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COL David D. Haight
Command Surgeon
U.S. Special Operations Command-Central



CAPT Scott A. Cota
Command Surgeon
U.S. Special Operations Command
**SOCOM's growing role in supporting
Conventional field surgical support**



**Dr. Frank
Butler**
Chairman
Committee
on TCCC
Joint Trauma
System (JTS)



**Mr. Edward
Whitt**
Program/Policy
Analyst
U.S. Defense
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MITIGATING THE PRE-HOSPITAL CARE GAP

Recent advances in treatment and skills training for prolonged field care are maximizing the critical "Golden Hour".

By Matt Kinney

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Refining SOF Surgical Support to Meet Joint Force Demand
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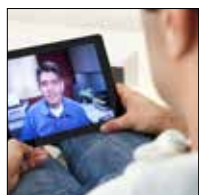


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SURGEONS ROUNDTABLE



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COL David D. Haight

Command Surgeon
U.S. Special Operations Command-Central (SOCCENT)

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Cover: The 65th Medical Brigade transports a casualty during the combined/joint MEDEVAC exercise at Hongcheon. (MEDCOM)

COMBAT & CASUALTY CARE

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INSIGHTS

With greater capability to address battlefield injury has come a greater responsibility for today's combat medics to provide care immediately following trauma. As such, the term "Golden Hour" is taking on more meaning, not for what can be done to stabilize a patient, but for what can now be done to provide them with a greater chance of full recovery.

The Spring 2018 issue of Combat & Casualty Care shines light on challenges faced by today's Conventional and Special Operations Forces (SOF) field medical teams as they work to implement the latest techniques in damage control resuscitation (DCR) and damage control surgery (DCS). The idea of prolonged field care helping maximize combat casualty survival is not new, however, the reality that today's advanced training and skills application are enabling trauma patients to experience positive long-term outcomes not possible even a decade ago is. In an exclusive with CAPT Scott Cota, Command Surgeon, U.S. Special Operations Command (USSOCOM), COL David Haight, Central Command (SOCCENT), and select SOCOM component command surgeons, leaders speak to the evolution of USSOCOM's critical role in helping mitigate growing conventional force field surgical needs in complex combat environments. Regions that today's U.S. combat missions are conducted in often have little to no infrastructure to support requirements for DCS or DCR. As such, the use of and reliance on sustained SOF missions for surgical support to Conventional operations has increased proportionately to expanding SOF operations.

With the expectation that those who serve the nation deserve only the highest standard of care, the U.S. Defense Health Agency (DHA), in coordination with leadership from the Committee on Tactical Combat Casualty Care (CoTCCC) and Joint Trauma System (JTS), is implementing new instruction to all levels of military trauma care training in an effort to ensure procedures for events such as hemorrhage, airway obstruction, and tension pneumothorax, are standardized across the DoD. In support of the standard, the use of increased automation in the form of artificial intelligence (AI) for TCCC is on the minds of staff every day at the Army's Combat Casualty Care Research Program (CCCRP), Ft. Detrick, MD.

In this issue's *Maximizing Outcomes* spotlight, readers get a look into advances in burn tissue recovery at the Army's Institute of Surgical Research (USAISR) and how they are helping burn and other skin trauma patients gain and maintain hope that greater recovery is possible. Be sure not to miss the latest advances in telemedicine from the Army's Telemedicine & Advanced Technology Research Center (TATRC) and Department of Veterans Affairs (DVA).

As always, we welcome your comments and suggestions!

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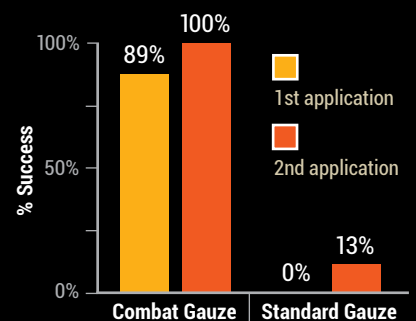
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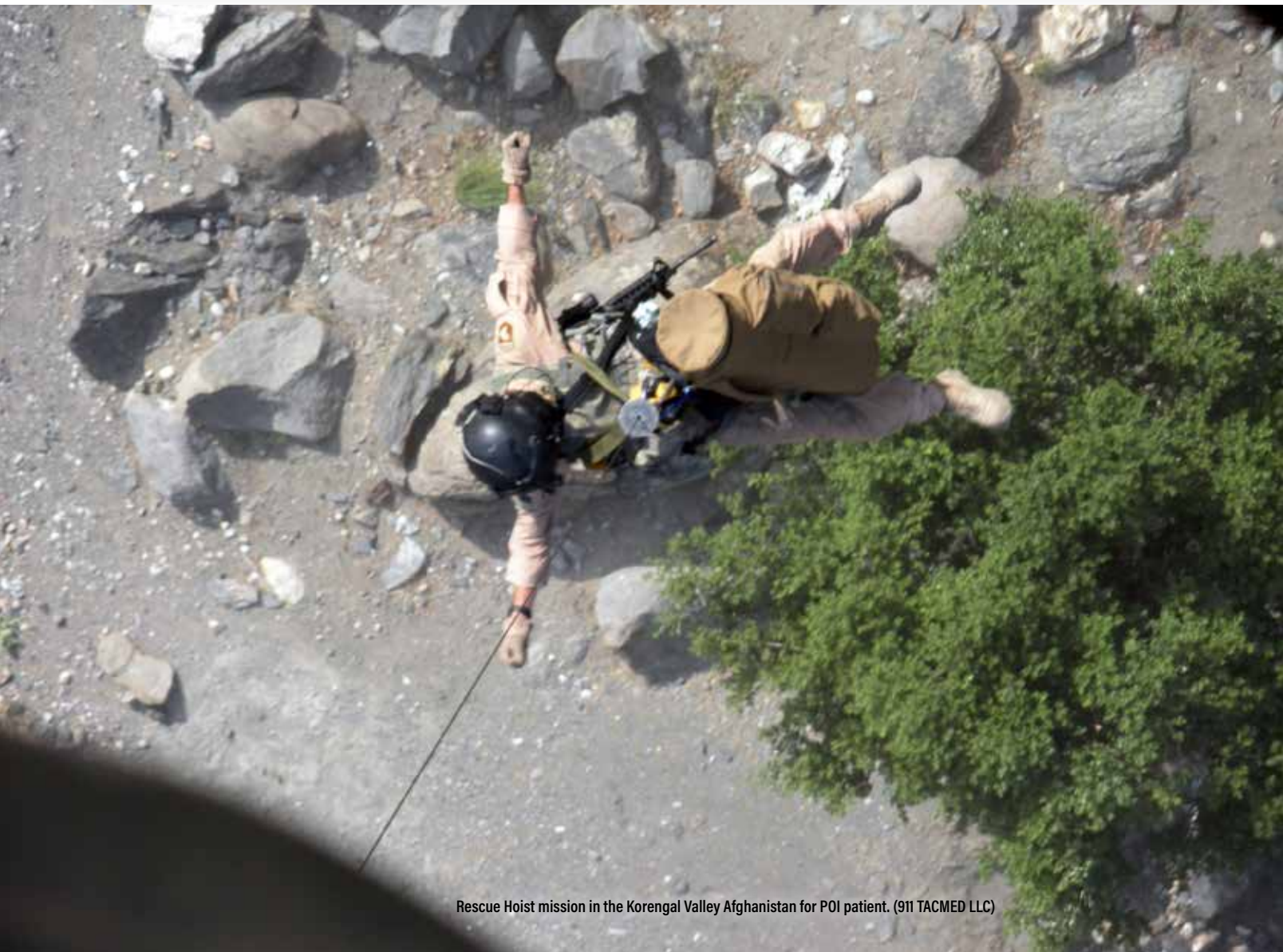
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EVOLVING “GOLDEN HOUR” CARE TO MITIGATE THE TREATMENT GAP

Almost two decades of recent warfare has taught U.S. combat medics hard lessons which have translated into advances in treatment and skills for prolonged field care in the critical “Golden Hour”.

By Matt Kinney, 68WF2 Critical Care Flight Paramedic (USA Ret.), Director, 911 Tactical Medicine LLC



Rescue Hoist mission in the Korengal Valley Afghanistan for POI patient. (911 TACMED LLC)

From an evolutionary perspective in applying modern combat medical technique to an understanding of prolonged field care, U.S. Military battlefield medicine has come a long way during the recent 17 years of wartime engagement. At the same time, the constant optempo reduced our ability to “sit on” patients when a quick evacuation was, in many cases, not an option. This was not a sudden loss but gradual over time, however, we were smart enough to notice it. This became evident in the differences in Iraq where the infrastructure supported everything we needed from Afghanistan where patient care carried much different requirements due to challenges posed by a more austere environment. The big difference

in infrastructure and terrain allowed us to make the “golden hour” standard or break it. In future wars, terrain and infrastructure will still play a factor but enemies who can deny our military the freedom of movement from the air, sea, and yes even the ground will during operations, require the combat medic to provide enhanced care at or near the point of injury and to continue treatment and management of patients in the prehospital environment outside of traditional doctrinal timelines.

In previous wartime engagements, U.S. forces had air superiority and plenty of freedom to maneuver assets across the battlespace. In Afghanistan, the extended time from Point of Injury (POI) to a forward

surgical team (FST) was dramatically reduced since the distance and terrain were a logistics problem for everyone. By splitting the FSTs and adding more medical evacuation (MEDEVAC) aircraft in strategic locations, we brought back the "golden hour" standard after 2009. I routinely saw times from POI to FST run above an hour and some up to five hours. However, even after this huge push to maintain the "golden hour" there was always the environment which could make you keep a patient for periods reaching a week or more. I've seen MEDEVAC birds grounded for over a month in certain locations, both rotary and fixed wing. The good news is that FSTs, after years of operating at half strength, will finally see an EMTOE change to make them a little more robust.

TCCC Literally Saves the Day

Perhaps more than any other single advance in combat medicine, the implementation of Tactical Combat Casualty Care (TCCC) standards across the DoD has been critical to the increased survivability rate of U.S. fighting forces. Bloody lessons learned by units such as the 75th Ranger Regiment and SOF communities were valuable lessons leading directly to TCCC standards becoming the DoD's standard for all combat prehospital care. These same standards have translated to care at home in the form of training for police, firefighters, EMTs, and first responders on essential techniques in bleeding control and TCCC. Today, civilian prehospital trauma care is actually behind combat trauma technique and learning from lessons more in war zones than city streets. Even with incremental improvements to patient care gaps remain for medics across the U.S. Joint Forces in teaching medics how to make the successful transition to post "golden hour" care. The challenge for many of today's combat-trained medics is that many remain at a 10 Level skillset with a lack of mixed field and clinical experience. TC8-800 level training has proven inefficient at building capability within the 68W combat medic community, providing only a means to maintain certification status. Our current survival rates rely heavily on medical evacuation assets to move casualties to a required surgical capability within an hour of injury. Absence of this asset will



Today's combat medic training involves beyond "golden hour" care to address potential post-initial trauma stabilization complications. (911 TACMED LLC)

demand that all medical providers across the forces forward of Role II must develop the skills needed to delay required definitive medical care from one to 24 hours, possibly more. Patients who need skeletal traction, treatment for compartment syndrome, blast lung, burns, poly trauma, severe TBI, or critically ill care, are just a few skillsets of the "what if" scenario for preparing for effective post "golden hour" patient care.

