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AIR FORCE MEDICAL SERVICE



2011 AFMS Medical Research Symposium

2-4 AUGUST 2011

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Proceedings of the 2011 AFMS Medical Research Symposium Volume 2. Enroute Care Track Abstracts and Presentations

Edited by: Ms. Velda Johnson



Held 2-4 August 2011 at the Gaylord National Resort Hotel and Convention Center 201 Waterfront Street National Harbor, MD 20745



Table of Contents

| Subject Page Nu | <u>ımber</u> |
|--|--------------|
| Introduction | 1 |
| Effects of Aeromedical Evacuation on Intracranial Pressure | 2 |
| Prolonged Hypobaria During Aeromedical Evacuation and the Effects on Traumatic Brain Injury | 9 |
| Critical Care Air Transport Team Severe Traumatic Brain Injury Short-Term Outcomes During F for Operations Iraqi Freedom/Enduring Freedom Between June 2007 and August 2010 | 0 |
| Closed Loop Control of FIO2 in Multiple Trauma Patients | 32 |
| Prehospital Oxygen Use in Civilian Trauma Care | 41 |
| Task Saturation in Critical Care Air Transport Team Advanced Training | 46 |
| The Impact of Prophylactic Fasciotomy Following Porcine (Sus scrofa) Hind Limb Ischemia/Reperfusion Injury | 53 |
| A Nursing Research System to Obtain Functional Outcomes and Provide Clinical Education Followartime Extremity Vascular Injury | |
| Major Arterial Vascular Injuries Sustained During Combat Operations: Demographics, Outcomes Lessons To Be Learned from Contrasts to Civilian Counterparts | |
| Advanced Team Training for Long-Range Extracorporeal Support Transport: The San Antonio M Adult ECLS Team experience | |
| Morphometric analysis of the torso arterial tree in a male trauma population | 83 |
| Porcine Arterial Repair with an Extracellular Matrix Bioscaffold (CorMatrix® ECM TM) | 89 |
| Prehospital interventions performed in a combat zone between November 2009 and December 20 | 10 93 |
| Factors Associated with US Military Died Of Wounds Rate in Iraq and Afghanistan | 101 |
| Critical Care Air Transport Team (CCATT) short term outcomes of casualties with spinal fracture moved with the Vacuum Spine Board between 2009 and 2010 | |
| Continuous Noninvasive monitoring and the Development of Predictive Triage Indices for Outcon Following Trauma | |
| Efficacy and Safety of Frozen Blood for Transfusion in Trauma Patients, A Multicenter Trial | 118 |

| Women's Health and Illness Behaviors in the Dep | eployed Setting |
|---|-----------------|
| | F J |



Proceedings of the 2011 AFMS Medical Research Symposium Introduction

The U.S. Air Force Medical Service presented the sixth annual Air Force Medical Research Symposium coordinated by the Air Force Medical Support Agency's Research and Development Division (AFMSA/SGRS). The symposium was held on 2-4 August 2011 in the Washington DC area at the Gaylord National Resort Hotel and Convention Center in National Harbor, MD. The symposium featured two half-days of plenary sessions, one and a half days of scientific presentations, and a poster session.

The symposium was organized into several tracks to include Enroute Care, Force Health Protection, Healthcare Informatics, Operational Medicine (In-Garrison Care), and Psychological Health/Traumatic Brain Injury, as follows:

- The Enroute Care Track addressed science and technology targeted at the continuum of care during transport from point of injury to definitive care including, but not limited to: Casevac, Medivac; Aeromedical Evacuation; Critical Care Air Transport; and Patient Staging. Further areas addressed included: patient stabilization; patient preparation for movement; impact of in-transit environment on patient and AE crew physiology; human factors concerns for AE crew or patient population; AE/medical personnel training; infectious disease/control; burn management; pain management; resuscitation; lifesaving interventions; and nutrition research in the enroute care environment.
- The Force Health Protection Track focused on prevention of injury and illness and the early recognition or detection of emerging threats for in-garrison or deployed operations. Topics of interest include research in bio-surveillance, infectious disease, emerging threats (pandemic response), protective countermeasures, disaster response/consequence management, toxicology/health risks (e.g., particulates nanomaterials, radiation, etc.), monitoring disease trends, other areas of preventive medicine, public and environmental health relevant to the military workforce.
- The Healthcare Informatics Track focused on the use of innovative information management & technology solutions that enhance healthcare delivery at any point of the full spectrum of patient care to include medical simulation and training.
- The Operational Medicine (In-Garrison Care) Track focused on care delivered in the outpatient or inpatient in-garrison setting and on enhancing the performance of airman in challenging operational and expeditionary environments.
- The Psychological Health/Traumatic Brain Injury Track addressed topics pertaining to screening, diagnosis, and treatment of TBI and/or Psychological Health in the military community. Specific focus areas within Psychological Health included depression, substance use disorders, family functioning, and suicide prevention. Topics of special interest included field-deployable diagnostic tests for mild TBI (concussion), blast modeling, large epidemiologic studies of Psychological Health and TBI, and strategies for translating research into practice.

These proceedings are organized into five volumes, as follows:

- Volume 1. This volume is a general overview of the entire 2011 Air Force Medical Research Symposium and includes abstracts of all the oral presentations and posters. First presented is the symposium's opening plenary session, followed by the abstracts from the four technical tracks, and then the closing plenary session. The abstracts associated with the poster session are in the last section of these proceedings. The agenda for the overall symposium is in Appendix A, attendees are listed in Appendix B, and continuing education information is in Appendix C of this volume. Appendices D-J are copies of presentation slides from the plenary sessions.
- Volume 2. This volume contains abstracts and presentation slides for the Enroute Care and Expeditionary Medicine Track.
- Volume 3. This volume contains abstracts and presentation slides for the Force Health Protection Track.
- Volume 4. This volume contains abstracts and presentation slides for the Healthcare Informatics Track.
- Volume 5. This volume contains abstracts and presentation slides for the Operational Medicine (In-Garrison Care) Track.
- Volume 6. This volume contains abstracts and presentation slides for the Psychological Health/Traumatic Brain Injury Track.

Effects of Aeromedical Evacuation on Intracranial Pressure

711 HPW/USAFSAM-ETS

Mr. Richard Branson

PURPOSE: Early evacuation of casualties has been a hallmark of the current conflict, with traumatic brain injury (TBI) being the defining injury. The effects of aeromedical evacuation (AE) on intracranial pressure (ICP) have not been studied in humans. METHODS: ICP and blood pressure were both continuously recorded during AE from in-theater hospitals to Germany in six patients with TBI. All patients were mechanically ventilated and had an intraventricular catheter and arterial lines. A recorder with airworthiness approval was connected to the output of a standard pressure transducer. Data were collected every second. The recorder also measured X,Y, and Z via an integral accelerometer. RESULTS: Six patients had complete take-off to landing data collected. In four of six patients there were sustained increases in ICP associated with take-off and/or during the 6- to 8-hr flight. These increases were often >50% from baseline and were sustained for >1 hr. However, no patient suffered sustained ICP increases >20 mmHg. All data were collected without identifiers and no attempt was made to link the collected data to patient information from medical records. CONCLUSIONS: This study demonstrates that observational data from current standard of care environments can be invaluable in identifying potential problems and solutions. Routine AE is associated with increases in ICP owing to environmental and injury factors. Monitoring during AE is possible without altering patient care.









4



Results

- Thirteen patients were identified.
- Six patients had successful monitoring of the entire transport.
- Data collection failures battery exhaustion, disconnected devices, IVC set to drain.
- Monitoring did not impact patient care or decision making.

Results

- No patient had sustained ICP > 20 mmHg during transport.
- A number of patients had increases in ICP during take-off and landing.
- During transport, ICP was commonly > 50% of baseline.

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 Frequent ICP spikes occurred during transport.

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Way Forward

- Continue data collection.
- Review regulatory requirements with goal of protecting subjects while allowing more complete data collection.
- Require new Patient Movement Item to collect data continuously for review.

Acknowledgments

- This work would be impossible without
 - Chris Blakeman, Dario Rodriquez, Carolina Rodriguez, Dennis Hanseman – UC
 - Rick Pettys, David Headley Sparxx Engineering
- Men and women of the U.S. Armed Forces

Cincinnati

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Prolonged Hypobaria During Aeromedical Evacuation and the Effects on Traumatic Brain Injury

711 HPW/USAFSAM-ETS

Dr. Gary Fiskum

BACKGROUND: Warfighters evacuated from combat theaters are exposed to decreased atmospheric pressure (hypobaria) during air transport. The focus of this project is to characterize the effects of hypobaria associated with aeromedical evacuation (AE) on animals subjected to traumatic brain injury (TBI) and test for clinically translational neuroprotective interventions targeted at these conditions. HYPOTHESIS: We hypothesize that (1) low atmospheric pressure present at AE cruising altitudes worsens outcome after TBI, (2) the effects of prolonged hypobaria on outcome after TBI are dependent upon timing of transport, (3) these effects reflect neuroinflammatory and/or cerebral metabolic changes, and (4) the neurologic outcome after TBI and AE can be improved by interventions that target neuroinflammation and brain oxygenation. STUDY DESIGN: Animals will be exposed to prolonged hypobaria (6 hr at 0.75 ATA), beginning at different times after TBI (6, 24, or 72 hr), representing immediate evacuation, standard, or delayed AE after injury in theater. Additional groups of animals will be exposed to primary hypobaria and then prolonged secondary hypobaria, modeling AE from Europe to the U.S. Two clinically relevant TBI models will be examined: (1) contusion-induced moderate TBI using the rat lateral fluid percussion model and (2) mild, blast-induced hyperacceleration TBI in rats as a model for TBI in occupants of vehicles hit by improvised explosive devices. Comparisons of long-term histopathologic and behavioral outcomes for animals in these groups will provide data to suggest the optimum time for primary and secondary AE after TBI, as well as the impact of poly-ADP-ribose polymerase administration or hyperoxia on subsequent outcome.



TRAUMATIC BRAIN INJURY A Major Warfighter Health Problem

- Over 300,000 warlighter victims of TBI, caused mainly by blasts.
 Many victims are occupants within vehicles targeted by improvised
- explosive devices.

 These vehicles and occupants can be exposed to large G forces, exceeding several hundred Gs.
- In addition to head impact injuries, acceleration may play an important role in TBI associated with underbody blasts.
- Victims of moderate-severe TBI and polytrauma with mild TBI undergo aeromedical evacuation (AE) to Landstuhl and subsequently to the



KNOWLEDGE GAPS

- Does AE worsen outcome after TBI?
- Is the negative impact of AE caused by hypobaria?
- Are different forms of TBI affected differently by hypobaria?
- Does hypobaria elevate intracranial pressure (ICP) and reduce brain oxygenation?
- Can time of AE optimize outcome?
- What level of inspired O₂ during hypobaria results in best outcome?
- Can outcome after TBI and hypobaria be improved by antiinflammatory interventions?

