Running a Military Training Center (C-STARS) at Shock Trauma: Integrating Providers into a Civilian Trauma System

Thomas M. Scalea, MD
C-STARS

- Started with a conversation in a small conference room with Ty Putnam
- It sounded like a good idea
- I had to convince the Dean
- Original concept was only readiness training
- Each iteration has become more sophisticated
Military-Civilian Trauma Partnerships: *Together improving care on the battlefield and at home*

**Thomas M. Scalea, M.D.**

The Honorable Francis X. Kelly Distinguished Professor in Trauma  
Director, Program in Trauma  
University of Maryland School of Medicine  
Physician-in-Chief, R Adams Cowley Shock Trauma Center  
Adjunct Faculty, US Air Force School of Aerospace Medicine
The Landstuhl “Prism”

Input: Chaotic, complex compilation of nationalities, diagnoses, medical records and damage control care processes from combat theaters.

Output: Stable patients following a consistent CPG-guided evaluation and with a complete and organized medical record who are evacuated to facilities throughout the world.
Military/Civilian Interfaces

- It turns out there are far more similarities than there are differences
- Shock is shock. In many ways, it does not matter where or how it occurs
- The principles of trauma care are constant
- We should be able to make this work
- Once one decides the goal, it is just then tactics
- We were lucky because we built on an already strong relationship with the US military
Unique Military Clinical Experience

There is a golden hour between life and death. If you are critically injured you have less than 60 minutes to survive. You might not die right then; it may be three days or two weeks later -- but something has happened in your body that is irreparable.“

-- R Adams Cowley
Dr. Cowley’s research of shock initiated with a $100K grant from the US Army.

In 1963, US Army Funded Research. Cowley received $800K to build the Center for the Study of Trauma (2- then 4-bed “death lab”).

After much discussion with the Maryland State Police, the rotary wing med-evac transport occurred in 1969 after the opening of the now five-story, 32-bed Center for the Study of Trauma.

In 1973, the Governor Marvin Mandel issued an executive order establishing the Center for the Study of Trauma as the Maryland Institute for Emergency Medicine.
Baltimore C-STARS

- Ten months per year
- 30 participants per month
- 16 years
- Over 5,000 Air Force men and women trained
- When one considers the number of casualties they have treated, I realize the magnitude of effect the program has had is enormous
C-STARs

- We added Anesthesiologists and CRNA’s
- We added Orthopedics
- We had an oral surgeon
- We debated having a military team with the rotators and rejected it
- As the war intensified, deployments became the norm
C-STARS

- I had great partners
- We imbedded permanent people. They were “permanent”
- They worked for me and the USAF
- Nurses and technicians fit in beautifully
- They worked shifts
- Everyone needs another nurse or scrub tech
- The surgeons were more problematic. Some were not interested. Others thought that they already knew it
Overview

What does C-STARS Baltimore bring to the AFMS?

- Pre-deployment trauma training
  - Provider Programs
  - Nursing Program
  - Technician Program
  - AFSOC & IDMT Program
- Deployment ready trauma/critical care assets
- Unique clinical opportunities
- DoD-focused research
Afghanistan

International Security Assistance Force
Regional Commands, Major Units, Provincial Reconstruction Teams

14 December 2010
The Evolution of C-STARS

- The ability to make the program mutually beneficial has really kept it alive
- We realized that if we all got smarter, then more military personnel and civilians would live
- The overlap provided great synergism
- It stopped just being about trauma and expanded to a number of innovative approaches to complex disease
- The Air Force won
- Shock Trauma won
- The patients won
- The system won
- Everybody won
A clinical series of Resuscitative Endovascular Balloon Occlusion of the aorta for trauma: a military-civilian collaboration in hemorrhage control

