HO; p = 0.34). However, elbow flexion contracture was significantly worse in the HO group (50 degrees vs. 30 degrees, p < 0.0001). Within the TBSA subgroups, the difference in flexion was most pronounced in the 20-40% TBSA group. This study provides additional understanding of the impact of HO and contracture in burn survivors.
Interprofessional team experiences for rehabilitation of newly acquired blindness through burn injury

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Recovery following catastrophic burn injury requires comprehensive, multidisciplinary care and often demands creative strategies for recovery. This case report outlines the unusual challenges presented by the rehabilitation of a burn survivor with greater than 70% TBSA skin involvement, loss of multiple hand digits, and complicated by new onset blindness. The plan of care spanned four months of inpatient rehabilitation and required development of innovative rehabilitation approaches including: coordination with the Canadian National Institute for the Blind, integration of outpatient services for the newly blind into the inpatient recovery program and discharge planning, inventive strategies for hand therapy that included integration of adaptive devices for vision loss, psychological support, and extensive planning with patient and family for life following hospitalization. The authors will review the case, the challenges it created for functional recovery, and the lessons learned throughout the care process.
Pediatric Frostbite: a 10-year retrospective study

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Background: Frostbite is a thermal injury that results when tissues are frozen. Literature is limited on children who are a vulnerable population not in control of their environment. The objective is to describe frostbite in children referred to a regional burn center from 2007 to 2017.

Method: Retrospective chart review of 47 patients < 18 years old examining demographics, history, management and environmental temperature at time of injury. *Proportions > 100% as individuals may have more than 1 factor at time of injury were identified: intoxication and supervision. Among patients 0-12 years, lack of supervision at time of injury was common (64.3%) and among older patients, intoxication was common (60.6%).

Results: Two prevailing factors at time of injury were identified: intoxication and supervision. Among patients 0-12 years, lack of supervision at time of injury was common (64.3%) and among older patients, intoxication was common (60.6%).

Discussion: To our knowledge, this is the largest retrospective study of pediatric frostbite. These findings call for targeted outreach to reduce frostbite incidence. For younger children, focus must be on involving and educating parents on risks of unsupervised care. For older children, informing youth on risks of frostbite alongside approaches to curb adolescent alcohol use are warranted.

<table>
<thead>
<tr>
<th>Age (median (IQR)):</th>
<th>15 (12,16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient (%):</td>
<td>48.9</td>
</tr>
<tr>
<td><strong>Management (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Dressing only</td>
<td>70.2</td>
</tr>
<tr>
<td>Surgical intervention</td>
<td>23.4</td>
</tr>
<tr>
<td>No intervention</td>
<td>4.3</td>
</tr>
<tr>
<td>Unspecified</td>
<td>2.1</td>
</tr>
<tr>
<td><strong>Injury temperature by Management (°C) (n=24)</strong></td>
<td></td>
</tr>
<tr>
<td>Dressing only</td>
<td>-18.0 (-16.1, -20.0)</td>
</tr>
<tr>
<td>Surgical intervention</td>
<td>-29.0 (-26.0, -30.0)</td>
</tr>
<tr>
<td><strong>Injury Circumstance (%)</strong> *</td>
<td></td>
</tr>
<tr>
<td>Walking outdoors</td>
<td>44.7</td>
</tr>
<tr>
<td>Loss of consciousness</td>
<td>27.7</td>
</tr>
<tr>
<td>Outdoor recreational sport</td>
<td>19.1</td>
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<tr>
<td>Suspected abuse/assault</td>
<td>12.8</td>
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<tr>
<td>Motor vehicle collisions</td>
<td>8.5</td>
</tr>
<tr>
<td>Evading authority</td>
<td>8.5</td>
</tr>
<tr>
<td>Unspecified</td>
<td>4.3</td>
</tr>
<tr>
<td><strong>Documented Factors (%)</strong> *</td>
<td></td>
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<tr>
<td>Alcohol</td>
<td>53.2</td>
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<tr>
<td>Smoking</td>
<td>34.0</td>
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<tr>
<td>Marijuana</td>
<td>23.4</td>
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<tr>
<td>Depression and/or suicidality</td>
<td>31.9</td>
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</table>
Predictors of Mortality in Patients with Necrotizing Fasciitis

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Background: Necrotizing fasciitis (NF) is a life-threatening infectious disease that can result in significant morbidity and mortality. Previous work has identified a number of factors, but these have not been verified in a large population. The objective of this study is to further examine the relationship of patient factors in NF mortality.

