

Canadian Special Interest Group

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Presentations

OBJECTIVE ESTIMATION OF SURVIVAL IN BURN PATIENTS REVISITED. *V. Wong, M. Gomez, R. Cartotto.* Ross Tilley Burn Centre, Toronto Ont.

Introduction: One widely disseminated approach to estimating the risk of mortality in burn patients is based on the presence or absence of 3 risk factors: age > 60 years, percentage of total body surface area (%TBSA) burn > 40% and presence of inhalation injury (Ryan CM, Schoenfeld DA, Thorpe WP, et al. Objective estimates of the probability of death from burn injuries. *New Engl J Med* 1998;338:362-6). Mortality is reported to be approximately 0.3%, 3%, 33% or 90% depending on whether 0, 1, 2 or 3 of the above-mentioned risk factors are present, respectively. Anecdotally, we observed that this approach was frequently inaccurate, and the purpose of this study was to objectively evaluate whether this approach correctly predicted mortality among our adult burn patients. **Methods:** Retrospective collection of data from all acute burn patients admitted to our adult regional burn centre between Jan. 1, 1999, and Dec. 31, 2005. Patients with do-not-resuscitate orders who died within 24 hours of admission were excluded. Patients were then stratified as to whether 0, 1, 2 or all 3 risk factors were present. Predicted mortality based on this stratification was then compared with actual mortality, and an area under the receiver operating characteristic (ROC) curve was measured to assess the discriminative capability of this predictive approach. All values are reported as the mean and standard deviation (SD), unless otherwise indicated. **Results:** Data from 1061 patients (273 female, 788 male; mean age 45, standard deviation [SD] 18 y; %TBSA burn 13, SD 15; 9% incidence of smoke inhalation injury) were analyzed. Overall in-hospital mortality was 6%. Age, burn size and incidence of inhalation injury were all significantly greater in the nonsurvivors than the survivors (all *p* values < 0.01). Actual mortality rates for the presence of 0, 1, 2 or 3 risk factors were 1%, 13%, 52% and 100%, respectively. The area under the ROC curve was 0.701 (standard error [SE] 0.041). When endotracheal intubation at admission was substituted as a risk factor instead of inhalation injury, actual mortality rates for the presence of 0, 1, 2 or 3 risk factors were 0.2%, 7%, 38% and 75%, respectively, and the area under the ROC curve increased to 0.880 (SE 0.031). **Conclusions:** The previously described approach to prediction of mortality using the presence or absence of risk

factors (age > 60 y, %TBSA > 40% and inhalation injury) was only moderately predictive based on the relatively low ROC curve area of 0.701. Use of intubation as a risk factor, instead of inhalation injury, improved the predictive capability of this approach.

SATISFACTION WITH USE OF AQUACEL-AG IN SUPERFICIAL PARTIAL THICKNESS BURN INJURIES IN PEDIATRIC OUTPATIENTS: AN EFFECTIVENESS ANALYSIS. *R. Mitchell, D. Baron, D. Nickerson.* University of Calgary, Calgary, Alta.

Background: AQUACEL-Ag is an antimicrobial hydrofibre dressing composed of sodium carboxymethyl-cellulose and impregnated silver that forms a gel when in contact with wound exudate. Efficacy studies in rigorously controlled settings have suggested that AQUACEL-Ag therapy is associated with increased comfort, decreased anxiety and pain during dressing changes, and fewer dressing changes than the current standard therapy of silver sulfadiazine dressing. **Goals:** To evaluate patient and parental satisfaction with AQUACEL-Ag therapy in superficial partial thickness burn injuries in a pediatric outpatient population using an effectiveness study of its use in standard practice. **Methods:** Subjects receiving outpatient AQUACEL-Ag therapy at the Alberta Children's Hospital were retrospectively identified starting from Jan. 1, 2007. The patient or the parents, as appropriate, completed a questionnaire to assess satisfaction with AQUACEL-Ag treatment as related to ease of application, comfort, activities of daily living, joint mobility, background level of anxiety, level of anxiety with dressing changes, cosmetic appearance of injury, pigmentation, redness, level of pain and overall satisfaction. **Results:** The study group consisted of 15 patients with 18 separate burn areas encompassing a mean of 2.1% (standard deviation [SD] 1.3%) of their body surface area. There were 9 males and 5 females of mean age 5.6 (SD 5.0) years. These subjects were treated a mean of 1.8 (SD 0.9) days after the burn injury and were contacted a mean of 118 (SD 34) days after the burn injury. Measures of satisfaction were out of 5 with lower numbers indicating greater satisfaction. Scores are presented as means (and SD): ease of application, 1.2 (SD 0.4); comfort, 1.8 (SD 0.9); activities of daily living, 1.6 (SD 1.0); joint mobility, 1.7 (SD 1.0); background level of anxiety, 1.5 (SD 0.8); level of anxiety with dressing changes, 1.9 (SD 0.8); cosmetic appearance of injury, 2.3 (SD 0.9); pigmentation, 2.4 (SD 1.1); redness, 2.1 (SD 0.8); level of pain in the first 2 days, 5.6 (SD 2.9); level of pain overall, 3.3