<table>
<thead>
<tr>
<th>Patient</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>24</td>
<td>59</td>
<td>25</td>
<td>40</td>
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<td>M</td>
<td>M</td>
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<td>F</td>
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<tr>
<td>Mechanism of injury</td>
<td>MVC</td>
<td>GSW</td>
<td>GSW</td>
<td>MVC</td>
<td>MCC</td>
<td>ATV collision</td>
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<tr>
<td>Injury Severity Score</td>
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<td>50</td>
<td>9</td>
<td>25</td>
<td>48</td>
<td>43</td>
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<td>Systolic Blood Pressure (SBP) prior to REBOA (mm Hg)</td>
<td>70</td>
<td>70</td>
<td>0</td>
<td>60</td>
<td>70</td>
<td>85</td>
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<tr>
<td>Cardiac arrest prior to REBOA</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>no</td>
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<td>SBP after REBOA (mmHg)</td>
<td>135</td>
<td>122</td>
<td>100</td>
<td>110</td>
<td>130</td>
<td>125</td>
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<tr>
<td>Time to occlusion (mins)</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
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<tr>
<td>Time of occlusion (mins)</td>
<td>12</td>
<td>16</td>
<td>70</td>
<td>60</td>
<td>65</td>
<td>36</td>
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<td>Surgery after REBOA</td>
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<td>Embolization after REBOA</td>
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<td>yes</td>
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<td>Complication of REBOA</td>
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<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
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<tr>
<td>Outcome</td>
<td>Alive</td>
<td>Alive</td>
<td>Alive</td>
<td>Alive</td>
<td>Brain death</td>
<td>Death (Care withdrawn)</td>
</tr>
</tbody>
</table>

Brenner et al 2013
Patients & Course of Resuscitation

- 4 REBOAs in an austere environment over two months
  - Torso gunshot or fragmentation wounds
  - Hemoperitoneum
  - Class IV shock
- Hand-held ultrasound used to guide femoral artery placement of 7Fr sheath
- ER-REBOA™ catheter positioning without x-ray
  - Zone I (N= 3)
  - Zone 3 (N=1)
Patient & Course of Resuscitation

- In all 4 cases REBOA use facilitated:
  - Normalization of SBP
  - Rapid sequence intubation / anesthesia
  - Initiation of whole blood transfusion
  - Damage control laparotomy
  - Attainment of surgical hemostasis
  - Inflation time range: 18-60 minutes
Unique Clinical Opportunities
Desperate ECMO treatment used at Bagram to breathe life into NATO ally

By Tech. Sgt. Nicholas Rau, 455th Expeditionary Wing Public Affairs / Published February 19, 2016

A 455th Expeditionary Medical Group team prepares to load a NATO ally, who required Extracorporeal Membrane Oxygenation team support, onto an aeromedical evacuation transport at Bagram Air Field, Afghanistan, on Feb. 18, 2016. The ECMO team, dispatched from San Antonio Military Medical Center, uses technology that bypasses the lungs and infuses the blood directly with oxygen, while removing the harmful carbon dioxide from the bloodstream. The patient was airifted to Landstuhl Regional Medical Center, Germany, where he will receive 7 to 14 days of additional ECMO treatment.

(U.S. Air Force photo by Tech. Sgt. Nicholas Rau)

PRINT | E-MAIL

BAGRAM AIR FIELD, Afghanistan -- A specialized team dispatched from San Antonio Military Medical Center combined efforts with the 455th Expeditionary Medical Group to perform a just-in-time treatment on Feb. 18 in order to save the life of a NATO partner.
# The Need for ECMO

## Wartime Experience

### Western Trauma Association 2012 Plenary Paper

Transportable extracorporeal lung support for rescue of severe respiratory failure in combat casualties

