ISSN 1553-9768 Winter 2011 Volume 11, Edition 1

Journal of Special Operations Medicine

A Peer Reviewed Journal for SOF Medical Professionals

See "From the Editor" for important changes to the JSOM!

This edition's feature articles:

- Public Health Operations in the JSOTF-P
- Maslow's Hierarchy of Needs: A Missing Link in COIN Strategy
- Optimizing Nutrition for Performance at Altitude: A Literature Review
- Soldiers Can Take It – A Conceptual Analysis of Trauma
- Feedback to the Field: An Assessment of Sternal Intraosseous (IO) Infusion
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Dedicated to the Indomitable Spirit & Sacrifices of the SOF Medic

Volume 11, Edition 1 / Winter 11 Journal of Special Operations Medicine ISSN 1553-9768

Journal of Special Operations Medicine

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ISSN 1553-9768

Top image: Barangay children participate in proper hand-washing exercises. *Photo by: MC2 Joshua Scott.*
Bottom image: An AFP Marine medic injects a cow with Ivermectin dewormer (Jolo)
Images are part of the **Public Health Operations in the JSOTF-P** article by CPT Dennis Rufolo and CPT Cyndie Facciolla, DVM.

From the Editor

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The *Journal of Special Operations Medicine's (JSOM)* mission is to promote the professional development of Special Operations and TEMS medical personnel by providing a forum for the examination of the latest advancements in medicine and the history of unconventional warfare medicine.

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MEDIC RECOGNITION

COL Peter Benson, USASOC Command Surgeon, pins a Meritorious Service Medal on SFC James Birchfield at the close of the Army Special Operations Forces Medical Conference 12 December. Birchfield, who is assigned to the 5th Special Forces Group (Airborne), was officially named the Special Forces Medical Sergeant of the Year.

Two U.S. Army Special Operations Command medics were recognized as the top Soldiers in their career fields at the Army Special Operations Forces Medic Conference, 12 December, and the Special Operations Medical Association conference, 14 December, at the Marriot Waterside Hotel, Tampa, FL.

SFC James C. Birchfield from the 5th Special Forces Group (Airborne) was officially named the Special Forces Medical Sergeant of the Year during a ceremony at the close of the ARSOF Medic Conference. SGT Jonathan Peney from the 1st Battalion, 75th Ranger Regiment was selected as the Special Operations Combat Medic of the Year. Peney was killed in action 1 June while deployed to Iraq. His wife Kristin and mother Sue accepted the award on his behalf at the SOMA conference Mess Night.

Birchfield, whose wife and daughter were present for his award presentation, was nominated for the award because of his outstanding service while deployed to Iraq, said MAJ David Bowling, 5th SFG (A) Company Commander. Bowling said Birchfield, an experienced medic, was personally responsible for training other medical personnel on his deployment. He said by sharing medical knowledge with others, Birchfield successfully trained several Soldiers who went on to save lives.

COL Peter Benson, USASOC Command Surgeon, presented the award to Birchfield and said he knew the award would be received with humility, maybe even too much. “Our medics are universally humble to a fault,” Benson said.

Upon receiving his award, Birchfield certainly proved Benson’s assessment of USASOC medics. “It’s an honor to represent my unit,” said Birchfield, “but far more medics in Special Ops deserve [the award] more than me. I just did my job every day.” Bowling disagreed with Birchfield. “His supervised treatment saved lives both directly and indirectly,” Bowling said. “He won’t say that he did anything special, but he really did.”

Peney’s performance was equally impressive. CPT Andrew Fisher, a physician assistant who deployed with Peney, described Peney as a great medic and Soldier who constantly did his best and continued to improve. “He was always a step above,” Fisher said. “He was always trying to do more.”

Fisher said Peney showed true bravery in his last mission. While their unit was in Kandahar province, Afghanistan, they were ambushed, and a team member was shot. Fisher said Peney was the first to rush through enemy fire in an attempt to save the Ranger’s life. While administering aid to the wounded Ranger, Peney was also shot. Fisher, who initially attended to Peney’s wound, nominated Peney for the award due to his selfless heroism on this occasion and many others. He said he is glad Peney was named Special Operations Combat Medic of the Year, a title he truly deserves. “It’s a great feeling knowing (USASOC) is able to recognize him, knowing what he did for his unit and his fellow Soldiers,” Fisher said. “It’s nice that all the medics from his company were present (for the award ceremony).”

Since his arrival at 1st Ranger Battalion in October 2007, SGT Peney has demonstrated nothing but excellence during 32 months of selfless service as a Ranger medic said CPT Fisher.

SGT Peney was initially assigned as a medic in Headquarters Company 1st Battalion, 75th Ranger Regiment in October 2007. Intrinsically motivated, SGT Peney captivated the medical staff’s attention as one to watch for positions of greater responsibility based on his maturity and eagerness to master his duties. SGT Peney was dependable in garrison and regularly performed his medic duties at sick call where he was always searching for ways to increase his understanding of medicine and ultimately provide better care for his patients. Over the course of four combat deployments in support of Operation ENDURING FREEDOM, SGT Peney participated in over 75 Special Operations raids. Based on his extensive combat experience and multiple trauma training courses, SGT Peney developed into an expert in trauma management and he took a vested interest in the professional development and training of the junior medics in the Battalion.

SGT Peney deployed to Operation ENDURING FREEDOM in August 2009 to December 2009. During this deployment, SGT Peney worked as a Platoon Medic for a Joint Task Force. He trained and mentored a junior medic with no combat experience to be able to deploy and operate as an independent platoon medic. During the deployment, SGT Perley also trained his entire platoon and members of other units in Ranger First Responder, a critical course that enables Rangers to treat life-threatening injuries on the battlefield.

SGT Peney graduated from Ranger School in May 2010. Just nine days after returning from Ranger School, SGT Peney volunteered to deploy to combat as part of the JTF surge force with Delta Company. Based on his limited recovery time following Ranger School, the newly married SGT Peney had the option to deploy six weeks later so he could spend time with his wife. However, SGT Peney could not stay back and watch his Platoon deploy to a combat zone without him. As a testament to his selfless service, SGT Peney left his new wife after being in Ranger School for three months and volunteered to deploy to combat in support of his Ranger buddies in Delta Company.

While deployed in support of Operation ENDURING FREEDOM, SGT Peney reacted and treated casualties from two separate incidents. During a complex attack at an airfield in Afghanistan, a Soldier stepped on a land mine. SGT Peney applied a tourniquet and stopped the bleeding before directing the Soldier's evacuation to higher care. In a separate instance, SGT Peney reacted to effective indirect fire outside of his barracks area. SGT Peney, with his aid bag flung over his shoulder, was the first to respond to the scene and immediately found five international workers wounded in the attack. With no regard for his own personal safety, SGT Peney immediately conducted a quick casualty triage and determined the most critical patient to be a man with an amputated leg. SGT Peney stabilized his patient and controlled the bleeding with proper application of a tourniquet. He directed that the other medics on the scene stabilize their patients and move them inside with his patient to the casualty collection point that he established. Like the seasoned combat veteran that he was, SGT Peney took charge and controlled the chaos in the room. He first cleared everyone out of the CCP and issued calm and clear directives to the three other medics, one physician's assistant, and the doctor. He triaged and organized the evacuation of all the patients based on their priority and subsequently all of the patients lived as a result of SGT Peney's courage under indirect fire, his responsiveness, and his expert application of trauma management.

On 30 May 2010, after his platoon successfully conducted a Search and Attack operation, they secured a strong point for the day. Shortly after sunrise, the enemy attacked the strongpoint from three directions with an intense barrage of small arms, rocket propelled grenades, and sniper fire. During the initial volley, a team leader on a rooftop was critically injured and sustained a gunshot wound to the right arm and right chest. Without hesitation and with complete disregard for his own personal safety, SGT Peney climbed a ladder thru effective automatic weapons fire to get to the rooftop. As he reached the top of the ladder, he was shot in the left flank and mortally wounded. He was posthumously awarded the Purple Heart, Meritorious Service Medal, and Bronze Star Medal. For his valorous actions, SGT Peney has been recommended for the Silver Star.

SGT Peney was a devoted and extraordinary Ranger medic. He possessed all of the talents and maturity necessary to excel both personally and professionally in any organization. He was an immeasurable asset to our organization and his moral compass and discipline were beyond reproach.

For his actions on and off the battlefield, Peney was posthumously named the 2010 U.S. Army Special Operations Command Medic of the Year and the Special Operations Medical Association Medic of the Year.

Peney's mother, Sue Peney, and his wife, Kristin, accepted the awards on his behalf at two different ceremonies in December, at the ARSOF and SOMA conferences. (See SOMA Update)

Selecting these awardees was no easy process, said MSG Rick Hines, U.S. Army Special Forces Command (USASFC) (Airborne), who was a member of the board that reviewed the award nominations and selected the winners. "It was very competitive, but we ended up with a clear consensus," Hines said. "(Birchfield and Peney) definitely stood out as going above and beyond."

Hines said the awards are important because they highlight the outstanding actions of dedicated individuals who raise the bar for other Soldiers. "The award recognizes our medics for doing extraordinary things," he said. "It holds up an example for all of us; this is what we should strive for in our field."

Sue Peney thanks the crowd at the Special Operations Medical Association Conference mess night 14 December, for remembering her son, SGT Jonathan Peney, who was killed in Afghanistan 1 June.

Photo by SrA Anna-Marie Wyant

SGT Jonathan K. Peney

Sergeant Jonathan Kellylee Peney, a U.S. Army Ranger was killed in action 1 June 2010, during combat operations in support of Operation Enduring Freedom while assigned to Company D, 1st Battalion, 75th Ranger Regiment, Hunter Army Airfield.

SGT Jonathan Kellylee Peney, 22, a native of Marietta, GA, was killed by enemy fire while moving under heavy fire to provide aid to a wounded Ranger in the Kandahar Province, Afghanistan.

After graduating from high school, Peney enlisted in the U.S. Army from his hometown of Marietta, GA, in November 2005. For more than two years, he served as a combat medic in 1st Battalion, 75th Ranger Regiment. He was on his fourth deployment in support of the War on Terror with three previous deployments to Afghanistan.

"SGT Peney was the epitome of our Ranger Medics – warrior first, expert in advanced medical treatment, and selflessly dedicated to the care of others – even at the risk of one's own life," said COL Michael E. Kurilla, Commander, 75th Ranger Regiment. "SGT Peney did not hesitate to move under heavy fire to the care of another wounded Ranger. He is a hero to our Nation, the 75th Ranger Regiment and his family."

"SGT Peney died while moving to provide life-saving aide to a fellow Ranger," said LTC Michael Foster, Commander of 1st Battalion, 75th Ranger Regiment. "Our Rangers continue to put their lives at risk in support of our nation's ideals. Keep your thoughts and prayers with them and their families."

SGT Peney completed Basic Combat Training at Fort Benning, GA, and Combat Medic Training at Fort Sam Houston, TX. He returned to Fort Benning in June 2006 and completed the Basic Airborne Course and the Ranger Indoctrination Program before attending the Special Operations Combat Medic Course at Fort Bragg, NC. Peney was then assigned to Company D, 1st Battalion, 75th Ranger Regiment in November 2007.

His military education includes the Basic Airborne Course, Ranger Indoctrination Program, Special Operations Combat Medic Course, and the U.S. Army Ranger Course.

His awards and decorations include the Ranger Tab, Expert Field Medical Badge, and the Parachutist Badge. He has also been awarded the Army Commendation Medal, Army Achievement Medal, Army Good Conduct Medal, National Defense Service Medal, Afghanistan Campaign Medal with combat star, Global War on Terrorism Service Medal, and the Army Service Ribbon.

Besides being posthumously promoted to sergeant, he was posthumously awarded the Bronze Star Medal, Purple Heart, and the Meritorious Service Medal.

Peney is survived by his wife and mother.

- RANGERS LEAD THE WAY! -

Public Health Operations in the JSOTF-P

CPT Dennis Rufolo; CPT Cyndie Facciolla, DVM

Abstract

Medical personnel have a proven operational and strategic role as part of Counterinsurgency (COIN) and Foreign Internal Defense (FID) operations. In addition to the traditional employment of medical assets in Medical Civic Action Programs, commanders can utilize their medical resources in a teaching and educational capacity to effectively target an entire village (men, women, and children), with minimal logistical support. In the Joint Special Operations Task Force-Philippines, Environmental Science Engineer Officers and veterinarians added additional capabilities and facilitated educational programs that stimulate the coordination of local, military, and government resources to improve public health infrastructure and make a sustainable, lasting impact.

The Joint Special Operations Task Force-Philippines (JSOTF-P) conducts an extensive Foreign Internal Defense (FID) mission in support of the Government of the Philippines (GRP) counterinsurgency (COIN) efforts in the southern Philippines.[1] The 1st Special Forces Group (Airborne) (1SFG (A)) veterinarian and environmental science engineering officer (ESEO) supported this mission by conducting separate medical and veterinary service missions in May and June 2010. The 1SFG (A) ESEO was part of a medical civic-action program (MEDCAP) in conjunction with medical and dental staff, while the veterinarian conducted a veterinary civic-action program (VETCAP) with the JSOTF-P and Marine Corps Special Operations Command (MARSOC) veterinarians. Although the JSOTF-P command deemed both the MEDCAP and VETCAP missions successful in their own right, upon return to CONUS the 1SFG (A) ESEO and veterinarian concluded these missions could merge into a joint Public Health Civic-Action Program (PHCAP). This model could be useful throughout the JSOTF-P, as well as other SOTFs worldwide.

The following vignettes from the 1SFG (A) ESEO and Veterinarian missions provide an overview of their separate public health missions supporting the JSOTF-P. These vignettes illustrate the potential of combining these two assets together with their ability to target an entire barangay (village) population with minimal logistical support, while also providing a sustained positive impact on their health and well-being.

ESEO Public Health Mission

In conjunction with 1SFG (A) medical and dental staff, the ESEO traveled to eleven barangays participating in MEDCAPs led by Armed Forces of the Philippines (AFP) and JSOTF-P personnel. The population attending the MEDCAPs consisted mostly of women and children, with some traveling significant distances from the barangay's outskirts to receive medical care. In general, many fewer men were present when operations primarily focused on medical care, as they were often in the fields tending to their crops and animals.

The ESEO's primary mission during the MEDCAPs was to work with the AFP and local Ministry of Health personnel to provide and facilitate public health education to the local populace. Large contingents of patients waiting to receive medical evaluations and treatment provided a captive audience for those involved with teaching the public health aspects of the MEDCAP. The public health educators were able to capitalize on this teaching opportunity and training event to provide a tremendous influence on the barangay's long-term well being.

Previous MEDCAPs in the area did not emphasize the public health education aspect to potentially chronic conditions, and instead focused more on acute interventions that provided a brief course of treatment (e.g., administration and distribution of antibiotics, etc). In contrast, educationally based programs have the potential to provide knowledge that can have an enduring effect on a given population. On Jolo Island, the ESEO collaborated with the island's WASH (water, sanitation, and hygiene) coordinator and Secretary General for Muslim Women of Peace Advocates to incorporate public health aspects into the MEDCAPs. Her initiative and willingness to travel to the barangays everyday to lead classes and discussions, and provide the local "face" to this influential audience was the critical asset for its success. On the other islands, the AFP and U.S. leadership did not conduct prior coordination with the local WASH personnel to integrate their capabilities into the MEDCAPs. Due to this lack of coordination, the U.S. Forces were more involved in the public health portion of the MEDCAPs than the Jolo Island model. Utilizing the Jolo Island model to increase planning and participation by the local government and host nation military, together with U.S. Special Forces leadership's unified appreciation and emphasis on the operational planning for the public health education aspect of MEDCAPs, would significantly improve their overall effectiveness.

The public health classes taught to the local women consisted of food and waterborne disease transmission cycles and food sanitation, along with recommended countermeasures. The food sanitation class was based on the World

Figure 1: *Barangay children participate in proper hand-washing exercises.*

Photo by: MC2 Joshua Scott

Health Organization (WHO) Keys to Safer Food, and then further tailored to the local constraints and limitations (e.g., no refrigeration, limited potable water).[2] Several classes evolved into interactive sessions in which the educators and local women conversed about their specific situations and how to best protect their families. From a public health perspective, those sessions where local women shared ideas and knowledge amongst themselves offered the best opportunity to provide sustainable health practices to the barangay's families. Children were also instructed on the

Figure 2: *Barangay children receive a class on the food and waterborne disease transmission cycle from a local teacher.*

Photo by: MC2 Joshua Scott

food and waterborne disease transmission cycle utilizing cartoon based visual aids, along with proper hand-washing exercises and coloring contests as they "pledged to wash their hands." The most successful sessions were those when older children took the initiative and led the younger ones in teaching the disease cycles and demonstrating proper hand-washing as the adults observed. As the public health education aspect continues to be incorporated into traditional MEDCAPs, the classes will continue to evolve and will have even greater potential to significantly improve the local food and water sanitation situation.

While at the barangays, the ESEO and local leaders conducted several water system assessments and provided their specific recommendations to protect the barangays' sources and distribution systems. As a result of the ESEO's water system assessments and the Jolo Island's WASH coordinator's persistent efforts, three barangays are piloting a novel method for the region to obtain potable water for consumption. The program, known as Solar Water Disinfection (SODIS) utilizes the sun's UV radiation to produce safe drinking water.[3] Implementation of these relatively simple recommendations will increase the potability of the barangays' water supply, and subsequently the barangays' long-term health. '

Figure 3: *Local leaders, WASH personnel, and a 1SFG (A) ESEO discuss the barangay's water system and specific remediation measures to protect their source and distribution system.*

Photo by: MC2 Joshua Scott

Veterinary Public Health Mission

The JSOTF-P Veterinarian directed and supervised the veterinary public health operations in the JSOTF-P. During the month of June 2010, the JSOTF-P veterinarian coordinated veterinary education and treatment operations on the islands of Jolo, Basilan, and Mindanao in coordination with the local governmental infrastructure, and with the assistance of the 1st SFG (A) and MARSOC veterinarians. The goals of the mission were to educate and empower local farmers, improve overall herd health, reduce zoonotic disease, and provide a linkage between the AFP and government resources.

Figure 4: *An AFP Marine medic injects a cow with Ivermectin dewormer (Jolo)*

On Jolo, all operations occurred in conjunction with the AFP and the Jolo Department of Agriculture. The AFP liaisons would choose locations for veterinary missions that were of strategic or operational importance, coordinate with the barangay leadership and local populace, and escort

Figure 5: *JSOTF-P Vet teaches seminar on Basilan*

the Operational Detachment-Alpha (ODA) and veterinary team to the barangay.

The Department of Agriculture and veterinarians began each mission with an educational seminar that included topics on overall herd health, reducing parasite transmission and infection, and how to administer medications to animals. The Department of Agriculture personnel used this forum to discuss current governmental programs (WASH, Dengue, and Malaria programs) and educate farmers on the hazards of pesticide usage and meat residues. Filipino farmers have a higher overall incidence of cancer than the general population, which the Department of Agriculture partially attributed to chronic pesticide exposure. In this area it was common for farmers to mix agricultural pesticides with coconut milk and apply the mixture by hand to the backs of cattle. Although effective, the product contained very high levels of xylene, which is a potent carcinogen. After the seminar, AFP medics (previously trained on appropriate techniques) administered oral and injectable dewormers and vitamin supplements to cattle, goats, and water buffalo under the supervision of U.S. veterinarians. Farmers were encouraged to treat their own animals and to bring any cats or dogs for rabies vaccination. An equal number of men and women attended the seminars and brought their animals for treatment. The authors hypothesize that the veterinary seminars attracted more males than the public health seminars because the men raised and tended the livestock.

Figure 6: *Animal Scientists, AFP, Provincial Vet, and 1SFG (A) Vet pause for a photo (Basilan)*

On the islands of Basilan and Mindanao, similar operations were conducted in the barangays. On Basilan, the JSOTF-P veterinarian, along with the Civil Affairs (CA) Team, AFP community liaison, and community leaders, coordinated a seminar for animal scientists, college students, veterinarians, governmental leadership, and farmers. This seminar covered a broad array of topics including toxic plants, toxic chemicals, zoonotic disease transmission, animal nutrition, herd health, and reproduction. The day following the seminar many of the attendees converged to provide veterinary care in local barangays. U.S. and Filipino veterinarians provided hands-on teaching to the college students, who conducted most of the treatments or taught the farmers. Additionally, the JSOTF-P Vet coordinated with the Marawi campus of Mindanao State University to hold a rabies awareness campaign and vaccination day which was a huge success.

During the month the veterinary team visited 15 barangays and treated hundreds of animals for parasites and nutritional deficiencies. However the tremendous success of the mission is not measured by these numbers. Instead the success of these missions is evident because they are sustainable and are ongoing. Currently, the Jolo Department of Agriculture is conducting public health and training seminars in conjunction with the AFP, both with and without U.S. involvement. On all three islands multiple agencies and individuals were inspired and enabled to spearhead public health, veterinary, and agriculture programs seminars in their respective areas of responsibility.

Conclusion

The partnership and collaboration of the government, military, and the local populace during these medical and veterinary seminars opened the doors for many new programs and initiatives.[4,5] Plans are in place for additional educational events, a comprehensive sanitary Dabīhah halal slaughter program in cooperation with the local imams, and the development of a co-operative system. The co-operative system will encourage farmers to pool resources for grazing areas, purchase veterinary supplies and equipment, and procure bulls with increased genetic potential. Local leaders are beginning to plan for future educational events for barangay leadership and medical personnel that highlight the importance of sanitation to overall public health and community well-being. These include on-site excreta collection and treatment; WASH outbreak response and investigation; water and vector-borne disease prevention; and sanitary rainwater harvesting methods.

The combination of public health efforts by the ESEO and veterinarian within the Special Operations community parallels the formation of the U.S. Army Public Health Command (Provisional). The Public Health Command (Provisional) is a MEDCOM initiative uniting the missions of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) and the U.S. Army Veterinary Command (VETCOM). Personnel from both organizations bring their specific public health specialties together to provide a combined effort promoting force health protection in support of the DOD's missions around the world.

Since some elements of the ESEO and Veterinary goals and missions inherently overlap, combining these two entities during operations grants a commander the ability to positively impact an entire community of men, women, and children with minimal logistical support.

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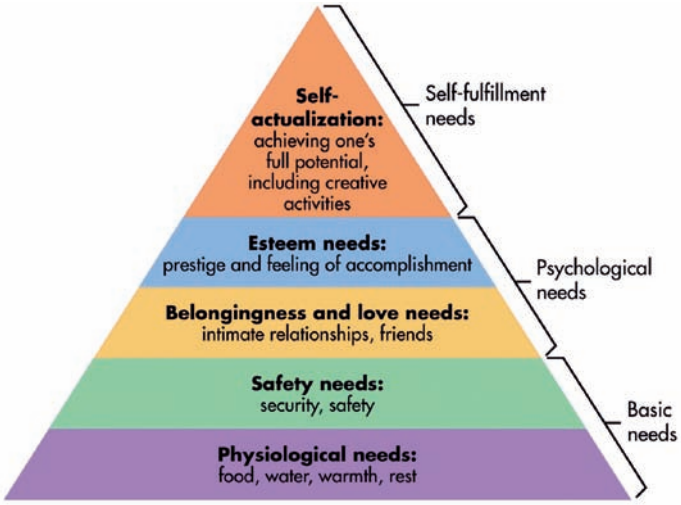
CPT Cyndie Facciolla is the 1st SFG (A) Veterinarian. While in this position she deployed to Afghanistan and the Philippines. She previously served in Korea as part of the 106th Med Det (VS). She is a graduate of Cal Poly State University, San Luis Obispo, and the University of California Davis, School of Veterinary Medicine.

Counterinsurgency, Healthcare, and Human Nature: Tapping Into the Hierarchy of Needs

LTC Jennifer Caci, MSC, MS

We have all done it, making the decision to choose what you need over what you want. At its most basic level, this behavior ensures survival. In the developed world, it may be difficult to see the connection between seemingly unimportant day-to-day decisions and life expectancy or reproductive success but in unstable or underdeveloped parts of the world having what you need instead of what you want can mean the difference between life and death. This is one of the more human elements of counterinsurgency (COIN) operations and a reality which has the potential to positively influence the current fight, if only we could all get together on it.