It is critical that POI care standards are maintained by continuing to develop and improve TCCC guidelines throughout the phases of care. Yet again we need to prepare for not being able to evacuate for multiple reasons. The SOF medical community has also seen a deterioration in extended patient sustainment skills over the years with the high optempo of deployments. The W1 (SOCMs) are great at trauma care but not designed for long-term patient sustainment. In recognizing this across the Force, the term that is "Prolonged Field Care" or PFC involves critical skills that need to be taught at the unit level and through specialized courses. Currently, PFC is still being developed to ramp up these skills across the fighting forces. Some





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elements of PFC involve safe houses being turned into ICUs so that medics will be able to maintain patients longer while out on patrol. Role I can "sit on" a patient while extended flights can be made with critical patients, all within the scope of standard prehospital skills. That said, mastering equipment currently fielded to maximize capability is paramount with the expectation that equipment

development will continue as we identify the skills and capability gaps in sustaining patients for prolonged periods across the forces. At the same time, medical equipment mobility must be sustained to get it to the fight. Some of these supplies could be dropped by drone to keep teams light and perishables on standby. Implementation of video/telemedicine for over the horizon operations is another tool. A nonprofit is currently using UAVs to drop blood parachute in remote areas of Africa. Another area in which we operate, so no need to reinvent the wheel.

No Substitute for Skills Training and Application

To address this need for more capability across the Force, the implementation of the Master Medic Course at Ft. Hood, TX for the 68W, the Expeditionary Medic Course at Ft. Bragg, NC, to be permanently located at Fort Sam Houston, TX, providing paramedic-level training, Medical Proficiency Training (MPT) through Level 1 Trauma/ICU Centers, and specialty courses are all part of what is being implemented across the Force for both SOF and conventional Medics. The F2 has seen the greatest increase in knowledge and capability over the last six years with paramedic and critical care training on the conventional side.

The reaffirmation or "tailgate medicine" where one starts care from a truck or structure has almost become a forgotten art. In the case of Forward Aid Station (FAS) and Main Aid Station (MAS) operations on a linear battlefield, one could temporarily halt movement and start patient treatment before setting the FAS or MAS as they leapfrog from one to the other. Continuing treatment would be critical as the mission continued forward. Without proper evacuation assets available, this would be the start of prolonged field care until you could get the patient to Role II level treatment.

Advanced Mobility Equals Patient Survival

An evolution in lift platforms is coming to join its place along side of the helicopter to alleviate the distance and speed limitations seen with conventional airstrip requirements. The vertical takeoff and landing (VTOL) such as the V-22, and future vertical lift (FLV) airframes (V-280 and S-97 still under development) offer the ability to land at a POI or perform a rescue hoist. These airframes can move wounded twice the speed and distance, reducing the time it takes to respond to a casualty and reduces the transport time that stresses the casualty's body. We are not just talking prolonged field care matters but things like pressures, noise, vibrations, gravitational forces, and more stressors that have a negative impact on the casualty. For operating areas like Africa, this is a dramatic game changer. Vertical lift capability reduces the number of airframes needed and requires less fuel than a helicopter.

Only with the Right Tools and Training

I believe next-generation gaps that need to be closed are a combination of TCCC, PFC, and continuing to develop better methods of getting the right gear to the combat medic to properly care for the wounded. I tell students all the time "medicine is medicine any way you look at it. Everything comes down to how you apply skills according to environment" and that's why it's absolutely critical to continually hone skills and know the equipment that enables the application of that knowledge.



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REDEFINING SOF SURGICAL SUPPORT TO MEET JOINT FORCE DEMAND

United States Special Operations Command (USSOCOM) missions have maintained global distribution into many isolated areas of the world. The regions that these missions are conducted in often have little to no infrastructure to support requirements for Damage Control Surgery (DCS) or Damage Control Resuscitation (DCR).

By CAPT Scott A. Cota, Command Surgeon, USSOCOM



Master Sgt. Kimelyn Hall, 36th Aeromedical Evacuation Squadron aeromedical evacuation technician, secures a litter to a litter stanchion on board a C-17 Globemaster III aircraft during Southern Strike 2018 at the Gulfport Combat Readiness Training Center, Mississippi. Southern Strike 2018 is a large-scale, joint multinational combat exercise that provides tactical level training for the full spectrum of conflict and emphasizes air dominance, maritime operations, maritime air support, precision engagement, close air support, command and control, personnel recovery, aeromedical evacuation, and combat medical support. (U.S. Air Force photo by Tech. Sgt. Ryan Labadens)

In certain areas of the world evacuation times can be delayed as competing missions and limited resources push casualty evacuation beyond the “Golden Hour”. The operational expectation that is often recognized by commanders who have experience in Iraq, Afghanistan or the Central Command Theatre is the “Golden Hour”. Increasing missions into minimally supported or previously unsupported areas of the globe may often necessitate risk mitigation and a strategy to minimize the risk. The strategy to minimize risk often includes requesting DCS or DCR for global SOF operations to support to USSOCOM missions. The increased use and reliance on sustained Special Operations Force (SOF) missions naturally increased the global requirements for surgical support and has increased proportionately to expanding SOF operations.

Increased Field Surgical Need in Wartime

As early as 2015, the request for DCS and DCR support to SOF operations far outpaced the inherent capacity of embedded SOF surgical teams such as the Air Force Special Operations Command (AFSOC) Special Operations Surgical Teams (SOST), so the Services filled the SOF support request with General Purpose Force individual augmentation or ad hoc surgical teams. By 2016, the rising requirement for DCS and DCR pushed a continuous demand signal on the Services conventional force medical departments to support global SOF. I believe this increasing demand signal helped to influence the Services to look for solutions. Demanding support for USSOCOM units taxed the services with those early requests

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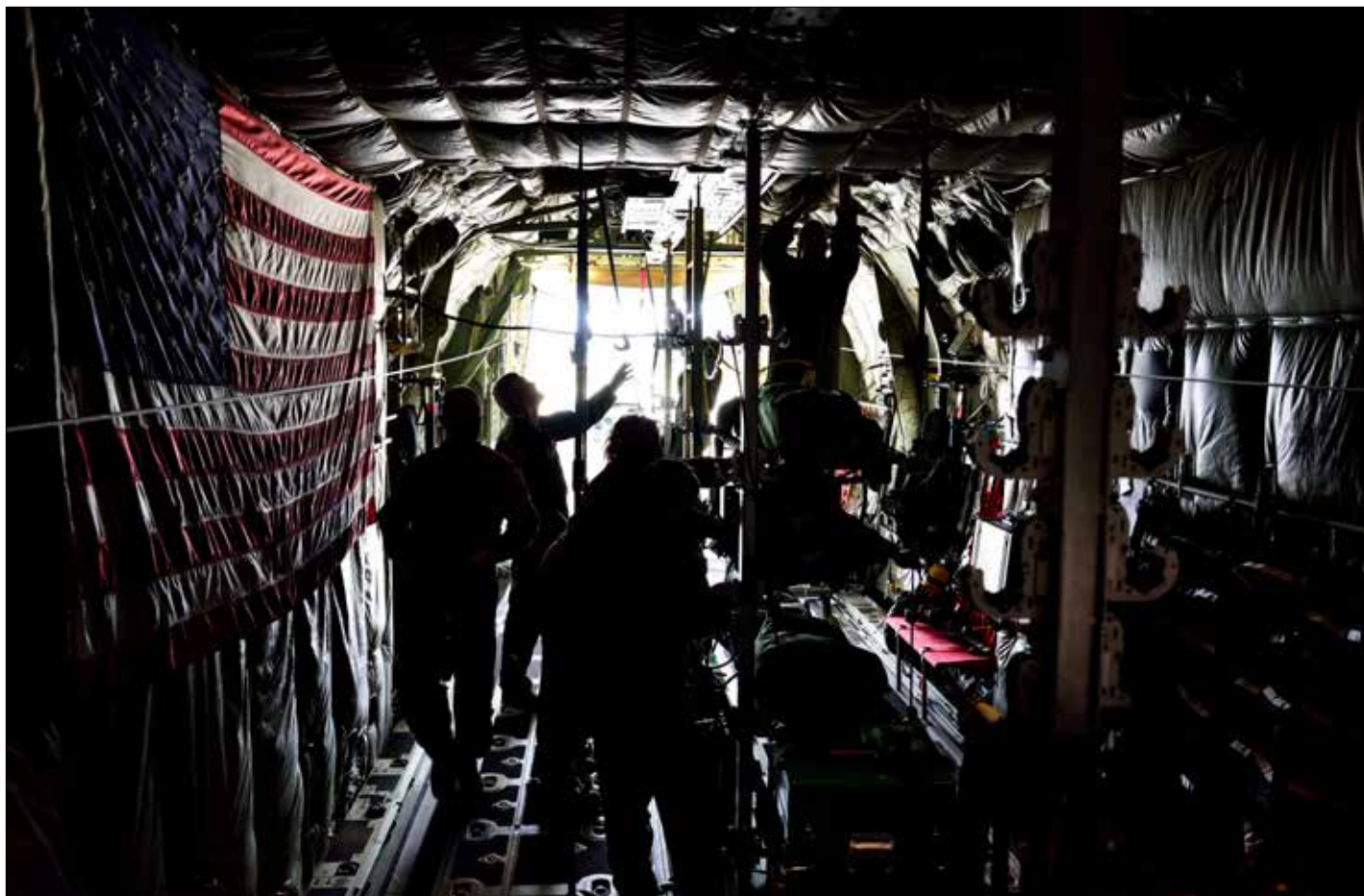


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Members from various aeromedical evacuation squadrons set up their medical equipment on an 815th Airlift Squadron C-130 Super Hercules aircraft at the Gulfport Combat Readiness Training Center, Mississippi, in preparation for an aeromedical evacuation exercise during Southern Strike 2018. Southern Strike 2018 is a large-scale, joint multinational combat exercise that provides tactical level training for the full spectrum of conflict and emphasizes air dominance, maritime operations, maritime air support, precision engagement, close air support, command and control, personnel recovery, aeromedical evacuation, and combat medical support. (U.S. Air Force photo by Tech. Sgt. Ryan Labadens)

and were supported by USSOCOM Commanders, the Joint Staff Surgeon, and not wavering in the scope or breadth of the high risk missions. The services were familiar with the SOST capability and its training, equipping and manning solutions and were synchronized with AFSOC to review the SOST.