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (yrs)</th>
<th>Injury</th>
<th>ECLS Device</th>
<th>ECLS Duration (days)</th>
<th>Outcome</th>
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<tr>
<td>1</td>
<td>24</td>
<td>blast injury, bilateral lower limb traumatic amputations</td>
<td>PECLA</td>
<td>12</td>
<td>survived</td>
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<td>2</td>
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<td>blast injury, brain injury</td>
<td>PECLA</td>
<td>8</td>
<td>survived</td>
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<tr>
<td>3</td>
<td>33</td>
<td>blast injury</td>
<td>PECLA</td>
<td>9</td>
<td>died</td>
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<tr>
<td>4</td>
<td>23</td>
<td>blast injury, brain injury</td>
<td>PECLA</td>
<td>8</td>
<td>survived</td>
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<tr>
<td>5</td>
<td>19</td>
<td>gunshot, pneumonectomy</td>
<td>PECLA</td>
<td>18</td>
<td>survived</td>
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<tr>
<td>6</td>
<td>20</td>
<td>motor vehicle collision, spinal cord injury</td>
<td>ECMO</td>
<td>7</td>
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<tr>
<td>7</td>
<td>29</td>
<td>blast injury, brain injury</td>
<td>ECMO</td>
<td>8</td>
<td>survived</td>
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<tr>
<td>8</td>
<td>25</td>
<td>gunshot</td>
<td>ECMO</td>
<td>7</td>
<td>survived</td>
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<tr>
<td>9</td>
<td>22</td>
<td>gunshot, pneumonectomy</td>
<td>ECMO</td>
<td>13</td>
<td>survived</td>
</tr>
<tr>
<td>10</td>
<td>21</td>
<td>gunshot</td>
<td>ECMO</td>
<td>6</td>
<td>survived</td>
</tr>
</tbody>
</table>
Lung Resuscitation Unit

- **2014** (opened 8/4/14)
  - 11 respiratory failure
    - 64% survival to discharge
  - 4 trauma
    - 25% survival to discharge
  - 2 pre lung transplant
    - None transplanted

- **2015**
  - 39 respiratory failure
    - 67% survival to discharge
  - 8 Trauma
    - 75% survival to discharge
  - 4 pre lung transplant
    - 50% transplanted

- **2016**
  - 63 respiratory failure
    - 84% survival to discharge
  - 10 Trauma
    - 80% survival to discharge
  - 5 pre lung transplant
    - 100% transplanted

- **2017**
  - 15 respiratory failure
    - 6 discharged alive
    - 4 died
    - 5 currently on ECMO
  - 4 Trauma
    - 2 died
    - 2 remain in hospital off ECMO
  - 3 pre lung transplant
    - 1 transplanted
    - 2 remain on ECMO
Critical Care Resuscitation Unit

- 64.5% increase in critical care transfers
- 93.6% increase in critically ill surgical transfers
- 22.6% reduction in lost admissions
- Significant reduction in time to patient arrival
- Accomplished this with a 3.9% increase in total adult ICU bed capacity
MEDICS IN MAYHEM
Air Force medical professionals train in civilian trauma unit
by TSgt Matthew Bates
29 June 2012

http://airman.dodlive.mil/2012/06/medics-in-mayhem/
Telemedicine-Critical Care

News & Events

DR. THOMAS SCALEA APPOINTED SYSTEM CHIEF FOR
CRITICAL CARE SERVICES FOR THE UNIVERSITY OF
MARYLAND MEDICAL SYSTEM

Friday, January 20, 2012

Thomas Scalea, MD has been appointed to the position of System Chief for Critical Care Services at the University of Maryland Medical System.

Since 1997, Dr. Scalea has served as the Physician-in-Chief at the University of Maryland R Adams Cowley Shock Trauma Center, and is also the Francis X. Kelly Professor of Trauma and director of the Program in Trauma at the University of Maryland School of Medicine. Dr. Scalea has been highly successful in developing a multidisciplinary collaborative group practice at the Shock Trauma Center, linking all of the constituents necessary to provide high quality care and continue to grow the services at the Shock Trauma Center despite significant limitations and resources.

Potential for remote monitoring not only patients in deployed facilities but also casualties en route
## DoD-Funded Research