BACKGROUND

- Goodman et al., Hypobaric hypoxia exacerbates the neuroinflammatory response to traumatic brain injury. J Surg Res. 2011 Jan;165(1):30-7.
- Goodman et al., Traumatic brain injury and aeromedical evacuation: when is the brain fit to fly? J Surg Res. 2010 Dec;164(2):286-93. Epub 2009 Aug 26. Review.

EXPERIMENTAL PARADIGM

- Subject adult male rats to TBI caused by either lateral fluid percussion (LFP) or underbody blast-induced hyperacceleration.
- Place in hypobaric chamber (0.75 atm) at different times after TBI and maintain for 6 h (initial AE) in the absence or presence of a subsequent 10-h period of hypobaria (secondary AE).
- Perform quantitative neurohistopathology and various behavioral outcome measurements at up to 30 days post-TBI.
 Collect serum for biomarker assays
- Compare outcomes among hypobaria groups (including sham exposure) and to sham-injured controls.
- Test for clinically realistic neuroprotective interventions.

LATERAL FLUID PERCUSSION



Pressure wave impacts the lateral parietal cortex
 Mild to moderate injury (small to moderate lesion volume)
 Diffuse axonal injury
 Chronic cellular inflammatory reactions
 Reproductible behavioral deficits

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UNDERBODY BLAST G-FORCE TBI EXPERIMENTS



Based on small-scale explosive loading, validated with full-scale explosions, and used for, e.g., v-hull protective design confirmation.





<section-header>



UNDERBODY BLAST TBI MODEL

- Does AE-related hypobaria worsen outcomes after blast TBI, and, if so, when is the optimal time for AE after blast exposure?
 - 6-h delay before 6-h flight (0.75 atm)
 - 24-h delay
 - 7-day delay
 - Sham exposure

UNDERBODY BLAST TBI MODEL

 Two flights worse than one?
 Compare initial flight @ 24-h delay to initial flight followed by 10-h flight at 4 days after TBI.

UNDERBODY BLAST TBI MODEL

- What is optimal ventilatory oxygenation on the initial flight?
 - Room air (mild hypoxia)
 - Supplemental O2 to maintain normoxia

d for oublic release: distrib.

- 100% O₂ (hyperoxia)

Note: We have found that hyperoxia can worsen outcome after rat contusion TBI, rat cerebral hypoxia, and canine cardiac arrest, due to exacerbation of oxidative stress and impairment of cerebral energy metabolism.

UNDERBODY BLAST TBI MODEL

- How does AE-associated hypobaria affect intracranial pressure and brain tissue oxygenation?
 - Measure ICP during and after 6-h flight starting 1 day after TBI.
 - Measure brain tissue O₂ during and after 6-h flight starting 1 day after TBI.
 - Compare to measurements made at same times after TBI using sham hypobaria.

LATERAL FLUID PERCUSSION TBI MODEL

- What is optimal time for AE after LFP exposure?
 - 6-h delay before 6-h flight (0.75 atm)
 - 24-h delay
 - 7-day delay
 - Sham exposure

LATERAL FLUID PERCUSSION TBI MODEL

 Two flights worse than one?
 Compare initial flight @ 24-h delay to initial flight followed by 10-h flight at 4 days after TBI.

LATERAL FLUID PERCUSSION TBI MODEL

- Can neurohistopathologic outcomes and behavioral outcomes after TBI and hypobaria be improved by administration of a PARP inhibitor?
 - Compare outcomes after initial flight using two different doses of PJ34 to those using drug vehicle administered at 2 h after LFP.

LATERAL FLUID PERCUSSION TBI MODEL

- How does AE-associated hypobaria affect intracranial pressure and brain tissue oxygenation?
 - Measure ICP during and after 6-h flight starting 1 day after TBI.
 - Measure brain tissue $\rm O_2$ during and after 6-h flight starting 1 day after TBI.
 - Compare to measurements made at same times after TBI using sham hypobaria.

FUTURE DIRECTIONS

- Additional TBI models, e.g., free-field blast exposure, polytrauma
- Large animals, e.g., pigs
- Additional AE factors, e.g., vibration
- Magnetic resonance imaging & spectroscopy
- Molecular effects of hypobaria on the injured brain
- Combination therapies, e.g., targeting energy metabolism and inflammation
- Translation to clinical studies using measurements of ICP, PtO2, MRI/MRS, serum biomarkers, and neurologic outcomes.
- Optimization of neurologic outcome after TBI for warfighter and civilian TBI victims.

Critical Care Air Transport Team Severe Traumatic Brain Injury Short-Term Outcomes During Flight for Operations Iraqi Freedom/Enduring Freedom Between June 2007 and August 2010

711 HPW/USAFSAM-FEEG

Lt Col L. Renee Boyd

A retrospective chart review was conducted for 560 patient movements (i.e., Balad to Landstuhl, Landstuhl to Bethesda) transported by critical care air transport teams (CCATTs) with severe traumatic brain injuries (TBIs) between 1 June 2007 and 31 August 2010. Severe TBI was defined by the Brain Trauma Foundation and classified based on loss of consciousness that lasts for more than 24 hours, post-traumatic amnesia lasting for 7 days or longer, and a Glasgow Coma Score of 8 or less. Records were obtained from the CCATT Pilot Unit at Wilford Hall Medical Center, Lackland AFB, TX, and a standardized abstraction form was utilized that included the following: age; sex; nature of injury such as blast, blunt, or penetrating; additional traumatic injuries; type of mechanical ventilation; and intracranial monitor intervention (ventriculostomy or ICP CODMAN monitors). Results of this study serve to expand the available aeromedical knowledge by specifically looking at the area of TBI to allow refinement of CCATT training and provide data for the future development of guidelines for air transport for validating and clearing flight surgeons.

















20









 Due to the difficulty in coding, these included mild, moderate, and severe TBI.

Distribution Statement A. Approved for public release, distribution is unlimited. Case Number: 88ABW-2011-0000, xx Jun 2011

Distribution Statement A. Approved for public release, distribution is unlimited. Case Number. 88ABW-2011-10000, xx Jun 2011



| 192 Patient Moves | | 192 Patient Moves | | |
|-----------------------|---------------------------|------------------------------|-----|--|
| | | • USA | 176 | |
| Males | 189 | Canada | 4 | |
| Females | 3 | Poland | 4 | |
| T ciliares | 5 | Bulgaria | 2 | |
| T1 | 21 | Georgia | 2 | |
| The average age for 1 | 21 patients was 30 years. | Denmark | 1 | |
| | | Romania | 1 | |
| | | Blank | 1 | |

| Dates | | de la companya de la comp | Top Patient Movement Areas | Ser. |
|-------|---------------------|--|---|------|
| 92 Pa | atient Moves | 1 Ce | for 180 Patient Moves | |
| | | | Bagram to LRMC | 54 |
| 2007 | 1 Jun – 31 Dec 2007 | 11 | LRMC to National Naval Medical Center | 38 |
| 2008 | 1 Jan – 31 Dec 2008 | 53 | Balad to LRMC | 35 |
| 2009 | 1 Jan - 31 Dec 2009 | 57 | Kandahar to Bagram | 20 |
| 2010 | 1 Jan – 31 Aug 2010 | 71 | LRMC to Walter Reed Army Medical Center | 16 |
| | | | Kandahar to LRMC | 8 |
| | | | LRMC to Brook Army Medical Center | 5 |
| | | | Camp Bastion to LRMC | 2 |
| | | | Camp Bastion to Bagram | 2 |






























Closed Loop Control of FIO2 in Multiple Trauma Patients

711 HPW/USAFSAM-ETS

Mr. Richard Branson

PURPOSE: Closed loop control (CLC) of inspired oxygen concentration (FIO2) may maintain oxygenation and conserve oxygen.

Methods: In a randomized cross-over trial, we compared a 4-hr period using standard of care (SOC) physician-directed FIO2 control to 4 hr of CLC of FIO2 in trauma patients. CLC was accomplished using a proportional-integral-derivative (PID) controller targeting oxygen saturation (SpO2) at $94\pm2\%$. The PID controller manipulated FIO2 to maintain the SpO2 target. A paired t-test was used to compare the variables between SOC and CLC groups.

Results: A total of 95 patients (82 men, 13 women; 76 white, 18 African-American, and 1 Asian) were enrolled. Mean $[\pm$ standard deviation (SD)] age was 36 ± 12 yr and mean ISS was 32 (range 16-50).

Mean oxygen usage was 1.5 L/min in CLC and 2.84 L/min during SOC (p< 0.0001). The mean (\pm SD) of total time in minutes per patient per 4-hr period with SpO2 \leq 88% was 0.55 \pm 1.37 with a range of 0-12.2 min in CLC and 1.28 \pm 2.64 in SOC with a range of 0-17.3 min (p<0.002). There were 91 low SpO2 events in the SOC group and 77 in the CLC group.

CONCLUSION: CLC of FIO2 provides consistent control of the target SpO2 without clinician intervention, which may offer advantages in the en route care setting.