Methodology: This study is a retrospective review on patients ≥ 18 years old diagnosed with NF at the provincial referral centres from 2004-2016. The following data was examined: demographics, comorbidities, laboratory values and length of stay.

Results: 321 patients satisfied the inclusion criteria: 278 survived and were discharged, 43 died in hospital. Table 1 shows the univariate analysis of mortality risk factors in patients with NF.

Data shown as n (%) or mean ± s.d.; a n= 255, b n=42, c n=271, d n = 250, e n=38; f Group A Beta-hemolytic Streptococci infection.

In multivariate analysis, elevated creatinine, lower blood platelets, the presence of GABS were the strongest predictors of mortality.

Conclusions: Multiple factors were associated with mortality in NF. The strongest univariate association with mortality was age > 60. In addition, a history of hypertension and/or dyslipidemia, renal disease, and the presence of GABS contributed to a predictive model.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Survived (n=278)</th>
<th>Deceased (n=43)</th>
<th>OR (95% C. I.)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt;60</td>
<td>66 (23.7)</td>
<td>27 (62.8)</td>
<td>5.42 (2.75-10.67)</td>
<td>0.001</td>
</tr>
<tr>
<td>Hypertension and/or dyslipidemia</td>
<td>122 (43.9)</td>
<td>30 (69.8)</td>
<td>2.95 (1.48-5.90)</td>
<td>0.002</td>
</tr>
<tr>
<td>Renal disease</td>
<td>31 (11.2)</td>
<td>13 (30.2)</td>
<td>3.45 (1.63-7.31)</td>
<td>0.003</td>
</tr>
<tr>
<td>ICU admission (% yes)</td>
<td>116 (45.5)a</td>
<td>32 (76.2)b</td>
<td>3.83 (1.81-8.13)</td>
<td>0.001</td>
</tr>
<tr>
<td>Blood transfusion (% yes)</td>
<td>109 (40.2)c</td>
<td>27 (62.8)</td>
<td>2.51 (1.29-4.87)</td>
<td>0.008</td>
</tr>
<tr>
<td>GABS (%)</td>
<td>102 (40.8)d</td>
<td>8 (21.1)e</td>
<td>2.32 (1.10-4.87)</td>
<td>0.013</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>15 ± 135.6</td>
<td>240.4 ± 168.6</td>
<td>N/A</td>
<td>0.007</td>
</tr>
<tr>
<td>Platelets (/μL)</td>
<td>0.37 ± 1.6</td>
<td>0.1 ± 0.3</td>
<td>N/A</td>
<td>0.02</td>
</tr>
<tr>
<td>Urea (mg/dL)</td>
<td>11.5 ± 14.1</td>
<td>19.8 ± 13.8</td>
<td>N/A</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Mental Health Outcomes of Necrotizing Fasciitis Compared to Matched Controls: A Retrospective Cohort Study

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Introduction: Necrotizing fasciitis (NF) is associated with extensive surgery, amputations, and prolonged hospitalization. What is not known is whether or not NF results in an increased incidence of mental disorders and associated healthcare utilization in the years after the infection compared to before infection. Patients who suffer traumatic injuries such as burns have increased psychopathology and need for care. NF is more severe than burns and therefore it is conceivable that NF survivors will have an increase rate of mental health outcomes.

Methodology: This study is a retrospective, administrative, population-based cohort study with matched controls (1:5) using administrative data. Outcomes of interest include depression, anxiety, substance abuse and any mental health that will be matched to controls in the 2-year period before the index date and the period of time following NF diagnosis.

Results and Discussion: The rates of mental health outcomes post infection compared to pre-infection are trending towards significance (p = 0.07). Pre-existing mental health outcomes in the NF population before the disease is significantly higher compared to match controls. Mental health status may play a role in susceptibility to NF infection. Results may be limited due to mental health seeking behaviors, stigma and restrictions of physician billing.

