2024 SOMSA ABSTRACTS

Special Operations Medical Association Training, Education & Scientific Assembly 2024

Recognized Research Track Abstracts

BEST OVERALL PRESENTATION

Effect of Fresh Whole Blood Donation on Human Performance in United States Special Forces

Alex P. Houser, DO, FAAFP[1], Mario A. Soto, MD, FACEP[1], Kathryn S. Bell, MS[2], Paul G. Goldberg, MS, RD[1], Kevin J. Cronin, MS, CSCS*D, RSCC*D[1], Rick C. Caldwell, 18D, SO-ATP[1], Brian K. Schilling, PhD[2]

[1] US Army Special Operations Command (USASOC)

[2] Kinesiology & Nutrition Sciences, University of Nevada Las Vegas, Las Vegas, NV

Introduction: Fresh whole blood has been the standard of care for the treatment of hypovolemia secondary to blood loss in the Tactical Combat Casualty Care guidelines since 2014. Current recommendations from the Prolonged Field Care Working Group state the impact to mission performance is not degraded with a 1-unit (450mL) donation. Many questions remain concerning the effects on small unit forces that donate at or near the point of injury while on mission. Because there is limited information on combat performance after donation, the purpose of this investigation was to examine the effects of blood donation on simulated battlefield tasks in U.S. Special Forces Soldiers.

Materials and Methods: A total of 17 U.S. Special Forces Soldiers participated in this study. Soldiers served as their own controls and were subject to blinded blood draw and a sham draw, which were ordered randomly and separated by 6 days. Outcome measures consisted of performance, capillary blood lactate, salivary osmolality, heart rate, and estimated core temperature. These measures were taken at baseline, then immediately following a 1,200m shuttle run, 3-event stress shoot, and 5-mile run, all while wearing a typical combat load.

Results: There was a moderate-to-large, statistically significant ($P<.05$) increase in shuttle run time due to blood donation ($\Delta=12.5$s, Hedges' $g=.0$). We also detected moderate, statistically significant increases in shooting scores ($\Delta=29.2$s, Hedges' $g=.5$) and 8km run times ($\Delta=3.9$m, Hedges' $g=.7$) due to blood donation. There was no interaction between event and blood draw condition for heart rate, estimated core temperature, blood lactate, or salivary osmolality. Blinding was only 26% effective, as Soldiers were able to correctly identify the procedure they were subjected to 74% of the time.

Conclusions: The moderate-to-large performance decrements found in this study are somewhat greater than those of previous studies. We believe that our results may be different due to the more demanding tasks that were performed after the blood draw in our investigation. It is also important to note that the performance effects were not related to heart rate, hydration, estimated core temperature, or lactate concentration. Future work in this area should concentrate on demanding, battlefield-specific tasks.

HONORABLE MENTIONS

Evaluation of the Performance of Medical Interventions in Simulated Arctic Conditions

Vik Bebarta, MD[1], Anne Ritter, DrPH[1], Elan Small, MD[1], James Eazor, MPH[1], Todd Getz, PhD[1], Arian Anderson, MD[1], Martin Musi, MD[1], Todd Miner, Ed.D[1], Sean Keenan, MD[1], Elaine Reno, MD[1], Gordon Giesbrecht, PhD[2], Charisse Comart, BS,[1] Tessa Vallin, BS,[1] Jay Lemery, MD[1]

[1] Department of Emergency Medicine, University of Colorado School of Medicine, Aurora, CO, USA

[2] University of Manitoba, Winnipeg, MB, Canada

Introduction/Background: Increased activities in the Arctic have garnered significant geopolitical interest, necessitating a robust Department of Defense Arctic Strategy. Conducting arctic military operations incurs exposure to harsh environmental conditions, including extreme cold temperatures. While limited data have demonstrated cold-induced deterioration in cognitive and physical performance, the full impact of cold on medical personnel performance is not well understood. The goal of this study was to elucidate the impact of an extreme cold environment on cognitive abilities and physical performance of life-saving interventions (LSIs) by medical personnel.

Methods: This study was a prospective, repeated measures trial of military servicemembers and medical providers in an extreme cold environment. The time to task completion and success rate for various LSIs as well as cognitive response and perceived stress were examined in warm (20°C) and cold (–24°C) conditions. Trial protocol involved pre-exposure cognition/physical testing, ambulation, medical task completion, and post-exposure cognition/physical testing. LSIs included (but were not limited to): extraglottic airway placement, needle decompression, hypothermia wrap application, peripheral intravenous (IV) access, blood transfusion, and cricothyrotomy.