Safety & Efficacy

- Safety Prevention of hypoxemia (SaO₂ ≤ 88%)
- Efficacy Ability of controller to maintain SaO₂ target (94% ± 2%)
- Oxygen conservation

Description

- FiO₂ automatically adjusted based on SpO₂, SpO₂target difference and trends in SpO₂.
- SpO₂ target is 94% (adjustable).
- If SpO₂ ≤ 88%, FiO₂ increases to 1.0.
- A combination of fine and coarse control.
- If SpO2 signal is lost, FiO2 remains constant.
- If FiO₂ increases > 10%, an alert is provided.





| Closed | Loop | FiO ₂ / | SpO ₂ |
|--------|-----------------------|--------------------|------------------|
| | and the second second | | |

Duration of Desaturation per Patient

| pH | 7.43 +0.05 | 7.42 + 0.05 | 7.44 +0.05 | 7.44+0.04 | Total Duration of DSAT by Patient |
|--------------------------|--------------|-------------|-------------|-------------|--|
| PaCO ₂ (mmHg) | 40.4 +4.7 | 41.1+4.3 | 388+45 | 38.6+ 4.1 | |
| PaO ₂ (mnHg) | 97.7 + 21.7 | 960 + 16.8 | 299 + 17.6 | 76.4 + 10.7 | 20 2 |
| SaC ₂ (%) | 95.2+2.3 | 952+229 | 933 + 2.0 | 93.5+2.0 | 2 (15 |
| FiO2 (%) | 045+0.11 | 0.43.+0.31 | 0.37+0.17 | 925+9.14 | |
| PEEP (conH2O) | 8.4 + 2.6 | 8.7 +2.4 | 84+26 | 8.4+2.6 | 5 I0 |
| Resprate (bjan) | 15.8 + 3.2 | 15.4+3.4 | 152 + 3.2 | 154+29 | 8 |
| Vr(mL) | 636+84 | 633+94 | 633 + 94 | 628+91 | 25 |
| PIP (conH2O) | 282 + 8.8 | 20.6+6.5 | 295+4.5 | 29.1+5.1 | 8 . march 1011 - 10 - 1 - 100 - 101 - 102 - addited |
| SP (mmHg) | 128 + 24.4 | 129.7+28.0 | 1276 + 27.7 | 131.6+29.8 | 3 0 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 |
| DP(mnHg) | 458 + 8.7 | 63.8 + 9.1 | 592+8.7 | 63.5+103 | 7 1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85 88 91 |
| MAP (mmHg) | 82.6 + 13.1 | 80.7 + 12.5 | 787 + 10.7 | \$0.7±11.5 | B 1 4 7 10 15 10 15 22 25 28 31 34 37 40 43 46 43 52 35 36 01 64 67 70 73 76 (3 62 83 68 31 |
| HR (typin) | 102.4 + 18.5 | 100 + 16.5 | 300 + 21 | 100.7+19.7 | Close loop Manual |















Acknowledgments

This work would be impossible without

- Mike Given, Ph.D. ONR
- Chris Blakeman, Dario Rodriquez, Carolina Rodriguez – UC
- George Beck, Dorian Lacroy Impact
- Men and women of the U.S. Armed Forces



Prehospital Oxygen Use in Civilian Trauma Care

711 HPW/USAFSAM-ET

Mr. Richard Branson

BACKGROUND: Trauma patients often receive prehospital oxygen (O2) without evidence of hypoxemia. Knowing the need for prehospital O2 could assist military planners. METHODS: A convenience sample of injured adults taken to a trauma center by six emergency medical services (EMS) agencies was studied. During transport, O2 saturation (SpO2) was continuously recorded. Prehospital and in-hospital O2 use were recorded. A conservative threshold for O2 need (SpO2<95%) was used to estimate maximum prevalence and defined per local EMS protocols. Analysis using the TCCC threshold of SpO2<90% was also performed. Categorical comparisons used chi-square or Fisher's exact tests; medians were compared with the Mann-Whitney U test. RESULTS: Of 290 screened patients, 154 had complete data. The median age was 37 (range 18-84), 77/154 (50%) were white, and 121/154 (79%) were male. The median injury severity score (ISS) was 5 (1-43), 55/154 (36%) had a penetrating injury, and 82/154 (53%) were admitted. During treatment 128/154 subjects (83%, 95% confidence interval 76%-88%) had a need for O2 where 113/154 (73%) had SpO2<95%, 52 (34%) were <90%, and 86/154 subjects (67%) received O2 during EMS transport. Those with O2 need were older (38 vs. 27 years; p=0.019) and had higher ISS scores (9 vs. 1; p=0.001). There was no difference in O2 need for those with or without penetrating (36% vs. 40%, p=0.684) or chest (27% vs. 19%, p=0.469) injuries.

CONCLUSION: At threshold of SpO2<95% and SpO2<90%, 30%-50% of civilian trauma patients required O2. The need for O2 remains sufficient to deploy some oxygen for those casualties who may benefit from supplemental oxygen.



How Much Oxygen **Do Trauma Patients Require?**

· Prehospital trauma life support (PHTLS)

- Administer 85% oxygen if respiratory rate is 20-30/min.
- "All patients with suspected traumatic brain injury should receive
- supplemental oxygen. - If pulse oximetry is not available, oxygen should be provided with
- a non-rebreather mask.
- "SpO2 should be at least 90%, 95%, or higher being optimal."
- "Oxygen saturation (SpO2) should be monitored in virtually all trauma patients." SpO2 target = 95%

How Much Oxygen **Do Trauma Patients Require?**

- Most combat casualties do not require supplemental oxygen, but administration of oxygen may be of benefit for the following types of casualties:
 - · Low oxygen saturation by pulse oximetry
 - Injuries associated with impaired oxygenation
 - · Unconscious casuality
 - · Casualty with traumatic brain injury (maintain oxygen saturation > 90%) · Casualty in shock

1 November 2010

· Casualty at altitude



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43



Results

- Based on EMS observation and SpO₂ 86 of 154 (67%) patients received oxygen
- Using a threshold of 95% SpO₂ 113/154 (73%) patients had relative hypoxemia
- Using a threshold of 90% SpO₂ 52/154 (34%) patients had relative hypoxemia
- Patients who received oxygen were
 Older 38 vs. 27 years (p=0.0019)
 - Greater ISS 1 vs. 9 (p=0.0001)

Results

• No difference in oxygen delivery with penetrating vs. blunt injury (36% vs. 40%, p=0.684).

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 No difference in oxygen delivery with thoracic vs. nonthoracic injury (27% vs. 19%, p=0.469).

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Conclusions

- Oxygen needs in civilian trauma based on an SpO₂ of <90% occur in 30% of patients.
- The amount of oxygen required to reverse hypoxemia is elusive.
- Civilian trauma patients do not suffer the degree of chest injury or exsanguination seen in theater.

Acknowledgments

- This work would be impossible without
 - Jason McMullan, Chris Blakeman, Dario Rodriquez, Carolina Rodriguez – UC
 - Clinical Study Assistants Department of Emergency Medicine

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Task Saturation in Critical Care Air Transport Team Advanced Training

11 HPW/USAFSAM-ETS

Dr. Timothy Pritts

BACKGROUND: An important part of the current combat casualty care paradigm is tactical and strategic aeromedical evacuation of critically ill patients. Care of critically ill patients in this environment, as delivered by Critical Care Air Transport Teams (CCATTs), is challenging and involves the execution of a myriad of tasks. The current experience of CCATT has led to increasing understanding of the challenges of task saturation in complex environments, but the occurrence of task saturation in the CCATT training environment is unknown. This study will increase our knowledge of the occurrence and nature of task saturation during simulated CCATT missions and will provide the groundwork for potential improvements in CCATT training to mitigate the effect of task saturation on patient care. HYPOTHESIS: We hypothesize that task saturation occurs during simulated CCATT missions.

STUDY DESIGN: We seek to increase our understanding of task saturation in the CCATT environment. This will be accomplished through observation of patient care during simulated CCATT missions from at least four consecutive CCATT advanced classes. This will establish the practicability of task saturation occurrence determination during simulated CCATT missions. We will then determine the potential effects of task saturation on loss of team effectiveness during simulated CCATT missions. We will gather data from four consecutive CCATT advance classes. Data will be obtained prospectively but analyzed in detail by a panel of educational and team training experts in a retrospective fashion over 6 months.





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function. Distibution Statement A: Approved for public release; distribution is unlimited. Gase Number: 88.46W 2011 4061, 25 Jul 2011









- · Initial assessment of patient status
- Assess and monitor a patient undergoing obvious deterioration
- Communication with team members and upper-level resident
- Basic emergency patient management
 principles

Gelea et J. Sagenitzanska, 300 Disklauten Stelanner A. Nanovaet for outlik estesse: datibution is unlimited. Case Number: 88,46W 2011 4061, 25 Jul 2011

PGY 1 RESIDENTS MAY NOT IDENTIFY PHYSIOLOGIC COMPROMISE DURING INPATIENT EMERGENCIES

| Score (%) How performed? | 1 Did not | 2 Poorly | 3 Correctly |
|-------------------------------------|--------------|-------------|----------------|
| Requests updated vitals | 9 (56) | 2 (13) | 5 (31) |
| Performs pulse exam and reassess | 4 (25) | 10 (63) | 2 (13) |
| Listens for breath sounds | 4 (27) | 3 (20) | 8 (53) |
| Places patient on monitor | 11 (73) | - | 4 (27) |
| Monitors blood pressure | 8 (53) | 4 (27) | 3 (20) |

Distribution Statement A: Approved for public release; distribution is unlimited. Case Number: 88A6W 2011 4061, 25 Jul 2011

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| | INTERNS MAY NOT | |
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| OM | MUNICATE EFFECTIVELY | |

| 1 Did not | 2 Poorly | 3 Correctly |
|--------------|-----------------------------|--|
| 8 (50) | • | 8 (50) |
| 3 (19) | 11(69) | 2 (12) |
| 10 (67) | 2 (13) | 3 (20) |
| 10(63) | 3 (19) | 3 (19) |
| | 8 (50) 3 (19) 10 (67) | Did not Poorly 8 (50) - 3 (19) 11(69) 10 (67) 2 (13) |

Distribution Statement A: Approved for public release; distribution is unlimited. Case Number: 88A6W 2011 4051, 25 Jul 2011

exacerbated by task saturation

interpret & Accounted for a drift planner diskip for is unlimited. Come Muchae: 28 AGM 2011 4051-25 Jul 2011

PGY 1 RESIDENTS DID NOT UTILIZE BASIC INTERVENTIONS DURING EMERGENCY SCENARIOS

| Score (%) How performed? | 1 Did not | 2 Poorly | 3 Correctly |
|-----------------------------|--------------|-------------|----------------|
| Evaluates airway | 7 (44) | 4 (25) | 5 (31) |
| Administers O ₂ | 7 (44) | 5 (31) | 4 (25) |
| Acknowledges IV access | 4 (25) | 7 (44) | 5 (31) |
| Administers IV therapy | 4 (27) | 6 (40) | 5 (33) |

Disfribution Statement A: Approved for public release; distribution is unlimited. Case Number: 85ABW 2011 4061, 25 Jul 2011

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The Impact of Prophylactic Fasciotomy Following Porcine (Sus scrofa) Hind Limb Ischemia/Reperfusion Injury

Brooke Army Medical Center

Capt Thomas Percival

BACKGROUND: Prophylactic fasciotomy has been used alleviate compartment syndrome after ischemia reperfusion injury. It has been purposed that prophylactically treating compartment syndrome will improve neuromuscular recovery of the limb therefore improving functional limb outcome. The purpose of this study is to quantify the neuromuscular recovery after prophylactic fasciotomy in a porcine model of hemorrhage and hind limb ischemia, METHOD: Swine (Sus Scrofa; 76 +/-6kg) were randomly assigned to no fasciotomy or prophylactic fasciotomy after ischemia via external iliac artery occlusion and arteriotomy. Class III shock was induced via a 35% blood volume variable rate hemorrhage and external iliac artery repair was achieved after 0, 3, or 6 hours of ischemia. Prophylactic fasciotomy of the anterior compartment was performed at the time of reperfusion. Compound motor action potential, sensory nerve action potential, nerve conduction velocity and gait testing was evaluated during the 14-day survival period to calculate the composite physiologic model of recovery (PMR). Necropsy was performed for evaluation of nerve and muscle histology. RESULTS: In hemorrhage alone, according to the PMR the recovery was 94+/-28%, 63+/-37% and 55+/-44% at 0, 3 and 6 hours of ischemia respectively. A significant difference was noted between 0 and 6 hours of ischemia (p<0.05). With fasciotomy, a recovery of 97+/-72%, 98+/-80% and 42+/-39% was noted after 0, 3 and 6 hours of ischemia. Compound motor action potential showed the greatest decrement with ischemic insult. Histologic analysis is currently on going. CONCLUSION: This study demonstrates the feasibility of fasciotomy in a porcine model. It validates the previous model of functional limb outcome with hemorrhage and hind limb ischemia in a porcine model and shows an apparent trend towards improved functional limb outcome if vascular repair and prophylactic fasciotomy are performed within 3 hours of ischemic time.