<table>
<thead>
<tr>
<th>Principal Investigator(s)</th>
<th>Fin. Award Title</th>
<th>TOTAL</th>
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<tr>
<td>Brenner/Fang</td>
<td>Clinical Study of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for Severe Pelvic Fracture and Intra-abdominal Hemorrhagic Shock using Continuous Vital Signs</td>
<td>455,776.00</td>
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<td>Facien</td>
<td>Hypobaria Exposure Timing after TBI: Targeted Modulation to Improve Outcomes</td>
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<td>Facien</td>
<td>Biomarkers and Treatment of Hypobaria-Exacerbated Traumatic Brain Injury</td>
<td>824,999.97</td>
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<td>Fiskum</td>
<td>Prolongation of Platelet Storage Time by Protection against Mitochondrial Energy Failure</td>
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<td>Fiskum</td>
<td>(Polytrauma) Effects of Hypobaria on Brain Injury and Mortality Following Head Trauma Combined with Hemorrhagic Shock</td>
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<td>Fiskum</td>
<td>Effect of Hypobaria during Septic Onset: Survival, Encephalopathy, and Energy Metabolism</td>
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<td>Fiskum</td>
<td>MRI and Neuropsychologic Measurements during Exposure to Hypobaria after Experimental TBI</td>
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<td>Fiskum/Miller/Fang</td>
<td>Exacerbation of Traumatic Brain Injury by Psychological Stress, Hypobaria and Hemocytodinemia</td>
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<td>Galvagno</td>
<td>Prehospital Testing to Detect Shock and Predict Need for Life-Saving Interventions (LSIs) and Clinical Course</td>
<td>763,343.00</td>
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<td>Grissom</td>
<td>Performance of Manual Ventilation by Airforce Medics</td>
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<td>Grissom</td>
<td>Evaluation of Handoff outcomes in a multi-site continuum</td>
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<td>Hu/Miller</td>
<td>ONSIGHT-4 - Validation of Automated Prediction of Blood Product Needs Algorithm Processing Continuous Non-Invasive Vital Signs Streams</td>
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<td>Hu/Miller</td>
<td>Developing Reliable Telemedicine Platforms with Unreliable &amp; Limited Communication Bandwidth (Optimal TeleMed)</td>
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<td>Hu/Miller</td>
<td>Validation of Prototype Continuous/Real-Time Vital Signs Video Analytics Monitoring System &quot;CCATT-Viewer&quot;</td>
<td>226,179.00</td>
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<td>Hu/Miller</td>
<td>ONSIGHT-3 - Validation of Automated Prediction of Blood Products, Critical Care, and Emergency Surgery Using Continuous Prehospital Non-Invasive Vital Signs Streams</td>
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<td>Kazai</td>
<td>Effect of Hypobaria after Polytrauma on Gut Function and its Microbiota</td>
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<td>Scalesa</td>
<td>Physiologic Response to Prolonged Resuscitative Endovascular Balloon Occlusion of the Thoracic Aorta in Swine</td>
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<td>Stein/Tang</td>
<td>&quot;Hit to Fly&quot; Biomarkers after TBI</td>
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<td>Stein/Fang</td>
<td>(Dual ICP) Assessing the Accuracy and the Impact of Standard-Practice Ventricular Drainage on Intracranial Pressure Measurements Following Traumatic Brain Injury</td>
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<td>Stein/Hu</td>
<td>Transport Assessment for Critical Traumatic Injuries Calculator (TACTICAL)</td>
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<td>Stein/Pasley</td>
<td>The Use of Acupuncture in Potentiating Functional Recovery in Spinal Cord Injury Subjects</td>
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<td>Choae</td>
<td>Extracellular RNA: Novel Biomarker and Potential Therapeutic Target in Trauma</td>
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### Office of Naval Research Grants

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<td>07/30/2008 - 03/21/2010</td>
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<td>11/20/2006 - 12/30/2007</td>
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<td>11/28/2005 - 03/31/2007</td>
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<td>N00014-01-1-1014</td>
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**TOTAL:** $13,031,131
Pre-Injury

Post-Injury

Post-Transplant
C-STARS

- Tyler Putnum
- William Beninati
- Thomas Grissom
- Sidney Brevard
- David Powers
- Raymond Fang
- Terrence Lonergan
- Joseph DuBose
Challenges

- The first problem was that we could not bill for services provided by military physicians. We simply changed the law.
- Military long term is short term in civilian practice.
- Military providers displace civilian providers who may need the work and certainly need the RVU’s.
- There can be significant differences in the goals of various military providers.
- The military reserves the right to change its mind at a moment’s notice.
- Deployments are a certainty. The only question is who and when.
- When deployments occur in bunches, the workforce shrinks considerably.
Our Nation’s Duty to Our Wounded Heroes
SUMMARY

- We did it because it was the right thing to do and I love being first
- We continue to do it for the same reasons
- I spoke for Shock Trauma and made an institutional commitment
- That commitment is as strong today as it was in 2001. It is not if, only how
- C-STARS is now a part of our DNA