One somewhat familiar way of categorizing what humans need to ensure survival was proposed by Abraham Maslow in 1943. Maslow's "hierarchy of needs" theory was developed as a means of describing the stages of psychological development in humans. There are many different representations of the hierarchy but the theory is most often depicted in a triangle shape divided into three categories and five levels.[1]



In describing the hierarchy, Maslow surmised that "once an individual has moved past a level, those needs will no longer be prioritized. However, if a lower set of needs is continually unmet for an extended period of time, the individual will temporarily re-prioritize those needs – dropping down to that level until those lower needs are reasonably satisfied again."[2] Health typically falls into one of the two lowest levels or can be seen as a bridge between those levels depending on which diagram you refer to and what sort of culture you are considering. Although it is true that Maslow's theory is not without criticism and it may not be wholly applicable in all situations, when focusing on the two bottom levels (the basic needs) it is difficult to argue against the fact that those needs must be met before a person can undertake more demanding endeavors. Simply put, fulfilling these needs is a requirement for human survival.

In the current COIN strategy in Afghanistan the flawed perspective regarding unmet basic needs is demonstrated by the overwhelming belief that schools/education should be one of the top non-kinetic efforts in attempting to build stability and/or improve the perception of the government (local or otherwise). Clearly if a person is frequently sick or starving they cannot take advantage of educational opportunities and would likely forego or defer an education in order to work. In this case, work is related to survival while education and even literacy are not. Moreover, the person who is sick or starving is likely to resent a government which focuses on an educational infrastructure without first addressing more basic needs such as the provision of medical care, the availability of safe water or a level of security which allows access to either. In the developed world, citizens think education is important because the "basic needs" are readily met, but when it comes to establishing stability in a developing country, it is imperative to adjust one's perspective and consider how priorities would change if those basics were not met. There are very few countries currently facing more challenges to the establishment and success of a functioning public health infrastructure than Afghanistan.

It is commonly known that in Afghanistan access to healthcare is significantly limited across much of the country. Not unlike other municipal services, the reasons for this range from the isolating geography to the repressive efforts of the insurgents. While the Ministry of Public Health (MoPH) has developed a national strategy which outlines the various components of the healthcare system and a timeline of the associated goals, they are currently not able to function effectively as a nationally coordinating entity that ensures execution of the strategy at regional, provincial, district and village level. In some cases, the security situation prevents representatives of the Ministry from working where they are most needed. In other cases, the person/staff is there, but the austerity of the environment limits communication, hinders logistics, and otherwise stymies efforts to build a functioning healthcare system, even at its most basic level.

The national-level documents which set the parameters for healthcare in Afghanistan are the Basic Package of Healthcare Services[3] and the Essential Package of Hospital Services.[4] These two documents are both nested in the Afghanistan National Development Strategy[5] and set reasonable expectations for the establishment of a healthcare/public health system. They

also take into consideration many of the challenges Afghanistan presents and acknowledge the fact that the country must embrace programs which others might consider simplistic unless the perspective is adjusted. Two such programs beginning to make headway in Afghanistan are midwifery and community health worker (CHW) training. The training addresses common health issues and provides feasible solutions which may actually have some success in lessening maternal and infant mortality, two of the most significant healthcare problems facing Afghanistan.

The CHW program is designed to reach the most remote areas through the training of local residents. This builds somewhat on the "health post" concept which already exists in parts of Afghanistan but it provides a more formally trained individual. Critical to the impact of this program is public health training in basic sanitation and hygiene, the single most effective way to lessen the spread of the infectious and communicable diseases that still plague much of the developing world. Another benefit is that both of these programs empower the Afghan people with the basic knowledge necessary to become healthier and get past the first levels of the needs hierarchy; this in turn reflects positively on the government. When these programs (or even the ideas that drive them) reach the parts of Afghanistan where healthcare is either restricted or provided by the insurgents, they can help to build communities that are more likely to deny the assistance of the insurgents as opposed to tolerating or supporting them out of necessity. Effective community health workers can even positively influence situations involving internally displaced persons who often go without assistance of any sort because they are not entitled to protection under international law, but remain the responsibility of their own government.[6]

For those who have not been to Afghanistan it may be difficult to imagine why, if reasonable guidance exists from the MoPH, the development of a healthcare system is not further along. Why does one of every four Afghan children die before the age of five?[5] Why are diseases like polio, malaria, typhoid, and cholera still commonplace?[5] Why are there still Afghans either relying on the insurgents for medical care or having their care restricted by them? Can anything actually be done about it anyway? Yes, there may be something that can be done and it is not difficult to grasp, it is in part just a matter of all of us sending out the same message from strategic planning down to tactical execution; one that echoes what the MoPH is trying to accomplish. This effort starts with very simple steps to improve the health of the population. In developed countries we may not frequently think about the fact that our population is quite healthy because we learn the value of hand-washing at an early age but if we did not teach one another to wash our hands after using the toilet or before eating a meal it would not be part of our culture and the good health we take for granted would not be the norm. Teaching one Afghan mother about the importance of hand washing has the potential to impact many people because verbal communication is central to the development of human society. Unfortunately, getting all of the entities in Afghanistan to send out a similar message, even when the MoPH[5] and ISAF[7] have already put it in writing, is much easier said than done.

In 2010 the International Security Assistance Force (ISAF) finally published guidance on the "acceptable" application of medically related missions as part of COIN operations in Afghanistan.[7] Unfortunately this document set some unrealistic requirements in the approved execution of medical engagements, medical outreach programs and the dreaded "MEDCAPs" (medical civic action programs). Just as unfortunate, it seems the leadership in Afghanistan and in fact many key players in the development of COIN strategy consider the term "MEDCAP" to be synonymous with short term, band-aid types of medical engagements with little potential for long term impact[7]. This simply does not have to be the case in the execution of medically based endeavors, even those which are executed for purposes other than development. Freedom of movement and passive information gathering are just as easily gained through education as they are through handing out pills. It takes no longer to impart basic public health knowledge and methods of sanitation on the host nation than it does to pack and hand out a bag of pills and the impact is just as rapid and much greater over the long term. It is time to make it clear from the tactical level that a MEDCAP is not necessarily bad, it is not necessarily short-sighted and it can support the strategic plan[5] while echoing the MoPH guidance. It can fit well into the execution of a comprehensive COIN strategy. If we are expected to leave Afghanistan in the fairly near future, the basic medical knowledge which could be imparted on the Afghan populace either formally or informally would undoubtedly help to build healthier communities over the long term and it should not matter what one entitles the effort.

Related to that is the often overlooked feedback relationship between increased access to care and improved security. It may take a bit of effort to implement the security which is initially needed to increase access to care but the payback comes in greater freedom of movement for our forces, greater independence for the local population, decreased tolerance of the insurgents and increased credibility for the government.[8,9] There are several recent examples from Afghanistan of discussions at key leader engagements which resulted in the LN leadership offering to provide improved security so that women and children could access care provided during Afghan-partnered village stability efforts. Though it may go without saying, healthier people are less likely to rely on external forces (either good or bad) for their survival.

One does not have to specifically agree with Maslow or the application of his theory to this particular situation to realize that access to healthcare and improved sanitation are paramount in the development of independent, self-sufficient communities whether they are outlined by tribal, geographic or political boundaries. As Hezbollah has clearly demonstrated in Lebanon, social services such as healthcare are an effective means of establishing power[10] and while the situation in Afghanistan is in some ways very different from that in Lebanon, the need of an organization to

influence the population in order to affect the human terrain remains the same.

For nearly ten years of involvement in Afghanistan most of the key players have ignored the potential to influence and learn from approximately half of that human terrain. Thankfully, ISAF, and specifically CJSOTF-A are now leveraging female Soldiers "at the tip of the spear" in the implementation of Female Treatment Teams (FTT), Female Engagement Teams (FET), and Cultural Support Teams (CST).[11,12] Through the application of the Medical Seminar concept (MEDSEM)[13] and other longer term approaches[14] these elements are already using Afghan-partnered community and individual public health education efforts to improve the peoples' perception of the Government of the Islamic Republic of Afghanistan (GIRoA) with great success. These same efforts are also empowering the Afghans and lessening the likelihood of them requiring or accepting the assistance of insurgent elements, even in the tumultuous south.

There are many critics who frequently express their opinion that the United States and its NATO partners will not leave Afghanistan with an "X" in the win column but their basic premise is flawed. Ultimately, it is the Afghans fight to win or lose; our role is to empower the Afghans while lessening the threat of external terrorism. One facet of this is arming the Afghans with the knowledge to take care of themselves and their government to take care of the population as a whole. The impact of this effort is two-fold; it can increase the human capital of the Afghan population while improving their perception of the government. The MoPH knows that the citizens of Afghanistan have one of the highest infant mortality rates in the world and they have a plan to mitigate it, but they need help getting the word out. Counterinsurgency is admittedly difficult but some of the endeavors which can positively influence it are not. Taking the time to become familiar with the Afghan healthcare strategy and being armed with that knowledge would be a worthwhile and low cost investment of our time. At the very least, it can facilitate interaction and program development at regional, provincial, district and village levels and increase freedom of movement in a given area.[8] At most it can empower the host nation, strengthen the Afghan people and discredit the enemy when they restrict access to care. It may not be glamorous but it can be effective especially if we are all sending the same message.

A government's ability to meet the needs of its people is fundamental in the development of sovereignty, but that ability must obviously cross the lines of operation. Focusing solely on security or governance or development instead of looking at them as an interlinked triad may allow minor movements of individuals up the "needs hierarchy," but it will never allow for a situation in which a community can move permanently beyond the basic needs. Public health and medical care, like many municipal endeavors, cross the lines of operation; they are linked to not only development, but also governance and security. The government cannot develop successful public health programs without community representation (governance) and they cannot gain credibility with programs the people cannot access (security). Evaluating COIN operations in the context of Maslow's hierarchy or other studies of human nature is a means of applying basic human behavior to the interconnectedness of the lines of operation instead of viewing each individually. Of course this is true well beyond medical efforts, but few other examples so clearly demonstrate the relationship between human behavior and comprehensive application of COIN. After all, humans are biologically driven to ensure survival of the species; fundamentally people not only want but need to ensure the well-being of those they care for or at least those with which they have some form of relationship. Hence, without a more comprehensive consideration of human nature as a factor in COIN from strategic planning down to tactical execution it is likely that long-term success will be forever fleeting.

Author's note: *Much of the discussion in this paper is based on my personal experience during multiple deployments to Afghanistan as opposed to referencing a document of someone else's thoughts or experiences. I am very thankful to everyone I have worked with downrange in both CJTF-82 and CJSOTF-A. Without their interest in this subject and their requests for information I would not have delved so deeply into the topic through the reading of thousands of SITREPs and operational updates nor would I have been privy to so many of the medically related experiences (both good and bad) of the personnel in the thick of the fight.*

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Optimizing Nutrition for Performance at Altitude: A Literature Review

SSgt Doug Kechijan

ABSTRACT

Human beings are unique for their capacity to maximize their physical potential through various means. High altitude mountaineering is one such way that people challenge generally accepted notions about what is biologically and evolutionarily possible. While a 20,000+ft summit may be uninhabitable for extended periods of time, enterprising individuals have demonstrated that even the most remote locations are accessible with sufficient physical effort and proper strategy. High altitude athletes, and the scientists who study them, generally focus their research and preparation on physiological parameters, with a particular emphasis on the cardiopulmonary system. While careful scrutiny in this area is certainly justified, the relationship between physiological output at altitude and nutrition is somewhat neglected in the literature. Many athletes, alpinists included, consider eating to be instinctive and mundane. However, very few activities at 30,000ft or even 15,000ft are intuitive. Furthermore, nutrition is one of the few variables mountain athletes can control in an otherwise unpredictable environment. Despite the intrinsic limitations and seemingly contradictory findings often associated with performance nutrition studies at high altitude, mountain athletes should adhere to certain dietary guidelines related to macronutrient composition, micronutrient supplementation, and hydration status.

In addition to elite climbers, military personnel routinely operate at altitudes above 13,000ft. Consider the case of a search and rescue team responding to a downed helicopter in Afghanistan. The terrain in Afghanistan necessitates that aircraft fly above mountain passes up to 15,000ft in altitude in low light conditions and inclement weather. The recovery team must respond immediately (e.g., no time to acclimate) once alerted about a crash in order to secure the site and provide medical care. Not only must the recovery team deal with obstacles inherent in any mountaineering expedition (e.g., weather, falls, frostbite, loss of communication, etc), it also faces possible resistance from a hostile force. Operators with inadequate nutrition are ill-prepared to effectively overcome these threats to mission success and, in turn, reach their patients expeditiously to perform life saving interventions. When suboptimal nutrition is regarded as an impediment to mission completion, the importance of fueling one's body on the mountain becomes much more difficult to ignore.

Unfortunately, the studies performed at high altitude are often conducted under field conditions, where it is difficult to control for certain variables. The "cleaner" studies, in turn, may lack construct validity because they fail to account for the dynamic nature of high altitude mountaineering. In the field setting, subjects are typically reluctant to alter their routines making it difficult to test different nutritional protocols. Additionally, few nutritional researchers have the training or desire to study subjects at 15,000+ft. Furthermore, what elevation above sea level constitutes "high altitude" for the purpose of making nutritional generalizations?

Researchers in this area are still learning to ask the right questions. The search and rescue team conducting a 24 hour operation at altitude, for example, probably has different nutritional needs than a team of climbers attempting to summit Mount Everest. One area of interest is the relative contribution of different macronutrients on performance at altitude, the implication being that an ideal ratio might exist. Combating weight loss caused by increased metabolic activity and decreased appetite at altitude is another subject of critical inquiry among climbers and sports nutritionists. However, considering successful athletes in various sports have a particular somatotype, perhaps a certain degree of weight loss at extreme altitudes is not only inevitable, but adaptive. As with most aspects of sports nutrition, the literature investigating the relationship between nutrition and performance at altitude generates as many questions as it answers. Despite the seemingly conflicting data, certain measures can be taken by alpine athletes to mitigate potential performance impairments at altitude.

"Making Molehills Out of Mountains: Maintaining High Performance at Altitude" is a review that addresses both physiological and nutritional considerations associated with high altitude performance. The authors defined high altitude as elevations above 2600m or 8600ft. High altitude physiology affects performance in the following ways:[1]

1) Low O_2 → Tissue Hypoxia → ⬇ Work Capacity of Cardiac and Respiratory Systems
2) 3% ↓ in exercise capacity for every 300m above 1500m.
3) Poor sleep quality compounds the decreases in exercise performance and cognitive function caused by hypoxia

The nutritional recommendations the authors advocate to maximize performance at altitude focus on hydration, nutritional quantity, and nutritional composition. Fluid loss at altitude is attributed to increased sweating from exertion, ventilation changes occurring in cold, dry air, and cold weather diuresis. The latter condition is characterized by the increased urine output associated with shunting of blood to the core and the deceivingly high pressure readings in the baroreceptors as the body attempts to maintain normothermia. Based on available research, the authors recommend that athletes working at altitude consume 3-5L of fluid per day to replace losses from respiration, urine, sweat, and heat regulation.[1] The authors caution that consuming too much water may be counterproductive because it disrupts the decrease in plasma volume and increase in hemoconcentration that may be a positive adaptation upon one's initial exposure to altitude. However, this concern seems more theoretical than practical since most athletes tend to underconsume fluid on the mountain, especially when they must melt snow to hydrate themselves.

With regard to nutritional quantity, Freidlander et al., emphasize the importance of adequate caloric intake at altitude. Weight loss at altitude, a common phenomenon, is triggered by increased basal metabolic rate (BMR), increased exertion, appetite suppression associated with hypoxia, and limited food availability.[1] While caloric deficit does not seem to affect performance in the short term, it may negatively impact work capacity in expeditions lasting weeks or months. Additionally, appetite may not reflect nutritional needs at altitude. Since the relative contribution of carbohydrates as a fuel source may increase at altitude, adequate carbohydrate intake is emphasized by the authors. In the short term (three weeks or less), caloric deficit may not impair performance as long as glycogen stores are maintained.[1] Consequently, the authors recommend that 60% or more of a mountain athlete's caloric intake come from carbohydrates as a means of ensuring adequate glycogen storage. While research on the effect of fat intake at altitude is limited, the authors regard high fat foods as valuable to alpine athletes because they tend to be calorically dense and easy to transport in the field. While Freidlander's guidelines for high altitude nutrition are generally conservative and uncontroversial, their carbohydrate recommendations are higher than what is supported in the literature.

Benso et al., assessed the metabolic and endocrine adaptations in nine male, well-trained, elite climbers from the 2004 Italian Mount Everest expedition team, five of whom reached the summit (8852m). The remaining four all climbed to at least 7500m. While the authors did not focus explicitly on nutritional interactions, their findings have nutritional implications. The climbing team completed a progressive acclimatization program prior to arriving at Mount Everest base camp and commencing the study. The subjects completed a metabolic and hormonal evaluation (following an overnight fast) one month before the expedition and at base camp upon returning from their summit attempt. While there is no mention of absolute caloric intake, the climbers had access to palatable foods and on average consumed a diet that contained 58% carbohydrate, 30% lipid, and 12% protein. The results were as follows: no Acute Mountain Sickness or edema, average weight loss of 5kg, ↑ growth hormone-insulin-like growth factor (GH/IGF-1), ↓T_3, no change in leptin or ghrelin despite body weight loss, ↑ prolactin and progesterone, ↓ testosterone, no change in cortisol, ↑ dependence on glucose, ↑ insulin sensitivity, and ↓ relative contribution from lipid.[2] The authors speculate that these changes may have been caused by low tissue oxygen, dehydration, and/or nutritional interactions. Since exercise is known to enhance GH response to GH-releasing factor, it is uncertain whether the GH increases were caused by exercise, altitude, or a combination of both; none of the subjects remained at base camp during the study so it is not possible to differentiate. The authors speculate that the upregulation of the GH/IGF-1 axis may trigger protein anabolism while influencing changes in carbohydrate and lipid metabolism.

They also speculate that prolactin may affect glucose metabolism.[2] Furthermore, they suggest the increase in prolactin may reflect stress induced changes in testosterone production. This suggestion is contradicted, they concede, by the lack of change in cortisol or adrenocorticotropic hormone (ACTH). The mechanism by which leptin and ghrelin remained the same despite the significant decrease in body weight requires further study. The results do, however, support the notion that satiety signals that suffice at sea level may be altered at high altitude, which reaffirms the notion that mountain athletes should not rely on hunger as an indicator of nutritional status. The authors deserve praise for collecting data under such severe conditions on world class athletes. Their findings help generate the following questions for future research:

1) Would the metabolic and hormonal profiles of these athletes vary if caloric intake was controlled (e.g., less of an energy deficit)?
2) Do these metabolic changes occur at lesser (albeit still "high") altitudes or are they specific to the tallest mountains in the world, like Mount Everest?
3) Is the increased dependence on glucose seen in these athletes a product of the relatively high exercise intensity they are able to maintain at altitude? Do well-trained, but not world-class climbers exhibit different substrate utilization while traveling at lower speeds and with less intensity?
4) In light of the possible influence of prolactin and progesterone on glucose metabolism, do females and males each have different nutritional needs at high altitude?

In another Mount Everest study, Reynolds et al., employed a double crossover design over nine weeks to determine the effects of variable macronutrient distribution at high altitude on five women and ten men from the United States, Mexico, and The Netherlands. The ten most experienced climbers attempted to summit while the other subjects never exceeded 5600m in altitude and remained primarily at base camp. All of the subjects followed a strict acclimatization protocol prior to arriving at base camp. The researchers divided the subjects

into a high fat, low carbohydrate group (35 and 50%, respectively), *A*, and low fat, high carbohydrate group (20 and 65%, respectively), *B*. The randomized crossover design protocol was as follows:

Weeks 1-3: Assigned Diet
Weeks 4-6: Alternate/Non-Assigned Diet
Weeks 7-9: Original, Assigned Diet

At base camp, climbers were given prepared meals based on previously stated food preferences. Foods were self-selected during the actual expedition due to logistical constraints not encountered at base camp. However, Diet A contained 49 items not permitted on Diet B, including tuna and sardines in oil, various cheeses, shredded coconut, margarine, and other high fat foods. All subjects kept daily food logs regardless of altitude attained. All but one subject lost weight. The authors did not consider the degree of overall weight loss excessive considering the extreme altitude. While the mean caloric intake for the climbers was significantly greater than that of the people who remained at base camp (2841 vs. 2442), there was an appreciable reduction in energy intake at progressively higher altitudes. The climbers did not alter their relative macronutrient contributions as they traveled further from base camp challenging the pervasive notion in the climbing community that carbohydrates are the preferred fuel at higher altitudes. This idea, the authors contend, is driven more so by anecdotal stories (one of which is an anonymous study from 1938) than actual research.

In fact, while the authors intended for the subjects from Groups A and B to have discrete relative dietary fat intakes, there was no significant difference in mean percent fat intake for either group.[3] The subjects appeared to self-select diets that provided 28% energy from fat and there was an apparent regression towards the mean carbohydrate and fat intake. That the subjects' preference for fat was higher than expected is encouraging when one considers that fatty foods occupy less space in a climbers pack than less calorically dense foods. Despite these trends, there was considerable variation in caloric intake among the subjects regardless of altitude reached. While formulas and algorithms for energy demands at altitude may be used as a guide, an individual approach is clearly needed.

The authors acknowledge that it is not feasible to discern the individual impact of the numerous stressors (e.g., cold, increased exertion, threats to survival, separation from family, etc) in a study of this nature. They follow that caution, however, by criticizing more rigid studies in hypobaric chambers that control for confounding factors: "Thus it is necessary to utilize actual mountainous conditions to discern the full impact on human performance".[3] There are advantages and disadvantages to both field and laboratory research at altitude making it especially hard to generate concrete recommendations. Due to the difficultly of finding subjects capable of "performing" under such arduous conditions, this study is limited by its small sample size. Another inherent limitation of field nutrition studies like this one is that data collection is contingent on accurate reporting from the subjects. The precision of such reporting may be compromised not only by impairments in cognitive function that occur at altitude but also by climbers' preoccupation with more pressing issues (e.g., survival!).

Another study by Reynolds et al., (different coauthors, 1999) examined the regional changes in body composition and net energy balance at high altitude (5300-8848m). Energy expenditure was assessed with doubly labeled water, a method that calculates carbon dioxide production and oxygen consumption from the excretion of different water isotopes and dietary records, respectively.[4] Three base camp personnel and seven climbers received doubly labeled water to determine energy expenditure on Mount Everest. The researchers were unable to control for variables like age and gender because assignment to the climbing team was dependent on previous mountaineering experience. Consequently, there was an overrepresentation of males in the climbing group and of females in the base camp group. Two months prior to leaving the United States, all subjects had their resting energy expenditure calculated by indirect room calorimetry. However, energy expenditure on the mountain was determined with doubly labeled water, which was a methodological limitation, albeit one justified under the circumstances. Body composition in the field was assessed with the skinfold method and there was no direct measure of the subjects' hydration status. All subjects were required to keep a detailed food log throughout the nine weeks. Body weight loss, not percent muscle mass or percent fat lost, was greater for the climbing group. Neither group lost a significant percentage of body fat relative to baseline measurements. Mean energy intake (2928 vs. 2149kCal) and percent increase in energy expenditure (298 vs. 243%) were considerably higher for the climbing group.[5]

The authors observed that the expected body weight loss did not correlate significantly with actual losses, a discrepancy they attribute to underreporting of kCals. As previously mentioned, food log accuracy is often questionable in field research of this nature. Nevertheless, in light of the various metabolic and hormonal changes that occur at altitude, a "calories in-calories burned" model seems an insufficient and overly simplistic means of predicting weight loss on Mount Everest. The authors also suggest that rapid bodyweight loss, fluid shifts, and dehydration at altitude may reduce the validity of skinfold measurement. Furthermore, skinfold measurement often fails to detect the subtle changes in body fat percentage that may occur at altitude. Nevertheless, they conclude that there may be a preferential loss of body fat reserves and sparing of muscle tissue at altitude.[5] This issue remains controversial in high altitude nutrition studies partially due to the lack of protocol standardization. Reynolds et al., propose that a certain amount of weight loss may be inevitable since it is so difficult to maintain adequate caloric intake at extreme altitudes. Consumption of high fat, calorically dense foods may, however, help minimize the degree of weight loss.[5]

The inability to isolate the effects of all the variables that may affect performance at altitude is a limitation of field nutritional research, like that conducted on Mount

Everest. Mount Everest is the absolute furthest thing from a controlled environment. It is often assumed that hypoxia triggers the physiological changes that occur at altitude. Rose et al. monitored six trained, young male subjects for 40 days in a hypobaric chamber to determine if hypoxia per se results in weight loss and changes in dietary preferences. The idea was to artificially replicate an expedition on Mount Everest, with the subjects "summiting" at a simulated altitude of 8,848m. The subjects were provided with three meals a day; the composition of which was 60% carbohydrate, 25% fat, and 15% protein. However, the subjects only consumed foods for which they had a taste. They also had access to various exercise devices in the chamber. Energy expenditure was calculated using a modified Harris Benedict formula. At the end of the 40 days, mean caloric intake decreased 43% and mean weight loss was 8.9%.[6] Unlike the Reynolds body composition study conducted on Mount Everest, there was no preferential retention of muscle mass; lean tissue accounted for 67% of the weight lost. The subjects lost more weight than the researchers expected based on the energy expenditure estimates. Predicting weight loss from formulas and simplistic models may be difficult as was alluded to previously.

