

Canadian Special Interest Group 2007

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Podium Presentations

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HIGH FREQUENCY OSCILLATORY VENTILATION (HFOV) FOR ARDS-RELATED OXYGENATION FAILURE IN ADULT BURN PATIENTS. *G. Walia, S. Ellis, R. Cartotto.* Ross Tilley Burn Centre, Toronto, Ont.

Introduction: High frequency oscillatory ventilation (HFOV) is a lung protective ventilation strategy which we routinely initiate for burn patients with severe oxygenation failure secondary to acute respiratory distress syndrome (ARDS). The purpose of this study was to review our cumulative experience with HFOV, with a specific emphasis on HFOV's effect on oxygenation failure. **Methods:** A retrospective analysis of all patients treated ≥ 4 hours with HFOV at an adult regional burn centre between Dec. 1, 1999 and May 30, 2006 was conducted. When HFOV was employed more than once in a patient, only the initial treatment was analyzed. The P_{aO_2} (partial pressure of oxygen, arterial)/ F_{iO_2} (fraction of inspired oxygen) ratio and OI (Oxygenation Index), where $OI = F_{iO_2} \times 100 \times \text{mean airway pressure}/P_{aO_2}$, were measured on conventional mechanical ventilation (CMV) just before HFOV initiation and after 1, 8, 16, 24, 48, 72 and 96 hours of HFOV. All values are reported as the mean (and standard deviation [SD]). One way ANOVA for multiple comparisons was used to compare oxygenation variables on CMV with those on HFOV. **Results:** Forty-nine patients (aged 43 [SD 17] years with 42% [SD 18%] total body surface area (TBSA) burns, 32% [SD 22%] TBSA full thickness burns, and admission APACHE II score 20 [SD 8]) were treated with HFOV. Inhalation injury was present in 19/49 (39%). Consensus criteria for the diagnosis of ARDS were met in 45/49 patients (92%). HFOV was started at 5.2 (SD 4.7) days post burn. Ventilation parameters on CMV, immediately before starting HFOV were F_{iO_2} 0.83 (SD 0.16), positive end-expiratory pressure (PEEP) 14 (SD 2) cm H_2O , and peak inspiratory pressure 35 (SD 5) cm H_2O . HFOV was initiated using a mean airway pressure (PAW) of 33 (SD 4) cm H_2O and a frequency (f) of 5 (SD 1) Hz. There was a significant improvement in the P_{aO_2}/F_{iO_2} ratio within 8 hours, and a significant reduction in the OI within 48 hours of starting HFOV (Table). HFOV was terminated at < 6 hours because of hypercapnic acidosis in 1 case. Reversion back to CMV occurred after 5.7 (SD 4.5) days of

HFOV. The mortality rate was 39%. **Conclusions:** HFOV was an effective ventilation strategy for burn patients with refractory ARDS-related oxygenation failure on CMV, producing significant improvement in oxygenation within 8 hours of initiation at significantly less mean airway pressure cost, as assessed by the OI.

Time	CMV; mean (and SD)*	Hour; mean (and SD)*						
		1	8	16	24	48	72	96
P_{aO_2}/F_{iO_2}	91 (29)	115 (73)	145 (81)†	157 (78)‡	164 (73)‡	188 (56)‡	202 (62)‡	221 (92)‡
OI	27 (9)	36 (16)	30 (17)	26 (13)	24 (12)	19 (7)§	17 (5)§	18 (8)§
No. of patients	49	49	46	45	44	40	33	28

CMV = conventional mechanical ventilation; SD = standard deviation; P_{aO_2} = partial pressure of oxygen, arterial; F_{iO_2} = fraction of inspired oxygen; OI = oxygenation index.
*Unless otherwise indicated.
†p < 0.005.
‡p < 0.001.
§p ≤ 0.05 v. CMV.

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A PRACTICE PROFILE SURVEY OF CANADIAN BURN THERAPISTS. *B. Nedelec, G. Rachelska, L. Kloda, N. Korner-Bitensky.* From the Faculty of Medicine, McGill University, and the Montréal Burn Centre, Montréal, Que.