Disclaimers

This study has been conducted in compliance with the Animal Welfare Act, the implementing Animal Welfare Regulations, and the principles of the Guide for the Care and Use of Laboratory \ Animals.

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.















- Univariate analysis of single measures endpoints were described by one way ANOVA
- Repeated measures of nerve conduction was combined in a mixed regression model to establish a physiologic measure of recovery (PMR) to characterize the ischemic threshold of the extremity

| | Results: Baseline | | | | | | | | | | | |
|-------------------------|--------------------------|-------------|-------------|---------------|--------------|--------------|--|--|--|--|--|--|
| Variables Means (SE) | 1 HR N=6 | 3 HR N=5 | 6 HR N=6 | 1 HR-F N=6 | 3HR-F N=6 | 6HR-F N=6 | | | | | | |
| Wt [kg] | 76.5 (1.2) | 76.2 (1.5) | 73.8 (2.9) | 73.7 (3.6) | 76.6 (2.6) | 77.9 (1.7 | | | | | | |
| MAP [mmHg] | 72 (2.6) | 69.6 (8.3) | 54.2 (6.2) | 60 (4.3) | 65.7 (4.2) | 62.7 (7.3 | | | | | | |
| LDH [U/L] | 297 (69) | 341 (33) | 228 (39) | 300 (58) | 275 (28) | 248 (35) | | | | | | |
| CK [U/L] | 1548 (918) | 1272 (431) | 1009 (266) | 807 (163) | 635 (67) | 688 (74) | | | | | | |
| Myoblogin [ng/mL] | 47 (11) | 38 (8) | 26 (2) | 49 (15) | 40 (7) | 46 (8) | | | | | | |

| | USA Institut | e of Surgical I | tesearch / Join | nt Battlefield I | Health & Trau | ma Institute | | USA | Institute o | f Surgical I | Research / J | oint Battlef | ield Health | & Trauma | i Institute |
|-------------------------|--------------|-----------------|-----------------|------------------|---------------|--------------|----------------------------|---------------|---------------|---------------|--------------|----------------|---------------|---------------|-------------|
| | | Resu | lts: Ba | seline | | | | 1 | | Re | sults: | Final | l – | | , |
| Variables Means (SE) | 1 HR N=6 | 3 HR N=5 | 6 HR N=6 | 1 HR-F N=6 | 3HR-F N=6 | 6HR-F N=6 | Variables Means (SE) | 1 HR N=6 | 3 HR N=5 | 6 HR N=6 | p-value | 1 HR-F N=6 | 3HR-F N=6 | 6HR-F N=6 | p-value |
| Tarlov Score | 4 | 4 | 4 | 4 | 4 | 4 | CMAP | 10.3 | 5.8 | 3.2 | <0.001 | 4.5 | 4.9 | 1.5 | 0.03 |
| CMAP | 12.5 (0.9) | 13.3 (1.8) | 12.3 (1.5) | 9.3 (1.2) | 10.3 (0.9) | 9.8 (1.2) | [mV] | (1.0) | (1.5) | (1.4) | | (0.3) | (1.3) | (0.7) | |
| [mV] SNAP | 14.5 (1.6) | 13.4 (1.6) | 11.0 (0.7 | 13.3 (1.2) | 14.9 (1.4) | 11.0 (1.4) | SNAP [uV] | 15.0 (2.1) | 8.1 (1.5) | 5.0 (0.9) | 0.04 | 11.5 (1.0) | 11.3 (1.1) | 5.1 (1.4) | 0,005 |
| [uV] NCV | 57.8 (2.7) | 58.2 (3.2) | 60.7 (2.9) | 56.4 (3.0) | 56.8 (3.1) | 55.4 (3.0) | AST [U/L] | 44 (6) | 45 (4) | 52 (4) | 0.65 | 50 (8) | 45 (9) | 50 (6) | 0.80 |
| [m/sec] | | 1 | 0.000 | | - | | Myoglobin | 63 (32) | 39 (7) | 39 (6) | 0.42 | 48 (9) | 23 (7) | 21(2) | 0.36 |
| Compartment Pressure | 9.1 (0.7) | 10.4 (1) | 8.2 (0.9) | 8.9 (1.0) | 9.3 (1.7) | 8.7 (0.9) | [ng/mL] | | | | | | | | |
| [mmHg] | | | | | | | Flows [cm/s] | 59.8 (5.1) | 68.3 (6.3) | 61.1 (6.8) | 0.08 | 64.2 (10.6) | 44.5 (7.8) | 65.1 (5.4) | 0.10 |



58









A Nursing Research System to Obtain Functional Outcomes and Provide Clinical Education Following Wartime Extremity Vascular Injury

USAISR

Capt Diane Lynd

Authors: Ivatury RA, Keltz BM, Lynd DL, Ames-Chase AC, Porras C, RasmussenTE, Feider LL

BACKGROUND: The rate of vascular injury in the wars in Iraq and Afghanistan are five times that previously reported in combat with extremity injury most common. Extremity vascular injury is associated with significant long-term morbidity and repairs requiring surveillance ensure best durability and outcome. Despite the commonality and significance of this injury pattern, current systems to ascertain patient-based outcomes and provide education are poorly developed. OBJECTIVE: To describe a novel system designed to contact troops in the years following extremity vascular injury to ascertain quality of life and limb outcomes and provide education on surveillance of vascular repair.

METHODS: A research team comprised of nurses with wartime experience conducted a review of the Joint Theater Trauma Registry (JTTR) identifying US troops having sustained extremity vascular injury. A medical record review was performed to confirm the presence of vascular injury and or injury repair and patient contact attempted. Informed consent was obtained and outcomes information was gathered using the Standard Form 36 (SF-36) and Short Musculoskeletal Function Assessment (SMFA). Vascular injury education was provided based on an algorithm that directs follow-up and surveillance.

Results: Extremity vascular injury was confirmed in 751 patients. Attempted contact of 189 (25%) and actual contact completed for 91(48%). Of the 91 patients contacted, 80 (88%) consented to participate, and 11(12%) either declined consent or were unresponsive. Of the 80 consented, 24 (30%) completed surveys and 56 (70%) are pending survey completion. Of the 24 respondents, 17 had salvaged limb with graft or patch or anastomosis primary repair and received education regarding the need for follow-up care with a vascular surgeon. CONCLUSIONS: Nursing-driven outcomes research and education are feasible following wartime injury. This method provides relevant insight into extent of recovery following injury on the battlefield and allows this information to be linked to early injury characteristics and management strategies.

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.



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- The author(s) acknowledge Joint Theater Trauma Registry (JTTR) for providing data for this study.
- This study was conducted under a protocol reviewed and approved by the US Army Medical Research and Materiel Command Institutional Review Board and in accordance with the approved protocol.
- There are no financial disclosures



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Background: Vascular Injury

- · Blood Vessel injury common injury pattern in combat
 - · Leads to significant morbidity & mortality
 - OIF/OEF vascular injury affects up to 12% of all combat wounded (White et al, 2011)
 - Varies by theater, mechanism of injury & operational tempo
- OIF/OEF/OND opportunity to develop a modern vascular registry to examine strategies in the care of casualties (Rasmussen et al, 2006)

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- Background: Registries
- Established at Walter Reed General Hospital in 1966 to:
 - Document & analyze blood vessel injuries in Vietnam
 - Provide long term follow-up and results
- Historical model for research and long term follow-up in military community
- Changes since Vietnam:
 - · Safety equipment available to service members
 - Technology: better medical records and tracking





- Consider ways a long-term outcomes based research method could benefit other research areas
- · Present early results & survey completion from study

• Ascertain first ever patient based outcomes data following wartime vascular injury

· Identify the incidence of vascular injuries related to combat

Contact service members who sustained vascular injuryDetermine if amputation in theatre leads to better mental or

physical health scores than vascular repairs

VII) objectives are:

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Methods: Key Components

1. Review of medical records to determine specific types of repair

- and subject outcome; multiple sources
- 2. Validated surveys to collect outcomes data
 - 99 questions total
 - Demographic questions
 - Short Musculoskeletal Functional Assessment
 - SF-36v2™ Health Survey (Short-Form Health Survey)
- 3. Uniquely qualified research team
- Physicians and nurses with wartime experience
- 4. Long-term follow-up with subjects
 - Currently on second survey cycle
 - Future follow-up



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Methods: JTTR query

- · Joint Theater Trauma Registry (JTTR) to identify study cohort
- Search Criteria for JTTR Query
 - Active Duty
 - · BI: Battle Injury
 - · Blast, penetrating & vehicle accidents
 - Vascular Injury with AIS 2-6 (no head)
 - · Documented vascular injury
 - · identified by ICD9 codes
 - Includes surgical procedures and Hemorrhagic control NOS
 - Operation: OIF/OEF











| Results: | Contact Attempts |
|----------|-------------------------|

| Phone Contact | |
|--|--------|
| Average, phone contacts with subjects before survey completion | 1.99 |
| Median, phone contacts with subjects before survey completion | 2.00 |
| Range, phone contacts with subjects before survey completion | 1 to 6 |
| Email Contact | |
| Email only contact (i.e. AKO) | n=12 |



Results: Demographics 1

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- · Extracted from medical records during chart review
 - Theatre of operation
 - OIF, n=144
 - OEF, n=15
 - Gender
 - Males, 156 subjects
 - · Females, 3 subjects




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|-------|--|
| | Results: Demographics 7 |
| | Self-reported occupational status at survey completion .oder. w6 |
| 61.94 | In School, n=2B (17.6%) AD, n=52 (2.7%) |
| 66.00 | |
| 19-96 | Employed, n=40. |
| | 66.00 |



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Conclusion

- Veterans from OIF/OEF with amputations and limb salvage have returned to duty, started degree programs and are actively involved in sports and recreational activities
- Long-term subject-based outcome studies are essential to ensure surgical care in theater allows for the best possible outcome for wounded warriors.