Results: This study enrolled 27 participants, with a mean of age of 34 year; 22 participants (81%) were male. Eleven (41%) were paramedics. The total time to task completion was significantly longer in the cold trial (increase of 5.2min, $P<.01$), including for cricothyrotomy ($P=.045$), hypothermia wrap application ($P=.013$), peripheral IV insertion ($P=.01$), tourniquet application ($P<.01$), junctional wound packing ($P<.01$), chest seal application ($P<.001$), and tranexamic acid administration ($P<.005$). In pre/post-testing between the warm and cold trial, there was a significant decrease for grip strength ($P<.04$), but not for other physical or cognitive measures.

Discussion and Conclusion: Understanding the impact of extreme cold environments on the performance of life-saving techniques is critical to the success of potential arctic operations. Preliminary data from this study demonstrate the significant impact the cold environment has on the performance of LSIs. Future analysis will include linear regression and further analysis into the failure of medical equipment in extreme cold. This trial has demonstrated the feasibility and utility of future work at the National Science Foundation laboratory focused on human performance in extreme cold.

Assessing Performance of Chemical Exposure Management in the Arctic Environment using the Cryosphere Austere Medicine Platform (CAMP)

Anderson AL[1], Bebarta VS[1], Giesbrecht G[2], Keenan S[1], Ritter, AC[1], Getz T[1], Eisenhauer IF[1], Eazor J[1], Comart C[1], Vallin T[1], Lemery J[1]

[1] Department of Emergency Medicine, University of Colorado School of Medicine, Aurora, CO, USA

[2] University of Manitoba, Winnipeg, MB, Canada

Introduction: The Department of Defense has identified readiness for future warfare in the circumpolar north as strategic initiative. Operations in extreme cold temperatures require specific modifications to accommodate and optimize human performance and to ensure medical device functionality in the event of chemical, biologic, radiologic, and nuclear (CBRN) threats. Rendering medical care requires cognitive and manual dexterity, yet a paucity of literature exists on human performance, material performance, and the effectiveness of current military clinical practice guidelines. In this study we assess performance of Tactical Combat Casualty Care (TCCC) CBRN initial management guidelines in an extreme cold (–24° C) environment to identify human and material performance limitations of current approaches to CBRN care under these conditions.

Methods: Thirty emergency medical services (EMS) medics performed TCCC CBRN clinical practice guideline (CPG ID:69) tasks in the National Ice Core Facility in room temperature (20°C) and extreme cold (–24°C) environments. Thirty-minute acclimatization preceded simulated performance of 11 life-saving interventions (LSIs) while maintaining chemical exposure precautions. LSIs were timed and observed for efficacy and equipment malfunction. Neuropsychological and cognitive testing was performed before and after each period of simulation.

Results: Preliminary results from 6 participants who completed both simulation periods demonstrated longer time to completion of CBRN tasks at extreme cold versus room temperature (35.8 vs. 26.9min, $P<.05$, 95% CI for difference 5.3–12.5min). Individual tasks most affected by the cold environment included donning of mission oriented protective posture (MOPP) gear, cricothyroidotomy, peripheral intravenous access, and CYANOKIT deployment.

Discussion: Preliminarily, this study demonstrated delayed time to deployment of current CBRN CPGs in an arctic environment and identified lessons learned from MOPP gear usage in the extreme cold. We identified equipment malfunction and medic performance limitations of arctic temperatures. We promise future data on the remaining participants and on human and neurocognitive performance, which should inform CPG revision and future research to improve approaches to prehospital field care.

Conclusion: Preliminary data from this arctic immersion CBRN simulation suggests that current CBRN protocols require increased time to completion and that material dysfunction is common in arctic temperatures. Final data from these trials should inform the revision of current CPGs.

Detection of Progressive Venom-Induced Consumption Coagulopathy (VICC) by Thromboelastography (TEG) in a Severe Rabbit Model of Crotalid Envenomation

Phylicia Irons, LT, MC USN[1,2], Chris Treager, LCDR, MC USN[1,2,3], David Spivey, LT, MC USN[1,2], Fernando Gonzalez, LT, MC USN[1,2], Sean Stuart, CDR, MC USN[2,4], Tyler Lopachin, LT, MC USN[2,5], Lorie Gower[2,6], Diana Sheldon[2,6], Dr. Emily Friedrich[2], Brittany Lassiter[2,6]

[1] Department of Emergency Medicine, NMRTC-Portsmouth, Portsmouth, VA

[2] Combat Trauma Research Group, NMRTC-Portsmouth, Portsmouth, VA

[3] Bravo Surgical Company, 2d Medical Battalion, 2d MLG, Portsmouth, VA

[4] Joint Task Force-Civil Support, Fort Eustis, VA

[5] 3d Medical Battalion, 3d MLG, Okinawa, Japan

[6] General Dynamics Information Technology, Falls Church, VA

Introduction: About 8,000 venomous snake bites occur in the United States yearly, 95% from pit vipers. Mortality occurs from venom-induced consumption coagulopathy (VICC). Crotalidae polyvalent immune Fab (CroFab) treats envenomation, but supply is limited and costly. Evaluation of VICC by thromboelastography (TEG) has been successfully tested by our group during in vitro simulated pit viper envenomation. This study compares TEG and conventional testing in the detection and reversal of VICC after CroFab administration.