Introduction: Rehabilitation after a burn injury is recognized as extremely challenging, yet little is known about the occupational therapy and physical therapy services that are provided to this patient population. The objectives of the study were to survey the occupational therapists (OTs) and physical therapists (PTs) treating individuals with burn injuries in Canada to determine their demographics, investigate the current services provided to this patient population and determine the learning resources that are available to the clinicians. **Methods:** The snowball sampling technique was employed to acquire an exhaustive list of Canadian OTs and PTs who dedicate a substantial portion of their clinical time to individuals with burn injuries. A self-report questionnaire containing both closed- and open-ended questions was mailed out to 131 potential participants in both English and French and a self-addressed, stamped return envelope. A follow-up email was sent 6 weeks later. **Results:** A total of

101 surveys were returned, 8 indicated wrong address, 31 clinicians were no longer working with individuals with burn injuries and 62 (38 OT; 24 PT) were completed. The majority were female (93%), working full-time (71%), and had a bachelor's degree (92%). Six percent had < 1 year experience working with burn survivors, 21% had 1–3 years, 34% had 3–10 years, and 39% had > 10 years. Questions regarding the work environment revealed that they worked in a teaching hospital (95%), in an urban setting (100%) that had an active burn research program (64%) but less commonly included rehabilitation research (52%). The therapists actively engaged in clinical teaching (100%) and worked with a multidisciplinary team (74%). Assessments typically used focused on impairment evaluation (goniometry 87%; dynamometer 50%; manual muscle testing 45%; Vancouver Scar Scale 40%; pinch metre 37%; pain-VAS 32%). The most commonly reported interventions were scar management (82%), range of motion (58%), splinting (56%), functional activities (55%) and strengthening (55%). Support was provided for continuing education (95%) in the form of financial support (84%), but less commonly time (47%). New information on burn injuries was easily accessible (84%) with 66% spending > 3 hours per month on continuing education activities. Additional practice profile information will be presented. **Conclusions:** Information about current practice is particularly useful to allow therapists to make comparisons to other practice milieus, to assist in defining practice issues and concentrate efforts so that limited research resources can be focused where it is deemed most important.

3

DEVELOPING A SAFE NON-REJECTABLE SKIN SUBSTITUTE: DIFFERENTIAL EFFECT OF INDOLEAMINE 2,3-DIOXYGENASE (IDO) EXPRESSION ON VIABILITY OF HUMAN T CELLS VERSUS SKIN CELLS. *F. Forouzandeh, R.B. Jalili, M. Germain, V. Duronio, A. Ghabary.* BC Professional Firefighters' Burn and Wound Healing Research Laboratory, Vancouver, BC.

Introduction: Although applying a skin substitute composed of keratinocytes is one of the most effective ways to help patients suffering from skin loss, preparing sheets of autologous keratinocytes has many limitations. Therefore, using an allogeneic and readily available skin substitute would be a logical alternative. IDO catalyzes tryptophan to kynurenine. Tryptophan is an essential amino acid and the least available one in the human body, and is required by all forms of life for protein synthesis and other important metabolic functions. Indeed, we plan to make use of IDO immunosuppressive properties to improve the acceptance rate of allogeneic grafted skin by making a non-rejectable allograft cultured skin substitute (NACSS). At this point, a major issue would be the effect of IDO expression on the skin cells, mainly keratinocytes and fibroblasts. As the survival of fibroblasts and keratinocytes is crucial for the efficacy of NACSS, we need to make sure that IDO expression will not disturb the survival of these cells. **Methods:** We have evaluated the cell survival rate of the human skin cells and human T cells by looking at the activation of apoptosis based on 7-amino-actinomycin D staining (7-AAD) of our suggestive IDO sensitive (CD4⁺ and CD8⁺ T cells) and resistant

(fibroblasts and keratinocytes) cells with flow cytometry, after being treated in a co-culture system with IDO expressing fibroblasts. Moreover, each of these cell types was treated by increasing concentrations of the main metabolites of tryptophan produced by IDO, kynurenin, and separately in tryptophan deficient media. In addition, cell proliferation arrest and anergy of the immune cells of each experiment has also been evaluated by [³H]-thymidine incorporation assay. In order to find out the mechanisms by which these cells behave differently in an IDO-induced tryptophan deficient environment we looked at stress-related pathways in these cells by looking at GCN2 kinase and caspase-3 activation in these cells. **Results:** After 4 days of co-culturing IDO expressing fibroblasts with our different bystander cells, we could see a significant decrease in cell survival of CD4⁺ T cells and CD8⁺ T cells compared with bystander fibroblasts and keratinocytes which mostly survive ($p < 0.01$). Moreover, we found that stimulated human T cells are more sensitive to our treatment. In addition, we figured out a considerable cell proliferation arrest in T cells co-cultured with IDO expressing fibroblasts versus non-treated groups ($p < 0.01$). We found convincing evidence that correlates different behaviours of these cells to differences in GCN2 kinase activation in them. **Conclusions:** This study supports the idea that preparation of a non-rejectable skin substitute is feasible and safe to use as wound coverage without compromising skin cell survival. The finding of this study would improve the rates of graft take through the development and application of a non-rejectable skin substitute in our future studies.