U.S. Army Medical Command (MEDCOM) responded with innovations to expand a modular capability by breaking up the larger field surgical team units and assembling smaller DCS and DCR teams. Navy and Marine Corps developed capability that was limited to the maritime environment. Mostly, the early service response was often to provide ad hoc individual augmentation teams that had none or minimal experience in supporting SOF operations. The requirement that USSOCOM missions needed Modular, Mobile, Minimally Dependent, and Tactically Aware DCS/DCR support was often validated but unfilled because a standardized general purpose force solution set did not exist. Depending on which Service was requested to fill the mission of DCS or DCR, the response often times expected by USSOCOM units was sorry we don't have that capability or that is not our mission. Most of the early versions of conventional surgical support provided to SOF missions were the repackaging of larger capability that existed with splitting of teams or piece-meal individual augmentation of joint teams. These teams were successful in their

primary medical mission, but lacked maneuverability, were not under command and control of the SOF units and often complained of skill degradation. The DCS or DCR support to USSOCOM units appeared to be a task that was at times ignored or caused angst due to the perceived over requesting of support.

By 2017, it was well known that the requirement could not be overlooked since USSOCOM operations increased into very isolated, unsupported parts of the world. In an additional effort to find support, many of the Theatre Special Operations Commands (TSOCs) networked with partner nations to understand or build additional capability with force provision from the partner nation. The United States military services looked at internal solutions and hoped to standardize with surgical teams similar to the train, man, equip plan that AFSOC provided to their Special Operations Surgical Teams (SOSTs).



Networking a Joint Solution

The continued demand signal for non-SOF DCS support for SOF missions drove change and allowed the SOCOM Surgeon to network with the services and share a joint solution to provide surgical teams. The joint effort was intended to deliver real solutions to support SOF missions with DCS and DCR at any location on the globe. During

this joint effort, Transportation Command Surgeon (TRANSCOM) played a key role to relieve the DCS support requirements by increasing capacity for casualty evacuation to areas with minimal support such as U.S. Africa Command (AFRICOM). In an attempt to control requests, planning estimates and risk management strategies advocated for stewardship of resources by the Joint Staff and USSOCOM Surgeons. This approach demonstrated to the services that SOF planners were attempting to push for support at times where support was truly required.

The Joint Staff Surgeon hosted capabilities-based assessments (CBAs) focused on defining the requirements of the Defense Trauma Enterprise, Prolonged Field Care and Field Resuscitation, so that the larger joint planning and requirements process could help drive change. The CBA focus areas along with the 2017 National Defense Authorizations Act (NDAA) recommending a Joint Trauma System pushed the focus on a DoD wide effort to provide DCS and DCR capability in a standard package. USSOCOM Surgeon advocated that DCS and DCR teams should broadly be SOF familiar and the USSOCOM Medical enterprise should look for opportunities to exercise with those general purpose force teams. In additional response to the 2017 NDAA, the Committee on Surgical Combat Casualty Care was stood up and modeled after the undeniable success of the Tactical Combat Casualty Care Committee and enabled a platform for SOF Surgical Teams to share their after-action reports, develop clinical guidelines, brief their capabilities and provide an opportunity to influence the direction of the Defense Trauma Enterprise.

In 2018, the move of the Defense Health Agency (DHA) to assume a combat support agency role and establish the structure of the Defense Trauma Enterprise will provide a catalyst toward the scaled down surgical support that USSOCOM missions expect. These missions vary from direct combat support, foreign internal defense, to unconventional warfare as Special Operations units carry out their 10 core tasks. The backbone of support to these missions is still the USSOCOM combat medic, but as resources and DCS/DCR teams are guided by DHA and stood up by the Services it is expected that the medic will obtain some relief from expanding capability expectations and very real prolonged field care situations. Since a system, the Defense Trauma Enterprise will recommend SOF familiarization the personnel in support of SOF missions will be more knowledgeable of SOF forces, have the appropriate subject matter expertise to support SOF missions and of course will be clear on limited infrastructure and prolonged CASEVAC.

Re-Thinking from a Training Focus

Many of the discussions with the Joint Services, and even internal to USSOCOM medical, revolve around development of a pathway or pipeline to keep knowledge, skills, and training up to date and current for surgical teams supporting USSOCOM missions. The training requirement is a dichotomy in that current surgical training is primarily minimally invasive and most combat wounds are complex and require open procedures. In addition, the trauma training required to treat combat injured is not easily obtained in the current Department of Defense medical facilities. So the AFSOC SOST model of obtaining training at civilian institutions was shared with the services and articulated to senior service medical decision makers. The ability to develop expanded telemedicine capability and push more procedures to medics and non-surgeon providers is being developed by USASOC. The proposal to embed surgical teams into SOF units and guide the



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training pipelines of DCS teams supporting SOF missions has been forwarded from JSOC to USSOCOM leadership for consideration.

The push to train in partner nation civilian trauma centers for SOF familiar surgical teams and the ability to formulate status of forces agreements with partner nations to train in foreign countries has to be expanded. It is recommended that this direction be explored by the Services as they stand up their modular surgical capability. USSOCOM medical enterprise support to educate and familiarize the SOF mission to general purpose force surgical teams could include expanding country agreements, cultural training, standardized tactical skills, weapons familiarization, expectation management for skill degradation and familiarity to Joint, Global Health Engagement, Medical Training and Foreign Internal Defense (FID) opportunities. Expanding the core tasks of surgical teams to include Guerrilla Warfare and Unconventional Warfare when feasible, to train partner Countries



Medical personnel assigned to the 1st Special Operations Medical Group treat a simulated patient in a C-146 Wolfhound during Emerald Warrior near Duke Field, Florida. At Emerald Warrior, the largest joint and combined special operations exercise, U.S. Special Operations Command forces train to respond to various threats across the spectrum of conflict. (U.S. Air Force photo by Staff Sgt. Trevor T. McBride)

in DCS and DCR capability, and learn the collection methods to report and document area capability. These tasks should be solicited, evaluated, validated and supported during SOF exercises. SOF exercises employing DCS and DCR capability should include full mission profile surgical team training, observation and where feasible the expansion of MEDIC Capabilities with enhanced telemedicine support. During these exercises communication networks have to include interoperable methods to communicate with partner nations and partner nation facilities. Overseas Medical Facilities should be included in

DCS and DCR training OCONUS when the MTF is geographically positioned to support more than one GCC. The techniques, tactics and procedures of patient movement, logistics support and equipment maintenance should also be exercised.

Visualizing the Challenges Ahead

Fast forward into the future. The DTE and the Trauma committees will improve the system of combat trauma care and I believe will lead to the standardized joint approach to mission support. Continuing to look at care at the point of injury (POI), prolonged field care and DCS/DCR outcomes will improve the quality of care and should include a broad range of educational and training experiences. USSOCOM will continue its efforts of collaboration with groups like JTAPIC to develop tactical context to injury reports, data analysis of injury patterns and the sharing of reports within the USSOCOM Medical Enterprise. Improving documentation and expanding tactical context to clinical outcomes will support resource requirements and prioritization of mission support. SOF operations will require Forecasting Medical Risk down to the POI and should continue development of life-saving capability with the expansion of autonomous blood delivery, rapid logistics support, 3D printing capability and Unmanned CASEVAC.

Surgical support to SOF missions has expanded to include an improved effort and response by the Services and really all of DoD medicine. There are still gaps that will require continued vigor and attention toward a modular, mobile, tactically aware and independent surgical capability that meets the expectation of USSOCOM operational support.

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AUGMENTING SURGICAL CAPABILITY TO FILL SERVICE-SPECIFIC NEED



Combat & Casualty Care recently spoke with Command Surgeons from a number of U.S. Special Operations Command (USSOCOM) component commands regarding lessons learned in field surgical practice during recent decades of U.S. combat commitment. As war efforts in Iraq and Afghanistan have contracted and expanded, U.S. military services and USSOCOM have adapted their forces to provide damage control resuscitation (DCR) and damage control surgery (DCS) capabilities far forward on the battlefield.

The views expressed are the personal views of the writers and do not necessarily represent the views of DoD or its Components.

Roundtable Participants:

- SOCCENT Surgeon COL David D. Haight
- AFSOC Surgeon Col. Rudolph Cachuela
- SOCAF Surgeon COL Ramey L. Wilson
- 528th Surgeon COL Jay Baker
- JSOC Surgeon COL Robert L. Mabry

According to Joint Publication 4-02: Joint Health Services Doctrine, current doctrine now views notional Roles of Medical Care as based on:

- **Role I: First Responder**
- **Role II: Forward Resuscitative Care**
- **Role III: Theater Hospitalization**
- **Role IV: Definitive Care**

Wartime Role Re-evaluation

According to Joint U.S. Department of Defense Doctrine, combat medical support forces have traditionally been organized and equipped to provide health service support in a tri-echelon order of point of injury care (Role I), primary care (Role II), and theater level (Role III) care, with the addition of definitive care at United States or overseas medical treatment facilities (Role IV).

In line with NATO forces view of Role II care, forward surgical/resuscitative capability has taken center stage as the key determinant of Role II level care. As joint doctrine has evolved, so has the manner in which Special Operations Force (SOF) Components have taken on the challenge of providing early resuscitative surgery for SOF.

Recent decades of combat medicine have highlighted challenges in providing care in counterinsurgency operations and on the noncontiguous battlefield, especially damage control surgery (DCS). Special Operations Forces (SOF) operations, in particular, have been challenged to enable operations with DCS, especially in Afghanistan and Iraq where planning requirements stipulated that DCS would be

provided within the “Golden Hour,” and as SOF operations were often far from the conventional medical assets providing support.

As a result, several different variations of expeditionary surgical capability were developed to meet the needs of the SOF commanders. Some of these solutions took existing surgical units and reorganized them to support SOF operations, other solutions started with a new approach and completely redesigned their units to become more expeditionary. As each force provider adapted and shaped the development of these units to include DCS to non-SOF forces, there has been a confusing litany of various names and compositions for DCS capabilities.

Joint SOF/Conventional Interoperability

During Operation Enduring Freedom, U.S. Special Operations Forces medics in Afghanistan used Army Forward Surgical Teams (FSTs), which were never designed to operate independently, and carved them up in small expeditionary teams and named them Golden Hour Offset Surgical Trauma (GHOST) teams. Traditional FSTs were a 20-person unit with 3 general surgeons, one orthopedist, 3 RNs, 2 certified registered nurse anesthetists (CRNAs), 1 administrative officer, 1 detachment sergeant, 3 licensed practical nurses (LPN)s, 3 surgical techs and 3 medics. The FST was designed to operate as a complete unit but have the ability to do split operations if needed. The U.S. Army is now in the process of converting all of their FSTs into Forward Resuscitation and Surgical Teams (FRSTs) which will be more mobile, modular and expeditionary.