Conclusion: This study highlights the importance of recognizing mental health issues in this population as it can predispose and alter outcomes in NF patients.
Epidemiology of Necrotizing Fasciitis: A 12 Year Experience of 340 Patients

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Introduction: Necrotizing fasciitis (NF) is an acute soft tissue infection of the deep fascia, subcutaneous tissue, and superficial fascia to varying degrees. It is associated with extensive surgery, amputations, and prolonged hospitalization that may increase stress on a patient and have deleterious consequences. The diagnosis is difficult and treatment involves emergent surgical intervention and antibiotic therapy. Manitoba has one of the highest proportion of NF. The purpose of this study is to examine the epidemiology of NF at a regional referral centre. We will examine what comorbidities are associated, the microbiology associated with the infection and the geographic distribution of NF in the province.

Methodology: The data analyzed in this study were collected from local burn registry using ICD-10-CA and ICD-9-CM codes to identify patients from 2004 – 2016. Descriptive statistics were obtained for all variables. Regression analysis was performed to identify determinants of death, amputation, and length of stay.

Results and Discussion: NF patients have a high prevalence of comorbidities. These include diabetes (41.2%), hypertension and dyslipidemia (47.9%) and smoking (31.2%). The Northern health region in Manitoba accounted for the highest incidence of NF (5.82/100 000).

Conclusions: This study reveals the characteristics and consequences of NF patients in Manitoba which in turn will help develop screening methods to identify individuals and prevent dire outcomes associated with NF.
Patterns of burn injuries in Manitoba: A population health study

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Background: The purpose of this study is to explore the geographic distribution of burns in Manitoba and the association between burns incidence and severity and area level household income.

Methodology: Data from the burn registry on adults, who presented to a regional burn center from 2006 to 2016, will be reviewed. Key patient demographics i.e. age, sex and mechanism of injury will be extracted from the burns data. The severity of injury will also be assessed using %TBSA and length of stay in hospital. Administrative data from the burn registry will be merged with the relevant census tracts in urban areas and the regional municipalities/subdivisions in rural areas, based on the postal codes. Income will be converted to quintiles based on total household income mean from Statistics Canada data. Descriptive statistics, the relative rate of burns, and differences in incidence and type of injury will be examined in a multiple regression model.

Results: We hypothesize that the incidence and severity of burns will be higher in lower household income areas.

Discussion and Conclusion: Understanding regional factors that affect the occurrence of burns, will help in identifying areas that are at a higher risk of burns. This will allow for development of more targeted strategies to reduce the incidence of burns.
Self-assembled skin substitutes (SASSs) as permanent graft skin: a case series of 14 severely burned patients

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Background: Currently, the standard treatment for severely burn injuries are split-thickness skin autografts (AGs). However, the skin harvest is limited by the availability of donor sites. This study evaluates the clinical outcome of autologous self-assembled skin substitutes (SASSs) as permanent coverage of full-thickness burn wounds.

Methodology: Patients, recruited through Health Canada’s Special Access Program, were grafted with SASSs on debrided full-thickness wounds according to the same protocol used for AGs. Grafted sites were photographed at different time points and an evaluation of graft take and persistence of the epithelium overtime were performed. For a subset of patients, scar parameters were evaluated using Cutometer, Mexameter and DermaScan devices. A biopsy was also taken on one patient to perform microscopic analyses.

Results: The SASSs were used on fourteen patients. The follow-up varied from 1 month to 8 years. The integrity of the transplanted SASSs persisted over time with no defect in epidermal regeneration. The sites grafted with TES were whitish, not as pigmented as the normal skin, despite some pigmentation spots that can increase in number and area with time depending on the Fitzpatrick skin phototype of the patients. Minimal scarring was observed and SASSs were comparable to adjacent AGs with respect to erythema, elasticity and skin thickness.

Conclusions: SASSs allow appropriate resurfacing coverage of full-thickness burns given its high graft take, functional characteristics, minimal scarring and the promotion of long-term tissue regeneration. When skin donor sites are lacking, SASSs could be a valuable alternative to treat extensive burn patients.
Survivor Feedback on Research and Network Content

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Background: Patient and survivor feedback is a valuable starting point to initiate relevant research, quality improvement initiatives and patient network content. Initiatives that involve health care recipients in research and innovation is integral to effective health care advancement.

Methodology: Surveys were distributed at an annual burn survivor conference. Two open ended questions were asked related to what areas the healthcare and research team should focus on in research and two questions elicited feedback on content for a national burn network.