Carbohydrate intake decreased from 62.1% to 53.2% by the end of the study.[6] The decrease in relative carbohydrate intake led the researchers to conclude that the apparent carbohydrate preference championed by many climbers is likely attributable to the convenience and accessibility of these foods, not to a physiological phenomenon. Since temperature and humidity were maintained at a comfortable level, it seems that hypoxia per se was responsible for the observed weight loss. Furthermore, while the subjects were encouraged to exercise, their activity levels were not comparable to those required on an actual expedition. While weight loss may have been influenced by malabsorbtion of macronutrients at increasing altitudes, this study was not designed to explicitly test for this phenomenon. The model (hypobaric hypoxia) created by the researchers more closely simulates the atmospheric composition at altitude than that marketed by manufacturers of various commercially available altitude simulators. These devices induce hypoxia by lowering the percentage of oxygen without decreasing the overall barometric pressure. Consequently, they may not induce the same favorable adaptations for athletes preparing for challenging expeditions. This study clearly exercises an appreciably greater degree of control over confounding variables than the research discussed previously. However, these other variables may, in fact, have nutritional implications that warrant additional research using a more integrated approach.

While most research investigating the relationship between nutrition and performance at altitude focuses on macronutrient composition, some studies have focused on micronutrient interactions. The need for varying amounts of micronutrients at high altitude remains controversial, as it does in other areas of sports nutrition. It is theorized that antioxidant requirements may increase at altitude due to increased exertion and changes in oxidative metabolism. Simon-Schnass, in her review "Nutrition at High Altitude", suggests that prophylactic vitamin E supplementation may combat free radical damage associated with increased oxidative metabolism from exertion at altitude. Since vitamin E combats free radical damage during various steps in the aerobic pathway, a vitamin E deficiency, she maintains, may promote decreased cellular respiration and energy production; possibly contributing to the reduction in anaerobic threshold at altitude. Such negative physiological changes may be compounded by low partial pressure of oxygen and decreased exercise intensities with the same perceived exertions[7].

In one vitamin E study conducted at altitude, there was no change in pentane exhalation with vitamin E supplementation compared to a > 100% increase in the control group at 5100m; pentane exhalation is indicative of vitamin E status and lipid perioxidation.[7] Assuming pentane exhalation does indeed reflect lipid perioxidation, at what point do increases in lipid perioxidation negatively impact performance or health? Simon-Schnass also proposes that vitamin E supplementation protects against alterations in red blood cell filterability and increases in blood viscosity caused by perioxidation of membrane lipids.[7] Protein C, a coagulation inhibitor, is thought to indicate the extent of vascular wall changes induced by oxidative damage. Simon-Schass suggests that decreases in Protein C promote increased coagulation, which, in turn, triggers protease release (to deal with the coagulation) and subsequent damage to proteins in endothelial cells. This hemodynamic cascade may increase the risk of frostbite, retinal hemorrhage, and pulmonary and cerebral edema; all of which are potentially debilitating on the mountain. Some of the literature suggests that vitamin E supplementation prevents the decreases in Protein C observed at altitude. Vitamin E, therefore, may stabilize endothelial cells and prevent protein degradation in the vasculature.[7] While the results of vitamin E supplementation are promising, additional research that controls for caloric intake and baseline nutritional status is needed to determine: 1) The point at which decreases in Protein C are pathological at altitude and 2) How long one can continue to perform at altitude with amplified lipid perioxidation before the changes become consequential.

The literature investigating the effects of different hydration strategies at high altitude is also quite scarce. Richardson et al. assessed the degree to which euhydration, hypohydration, and hyperhydration during actute normobaric hypoxic conditions trigger Acute Mountain Sickness (AMS) symptoms and alter various physiological markers. The symptoms of AMS (nausea/vomiting, headache, dizziness, fatigue), while not suggestive of performance per se, should be avoided to optimize physiological output.[8] Increased water vapor loss, energy expenditure, and ventilation at altitude promote dehydration. At sea level, dehydration is associated with decreased oxygen delivery, heat dissipation, and cognitive function.[7] Overhydration, despite its positive effects on stroke volume, vasodilation, and heat dissipation at sea level, may worsen intracranial pressure and headaches at altitude via increases in extracellular volume.

For this study, eight physically active males, none of whom had spent time above 2000m in the previous two

months, completed intermittent walking tests at 50% VO_2 max after controlled euhydration, hyperhydration, and hypohydration in a normobaric hypoxic state with a seven day washout period between tests.[8] Hydration status was characterized by the degree to which subjects were permitted to replenish lost fluids following a moderate running session conducted fifteen hours prior to the actual test. The hypo- and hyperhydration states induced greater physiological strain and AMS related symptoms.[8] Although the authors were unable to identify the mechanism, the AMS symptom scores suggest that the hypo and hyperhydration states adversely affect feeling state, especially headaches, compared with euhydration.[8]

Based on the 0.6L/h sweat rate observed in the euhydrated state, Richardson et al., recommend that people consume up to 5L of fluid spread throughout the day in acute hypoxic environments. Moreover, because increased physiological strain may exacerbate AMS symptoms, a hydration state within normal physiological limits is optimal;[7] urine color at ~2, urine specific gravity < 1.015, and urine osmolality < 400 mosm/kg should be maintained during acute hypoxic exposure. While these recommendations seem reasonable, the following methodological limitations necessitate the need for additional research in this area:

1) Extremely fit individuals, like elite climbers and military Special Operations Forces, may react differently to various hydration states than did the subjects in this study, whose mean $V0_2$ max was 43ml/kg min. Are these results also typical of people, like many alpinists, who do take the time to acclimatize prior to exposing themselves to more extreme altitudes?
2) The observed effects of different hydration states may vary with greater exercise intensity and duration.
3) The study was conducted under normobaric conditions. Exposure to a lower percentage of oxygen at sea level may produce different physiological adaptations and responses than the hypobaric hypoxia encountered on the mountain. Environmental obstacles, like extreme cold, and increased stress may also confound the results.

These critiques not withstanding, the authors' emphasis on euhydration has important implications for rescue personnel and climbers treating AMS-related symptoms, namely that overhydration, in the form of large intravenous fluid boluses advocated by some medical protocols, is not necessarily the best way to reverse the extreme dehydration often encountered on the mountain. Consequently, developing a field expedient method of assessing hydration status may help optimize performance at altitude.

Based on the available literature, military personnel operating at altitude should focus on the following nutritional areas: maximizing caloric intake, adequate hydration, glycogen retention, and antioxidant support. Macronutrient percentage recommendations are generally impractical for climbers, especially those lacking the medical supervision commonly accessible on high profile expeditions like Mount Everest. Many of the altitudinal nutrition studies are conducted on Mount Everest because its base camp is able to accommodate so many physicians and researchers. Teams on Mount Everest typically more easily obtain funding for their research projects. While most climbers do not expose themselves to the extreme conditions that characterize places like Mount Everest, they too are limited by logistical and practical constraints; often more so because they do not have access to a resupply network. Furthermore, blanket macronutrient percentage recommendations are useless if they conflict with an athlete's individual preferences at altitude.

Consequently, adequate preparation is crucial. Operators should conduct numerous training sessions at less daunting altitudes to determine what foods they can tolerate. Since insufficient energy intake is so pervasive at altitude, simply consuming more calories may be a more reasonable goal for mountain teams and small units than trying to ascertain an appropriate ratio of carbohydrates, fats, and protein. However, as many authors emphasize, athletes should experiment with high fat, energy dense foods because these food sources may help Operators maintain a more neutral energy balance. While the degree to which weight loss at altitude impairs performance is still uncertain, Operators should seek to avoid drastic bodyweight changes. Adequate caloric intake is probably less important for units conducting shorter patrols (<48 hours, like the search and rescue team example from the introduction), but even these personnel should travel with energy dense snacks and a premixed liquid carbohydrate solution if possible. Once again, these teams should conduct training evolutions at altitude to determine how little food they need for sustenance on these shorter, albeit often more intense, outings. Regardless of the duration of exposure to altitude, the food Operators do bring to the field must be lightweight, easy to prepare, and palatable.

Like all endurance athletes, military Operators should seek to maximize glycogen storage during missions at altitude, especially since glycogen retention may be compromised by negative energy balance; this is a difficult fate to avoid during strenuous expeditions. While some researchers have recommended 1000-1200g carbohydrates/day for ultra endurance athletes, military personnel are unlikely to carry this amount of food. It's a vicious cycle: adding weight to one's pack, increased energy expenditure, greater need for food, etc. Nevertheless, a daily carbohydrate intake of around 600g, as advocated by some authors,[9] seems realistic. Mountain athletes who commence operations from base camps or military installations typically leave their staging area with 2-4L of fluid to avoid having to melt snow during the expedition. Such personnel should premix their water with a carbohydrate, electrolyte solution since they are unlikely to carry powders in the field. Additionally, they should ensure that they are adequately hydrated prior to breaking camp. The use of a prefilled "camel back" or water bottle while moving is essential. Since measuring specific gravity is generally not feasible in the field, urine color seems to be the most practical means of assessing hydration status at the moment.

Vitamin supplementation at altitude remains somewhat controversial. However, in light of the promising vitamin E research in this area, Operators should, at a minimum, ensure that they are not deficient in any micronutrients, especially vitamin E, prior to commencing physically demanding expeditions. Supplementing with 200mg of Vitamin E twice daily while on the mountain may help minimize oxidative damage even in alpinists with no preexisting deficiency.[7] Although optimizing nutrition for performance at altitude remains as much an art at this point as a science, units deployed to high altitude locations must be as thorough about nutritional strategy as they are about equipment selection, physiological training, and tactical preparation.

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Soldiers Can Take It – A Conceptual Analysis of Trauma

Kate Froede, BNSc., MSN, RN

ABSTRACT

Purpose: This article will analyze the concept of trauma, and illustrate distinctions between accepted definitions and actual meaning. For populations at high risk for exposure to traumatic situations, such as Special Operations Forces (SOF) and deployed military personnel, delineating the beliefs and environment-specific comprehension of trauma and its consequences is imperative. **Background:** Trauma is a common term in health sciences literature and in the social vernacular, but is often misunderstood and lacks specificity. Differences in perception of what trauma is and is not may exist even between civilian and military populations. Therefore, the concept of trauma warrants clarification, to define the terminology and to use it appropriately with full understanding. **Data sources:** EbscoHost, PubMed, CINAHL, MedLine, and Google Scholar. Only English-language results were accepted, and were limited to publications from the dates of 1975-2010.

INTRODUCTION

Misunderstood concepts produce bad science, and even worse care delivery.[1] For those who provide and study trauma care, the concept of trauma should be universally understood. Superficially, the term "trauma" appears to be a well-defined and universally understood concept. There is even trauma on television.

However, within theaters of combat, the perception and definition of trauma may be different. The earliest mention of trauma and traumatic experiences in the literature suggest that this concept may have been borne of Soldiers and their experiences in war. Yet we have managed to marginalize the concept of trauma, because with war comes violence, and with violence comes death and injury.

PURPOSE & GOALS

"If a concept is used without first being clearly defined, then any work on which it is based also will be unclear…".[2] We have to pick apart what we know to be true of trauma if we want to actually contribute positively to trauma science.[3]

How does trauma relate to views of injuries in combat, and the severity of those injuries and experiences? Can we add to the body of knowledge anymore? Is there evidence that needs clarification? A lot of the produced evidence demonstrates a lack of clear understanding of this concept.[4] The way we toss around the term "trauma" stifles the gravity of the word and our understanding of what trauma does. We need to narrow and focus on an often-overused and tacitly accepted term to better define the strength of it. To better use the terminology in describing injuries sustained within military populations, we have to grasp the gestalt of the words in our clinical lexicon.

Special Operations Forces represent and sustain some of the most transparent examples of what is referred to as "trauma," SOF may experience and have treated many of the most grave and complex traumatic injuries in combat. "Even the most novel and sophisticated methods in the presence of unclear thinking can impede scientific progress."[5] Despite the acumen of SOF medical personnel, all are at risk of providing sub-standard care if comprehension the basic concept is lost.

The first order of business is to assess what is known, which including identification of the phenomenon in question.[6] What are the etiologic factors in trauma? How can we frame this question?

Haddon's Matrix is especially salient to trauma in that it provides a strong framework for empirical study.[7] To develop strategies to understand trauma, we first intersect the agent (harmful amounts of energy) with the host (Soldier) and the environment (combat). This narrows down many factors that contribute to trauma experienced in combat.

We can then define the actual event which causes trauma, determine mechanisms of injury, and then develop evidence-based interventions. Simply put, the process is to "(a) define the dimensions of the matrix; (b) review the literature; (c) use existing science and theory to identify and develop potential interventions. Ultimately… scientists test the effectiveness of the interventions to prevent, reduce, or control injury using rigorous scientific methods".[3]

DEFINITIONS

The common use of the word "trauma" originates from the Greek "traumata," meaning "to wound" or "I injure".[9] More specifically, trauma is explained as an "… event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others".[10] This concurs with the American Psychological Association's criteria for trauma.[11] Both definitions indicate significant damage to the integrity of a person's body or soul. Emotionally, trauma is "an extremely distressing experience that causes severe emotional shock and may have long-lasting psychological effects".[12]

Generally, we know trauma comes from damaging events and progresses to more specific indicators of severity.

Non-clinical synonyms describe trauma as upset, disturbance, ordeal, suffering, pain, strain, distress, and damage.[13] All definitions and synonyms for trauma indicate severity that's way beyond the scope of words like mild or moderate. Ironically, the opposites of trauma are what we hope to accomplish as providers: restoration, alleviation, healing, help, and relief.[13]

How does trauma fit in operational settings? What is an "operational setting"? "… A precise operational definition by its very nature increases the validity of the construct".[14] Essentially, an operational definition describes how something is measured. If report that a patient has a LeFort Type II fracture, pretty much all trained personnel can envision the injury. Yet the military lags behind in operational definitions, and sometimes declares a definition operational when it has no such measurements in the description.

For example, in 2008, a memorandum to deployed United States forces in Iraq stated that medical management and "… diagnosis of concussion must include the military operational definition of (mild traumatic brain injury)…".[15] Would everyone understand what mTBI is, based on the terminology provided? The terms are inherently conflicting: mild, traumatic, and injury. Trauma and injury sound similar, but trauma is grievous pain and disruption. Injury is the act of loss or hurt sustained by trauma.[9] Mild denotes peaceable, placid, and soft gentility, in direct opposition to an event that is disruptive and damaging.[12] Why are we describing trauma with such oppositional terms?

Operational definitions are those in which the concrete and specific definition is constructed and worded in terms of the operations by which observations are categorized or measured.[16] The observations of sustained trauma need categorical, measured systems to indicate severity of injury. Defining traumatic brain injury (TBI) as "mild" does not result in an operational definition.

Trauma is a concept that requires measurement by validated tools and instruments which can index and score acuity. Subjective antonyms of trauma confuse and detract from the implied gravity of the injury sustained. If we are going to develop and use indices to describe severity, our concept has to be crystal-clear and painstakingly analyzed.[14,17] After the concept is clear, the tools that measure combat-specific trauma have to also be reanalyzed; the metrics have to match the concept.

Historical and Cultural Definition

Historically, the concept of trauma is defined by the military and their experiences in battle. Today, the same images of Soldiers in combat marginalizes trauma as an inherently damaging experience, because the concept of "Soldiers can take it" pervades, but few understand the traumatic severity. After years of war, both military and civilian populations have become numb and accustomed to images of warfare.[18] This vicarious trauma tends to result in apathy.

The military sustains the majority of the most complex and injurious trauma. The suffering experienced by civilians who sustain trauma is often misperceived by the military. For example, it might be difficult for an SOF Operator on his sixth deployment to Afghanistan to sympathize with the post-traumatic stress reactions of a bank teller who was once robbed at gunpoint.

Combat trauma is an expected consequence of operations and an accepted part of engagement. Hungarian psychoanalyst Sandor Ferenczi (1873-1933) caught this after World War I. It is interesting to note that Ferenczi's early writings on trauma were in connection with the *war*, and based on his experience with *Soldiers* who suffered … look at the culturally defined field of common meaning that the notions of a Soldier, army and military have".[19]

In studying and writing about trauma, Ferenczi chose to use a common phrase in his mother tongue, "*Katonadolog*" (Soldiers can take it).[19] Even early on, society's introduction to the concept of trauma was from witnessing Soldiers in war and after. "Soldiers can take it" highlights the divide between how the military and civilians perceive trauma. The context and culture in which trauma occurs produces the gravity assigned to it; the definition of civilian is "one who is not military".[9]

The very nature of unconventional warfare requires that SOF personnel willingly expose themselves to situations in which they are likely to sustain trauma, and to inflict it when required- without pause or question. "This seemingly disciplined subject can endure and obliterate everything, as a Soldier is expected to do…".[19] Universal acceptance of trauma as an expected consequence of military engagement has quite possibly desensitized the public – and perhaps even the conventional military and SOF personnel – to the intense and damaging impact of the experience on the body and the soul.[18]

Literature Review

The initial literature review used the term trauma. The author soon discovered that most of the results related only to providing trauma care or PTSD. Therefore, the author identified attributes and synonyms to help in the search.

MeSH is the "the National Library of Medicine's (NLM) controlled vocabulary thesaurus".[20] It consists of "sets of terms naming descriptors in a hierarchical structure that permits searching at various levels of specificity".[21] Twenty-one items were returned, and the heading "Wounds and Injuries" was selected. The MeSH definition provided was "damage inflicted on the body as the direct or indirect result of an external force, with or without disruption of structural continuity."[20]

The subject heading was exported to a PubMed search, which returned 45,605 results. Application of Boolean operators "AND definition," returned 1,704 results. When "AND concept" was applied, none of the 69 returned results indicated existing literature specific to conceptual analysis of trauma. To ensure thorough review, the Cumulative Index to Nursing and Allied Health Literature (CINAHL®) was then searched to confirm the dearth of existing publications regarding the precise concept of trauma.[22] The phrase "Concept analysis AND trauma" was used in several different search techniques through CINAHL®. One result returned, but the citation was the conceptual analysis of *risk* for trauma, emphasis mine.[23]

Additional searches in CINAHL® and Google Scholar© were attempted in identical fashion, using identified synonyms and attributes of trauma, such as hurt, wounds, and injury. No results were returned that were specific to conceptual analyses of hurt, wounds, and/or injury. Many results indicated functional analyses of injuries, and other analyses of *hurt feelings* and similar terminologies. Ultimately, exhaustive review of the literature did not reveal previous analysis of concepts trauma, hurt, wounds, or injury.

Given that a previous concept analysis of trauma wasn't found in the literature review, it's possible that we're providing care and producing science without fully understanding what trauma is and what is means.

Attributes

Related concepts and defining attributes are characteristics of a concept that present repeatedly in the literature. Attributes of trauma include damage, grievance, wrong, hurt, upset, disturbance, distress, and pain.

Antecedents

Events or incidents occurring before the concept are antecedents.[14] Further reviews of the literature to determine antecedents of trauma or traumatic events revealed little. Attributes of trauma were used to determine possible antecedents. Many models of epidemiology and public health methodologies appeared in the literature after the attribute injury was substituted as a search term. Haddon's Matrix was the most applicable antecedent, and it can be used as a model for studying injuries and injury prevention strategies.[8] The framework of Haddon's Matrix mimics the characteristics of antecedents. By using the host-agent-environment model from the Epidemiological Triangle, Haddon's Matrix describes interacting factors that contribute to the injury process.[8]

The host is the person at risk for injury. The agent of injury is energy (causing trauma), transmitted to the host through a mechanism. The environment includes all the characteristics of the setting in which the traumatic event occurs; for SOF personnel, the environment would be mostly austere environments constituting theaters of combat operations.

Haddon's initial configuration refers to phases: pre-event, event, and post-event. The pre-event, or antecedent leading up to trauma, would be precipitating factors, or exposure to risk. Although we see Haddon's framework mostly in civilian injury research, it applies easily to deployed SOF personnel, or SOF personnel training in remote wilderness environments. For instance, the antecedent to combat trauma is risk and exposure- found easily in-theater.

Trauma is an "event or events that involve actual or threatened death or serious injury, or a threat to the physical integrity of self or others".[10] Combining that definition of trauma with the antecedent of exposure demonstrates that direct injury is not necessary to precipitate trauma. Risk of harm or injury may be enough to replicate the event or produce a response.

For example, Special Operations aviation personnel might not sustain direct hits from small-arms fire while airborne, or sustain injuries from a ground-level explosion. Yet the exposure to the antecedent and threat of death, or constantly witnessing traumatic events, may be enough to initiate a traumatic response. We know repetitious exposure to trauma evokes similar bio-behavioral responses to actual trauma, even if the threat is indirect.

Critical Attributes

Critical attributes of a concept analysis provide the most insight.[14] First, trauma is a disruptive and forceful event. Second, trauma does not always disrupt the integrity of an individual's body or mind. Proximity and exposure may be enough to damage an individual. Third, and especially salient to SOF populations, is expectation.

The expectation of exposure to violence and risk of trauma in SOF personnel is expected. Experienced Operators have keen situational awareness and comprehension of risks within the battle space. In the context of combat, we perceive trauma as less of a shock in the sense that it is expected- trauma and injury are consequences of military engagement. Trauma can also occur cumulatively: "trauma does not have to mean the occurrence of one, major, catastrophic event".[18]

Consequences

Consequences of direct trauma to a person (host) by an instrument or vector can result in significant bodily injury, with ranges of severity from disruption of structural integrity to injuries that cannot sustain life. Trauma is a broad term, and used often to describe a stressful event. However, stress reactions in response to trauma are not necessarily outcomes from trauma, but more a variable and individual consequence of exposure to trauma. Behavioral consequences of direct or vicarious exposure to trauma include intrusive symptoms such as obtrusive thoughts, flashbacks, and nightmares; constrictive symptoms include feeling numb and dissociative.[24]

We expect to see extreme disruption of the body in our patients. We know what the consequences of trauma are: they will be serious, disruptive, and grim.

Model Case

Case examples demonstrate the critical attributes of trauma. In a model case, the most pure and obvious example of the concept is presented.[14] In the following model case, the critical attributes of disruption, exposure, forcefulness, and expectation are presented to demonstrate a model case of trauma experienced by an SOF element.