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Major Arterial Vascular Injuries Sustained During Combat Operations: Demographics, Outcomes, and Lessons To Be Learned from Contrasts to Civilian Counterparts

Brooke Army Medical Center

Capt Nicholay Markov

INTRODUCTION: Vascular injuries account for 12% of all combat-related injuries in recent conflicts in Iraq (OIF) and Afghanistan (OEF). We reviewed the epidemiology and outcomes of these injuries from the Joint Trauma Theater Registry (JTTR), contrasting these results with civilian counterparts from the National Trauma Databank (NTDB). METHODS: JTTR query identified major arterial vascular injuries (Non-compressible = axillary, subclavian/innominate, aorta, carotid, iliac; Compressible = brachial, femoral, popliteal) in coalition casualties from 2002-2006. The demographics, patterns and severity of outcomes of these injuries were evaluated and compared to civilian NTDB counterpart's age 18-35 using Propensity Score matching. RESULTS: JTTR identified 380 patients meeting criteria. The majority of injuries were the result of an explosion (68.7%) or GSW (28.2%). GCS was ≤ 8 in 34.3%, ISS > 15 in 44.5%, and 20.5% had hypotension (SBP <90) on arrival to a theater hospital. Comparison to unmatched NTDB patients meeting study criteria (n = 7400) revealed that JTTR patients were more likely to have sustained arterial injury at compressible sites (55.5% vs. 38.6%, p < 0.001) and were more likely to have concomitant venous injury (54.5% vs. 18.4%, p < 0.001). Comparison of 167 propensity score matched (1:1) JTTR to NTDB counterparts revealed a significantly lower mortality rate among JTTR patients overall (4.2% vs. 12.6%, p = 0.006; OR 0.30 [0.13-0.74], those with arterial injury at non-compressible sites (10.8% vs. 36.5%, p = 0.008; OR 0.21 [0.06-0.71] and for ISS > 15 (10.7% vs. 42.4%, p = 0.006; OR 0.16 [0.04-0.65]). CONCLUSIONS: Comparison to civilian counterparts has inherent limitations, but reveals improved survival among combat-related vascular injuries overall, for non-compressible arterial injuries and among the most severely injured. The etiology of these findings is likely multi-factorial and warrants further investigation.





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USA Institute of Surgical Research / Joint Battlefield Health & Trauma Institute Methods: Statistical Analysis

- JTTR and NTDB variables compared
 - Means and standard errors
 - Mortality odds ratios
- Propensity Score Matching
 - Used for matching
 - Predictor variables matched to mortality calculated
 Age, gender, first systolic blood pressure, Glasgow Coma Score, and Injury Severity Score
 - Matched subjects compared

USA Institute of Surgical Research / Joint Battlefield Health & Trauma Institute Results: Overall (Unmatched)

| | | JTTR | NTDB | p = value |
|--------------------------------|------------------------|----------|-------------|-----------|
| Nu | mber | 380 | 7020 | N/A |
| Age | (years) | 25.7±6.5 | 31.6 ± 10.1 | <0.001 |
| Mei | n (%) | 98.7 | 82.8 | NS |
| Injury Pattern (%) | Explosion | 68.7 | ٥ | <0.001 |
| | Penetrating | 28.2 | 50.0 | <0.001 |
| | Blunt | 3.2 | 50.0 | <0.001 |
| | npressible nage (%) | 26.6 | 61.4 | <0.001 |
| Morta | lity (%) | 8.4 | 28.6 | <0.001 |
| Mortality Predictors (%) | GCS <8 | 34.3 | 35.8 | 0.584 |
| | ISS>15 | 44.5 | 67.9 | <0.001 |
| | SBP<90 | 20.5 | 27.3 | 0.005 |

| USA Institute of | Methods | | Results: Matched | | | |
|------------------|--------------------------------------|------------------|------------------|-------------------|------|----------|
| | 2 NTDB ↓ 1 – Dec 2006 (6 year) | | | JITR | NTIB | p = valu |
| | ascular Injury | Nur | nber | 167 | 167 | N/A |
| *18-55 V | | Morta | lity (%) | 4.2 | 12.6 | 0.006 |
| •18-55 y | ears old | Subgroup | NCAI | 10.8 | 36.4 | 800.0 |
| · · · · · | Property | Mortality (%) | NCAI + ISS>15 | 14.3 | 63.2 | 0.005 |
| | Score N atching | NCAL-N | on-Compress | ble Arterial Inju | -N | |





Advanced Team Training for Long-Range Extracorporeal Support Transport: The San Antonio Military Adult ECLS Team experience

59 MDW

Lt Col Jeremy Cannon

BACKGROUND: Combat casualties with severe respiratory failure may require extracorporeal life support (ECLS) to permit safe long-range transport. To meet this need, a transport team trained in ECLS indications, physiology, and equipment is required. This report summarizes the training activities of the San Antonio Military Adult ECLS Team over the previous 10 months. METHODS: Physicians and nurses with experience in combat casualty care, advanced critical care therapies, and long-range transport were identified as potential candidate ECLS team members. Training included didactic modules on the indications for extracorporeal support, modes of support, and troubleshooting. Hands-on simulation and live tissue training reviewed circuit setup and emergency scenarios. Expert instructors for these sessions were drawn from well-established military and civilian ECLS teams.

RESULTS: To date, 7 physicians, 10 nurse specialists, and 1 clinical nurse specialist have been selected for training as candidate members of the San Antonio Military Adult ECLS Team. Of these 18 candidates, 18 (100%) have completed a didactic course, 10 (56%) have undergone simulation training, and 11 (61%) have participated in at least 1 live tissue training session. More nurse candidates have completed hands-on simulation training than physician candidates (70% vs. 43%) while fewer nurses have participated in live tissue training as compared to physicians (30% vs. 100%).

CONCLUSIONS: Establishing a team capable of long-range ECLS transport requires intensive training in cardiopulmonary physiology and ECLS equipment and techniques. Military and civilian teams experienced in neonatal, pediatric, and adult ECLS have worked over the past 10 months to provide our candidate team members the knowledge and skill to perform ECLS in garrison and during transport. Future efforts will focus on completion of simulation and live tissue training, maintenance of qualifications, and bedside experience with ECLS patients.

Advanced Team Training for Long-Range Extracorporeal Support Transport: the San Antonio Military Adult ECLS Team Experience

> Jeremy W. Cannon, MD, SM, FACS Li Col, USAF, MC Trauma & Acute Care Surgery Brooke Army Medical Center Aug 3, 2011 jeannon@mtassmed.org 210-289-7672

The opinions and assertions contained herein are the <u>private views of the presenter</u> and are not to be construed as official or reflecting the views of the Department of the Air Force or the Department of Defense.

I have no commercial or financial interests to disclose.



Adult Extracorporeal Life Support...

Doesn't make any sense ...





Background



ECLS emerged from the advances made for cardiopulmonary bypass.

n=21 NEW THERAPY N=21 CONTROL THERAPY N=19 SURVIVAL (Kaplan-Meler) 80 60 1975-79 40 20 0^+0 38 30 60 90 DAYS AFTER RANDOMIZATION JAMA Nov 1979;242(20): 2193-6. Am J Resp CC Med 1994;149:295-305.

mortality benefit.

Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial



CARING FOR THE CRITICALLY ILL PATIENT

Extracorporeal Membrane Oxygenation for 2009 Influenza A(H1N1) Acute Respiratory Distress Syndrome

Adult ECLS and ECCO₂R trials showed no

The Australia and New Zealand Extraoroporeal Membrane Oxygenation (AVZ ECMO) Influenza Investigators⁴ Const radiograph Son



JAMA Oct 2009;302(17)

68 on ECMO

54 alive (79%) 6 still in ICU ->2 on ECMO 16 still in hospital

JAMA-EXPRESS

ECLS equipment HAS evolved significantly ECLS equipment HAS evolved significantly in the last decade.

PMP Membrane = Low resistance = Less coagulopathy Centrifugal Pump = Short Circuits = Less Inflammation



in the last decade.

PMP Membrane = Low resistance = Less coagulopathy Centrifugal Pump = Short Circuits = Less Inflammation

Single site cannulation for VV ECLS =



ECLS equipment HAS evolved significantly in the last decade.

- PMP Membrane = Low resistance = Less coagulopathy Centrifugal Pump = Short Circuits =
- Less Inflammation

Transport equipment dramatically downsized





Air Transport of Patients With Severe Lung Injury: Development and Utilization of the Acute Lung Rescue Team

Gina B. Doriac, MD, FACP, Raymond Fang, MD, FACS, Valerie M. Praitt, MD, Peter A. Marca, MD, FCCP, Heidi M. Stewart, RN, MSN, CCRN, Stephen L. Bartner, MD, FACS, and Warren C. Dorlac, MD, FACS UTrauma 2009:55:5154-71.

Closing the "Care in the Air" Capability Gap for Severe Lung 11 act : 17 mo Injury: The Landstuhl Acute Lung Rescue Team and Extracorporeal Lung Support 29 act : 39 mo

JTrauma 2011;71:591-97











- Live Tissue Training



ECLS currency requires a commitment to Year-round multi-modal education.

- Didactics - ELSO Meeting - WHMC Course
- Live Tissue Training - Animal Lab - Clinical Cases

Simulation



ECLS simulation allows review of critical scenarios in a safe, reproducible environment.

Pre-test/Subjective

- Scenarios - Circuit Review
 - Mechanical (7) - Physiology (6)

Participants

- Test Team
 - Critique Team

- Instructors Post-test/Subjective



Simulation improves cognitive function and subjective comfort with ECLS.



1 DOC + 5 SPECS 24 Q's + Scenario + Diagram Pre-programmed Sim Man



Cognitive (n=6)

All team members have completed 2 of 3 training modes in 1 year.