The U.S. Air Force's previous surgical teams, Mobile Forward Surgical Teams (MFST), comprised of a general surgeon, orthopedic surgeon, anesthesiologist, emergency medicine physician, and surgical technician (previously an OR nurse) were re-organized in November 2017, and re-named Ground Surgical Team (GST). The GST now includes a general surgeon, anesthesiologist, critical care nurse, emergency medicine physician, surgical technician, and a medical operations officer. Similar to the FSTs, these teams were designed to augment expeditionary medical units in a modular fashion, but the Air Force units are also designed to operate independently.

The U.S. Navy has an Expeditionary Resuscitative Surgical System (ERSS), a 9 man surgical team meant for USN SOF support. The Navy also has a 36-man Navy Expeditionary Medical Unit (EMU), that is neither expeditionary, nor mobile, and provides services from a fixed location.

The U.S. Marine Corps designates a Surgical Company to provide surgical care for Marine Expeditionary Force (MEF) personnel with one Surgical Company per Infantry Regiment. Doctrinally, the Surgical Company consists of 4 Forward Resuscitative Surgical Systems (FRSS), 4 shock trauma platoons, and 4 en route care teams. Marine Corps FRSS is an 8-person team with 2 surgeons and an anesthesiologist.

And finally, U.S. Air Force Special Operations Command (AFSOC) has developed and fielded the Special Operations Surgical Team (SOST) and the U.S. Army has the Special Operations Resuscitation Teams (SORTs). There are currently no expeditionary surgical teams within U.S. Marine Special Operations Command nor U.S. Naval Special Warfare (NAVSPECWARFARE) Command.

Myriad Options Challenge Need Targeting



COL David D. Haight
SOCCENT Surgeon

In the current Iraq, Syria, and Afghanistan conflicts, the U.S. Central Command (CENTCOM) Commander and staff have a dizzying array of GSTs, FSTs, SOSTs, SORTs, EMUs, and Expeditionary Medical Support (EMEDs) distributed across the battlefield. What is clear is that the multiple different surgical capabilities make for a difficult task for the medical personnel determining best distribution of medical resources to support a largely Special Operations Force on the ground. What is needed is a common surgical team construct across the Services that is mobile, highly capable and can be utilized across all theaters.

“The various surgical teams across services have different capabilities and limitations,” noted COL Dave Haight, U.S. Special Operations-Central Command (SOCCENT) Surgeon. “Newer SOF surgical teams such as the SOST and SORT are better able to perform the missions required to support SOF missions, as they are more modular, mobile, and trained to work supporting SOF mission sets. An FST can provide exceptional care in a specific location but cannot move as readily as the SOST/SORT.”

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Members of the 528th SB(SO)(A) SORT perform damage control resuscitation on the front lines in support of Special Operations Forces. (USSOCOM)

The Air Force's SOST is one team that has gained great notoriety of late for their mobility, capability, and actions. "We created SOST shortly after 9-11 to meet the U.S. Special Operations Command (SOCOM) requirement for a rapidly deployable forward resuscitation damage control surgery capability that could operate outside the wire in austere conditions," said COL Rudolph "Rudy" Cachuela, AFSOC Surgeon. "We also wanted to include a tactical patient movement capability into this package. We initially did this by taking the Air Force Medical Service (AFMS) Mobile Forward Surgical Team (MFST) and the Critical Care Air Transport Team (CCATT) packages from the conventional force and began to adopt them for AFSOC." This included modernizing their equipment packages to make them lighter, more mobile, and also adapting their training to make them more tactically competent. The packages became the first SOST and Special Operations Critical Care Evacuation Teams (SOCCET). "As we began deploying these teams, we realized that the members of these teams needed to be clinically outstanding since they were working outside of the expeditionary military treatment facilities (MTFs) in less than ideal conditions," Cachuela added. "In order to ensure this, we began embedding the SOST/SOCCET into civilian level one trauma centers. In 2010, we located our teams at University of Alabama Birmingham (UAB) and St. Louis University (SLU). Currently, our teams are working out of UAB,



University Medical Center in Las Vegas, and University of Miami/Ryder Trauma Center."

"We also realized that these teams needed to be tactically competent. They needed to be able to move, shoot, communicate, if required, to be able to operate with the Joint SOF warfighter and placed these teams into the 24th Special Operations Wing which is our Special Tactics unit and allowed the 24 SOW to organize, train, and equip these teams in the area of tactics," Cachuela emphasized.

"We continue to modernize these teams to include taking advantage of commercial off-the-shelf (COTS) technology to reduce their footprint and increase their mobility. We do this through our own SOF specific medical combat development division that works with both AF research labs, the SOF enterprise, academic, and private industry to continue to modernize our capabilities. Having our own modernization division allows us to rapidly acquire new technology to include testing and then quickly fielding these technologies. Closely reviewing AARs from deployments and JTS data allows us to continue to identify requirements and improve our capabilities," he noted.

Today's SOST meets the requirement for a mobile, rapidly deployable forward resuscitation/damage control surgery/tactical critical care transport capability that is clinically outstanding/tactically competent and can operate in austere environments. Current SOST

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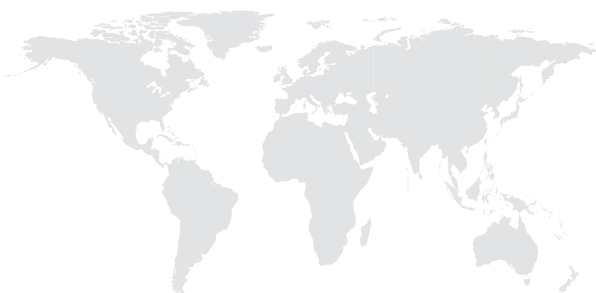
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members undergo a formal accession and selection process to include evaluating their clinical skills and physical skills. They are also assessed by an operational psychologist,” Cachuela indicated. “We have recently stood up a Reserve SOST capability and are in the process of standing up a SOST capability within the Guard force.”

Improving Modularity for Flexible Response

Modernization efforts continue to include ongoing equipment and supply testing and acquisition to make our teams even lighter while maintaining or increasing their capabilities. “We are also modernizing SOST Techniques, Tactics and Procedures (TTPs) to include the ability to operate in a chemical, biological, radiological, nuclear (CBRN) environment to include medical management of CBRN casualties,” noted Cachuela. “Modularity of our SOST equipment packages is key here so that our teams can just take what they need to support the SOF mission across the full spectrum of mission sets. We continue to review After Action Reviews (AARs) and Joint Trauma System (JTS) data to ensure we are adapting to a constantly changing environment, and work closely with our operators as we plan for future conflicts.” “We also look for opportunities to integrate ourselves into the entire Joint Trauma System and SOF enterprise to include training with our sister Service and coalition partners, other AFSOC expeditionary capabilities to include Special Operations Forces Medical Element (SOFME), SOFME augmentation packages, and AFMS conventional expeditionary medical capabilities,” Cachuela added.

In a similar fashion, U.S. Army Special Operations Command (USASOC) developed a SORT concept and currently possesses three SORTs within the 528th Sustainment Brigade (SO) (A) of 1st Special Forces Command. “SORT comprises the following personnel: Flight Physician (61N), Critical Care Nurse, 3x Special Operations Combat Medics, and ancillary support staff with specialization in radiology, laboratory, and patient administration,” noted COL Jay Baker, Command Surgeon, 528th Sustainment Brigade. “These teams currently provide expeditionary medical care in austere locations with limited resources and support. The skill sets that the SORT brings include but are not limited to: point of injury care; triage, emergency and critical care; damage control resuscitation; prolonged field care; critical care transport; integration with surgical assets; and technical rescue. In addition to their medical skill sets, SORTs constantly train to be tactically proficient,” Baker added.

Since their creation in 2008, SORTs have deployed in support of SOF operations in Afghanistan, Africa, Syria and Iraq. “Actual implementation of the SORT is variable and dependent on the needs of the ground commander, with flexible manning, equipping and ability to support diverse mission requirements,” Baker emphasized. “The SORT is frequently employed as smaller sub-teams or even as individual Special Operations Combat Medics (SOCMs) to augment the organic medical capabilities of SOF teams. The ability to be flexible in their employment has been key to the SORT’s success on the contemporary battlefield,” he iterated.

With the recent recognition that the majority of potentially survivable injuries on the battlefield are due to non-compressible truncal hemorrhage, organic surgical capability was recognized as a critical capability in the U.S. Army Special Operations Forces

(ARSOF) 2022 strategy. A force design update is currently pending approval by the Pentagon, which will transform the SORTs into ARSOF Forward Resuscitative Surgical Teams (FRSTs), beginning with a similar construct to the conventional Army FRST. Key personnel changes from SORT to ARSOF FRST include the following: Each team will add a general surgeon (61J) and CRNA; the flight physician (61N) billet will become an emergency physician (62A); an emergency nurse will be added to the critical care nurse; SOCMS will be substituted for the LPN and OR tech. “We are currently looking to substitute a surgical PA for the orthopedic surgeon, with anticipation that they will be the team leader,” Baker indicated.

ARSOF FRSTs will be manned, equipped, and trained in order to preserve the ability of the SORT to provide flexible medical augmentation to ground commanders depending on mission requirements. In accordance with NDAA 17, USASOC plans to embed ARSOF FRSTs in high quality, high volume civilian Level I trauma centers at Grady Hospital in Atlanta, GA, and Carolinas Medical Center in Charlotte, NC. Demanding tactical training will continue to take place at Fort Bragg in order to sustain the high levels of the tactical proficiency that have set apart SORT capability from its inception.

Command Coordination for Enhanced Patient Mobility

COL Ramey Wilson, Command Surgeon for Special Operations Command – Africa (SOCAFRICA), and previous Command Surgeon for Joint Special Operations Task Force (JSOTF)-Afghanistan, noted that “Army and Air Force teams have different capabilities. The Air Force teams, for example, have a medical planner (but no orthopedic capability), while the Expeditionary Resuscitation and Surgical Teams (ERST) provided by the Army (an ad-hoc capability designed to meet a specific capability requirement) has an orthopedic provider but no planner.” “The small expeditionary nature of these teams shifts the risk for patient care. While it provides damage control surgery (DCS) closer to potential injury, their small size challenges their ability to hold patients post-operatively,” Wilson emphasized.

As a consequence, SOCAFRICA has worked deliberately with U.S. Transportation Command to expedite out of theater movement of patients in order to move the patients and allow the surgical teams to reset and prepare for their next mission or patients. “While the surgical teams help enable operations, the geographical and political challenges of Africa, challenge the ability to provide DCS in a timely manner and evacuate the patient to Germany for

follow-on care,” Wilson noted. “These factors challenge blood resupply and medical maintenance, as well.”