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(SD 2.3); level of pain during dressing changes, 3.1 (SD 2.5); and overall satisfaction, 1.3 (SD 0.6). **Conclusion:** This effectiveness assessment of AQUACEL-Ag therapy in superficial partial thickness burn injuries in a real-world pediatric outpatient population indicates a very high level of patient and parental acceptance.

THE EFFECTS OF TOPICAL EPINEPHRINE ON HEMODYNAMICS AND MARKERS OF TISSUE PERFUSION IN BURNED AND NON-BURNED PATIENTS REQUIRING SKIN GRAFTING. *A.A. Papp,* A.V. Unasaro,† E.T. Ruokonen.†* From the *BC Professional Firefighters' Burn Unit, Vancouver General Hospital, Vancouver, BC, and the †Departments of Anaesthesia and Critical Care, Kuopio University Hospital, Kuopio, Finland.

Objective: To compare the systemic effects in burn and non-burn patients undergoing skin grafting with or without the use of topical epinephrine to control bleeding. **Background:** The effects of topical epinephrine on hemodynamics and bleeding are mainly documented with burn patients. No reports are available on the effects of topical epinephrine on non-burn patients especially on markers of tissue perfusion. **Methods:** A prospective study where topical epinephrine was used on burn and non-burn patients; 5 patients served as controls without epinephrine usage. Catecholamine concentrations were measured, and to estimate the systemic effects of epinephrine, serum lactate and pyruvate concentrations were analyzed and perioperative hemodynamic changes recorded. **Results:** Compared with the baseline values, there was a significant increase in the heart rate, serum epinephrine and lactate concentrations and lactate-pyruvate (LP) ratios in the burn patients and an increase in the epinephrine concentrations in the non-burn patients at 1 and 2 hours. Epinephrine and lactate concentrations and LP ratios were also higher in the burn patients compared with the other groups. Altogether, there were no changes in the control group. **Conclusion:** This study showed that the use of topical epinephrine has systemic effects on hemodynamics and serum epinephrine concentrations. Increased epinephrine concentrations in burn patients suggest increased absorption properties in these patients. The increased lactate concentrations and LP ratios suggest tissue ischemia, likely in skin.

ELECTRIC INJURY AND DELAYED SPINAL CORD INJURY: A CASE REPORT. *A. Seal, F. Yau, A. Papp.* BC Professional Firefighters' Burn Unit, Vancouver General Hospital, Vancouver, BC.

A 24-year-old previously healthy man was brought to the Vancouver General Hospital after trying to steal copper electrical rod from a substation. He was using a wrench to loosen a screw on the rod when he sustained electric injury. He had a history of smoking, alcohol and crystal methamphetamine use. On examination he was moving all 4 limbs, had normal sensory and motor exam. He had burns to both hands, upper chest, right knee, right upper anterior calf and left thigh. His creatine kinase level went from 3793 to 17430 to 248; troponin went from 0.31 to 3.25 to 0.1. On post-burn day 2, he was unable to move both legs but had normal sensation. Rectal tone was present but weak. Spinal MRI was normal with no hemorrhage or spinal cord compression. Somatosensory evoked potential was also normal. Surgical treatment was initiated after other examinations were done. Eventually he needed repeated operations

including a pedicled gastrocnemius-flap to cover his exposed knee joint. He is gradually regaining mobility in his lower extremities and is in a rehabilitation centre. This presentation focuses on the case report and on knowledge about late spinal cord injury in electrical burns.

Posters

PRIMARY HUMAN KERATINOCYTES EXTERNALIZE SEVEN 14-3-3 ISOFORMS VIA EXOSOMES. *M. Chavez-Munoz, J. Morse, R. Kilani, A. Ghahary.* Burn and Wound Healing Research Laboratory, Jack Bell Research Centre, Department of Surgery, University of British Columbia, Vancouver, BC.