Results: Twenty one participants completed the survey. There was a high level of interest in continuing research to improve symptoms such as pain, itchiness and extent of scarring. There were also recommendations for network content on recovery issues. These included nutrition, returning to work challenges, wound care dressings and other lifestyle related information. General recommendations for an e-based platform included regularly updating the content and providing regular featured topics.

Conclusions: Burn survivors are interested in ongoing research, quality initiatives and a variety of recovery topics. There is a high interest in current research strategies and innovation. Feedback reinforces the value of knowledge translation to consumer groups.

Discussion: There are many opportunities to secure survivor feedback to enhance patient service delivery and research. Patient communication websites provide a platform to share innovation and strengthen ties within the burn community.
Immunoprofile of PBMCs may offer prognostic value in sepsis

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Sepsis is a potentially lethal complication of infection, it remains the leading cause of mortality in ICUs (intensive care units) in first-world nations. Early diagnosis leading to and management of sepsis drastically improves patient survival, thus there is an eminent necessity for a reliable prognostic test. However, the complex immunologic events preceding sepsis remain elusive. We explore the validity of leukocyte cell surface markers as potential biomarkers for the prediction of sepsis and clinical outcome. We have identified potential candidates and cytokine expressional profile of peripheral blood mononuclear cells (PBMCs) in high-risk patients differently regulated in patients who develop sepsis. Patients with burn injury are at high risk of developing sepsis secondary to infection due to the nature of injury. We conducted a prospective cohort study with patients admitted to a regional burn center between 2015-2017. 60 patients were enrolled and PBMCs were isolated using fresh blood within 3 hours of draw using Percoll gradient. Cell surface markers and inflammatory cytokine expression were analyzed using flow cytometry. We identify candidate markers differentially regulated in pre-septic versus non-septic patients. A particular subset of leukocytes showed low expression (2-3%) in our healthy controls. Burn injury increased the prevalence of inflammatory cytokine expression on HLA-DR positive leukocytes. A population of patients exhibited a cytokine trajectory significantly higher than their TBSA matched counter-parts. These patients went on to develop sepsis. PBMCs provide insight into the complex immunologic events preceding sepsis and may represent potential biomarkers for the acute prediction of sepsis.
Background and Objectives: Wound healing and its complications are the major underlying reasons for morbidity and mortality of burn patients. Therefore, there is an urgent need to develop skin substitutes (SSs) to deliver cells to the wound bed and promote wound healing. Due to good biocompatibility, and especially anti-oxidant property, pullulan/gelatin scaffolds have been studied in our lab to deliver progenitor fibroblast and keratinocyte. However, optimization is necessary due to lack of stability during transportation and handling and unsatisfied cell delivery.

Methodology: The second generation of scaffold with physically cross-linked pullulan and chemically cross-linked gelatin (PG2) was developed by salt-leaching fabrication method, and compared to Integra® dermal regeneration template (Integra®) from aspects of material properties, biocompatibility and wound healing with mouse model.

Results: PG2 shows interconnected round-shaped pores with the range of 20 - 200 um and the porosity around 74%. Ideal water retention, fast swelling, enzyme-degradation and anti-oxidant property were found in PG2. In vitro cell study demonstrates that cells incorporated in PG2 have a comparable viability (86-90%), penetration capability (164-201um), and proliferation capacity (35%) to Integra®. Animal study revealed more granulation tissue and less myofibroblast on PG2-treated wounds.

Conclusion: PG2 scaffold is a promising and affordable candidate as a cell-delivery substitute for skin regeneration.
Metformin treatment rescues muscle wasting and increases the number of satellite cells following thermal injury in mice

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Background and Purpose: Severe burn results in a prolonged hypermetabolic response that causes significant muscle wasting. A drug that may have a beneficial effect on muscle regeneration is Metformin. The objectives of this study were to examine changes in muscle progenitors after burn injury and whether metformin can rescue burn-induced muscle atrophy. We hypothesize that metformin treatment will mitigate muscle atrophy after thermal injury by increasing the proliferation and differentiation of muscle stem cells.