An SOF task force team prepares to enter and clear a one-story building in Khost Province, Afghanistan. As the team members enter the structure, a pressure-plate IED detonates. The IED was poorly constructed and placed against a non-load bearing wall. The first team member takes the brunt of the detonation, and is killed instantly. Two team

members are blown to the floor and suffer amputation of lower extremities, caused by shrapnel secondary to the blast wave. The three remaining team members on the inside are knocked unconscious and sustain various penetrating injuries from shrapnel.

Borderline Case

Borderline cases demonstrate the concept as it is understood from almost all attributes save one or two.[14] In the following borderline case, the same critical attributes are utilized, but serve to identify misconceptions that may surround the concept.

An Infantryman is driving a large military vehicle to an on-post facility, where the Soldier will wash the truck. While driving the vehicle within accepted operational speeds on a domestic road in the United States, the rear tire of the truck is punctured and violently tears off from the wheel's rim. The truck swerves off the road and rolls down into an irrigation ditch, causing the driver to smack his head on the window and lose consciousness. This Soldier was not expecting this event to occur, and the consequence was not an expected possibility.

Related Case

Related cases are similar to the specific concept, but they do not contain all the defining attributes, despite connections to the model case and similarities to the main concept.[14] The following related case shows surrounding concepts to trauma, but differences are evident.

The year is 2007. A personal security detail is riding in a convoy of vehicles along Route Irish in Baghdad. Military explosive ordinance disposal (EOD) team members halt the entire convoy. The EOD team notifies the convoy commander that there is an improvised explosive device (IED) buried underground fifty meters in front of the convoy, and the EOD team will neutralize the device. The convoy commander stands outside of his assigned vehicle and watches the planned detonation.

Ten pounds of military-grade explosives detonate one hundred pounds of IED explosive material, which exponentially compounds the blast's force. The combined blast pressure unleashes a concussive force beyond the fifty-meter radius. The convoy commander is knocked to his knees but does not lose consciousness, nor does he sustain any external wounds.

Contrary Case

Contrary cases show exactly what the concept is not, as demonstrated by the following case.

A medical student in the United States gets into his car after class, and drives home. E very traffic light is green, a police cruiser is traveling the same route as the student, and the roads are clear. The car's radio is playing his favorite songs, and the car's engine is finely tuned and runs smoothly. He arrives home without incident.

Revised Definition

All definitions and the literature indicate that trauma is a concept that carries gravity germane to the disruption it causes. Therefore, the revised definition will include several key attributes most salient to the concept: *Trauma is a measurable event in which significant amounts of damaging energy transfers to a host, causing considerable disruption to physiological, structural, or psychological integrity. Outcomes from traumatic injury include physiologic and emotional responses of varying magnitudes, but exclude those of inconsequential and negligible natures.*

For Special Operations personnel, this revised definition serves to refute subjectivity suggesting that combat trauma has insignificance, and avoids dismissal of signs indicating exposure to trauma, labeling it as "mild" or "moderate". The way we currently use terminology regarding trauma has been minimized to the point that those words no longer serve to define.

Conclusions

Trauma is a concept of different meanings in different populations. Trauma differs between civilian and military medical professionals, and possibly even between conventional and unconventional military medical structures. Not everyone knows intrinsically what trauma actually means, or in what contexts it exists. Two wars' simultaneous operation has produced unprecedented advancement in technical trauma science. However, both research and theory require precise definitions and concept analysis to standardize and guide exploration and study of this phenomenon.

Neglecting to analyze the concept of trauma is the first misstep in the production of bad science. Accurate measurement of variables can occur only after painstaking clarification of the concept in question precedes the quantification. Extensive research exists specific to human responses to trauma in militarized situations. However, application of concepts with clear definitions is a key component in delivering trauma care and predicting recovery from traumatic injuries sustained in combat.[25,26]

Said Alice to the Cheshire Cat: '"Would you tell me, please, which way I ought to go from here?' she asked. 'That depends a good deal on where you want to get to,' responded the Cat. 'I don't much care where,' answered Alice. 'Then,' said the Cat, 'it doesn't matter which way you go,'" (p. 62).[27] If we care little for the basic concepts that define Special Operations medicine, then we have very little to guide us.

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Feedback to the Field: An Assessment of Sternal Intraosseous (IO) Infusion

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Disclosure: The opinions and assertions contained herein are the private views of the authors and not to be construed as official or as reflecting the views of the Departments of the Army, Air Force, or Defense.

Abstract

Intraosseous vascular infusion (IO) is a recognized alternative to peripheral intravenous infusion when access is inadequate. The sternum and proximal tibia are the preferred sites. A review of 98 cases at autopsy revealed successful sternal IO placement in 78 cases (80%). Assuming a worst case scenario for placement (pin mark and no tip in bone [17 cases] and tip present and not in the sternum [3 cases]), attempts were unsuccessful in 20 cases (20%). We draw no specific conclusions regarding sternal IO use, but hope that personnel placing these devices and those providing medical training can use the information.

Introduction

"Feedback to the Field" (FT2F) is a communication intended to provide potentially useful observational data to medical providers and medical trainers. Those in receipt decide if the information is valuable and how it is used.

These case-based observations made by the Armed Forces Medical Examiner System (AFMES) are de-identified and unlinked to occurrence. They do NOT assess effectiveness or relation to outcome. They do NOT suggest or advise on current or proposed policy.

Because the observations are derived from the autopsy procedure at the Port Mortuary, Dover Air Force Base, Delaware, the cases are Killed in Action/Died of Wounds (KIA/DOW) and do NOT reflect Wounded in Action (WIA) experience. In addition, the possible effects of handling and transportation from theater must be considered.

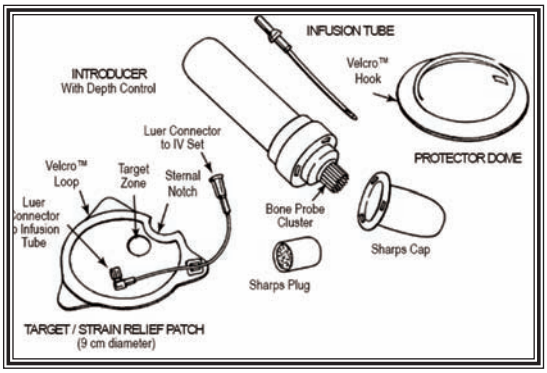
The Defense Medical Material Program Office (DMMPO), which falls under the Office of the Assistant Secretary of Defense (Health Affairs) Force Health Protection & Readiness, receives and reviews FT2F communications and then distributes them electronically. The following material on Sternal Intraosseous Intravenous Devices is taken from the 7th FT2F distribution made in December 2010. If you do not receive FT2F distributions and wish to be added to the list, contact DMMPO (Appendix I).

Background

Intraosseous vascular infusions (IO) are a recognized alternative to peripheral intravenous infusions when access is inadequate. Current use of IO devices is popular in emergency medicine, with focus on critically ill patients in the out-of-hospital setting.[1] In the military, the sternum and proximal tibia are the preferred sites.

The principal sternal IO device being taught and distributed by the Department of Defense (DOD) is the FAST-1 (Pyng Medical) (Figures 1-3).[2] There are three versions of this device. Device placement is guided by a template that is positioned using the sternal notch as a reference. The introducer is

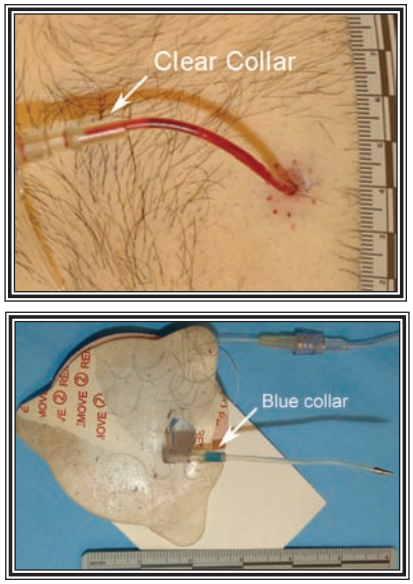
Figures 1a & b. *FAST-1, second version. A. Photo. B. Schematic. (the first version requires a removal tool). Both figures courtesy of Pyng Medical, Vancouver, Canada.*



Figures 2 a & b. *A. FAST-1 in place with cover over the target patch. B. Exposed insertion site. Note the circle of pin marks around the infusion tube left by the introducer (arrow).*

Figure 3. *Placement of the device uses an adhesive template, the sternal notch for positioning, and the introducer is placed in the circular template cutout (target zone). Figure courtesy of Pyng Medical, Vancouver, Canada.*

placed in a circular target zone (Figure 3). The first version with the clear collar requires a removal tool; the second version, which has a blue collar, can be extracted without a tool (Figures 4a & b). Retention of the metal tip after removal has been reported by users. Manufacturer's instructions direct users to grasp the infusion tube with fingers or clamp and pull perpendicular to the manubrium. This should be one continuous motion until removed. The tube, not the luer connection, is used to pull for removal. Other sternal devices are available and may appear in emergency care facilities within the DOD. One of these, the EZ-IO (Vidacare) sternal needle, can be inserted manually or with a power driver. This was the topic of a prior FT2F communication.



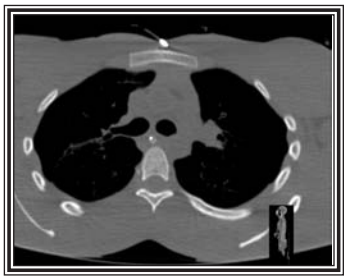
Figures 4a & b. *Removal issues.*
A. The first version with the clear collar (top left) requires a removal tool.
B. The second version of the FAST-1 now being fielded and not requiring the tool has a blue collar. (bottom left) The tube can be pulled out manually. Reports of tip retention in the sternum with the second version have been received.

Figures 5 a & b. (*A) Axial-left and (B) sagittal-below, computed tomography show the metal tip of the infusion catheter in the manubrium of the sternum.*

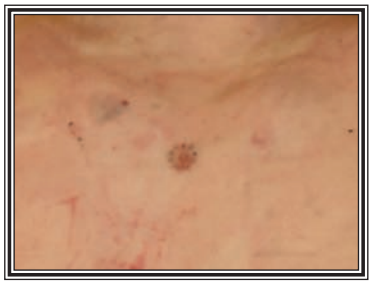
Observations Of FAST-1 Use

We reviewed 98 cases reported as showing evidence of sternal IO infusion at autopsy. The acquisition of full body postmortem digital radiographs and computed tomography (CT) images prior to autopsy (Figures 5a & b above) allowed retrospective analysis of these cases.

In 81 cases, the sternal IO infusion device was localized by CT identifying the metal tip of the infusion tube. The CT images enabled precise determination of position within or outside the sternum (Figures 6a & b). In 17 cases, the autopsy showed use of a sternal infusion device (the presence of a pin marking footprint), but a device was not physically present on CT. (Figures 7a & b).

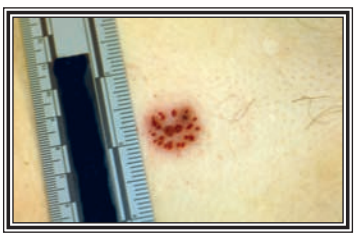


Figures 6a & b. *A. External photograph-left. B. Axial computed tomography-below shows the sternal infusion device is not in the manubrium.*



Figures 7a & b. *Two example cases (A-left and B-below) show pin marks and no device present. No retained metal tip was noted on computed tomography.*

In these cases, the radiographs and CT revealed no metal tip in the sternum or adjacent soft tissue. Our assumption is that unsuccessful attempts at



placement occurred in these pin mark cases because instructions in theater are to ship human remains without removal of devices used in emergency medical treatment (e.g., tourniquets, endotracheal tubes, chest tubes, intravenous devices). When pin marks are present without the device components, we do not know how the procedure was performed. It is possible the device was used without the template or that the template was not optimally positioned. We have observed some cases with a high pin mark pattern (e.g., marks in line with the ridge of the clavicle) (Figure 8).

Figure 8. *High placement pattern noted in some cases with pin mark only. The marks appear in line with the ridge of the clavicle (dotted line). It is not known if the target patch was used in these cases or how it was placed if used.*

Conclusion

To estimate the success rate of sternal IO placement, we noted positive verification in 78 (80%) of the 98 cases. Assuming a worst case scenario when pin mark was found with no tip in bone (17 cases) and tip present and not in the sternum (3 cases), attempts were unsuccessful in 20 (20%) of 98 cases.

Discussion

This information is presented as "observational data" only. We have no knowledge of the echelon of care, facility, and individual(s) involved in device placement. It must be appreciated that battlefield conditions and treatment situations are highly variable and represent the most extreme circumstances for rendering emergency care. In a civilian report of FAST-1 use, a 74% success rate for first-time users and 95% success rate for experienced users gave an overall success rate of 84%.[3] Special Operations Medical personnel in a non-combat study were found to have a 94% success rate with the FAST-1 (29 of 31 attempts).[4] Using the "worst case" scenario noted above has led to estimation of an 80% success rate; this may be considered satisfactory in a battlefield environment. We know healthcare providers do not propose a success rate less than 100% as a desirable goal.

This presentation makes no association between sternal IO position and outcome of treatment. We are seeing non-survivors and have no data on wounded with sternal IO devices. This could bias our observations to the most difficult cases and environments where care was rendered. Consequently, we cannot draw specific conclusions regarding sternal IO use but hope that personnel placing these devices and providing medical training can use the information. With awareness of these findings, further questions are: (1) Can this rate be improved in the battlefield environment? And, if so, (2) How can improvement be accomplished?

DMMPO Recommendations/Actions

- Leave medical equipment and devices on Killed In Action and Died of Wounds patients
- Review training techniques & TTPs
- Report equipment issues to ensure proper resolution (Appendix I)

The following information for sternal IO devices is provided:

- FAST-1 6515-01-536-9363 and 6515-01-530-6147
- EZ IO (manual sternal needle) 6515-01-559-6311 and 6515-01-559-7489
- FAST-X Sternal NSN in processing.

The material distributed by FT2F is intended for education and training purposes. We encourage its use at all levels. If portions are extracted, they must include the following credit line: *Source: Armed Forces Medical Examiner System.*

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APPENDIX I

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Altered Mental Status in a U.S. Army Special Forces Soldier

SFC Jonathan Brandon, 18D and MAJ Guyon J. Hill, MD

Abstract

Special Operations medical provider must be familiar with the differential diagnosis for a patient with altered mental status since it includes multiple life-threatening illnesses. Potential diagnoses include meningitis, encephalitis, malaria and many others. While preparing to evacuate to definitive care from an austere location, they must also be prepared to initiate empiric therapy that is specific to the patient and the area of operations. We present a case of a U.S. Army Special Forces Soldier that developed limbic encephalitis of presumed Herpes Simplex Virus (HSV) origin. We will review the key differential diagnoses for this presentation with a focus on infectious etiologies. We will also summarize current diagnostic and therapeutic strategies. Our recommendation is to initiate oral acyclovir when IV acyclovir is not available and this diagnosis cannot be excluded.

Introduction

Encephalitis is a predominantly viral infection of the central nervous system (CNS). Multiple different viral etiologies are possible and the ultimate cause may not be identified. A broad spectrum of presentations may occur. Frequently encountered symptoms include altered mental status, fever, and a variety of neurologic deficits. These may range from minor deficits to flaccid paralysis or coma. Memory deficits, personality changes and seizures may also be present. Potential pathogens vary considerably based on seasonal variation and geographic considerations. MRI of the brain is the ideal imaging modality and the diagnosis can be confirmed with polymerase chain reaction (PCR) testing of the cerebrospinal fluid (CSF).

Case Report

A 35-year-old male U.S. Army Special Forces Soldier self-referred to the Emergency Department (ED) of his local military treatment facility with the chief complaint of headache, disorientation and increasing memory difficulties. He had noticed these symptoms 12 hours prior to presentation and they had been progressing throughout the day without any other associated symptoms. He had recently returned from a 6-month temporary duty assignment in Hawaii, but had no other recent deployments or international travel. He had no preceding illness.

On presentation to the ED, the patient was confused and was noted to have obvious difficulty forming new memories. He reported having difficulty focusing. He denied fever, headache or other symptoms. The patient had no significant past medical history. Vital signs were all found to be within the normal range and he was afebrile. His physical exam was unremarkable, to include the absence of nuchal rigidity, petechiae or other rashes. His Glasgow Coma Scale was 15. A consult was placed from the ED to the on-call Neurologist who arranged to see the patient in his clinic within the next 72 hours. The Neurologist requested an MRI be completed prior to the outpatient visit, but recommended deferring the lumbar puncture and all other studies. His diagnosis on discharge was Transient Global Amnesia.

The following day, the Soldier presented to his Special Forces Medical Sergeant (18D) and complained of a febrile illness at that time. At 24 hours after initial presentation, the 18D and the Battalion Surgeon escorted the Soldier back to the ED. At that time, he was noticeably more confused and he began confabulating. His only other complaint at that time was several episodes of emesis. Again, his physical exam was unremarkable, and his vital signs to include temperature were all within normal limits.

The patient was immediately started on IV acyclovir, ceftriaxone, and dexamethasone to empirically treat both meningitis and encephalitis. Encephalitis was suspected due to the patient's rapidly worsening short-term memory. A lumbar puncture (LP) was performed, the results of which were consistent with a viral process (WBC 93, RBC 2, glucose 55, protein 66). He was admitted for further treatment and evaluation due to concern for encephalitis. PCR testing for both HSV 1 and 2 was negative, as were all other tests run on the CSF. A head CT without contrast was unremarkable. A MRI performed four days post onset revealed abnormalities in the bilateral medial temporal lobes, caudate heads, left putamen, and both mammillary bodies. These findings were considered atypical for HSV encephalitis, but more typical for an autoimmune etiology. Extensive additional testing and imaging to rule out rheumatologic or paraneoplastic causes was negative. Post-vaccinial encephalitis was considered as the Soldier had received his small pox vaccine two weeks prior; however, additional PCR for this etiology was also negative. Serum was positive for HSV IgM with HSV IgG being negative suggesting an acute infection. No epileptiform activity was detected on an EEG. The patient underwent a repeat lumber puncture that demonstrated a decline in his WBC count to 53 while on acyclovir (RBC 2, Protein 45, Glucose 7), but all other CSF studies to include repeat PCR testing were again negative. A follow-up MRI performed at seven days post-presentation revealed stable lesions.

The patient remained hospitalized for 14 days while receiving IV acyclovir and further evaluation. During his stay, he developed a systemic reaction to IV acyclovir

that manifested as a diffuse erythematous rash. Due to the presumption of HSV encephalitis, the decision was made to continue the medication and the addition of diphenhydramine reduced his symptoms dramatically. His anterograde amnesia mildly improved during this time. He was discharged and received a total of 21 days IV acyclovir with improvement in both clinical status and laboratory values. The patient did not display seizure activity at any time. The only other symptom he reported was occasional moderate headaches, which were relieved with either ibuprofen or acetaminophen. The patient scored 28/30 on a mini-mental status exam eight days after discharge. The final diagnosis was limbic encephalitis of HSV origin although PCR was negative on both occasions. This patient was presumed to have HSV encephalitis due to his improvement while on acyclovir. The possibility that the patient's encephalitis was caused by a herpes virus other than HSV 1 or 2 also exists (e.g., human herpes virus 6 or HHV 6).

Follow-on care was performed on an outpatient basis that included cognitive rehabilitation at Stanford University for four months. He was returned to full duty 9 months post onset with minimal neurological sequelae. He continues to function on an Operational Detachment - Alpha without any duty restrictions.

Discussion

Herpes Simplex Virus is the most common cause of severe sporadic encephalitis in North America and in the world. Although it has the highest mortality rate, it is also the most treatable form of encephalitis.[1,2,3] It is known for the serious, often long-term, neurological sequelae that affect many survivors even after receiving treatment. However, prompt recognition and early treatment can still provide good patient outcomes. Mortality reaches 70% in untreated cases of HSV encephalitis, but decreases to 19-28% with appropriate diagnosis and treatment.[4,5]

Primary signs and symptoms may include fever, headache, nuchal rigidity, focal neurologic deficits or memory loss. Altered mental status or seizure activity may also be present. Altered mental status may refer to many alterations in brain function; these effects can range from minimal to encephalopathy and coma. They may include: confusion, loss of orientation, delirium, lethargy, emotional lability, psychomotor retardation and others. Onset can be acute, or present with the prodrome of a flu-like illness. This patient's presentation is unusual in that he never exhibited any focal neurologic signs or seizures. He complained of subjective fever upon his second presentation, but did not exhibit objective fever prior to admission to the hospital. It is unknown if he was taking antipyretics due to his difficulties with short-term recall at that point.

The differential diagnosis for this presentation is extensive, especially within the spectrum of medicine in Special Operations where Soldiers travel throughout the world. A thorough travel and exposure history must be elicited. Numerous infectious etiologies for viral encephalitis exist and are often endemic to specific regions or show seasonal variation. Many other viruses can cause encephalitis and their clinical presentation is the same as HSV encephalitis. Most infections by viruses that cause encephalitis are subclinical, and encephalitis from HSV is itself a rare complication. These include the St. Louis encephalitis, West Nile encephalitis, Eastern Equine encephalitis, Japanese encephalitis (in Asia) or encephalitis from other herpes viruses. Meningitis, especially if caused by tuberculosis, may have a similar presentation. Malaria must be considered in a patient with history of potential exposure, even with appropriate prophylaxis. Other differential diagnoses include subdural hematoma or empyema, intracranial neoplasms (primary or secondary), vasculitis, brain abscess, rabies and drug-induced encephalopathy.

HSV appears to infect cerebral tissue through the trigeminal nerve or the olfactory route, but may also develop secondarily to viremia. Infection can result from a primary HSV infection of the oropharynx, a recurrent HSV infection, or without any previously identified HSV infection as in this patient. The predominant result is hemorrhagic necrosis and petechial hemorrhage in the inferior and medial temporal lobes and portions of the frontal lobes. Either HSV-1 or HSV-2 can cause encephalitis in the neonatal period, but HSV-2 is more common and is usually caused by contact with infected maternal secretions during birth. HSV-1 is the predominant cause of HSV encephalitis in the vast majority patients past this period.

PCR testing of the CSF is rapid and highly sensitive and specific, and has become the standard of diagnosis for HSV encephalitis.[6,7] PCR should be positive within 24 hours of onset, with a sensitivity of 98% and a specificity of 94-100%. It remains positive throughout the first seven days of antiviral therapy.[3,7] Cranial CT scan may demonstrate temporal lobe hypodensity, but only has an early sensitivity of 50%.[3] CT imaging may be useful to rule out other differentials, such as space-occupying lesions. MRI is the most sensitive and specific imaging modality for HSV encephalitis and can help expedite the diagnosis. It shows abnormalities in almost all cases, especially when conducted early in the disease process. It frequently shows very characteristic temporal lobe lesions. Brain biopsy should be considered for patients with a negative PCR that still present with a high suspicion for HSV encephalitis.[2,3] Regardless of the efficacy or availability of laboratory testing or imaging, antiviral chemotherapy must not be delayed.

Intravenous acyclovir is the standard for treatment of HSV encephalitis. It must be initiated as soon as Herpes encephalitis is clinically suspected to maximally reduce mortality and improve neurologic outcomes in survivors.[2,3] This is especially true in clinical environments that are more austere where MRI and CSF studies aren't possible and there may be delays in definitive diagnoses. The patient's age and state of consciousness at the time of initial therapy greatly impact the mortality rate as well as morbidity. Most patients who survive will still have some degree of neurological dysfunction. The normal duration of IV therapy is 14-21 days and the drug is generally well tolerated. Although this pa-

tient exhibited a systemic reaction, it was well controlled with the addition of diphenhydramine and he was able to continue therapy.

Although IV acyclovir is rarely carried by SOF medical providers, oral acyclovir is more readily available. Oral acyclovir has a bioavailability of only 10%-30%.[8,9] In our opinion, however, oral acyclovir should be considered until the appropriate treatment and diagnosis can be provided when encephalitis is suspected. We were only able to find one case report in the literature documenting the treatment of suspected HSV encephalitis with oral acyclovir.[8] No trials were found. This patient from India, however, responded dramatically to a 10-day oral course even when it was started on the 6th day of symptoms. An oral preparation was used in that child due to the parent's inability to afford the IV medication. In addition, adding PO or IV acyclovir to the treatment protocol for meningitis is reasonable if the means are not available to narrow the diagnosis.