Different isoforms of 14-3-3 protein have been involved in a wide range of vital regulatory processes. Our group for the first time showed that 14-3-3 proteins are released to the extracellular environment and are found to be a potent matrix metalloproteinase (MMP) stimulators in fibroblasts. The mechanism by which 14-3-3 proteins are externalized is unknown. Here we hypothesized that the pathway of releasing these proteins is due to exosome-dependent secretion. To test this hypothesis, primary human keratinocytes and primary human fibroblasts were isolated from human foreskin. Exosomes were purified from keratinocyte condition medium. Exosomal preparations and keratinocyte lysates were analyzed by several techniques, including Western blot, transmission electron microscopy (TEM) and immunogold labelling. In order to prove the mechanism, fibroblasts were treated with conditioned medium from keratinocytes before and after exosome purification. Western blot analyses of the exosome preparation indicated that this fraction contains all 7 mammalian 14-3-3 isoforms. Furthermore, TEM revealed small vesicles under 100 nm in diameter with the distinctive saucer-like shape that is a salient feature of exosomes. MMP-1 expression confirmed the release mechanism of 14-3-3 protein to the extracellular environment and also explains its expression when fibroblasts are cocultured with keratinocytes. This study unravels the possible mechanism by which 14-3-3 proteins are released to the extracellular space.

POLYMEM DRESSING FOR SKIN GRAFT DONOR SITES IN CHILDREN AND ADULTS. *J. Tamir, J. Haik.* Division of Plastic and Reconstructive Surgery Department, Burn Unit and Wound Care Center, Haim Sheba Medical Center, Israel.

Background: Skin grafting is one of the most common surgical procedures to cover acute and chronic wounds. The traditional donor site dressing is gauze soaked with paraffin. Recent studies showed the advantages of moisture holding dressings over the traditional dressing. PolyMem (Ferris Mfg. Corp.) is a semipermeable polyurethane foam dressing with the addition of surfactant (F 68), glycerin and starch. It creates an optimal moisture balance and does not adhere to the wound surface. **Objective:** We present our experience in treating skin graft donor sites in children and adults with PolyMem wound dressing. **Methods:** PolyMem dressing was determined as the dressing of choice for all the skin graft cases done in our department. We compared the ease of application, pain reduction and donor site epithelization between PolyMem and paraffin-soaked gauze. PolyMem dressing was changed every 2-3 days, and the gauze dressing

was left adhered to the wound until epithelization was complete. **Results:** Our 4 years experience in treating skin graft donor sites in children and adults with PolyMem wound dressing was presented. Between 2004 and 2008, we completed skin grafts on 800 patients using PolyMem to dress the donor site wounds. Six-hundred and fifty-six (82%) patients were adults and 144 (18%) were children. The primary wounds were burns, penetrating trauma and chronic wounds. Compared with the traditional paraffin-soaked gauze we have used in the past, we observed a dramatic reduction in donor site pain, much less traumatic dressing exchange in burned children, decreased donor site infection rate and a faster donor site epithelization rate. **Conclusions:** Our clinical experience after 800 cases using the PolyMem foam proved that the dressing has many advantages over paraffin-soaked gauze in skin graft donor site wounds. Further prospective and comparative study is needed.

Educational symposium

ANTIMICROBIAL RESISTANCE IN BURN UNITS. A.E. Simor. Department of Microbiology and Infectious Diseases, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont., and Chair, Canadian Nosocomial Infection Surveillance Program.

Burn injured patients admitted to intensive care units are at high risk of developing infections. Consequently there is a high intensity of antibiotic use in burn units, and this has been associated with the emergence and transmission of antimicrobial-resistant organisms. The major antibiotic-resistant pathogens identified in burn units include: methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* species (VRE), *E coli* and *Klebsiella* species producing extended-spectrum β -lactamases (ESBLs), and multiresistant *Pseudomonas aeruginosa* and *Acinetobacter* species. Treatment options for the management of infections caused by these organisms are often limited, and they may be responsible for outbreaks in burn units. This presentation will review the epidemiology and impact of antimicrobial-resistant organisms in burn units. Risk factors associated with acquisition of antibiotic-resistant pathogens will be highlighted, and strategies that have been effective in limiting the emergence and spread of antibiotic resistance in burn units will be considered.

PREVENTION OF NOSOCOMIAL PSEUDOMONAS INFECTIONS IN BURN UNITS: IMPACT ON OUTCOME. E.E Tredget. Director, Firefighters' Burn Treatment Unit, Edmonton, Alta.

Background: *Pseudomonas aeruginosa* remains a serious cause of nosocomial infection and septic mortality in burn patients. This study was conducted in order to quantify the impact of nosocomially-transmitted resistant *P aeruginosa* in a burn population. **Methods:** Using a TRACS burn database, 48 patients with *P aeruginosa* resistant to gentamicin were identified (*Pseudomonas* group). Thirty-nine were case-matched to controls without resistant *P aeruginosa* cultures (control group) for age, total body surface area (TBSA), admission year and presence of inhalation injury. Mortality and various morbidity end points were examined, as well as antibiotic costs. **Results:** There was a significantly higher mortality rate in the *Pseudomonas* group