The future—Transport Simulation for in-house and long-range transport.



| Cardiothoracic Surgery | Pulm/Med/CC | ECLS Coordinators | Collaboration across |
|--|--|---|----------------------|
| Mike Hines Joff McNeill Jonathan Haft Jorry Pratt | Jeremy Pamplin Steve Derdak Thomas Zanders ISR/CC | Kathryn Negaard Heather Campbell Bernadette Ellicit Cheryl Collicott | Altitude Research |
| Trauma/CC Mark Gunst Alan Murdock | Lee Cancio Kevin Chung Chris White | ISR CNS Dave Allen | Research Hard |
| Dave Zonies Stephanie Savage Ray Fang Lena Napolitano Pauline Park | Nephrology Casey Cotant Molly Tilley | Perfusion/RT Rex inceldon Josh Walker Slephen North | VET |
| Pauline Park | Cardiology | Education/Training | Hannala 1 2 IV |

Vascular Surgery Todd Rasmussen

Surgical Oncology Dave Smith



Neonatology Melissa Tyree Mark Ogino Dan Dimberger

Andy Muck

Karin Hawkins

Emergency Medicine

Education/Training John Mechtel Research

Roy Garcia Deb Niemeyer Angy Batchinsky

Collaboration across CONUS and Europe



Conclusions

- ECLS has evolved dramatically over 40 yrs.
- In respiratory failure, ECLS permits the return to lung protective settings & early mobility.
- ECLS training requirements are multimodal and transport adds an additional layer of complexity.
- The San Antonio Military Adult ECLS Transport Team is prepared to extend our support for spiratory failure patients globally.

Morphometric analysis of the torso arterial tree in a male trauma population

Brooke Army Medical Center

Capt Nicholay Markov

INTRODUCTION: Management of torso hemorrhage may include resuscitative aortic occlusion to support central pressure while bleeding is temporized. The objective of this study is to characterize axial arterial anatomy of the torso in a trauma population including definition of distances and diameters correlated to an external measure of torso extent. METHODS: Two-hundred consecutive contrast-enhanced CT scans of the chest abdomen and pelvis performed for trauma in men (April 2009 – April 2010) were examined. One hundred eight scans qualified for analysis using Volume ViewerTM software. Centerline distances were measured between the common femoral arteries (CFA) and the origin of the primary branch vessels of the aorta additionally the aortic diameter at each point was determined. RESULTS: The mean age of patients was 31.5 (19-45) years. Mean distances and ranges from the left and right common femoral arteries to arterial landmarks are as follows: Left Common femoral artery to the left subclavian artery, celiac artery take off and aortic bifurctation were 537mm (472-632mm), 327mm (290-413mm) and 207mm (146-281mm) respectively. Right common femoral artery to the left subclavian artery, celiac artery take off and aortic bifurcation were 546mm (484-622mm), 335mm (274-412mm) and 201mm (165-278mm) respectively. The diameter of the thoracic aorta at the level of the left subclavian artery was 21.6 mm (16.3 mm-26.9 mm). Aortic diameters at the level of the Celiac and aortic bifurcation are 17.3 mm (12.3 mm-22.5 mm) and 14.1 mm (10 mm-18.1 mm) respectively. The diameter of the right and left external iliac arteries was 8.9 mm (5.1 mm-12.5 mm) and 8.8 mm (4.8 mm-12.8 mm) respectively.CONCLUSION: This study provides the first CT-based morphometric analysis of the torso arterial tree. Information from this study may facilitate the development and accurate implementation of resuscitative endovascular aortic balloon occlusion without the need for fluoroscopy.



USA Institute of Surgical Research / Joint Battlefield Health & Trauma Institu

Disclaimers

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.



















Thank You

Porcine Arterial Repair with an Extracellular Matrix Bioscaffold (CorMatrix® ECMTM)

USAF / 60 MDG

Capt Brian Gavitt, Capt Matthew Chauviere, Capt Geoffrey Douglas, Capt Ryan Schutter, LtCol Daren Danielson, Col Jerry Pratt, Col(sel) Darrin Clouse, Maj Megan Steigelman, W. Douglas Boyd MD, J. Kevin Grayson DVM, PhD

Department of Surgery, David Grant Medical Center, Travis AFB, CA

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OBJECTIVE: Options for immediate peripheral vascular reconstruction are limited. Autogenous vein may not be available and is difficult to procure. Prosthetic materials have significant complication profiles in contaminated wounds, limiting their use in vascular trauma. We evaluated an alternative graft material consisting of a porcine-derived extracellular matrix (ECM) bioscaffold (CorMatrix® ECMTM, CorMatrix Cardiovascular, Inc., Atlanta, CA). Our study sought to establish early patency and histologic characteristics of CorMatrix® ECMTM for use in arterial repairs in swine. METHODS: Four crossbred swine had a 2 cm carotid arteriotomy created through a midline neck incision. The arteriotomy was repaired with a CorMatrix® ECMTM patch. Aspirin and clopidogrel were administered starting 48 hours prior to surgery and continued daily. Angiography was performed prior to euthanasia and followed by thorough necropsy and histologic evaluation. RESULTS: The animals had uncomplicated postoperative courses. Swine were sacrificed at one and four weeks after surgery. Arteriograms confirmed graft patency in all cases. Histologic assessment confirmed patency without evidence of thrombosis. The ECM patch was well populated with cells by one week. The implanted patch material was largely reabsorbed at 4 weeks and replaced by site-appropriate tissue consisting of organized smooth muscle, collagen, and endothelium. Neovascularization was seen within the remaining patch material.

CONCLUSION: In this pilot study, CorMatrix® ECM[™] was an effective material for porcine carotid arterial repairs. ECM remodeling begins within one week and elements of normal vascular structure are seen. Further studies will be required to assess long term patency and elucidate the mechanisms of site-appropriate remodeling. DISCLAIMER: The animals involved in this study were procured, maintained, and used in accordance with the Laboratory Animal Welfare Act of 1966, as amended, and NIH 80 23, Guide for the Care and Use of Laboratory Animals, National Research Council. The views expressed in this material are those of the authors, and do not reflect the official policy or position of the U.S. Government, the Department of Defense or the Department of the Air Force. The work reported herein was performed under United States Air Force Surgeon General approved Clinical Investigation No. FDG20100034A. The opinions and/or assertions expressed in this article are solely those of the authors and do not reflect the official policy of the U.S. Air Force, the Department of Defense, or U.S. government.











Prehospital interventions performed in a combat zone between November 2009 and December 2010

Enroute Care Research Center

Lt Col Vikhyat Bebarta, MD

OBJECTIVE: To describe prehospital interventions performed during the resuscitation of casualties in a combat zone. METHODS: We performed a prospective observational study recording: mechanism of injury (MOI), application of nasal/oral airway, endotracheal intubation or cricothyroidotomy, chest needle decompression, chest tube placement, chest seal application, tourniquet, use of pressure packing with/without hemostatic agent and implementation of hypotensive resuscitation. In 2010 we added: vascular access, fluid administration, hypothermia prevention and use of TCCC card. The enrolling provider determined if an intervention was not performed that was necessary (missed LSI). All data was reported in a descriptive manner. RESULTS: 652 patients met the inclusion criteria; mean age was 25 yrs (SD 8) and 97.4% were male. The MOI was explosion in 413 (63.3%), penetrating in 138 (21.2%) and blunt in 101 (15.5%). 39 casualties underwent an airway intervention (6.0%), with 34 (5.2%) missed LSIs; 30 underwent a chest intervention (4.6%), with 13 (2.0%) missed LSIs; 369 (13.3%) underwent a hemorrhage control intervention with 21 (3.2%) missed LSIs and 25 (3.8%) had hypotensive resuscitation applied with 8 (1.2%) missed LSIs. Vascular access was obtained in 206 of 339 casualties (60.8%) with 79 (23.3%) missed LSIs. Prehospital hypothermia prevention was employed on 244 of 339 casualties (72%) and 58 (17.1%) had their TCCC card turned in. The primary limitations include the nature of enrollment being a convenience sample and the descriptive nature of the study.

CONCLUSION: This represents the largest collection of prehospital interventions performed during the resuscitation of casualties in a combat zone.





Problem

- We do not accurately capture Life saving interventions performed in combat
- We cannot improve on performance of LSIs by medics

Objective

To describe pre-hospital interventions performed during the resuscitation of casualties in a combat zone

Methods

- We performed a prospective observational study recording:
 Mechanism of injury (MOI)
 - Airway interventions to include:
 - Application of nasal/oral airway
 - Endotracheal intubation
 - Cricothyroidotomy

Methods

Chest Interventions to include:

- Chest needle decompression
- · Chest tube placement
- Chest seal application
- Hemorrhage Interventions to include:
 - Tourniquet application
 - Use of pressure packing with/without hemostatic agent
 - Implementation of hypotensive resuscitation.



In 2010 we added: Vascular access Fluid administration

Fluid administration Hypothermia prevention Use of TCCC card

) Methods

 The enrolling provider determined if an intervention was not performed that was necessary (missed LSI)

 All data was reported in a descriptive manner

Enrolling LSI Sites

Included:

- Bagram AB
- FOB Shank
- FOB Ghazni
- Kandahar
- Dwyer
- Salerno

Results

- 652 patients met inclusion criteria
- Mean age was 25 yrs (SD 8)
- 97.4% were male

Results

The MOI was:

- Explosion in 413 (63%)
- Penetrating in 138 (21%)
- Blunt in 101 (16%)

💮 Airway

39 casualties underwent an airway intervention (6.0%)

- Nasal/Oral Airway 10 (1.5%) casualties
- Intubation 14 (2.2%) casualties 13 ETT
 - 1 King LT
- Cricothyroidotomy 15 (2.3%) casualties

🕤 Airway

34 (5.2%) missed LSIs were identified by the receiving facility provider

Chest Intervention

30 received chest intervention (4.6%):

- Chest needle decompression 11
 (1.7%) casualties
- Chest tube 7 (1.1%) casualties
- Chest seal 12 (1.8%) casualties

Chest Intervention

11 (1.7%) missed LSIs were identified by the receiving facility provider

Hemorrhage Control

369 (13.3%) underwent a hemorrhage control intervention

- Tourniquet 95 tourniquets in 87 (13.3%) casualties
- Pressure packing (non-hemostatic agent) 262 (40%) casualties
- Pressure packing (with hemostatic agent) 20 (3%) casualties

Hemorrhage Control

21 (3.2%) missed LSIs were identified by the receiving facility provider

Hypotensive Resuscitation

- Hypotensive resuscitation 25 or 3.8% of casualties
- 8 (1.2%) patients were identified by the receiving provider who should have had hypotensive resuscitation implemented in the field

Resuscitation

Vascular access was obtained in 206 of 339 casualties (60.8%) 195 IVs placed 16 IOs placed

79 (23.3%) missed LSIs were identified by the receiving facility provider

Resuscitation

152 casualties out of 339 received fluids in the pre-hospital setting: 111 received NS (73%) 30 received LR (19.7%) 16 received Colloids (10.5%) 2 Other

Hypothermia Prevention

244 out of 339 or 72%:

211 had a blanket 29 had a space blanket 6 – HPMK 2 – body bag 1 – unknown



The TCCC card was turned in with 58 out of 339 casualties (17%)

147 out of 652 had prehospital vitals signs, (22.5%) casualties

Climitations

Convenience sample Not knowing who performed the LSI Data collection during resuscitations Descriptive study



Largest study of pre-hospital interventions performed during resuscitation of combat casualties

Most common – airway, hemorrhage control, fluid resuscitation, and hypothermia treatments

Highest miss rates – fluid resuscitation, hypothermia prevention, TCCC card use, and prehospital vital signs

Factors Associated with US Military Died Of Wounds Rate in Iraq and Afghanistan

USAIR

CPT Shimul Patel

BACKGROUND: Died of wounds (DOW) rates are cited as a measure of combat casualty care effectiveness but do not account for patterns of trauma or battlefield lethality. The objective of this study is to identify injury patterns, injury severity, and mechanism of injuries that prevail in months of higher DOW rates.