This patient had an excellent outcome despite developing a potentially devastating disease. His presentation was highly unusual in that his only objective symptom at the time treatment was severe difficulty with short-term memory. The vast majority of patients with encephalitis will be febrile. It is difficult to estimate the degree to which he would have manifested other typical symptoms such as fever, focal neurologic deficits, seizures, or other forms of altered mental status if he had not received treatment in the early stages of his disease process. It is, however, highly probable that his outcome was greatly improved with the prompt and empiric initiation of acyclovir. Acyclovir is the only treatment option for HSV encephalitis. As this is the only treatable form of encephalitis, any suspected encephalitis should be treated empirically with acyclovir. The potential differential diagnoses for a patient with altered mental status are myriad and may include multiple infectious and non-infectious causes. For this reason, a thorough consideration of the area of operations, the patient's risk factors, and potential consultation with expert medical providers can help taylor therapy and improve patient outcomes. If the patient presents in an austere area, it may be necessary to treat empirically for more than one possible disease (e.g. encephalitis and meningitis) by combining acyclovir with other medications while the patient is being evacuated for further evaluation and treatment.

Conclusion

HSV Encephalitis is a potentially catastrophic disease that should be considered in any patient altered mental status, especially if they present with fever. The prognosis for a patient with this disease can be dramatically improved with prompt recognition and the initiation of IV acyclovir. Acyclovir should be started immediately and continued until the diagnosis can be ruled in or excluded. When IV acyclovir is not available, we recommend starting PO acyclovir while the patient is being evacuated to definitive care. Recognition of this disease, and initiating treatment are within the scope of practice for the SOF Medic. Based on the potential mortality and morbidity associated with this diagnosis, this disease should receive increased emphasis in training and certification programs for the SOF Medic.

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Survey of the Indications for Use of Emergency Tourniquets

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Abstract

Indications and evidence are limited, multiple and complex for emergency tourniquet use. Good recent outcomes challenge historically poor outcomes. Optimal tourniquet use in trauma care appears to depend on adequate devices, modern doctrine, refined training, speedy evacuation, and performance improvement. Challenges remain in estimation of blood loss volumes, lesion lethality, and casualty propensity to survive hemorrhage.

Summary Background Data: Evidence gaps persist regarding emergency tourniquet use indications in prehospital and emergency department settings as indication data are rarely reported. **Methods:** Data on emergency tourniquet use was analyzed from a large clinical study (NCT00517166 at ClinicalTrials.gov). The study included 728 casualties with 953 limbs with tourniquets. The median casualty age was 26 years (range, 4-70). We compared all other known datasets to this clinical study. **Results:** Tourniquet use was prehospital in 671 limbs (70%), hospital only in 104 limbs (11%), and both prehospital and hospital in 169 limbs (18%). Major hemorrhage was observed at or before the hospital in 487 (51%) limbs and minor hemorrhage was observed at the hospital in 463 limbs (49%). Anatomic lesions indicating tourniquets included open fractures (27%), amputations (26%), soft tissue wounds (20%), and vascular wounds (17%). Situations, as opposed to anatomic lesions, indicating tourniquets included bleeding from multiple sites other than limbs (24%), hospital mass casualty situations (1%), one multiple injury casualty needed an airway procedure, and one casualty had an impaled object. **Conclusions:** The current indication for emergency tourniquet use is any compressible limb wound that the applier assesses as having possibly lethal hemorrhage. This indication has demonstrated good outcomes only when devices, training, doctrine, evacuation, and research have been optimal. Analysis of emergency tourniquet indications is complex and inadequately evidenced, and further study is prudent. Prehospital data reporting may fill knowledge gaps.

Objective: The purpose of this study is to report and analyze emergency tourniquet use indications to stop limb bleeding.

Introduction

For two millennia, the indication for emergency tourniquet use has been a most controversial first aid topic,[1-7] but recent tourniquet use in war has had favorable results in terms of hemorrhage control and major survival improvement with minor morbidity risk.[8-12] The most important issue regarding emergency tourniquet use is the decision of the applier when or if to use one — in other words, what is the indication? Few studies offer much insight on tourniquet indications beyond clinician experience; so analysis has been limited. We completed a large clinical study at a combat support hospital in Baghdad, Iraq,[11-12] and such recent reports with new evidence permit a fresh look at this controversial first-aid device. Proponents of Tactical Combat Casualty Care advocated that the indication for emergency tourniquet use was any compressible limb wound that the applier assesses as having possibly lethal hemorrhage.[13] However, there was no data on which to evidence that premise. The purpose of this study is to report and analyze tourniquet indications from that trial.

Methods

The current report was designed to report indications data for a clinical study, a performance improvement project on tourniquet use (NCT00517166 at ClinicalTrials.gov). This study was conducted under a protocol reviewed and approved by the Brooke Army Medical Center Institutional Review Board and was conducted in accordance with the approved protocol. The study setting was a combat support hospital (CSH) in Baghdad, Iraq. Tourniquet use during the study period was a standard prehospital hemorrhage control measure. Individual Soldier training is based on Tactical Combat Casualty Care as in Pre-Hospital Trauma Life Support teaching, see appendix.[13] All deployed U.S. servicepersons are issued a tourniquet in their Individual and Vehicle First Aid Kits as well as medic assemblages, and they get tourniquet training with instructions to apply them as soon as possible to stop potentially lethal external limb bleeding. The study period was from 2006 to 2007 and included 728 casualties in three study portions with three different site investigators who studied 232, 267, and 225 casualties in each portion. The first and second portions have been reported regarding the mortality and morbidity, but little data on indications were included in those reports.[11-12, 14]

Table 1: Emergency Tourniquet Indication Evidence

Evidence	Citation	General Level of Evidence
Anatomic Indication		
Traumatic amputation	9,10,11,20,24,25,66	Mid
Arterial disruption	9-11,20,23-25	Mid
Venous disruption	11	Low
Open fracture	9,11,13,20	Low
Soft-tissue injury	9,11,20,24	Low
Impaled object	9	Low
Neurologic injury	9	Low
Expanding hematoma	23	Low
Miscellaneous	11	Low
Situational indication		
Care under fire	8-11,14,15,24,25	Mid
Mass casualties	9,11	Low
Multiple-injury casualty	9,11,	Low
Darkness	9	Low

Table 2: Tourniquet Use Indications of Lakstein et al.[9]

- Failure to stop bleeding by direct pressure bandaging injury does not allow direct control of bleeding with a bandage, or objective factors
- Amputation
- Bleeding from multiple locations
- Protruding foreign body
- Need for immediate airway management or breathing control
- Under-fire situation
- Total darkness
- Mass casualty event

Indications are of two types — anatomic and situational (Tables 1 and 2[3]). Anatomic indications are tissue lesions with limb bleeding that risk death, such as a mid-thigh gunshot wound with femoral artery transection. Anatomic indications are defined medically and can be confirmed surgically. The investigators determined whether the bleeding was major or minor based on the wound, casualty appearance, and care provided. Anatomic injuries of the limb are categorized as amputation, open fracture, vascular injury, etc. Situational indications are predicaments in which appliers choose a tourniquet as the best treatment for reasons other than the lesion itself (e.g., care under fire on the battlefield)[15, 16] and are defined and determined by rescuers. We also categorized the reason for use from our understanding of the applier's situation which included non-anatomic (non-lesion) reasons such as care under fire, mass casualties, and a multiply injured casualty.

Vascular lesions were defined conventionally similar to prior war studies in that visibly transected named arteries were recorded by surgeons. Also according to convention, the vascular lesion category included fractures with such lesions, but traumatic amputation was categorized different than vascular lesions since they were so severe. The soft tissue category did not include lesions with arterial injury. Also, the fracture category excluded arterial lesions and amputations (which routinely transected bone).

Results

A total of 728 casualties (692 male [95%], 35 female [5%], one unknown) had 953 limbs with tourniquets of which 476 were left and 477 were right (50% each). Limbs included 679 lower extremities (71%) and 274 upper extremities (29%). Tourniquet use was prehospital only in 671 limbs (70%), hospital only in 104 limbs (11%), both prehospital and hospital in 169 limbs (18%), and unclear in 9 limbs (1%). Prehospital use with or without hospital use occurred in 840 limbs (88%). The median casualty age at presentation was 26 years (range, 4-70) (Figure 1). The nationalities of the casualties were mostly American and Iraqi but represented a broad array of 15 nations with subjects vulnerable to violence in and around Baghdad during the Operation Iraqi Freedom study period (Table 3). The median follow up was five days (range, 0.5-624) for the first 499 casualties and was seven days (range, 0.5-624) for the first 232 casualties; the final 225 casualties were not followed beyond discharge from the study site.

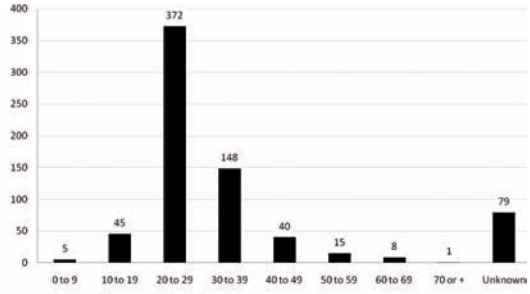

Figure 1: Title: Study Group Age Distribution.
Legend: The casualty count is the y-axis, and the age ranges in years is the x-axis. Of 728 casualties

Table 3: Casualty Counts by Nationality of Origin.

Casualty Nationality	N
American	362
Iraqi	343
British	4
Indian	3
Brazilian	2
Armenian	2
South African	2
Unknown	2
Polish	1
Nepali	1
Irish	1
Chilean	1
Jordanian	1
El Salvadoran	1
Kenyan	1
French	1

Indications for tourniquet use were examined in three ways by the investigators.

- First, regarding whether the reason to use the tourniquet was major hemorrhage or minor hemorrhage such as during care under fire or mass casualties. Major hemorrhage occurred in 487 (51%) limbs, while 463 limbs (49%) had minor hemorrhage. One casualty also had four limbs involved with coagulopathic hemorrhage during intensive care, and another casualty had one limb with an unclear indication.
- Second, 162 limbs had open fractures (27%), 156 had traumatic amputations (26%), 122 limbs involved soft tissue wounds (20%), 102 limbs had vascular wounds (17%), 65 limbs included other injuries (11%), two limbs were crushed, one limb

suffered an avulsion injury, and one limb had an unclear limb. This second look at anatomic injuries was a limited data set to the first 232 casualties and last 225 casualties as the interim period was absent such summary data.

- Third, we observed that 175 limbs (61%) had bleeding from multiple limb wounds, 64 limbs (39%) had single limb wounds, and one limb (1%) had unknown wound. Additionally, we had a record of only one limb in a multiple-injury casualty that needed an air way procedure, one limb with care under fire, one limb with an impaled object, and two limbs with un clear situations. This third look was limited to the last 228 casualties since that was the type of data collected. The investigators believed that situational data like care under fire was under-reported and such prehospital data was rarely given or available.

Discussion

The main finding of the present study was that the current indication for emergency tourniquet use is any compressible limb wound that the applier assesses as having possibly lethal hemorrhage. With this large dataset of the indications for emergency tourniquet use we filled the knowledge gap regarding the frequency of various indications.

Anatomic Indications

Open fractures were the most common indication in the present study at 27%. Open fractures can bleed much and long, even without an artery lesion,[17-20] and have ranged from 25% to 41% of the injured casualties with emergency tourniquet use in recent wars.[9, 11, 21]

Traumatic amputations were the second most common indication in the present study at 26%. Traumatic amputations include artery and vein loss of varying degree and have ranged from 18% to 31% of the injured casualties with emergency tourniquet use in recent wars.[9, 11, 21] Proximal amputations are more lethal than distal ones, and multiple amputations are more lethal than single ones.[22]

Soft tissue wounds were the third most common indication in the present study at 20%. Soft-tissue injuries are generally less lethal than others; their frequency is generally thought to be low but in reality is high. Soft tissue wounds are a common indication for tourniquet use.[11,23] Superficial injuries constituted 15% to 25% of recent tourniquet applications, apparently during care under fire.[9-11,21,24-26] Even when a named vessel is not involved, wound volume, extent of tissue damage and injury severity have been associated with blood loss volume and mortality rates.[27-28] The importance of soft-tissue injury, especially of muscle (which makes up 40% to 50% of cellular body tissue mass), is often underestimated in hemorrhagic shock because soft-tissue injury is less lethal than artery injury. Massive soft-tissue injuries can be associated with hyperkalemia (and hyponatremia) after resuscitation. Leaked cellular potassium can be later cleared with reperfusion into core circulation.[29] Soft-tissue injury has been added to models of lethal trauma, and such additions increase mortality prediction accuracy although operational definitions of soft tissue injury differ.[30] Traumatized small vessels may clot off better than larger ones but may consume more coagulation factors and result in coagulopathy.[31] Soft-tissue wounds can be associated with direct erythrocyte disruption and traumatic hemolysis, which have been shown to increase lethality of hemorrhagic shock by potentiating coagulopathy.[32]

Vascular lesions were the fourth most common indication in the present study at 17%, and arterial injuries have ranged from only 8% to 28% of the injured casualties with emergency tourniquet use in recent wars.[9,11,21] Vascular lesions may or may not in and of themselves present with clear or hard signs, and may only present with unclear or soft signs (Table 4). The hard and soft signs of vascular injury overlap substantially with both the other non-vascular injuries indicating tourniquet use, complications like compartment syndrome, and trauma care like pulselessness from tourniquet use.

The general appearance of the wound may influence rescuers more than specific lesions or bleeding. Less visibly injured casualties were less likely to get tourniquets in the prehospital setting despite subsequently confirmed arterial injury or significant hemorrhage, and this is similar to a prior investigation from the study site.[10] For recent casualties in Baghdad, some had a prehospital applier use their first tourniquet outside of training, and few medics applied tourniquets to more than a few casualties.[11]

Table 4: Hard and Soft Signs of Arterial Injury[67]

Physical Findings (Hard Signs) Indicating Operative Artery Exploration:

- Pulsatile bleeding
- Expanding hematoma
- Palpable thrill, audible bruit
- Evidence of regional ischemia
  - o Pallor
  - o Paresthesia
  - o Paralysis
  - o Pain
  - o Pulselessness
  - o Poikilothermy

Physical Findings (Soft Signs) Suggesting Further Evaluation:

- History of moderate hemorrhage
- Injury (fracture, dislocation, or penetrating wound) in proximity to a major artery
- Diminished but palpable pulse in an injured limb
- Peripheral nerve deficit

Situational Indications

Uncontrolled hemorrhage has been the most common cause of death on the battlefield, and limb hemorrhage is a common preventable cause.[32-35] In most studies care under fire is the most common situation for application of emergency tourniquets.[9,24,25,36-40] Due to our methods and hospital base, the investigators believe they under-sampled care under fire because no one reported that prehospital data to them.

Mass casualty situations tax trauma systems and tourniquet use enables providers to attend safely and effectively to more casualties quickly.[10,11,41] For example, 28 war casualties entered the CSH emergency department in a 25-minute span

after an explosion. All had limb injuries, three died early, eight had tourniquets, several had resuscitation procedures, and half required emergency surgery. Tourniquets helped providers triage, resuscitate, stabilize, and save 25 casualties.[11]

One casualty each suffered from an impaled object, coagulopathic hemorrhage, and multiple-injuries. The last casualty may have required several simultaneous resuscitative procedures for best care.[9,42] A casualty with a simple, rapid, severe arterial hemorrhage can have bleeding stopped more easily and can be resuscitated more easily than one with multiple, extensive hemorrhaging wounds.[15,27,41,42]

Application of the Findings

The positive predictive value of clear findings (e.g., bright red blood spurting high with pulsations) from a simple lesion (e.g., a wrist wound where the radial artery is routinely palpable) observed acutely by an experienced clinician (r.g., vascular surgeon) under optimal lighting in safety may be high, but rarely in reality are such lesions or conditions so simple or optimal.[43] The exact type of vessel injury, severity, and location is difficult to ascertain without surgical exploration.[43] Soldiers or medics looking at a bloody limb may not be able to determine what tissues are injured[8,25,41] or distinguish arterial from venous bleeding.[44] For example, in a simulated casualty with a simulated thigh wound, less than half of military student medics after basic training could recognize and appropriately treat life-threatening hemorrhage.[45]

Venous bleeding presents a number of first aid problems. Low-pressure venous bleeding may not be as noticeable as arterial bleeding and go undetected longer, since vein anatomy precludes adequate lumen constriction and vessel contraction. Therefore veins retract little, resulting in continued bleeding if untreated. The capacity of observers to differentiate arterial and venous bleeding is limited, especially as time progresses after injury as anatomic, physiologic, and treatment effects mix together. Brief venous bleeding is rarely lethal or uncontrollable after limb elevation and compression.[46-49] Experts noted a lack of evidence of efficacy for elevation and compression; so in tactical situations, these experts no longer recommend limb elevation and pressure point use.[38,50,51] The investigators cannot say that tourniquet placement is mandatory in high-risk cases because lesser measures used by skilled persons may work quickly in some circumstances.

Difficulties in estimating blood loss volumes and predicting consequences complicate the decision to apply tourniquets in emergent situations. Casualties can bleed incrementally throughout care, particularly on the first day;[10,16,18,52] but few observers see all prehospital, emergency department, operating room, intensive care unit, and ward blood loss that occurs.[26] Clothes, equipment, medical drapes, or blankets can obscure the casualty's bleeding.[26] Visual estimation of blood loss, even by surgeons, is too inaccurate to be clinically useful.[53-55] Underestimation is more common than overestimation,[53,56-58] especially with higher volumes of hemorrhage.[53,57] this study offers a low-to-high need for tourniquet use based on bleeding, but situational indications can substantially increase user willingness (**Table 5**).

Table 5: Decision Matrix on Need for Tourniquet Use

Tourniquet Need	Bleeding		
	Rate	Color	Volume
Low	Slow	Dark	Small
Medium	Medium	Mixed	Medium
High	High	Bright	Large

Numerous aspects of arterial lesions affect hemorrhage. Extremity arterial lesions are generally more lethal than venous lesions, and higher arterial pressure can cause more rapid loss of blood volumes.[46] Proximal arterial lesions are more lethal than distal ones, probably because greater vessel caliber at a higher pressure permits larger volume and more rapid blood loss.[16,17,22,59] Normal blood flow is proportional to the fourth power of the vessel radius. Flow is estimated by Poiseuille's law: $Q = (\Delta P \pi r^4)/(8\eta l)$, where Q is the volumetric blood flow rate; ΔP is the driving pressure drop; π is a constant, approximately 3.14; r is the vessel radius; η is the dynamic viscosity; and l is the length of the vessel. This equation also helps explain how wide tourniquets, blood pressure cuffs, and Military Anti-shock Trousers stop flow at low pressures as l increases. Hemorrhage rate from a vessel leak is estimated initially by a derivation of Bernoulli's equation: $Q = A\sqrt{[(2\Delta P)/\rho + v^2]}$, where the hemorrhage rate (Q) = the laceration area (A) times the square root of twice the transmural pressure change (ΔP) divided by the blood density (ρ) plus the velocity (v) squared.[60-63]

Stopping bleeding is a simple aim but a complex task. The overall goal is to maximize survival, and its corollary is to minimize morbidity — life over limb. The immediate aim is to stop the bleeding, which prevents the onset of hemorrhagic shock and thereby increases survival time.[12] Increased survival time allows better resuscitation and thus increases overall survival with minimized morbidity.[11,12] The aims of tourniquet use in prior doctrine were unspecified but now include survival rate (survivor percentage of all casualties with tourniquet use), survival time (hours permitting resuscitation), hemorrhage control (stopping visible external bleeding), stopping the distal pulse (if there is a distal limb with a palpable pulse present), limb function preservation, and rescuer safety while under fire. Each aim has utility. Hemorrhage control, including tourniquet use in battle casualties, has been associated with shorter and less severe hemorrhage and shock, which decreased transfusion requirements and some sequelae.[10,11,27]

Empirically, with the given training, doctrine, fielding, and performance improvement work, appliers in Operation Iraqi Freedom did a good — although imperfect — job of determining which limb-injured casualties were at risk for death from bleeding.[10,11] In the first Baghdad survey, an 18% unindicated tourniquet use rate led to improved education and training.[10] In a recent survey, only 5% of casualties had no situational or anatomic indication for the tourniquet use, and all 5% had prehospital tourniquets.[11] Furthermore, emergency department use was never seen to be unindicated.[11] However, there later were 2% of cases in which prehospital use was indicated, but no tourniquets were available or accessible before the casualties exsanguinated and died.[11]

Study Limitations and Future Directions

The data in this study is limited in quantity and qual-

ity mostly due to war circumstances and the difficulty of doing an emergency performance improvement project at a busy CSH trauma center. When errors in resuscitation are studied and measured, they occur in almost every case although failure to observe or record relevant bedside information has been infrequently associated with adverse outcomes.[64] The team's experience is similar to that of this study, and this report provides a data collection sheet for use as an aid in making resuscitation decisions (Figure 2: Data Collection Sheet).

The visual anatomic indications for emergency tourniquet are intuitive but difficult in both practice and clinical study (Table 6). Furthermore, casualty propensity to survive hemorrhage currently appears complex and unpredictable.[65] Currently, no easy fix exists for the complex problem of limb hemorrhage control, resulting in an apparent need to balance multiple essentials of tourniquet best care until breakthrough ideas or technologies are developed (Table 7).

TOURNIQUET DATA COLLECTION SHEET

Patient Name:		ID #		Lived/Died:		Injury date:		Death date:
Last Follow-up Date:		Age (years):		Sex: ☐ M ☐ F		Nationality:		Job:
Limb Injury Left upper extremity (LUE), right UE (RUE), left lower extremity (LLE), right LE (RLE)	**Devices** CAT (C) SOFTT (S) EMT (E) Other (O)	**Placement** Arm (A) Forearm (FA) Leg (L) Thigh (T)	**Setting** Hospital (H) Pre-hospital (PH)	**Bleeding** Stopped (0) Decreased (-) Increased (+)	**Distal Pulse** Absent (Abs), Present (Pres) Is distal pulse present during use?	**Time On/Off** Record on time/record off time to calculate duration of use in minutes.	**Duration of Use (min)**	**Morbidity** A: Amputation C: Clot (DVT/PE) F: Fasciotomy M: Myonecrosis P: Palsy (nerve) R: Renal (failure) U: Myoglobinuria Pain	**Result/When** Limb Outcome: Saved (S), Lost Explain why lost and give date lost.
☐ LUE	☐C ☐S ☐E ☐O	☐A ☐FA ☐L ☐T	☐PH ☐H	☐0 ☐- ☐+	☐Abs ☐Pres	/	min		☐ Saved ☐ Lost:
☐ RUE	☐C ☐S ☐E ☐O	☐A ☐FA ☐L ☐T	☐PH ☐H	☐0 ☐- ☐+	☐Abs ☐Pres	/	min		☐ Saved ☐ Lost:
☐ LLE	☐C ☐S ☐E ☐O	☐A ☐FA ☐L ☐T	☐PH ☐H	☐0 ☐- ☐+	☐Abs ☐Pres	/	min		☐ Saved ☐ Lost:
☐ RLE	☐C ☐S ☐E ☐O	☐A ☐FA ☐L ☐T	☐PH ☐H	☐0 ☐- ☐+	☐Abs ☐Pres	/	min		☐ Saved ☐ Lost:

DRAW AND WRITE NOTES ON AND NEAR OUTLINE Front Right Back Right Explain trials of conversion to pressure dressing:

Was any vessel visibly injured? ☐ Yes	☐ No	Vessel Name:		
Nerve palsy was at the level of:	☐ Wound	☐ Tourniquet	☐ Unknown	☐ No palsy
Shock onset:	☐ None	☐ Before tourniquet use	☐ After tourniquet use	☐ Unknown
TK device make/type/Description Notes: ☐ CAT ☐ SOFTT ☐ EMT		Improvised: from		Other make:
Side by side use? ☐ Yes: ☐ LUE ☐ LLE ☐ RUE ☐ RLE		Why?		Response to more TKs:
Main Indication: ☐ Medical ☐ Tactical ☐ Unknown Lesion notes:		Tactical Indication: ☐ None ☐ Care under fire ☐ Darkness ☐ Unknown ☐ Other (describe)		
Medical Indication: ☐ Mass casualties ☐ Multiply injured patient ☐ Exsanguination-failed countermeasures (e.g., pressure dressing)				
Use intent: ☐ Arterial (routine) ☐ Only as venous tourniquet ☐ In case of re-bleed (purposefully loose—never tightened) ☐ Unknown				
Placement: ☐ Proximal to wound (routine) ☐ Distal to a wound ☐ Atop wound ☐ Wound too proximal for tourniquet to fit normally proximal				
☐ Breakage ☐ Wear & tear ☐ Mishap ☐ Loose ☐ None		Explain if not none:		
Applier level: ☐ Self ☐ Lay ☐ Soldier ☐ Medic ☐ Nurse ☐ Physician assistant ☐ Physician ☐ Unknown		Applier name: Notes on use:		
POC:	Field Provider/Notes:		Patient Unit:	
ER Provider:	Surgeon:		☐ Admit ☐ Transfer ☐ Morgue Hospital Name:	
Who indicated tourniquet(s)? ☐ Self ☐ Lay ☐ Medic ☐ Nurse ☐ Physician assistant ☐ Physician ☐ Surgeon ☐ Other ☐ Unknown				
Explain fully if amputation was ☐ Injury ☐ emergency completion surgery ☐ failed salvage (>24hr) ☐ reconstruction		Note why: Note when:		
Other notes on treatment: ☐ Limb exposed to ambient temperature ☐ Limb actively cooled ☐ Hemostatic dressing:				
Reminder to clean tourniquet/dry/replace in treatment area; remove from use if unserviceable. Explain if unserviceable:				

Conclusion

Indications for emergency tourniquet use are complex and have been rarely evidenced so these findings fill knowledge gaps. The current indication for emergency tourniquet use is any compressible limb wound that the applier assesses the potential for lethal hemorrhage. In complex situations, it is difficult to tell how much a casualty bled. Optimal healthcare appears to depend upon adequate fielding of effective devices, modern doctrine, specific training, speedy evacuation, and refinements through performance improvement. Analysis of emergency tourniquet indications is complex and inadequately evidenced, so further study, particularly emphasizing prehospital data, is prudent.