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MANAGEMENT OF NOISE FROM HIGH FREQUENCY OSCILLATORY VENTILATION IN AN ADULT BURN CENTRE. *K.E. Smith, S. Ellis.* Sunnybrook Health Sciences Centre, Toronto, Ont.

Introduction: While the use of High Frequency Oscillatory Ventilation (HFOV) in burn patients and neonatal patients has been the focus of recent studies, little or no attention has been paid to the noise of the HFOV and its effects on patients in burn intensive care units (ICUs) and non-burn ICUs. The purpose of this study was to examine the relationship between noise from the HFOV and the known effects of noise exposure on adult burn and non-burn ICU patients. **Methods:** We reviewed our current practice of using foam ear plugs 24 hours per day in all our patients who require HFOV between June 2005 and December 2005. Noise levels were measured in single-patient rooms while HFOV therapy was in use. The noise levels were measured using a standard sound level meter, at the level of the patient's ear. **Results:** The noise levels among 4 patients in our burn ICU with HFOV during the study period were 73 dB at the level of the patient's ear (equivalent to a common household blender), and 82 dB when the HFOV alarmed (equivalent to the sound of a power saw). The ear plugs that our centre currently use reduce noise by 29 dB, thereby ameliorating the sound of the HFOV alarm to 53 dB and the sound of the HFOV in normal mode to 44 dB. **Conclusions:** There is significant benefit to the use of ear plugs during HFOV therapy and further research should be conducted to explore other practices to enhance the sleep and comfort of ventilated ICU burn and non-burn patients.

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SEVERITY OF TERROR-RELATED BURN INJURIES IN THE ISRAELI–PALESTINIAN CONFLICT. *J. Haik,* A. Livan,* A. Givon,† A. Tessone,* E. Winkler,* D. Mendes,* O. Goldan,* E. Regev,* G.N. Gil,* A. Orenstein,* K. Peleg,† J. Jeroukhimov,‡ B. Kessel,‡ Y. Klein,‡ M. Michaelson,‡ Y. Mintz,‡ A. Rivkind,‡ D. Soffer,‡ D. Simon,‡ G. Shaked,‡ M. Stein, I. Waksman.* From the *Burn Unit & Department of Plastic Surgery, and the †National Center for Trauma & Emergency Medicine Research, Gertner Institute for Epidemiology and Health Policy Research, Sheba Medical Center, and the ‡Israeli Trauma Group, Israel.

Background: Due to the explosive and suicide bombing attacks that marked a new era in the Israeli–Palestinian conflict since October 2000, we have found a rise in the incidence of thermal injuries among victims. We have shown in a previous paper that the incidence of burns has risen in terror victims in similar proportions to the number of patients of overall trauma (Haik J, Tessone A, Givon A, et al. Terror-inflicted thermal injury: A retrospective analysis of burns in the Israeli-Palestinian conflict between the years 1997 and 2003. *J Trauma* 2006;61:1501-5). This paper presents data of terror-related injuries and burns from the Israeli National Trauma Registry (ITR) during the years 1997–2003, comparing the severity of terror victims with and without burn injuries. **Methods:** We analyzed the demographic and clinical characteristics of 219 terror-related burn patients compared with 2228 terror victims with no associated burns and 6545 non-terror-related burn patients admitted to hospitals in Israel between 1997 and 2003. Data were obtained from the ITR. **Results:** The majority of terror-related injury patients had multiple injuries other than burns (87.2%), while only 10.4% of non-terror burn injury patients had other associated injuries. For ICU admittance, 49.8% of terror-related burn injury patients were admitted, while only 11.9% of non-terror-related burn injury patients and 23.8% of terror patients without burn injuries were admitted. The mean length of stay at the hospital was 18.5 days for terror-related burn injury patients, 11.1 days for non-terror-related burn injury patients and 9.5 days for terror-related injury patients without associated diagnosis of burns. In all the Injury Severity Score (ISS) values above 9, the percentage of terror victims with associated diagnosis of burns was significantly higher compared with the percentage of terror victims without associated diagnosis of burns and burns not related to terror. The mean hospital mortality for burn injuries is 3.4%. Burns related to terror have a mortality rate of 6.4%. An almost similar mortality of 6.6% has been seen in terror victims without associated burn diagnosis. **Conclusions:** Burn victims have more severe injuries when associated with terror. Terror victims with associated burn injuries suffer from more severe injuries when compared with terror victims without burns and to victims of burns not related to terror. Although the injuries of terror-related burn victims are more severe, as shown in all parameters that were measured, the overall in-hospital mortality was the same as for terror victims with no burns. Burns are not a major factor influencing in-hospital mortality in terror victims.