(33% v. 8%, $p < 0.001$), compared with the control group. Length of stay was increased in the *Pseudomonas* group (73.4, standard deviation [SD] 11.6 v. 58.3, SD 8.3 d). Ventilatory days (23.9, SD 5.4 v. 10.8, SD 2.4 d, $p < 0.05$), number of surgical procedures (5.2, SD 0.6 v. 3.4, SD 0.4, $p < 0.05$) and amount of blood products used (packed cells 51.1, SD 8.0 v. 21.1, SD 3.4, $p < 0.01$; platelets 11.9, SD 3.0 v. 1.4, SD 0.7, $p < 0.01$) were all significantly higher in the *Pseudomonas* group. Cost of antibiotics was also significantly higher (\$2658.52, SD \$647.93 v. \$829.22, SD \$152.82, $p < 0.01$). **Conclusions:** Nosocomial colonization and/or infection of burn patients with aminoglycoside-resistant *P aeruginosa* is associated with significantly higher morbidity, mortality and cost of care. Increased resource consumption did not prevent significantly higher mortality rates when compared with control patients. Thus prevention, identification and eradication of nosocomial *Pseudomonas* contamination are critical for cost-effective, successful burn care.

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TOPICAL ANTIMICROBIAL AGENTS. R. Cartotto. Ross Tilley Burn Centre, Sunnybrook Health Sciences Centre, Toronto, Ont.

This is a review of the currently used topical antimicrobial agents for burn wounds, including indications for use, and the selective advantages and disadvantages of individual agents. Topical antimicrobial agents continue to have an important role in the management of the acute burn wound, although early surgical excision has eliminated the need for prolonged application to a burn wound. The emergence of antibiotic-resistant bacteria has stimulated a renewed interest in use of ionic silver compounds as a means to control these organisms. Also, the role for some of the topical agents has been expanded to include use on freshly applied skin grafts and skin substitutes. 0.5% silver nitrate solution, one of the earliest topical antimicrobial agents, is effective against most *Staphylococcus* and *Pseudomonas* species, gram-negative aerobes and *Candida albicans*. However, it is somewhat messy and cumbersome to use, and stains all surfaces brown or black. It penetrates burn eschar poorly, and its use can be associated with electrolyte disturbances (hyponatremia) and methemoglobinemia. Silver sulphadiazine (SSD) is another silver-based compound that has a similar spectrum of activity to silver nitrate, but it is easier to apply and use. It is a 1% water-based cream that is soothing to apply but, like silver nitrate, does not penetrate eschar well. Repeated application leaves a coagulum or "pseudo-eschar" on the wound surface that must be distinguished from a true eschar. Transient leukopenia, previously thought to be an adverse effect of SSD application, likely is related to only coincidental systemic inflammatory response syndrome (SIRS) and causes no ill-effects. Cutaneous hypersensitivity reactions are reported but quite rare. Mafenide acetate, also known as sulphamylon, is available as an 11% cream or a 5% aqueous solution. Although it is effective against most gram-negative aerobes, it does not reliably cover methicillin-resistant *Staphylococcus aureus* (MRSA) and fungus. Mafenide's main advantage is its deep penetration ability, which makes the 11% cream ideal for application to invasive burn wound infections and to deep ear burns to prevent suppurative chondritis (a necrotizing infection) of the ear cartilage framework. However,

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sulphamylon is painful to apply, is associated with metabolic acidemia and compensatory increases in minute ventilation and with cutaneous hypersensitivity reactions in approximately 5% of cases. The aqueous solution is useful for postoperative irrigation of fresh skin grafts and skin substitutes. The Acticoat dressing releases ionic silver onto a moist wound surface continuously for 48–72 hours. The ionic silver has a broad spectrum of coverage, including MRSA, vancomycin-resistant *Enterococcus* species (VRE) and fungus. Because it has sustained effects, fewer dressing changes are required, reducing costs and nursing workload. It is particularly useful on fresh grafts and skin substitutes such as Integra.

BURN UNIT INFECTION CONTROL PRACTICES: NURSING IMPLICATIONS. *J. Knighton*. Clinical Nurse Specialist—Burns, Ross Tilley Burn Centre, Sunnybrook Health Sciences Centre, Toronto, Ont.

Infection in the burn patient continues to be a leading cause of morbidity and mortality. The importance of infection control in burn care is widely recognized and provides the team with many unique challenges. The onus for excellent practice lies with all members of the team and, in particular, burn nurses. This brief presentation will provide a review of common infection prevention and control strategies, from a burn nursing perspective, including body substance precautions, use of personal protective equipment, the patient/burn unit environment, guidelines for culturing and surveillance, care of patients with resistant organisms and ongoing monitoring of current practice. At present, there is variation in infection control practices between burn units and no evidence-based standards of care. However, this review will present those principles which guide practice in many burn units across North America and identify areas where there are differing opinions.