Disclaimer: The work was supported by U.S. Army internal funds. Financial Disclosures that might relate to this manuscript: Dr. Kragh is an employee of the U.S. Government and has consulted at no cost with Tiger Tourniquet, LLC, Tactical Medical Solutions, LLC, Combat Medical Solutions, Inc., Composite Resources Inc., Delfi Medical Innovations, Inc., North American Rescue Products LLC, H & H Associates, Inc., Creative & Effective Technologies, Inc., TEMS Solutions, LLC, Blackhawk Products Group, and Hemaclear. He has received honoraria for work for the Food and Drug Administration for device panel consultation. He has received honoraria for trustee work for the non-profit Musculoskeletal Transplant Foundation.

Acknowledgments: Otilia Sánchez aided in manuscript preparation.

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Key words: hemorrhage, shock, resuscitation, first aid.

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Table 6: Questions for Further Tourniquet-Related Study

1. How difficult is direct pressure normally or under fire? What is the quality and quantity of evidence that it is effective? What about limb elevation or pressure points?
2. Should tourniquets be placed very proximal during care under fire so a proximal wound is not missed before the casualty is removed from danger before the survey for controllable hemorrhage is complete?
3. How can emergency care researchers effectively gather meaningfully complete data?
4. Which civilian situations are similar to military ones for considering emergency tourniquet use?
5. What civilian situations are evidenced regarding tourniquet use?
6. What data can be meaningfully collected regarding resuscitative tourniquet use in the prehospital or emergency room settings?
7. What candidate procedures may be indicated during resuscitation with concurrent tourniquet use in a multiply injured casualty?
8. What meaningful data can be collected during or after mass casualty situations?
9. How can civilians adequately prepare for mass casualties without tourniquet experience, training, or doctrine?
10. In the face of absent or inadequate tourniquet training and doctrine, how can civilian mass casualty situations be handled best?
11. What present user or data needs are unmet regarding pressure dressing techniques and training? Pressure points? Limb elevation?
12. What data are available to form guidelines regarding pressure dressings with or without novel hemostatic agents or tourniquet use?
13. What data exist regarding conversion of tourniquet use to pressure dressing use?
14. How does a circumferential pressure dressing differ from a venous tourniquet?
15. What of the 'pop a clot' phenomena with normo-tensive resuscitation or over resuscitation with pressure dressing use?
16. How well does a lay person put on pressure dressing even if trained? Complex cases.
17. What is the failure rate of pressure dressings? Death rate? Morbidity rate?
18. Might pressure dressings for open fractures be evidenced to save lives?
19. How can one avoid a pressure dressing acting like a venous tourniquet yet still control hemorrhage? When or if does it matter?
20. How exactly does one learn to put on a pressure dressing for mangled limbs?
21. With massive wounds of soft tissue, how do providers put on a pressure dressing?
22. Can a pressure dressing be placed safely under fire?
23. How do we differentiate bleeding types (active, venous tourniquet, rebleeding, 'pop a clot', and drainage)?
24. How do we teach such differentiation? Is it worthwhile?
25. What are the consequences of under or over resuscitation of tourniquet casualties?
26. How does one optimize resuscitation in austere environments?
27. How does one best teach the bleeding limb imperatives to the uninitiated?
28. How is that we determine which lesions have lethality?
29. Can we better determine the lethality of lesions?
30. How can we teach what lesions are lethal?
31. What can policy makers do to improve tourniquet availability and improve doctrine and training?
32. How can the lessons learned recently be communicated effectively?
33. Can a health care system expect good results without implementing what may be essential?
34. Do first aid hemostatics and tourniquet use affect each other?
35. Are the experiences reported from Baghdad consistent over time?
36. What are the associations among tourniquet use, survival, injury severity, and fasciotomy rates?
37. Are the experiences of other US military services similar to the Army's?
38. Are the experiences of other military forces similar to the US's?
39. Is meaningful civilian data collection possible?
40. What tourniquet guidelines are best for lay persons, medics, physicians, or executives?
41. What device design items are of practical concern to manufacturers and users?
42. What risks and benefits would tourniquets pose when incorporated into clothing or uniforms?
43. Can we integrate an in-uniform tourniquet system into Future Force Warrior?
44. What are the limits of what is anatomically amenable to tourniquet application?
45. How do we assess for discontinuation of tourniquets once bleeding is controlled by other means?
46. Before releasing any tourniquet on a patient who has been resuscitated for hemorrhagic shock, should a positive response exist to resuscitative efforts (i.e., a peripheral pulse normal in character and normal mentation if there is no traumatic brain injury?
47. What operational definitions of hemorrhagic shock are useful prehospital?
48. Is the proper use of the tourniquet to only stop hemorrhage or to also stop the distal pulse? Are the two conditional?
49. How exactly does one provider elevate and compress bleeding in a fractured or mangled extremity?

Table 7: List of Possible Potential Breakthrough Ideas or Technologies

- Improved capacity to predict patient lesions that are lethal; e.g., genetic markers
- Improved capacity to differentiate arterial from venous bleeding
- Improved understanding of hemostatic devices or techniques (e.g., pressure points, limb elevation, pressure dressings, hemostatic devices)
- Prehospital coagulators (perhaps ultrasonic, chemical, or thermal)
- New hemostatic dressings, powders, liquids, foams, or sprays
- New pressure dressings or devices; e.g., proximal lesion tamponade by balloons
- Smart tourniquet (adjusts pressure; has timer, manometer, and pop-off valve)
- Combinations of the above

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appendix

Tactical Combat Casualty Care Guidelines – Hemorrhage Control Excerpt
1 November 2010

Basic Management Plan for Care Under Fire

7. Stop *life-threatening* external hemorrhage if tactically feasible:
   - Direct casualty to control hemorrhage by self-aid if able.
   - Use a CoTCCC-recommended tourniquet for hemorrhage that is anatomically amenable to tourniquet application.
   - Apply the tourniquet proximal to the bleeding site, over the uniform, tighten, and move the casualty to cover.

Basic Management Plan for Tactical Field Care

4. Bleeding
   a. Assess for unrecognized hemorrhage and control all sources of bleeding. If not already done, use a CoTCCC-recommended tourniquet to control life-threatening external hemorrhage that is anatomically amenable to tourniquet application or for any traumatic amputation. Apply directly to the skin 2-3 inches above wound.
   b. For compressible hemorrhage not amenable to tourniquet use or as an adjunct to tourniquet removal (if evacuation time is anticipated to be longer than two hours), use Combat Gauze as the hemostatic agent of choice. Combat Gauze should be applied with at least 3 minutes of direct pressure. Before releasing any tourniquet on a casualty who has been resuscitated for hemorrhagic shock, ensure a positive response to resuscitation efforts (i.e., a peripheral pulse normal in character and normal mentation if there is no traumatic brain injury (TBI).
   c. Reassess prior tourniquet application. Expose wound and determine if tourniquet is needed. If so, move tourniquet-from over uniform and apply directly to skin 2-3 inches above wound. If a tourniquet is not needed, use other techniques to control bleeding.

d. When time and the tactical situation permit, a distal pulse check should be accomplished. If a distal pulse is still pres ent, consider additional tightening of the tourniquet or the use of a second tourniquet, side-by-side and proximal to the first, to eliminate the distal pulse.
e. Expose and clearly mark all tourniquet sites with the time of tourniquet application. Use an indelible marker.

Basic Management Plan for Tactical Evacuation Care

* The term "Tactical Evacuation" includes both Casualty Evacuation (CASEVAC) and Medical Evacuation (MEDEVAC) as defined in Joint Publication 4-02.

3. Bleeding

a. Assess for unrecognized hemorrhage and control all sources of bleeding. If not already done, use a CoTCCC-recommended tourniquet to control life-threatening external hemorrhage that is anatomically amenable to tourniquet applica tion or for any traumatic amputation. Apply directly to the skin 2-3 inches above wound.
b. For compressible hemorrhage not amenable to tourniquet use or as an adjunct to tourniquet removal (if evacuation time is anticipated to be longer than two hours), use Combat Gauze as the hemostatic agent of choice. Combat Gauze should be applied with at least 3 minutes of direct pressure. Before releasing any tourniquet on a casualty who has been resuscitated for hemorrhagic shock, ensure a positive response to resuscitation efforts (i.e., a peripheral pulse nor mal in character and normal mentation if there is no TBI.)
c. Reassess prior tourniquet application. Expose wound and determine if tourniquet is needed. If so, move tourniquet from over uniform and apply directly to skin 2-3 inches above wound. If a tourniquet is not needed, use other techniques to control bleeding.
d. When time and the tactical situation permit, a distal pulse check should be accomplished. If a distal pulse is still present, consider additional tightening of the tourniquet or the use of a second tourniquet, side by side and proximal to the first, to eliminate the distal pulse.
e. Expose and clearly mark all tourniquet sites with the time of tourniquet application. Use an indelible marker.

COL Kragh is a prior 3d Ranger Battalion Surgeon and is now an Army orthopedic surgeon at the US Army Institute of Surgical Research. He researches combat casualty care and is an expert in the emergency use of tourniquets.

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Physiological and Psychological Characteristics of Successful Combat Controller Trainees

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ABSTRACT

Objectives: The United States Air Force (USAF) Combat Controller (CCT) training pipeline is extremely arduous and historically has an attrition rate of 70-80%. The primary objective of this study was to identify the physiological, psychological, or demographical characteristics associated with successful progression through the CCT pipeline program. **Methods:** A battery of physiological measurements, biographical information, and psychological tests were used to determine the profile of a successful CCT trainee. These measures were chosen on the basis of being standard physical fitness parameters, CCT-specific physical attribute indicators or validated psychological surveys. A multiple of physical tests served as measurements for cardiovascular endurance (VO_2max and running economy), "anaerobic" capacity (Wingate power and loaded anaerobic endurance treadmill tests), body composition skinfolds measurements, power (Wingate and vertical jump), and reaction time (Makoto eye-hand test.) Each test was conducted using a standardized protocol. Psychological characteristics were explored through use of the International Personality Item Pool (IPIP-NEO) and the Mental Toughness Questionnaire 48 (MTQ 48). **Results:** Our findings revealed the following mean characteristics of 109 CCTs who completed Phase I of the pipeline and achieved their 3-level rating: 23 years old, 1.8m tall, 81kg, 12% body fat, VO_2max of 59ml/kg/min, vertical jump of 62cm, able to generate 11.4W/kg peak power and 9.3W/Kg mean power during Wingate tests, overall mental toughness rating of 8 (out of 10) with high levels of extraversion and conscientiousness and low levels of neuroticism. The most popular competitive sport played in high school was football, followed by track, wrestling, and baseball. **Conclusions:** The results of the investigation confirm that CCT trainees who have achieved a 3-level rating possess much higher than average levels of aerobic and anaerobic fitness, power, mental toughness, extraversion and conscientiousness. They possess lower than average levels of neuroticism and openness to experience. These results may prove useful in refining the selection criteria and in designing training for CCT trainees.

INTRODUCTION

Historically, the nearly 24-month U.S. Air Force CCT training pipeline has had an attrition rate over 70%. Primary reasons for this attrition include self-initiated elimination, failure to meet physical and academic standards, and both acute and chronic overuse injuries. To successfully navigate the training pipeline it appears that candidates must possess very high levels of motivation, physical fitness, and mental toughness. Identifying what levels of these attributes potential candidates require to be successful is of critical importance to reducing training attrition. Additionally, these attributes can be utilized to tailor training programs to best strengthen each individual and increase the likelihood for training completion. The primary objective of this study was to identify the physiological performance, psychological and demographic characteristics associated with the successful progression through the Combat Controller (CCT) pipeline program.

Multiple studies have looked at predicting success in various military career fields and athletic performance. A recent study by Simpson et al.[1] looked at multiple physiological variables and performance markers from three physical tests. They concluded that two tests, a maximal treadmill test and two-mile backpack run, were useful performance indicators and could be employed in the screening and selection of potential recruits. Pope et al.[2] investigated 1,317 male Australian Army recruits to predict attrition in basic military training. The results revealed a strong negative association between higher fitness and risk of attrition. Similarly, psychological traits have been demonstrated to successfully predict, or at least correlate with, military and athletic achievement. Hartmann et al.,[3] administered three psychological measures to determine the predictive validity of training performance in 71 male applicants at the Naval Special Forces of Norway. Three Rorschach variables accumulated incrementally in the prediction of training completion. Psychological attributes of successful athletes have also been studied. Highlen and Bennett[4] were able to identify qualifiers for the elite Canadian wrestling teams based on the athletes psychological profiles with an 85%accuracy rate.

METHODS

Participants

A total of 109 CCT trainees, age 19-30, signed institutionally approved informed consent documents and were enrolled into the study. All trainees had successfully completed the first year of CCT training and achieved their 3-level status as an Air Force Combat Controller.

Facilities

Data collection was performed at the CCT Physical Training Facility. Physical testing was incorporated into the pre-SCUBA phase of training, occurring during the first two months of the 12-month program. Test results were quickly analyzed and enabled the prescription of individualized exercise regimens.

Experimental Design

A battery of physiological measurements, biographical information, and psychological tests were used to determine the profile of a successful CCT trainee. These measures were chosen on the basis of being standard physical fitness parameters, CCT-specific physical attribute indicators, or validated psychological surveys. A battery of physical tests served as measurements for cardiovascular endurance (VO_2max and running economy), "anaerobic" capacity (Wingate and loaded anaerobic endurance treadmill tests), body composition (skinfold measurements), power (Wingate and vertical jump), and reaction time (Makoto tower test). Each test was conducted using a standardized protocol. Psychological characteristics were explored through use of the International Personality Item Pool (IPIP-NEO) and the Mental Toughness Questionnaire (MTQ-48).

Procedures

Body Composition: Subjects' skinfolds were taken by Lange calipers (Cambridge Instrument, Cambridge, MD) at the standard chest, abdomen, thigh, subscapular, axillary, tricep and suprailliac sites. Three samples were taken and the average measure was used as the final value. The sum of these sites was used to determine body density.[5] Body fat percentage was computed from body density using the Siri equation.[6]

Cardiorespiratory Endurance: Maximal oxygen uptake (VO_2max) and running economy protocols were conducted on a Woodway DESMO treadmill (Woodway USA, Waukesha, WI). Each subject was fitted with a harness and a facemask to collect expired air for the Parvo Medics' TrueOne 2400 metabolic measurement system (Consentius Technologies, Sandy, UT). Subjects wore a Polar heart rate monitor transmitter (Polar Electro, Inc., New York, NY) around the chest to measure heart rate (HR) response throughout the warm-up, test, and recovery phases of the protocols. After a one-minute rest period to verify transmitter communication, subjects performed a two-minute walk at 2.0 mph. Upon completion of the two-minute walk, treadmill speed increased to 7.0 mph at 0% grade. This speed and grade were maintained for three minutes to test for 7.0 mph running economy. Following that stage, the 7.0 mph speed was maintained while the grade increased by 2% increments every minute until it reached a 10% grade, after which it increased by 1% each minute until it reached a 15% grade or until subjects reached volitional fatigue. If subjects did not reach volitional fatigue at the maximum treadmill grade of 15 %, the treadmill speed increased by 0.5 mph every minute until the subject reached volitional fatigue. Once volitional fatigue was reached, the treadmill's speed slowed to a 2.0 mph pace at 0% grade to induce active recovery until his heart rate dropped below 120 bpm. At the one minute recovery stage, the subject received a finger stick for blood lactate collection (10 microL). These one-minute post-test lactates were analyzed using the Lactate Pro system (Arkray, Inc., Kyoto, Japan).

Battlefield Airman Test. The Battlefield Airman Test (BAT) is an anaerobic endurance test designed by the investigators specifically for this population using the Woodway Force 2.0 human powered treadmill. Subjects were fitted with a Polar heart rate monitor transmitter that monitored HR throughout the warm-up, test, and recovery phases. First, the subjects performed a two-minute warm-up on a Woodway Desmo treadmill striving to achieve a warm-up heart rate of 130-140 bpm. A Woodway waist belt was donned following the warm-up and attached to a force transducer on the rear post of the Force treadmill. The treadmill was pre-programmed with five pounds of resistance internally loaded to the treadmill belt to provide extra load and to help alleviate any balance issues. Subjects started to jog and then were given five seconds to achieve a self-selected speed above 7.0 miles per hour. The test continued until the subject could no longer maintain a speed greater than 7.0 mph. All subjects were given one warning to increase their speed if they dropped under 7.0 mph and the test was terminated if they couldn't increase their speed or when the subject dropped below 7.0 mph for the second time.

Wingate Tests. Each subject accomplished an upper body and lower body Wingate anaerobic test (WAnT) on a Monarch 894E Ergomedic Wingate Test Ergometer (Monarch, Seattle, WA). These instruments are specially designed systems with instantaneous loading and braking features. For the lower body test, the seat height was adjusted so that no more than five degrees of knee flexion was present when the leg was fully extended. Each subject performed a 3-5-minute warm-up period striving to achieve a warm-up heart rate of 130-140 bpm including two or three 5-second high revolution spins. Resistance for the test was set at 7.5% (lower body) and 5.0% (upper body) of the subject's body weight within a 0.1 kg resolution of resistance range. A Polar heart rate monitor transmitter monitored HR throughout the warm-up, test, and recovery. The WAnT consisted of a countdown phase and a 30-second (legs) or 15-second (arms) all-out pedaling phase. During the first five seconds of the countdown the subject pedaled at a comfortable cadence. At that point, subjects began pedaling at maximum speed at 1/3

peak resistance. When subjects' rpms exceeded 150, test resistance was added instantaneously by dropping the weight rack. At one minute post completion, subjects received a finger stick for blood lactate collection (10 microL). These one-minute post-test lactates were analyzed using the Lactate Pro system (Arkray, Inc., Kyoto, Japan). Because Wingate norms for elite athletes have not been firmly established we calculated initial norms for elite athlete upper body absolute and relative peak power using one-half standard deviation from the mean in each direction and published them here.

Reaction Time. Eye-hand reaction speeds were measured on the Makoto Sports Arena (Makoto USA, Centennial, CO) in reactive and proactive modes. A one minute rest was given between tests. Each test was performed twice and the better of the two scores was recorded. In the proactive test, the targets on a single tower remained activated until hit by the subject. The results of the proactive test were the average time to hit each target. In the reactive test, targets on a single tower only remained active for 0.74 seconds. If the subject did not hit the target in the allotted time, then the occurrence was recorded as a miss. The results of this test were the percentage of targets hit and the average time to hit each target. There are no published norms for eye-hand reaction on the Makoto. Therefore, we calculated initial norms for elite athlete upper body absolute and relative peak power using one-half standard deviation from the mean in each direction and published them here.

Vertical Jump. A Vertec (Questec Corp., Northridge, CA) vertical measuring device was used to measure vertical jump height. Standing height of the subject was taken with one arm fully extended upward. Then the subject was asked to jump up to touch the highest possible vane while keeping both feet on the ground before starting the jump. Countermovement was allowed but approach steps were not. The subject continued jumping, with brief rest periods between jumps, until the peak height stalled for two consecutive jumps. Jump height was the difference between standing height and peak jumping height.

Psychological Testing. The International Personality Item Pool Representation of the NEO PI-R™ (IPIP-NEO, Dr. John A. Johnson, Penn State University) compares a subject on each of the five broad domains of the Five Factor Model of Personality to other individuals of the same sex and age in the United States. These five domains are extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Each of the domains is then comprised of six sub domains to give a more detailed description of their personalities. The results do not reveal hidden, secret information about the subject nor does the IPIP-NEO assess serious psychological disorders. The subjects completed the 120-item computerized questionnaire at the beginning of their participation in the study.

The MTQ 48[7-8] assesses a subject's ability to withstand pressure in a range of environments. This 48-question written test measures the different elements of performance related characteristics in four core components: challenge, control, commitment, and confidence. Each subject's answers were input into the MTQ 48 database and used to create a Coaching Report describing each subject's level of mental toughness. This Coaching Report provides trainers and coaches with a narrative about an individual's leadership style and offers coaching suggestions that will help the trainer or coach to better understand their trainee or team. The subjects completed the questionnaire both at the beginning and at the end of their participation in the study. Only the initial survey was used for this analysis due the lack of differences between test results.

Trainees also completed a short demographics questionnaire that asked about their history of participation in organized sports.

Statistical Analyses

Descriptive statistics were used to provide the physical and psychological profile for each parameter that was measured. Mean ± standard deviation (SD) were calculated and compared with appropriate normative data.

Results

Table 1 summarizes the means and standard deviations for age, height, weight, and body composition. Ages ranged from 19 to 30 years. Height and weight ranged from 1.68 m to 1.94 m and 65.0 to 95.5 kg respectively. Percent body fat ranged from 3% to 20%.

Table 1. Demographic and body composition results

	Age	Height (m)	Weight (kg)	% Body Fat
Mean	23.3	1.78	80.82	12.39
SD	2.9	0.06	6.56	3.08

Table 2 shows means and standard deviations for the cardiovascular measures of VO_2max in both relative ($mL \cdot kg^{-1} \cdot min^{-1}$) and absolute terms ($L \cdot min^{-1}$), maximal heart rate (bpm), maximal respiratory exchange ratio (RER), and running economy ($mL \cdot kg^{-1} \cdot min^{-1}$). Relative, absolute, and running economy VO_2 max ranged from 50.2 to 70.5 $mL \cdot kg^{-1} \cdot min^{-1}$, 3.88 to 6.07 $L \cdot min^{-1}$ and 27.4 to 45 $mL \cdot kg^{-1} \cdot min^{-1}$ respectively. Maximal heart rate values ranged from 182 to 216 beats per minute while max RER values ranged from 1.12 to 1.38.