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NITRIC OXIDE GAS (gNO): A POTENTIAL NEW ANTIMICROBIAL THERAPY FOR MULTI-DRUG RESISTANT WOUNDS. *C.R. Miller, B. McMullin, S. Dimond, S.R. Meredith, R. Morley, J.C. Boyle, N.J. Carr.* BC Professional Firefighters' Burn & Plastic Surgery Unit, Vancouver General Hospital, Vancouver, BC.

Introduction: As the colonization and infection of wounds with multi-drug resistant bacteria becomes increasingly common, health care providers look for alternate therapeutic modalities to decrease bacterial load and promote wound healing. Exogenous topical nitric oxide gas (gNO) presents a novel approach to bacterial control with encouraging in vitro and in vivo results. Aim: To administer exogenous topical gNO to wounds colonized or infected with multi-drug resistant bacteria and to study the effect on bacterial burden, wound appearance and healing, and split thickness skin graft take. **Methods:** Topical gNO (200 ppm) at 1.0 L/min was applied for 9 hours once daily to wounds colonized or infected with multi-drug resistant bacteria using an occlusive delivery system. Wounds were serially swabbed for culture and sensitivity and observed for healing on a daily basis. **Results:** We present our experience with gNO demonstrating reduction of bacterial load, improved split thickness graft take, and ultimate closure of wounds colonized with multi-drug resistant bacteria. **Conclusions:** Topical gNO represents a novel approach to antimicrobial therapy of wounds contaminated with multi-drug resistant bacteria, and potentially offers an alternative treatment modality for these challenging wounds.

Poster Presentations

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PREDICTORS OF CHILD DISTRESS DURING THE TREATMENT OF YOUNG SCALD BURN CHILDREN: A PILOT STUDY. *A. Young,* P. Hubley,† M. Hanson,† H.M. Clarke.†* From *Simon Fraser University, Vancouver, BC, and the †Hospital for Sick Children, Toronto, Ont.

Objectives: The objectives of this study were to evaluate the associations between parents' emotional reactions to their child's scald injury, the child's pre-existing temperament characteristics, and the level of distress expressed by the child during burn treatments. **Methods:** A prospective study of children between the ages of 1 and 5 years, who were hospitalized for scald injuries over 5% total body surface area (TBSA) and their parents. Demographic data was collected from the health record, children and parents were videotaped during 3 treatment sessions (mean length of treatment 43 min), and parents completed a series of questionnaires including the Toddler Temperament Scale (Fullard, McDevitt and Carey, 1984), the Behavioral Styles Questionnaire (McDevitt and Carey, 1978) and the Parental Emotional Response Questionnaire-burn version (PERQ-bv) adapted from Cohen and Mannariono (1996). Videotapes were scored using Jay and Elliot's (1984) Observational Scale of Behavioral Distress and the Child–Adult Medical Procedure Interaction Scale-short form (CAMPIS) by Blount, Sturges and Powers (1990). **Results:** Data from

18 participants will be reported. Parents expressed significant distress about their child's injury on several PERQ-bv items. The very youngest children experienced the most distress. Overall, observed child distress (OBDS) was significantly associated with the temperament subscales of adaptability and daily cycles. Parent distress was significantly associated with the activity and persistence subscales. On the CAMPIS measures, nurses demonstrated more coping promoting strategies with children, while parents demonstrated the use of more distress promoting behaviours when they participated in burn treatments. This poster presentation will report the quantitative analysis, study limitations and implications for clinical practice.

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THE RECIPE CARD: INGREDIENTS FOR THE OPTIMAL PAEDIATRIC BURN TREATMENT. *S. Oppedisano, S. Alexander.* Hospital for Sick Children, Toronto, Ont.

Hospitalization after a major burn injury presents a time of acute stress and anxiety for children. The daily débridement and dressing change is often a very painful procedure, however, a necessary component to burn care. Children can experience

overwhelming distress and lack of control around this procedure. In order to minimize distress around dressings, a "recipe card" was created by our pediatric burn unit. This poster presents this innovative nursing tool which outlines for the patient, nursing team and family those strategies, processes and/or comfort items that support an optimal dressing change for each child. It is a card that lists coping "ingredients" that a child/family chooses for his/her own treatment and is updated daily to ensure it reflects the patient's changing needs. Ingredients can include items such as environmental preferences (i.e., music), people who support the patient (i.e., mom, uncle), comfort objects (i.e., blanket) and suggestions regarding the process (i.e., "Tell me what you are going to do before you do it"). In this way, the recipe card becomes the child's voice, speaking out about how the burn team can best help him/her cope with dressings and gives a child some control in a situation that inherently lacks control. Since its inception, the recipe card has promoted consistency and communication, empowered patients and families, and fostered our ability to provide family-centred care. It is a simple tool that can be adapted by any nursing team to help support a child that will undergo repeated traumatic and/or painful procedures.

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