Methods: Highest (HDOW) and lowest (LDOW) monthly DOW rates from 2004-2008 were identified from Department of Defense casualty databases and used to direct a search of the Joint Theater Trauma Registry. Casualties from HDOW and LDOW were combined into cohorts and injury data analyzed and compared.

RESULTS: HDOW rates were 13.4%, 11.6% and 12.8% [mean=12.6%]; LDOW rates were 1.3%, 2.0% and 2.7% [mean=2.0%] (p< .0001). HDOW (n=541) and LDOW (n=349) groups sustained 1,154 wounds (head-24%, chest-12%, abdomen-10%, extremities-37%). Overall injury severity score (ISS) was greater in HDOW than LDOW (11.1 \pm 0.53 vs. 9.4 \pm 0.58; p=0.03), as were casualties with ISS >25 (HDOW: 12% vs. LDOW: 7.7%; p=.04). Excluding minor injuries (AIS=1), HDOW had a greater percentage of chest cell injuries than LDOW (16.5% vs. 11.2%, p=.03). Improvised explosive devices were more common causes of injury in HDOW (58.7% vs. 49.7%; p=0.007) which also had a greater proportion of Marine Corps service affiliation casualties (p=0.02).

CONCLUSIONS: This study provides novel data demonstrating variations in died of wounds rates. Discernable differences in injury severity and wounding patterns are associated with large differences in DOW rates. Fluctuations in DOW rates may be more a reflection of enemy activity than a gauge of combat casualty care.





Disclaimer

The viewpoints expressed in this manuscript are those of the authors and do not reflect the official position of the United States Department of Defense or the United Kingdom's **Defence Medical Service**




| USA Institute of Surgical Research / | Joint Battlefield Health & Trauma Institute |
|--|---|
| Epidemiology of | UKNCTH |
| UK JTTR: 2001 to 2011 | |
| _ | |
| UK JTTR: 2001 to 2011 All UK Combat Wounded • KIA: 375 • DOW: 64 • WIA: 1374 | Casualty Fatality Rate: 24.2% |
| ↓ | |
| UK JTTR: 2001 to 2011 All UK NCTH • KIA: 173 • DOW: 21 • WIA: 40 | Casualty Fatality Rate: 82.9% |



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Demographic and Injury Score Data

| | | KIA | DOW | WIA | p value |
|--------------|---------------------------------|----------------|----------------|--------------|---------|
| | Number | 173 | 21 | 40 | |
| | Male (%) | 170 (98%) | 21 (100%) | 40 (100%) | 0.488 |
| | $\mathbf{Age} \pm \mathbf{SD}$ | 26.1 ± 6.3 | 25.1 ± 6.1 | 25.3 ± 6.0 | 0.630 |
| Mechanism of | Blast | 131 (76%) | 16 (76%) | 31 (78%) | 0.972 |
| Injury | GSW | 42 (24%) | 5 (24%) | 9 (22%) | |
| | $\mathbf{NISS} \pm \mathbf{SD}$ | 71 ± 9 | 62 ± 13 | 42 ± 17 | < 0.001 |
| | $ISS \pm SD$ | 65 ± 16 | 49 ± 17 | 31 ± 11 | < 0.001 |











- A significant proportion of both KIA and DOW are a result of Torso Vascular Disruption in these zones
- Clinically most meaningful when a physiological or procedural filtered added
- This cohort forms the basis of a future study group to improve the management of Non-Compressible Torso Hemorrhage

USA Institute of Surgical Research / Joint Battlefield Health & Trauma Institute Remember this Patient?





Questions please

Critical Care Air Transport Team (CCATT) short term outcomes of casualties with spinal fractures moved with the Vacuum Spine Board between 2009 and 2010

59 MDW

Lt Col Vikhyat Bebarta, MD

OBJECTIVE: To describe the outcome of patients managed by CCATT with the Vacuum Spine Board (VSB) to stabilize unstable spine fractures between July 2009 and June 2010. METHODS: We performed a retrospective chart review evaluating short term events/outcomes of casualties transported on the VSB by CCATT. Complications and the Injury Severity Score (ISS) were obtained from the Joint Theater Trauma Registry (JTTR). All data was reported in a descriptive manner. RESULTS: 73 patients met the inclusion criteria, resulting in 107 patient moves. The MOI was explosion in 48 (65.8%), blunt in 22 (30.1%) and penetrating in 3 (4.1%). The mean ISS was 23.5 (SD 13.4). 64 patients were ventilated (59.8%), 10 received vasoactive medications (9.4%), and 13 received blood products (12.2%). Regarding complications: 10 had skin breakdown associated with the VSB (9.3%) and there were 2 cases of neurological deterioration which were attributed to progression of the original neurological insult (1.9%). There were 3 episodes of transient desaturation (2.8%) and 13 of transient hypotension (12.2%). We did not encounter any deaths, loss of airway or chest tubes. The primary limitations include the retrospective and descriptive nature of the study as well as the small number of casualties studied.

CONCLUSION: The VSB was successfully used to stabilize spine injuries during transport. We did note a skin breakdown rate of 9.3%. A risk/benefit assessment must be performed before deciding to use the VSB to transport casualties with spine injuries.













Continuous Noninvasive monitoring and the Development of Predictive Triage Indices for Outcome Following Trauma

711 HPW/USAFSAM-ETS

Dr. Colin Mackenzie

BACKGROUND: Expeditionary military triage uses basic vital signs of mental state, heart rate, and perfusion pulse pressure. Technological progress allows collection of increasing amounts of patient physiologic data that may be used to provide continuous monitoring of triage parameters. HYPOTHESIS: Continuous noninvasive vital signs data collected in the first hour of trauma patient resuscitation predict resuscitation requirements and identify necessity for major life saving interventions (LSIs) and 48-hr patient outcomes. Critically abnormal values ("No-Fly" decision-makers/triage tool) can be determined for several different variables derived from the photoplethysmographic (PPG) waveform and from absolute values of pulse oximetry data for injured patients by application of signal processing. SPECIFIC AIMS AND STUDY DESIGN: Employ continuous noninvasive vital signs data (pulse oximetry, blood pressure, electrocardiogram, and respiration) collected in trauma patients during their initial 1 hr of resuscitation after admission and assess sensitivity, specificity, and predictive value in predicting LSIs within 24 hr of admission. Calculate surrogate measures of perfusion (perfusion index, pulsatility, variability, pleth variability index, and O2 delivery index) and derive trends and absolute values of total hemoglobin [Hb] from PPG waveforms. Compare bleeding diagnoses, shock, and fluid resuscitation needs identified by these surrogate values to predictions obtained from invasive measures of pulse oximeter and other vital signs signals, injury severity score, and revised trauma score predictions of outcome. Compare analyses based on trends of vital signs data versus those based on analyses of continuous waveforms.





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- Prediction and trending of events actionable with intervention: including hypoxemia, hemorrhagic shock, need for blood transfusion, chest decompression, airway management and other life-saving interventions (LSIs), and abdominal surgery to control hemorrhage
- 3. Usability across the echelons of trauma care, with different providers and environments
- 4. Easy start, with no calibration, minimal warm-up, limited maintenance required, and limited operator training
- Overall status of multiple physiological systems vital to survival from trauma, with several alternative potential sensor monitoring sites

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Emerging pulse oximetry technologies now provide the ability to continuously monitor

- 1. Hemoglobin concentration (Hb) as a marker for hemorrhage
- 2. Oxygen saturation (SpO2) to identify hypoxemia
- Photoplethysmographic (PPG) waveforms to permit calculation of a peripheral perfusion index (PI) that serves as a marker for hypoperfusion by subtraction of pulsatile from nonpulsatile oximetry signals
- 4. Pleth variability index (PVI) to assess volume status
- Oxygen transport index (a combination with Hb, SpO2, and PPG waveform analyses)
- waveform analyses) 6. Carboxyhemoglobin (COHb) as a tool to detect exposure to in-flight
- carboxynemoglobin (comb) as a closi to betect exposure to in-lingit carbox monoxide for both casualties and flight crew
 Methemoglobinemia (MetHb) to detect exposure to burning plastics by
- real-time co-oximetry
- 8. Respiratory rate, by acoustic and respiratory-induced variation PPG signal processing

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Task 2: Purpose and Product

- The purpose of Task 2 is to predict the ABCs (airway, breathing, circulation) of resuscitation from analysis of pulse oximeter PPG and other vital signs signals. The prediction algorithms will be tested, including PPG waveforms and their derived variables, before and after algorithms have been modified by systematically changing parameters to maximize predictions while minimizing false positives.
- The product of Task 2 will be features of PPG waveforms and other vital signs identifying the need for the ABCs and other LSI resuscitation interventions.

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Project Task 3: Purpose and Initial Development

- Task 3: Testing the PPG algorithmic prediction of blood transfusion, LSIs, and 48-h outcome will be validated in live clinical settings. The purpose of Task 3 is to provide "ground truth" measures of prediction performance and potential impact on clinical practice.
- During initial development Task 3, the decision support system will be displayed to the clinicians (including U.S. Air Force (USAF) personnel with combat experience) to obtain questionnaire evaluation feedback as different approaches are tested.

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- Algorithms predicting the need for LSIs (tracheal intubation, crystalloid resuscitation, chest tube insertion, abdominal surgery, within 3, 6, 12, and 24 h of Shock Trauma Center admission).
- Identification of critically abnormal values of vital signs and pulse oximetry data (No Fly decision makers).