Wilson also notes that “the lack of an enterprise-wide medical documentation system to support DCS and critical care evacuation in immature theaters is a major issue. There is currently no fielded medical documentation system equipped to meet the challenges of austere, small-footprint care that requires multiple patient handoffs. While forces have been criticized for a lack of documentation, the reality is that they are sending their documentation with the patients, but it is never arriving at its final destination to be scanned into the electronic medical record,” he added. “We are not operating in Afghanistan or Iraq where it is one leg of evacuation to a Role 3 hospital. We have almost



COL Jay Baker
528th Surgeon



COL Ramey L. Wilson
SOCAFRICA Surgeon

zero success of our written documentation making it back to Landstuhl Regional Medical Center (LRMC), our closest Role 3 facility. That being said, the surgical teams that currently support SOCAFRICA operations are much better prepared than the FSTs previously used as GHOST teams in Afghanistan, as at least the current teams are equipped and trained for their expeditionary missions with SOF."

There was universal agreement among the group that what is needed is improved standardization among the force providers on the composition, capabilities, equipment and training by the various force providers to provide better interoperability among the DCS capabilities. "We feel that the services, under the direction/supervision of the Joint Staff, should establish core principles, policies and procedures to decrease the friction created by these various flavors of DCS," Wilson said. "Across the board, component surgeons are concerned about skills maintenance and skill maintenance for these teams while deployed is a continual concern for force providers. While Africa, for example, is a lower risk area in terms of kinetic operations, the lack of adequate medical infrastructure in their partner nations and the tyranny of distance and transportation mandate the need for DCS capabilities. Skill degradation during deployments is an enterprise-wide problem and while services are now looking at how they sustain wartime surgical skills while in the garrison environment, a lot of effort has not been put into exploring ways to sustain skill levels while deploying in a low-patient volume environment." Dr. Wilson also

suggests that SOF medicine needs to continue to capture and publish the experiences and the lessons learned from these small teams into the peer-reviewed literature.

Continuing to Adapt to Changing Need



COL Robert L. Mabry
JSOC Surgeon

It is clear that expeditionary, small, mobile surgical teams are the way of the future to support SOF. Split FSTs, SOSTs, and SORTs have proven their ability to provide exceptional damage control on the battlefield. "We need to continue to refine our processes and constructs to develop the right answer to a more maneuverable surgical capability in support of SOF operations," said Haight. "The way forward is a joint solution, but regardless of the direction taken with surgical support on the battlefield," said COL Bob Mabry, U.S. Joint Special Operations Command (JSOC) Surgeon. Mabry cautions that the smaller these teams are, the more "expert" they need to be. "Otherwise we are putting something out there that will likely fail when put to the test," Mabry noted. "With a small team, you have no backup, you have no one to ask for help or advice. With just one severely injured casualty everyone on a small team will quickly become task saturated. If just one of the team is marginal in best of conditions, the team will fail when stressed. All on this team need to be 'A game players' and meet the National Academy of Medicine's definition of trauma "experts" with trauma fellowship training and years of experience at a busy, top-quality trauma center."

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NEW U.S. MILITARY STANDARD FOR BATTLEFIELD TRAUMA CARE

Combat & Casualty Care spoke with Dr. Frank Butler, Committee on Tactical Combat Casualty Care (TCCC) and Mr. Edward Whitt, U.S. Defense Health Agency (DHA), about how advances in battlefield trauma care that emerged from the wars in Iraq and Afghanistan and DoD's new instruction making training in TCCC mandatory for everyone in the military, will translate into American lives saved during future conflicts.

Interview by Christian Sheehy, C&CC Editor



75th Ranger Regiment medical personnel conducting night-time training for fresh whole blood transfusion. (Photo Courtesy LTC Ethan Miles)

C&CC: The Committee on Tactical Combat Casualty Care (CoTCCC) was established in 2002 and the Joint Trauma System (JTS) was founded in November 2004. Can you speak to how these two organizations have advanced combat casualty care in the U.S. Military?

Dr. Butler: It's very natural that times of war help to bring about improvements in trauma care. As additional experience is gained and new evidence emerges, opportunities to improve care are identified and implemented. This is precisely the definition of a continuously learning trauma care system.

Numerous examples of needed change have been addressed by the CoTCCC during the 17 years of war in Iraq and Afghanistan. Examples include:



Dr. Frank Butler
CoTCCC

The 2-inch needles that were used to perform needle decompression of suspected tension pneumothoraces at the start of the conflict in Afghanistan wars were found to be too short to reliably penetrate the chest wall of U.S. military personnel. There were two potentially preventable deaths identified by the Armed Forces Medical Examiner System as a result of failed needle decompression with 2-inch needles. Subsequently, Dr. Ted Harcke's virtual autopsy study found that a 3.25-inch needle was needed to achieve 99% success in reaching the pleural cavity and decompressing tension pneumothoraces. When this new evidence came to light, the U.S. Army Surgeon General directed the use of a 3.25-inch needle instead of the previously used 2-inch needle and TCCC adopted this standard shortly thereafter. There have

been no documented incidents of preventable death in the military due to failed needle decompression since this change was made. Further, a recent study from the Mayo Clinic clearly demonstrates the superiority of a 3.25-inch needle over a 2-inch needle for needle decompression. No procedural complications were reported from the use of either length of needle.

Another example of TCCC-led improvement occurred following the sudden increase in dismounted Improvised Explosive Device (IED) attacks in Afghanistan. After the Taliban lost the ground war to coalition forces, they shifted tactics around 2010 to a strategy based on maiming coalition combatants who stepped on pressure-activated IEDs, creating a sudden increase in the severe lower extremity and pelvic injury pattern that these devices cause. The Army Surgeon General formed a Task Force to address this new injury pattern that became known as Dismounted Complex Blast Injury (DCBI). Because DCBI often entails bilateral proximal lower extremity amputations accompanied by groin and pelvic injuries (junctional hemorrhage), the CoTCCC subsequently recommended the carriage and use of junctional tourniquets designed to compress the femoral artery at the level of the inguinal ligament to control inguinal and proximal lower extremity hemorrhage that is not easily controlled with extremity tourniquets. These devices are now available for medical providers.

A third example of a rapid response to an opportunity to improve was the adoption of oral transmucosal fentanyl (OTFC) as an alternative to intravenous (IV) morphine when opioid analgesia is needed to relieve the pain of combat wounds. IV morphine works much more quickly than IM morphine, but entails the added step of establishing IV access. OTFC combines analgesic efficacy almost equivalent to IV morphine in terms of speed and potency of pain relief but eliminates

the requirement to start an IV. The CoTCCC moved quickly to incorporate OTFC as a new analgesic option in the TCCC guidelines after the 2004 paper published by Kotwal and O'Connor demonstrated the safety and efficacy of this novel approach to battlefield analgesia.

A final example was the experience with the topical hemostatic agent WoundStat. A study from the U.S. Army Institute of Surgical Research (USAISR) in 2009 compared the efficacy of a number of new hemostatic agents with the previously recommended hemostatic dressings in TCCC. This study found that the new hemostatic agents Combat Gauze™ and WoundStat™ were consistently more effective than HemCon and QuikClot, the TCCC hemostatic agents recommended at the time. There was also no significant exothermic reaction noted with either agent, in contrast to the strong exothermic reaction found with QuikClot granules when they are exposed to liquid, such as blood. Although Combat Gauze and WoundStat were both found to be more effective than the previously recommended hemostatic agents, combat medics/corpsmen on the CoTCCC expressed a strong preference for a gauze-type agent rather than a powder or granule. This preference was based on combat experience that found that powder or granular agents were problematic in windy environments or during helicopter evacuations with strong rotor wash. Powders and granules were also noted to work poorly in wounds where the bleeding vessel was at the bottom of a narrow-wound tract. Based on these observations, Combat Gauze™ was recommended as the first-line treatment for life-threatening hemorrhage that is not amenable to tourniquet placement and WoundStat was recommended as a back-up option should Combat Gauze not be effective at controlling bleeding. Subsequent animal model studies at USAISR, however, found that WoundStat caused the formation



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of occlusive thrombosis in injured vessels as well as well as distal thrombosis in vital organs. These safety concerns resulted in the removal of WoundStat from the TCCC Guidelines and discontinuation of its use in the U.S. military.

C&CC: In terms of the primary areas of concern in battlefield trauma care such as hemorrhage control, airway obstruction, and tension pneumothorax, how has TCCC reduced the numbers of preventable deaths from these causes?

Dr. Butler: Battlefield trauma care for most of the U.S. military at the start of the conflict in Afghanistan in 2001 did not include tourniquets or hemostatic dressings; called for resuscitation of casualties in shock with two rapidly infused liters of crystalloid solution; had no intraosseous devices; and saw prehospital analgesia attempted with intramuscular (IM) morphine. Today's TCCC-trained first responders (medical and non-medical) are far more capable of providing lifesaving care to our combat wounded. This new DoD Instruction will help to preserve those advances and to ensure that they are carried forward in support of a full range of military operations (both peacetime and wartime).

Combat units that have trained all of their members in TCCC have achieved the lowest incidence of preventable deaths among their unit's casualties in the history of modern warfare. The overwhelming published evidence as well as battlefield experience has resulted in all Services in the U.S. Military and many allied nations using TCCC to care for their combat wounded. The civilian sector continues to increase their use of TCCC-based prehospital trauma training.



Mr. Edward Whitt
Defense Health Agency

C&CC: With combat casualty care often performed under hostile fire and entailing evacuations that can take extended periods of time due to distance, environmental conditions, and the threat of hostile fire to the evacuation platforms, can you speak to ways that modern TCCC is enabling positive outcomes?

Dr. Butler: The fundamental goal of TCCC has always been to reduce the number of preventable deaths in combat casualties. w, which is the parent organization for the CoTCCC, closely tracks the number of preventable deaths and other opportunities to improve care in U.S. combat casualties. When a potentially preventable death occurs, the CoTCCC and the JTS evaluate what factors might have avoided the fatality and change TCCC recommendations, equipment, or training as needed to try to prevent deaths from that cause in the future.

The DoD advocates for non-medical personnel to be trained in TCCC to perform lifesaving interventions. Control of external hemorrhage with tourniquets and hemostatic dressings as well as managing the airway with simple maneuvers are the three best examples of care that can be provided by a non-medical person. These interventions are taught in the TCCC for All Combatants curriculum that has now been mandated to replace first aid, self-aid, and buddy care for all Service members.

C&CC: How will the newly published revised DoD Instruction on Military Readiness Training – including TCCC – help improve battlefield trauma care in the U.S. Military?

Mr. Whitt: Despite the successes mentioned above, several surveys of prehospital trauma care in combat theaters have shown that



Ongoing treatment and assessment during tactical evacuation. (MEDCOM)

TCCC is not being implemented evenly across the battle space. These variations are occurring in both the Special Operations command and the conventional forces. Why has this been happening? In the past, we have taught physicians Advanced Trauma Life Support (maybe) and then assigned them to operational units and expected that they will be able to effectively supervise combat medics, corpsmen, and PJs who were frequently taught battlefield trauma care based on TCCC concepts.