Table 2. Treadmill VO_2max and running economy results

	VO_2max ($mL \cdot kg^{-1} \cdot min^{-1}$)	VO2max ($L \cdot min^{-1}$)	Maximal Heart Rate (bpm)	Maximal Respiratory Exchange Ratio	Running Economy ($mL \cdot kg^{-1} \cdot min^{-1}$)
Mean	58.90	4.75	196	1.24	35.59
SD	4.58	.44	8.08	.05	2.41

Table 3 displays means and standard deviations for the Makoto proactive reaction time and percentage of targets hit during the reactive test. Scores for proactive reaction time ranged from 0.38 to 0.75 s. The percentage of targets hit during the reactive test ranged from 24% to 100%.

Table 3. Eye-Hand reaction time and accuracy results

	Proactive Reaction Time (s)	Reactive Accuracy (% hit)
Mean	0.57	0.61
SD	0.06	0.17

Table 4 displays means and standard deviations for the "anaerobic" and power tests.

Table 4. Battlefield Airman Test (BAT), Wingate tests, and vertical jump results

	BAT distance (m)	BAT Work (J)	Lower Wingate Peak Power (W/kg)	Lower Wingate Peak Power (W/kg)	Upper Wingate Peak Power (W/kg)	Upper Wingate Mean power (W/kg)	Vertical Jump (cm)
Mean	267.02	9.40	11.39	9.27	8.06	6.37	62.26
SD	75.97	2.29	1.65	0.83	1.36	0.79	8.53

Because Wingate norms for elite athletes have not been firmly established, the investigators calculated initial norms for elite athlete upper body absolute and relative peak power (see tables 5 & 6.)

Table 5. Combat Athlete Lower Body Absolute Peak Norms (W)

	STTS Trainees	USAFA Athletes
Elite	1101	1163
Excellent	1044	1127
Above Average	986	1056
Average	929	950
Below Average	872	844
Fair	815	744
Poor	758	739

Table 6. Combat Athlete Lower Body Relative Peak Norms (W/kg)

	STTS Trainees	USAFA Athletes
Elite	13.86	13.74
Excellent	13.11	13.39
Above Average	12.36	12.70
Average	11.61	12.00
Below Average	10.87	11.31
Fair	10.12	10.27
Poor	9.37	9.57

Table 7. Combat Athlete Upper Body Absolute Peak Power Norms (W/Kg)

	STTS Trainees
Elite	816
Excellent	764
Above Average	713
Average	661
Below Average	610
Fair	559
Poor	507

Table 8. Combat Athlete Upper Body Relative Peak Power Norms (W/Kg)

	STTS Trainees
Elite	10.08
Excellent	9.47
Above Average	8.85
Average	8.23
Below Average	7.62
Fair	7.00
Poor	6.39

Table 9 displays calculated norms for CCT trainees for the BAT.

Table 9. BAT Anaerobic Endurance Initial Norms (yards)

	STTS Trainees
Elite	371.19
Excellent	337.83
Above Average	304.47
Average	271.10
Below Average	237.74
Fair	204.38
Poor	171.02

Table 10 displays calculated norms for CCT trainees for the Makoto reaction time tests.

Table 10. Eye-Hand Proactive and Reactive Norms

	Proactive (sec)	Reactive (% correct)
Elite	.44	87%
Excellent	.47	78%
Above Average	.50	70%
Average	.53	61%
Below Average	.56	53%
Fair	.59	44%
Poor	.62	36%

Table 11 displays means and standard deviations for the post-test peak lactate values from the "anaerobic" test.

Table 11. Peak Lactate Values

	Post VO2 max Peak Lactates ($mmol \cdot L^{-1}$)	Post BAT Peak Lactates ($mmol \cdot L^{-1}$)	Post Upper Body Wingate Peak Lactates ($mmol \cdot L^{-1}$)	Post Lower Body Wingate Peak Lactates ($mmol \cdot L^{-1}$)
Mean	12.88	13.60	9.18	10.72
SD	2.88	3.0	3.91	3.21

Table 12 shows the results of mean and standard deviation for the International Personality Item Pool five domains: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience.

Table 12. International Personality Item Pool results

	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness to Experience
Mean	77.79	44.70	78.99	19.82	23.33
SD	18.46	22.16	18.62	15.71	20.92

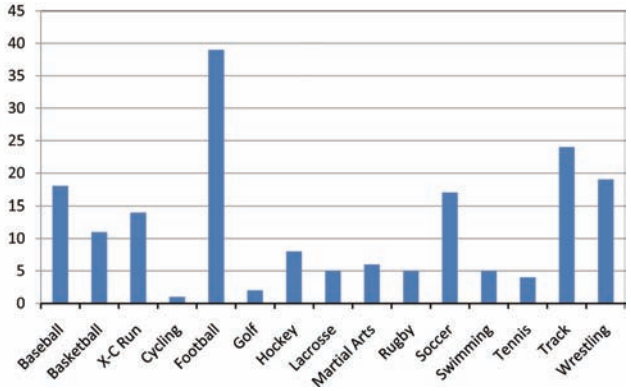
Table 13 shows the results for each of the core components of the Mental Toughness Questionnaire 48 and their overall mental toughness.

Table 13. Mental Toughness Questionnaire 48 results

	Overall Mental Toughness	Challenge	Commitment	Control	Confidence	Average less Overall Mental Toughness
Mean	7.9	7.0	8.0	7.3	7.5	7.3
SD	1.6	1.8	1.6	1.8	1.7	1.3

Of 23 sports listed on the demographics survey, football was the most common competitively played sport in high school, college or with a competitive club, followed by soccer, track and baseball. Figure 1 displays the frequencies for the most commonly played 15 sports.

Figure 1. Frequency distribution of commonly played sports (n = 109)



Discussion

Due to the extreme physical demands of CCT pipeline training, the investigators expected successful CCT students to possess much higher than average measures of physical fitness. Anecdotally, it is well established that only the very fit are able to adapt to the demands of CCT pipeline training. The results of this investigation confirmed that observation, as the performance measures observed compare very favorably to established norms and are even better than those of many athletic/sports and other military populations.

CCT trainees' mean percent body fat was measured at 12.3%. That value lies at approximately the 70th percentile according to normative data described in the American College of Sports Medicine's (ACSM) Guidelines for Exercise Testing and Prescription.[9] That their mean body fat percentage was not lower is likely due to CCT students undergo a large amount of swim training and that they are not strictly endurance athletes who are simply running 10-12 miles per day. The swim training is often performed in relatively cold water. There is evidence that competitive swimmers have higher body fat levels than competitive runners,[10] and that cold water swimming increases appetite and caloric intake which can result in higher body weights and lower body densities.[11] A range of 6-12% body fat is generally considered a good range for most elite athletes and the trainees fall on the high side of this range.

Their mean VO_2max ($58.97\ mL \cdot kg^{-1} \cdot min^{-1}$) places the CCT trainees well above the 90th percentile in the ACSM standards[9] and those of the National Strength and Conditioning Association.[12] That score is approximately $10.0\ mL \cdot kg^{-1} \cdot min^{-1}$ higher than that observed in most other published data of military personnel,[13-15] $5mL \cdot kg^{-1} \cdot min^{-1}$ higher than college football skill players[16] and is roughly comparable to that of university-level soccer players.[17]

Impressive means for VO_2max were generally expected given the amount of endurance training performed in the CCT pipeline. However, the investigators also observed better strength/power capability than one might have expected as evidenced by vertical jump and Wingate test results. CCT students' mean vertical jump measured 62.3 cm, roughly equivalent to that of high school football running backs and

receivers, and recreational college athletes.[12] CCT students also scored quite high on Wingate tests. Mean average power was 9.27W/kg. They averaged a peak power of 11.39W/kg. These results are above the 90th percentiles for males of 8.24 and 10.89W/kg for average and peak power, as established by Maud and Schultz.[18] The CCT trainees compared very well in lower body absolute (W) and relative (W/kg) peak power to cadet athletes (football, lacrosse, baseball, etc.) at the United States Air Force Academy (see tables 5 & 6).

The Battlefield Airman Test (BAT) is a new anaerobic endurance test developed specifically for this population. The initial norms for the population are presented in Table 12. There was a consensus among the trainees and Special Tactics Training Squadron (STTS) instructors during informal feedback sessions that the BAT accurately represented what a CCT will experience in the field. Although CCT physical training has not traditionally included much strength or power training, much of their operational training includes a substantial amount of power movements such as loaded jumping and high-intensity running. The CCT trainee is required to maintain high intensity training over several minutes as they fast rope down to the ground from the helicopter and then move to secure a position. Some CCT instructors have begun to incorporate more strength and power exercise in their physical training programs.

The high level of physical fitness demonstrated by successful CCT trainees was expected. Trainees with poor or moderate levels of physical fitness would likely be unable to adapt to the rapidly increasing physical stresses of CCT pipeline training. Previous research[2] has clearly indicated a strong negative association between fitness and risk of attrition in military training and between fitness and injury during athletic training.[17] Similar associations can be seen for certain psychological characteristics of individuals undergoing difficult training.[3] Successful CCT trainees displayed high levels of several of these characteristics.

The IPIP-NEO found that CCT trainees fall within the highest 30% of population scores for extraversion and conscientiousness. Highly extraverted individuals enjoy being around others, are full of energy, are action-oriented, express positive emotions, and look for opportunities for excitement. Facets of extraversion include friendliness, gregariousness, assertiveness, and excitement-seeking. It stands to reason that this component is high for CCT trainees because they must stay positive even in situations that look bleak. Their successful completion of training and, later, their lives and the lives of their teammates will depend upon it. The benefits of these individuals scoring high in the conscientiousness domain (mean = 78.99) indicate they avoid trouble, achieve success through purposeful planning and persistence, and are seen by others as intelligent and reliable. Facets of conscientiousness are self-efficacy, orderliness, dutifulness, achievement striving, self-discipline, and cautiousness.[19] These qualities are also vital to CCTs as they must excel as both leaders and followers and need high levels of internal motivation. Both extraversion and conscientiousness are critical components to working effectively in the types of small but highly dynamic teams in which the CCTs operate.

The trainees had scores comparable to the lower quartile of U.S. adult males in neuroticism and openness to experience. Facets of neuroticism include anxiety, anger, depression, self-consciousness, immoderation, and vulnerability. Individuals that score low in this area are less easily upset and are less emotionally reactive. Obviously, these traits would be detrimental in CCTs due to their need to stay calm and focused in difficult situations. They tend to be calm, emotionally stable, and free from persistent negative feelings. Openness to experience distinguishes the cognitive style differences of highly creative people from those that are down-to-earth, conventional people. The facets of openness to experience include imagination, artistic interests, emotionality, adventurousness, intellect, and liberalism. Scoring lower in this area, as the trainees did, indicates having narrower, common interests, and preferring the plain, straightforward, and obvious over the complex, ambiguous, and subtle. It appears this trait is common among CCTs because although improvisation is an important skill, generally they must make decisions quickly and as practically as possible. Their training teaches them to keep things simple and easily accomplishable rather than complex and time consuming. Clough et al.[8] found that individuals who tend to be sociable and outgoing; they are able to remain calm and relaxed, are competitive in many situations and have lower anxiety levels than others are also mentally tough.

High levels of extraversion have been associated with high levels of mental toughness.[8] Our results support that association as, in addition to observing high levels of extraversion, we scored CCT trainees' mean mental toughness at 7.9 on a 10-point scale. It is not surprising that trainees had high scores for overall mental toughness. Trainees who lack mental toughness are unlikely to complete the first year of the grueling CCT training pipeline. Individuals with an overall mental toughness score of that level have confidence in their ability to take on and succeed at demanding tasks. They can deal with unforeseen circumstances without undue stress, are unlikely to give up, and see difficult situations as a challenge or opportunity for personal development rather than a threat to their security. In addition, extroverts appear to be in better control of their emotions and can cope with difficult events and stay calm and stable under pressure.[8]

We found an overall mental toughness score of 9 for the mode (26.42%) among trainees. Individuals in this category are able to cope effectively with most of life's challenges, and will use them as a way to enhance their personal development .[8] Occasionally they will take on more challenges than they can handle, but unlike an individual with a score of eight, these individuals are able to complete the task even under difficult conditions, finding different ways to motivate themselves from within. This supports Maddi's[20] research findings that military personnel undergoing hardiness training increase their motivation to execute the transformational coping and effective self-care needed to overcome stressful circumstances. This is strikingly identical to the mindset the CCT training pipeline teaches and reinforces. Successful trainees demonstrate high levels of self-confidence and are self-as-

sured. Their peers see them as high achievers, determined to succeed at a task even when the task is very difficult and others have given up or failed.

A wealth of evidence shows that individuals who possess high levels of mental toughness and/or hardiness are better physical performers. Hardiness is closely related to mental toughness and is defined as a set of personal characteristics that provide the courage and strategies to turn stressful circumstances into opportunities for enhanced performance, leadership, conduct, health, and psychological growth.[21-22] Sheard and Golby[23] found that mental toughness, hardiness, focus, optimism, and self-belief are the crucial psychological characteristics that distinguish elite-level sport performers from their sub-elite counterparts. Other research[4, 24] has indicated that superior mental toughness is highly related to successful sports performance. Moreover, Crust and Clough[25] have demonstrated a significant correlation between mental toughness and physical endurance. Considering these results and the physical and psychological stress of the CCT pipeline, it is unsurprising that most successful CCT trainees possess high levels of mental toughness.

Conclusions

The purpose of this research investigation was to identify the physiological performance, psychological, and demographic characteristics associated with the successful progression through the Combat Controller (CCT) pipeline program. The results of the investigation confirm that CCT trainees who have achieved a 3-level rating possess much higher than average levels of aerobic and anaerobic fitness, power, mental toughness, extraversion and conscientiousness. They possess lower than average levels of neuroticism and openness to experience. We submit that these characteristics can be used to improve future selection and training of CCT trainees. Selecting individuals with traits similar to those found here could profoundly reduce injury and attrition in the early stages of the pipeline. Similarly, designing training to move CCT candidates towards these means could potentially reduce attrition and result in 3-level CCTs who are better prepared to advance in their training.

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ACKNOWLEDGMENTS

The authors wish to thank Major Chris Larkin, Mr. Bill Lyons and Mr. Vint Anderson, Combat Athlete Cell, Special Tactics Training Squadron, Hurlburt Field, Florida for providing access to the trainees, assistance with data collection and all-around support for this project.

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Abstracts from Current Literature

Air Medical Evacuations of Soldiers for Oral-Facial Disease and Injuries, 2005, Operations Enduring Freedom/Iraqi Freedom

Mitchener, Timothy A.; Hauret, Keith G.
Military Medicine, Volume 174, Number 4, April 2009, pp. 376-381(6)

Abstract

This retrospective study was conducted to assess the nature and causes of serious oral-facial illnesses and injuries among U.S. Army personnel deployed to Iraq and Afghanistan in 2005. Information for this study came from the U.S. Air Force Transportation Regulating and Command and Control Evacuation System (TRAC2ES) database for medical evacuations (MEDEVACS) for 2005. The study found 171 oral-facial MEDEVACS out of Iraq (cumulative incidence: 13.3/10,000 Soldiers per year) and 35 out of Afghanistan (cumulative incidence: 21.6/10,000 Soldiers per year), a total of 206 MEDEVACS. Fifty-three percent (n = 109) of oral-facial MEDEVACS were for battle injuries caused by acts of war. Thirty-one percent of all oral-facial MEDEVACS (n = 64) were for diseases of the oral cavity, salivary glands, and jaw. Sixteen percent (n = 33) of oral-facial MEDEVACS were for nonbattle injuries, primarily fractures of the face bones, for the most part because of motor vehicle accidents.

Long-Term Consequences of Kidney Donation

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The New England Journal of Medicine Volume 359: 2545-2557 January 29, 2009 Number 5

Abstract

Background: The long-term renal consequences of kidney donation by a living donor are attracting increased appropriate interest. The overall evidence suggests that living kidney donors have survival similar to that of nondonors and that their risk of end-stage renal disease (ESRD) is not increased. Previous studies have included relatively small numbers of donors and a brief follow-up period. **Methods:** We ascertained the vital status and lifetime risk of ESRD in 3698 kidney donors who donated kidneys during the period from 1963 through 2007; from 2003 through 2007, we also measured the glomerular filtration rate (GFR) and urinary albumin excretion and assessed the prevalence of hypertension, general health status, and quality of life in 255 donors. **Results:** The survival of kidney donors was similar to that of controls who were matched for age, sex, and race or ethnic group. ESRD developed in 11 donors, a rate of 180 cases per million persons per year, as compared with a rate of 268 per million per year in the general population. At a mean (±SD) of 12.2±9.2 years after donation, 85.5% of the subgroup of 255 donors had a GFR of 60 ml per minute per 1.73 m2 of body-surface area or higher, 32.1% had hypertension, and 12.7% had albuminuria. Older age and higher body-mass index, but not a longer time since donation, were associated with both a GFR that was lower than 60 ml per minute per 1.73 m2 and hypertension. A longer time since donation, however, was independently associated with albuminuria. Most donors had quality-of-life scores that were better than population norms, and the prevalence of coexisting conditions was similar to that among controls from the National Health and Nutrition Examination Survey (NHANES) who were matched for age, sex, race or ethnic group, and body-mass index. **Conclusions:** Survival and the risk of ESRD in carefully screened kidney donors appear to be similar to those in the general population. Most donors who were studied had a preserved GFR, normal albumin excretion, and an excellent quality of life.

Major Depressive Disorder in Military Aviators: A Retrospective Study of Prevalence

Lollis BD; Marsh RW; Sowin TW; Thompson WT
Aviat Space Environ Med 2009; 80:734-7.

Abstract

Introduction: The occurrence of major depressive disorder (MDD) among military pilots and navigators poses questions with respect to medical care and waiver policy, but the prevalence of such disorders is unclear. We studied the epidemiology of MDD in a USAF aircrew population. **Methods:** The occurrence of MDD was determined for the period 2001-2006

using the USAF Aeromedical Information Management Waiver Tracking System, which records medical disqualifications and waivers for the entire population of both qualified and disqualified (grounded) USAF aviators. **Results:** The mean annual population of USAF pilots and navigators averaged 17,781 during the study period. The database yielded 51 cases of MDD, of which 8 were recurrent and 43 were single episodes. All of the recurrent cases were disqualified, while 18 of the single-episode cases (42%) received a flying waiver after being asymptomatic without medications for at least six mo. Estimated annual MDD prevalence was 0.06% for the study population. In comparison, the annual prevalence of MDD is 6.7% in the general U.S. population, 2.8% among groups of executives and 4.1% among professionals. Odds ratios were 128 (68,238), 51 (27,96), and 76 (41,142) for the general population, executives, and professionals, respectively. **Discussion:** Annual MDD prevalence among USAF pilots and navigators was significantly lower than that of the general U.S. population. The difference may reflect lower aircrew vulnerability to depression because of selection and training processes or lower rates of self-report and treatment due to feared aeromedical and/or career consequences.

A Pilot Study Evaluating Surfactant on Eustachian Tube Function in Divers

Duplessis, Christopher; Fothergill, David; Gertner, Jeff; Hughes, Linda; Schwaller, Derek
Military Medicine, Volume 173, Number 12, December 2008, pp. 1225-1232(8)

Abstract

Background: Middle ear barotrauma (MEBT) is the most common medical complication in diving, aviation, and hyperbaric medicine. Eustachian tube dysfunction (ETD) quantifies the inability to open the eustachian tube (ET), risking MEBT. Surfactant administration improved ET function and efficaciously treated otitis media in a host of animal models. We performed a pilot study evaluating the efficacy of intranasal surfactant administration in reducing MEBT in repetitive diving. **Methods:** Eight divers participated in a subject-blinded, placebo-controlled, random order, multiarm (air and O2)-repeated measures trial investigating the relative efficacy of intranasally administered surfactant, acetylcysteine and oxymetazoline, and orally administered pseudoephedrine versus saline-placebo in middle ear equilibration during repetitive, multiday diving. S ubjects were tested with the Nine-Step Inflation/Deflation Tympanometry Test (NSI/DT) and sonotubometry (testing eustachian tube opening pressure [ETOP]) before and immediately after each dive. **Results:** Significant interaction effects were found for drug-by-test ($F_{8,668} = 4.05$; $p < 0.001$) and the three-way interaction of drug-by-dive-by-test ($F_{16, 668} = 2.47$; $p = 0.001$) in sonotubometry testing. The ETOP revealed trends toward lowered (improved) values post- versus predive in all treatment arms, which was significant for oxymetazoline ($p = 0.04$). Only four of the eight subjects experienced any holds during diving. Statistical analysis of the NSI/DT data showed that none of the drug interventions resulted in improvements in ET function over that expected by chance. **Conclusions:** There is large intra- and intersubject variability in daily functioning of the ET as measured using the NSI/DT and sonotubomtery (ETOP). Sonotubometry engendered trends toward lowered (improved) values post- versus predive in all treatment arms. The repetitive dives did not result in a significant decrease in ET function as evidenced in the saline-placebo trials, circumventing an ability to detect superiority among the various treatment arms in our subject population. Additionally, since our study was underpowered to detect significant effects, we can only assert that various inhalational agents may improve middle ear ventilation in repetitive diving warranting further study. A larger subject population including subjects diagnosed with ET dysfunction may provide more statistical power to discern the benefit of inhaled agents as a useful prophylactic for preventing or reducing ET dysfunction during diving and/or hyperbaric/hypobaric pressure changes.

An Exploratory Study of Neuroimaging, Neurologic, and Neuropsychological Findings in Veterans with Traumatic Brain Injury and/or Posttraumatic Stress Disorder

Brenner, Lisa A.; Ladley-O'Brien, Susan E.; Harwood, Jeri E. F.; Filley, Christopher M.; Kelly, James P.; Homaifar, Beeta Y.; Adler, Lawrence E.
Military Medicine, Volume 174, Number 4, April 2009, pp. 347-352(6)

Abstract

Seventy-two veterans with traumatic brain injury (TBI), posttraumatic stress disorder (PTSD), or both participated in assessment procedures to evaluate between group differences. Half the sample was randomly selected for magnetic resonance imaging (MRI). Neurologic examinations were conducted using the Neurologic Rating Scale (NRS). Neuropsychological measures included the Paced Auditory Serial Addition Test (PASAT), Rey Auditory Verbal Learning Test (RAVLT), Conners' Continuous Performance Test II (CPT II), and Halstead Impairment Index (HII) including the Booklet Category Test (BCT). Data were analyzed using linear regression. Participants with moderate/severe TBI were significantly more likely to have trauma-related imaging findings, and more severe TBI predicted lower scores on the NRS. No significant between-group dif-

ferences were identified on the HII, PASAT, RAVLT, or CPT II. TBI group performance was significantly better on the BCT. More severe TBI predicted abnormal imaging findings and lower NRS scores. Hypothesized between-group differences on neuropsychological measures were not supported.

Managing Aviator Fatigue in a Deployed Environment: The Relationship Between Fatigue and Neurocognitive Functioning

Rabinowitz, Yaron G.; Breitbach, Jill E.; Warner, Christopher H.
Military Medicine, Volume 174, Number 4, April 2009, pp. 358-362(5)

Abstract

The current military battlefield requires aviators to make split-second decisions that often have life-and-death consequences, making identifying predictors of diminished cognitive performance a vital aeromedical and safety concern. The current study explored the relationship between aviator effectiveness, as determined by sleep-wake patterns, and neurocognitive functioning in a brigade-size rotary wing aviation element deployed in Iraq. Actigraphy and the Fatigue Avoidance Scheduling Tool (FAST) were used to assess the ratio of sleep-wake patterns over a 24-hour time period, and a computerized multitasking measure, which mimics the task demands of flying, was utilized to evaluate neurocognitive functioning during preflight operations. Results showed a significant positive association between level of effectiveness and neurocognitive functioning before flight operations. The reported sleep habits and trends in types of sleep difficulties are noted. The results speak to the potential efficacy of using actigraphy and software to evaluate a pilot's effectiveness before flight operations, and suggest that flight surgeons and psychologists may be able to play a vital role in improving overall sleep patterns and enhancing the warfighting efforts of aviators in combat. They also suggest that mandated crew rest and evaluation of total reported sleep time may not be sufficient to ensure optimum performance levels.