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20

and consultants
• Interim and Final Reports to USAF

· Publications: Abstracts, presentations, papers

as a result of the data gathering and analyses

· Meeting Reports: With clinicians, investigators,

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Center resuscitation

116



Efficacy and Safety of Frozen Blood for Transfusion in Trauma Patients, A Multicenter Trial

711 HPW/USAFSAM-ETS

Ms. Samantha Underwood

BACKGROUND: Blood transfusion is one of the most commonly utilized life saving therapies in combat casualty care. Blood stored up to 42 days develops a "storage lesion" that may impair organ perfusion. Transfusion is associated with increases in multiorgan failure and mortality. Our laboratory has shown that older blood (ORBC) causes decreased tissue oxygenation (StO2). Cryopreserved blood (FRBC) is prepared from 2- to 6-day-old blood and allows for longer storage periods, and the process of deglycerolizing and washing FRBC after thawing appears to remove cells with abnormal morphology and pro-inflammatory mediators. The effects of FRBC on perfusion, biochemical changes, inflammatory changes, and clinical outcomes in recipients have not been studied. HYPOTHESIS: We hypothesize that transfusion of FRBC will be superior to transfusion of ORBC with respect to physiologic, biochemical, and clinical parameters but will not be inferior to transfusion of younger red blood cells (YRBC) with respect to the same parameters. STUDY DESIGN: We will prospectively study 288 trauma patients requiring a blood transfusion at six Level 1 trauma centers over a 1-yr period. Subjects will be randomized to receive FRBC, YRBC (≤ 14 days storage), or ORBC (>14 days storage). StO2 will be measured using a noninvasive near-infrared spectroscopy probe to determine whether ORBC causes a decrease in StO2 compared to YRBC and FRBC. Additionally, mediators of the storage lesion, inflammatory parameters, and clinical outcomes will be evaluated and compared between the three groups and correlated with changes in tissue perfusion. This study will be completed in 2 yr.







| Preliminary Study | StO ₂ Monitoring |
|--|--|
| Hypothesis – Patients who received older blood would achieve less of an increase in StO ₂ than patients who received younger blood. | Probe placed on thenar eminence Before, during, and up to 4 h following transfusion Controls for 8 h |
| TRADUMA Dictorious Statement A Approval for posite messary aptrophon is unimmed; Cose Number 884894-2011-5830; 16 JU 2011 | Encland and a second of policy relation addition is unimited; Case Number: 65489-2011-3550, 16 Jul 2011 |





| AICU OI | nuer the | e Curve (| AUCJ | Cryopreserved Blood |
|--------------------------------------|----------------------|------------------------------------|------------------------------------|---|
| | | | | Stored at -80 °C Up to 10 yr |
| | Controls (n = 15) | Old Blood ≥ 21 days (n = 17) | New Blood < 21 days (n = 15) | Thawing and deglycerolization required |
| Pre-transfusion AUC | 5341 ± 366 | 5205 ± 590 | 5184 ± 563 | Decreased metabolic changes |
| Transfusion AUC | 5381 ± 333 | $4885 \pm 615^*$ | 5200 ± 510 | Inflammatory substances removed |
| Post-transfusion AUC | NA | 5014 ± 674* | 5210 ± 374 | innanniatory substances removed |
| *Mean ± standard deviati p < 0.05 | ion | | | |











Sponsored by 711th Human Performance Wing, Air Force Research Laboratory, under agreement number FA8650-09-2-6035 and FA8650-10-2-6143

TRAUMA

Women's Health and Illness Behaviors in the Deployed Setting

59 CSPG/SGVUS

Lt Col Candy Wilson

Military women are regularly deployed to austere settings for war and humanitarian missions. The deployed population consists of 10% women. Women's sex-specific health care needs pose a special challenge for women and health care providers in an austere or ship setting where anonymity cannot be guaranteed, self-care supplies are limited, and health care professionals' lack confidence to care for private gynecological concerns. The purpose of this study was to gain a better understanding of the illness behaviors of deployed military women in regards to their genitourinary (GU) health. Ethnography was used to explore and analyze the data because the military has been described as its own culture. The sample consisted of 43 military women from the US Army, Air Force, and Navy who were either deployed or had been deployed within the past year. The researchers uncovered three themes, which included (1) The Sphere of Control, (2) The Dynamics of Trust, and (3) Life in a Deployed Setting. This study is significant to nursing research because it exposes the influence of culture on GU symptom management. Recommendations from this investigation include: (1) a need for better incremental, pre deployment and in theater education for women and medics; (2) informing leaders about the need to ensure the supply of self-care treatments and women's feminine hygiene products are available; and (3) promoting the role of family support stateside as a resource for information, supplies, and emotional support. This study was funded by the TriService Nursing Research Program (N08-P03).



Let Me Tell You Sister: Seeking Women's Health Care in Deployed Settings

> Candy Wilson, Lt Col, USAF, NC PhD, APRN Women's Health Nurse Practitioner

Disclaimer

- The views and opinions of this presentation are of the author and do not represent the position of the United States Air Force, Department of Defense, or the United States government.
- The author reports no conflicts of interest.

Acknowledgements

• This study was funded by the TriService Nursing Research Program (TSNRP). N08-P03.

Purpose of Study

- The purpose of this study was to gain a better understanding of the illness behaviors of military women in regards to their genitourinary (GU) health during their deployment.
- Illness behavior is the perception of bodily changes and interpretation of the symptoms as illness or variations of wellness (Mechanic, 1986; McHugh & Vallis, 1986).

Background

• Military women

- Make up 10% of the deployed population
- Work in non-traditional roles that have few female peers and mentors
- Forward deployed with limited or no gynecologic provider
- Mostly child-bearing age

Previous Work

- Wilson (2006) conducted secondary analysis of data gathered from previous study
 - 497 military women
 - Self-treated for symptoms less while deployed
 - Sought care more in the most austere conditions
 - When choosing to seek health care:
 Women living on a ship experienced greater embarrassment
 - Women living in tent experienced more job constraints

Design and Methods

- Ethnography was used to explore and analyze the data
 - Ethnography has anthropological roots that uncover cultural norms
 - The military is described as a unique culture
 - Illness behaviors also can include the validation from others about the symptoms perceived

Data Gathering

- Unstructured interviews were transcribed and coded
 - Interviews lasted approximately 45 minutes at a location that was mutually convenient and private
 - PI and mentor coded transcripts
- Observations were documented with researchers' field notes
- Deployed researcher's diary



- A purposive sample of military women were sought for their deployed experiences
- Women from all branches, rank, ethnicity, and marital status
- Two-phased recruitment
 - Flyer advertisement
 - Snowball sampling

Inclusion/Exclusion Criteria

- Inclusion criteria:
 - Any female military member 18 years and older.
 - Been deployed less than one year ago or currently deployed.
 - Managed GU symptoms while deployed
 - Did not have to be diagnosed by a health care provider
 Symptoms were typically related to UTI or vaginitis /vaginosis
- Exclusion criteria:
 - Deployed greater than one year ago

| | emograph | | |
|--------------------------|--|--|--|
| Demographic | N = 43 women (Withdrawal = 1) | | |
| Age | Range 20-49 (mean 30, median 27) | | |
| Rank | Junior enlisted = 7 NCO = 22 Senior NCO = 3 | CGO = 5 FGO = 3 <i>Missing = 2</i> | |
| Race/Ethnicity | White = 19 Black = 14 | Hispanic = 5 Other = 5 | |
| Marital Status | Never married = 9 Significant other = 2 Marrie d 25 | | |
| Number of Children | Range 0 - 5 (mean = 1, median = 1, missing = 4) | | |
| Number of times deployed | Range 1-5 (mean = 2, median = 1, missing = 4) | | |

Findings

- Three themes were uncovered:
 - Life in the Deployed Setting
 - The Sphere of Control
 - The Dynamics of Trust



- Laundry
- Limited hygiene supplies or OTC medications at the exchange
- Job requirements
- Toilet Facilities
 - It's filthy. There's just nasty trash thrown everywhere. The sinks are covered in God knows what. People would blow their nose in the sink.

Life in the Deployed Setting

- Uniforms
- Weather
- Showers
 - You just went in and took your 3 minute combat shower and when it was winter time the water was freezing and in the summer time, the water is burning. You never really felt like you got clean over there because the second you get out of the shower, you're sweating again.

Sphere of Control



Sphere of Control

- Women's ability to control the environment in which they were assigned.
- Creative management to maintain control was a priority in their daily activities.
- Control over genitourinary symptoms was believed to be important in order to preserve future fertility and this control was not to be taken for granted

Sphere of Control

Menstruation management

- "...you're with a bunch of guys and you're out on a mission for like eight hours and I can pee in a bottle like this guy, but I can't change a tampon".
- Internet ordering
 - "She just told us, woman to woman, [about Internet ordering]. She just gave us the 411".

Dynamics of Trust

Trust in Self

- Appraisal of symptoms
- Know when to self-treat
- Know when to seek medical care
 - "[The medications] cleared up my infections for maybe a month. I don't even know if that long. But it came back, but by that time, I was just kind of like....whatever. I can take more, [or I can take] pro-biotic yogurt. I mean I just kind of started looking for things on my own."

Dynamics of Trust

Trust in Family

- Information
 - "And if [my grandmother] didn't know about it, she'd look it up while I was on the phone".
- Supplies
 - "So he can go out and know he's taking care of me by getting these things together...so he can participate in [the deployment]
- Support
 - "Your family back home is the biggest thing here. And I don't think they realize that, but they really are like the biggest help".

Dynamics of Trust

- Trust in providers
 - Expertise
 - "He asked me what I thought it was...well, heh! I guess I am a doctor"
 - Resources

Dynamics of Trust

Trust in System

- Have supplies to appropriately diagnose and treat symptoms
- Prepare women for deployment
 - "More briefings, I guess...some kind of encouragement for girls to talk".

Discussion



Discussion

- The deployed setting is unpredictable
- The support of others is important to overcome obstacles and limitations
- The role of the family cannot be emphasized enough

Limitations

- Not all interviews were collected in theater
- No Marine women were included in the study

Recommendations

- Prepare women before deployment
 - If they have a gynecologic history to bring supplies
 - Internet ordering
 - Bring hygiene supplies
- Tell women to prepare the family
 - Include the family during the predeployment preparation, especially female family members or husband

Future Research

- Study in progress to interview medics about their perception of women's illness behaviors
- Study in progress to evaluate the use of a Expedient GU Self-diagnosis kit
- Mentor program (similar to a sponsor program)
- Website specific for deployed women to ask about medical care, available to the family

Thank You