Another challenge has been that many "TCCC" courses (unit-based, service-based, and vendor-based) – aren't really teaching TCCC. There have been notable instances of incorrect messaging and, in some cases, even inappropriate and potentially dangerous training. This incorrect messaging has been DIRECTLY associated with adverse outcomes in combat casualties. In the absence of a standard, high-quality, TCCC course with a professionally developed curriculum, "TCCC Training" in the DoD in the past could wind up being an hour of Powerpoint slides or 11 days of inappropriate training - or anything in between.

The recently revised MRT DoDI incorporates years of lessons learned by replacing antiquated medical training (first aid, self-aid, and buddy care) with TCCC for all Service members (medical and non-medical). The October 2011 MRT DoDI, mandated that the Secretaries of the Military Departments fund and train all Service members on first

aid, although several variations existed across the department, resulting in nonstandard, antiquated medical training. On February 17, 2017 Secretary of Defense (SECDEF) Mattis directed the DoD to "establish cross functional teams to address improved mission effectiveness and efficacies within the DoD." The revised MRT DoDI directly supports "cross-functional teams" by ensuring that all Service members know how to use the contents of their Joint First Aid Kit. TCCC directly supports the SECDEF's goal of increasing the lethality of the force through increased warfighter confidence, preparing them to treat themselves or their battle buddy. The United States continues to witness countless acts of violence both at home and abroad where TCCC principals are directly attributed to saving lives. When the Secretaries of the Military Departments operationalize this policy within the DoD, there will be a reduction in preventable deaths.

C&CC: Are the advances that TCCC and the JTS have made in caring for casualties on the battlefield being translated into use in the civilian sector?

Dr. Butler: Absolutely - especially in the area of external hemorrhage control. The American College of Surgeons in 2013 began to sponsor the Hartford Consensus program, led by Connecticut trauma surgeon Dr. Lenworth Jacobs. The Hartford Consensus effort was designed to transition the TCCC external hemorrhage control measures that have proven so successful on the battlefield to the civilian sector. This program has been very effective in promoting the use of tourniquets and hemostatic dressings by law enforcement officers, firefighters, and EMS personnel. The Hartford Consensus was followed by the White House-led Stop the Bleed program that focuses on teaching these same skills to non-medical individuals who may happen to be present when a trauma victim has life-threatening external hemorrhage. Having a strong base of non-medical civilians able to perform these interventions is especially important in mass casualty incidents such as terrorist bombings and active shooter incidents. Many lives have already been saved by the prompt use of tourniquets and hemostatic dressings as these incidents unfortunately continue to become increasingly prevalent.

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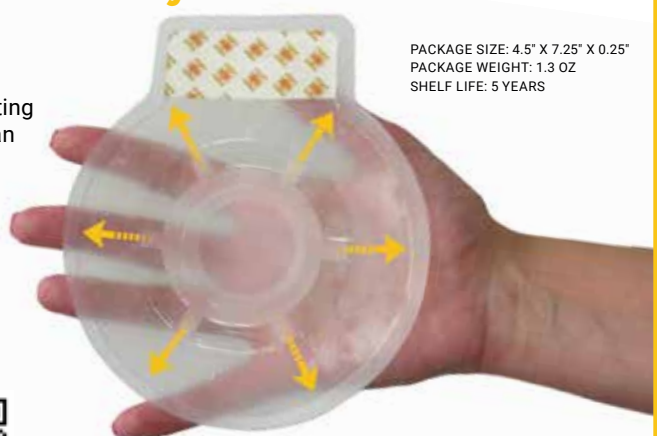
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BALANCING AUTONOMY AND COMBAT CASUALTY CARE

The U.S. Army's Medical Research and Materiel Command (USAMRMC) Combat Casualty Care Research Program (CCCRP), in cooperation with USAMRMC's Telemedicine & Advanced Technology Research Center (TATRC), is pushing field medical capabilities in artificial intelligence (AI).

By COL Michael R. Davis, Director, USAMRMC Combat Casualty Care Research Program (CCCRP) and Dr. Gary R. Gilbert, Lab Manager, Telemedicine & Advanced Technology Research Center (TATRC) Operational Telemedicine and Medical Intelligent Systems Lab



A graphic depicting a future casualty evacuation mission module concept for the multi-role ARES Unmanned Aerial System platform. (TATRC)

Harnessing the capabilities of automated technology may indeed be the single greatest challenge for participants on the future battlefield. At the same time, it may also be the only objective way to measure success. After all, according to current military guidance, future battles will likely take place in the kinds of dense cityscapes that American forces have yet to encounter on a large-scale basis. The sprawling and rugged rural areas that set the stage for recent conflicts in Iraq and Afghanistan will soon be replaced by cramped, densely-populated urban areas likely packed with any number of various hazards for U.S. servicemembers. The sea change is obvious then: tight maneuvers in a highly restricted setting where previous superiorities in both communications and air support are presumably and substantially challenged, and –by that same token– where any injury may require prolonged field care for an unspecified time.

As in every facet of military success, cooperation is key. Therefore the teaming efforts of both the Combat Casualty Care Research Program (CCCRP) and the Telemedicine and Advanced Technology Research Center (TATRC) –both entities found beneath the U.S. Army Medical Research and Materiel Command (USAMRMC) umbrella– will be integral in developing the tools and capabilities needed to weather this coming shift; as we wade into everything from artificial intelligence (AI) to robotics to the aforementioned research into unmanned vehicles.

Tapping Untapped Artificial Intelligence

From the AI perspective, the constant goal on the future battlefield will be to connect a point-of-care medic with decision support and advanced situational awareness platforms in order to enhance overall medical treatment. While current systems push monitoring data and medical encounters to a single location (point-to-point communication) the future is to have standalone capabilities obviating

dependence upon contested communication space. Such systems are currently being researched with prototypes being developed and will over time add the capability of remote medical care. These systems will substantially augment casualty care to the patient both in the prolonged care and en-route care environments via the use of semi-autonomous/ autonomous evacuation vehicles.

A concept that perhaps combines both those latter two points is the realization of automated vascular access; a technological application in which miniaturized robotic units can (and likely will) be applied onto an injured Warfighter's leg and then, using ultrasound capabilities, automatically identify and access the correct vessel in a casualty's leg to deliver fluids and medication. Automation of time-consuming (yet nonetheless relatively simple) medical tasks like this one could save exponentially more lives on the battlefield than current efforts can, thus enabling stronger resiliency and more fully-realizing the sustainability of a smaller, leaner forward unit. Such technology is likely between one and three years away.

Perhaps the greatest area of promise, however, lies in the full-scale use of wholly unmanned vehicles and their capacity to facilitate the synergy of the overall combat effort. For instance, given current capabilities in this area, it's easy to envision the eventual development and deployment of large-scale military-grade drones charged with carrying blood to far-forward areas – areas that simply may not allow (via consequence, circumstance or both) for human interaction at the same level. Such technology would then allow for the necessary transport of lifesaving capabilities without the potential human cost of said transport. Further still, and as a result, the most immediate and impactful benefit of said technology may then lie in its ability to deliver damage control and resuscitation technologies to the Warfighter the point of injury. To that end –and just as an example– the Defense Advanced Research Projects Agency (DARPA) continues

work on the long-gestating Aerial Reconfigurable Embedded System (ARES), which is essentially a large unmanned drone designed to carry a slew of different mission modules as required. With the ability to transport up to 3,000 pounds of supplies, the ARES has the ability to make a sizable impact in medical delivery and resupply efforts.

Automation Enough for Austere Environmental Control

As such, the potential benefits of leveraging robotics and autonomous systems (RAS) during future conflicts is widely recognized across the DoD. Leveraging advancements in both DoD RAS platforms and medical-specific autonomy research being



COL Michael Davis
CCCRP Director



Dr. Gary Gilbert
USAMRMC Lab Manager

executed by the DoD, its corporate partners, and academia, it may be possible to use said systems as future force multipliers on the austere battlefield by injecting both capacity and expertise in far-forward areas. In such situations, the combination of human experts, medically-specific artificial intelligence, and local care providers could and would act as a team to provide the required expertise and capacity available at the point-of-care in future operational environments. Indeed, it is likely that future casualty care providers will rely heavily on the support of medical RAS technologies and, also, use medical-intelligent systems and robotics with varying degrees of autonomy.

Continuing, TATRC is also investigating a number of point-of-care and en-route care physiological monitoring capabilities that use wireless medical bio-sensor technology. One such system will enable the medic to monitor up to six casualties simultaneously as wireless medical sensors provide information on heart rate, blood pressure, and other vitals. Through further research and development, such information may then be transmitted to the tactical MicroCloud, providing the backbone of a system that will provide the point-of-care medic with a virtual lifeline to a medical provider at a higher echelon of care. This kind of additional guidance may be the link required to increase the survivability of casualties during lengthy prolonged field care efforts.

It's important to note here that all current research efforts in this vein revolve around systems capable of operation in a so-called "no-communication" or "low-communication" environment. Given the expected substantial degradation of communications capabilities on the future battlefield, such technologies will be key to success. The use of cloud technology on the battlefield at a Brigade level (and lower) will likely be a game changer; enhancing a medic's training and treatment support during long periods of care when casualty evacuation is delayed. The tactical MicroCloud will enable a medic to obtain the resources needed to sustain a patient until evacuation is available.

It is also similarly important to note that the ability of RAS to provide these benefits depends on the maturation of key "enabling technologies" in the areas of robotics and autonomy. Said "enabling technologies" include both the design and development of next-generation intelligent medical systems capable of providing remote patient support and, in addition, the methods of integrating these medical systems with emerging multi-purpose RAS platforms. To aid the maturity and application of these technologies, the USAMRMC has recently established long-term research areas in future medical robotic systems and autonomous, unmanned capabilities that are capable of supporting casualty care while minimizing the medical logistic footprint in far-forward and dispersed geographic environments. Such research includes utilizing artificial intelligence and closed-loop control to support both prolonged field care and en-route care with limited or absent medical care personnel. TATRC's research also includes delving into emergency medical resupply technologies for integration with emerging multi-purpose RAS platforms in support of the Army's "Multi-Domain Battlefield" concept.

Evacuation by Automation

Robotic and autonomous combat casualty care and evacuation in unmanned systems present significant research challenges. Artificial intelligence and machine-learning systems are heavily data-driven technologies, and therefore further developing combat casualty

care systems that use those technologies requires a well-populated and reliable combat trauma database; such is the purpose of the Department of Defense Trauma Registry (DoDTR) located at the U.S. Army Institute of Surgical Research (USAISR) in San Antonio, Texas. This registry is continually being populated with electronically formatted information about the demographics, injury-producing incidents, diagnosis and treatment efforts, and eventual outcomes of injuries sustained by both U.S. and non-U.S. military members and both U.S. and non-U.S. civilian personnel in both wartime and peacetime from the point of injury to final disposition.