Methods: An IACUC-approved protocol using Oryctolagus cuniculus was used in this two-phase study. Phase 1 determined the lethal dose (LD50) of intravenous (IV) Crotalus atrox venom required for VICC using 3 groups, obtaining blood, and performing the analysis with TEG and conventional coagulation markers. Phase 2 utilized 3 arms: untreated, medium, and max dose CroFab. Each arm received the calculated LD50 IV venom followed by CroFab. After CroFab, blood was collected to monitor coagulopathy. For comparison, values were converted to a unitless value based on reference ranges.

Results: In Phase 1, PT showed a difference between dose groups at T+10min after envenomation. In contrast, R time showed differences at T+1min with more prolonged R time in higher doses. Thrombocytopenia was demonstrated at T+1min, while MA did not show a difference until T+10min. In Phase 2, when comparing PT and R time between the dose groups, TEG showed higher sensitivity in the early detection of the reversal of VICC. Thrombocytopenia was more pronounced in the untreated arm with a significant difference at T+10min, whereas the MA did not show sensitivity toward the detection of reversal. With CroFab, the α-angle did not show differences between groups until T+180min and did not reach a significant difference, while fibrinogen showed no difference overall and there was no difference between the two.

Discussion: In our model, certain TEG markers detected envenomation faster than standard methods. We found that TEG markers can detect correction of VICC after CroFab sooner than traditional markers. Overall, these findings suggest TEG

may be an asset when assessing and treating this life-threatening condition. This can be brought to the role 1 setting as TEG is becoming more portable and accessible.

Every Minute Matters: A Comparison of IV vs IO Access to Achieve Timely Transfusion Following Penetrating Trauma

Piehl M[1], Broome JM[2], Dransfield T[3], Marino M[3], Duchesne J[4]

[1] WakeMed Health and Hospitals, Raleigh, NC

[2] Medstar Georgetown Washington Hospital Center, Washington, DC

[3] New Orleans Emergency Medical Services, New Orleans, LA

[4] Tulane University School of Medicine, Department of Surgery, New Orleans, LA

Introduction: Prehospital transfusion improves trauma outcomes in military and civilian air medical rescue. Recently, the first study demonstrating a mortality benefit for blood transfusion in civilian ground emergency medical services (EMS) was published, demonstrating that advanced resuscitative care (ARC) can be effectively provided for penetrating trauma in fast-past urban EMS environments. Since 50% of patients in that study had intraosseous (IO) access, we hypothesized that prehospital transfusion via IO or intravenous (IV) routes would provide similar survival benefit for patients with severe hemorrhage.

Methods: This was a single-year, prospective study of ARC bundle administration in an urban EMS system with 70,000 annual responses. The ARC bundle included 2U packed red blood cells, tranexamic acid, and calcium. Administration criteria were penetrating injury with systolic blood pressure (SBP) <70 or <90mmHg with a heart rate (HR) >110. Patients with blunt injuries, isolated traumatic brain injury, and cardiac arrest were excluded. Patients were categorized by first access type (IV vs. IO) and compared. Primary outcomes of interest were in-hospital mortality and prehospital timing intervals.

Results: A total of 62 patients (32 IV, 30 IO) were included for analysis. The study cohort was predominantly African American (97%) and male with a median (IQR) age of 32 (24–40). No differences in demographics were observed between groups. Vital signs on initial EMS evaluation (SBP, HR, shock index) did not differ between groups. Median time from EMS arrival to blood administration did not differ between groups (7 vs. 6min, *P*=.88). Intervals from EMS scene arrival to hospital arrival were similar between groups (16 vs. 15min, *P*=.67). Median new injury severity score (NISS) and body region Abbreviated Injury Scale (AIS) did not differ between groups. Both 24-hour mortality (6% vs. 7%, *P*=.83) and total in-hospital mortality (9% vs. 10%, *P*=.74) were similar between groups.

Conclusions: Early blood transfusion can save lives in chaotic urban EMS environments with short transport intervals. Our data demonstrate that patients with severe penetrating trauma had similarly low mortality and short transport times when rapid blood transfusion was provided via IV or IO routes. This has important implications for choice of initial vascular access in the prehospital management of patients with penetrating trauma with hemorrhagic shock.

PMID: 39292948; *DOI:* 10.55460/BKC3-PW0B