Methods: Young (8 weeks) mice were subjected to a 30% TBSA thermal injury via a 98°C water bath. The groups were: sham, burn, and burn + metformin treatment. The animals were sacrificed at 2 and 7 days and gastrocnemius muscle was collected for histological and protein analysis. Results: There was a decrease in myofiber size at 2 and 7 days post-burn. Metformin treatment rescued muscle wasting at 7 days. To examine changes in muscle stem cells, we performed immunohistochemistry for Pax7 and MyoD, markers of proliferating and differentiating muscle stem cells respectively. The number of Pax7+ and MyoD+ cells was significantly decreased at 2 days, however there was a significant increase at 7 days in the metformin. Western blotting showed a significant increase in Pax7 and MyoD protein level at 7 days in the metformin group. Conclusions: Metformin treatment after thermal injury can rescue muscle atrophy and has a beneficial effect on the number of muscle stem cells in mice. Treating burn patients with metformin may mitigate muscle wasting in addition to managing hyperglycemia.
Background and Purpose: The traditional antibacterial releasing systems are based on the continuous drug elution, even if there is no bacterium. This unneeded release can cause cytotoxicity, healthcare costs, and delayed healing. We designed a bacteria-responsive nanofibrous wound dressing, which can be degraded in presence of bacteria to release antimicrobial agent.

Methodology: A model biocide, benzylidimethyltetradecyl ammonium chloride (BTAC), was incorporated into a bacteria-degradable polymer in two ways: evenly distributed inside the polymer as single nanofibers and encapsulated in a core surrounded by the same polymer as core-shell nanofibers. Release profile of BTAC, antibacterial efficacy, and cytotoxicity of the nanofibers were examined.

Results: Nanofibers showed higher drug release during 1 h in the bacterial supernatant (32%) than in tryptic soy broth (10%) or in fibroblast cell supernatant (11%). Total kill (8.8 log reduction) of S. aureus was obtained by single nanofibers within 1 h and by core-shell nanofibers within 2 h. The nanofibers exhibit minimal cytotoxicity against fibroblast (>80% viable cells-24 h contact). Free BTAC, at a concentration equivalent to released BTAC from nanofibers, presented faster total kill of S. aureus (within 20 min) but severe cytotoxicity (12% viable cell after 24 h).

Conclusions and Discussion: The enzyme in the bacterial supernatant facilitated the drug release. Due to drug preservation in the core, core-shell nanofibers showed more controllable release (slower kill) than single nanofibers. With responsive biocide release, nanofibers did not cause severe cytotoxicity. This result confirmed bacteria-responsive release of drug loaded nanofibers.

Keywords: Bacteria-responsive, Nanofibers, Antibacterial
The importance of a 3D-based approach with personalized models for accurately assessing total body surface area

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Objective:
In this paper, the relevance of a new three-dimensional computer-based framework with personalized 3D models for accurately assessing the TBSA is demonstrated through preliminary results and validation studies.

Methods:
First, a 3D rendering interface was developed for representation and calculation of TBSA. The personalized 3D models were built from anthropometric measurements using MakeHuman software. 15 paired models were randomly built with an equal body surface area but a different morphology. The difference of local body surface area, TBSA burned and Parkland fluids between each paired models were observed to highlight the impact of morphology's variation on the TBSA. Finally, a preliminary validation study was made on 4 mannequins by 14 volunteers to assess the accuracy of the 3D models built with MakeHuman software and TBSA burned assessment with the proposed method.

Results:
Small variations in the morphology impacted the TBSA assessment. Mannequin’s 3D models built with MakeHuman software presented an absolute error of 3 ± 2.2 % with no significant difference with their scans. The proposed approach allows for a better assessment of TBSA with a lower variability. No significant difference in the scores for expert and non-expert conditions was observed.

Conclusion:
Personalized 3D model to the patient’s morphology is suggested to overcome the difficulty of patients with specific morphologies such as obese and children. The proposed framework appears to be relevant for personalizing and accurately assessing TBSA and could reduce morbidity and mortality.