Likewise, artificial intelligence and machine learning systems use heuristic reasoning or rather, "leaps of faith"- and therefore don't necessarily produce the same result every time. Therefore it is difficult to prove that their algorithms are correct. This is a significant research challenge if these technologies are to be certified for use by the U.S. Food and Drug Administration as safe for clinical decision making and treatment. Robotics, as we know them today, tend to be larger, heavier, and use more power than equivalent biological systems. Use of these systems could present a significant logistical challenge, take up limited cargo space, and add weight to combat vehicles or to otherwise already burdensome combat loads if carried into battle by dismounted warfighters.

TATRC is addressing this problem by working with leading universities to exploit newly-emerging (and so-called) "soft robotics" technologies that mimic biological systems and therefore are more compact, lighter in weight, more flexible. Adapting unmanned platforms currently being designed without regard to human passenger comfort or safety will require development of mission-dictated flight performance constraints on unmanned air systems and augmentation of shock absorption on unmanned ground systems. Likewise providing the "human touch" element of patient care when human en-route care attendants are not present requires significant research in the human dimension; to be addressed by the USAMRMC through the Army Medical Manned-Unmanned Teaming & Virtual Health S&T task areas.

Within the Multi-Domain Battle environment, safely navigating robotic unmanned platforms through hostile terrain or air space to perform emergency medical resupply and autonomous evacuation of casualties - perhaps- without combat air protection or with denied communications, will require new levels of autonomy. Such efforts require a high level of coordination between the CCCRP, TATRC, other laboratories within the USAMRMC, and those of the rest of the Army, the other services, and DoD to ensure that planned research in medical robotics and autonomy align with the CCCRP's research and development initiatives. Capabilities are integrated early with the common user platforms on which they will reside, and leverage necessary enabling technologies research ongoing elsewhere.

Full Steam Ahead

While the future is by definition an unknowable entity, the path that both the CCCRP and TATRC are charting right now reveals perhaps the most sure-footed way forward. This blueprint, with its focus on trauma-based psychological demands, warfighter requirements, technology, and forward-leaning excellence in scientific research, is specifically focused on the wholesale adaptation to the restraints of the coming battlefield. For it is only through understanding the rules of this new game that we can develop the strategies required to fight, to win – to dominate.

EVOLUTION OF REMOTE DAMAGE CONTROL RESUSCITATION

By Randall Shaefer (LTC, USA Ret.), Division Director, Research, Southwest Texas Regional Advisory Council



The Southwest Texas Regional Advisory Council (STRAC) provides deployable medical care for the Fiesta celebration in downtown San Antonio, Texas. (STRAC)

Within the last decade, substantial improvements in combat casualty outcomes have been a consequence of the revolutionary change in the paradigm of massive hemorrhage resuscitation coined Damage Control Resuscitation (DCR). It is borne out of a novel scientific discovery made by U.S. military physicians managing severely injured casualties within military medical treatment facilities (MTF) on the battlefield. The principle of DCR evolved as a natural extension of the philosophy of damage control surgery to control significant hemorrhage after injury. The basic tenets of DCR are based on the mitigation of the “lethal triad” of injury manifested by acidosis, hypothermia, coagulopathy utilizing a resuscitation strategy that allows permissive hypotension and promotes early hemostasis. The hemostatic element is attained by virtue of a balanced resuscitation of red blood cells, plasma, and platelets directed at the early amelioration of the coagulopathy of trauma.

Despite the obvious clinical successes of this innovation, a significant clinical gap was identified by a review of all battlefield deaths from 2001-2011 in which the majority of battlefield injury mortality (87%) occurred in the field prior reaching an MTF. Of the prehospital battlefield deaths, 24% were potentially survivable of which 90% died as a result of hemorrhage. Philosophically, as time to surgical control of hemorrhage is contingent upon the availability of evacuation assets, it follows that moving resuscitation assets forward to the casualty will bear

the potential to extend the window of survival to reach definitive care.

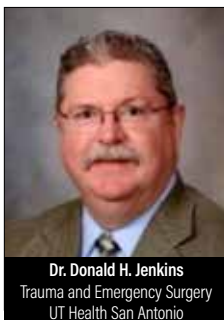
Pushing DCR Closer to Point of Injury

Remote Damage Control Resuscitation (RDCR) is the embodiment of this forward application of Damage Control Resuscitation (DCR) concepts, which includes both hemorrhage control techniques and hemostatic resuscitation with blood and blood products. Research led by Dr. Donald Jenkins, Col, USAF, MC (Ret), a principal architect of the Joint Theater Trauma System in Iraq and Afghanistan, showed that combining the practice of prehospital transfusions with specially tested units of whole blood, rather than transfusing individual blood components of red cells, plasma or platelets, is most effective in treating trauma victim suffering from significant blood loss. “The general mortality rate for critically injured patients requiring massive transfusions at hospital trauma centers is 75 percent,” said Jenkins. “Our battlefield experience showed that providing earlier, prehospital transfusions of whole blood, rather than blood components or primarily red blood

cells, brought mortality rates down as low as 20 percent.” As the military postures itself to fight future conflicts with delayed and/or prolonged evacuation distances and times, it is imperative to identify ways to improve warfighter survivability by providing the appropriate intervention as close to the point of injury as possible.



Mrs. Randall Schaefer
Research Director, STRAC



Dr. Donald H. Jenkins
Trauma and Emergency Surgery
UT Health San Antonio

Where You Live Should Not Determine If You Live: “Brothers in Arms”

Southwest Texas launched an initiative to put Low Titer O-positive Whole Blood (LTOWB) at 17 geographically dispersed civilian helicopter emergency medical service (HEMS) bases and in both of San Antonio's Adult Level I trauma centers: University Hospital and San Antonio Military Medical Center (SAMMC). San Antonio, Texas has a robust trauma system, led by Southwest Texas Regional Advisory Council (STRAC), a 501(c)(3) organization designated by Texas statute for the development, implementation, and oversight of the regional trauma system for Southwest Texas. STRAC's trauma membership consists of over 70 ground EMS providers, three air medical providers, numerous Level IV trauma centers, four Level III trauma centers, and two adult Level I trauma centers and one pediatric Level I trauma center. The geographic area of responsibility covers over 26,000 square miles of urban, rural, and frontier areas. Guided by the motto “do what is best for the patient”, STRAC leads this regional LTOWB program in collaboration with the South Texas Blood & Tissue Center (STBTC), University Health System (UHS), the San Antonio Military Medical Center (SAMMC), the US Army Institute of Surgical Research (USAISR), the University of Texas Health San Antonio (UTHSA), and air medical services represented by Air Evac Lifeteam, PHI Inc., and San Antonio AirLIFE. Funding to develop the initiative came from San Antonio Medical Foundation, STBTC, and STRAC.

Southwest Texas is the first region in the country to broadly implement a prehospital LTOWB program. Branded under the moniker “Brothers in Arms,” the name of the program lends to the specific recruitment of O-positive male donors. Although the universal blood type used for emergency transfusions is O-negative, it is present in just 7 percent of the population; whereas more than 30 percent of donors are type O-positive. Men tend to have lower levels of certain types of antibodies in their blood than women, reducing the possibility of adverse reactions in patients. The largest challenge to successfully implementing a program of this caliber is recruitment and retention of donors. South Texas Blood and Tissue Center has developed the “Brothers in Arms” recruitment program to develop a sustainable source of LTOWB. STBTC's sister blood-testing organization, QualTex Laboratories, worked with the Army Blood Program to develop the testing protocols to identify O-positive donors with low antibody levels, making it possible to use O-positive blood for civilian trauma victims. “The STBTC commitment to improving the survival of prehospital trauma patients by providing LTOWB product is unprecedented,” says Jenkins.

One of the program successes was developing a system in which LTOWB unused by the HEMS agencies is cycled into the civilian Level I trauma center prior to product expiration. Thus, major trauma patients that did not arrive by helicopter are receiving the benefits of LTOWB and the program minimizes product waste due to expiration. While the process is currently in place at University Hospital, efforts are underway to include San Antonio Military Medical Center into the rotation. This would allow the Armed Services Blood Program LTOWB that is currently collected and being used at SAMMC to be sent directly into military operational areas. Another success of the Brothers in Arms program is the ability to collect data and outcomes to validate current Tactical Combat Casualty Care (TCCC) guidelines through the Remote Trauma Outcomes Research Network (RemTORN).



As a strategy to minimize waste of Low Titer O Positive Whole Blood (LTOWB), pre-hospital units are cycled into University Hospital San Antonio fourteen days prior to expiration. (UT Health San Antonio)

Military-Civilian Medical Research Collaboration

RemTORN is a military-civilian collaboration to study and validate current TCCC & RDCR tenets and identify novel prehospital strategies for the future battlefield environment. It is a collaborative project between STRAC, the University of Texas Health San Antonio (UTHSA), and the Department of Defense, funded through the U.S. Army Medical Research and Materiel Command's Combat Casualty Care Research Program. This unique research platform is directed by Principal Investigator, Dr. Brian Eastridge, COL, MC, USA, who likewise lead the development and implementation of the Joint Trauma System and is currently the Chief of the Division of Trauma and Emergency Surgery at UT Health San Antonio.

STRAC fosters civilian and military collaboration by designing and executing research studies relevant to trauma care in remote and austere environments such as those experienced by our rural and frontier hospital system partners and the military in a deployed environment. With large geographical distribution of patients, lack of robust medical resources, and transport times from point of injury to a Level 1 Trauma of greater than an hour, Southwest Texas is the ideal location for military-civilian prehospital casualty care research collaboration. It is a unique environment that can address capability gaps for TCCC and Prolonged Field Care (PFC), such as RDCR. The use of prehospital LTOWB within a well-defined system of care is a natural translation of lessons learned from the deployed environment as both environments share the tyranny of time and distance to definitive care.

Future Opportunities

Based upon the successful implementation of LTOWB onto the HEMS platform, it will be feasible to expand patient access to LTOWB at all points in the continuum of care, to include 13 Southwest Texas rural community and critical access Level IV trauma centers, and ground emergency medical services. Based upon recent studies of LTOWB use in pediatric patients, expansion of the LTOWB capability into the civilian pediatric Level I trauma facility is also underway. “By undertaking this project and others like it in the future, Southwest Texas medical leaders are committed to saving lives in our community as well as those on the battlefield today and tomorrow,” Jenkins conveyed.

ACCELERATING CASUALTY REBOUND

Next-generation advances in combat casualty care are being made at the U.S. Army Institute of Surgical Research (USAISR) that are helping to reduce the “long-term” in “long-term recovery.”

By COL Booker King, Director, Burn Center, USAISR

Surgeons at the 86th Combat Support Hospital in Baghdad, Iraq treat severe injury to a local national after an IED event. (USAISR)



The primary mission of the U.S. Army Institute of Surgical Research (USAISR) is to conduct research that focuses on “optimizing combat casualty care”. The USAISR has a research directorate that is composed of several “task areas” each of which are dedicated to a specific aspect of combat casualty care. Some areas of focus that has direct implications to the delivery of care on the battlefield are: innovative therapies used in the management of compressible and non-compressible hemorrhage and the use of whole blood in damage control resuscitation. Research at the USAISR Burn Center contributed to the development of a decision support device used for burn resuscitation. The Burn Center is also engaged several studies in the field of regenerative medicine. This is a new frontier in burn care with the sole aim of developing products for wound coverage through the use of novel biologic therapies.



COL Booker King
Director, Burn Center, USAISR

Bleed Mitigation and Blood Restoration

Early in recent conflicts, compressible extremity hemorrhage was identified as a preventable and significant cause of death and morbidity on the battlefield. USAISR was involved in the evaluation of tourniquets which ultimately resulted in the recommendation to field the Combat Application Tourniquet (CAT) to U.S. military personnel deploying into operational theaters worldwide. Subsequent studies have shown significant improvement in this cohort since this recommendation was implemented. Junctional hemorrhage is caused by bleeding from the axilla, upper groin, lower abdomen and base of the neck. This type of hemorrhage became much more prevalent since the standard CAT tourniquet was effective at stopping bleeding from extremities but was ineffective at controlling bleeding from these sites. There are

currently three devices that are FDA approved and were developed through collaboration between the military, civilian institutions and industry. These devices have already shown great benefit on the battlefield.

In 2007, Borgman and associates reported improved survival in combat casualties that were resuscitated using packed red cells (PRBC's), fresh frozen plasma (FFP) and platelets (PLT) transfused at ratios of 1:1:1. Recent studies showed the utility of warmed whole blood for massive transfusion in combat casualties. The use of whole blood is by no means a new therapy, in fact, its use dates back to World War I. We are rediscovering the importance of this therapy. Its use is also an example of military discoveries translating into an advancement in civilian trauma care. The use of whole blood is now being investigated at several civilian trauma centers.

One new technique that has been recently studied at the USAISR and several civilian trauma centers as well is the Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA). The technique uses a device that consists of a catheter designed to enter the arterial system with a special occlusive balloon at its tip. The catheter is inserted into an artery, usually the femoral arteries in the groin, then advanced past the site of bleeding in the abdomen or the chest. The balloon is then inflated and it partially prevents the flow of blood to the area of the injury. Thus this technique allows for the temporary control of hemorrhage until more definitive management of bleeding can be performed. This obviates the need to invasively enter the abdominal or chest cavity to gain control of massive bleeding. Initial studies are promising but this technology is relatively new. The procedure does require that the technician have basic knowledge of endovascular techniques.

Manley and associates published a case series where REBOA was used in an austere setting by a forward deployed mobile surgical unit. A specially designed ER-REBOA kit allowed for the placement of the device without the use of fluoroscopy or ultrasonography. Four patients were stabilized using this device and all four patients were safely evacuated to the next level of care. This case demonstrates that REBOA technology may have usefulness on the battlefield. The use of REBOA in the pre-hospital setting is now being studied with training geared to special operation medics.

Enabling More "Return" from Burn

The care of the thermally injured combat casualty can be difficult and often the care begins at forward mobile medical hospitals at or near active engagement. These patients may present with a variety of severe injuries in addition to their burn injury some of which can be immediately life-threatening. This combination of injury patterns was observed in military personnel who were victims of attacks using incendiary explosive devices. The patients with severe thermal injury were more likely to be treated by providers with little or no training in burn care. This fact highlights the importance of pre-deployment training which USAISR Burn Center has supported since the earliest days of the war. The outcome of severely burned patients is heavily dependent on the initial stabilization (management of potentially life-threatening injuries) and on burn resuscitation. A disparity in resuscitation practices was observed early in the recent conflicts. The institution of compressive Clinical Practice Guidelines (CPG's) by the Joint Trauma System (JTS) has led to improved patient outcomes.

To aid with the resuscitation of burn casualties on the battlefield, USAISR developed a burn resuscitation decision support device.

This device is a portable tablet capable of recording the patient's fluid intake and urine output on an hourly basis. The unique feature of this device is that it uses a complex algorithm to determine the adjustment in intravenous fluid rate and make recommendations to the provider. The device also graphically displays the progress of the resuscitation and will give visual alerts when the amount of fluid resuscitation is dangerously high. The "Burn Navigator® (Arcos)" is now commercially available as an FDA approved device which is marketed for use at burn centers internationally. A durable version of the Burn Navigator® (re-enforced portable computer tablet) is due to be fielded to deploying units very soon.

Severe burn injury will require definitive wound closure if the patient is to survive. With a large surface area of burn, the patient will have limited areas of innate donor skin for wound coverage. Therefore, much recent research has been devoted to regenerative medical technologies. The USAISR has been involved in two clinical trials in this area – ReCell® and StrataGraft. ReCell® is a portable device that creates an epithelial cell suspension solution using a postage stamp sized harvest of the patient's skin. When the solution is applied to an open wound it results in coverage of an area EIGHTY times the size of the original harvest. StrataGraft is another experimental product derived from skin progenitor cells. Under investigation is whether sheets of StrataGraft placed on an open wound would eventually be replaced by intact skin. Both of these regenerative technologies have potential use in the treatment of severe burns in combat casualties.

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PTSD: ACCENTUATING HOLISTIC CARE FOR LONG-TERM BETTERMENT

The Department of Veterans Affairs (DVA) Tennessee Valley Healthcare System (TVHS) is an integrated tertiary healthcare system offering advanced, first-line therapy for the long-term treatment of Post-Traumatic Stress Disorder (PTSD).

By Dr. Allison Bradshaw and Dr. Julie Burnett, VA Tennessee Valley Healthcare System

Comprised of two hospitals, the Alvin C. York Campus in Murfreesboro and the Nashville Campus, as well as more than a dozen community-based outpatient clinics in Tennessee and Kentucky, the Department of Veterans Affairs (DVA) Tennessee Valley Healthcare System (TVHS), provides ambulatory care, primary care, and secondary care in acute medicine and surgery, specialized tertiary care, transplant services, spinal cord injury outpatient care, and a full range of extended care and mental health services.

The mission of the Tennessee Valley Healthcare System is to “enhance the health and well-being of veterans who entrust us with their care,” and the vision is to “provide the right services at the right time for the right reason.” Critical to achieving both is finding the most effective ways for providers to engage with the nearly 100,000 enrolled veterans, more than 40,000 of whom are living in rural areas. Providing quality care is of course the biggest part of the equation but delivering it in ways that make it easy and convenient to reach out for help is also paramount. TVHS providers are leveraging advances in communication technologies through the web and mobile devices to provide care for veterans who may otherwise have been unreachable.



VA healthcare providers in Middle Tennessee use secure video conferencing through the VA Video Connect app to consult with Veterans in their homes. The Tennessee Valley Healthcare System is leveraging advances in communication technologies like this to provide care for veterans who may otherwise have been unreachable. (U.S. Department of Veterans Affairs)

been few and far between. We have also been limited in doing TMH in the past due to a lack of space to see these veterans at their closest VA community clinic (for some sites, not all of them), but now that more providers are trained to do TMH at home, this should be less of an issue.

Again, the treatments themselves are very similar to those in which veterans participate on site. Online training is a great option for veterans who are unable to participate in face-to-face therapy (via telehealth or in a clinic). However, these veterans will not have direct feedback from other group members or their

therapist, which puts the onus of problem-solving and utilizing skills solely on the participant.

Web-accessible Information

For some things, veterans are just told about the resources. For instance, I ran a Problem-Solving Therapy (PST) group, and I suggested that group members who were interested download the app to use as a companion. For veterans I thought would benefit from PST but couldn't attend the group, I would give them the Veteran Training website and suggest that they consider using the online version. They could do that on their own, or they might use the online training as a starting point in individual therapy.

I do think many veterans like the apps. I found the PE app particularly useful. Several of the veterans in an anger management group that I facilitated used mindfulness coach-type apps, and they really seemed to enjoy them and use them frequently. Of course, there are always some who prefer not to use apps or online training, and that's okay—they're not required.

Technology is great, but it's not everybody's thing, and that's okay. We will continue to see veterans in person, and no one ever has to use an app or a video training. Technology just gives us more options in terms of service delivery, and we hope that means we're able to meet the needs of more veterans. Many studies have shown strong evidence that family participation in the mental health care of individuals contributes to improved treatment outcomes and patient satisfaction. So, involving the family is ideal, when possible. The PTSD family coach app gives family members the opportunity to learn more about PTSD, gain tips on how to support their loved one, and use tools that help family members manage their stress. Similar to the PTSD Coach app for veterans, it can be used as a standalone tool for a family member, or as a supplement to therapy.

Telemedicine to the Fight

Probably the most significant recent advance in PTSD care is the use of tele-mental health (TMH). Providers are now able to see veterans who would otherwise be unable to participate in psychotherapy. There has been substantial research that supports the use of Cognitive Processing Therapy (CPT) and Prolonged Exposure (PE) via TMH, and CPT and PE delivered via TMH are considered first-line treatments for PTSD, just as face-to-face therapy would be.

In terms of CPT and PE, it really hasn't changed much at all! We still follow the same evidence-based protocols. Most of the changes are related to how we administer symptom measures and review homework since we can't hand papers back and forth—logistical changes, really.

The most important thing about tele-mental health is that it allows us to see veterans who might otherwise be lost to mental health treatment. We can provide evidence-based psychotherapies with high confidence that we are still providing gold-standard therapies to veterans who might not have the opportunity to participate without that modality.

TMH has some unique difficulties, like sharing documents. Every now and then, technology fails, too; however, those times for me have

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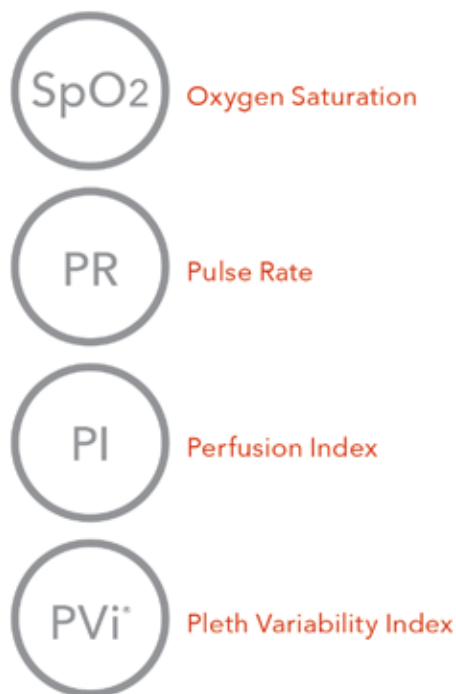
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