Keywords: TBSA, 3D model, anthropometry.
EXOSOMES ENRICHED IN THE ACELLULAR WHARTON’S JELLY OF THE HUMAN UMBILICAL CORD ENHANCES SKIN WOUND HEALING

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Background: Burn injuries lead to dramatic physiological changes which include impaired wound healing. We recently reported that acellular gelatinous Wharton’s jelly (AGWJ) from the human umbilical cord enhances wound healing in-vitro and in-vivo. However, the active ingredient(s) of AGWJ is unknown. Objective: Analyze the native extracellular factors of AGWJ and identify components which are beneficial for wound healing. Methodology: Isolated and fractionated AGWJ. Mass spectrometry on AGWJ, isolated exosomes from AGWJ. In-vivo, performed 6mm punch biopsies on backs of BALb/c male mice; wounds were treated with control matrigel, matrigel + AGWJ and matrigel + exosomes from AGWJ. Results: AGWJ significantly enhanced fibroblast migration and changed morphology to a myofibroblastic phenotype, confirmed by upregulation of alpha smooth muscle actin (αSMA). In-vivo, smaller wound length in the AGWJ treated mice were observed, with greater αSMA expression. Interestingly, the number of F4/80+ve macrophages were significantly higher in the AGWJ group compared to controls, suggesting that AGWJ enhances macrophage accumulation, leading to faster upregulation of αSMA causing faster contraction. Mass spectrometry on AGWJ revealed a protein characteristic of exosomes. In murines, wounds treated with only exosomes from AGWJ were smallest in length compared to controls, suggesting that exosomes in AGWJ contains an active ingredient that enhances wound healing. Additionally, exosomes displayed an enrichment of TGF-β protein. Conclusion: Data suggests that exosomes in AGWJ enhance wound healing through an increase in the number of myofibroblasts in granulation tissue. AGWJ is biological, cost effective and globally available which makes it a highly promising wound healing remedy.
ADIPOSE TISSUE SECRETIONS INDUCE POST-BURN HEPATIC HYPERMETABOLISM

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Background: The hypermetabolic response to severe burn injury is strongly correlated to patient mortality. Despite its impact, the underlying cause of this response remains uncertain. The presence of hyperlipidemia and hepatic steatosis post-burn injury suggests that crosstalk between adipose tissue and the liver is involved. This study investigated the effects of factors released from the adipose tissue on hepatocyte bioenergetics and metabolism.

Methods: Adipose tissue was collected from healthy controls and burn patients, and incubated in low glucose DMEM media. HepG2 cells were then incubated in the adipose tissue-conditioned media for 24 hours. High throughput respirometry was conducted on the isolated mitochondria of HepG2 cells using a XF96 analyzer to determine whether the explants affected mitochondrial metabolism. Milliplex was used to obtain a cytokine profile of the adipose tissue-conditioned media. The effects of the conditioned media on HepG2 fatty acid metabolism were explored through Oil Red O staining.

Results: HepG2 cells displayed higher basal levels of mitochondrial respiration and increased triglyceride content when treated with conditioned media obtained from the adipose tissue of burn. Adipose tissue received from burned patients released greater levels of proinflammatory cytokines than adipose tissue received from control subjects.

Conclusion: The data described above indicates that burn injury induce adipose tissue to release mediators which influence hepatocyte metabolism in an ex vivo fat explant model. These changes are synonymous with hyperactive liver mitochondria and hepatic steatosis reported after burn injury, thus providing support for the role of adipose tissue-secreted factors in promoting liver dysfunction and hypermetabolism.
Is the increased mortality in elderly burn patients due to the acute phase response?

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Background and Objective:
The survival of elderly burn patients remains unacceptably poor despite modern and protocolized care. The acute phase, defined as the first 96 hours after burn, includes the resuscitation period and influences survival. We aimed to identify and compare differences in the acute phase response to severe burn injury between adult and elderly patients.

Methodology:
All patients admitted within 3 days of injury with ≥20% TBSA to our burn centre. Clinical hemodynamic measurements, biomarkers, volume of fluid resuscitation, cardiac agents, and the inflammatory response, determined in plasma by cytokine profiling, were compared between adult (aged < 65 years) and elderly (aged ≥65 years) patients.

Results:
A total of 130 patients were included, with 108 adults and 22 elderly. Inhalation injury and % TBSA burn were not significantly different. Fluids, colloids, and urine-output were also similar. Elderly patients had a significantly lower heart rate, lower cardiac index, and lower MAP (p < 0.05). Elderly patients had significantly lower levels of pro-inflammatory IL-6 and chemokines including MCP-1, MCP-3, MIP-1α and MIP-1β (p <0.05). Overall mortality was significantly higher in elderly patients (6% vs. 50%, p <0.0001).

Conclusions and Discussion:
The acute phase response after burn is distinct between elderly and adult burn patients and characterized by cardiac depression leading to hypoperfusion and hypo-inflammation. The attenuated acute phase response in elderly burn patients might contribute to subsequent increased organ failure and mortality. Further work on the cellular level is necessary to identify where burn care providers can further intervene to improve the outcome of elderly patients.
St. John’s Rehab Outpatient Burn Program Evaluation: A S.W.O.T Analysis

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St. John’s Rehab offers Ontario’s only dedicated specialized burn rehabilitation program. The hospital provides multi-disciplinary services to address the physical, psychosocial and vocational needs of individuals with severe burn injuries. The outpatient burn program at St. John’s recently conducted a SWOT analysis to evaluate our program. The SWOT is a tool from the business world for program evaluation and strategic planning. Increasingly being used in healthcare settings, the SWOT framework provides opportunities to reflect on key internal and external issues under the categories of Strengths, Weaknesses, Opportunities, and Threats. For this evaluation, representatives from the clinical, administrative and management teams were interviewed. The results of the SWOT showed the program’s strengths include: a comprehensive multi-disciplinary team, experienced burn clinicians, innovative burn rehab techniques, and strong Physiatry involvement. On the other hand, a large learning curve for new clinicians, limited time and resources, limited inter-professional burn team rounds, and a lack of peer support options were identified as program weaknesses. Externally, the opportunities identified comprise of leading burn rehab research, promoting knowledge translation and continuing to be innovative in burn rehab techniques. The threats include a limitation in each of the following: burn knowledge in the rehab community, available burn rehab research and best practice guidelines, and discharge options in the community for patients. The purpose of this presentation will be to present current and future strategies to capitalize on the strengths and opportunities of our burn program, as well as strategies to address the weaknesses and threats identified.
Pediatric burns: Clinico-epidemiological evaluation via an outpatient database

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Background: Burn injuries account for significant morbidity in the pediatric population. There is no structured data about pediatric burns in Eastern Ontario. There is minimal data looking at the association between patient demographics and burn type in Canada. Objectives: The aim was to establish a pediatric burn database in order to assess our current standard of practice, the burn epidemiology in our catchment area, and possibly create focused burn prevention programs. The epidemiological profile included the association between burn type and patient socioeconomic status (SES), as well as rural/urban location. Methodology: A pediatric burn database was built in REDCap at the Children’s Hospital of Eastern Ontario retrospectively for 2010-2015. Data points included demographic data, clinical information about burn injury, dressings, and clinical outcomes. SES was classified based on average real estate prices in the last 5 years. Results: 695 patients were seen as outpatients. Burns included 54.5% scald, 32.4% contact, 10.2% free flame, and 2.9% other. Mean age was 4.25 years, mean TBSA was 4.4%. Infection rate was 5.7%. Patients from rural areas had significantly more flame and contact burns (p <0.05), those from urban locations had more scald burns (p <0.0001). Patients of low SES sustained significantly more flame burns (p=0.008099), those of moderate-high SES sustained more scald burns (p=0.027233). Conclusion: The paediatric burn injuries in our catchment area are mainly scald burns, with low infection rate. Burn prevention programs should consider the location, as well as SES. Primary burn prevention through education is essential in future burn reduction strategies.
Adrenergic Receptors Mediate Endoplasmic Reticulum Stress in Metabolic Cells

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Severely burned patients suffer from a hypermetabolic syndrome that can last for years after the injury has resolved. The underlying cause of these metabolic alterations most likely involve the persistent elevated catecholamine levels that follow the surge induced by thermal injury. At the cellular level, endoplasmic reticulum (ER) stress in metabolic tissues is a hallmark observed in patients following burn injury and is associated with several detrimental effects. Therefore, ER stress could be the underlying cellular mechanism of persistent hypermetabolism in burned patients. Here, we show that catecholamines induce ER stress and that adreno-receptor blockers reduce stress responses in hepatocytes and adipocytes. Our results also indicate that norepinephrine (NE) significantly induces ER stress in hepatocytes and adipocytes. Furthermore, we demonstrate that the alpha-1 blocker, prazosin, and beta blocker, propranolol, block ER stress induced by NE. Thus, these findings reveal the mechanisms used by catecholamines to alter metabolism during periods of injury and suggest inhibition of the receptors utilized by these agents should be further explored as a potential target for the treatment of ER stress-mediated disease.