FIA Score: A Simple Risk Index for Predicting Fatality in Aviation Crashes

Li, Guohua MD, DrPH; Gebrekristos, Hirut T. MPH; Baker, Susan P. MPH, ScD (Hon)
Journal of Trauma-Injury Infection & Critical Care. 65(6):1278-1283, December 2008.

Abstract

Background: Previous studies have identified a variety of risk factors for occupant fatality in aviation crashes. A simple composite index measuring the risk of fatality in a given crash, however, is lacking. **Methods:** The FIA Score is a four-point (0-3) index based on the number of three risk factors for occupant fatality present in a given aviation crash: fire, instrument meteorological condition, and being away from airport. We assessed the validity of this risk index using aviation crash investigation data from the National Transportation Safety Board for the years 1983 to 2005. Sensitivity, specificity, and area under the receiver operating characteristic curve according to the type of flight operations were computed. The analysis was first limited to pilot-in-command fatality and then replicated to any fatality. **Results:** The study sample consisted of 44, 828 aviation crashes, in which 7,889 (18%) pilots-in-command were fatally injured. The pilot crash fatality rate was 3%, 18%, 62%, and 89% for FIA Scores of 0 (none of the 3 risk factors present), 1, 2, and 3 (all 3 risk factors present), respectively. The FIA Score performed consistently well in predicting pilot fatality in crashes involving different types of flight operations. The area under receiver operating characteristic curve was 0.86 (95% confidence interval [CI]: 0.78-0.95) for major airline crashes, 0.83 (95% CI: 0.80-0.85) for commuter and air taxi crashes, and 0.81 (95% CI: 0.81-0.82) for general aviation crashes. The results were similar when the outcome was measured by whether or not the crash resulted in any fatality. **Conclusions:** The FIA Score appears to be a valid tool for measuring fatality risk in aviation crashes. Given its simplicity, the FIA risk index should be readily applicable to trauma research and prevention.

The Coagulopathy of Trauma: A Review of Mechanisms

Hess, John R. MD, MPH, FACP, FAAAS; Brohi, Karim MD; Dutton, Richard P. MD, MBA; Hauser, Carl J. MD, FACS, FCCM; Holcomb, John B. MD, FACS; Kluger, Yoram MD; Mackway-Jones, Kevin MD, FRCP, FRCS, FCEM; Parr, Michael J. MB, BS, FRCP, FRCA, FANZCA, FJFICM; Rizoli, Sandro B. MD, PhD, FRCSC; Yukioka, Tetsuo MD; Hoyt, David B. MD, FACS; Bouillon, Bertil MD
Journal of Trauma-Injury Infection & Critical Care. 65(4):748-754, October 2008.

Abstract

Background: Bleeding is the most frequent cause of preventable death after severe injury. Coagulopathy associated with severe injury complicates the control of bleeding and is associated with increased morbidity and mortality in trauma

patients. The causes and mechanisms are multiple and yet to be clearly defined. **Methods:** Articles addressing the causes and consequences of trauma-associated coagulopathy were identified and reviewed. Clinical situations in which the various mechanistic causes are important were sought along with quantitative estimates of their importance. **Results:** Coagulopathy associated with traumatic injury is the result of multiple independent but interacting mechanisms. Early coagulopathy is driven by shock and requires thrombin generation from tissue injury as an initiator. Initiation of coagulation occurs with activation of anticoagulant and fibrinolytic pathways. This Acute Coagulopathy of Trauma-Shock is altered by subsequent events and medical therapies, in particular acidemia, hypothermia, and dilution. There is significant interplay between all mechanisms. **Conclusions:** There is limited understanding of the mechanisms by which tissue trauma, shock, and inflammation initiate trauma coagulopathy. Acute Coagulopathy of Trauma-Shock should be considered distinct from disseminated intravascular coagulation as described in other conditions. Rapid diagnosis and directed interventions are important areas for future research.

Artesunate for the Treatment of Severe Falciparum Malaria

Philip J. Rosenthal, MD
The New England Journal of Medicine. Volume 358:1829-1836 April 24, 2008 Number 17

EXCERPT

This Journal feature begins with a case vignette that includes a therapeutic recommendation. A discussion of the clinical problem and the mechanism of benefit of this form of therapy follows. Major clinical studies, the clinical use of this therapy, and potential adverse effects are reviewed. Relevant formal guidelines, if they exist, are presented. The article ends with the author's clinical recommendations.

A previously well, American-born 35-year-old man presents with a five-day history of fever and progressive dyspnea and a two-day history of jaundice. An evaluation three days before his presentation led to a diagnosis of a viral syndrome. The patient . . .

Monovalent Type 1 Oral Poliovirus Vaccine in Newborns

Nasr El-Sayed, MD, MPH; Yehia El-Gamal, MD, PhD; Ahmed-Amr Abbassy, MD, PhD; Iman Seoud, MD, PhD; Maha Salama, MD; Amr Kandeel, MD, MPH; Elham Hossny, MD, PhD; Ahmed Shawky, MD; Heba Abou Hussein, MD, PhD; Mark A. Pallansch, PhD; Harrie GAM van der Avoort, PhD; Anthony H. Burton, BS; Meghana Sreevatsava, MPH; Pradeep Malankar, MD; Mohamed H. Wahdan, MD, PhD; and Roland W. Sutter, MD, MPHTM
The New England Journal of Medicine. Volume 359:1655-1665 October 16, 2008 Number 16

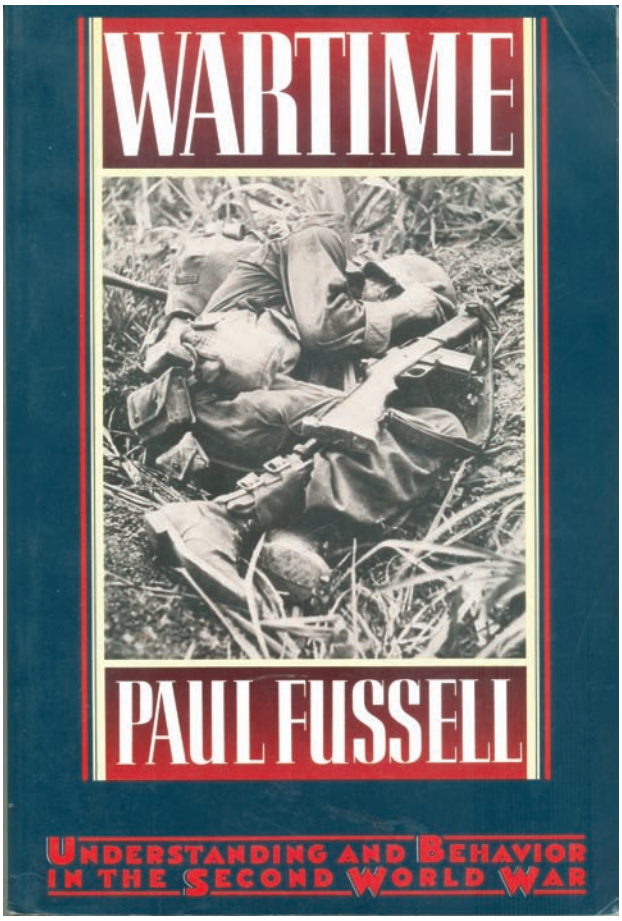
ABSTRACT

Background: In 1988, the World Health Assembly resolved to eradicate poliomyelitis. Although substantial progress toward this goal has been made, eradication remains elusive. In 2004, the World Health Organization called for the development of a potentially more immunogenic monovalent type 1 oral poliovirus vaccine. **Methods:** We conducted a trial in Egypt to compare the immunogenicity of a newly licensed monovalent type 1 oral poliovirus vaccine with that of a trivalent oral poliovirus vaccine. Subjects were randomly assigned to receive one dose of monovalent type 1 oral poliovirus vaccine or trivalent oral poliovirus vaccine at birth. Thirty days after birth, a single challenge dose of monovalent type 1 oral poliovirus vaccine was administered in all subjects. Shedding of serotype 1 poliovirus was assessed through day 60. **Results:** A total of 530 subjects were enrolled, and 421 fulfilled the study requirements. Thirty days after the study vaccines were administered, the rate of seroconversion to type 1 poliovirus was 55.4% in the monovalent-vaccine group, as compared with 32.1% in the trivalent-vaccine group ($P<0.001$). Among those with a high reciprocal titer of maternally derived antibodies against type 1 poliovirus (>64), 46.0% of the subjects in the monovalent-vaccine group underwent seroconversion, as compared with 21.3% in the trivalent-vaccine group ($P<0.001$). Seven days after administration of the challenge dose of monovalent type 1 vaccine, a significantly lower proportion of subjects in the monovalent-vaccine group than in the trivalent-vaccine group excreted type 1 poliovirus (25.9% vs. 41.5%, $P=0.001$). None of the serious adverse events reported were attributed to the trial interventions. **Conclusions:** When given at birth, monovalent type 1 oral poliovirus vaccine is superior to trivalent oral poliovirus vaccine in inducing humoral antibodies against type 1 poliovirus, overcoming high preexisting levels of maternally derived antibodies, and increasing the resistance to excretion of type 1 poliovirus after administration of a challenge dose.

Book Review

Wartime: Understanding and Behavior in the Second World War

By Paul Fussell. New York, New York: Oxford University Press. 1990. ISBN 0-19-506577-8.
Review by LTC Craig A. Myatt



What Paul Fussell describes about war in his text *Wartime: Understanding and Behavior in the Second World War* is relevant to any reader in the Special Operations Forces community interested in the diversity of national, institutional, cultural, and social messages used by modern nation states to justify warfare. Written in 1989 after the Vietnam era, Fussell's book focuses on understanding war and wartime behaviors during World War II (WWII). Though he references other wars fought by the United States of America, such as World War I, the Korean War, and the Vietnam War, Fussell concentrates on the behavioral absurdities unique to war in the setting of WWII. The author makes no apologies for war. He understands its economic utility. Fussell looks at war from an interconnected global, national, strategic, operational, and tactical perspective while imploring his reader to recognize the awful human toll of modern warfare.

Fussell's discussion on wartime attitudes, beliefs, and commitments starts with a prediction made in 1940 by Colonel William Donovan, first Director of the American Office of Strategic Services, in a pamphlet titled *Should Men of 50 Fight Our Wars?* Fussell indicates that Donovan shared a vision in 1940, months before Pearl Harbor, and years ahead of Bataan, Guadalcanal, Saipan, Iwo Jima, Okinawa, Cassino, and Normandy that older men "riding to war on wheels" (instead of marching to war) could easily fight the pending war and thereby spare the young. Pre-WWII attitudes as expressed by leaders such as Donovan reflected global social concerns regarding an anticipated need for young men to fight a pending war.

For young and old fighting in WWII, Fussell demonstrates that pre-war social attitudes, though easily misaligned as a consequence of unrealistic expectations prior to war, shape the beliefs and commitments of nations on the brink of waging war. Fussell creatively depicts how the formulation of beliefs in the civilian and military populations easily diverges from pre-war attitudes and aligns with the expressed beliefs of national executive leadership. He cites the role of United States (U.S.) President Franklin Roosevelt as an example.

Before U.S. forces entered WWII, Roosevelt capitalized on the modest values of a nation recovering from economic depression. He avoided pre-war hype. Following the attack of Japanese forces against U.S. forces at Pearl Harbor, he strategically shaped national beliefs in support of war. Roosevelt garnered and sustained resolve for war from attributes that characterized the nation's ability to rise above the constraints of economic depression.

Senior U.S. military leadership operationally synchronized the thematic scope of their messages with those of President Roosevelt. The messaging content may have differed (especially those messages tainted with racism), but not the themes. Fussell describes how the synchronized executive messaging from U.S. leadership resonated across the Services and

throughout the ranks. The effective thematic messaging normalized a wave of beliefs required to draw necessary commitment from the average soldier, sailor, marine, and airman to keep fighting in a war they quickly learned to hate.

In developing an understanding of war for the reader, Fussell describes how easily exhaustion from war arises even in healthy, strong, and committed fighting forces. He states, "War quickly exhausts men until they reach a point where they want not return." The relevance of Fussell's depiction reinforces for contemporary readers the notion that wartime behaviors of tactically trained forces in today's military are not much different than those seen in the fighting forces of previous wars. Fussell's work also is a reminder that despite the best of national executive leadership communication, U.S. Service members (along with their Allied counterparts) fought somewhat insulated from larger realities as they drank alcohol excessively, experienced intense boredom between battles, and confronted an absurdity of mixed social optimism and euphemism in those unfamiliar with the wartime experience. The fog of war, by Fussell's accounts, becomes filled with rumors, blundering mistakes, foul language, and despair coupled with a myriad of other less acerbic messages conveyed in song, on the radio, and in literature and cinema.

The focal point of understanding presented by the author offers contemporary readers insight into wartime behaviors in civilians and deployed military personnel. Fussell suggests that during war, for better or worse, a nation and its fighting force are shaped politically, socially, and culturally by national leaders. The messaging from U.S. national leadership that lent purpose to the wartime effort did not always correlate directly with the behaviors exuded in WWII era U.S. forces. Nevertheless, Fussell shows how dramatically the impact of synchronized executive-level communication influences a commitment for successful national outcomes in wartime.

Fussell makes comparisons between Roosevelt and Nazi Germany's Adolf Hitler that show how tenuous national leadership influence can be. Roosevelt's death in April 1945 signaled to Hitler, if only for a fleeting period of days, that fate would make Germany the victor. According to Fussell, Hitler viewed Roosevelt's death as a positive sign, a miracle, similar to the positive omen Frederick the Great of Prussia experienced when Germany's historical predecessor and hero (allied with the British) defeated, Austria, France, and Russia in the Seven Years War following the unexpected death of Russia's Czarina Elizabeth in 1762. Fussell's comments imply that the level of commitment shaped by Roosevelt in wartime did not dissipate upon his death.

Roosevelt's death did not shatter American commitment, resolve, or resilience. The responsiveness of committed belief shared by Roosevelt outlasted his existence. In the end President Harry Truman and General Dwight Eisenhower sustained the nation's commitment to win the war. The behaviors and understanding of war formulated by Roosevelt's dynamic and timely executive leadership communication applications lifted even the most disillusioned civilians and anguished American fighting forces, young and old, beyond the awful human toll of modern warfare to the desired national outcome of victory.

From the Command Surgeon

Virgil “Tom” Deal, MD
COL, USA
Command Surgeon
HQ USSOCOM

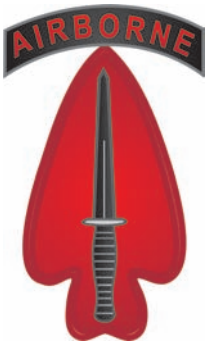
Greetings to all and to the New Year. It was great to see 1,600 (a new record) of you all at the SOMA conference last month. The Association did a terrific job of pulling together a superb selection of topics, speakers and exhibits that facilitated an excellent exchange of information, observations and lessons learned.

One set of “best practices” I picked up from CAPT (Sel) Penny, LT Viayra and LCDR Conza’s had to do with health and performance assessment and documentation, which, also fits in nicely with the CJCS Guidelines for 2011. The Guidelines assign a very high priority to improving the health of the force and restoring readiness. The recent guidance on blast exposure also mandates that blast exposure must be annotated in the permanent medical record. This medical team routinely reviews the medical record of all personnel several months before their anticipated departure to ensure that all health issues have been addressed and adequately documented. Getting health data into the permanent record from injuries, illnesses, and exposures while deployed, particularly on some of our missions is a long standing challenge for SOF. I recommend all of us consider a new gold standard: a unit level review of every medical record after deployment and prior to your servicemember’s departure from your unit. Hopefully several R& D efforts are going to very soon produce some helmet-mounted blast ‘dosimeters’ that can be read in real time. The recent news about blood biomarkers for TBI also holds a lot of promise.

This NSW team is at least at the head of the pack in documenting a good base of Human Performance metrics and a solid neurocognitive baseline at arrival and with appropriate follow-ups. I know that all of our units are getting these practices and data into our concept and documentation of the life cycle management of the human weapon systems platform (if you’ll pardon my sounding like a GM mechanic), but this brief allowed a good overview of a well integrated program. Kudos to NSW! Just one example last month of great SOF Medics providing great care in USSOCOM.

Best Wishes to all for the year ahead

USASOC



Peter J. Benson, MD
COL, USA
Command Surgeon

The ARSOF Medics' Conference, which preceded the SOMA Conference, was a great benefit for the Deputy Chief of Staff Surgeon, and surgeon office staff to interface with a great group of Special Operations Providers. Formerly, the USASOC Surgeon's Conference, the meeting was renamed to give a better venue to discuss issues that are important to and impact the end-user in this business – the Special Forces Medic, the Special Operations Combat Medic and the Civil Affairs Medical Sergeant. It was felt that there was not an adequate chance/ability for the ARSOF medic community to meet in a professional forum to exchange information, experiences, techniques and equipment ideas. The Forum also provided an opportunity to give information on career issues and receive feedback.

This seems to be the only meeting where the NCO medical leadership of ARSOF Medicine comes together – and that needs to change. The presentations and hands-on practicum sessions were geared to provide useful learning experience to those attending. Unfortunately, not as much of the program was devoted to the ARSOF professional providers and commissioned corps medical leadership. In the future, the agenda will continue to be refined so there may be a two-tracked schedule to address the interests and needs of all participants.

The Special Operations Medicine Association (SOMA) Conference, in Tampa, was again a great opportunity to confer with so many of USASOC's medical personnel. I appreciate all who took the time and effort to make the conference worthwhile. The SOMA continues to grow with an increasing number of international attendees, including our international coalition partners and allies who gave some excellent presentations and led significant discussions. The medical commonality that is being achieved through NATO, ISAF and other partnerships is globally beneficial to SOF as a whole. The drive to achieve a common medical practice standard for SOF medics and a SOF-capable, light Role-2 surgical element is the ultimate medical "high ground". I continue to encourage all ARSOF providers to share their expertise and knowledge with our international partners and SOMA members. Increasing SOMA's global identity is good for the organization and for SOF medicine.

Keep doing what you do – you're the best in the World.
Sine Pari

COMPONENT SURGEON

AFSOC

Timothy D. Robinette, MD, CFS
Col, USAF
Command Surgeon

The fact that the last two consecutive editions of JSOM centered on preventive medicine highlights two interesting points. First, preventive medicine in Special Operations is more significant than ever especially regarding global engagement. Second, the special operations medical community has an impressive depth and an abundant wealth of preventive medicine expertise and experience.

The primary focus of this aptitude will rightfully remain keeping our troops healthy and in the fight. But the emerging strategic role of stability operations in our ongoing conflict against transnational terrorism, and the insurgencies that harbor them, gives us an opportunity to use our preventive medicine assets in new ways. The most critical vulnerability of any insurgency is the level of support it has among the local population. Special Operations preventive medicine can exploit this vulnerability while gaining the trust of the indigenous peoples.

Department of Defense policy directs all service branches to develop robust capabilities to execute stability operations (DoDI 3000.05, *Stability Operations*). More specifically, DoDI 6000.16, *Military Health Support for Stability Operations*, makes clear that we prepare for Medical Stability Operations (MSOs) as well. The goal of MSOs is to establish or reconstitute healthcare capabilities for the populations of failed or failing states when indigenous, foreign, or U.S. civilian professionals cannot do so. To meet this challenge, AFSOC established the Irregular Warfare/Medical Stability Operations (IW/MSO) division within the Command Surgeon directorate. IW/MSO personnel are tasked to organize, plan, coordinate and de-conflict joint and combined irregular warfare and medical stability operations. By leveraging our existing proficiencies across a broad spectrum of professional disciplines, we formed deployable teams that can respond to requests for IW and MSO support from all Theater Special Operations Commands.

We work through the Geographic Combatant Commanders and Theater Special Operations Commands supporting theater engagement plans and objectives. Our intent is to augment existing programs of U.S. government or non-governmental organizations. Through joint and combined missions and exercises we can gain access to indigenous populations and host nation medical professionals that serve them in locales that are generally inaccessible to other organizations due to the high security risks or their austere locations.

While we can employ a broad array of scalable and rugged teams that may be tailored for specific mission profiles, the philosophy of preventive medicine must remain at the core of MSOs. Medical and Dental Civic Action Programs (MED/DENTCAPs) have long been used by the U.S. military to gain access to local populations, but their focus was seldom on building host nation healthcare capacity. MSOs, on the other hand, are Special Operations Force (SOF) partnerships and mentoring efforts. By working with our host nation military SOF teams we can provide the local medical professionals the expertise to raise the baseline community preventive health and improve the fundamental healthcare needs of the population they serve.

Never before has military preventive medicine been more dynamic or as crucial as it is now. MSO preventive medicine is AFSOC's most recent innovation to support the Department of Defense in theater engagement. I give thanks to all the SOF preventive medicine personnel, medics and their families for their work and sacrifice. Their innovation is critical to the security of our great nation.

COMPONENT SURGEON

NAVSPECWARCOM

Gary Gluck, MD
CAPT, USN
Command Surgeon

Greetings Friends and Colleagues,

2010 has come to a close and we're planning for the many challenges in the coming year. We have plenty to accomplish in 2011, but I think I'll hold off on delving into future plans, and spend some time reflecting on the many accomplishments and challenges of Naval Special Warfare (NSW) Medicine over the past year.

The Tactical Athlete Program (TAP) made impressive gains in 2010. We have nearly completed hiring of our civilian human performance and sports medicine experts to reach Initial Operational Capability (IOC) for the program. We also welcomed aboard an impressive cadre of Navy Physical Therapists to our ranks. We're fortunate to have recruited some of the finest professionals Navy Medicine and the civilian athletics community has to offer. I'm confident that our operators are receiving the highest level of human performance training and sports medicine care to minimize their injuries, maximize their performance and combat readiness, and enhance their career longevity and quality of life following their service to our country. The ultimate indication of success will be when the Orthopedics Major Joint Surgeons at Balboa and Portsmouth start complaining about not having enough surgical cases!

An additional accomplishment of the TAP includes a very successful operating budget acquisition for the Program Objective Memorandum for Fiscal Years 2012 – 2016 (POM 12-16). Thanks to expert input and excellent support all the way up the chain, the TAP program now has a good compliment of personnel AND a future operating budget!

Next up is submission of the Full Operational Capability (FOC) requirements for additional TAP personnel based on the U.S. Special Operations Command (USSOCOM) approved manning ratios for the program. Thanks again to SOCM Mercer at USSOCOM and many of our organic program staff members for leading this program from the grass roots-level to a USSOCOM Program of Record!

Following the U.S. Army Special Operations Command's lead, we are initiating use of the ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) tool to detect mild traumatic brain injury (mTBI). We've secured our contract and begun training our providers to administer and interpret the test. Though we're still developing our "clinical practice guidelines," we intend to field this capability as soon as possible. The intent is to give our Special Operations Medics and Independent Duty Corpsmen at the forward operating bases another tool to help detect mTBI. This isn't a stand-alone assessment tool. It's always used in conjunction with the Office of the Secretary of Defense's mandated "Directive Type Memorandum" on the detection and treatment of TBI. That means all suspected mTBI patients will have a full clinical assessment to include a neurologic exam and Military Acute Concussion Evaluation (MACE) test and follow on ImPACT testing. All of this data will be provided to the responsible credentialed provider to interpret and decide on the proper disposition of the service member. To our NSW providers; get your ImPACT training as soon as possible so you can administer this test anywhere the internet is available and receive immediate feedback to help detect and monitor recovery from mTBI.

Finally, we're concentrating our efforts to firmly establish our Combat Operational Stress Control (COSC) Pro-

grams. Throughout 2010, we spread the most successful COSC Programs across the Force, and we continue to work on improving these programs. The USSOCOM Special Operations Forces Resiliency Enterprise Program (SOFREP) is now a Program of Record and the SOFREP staff has paired-up with the Naval Health Research Center to hire a Biostatistician. We hope to apply this Biostatistician's skills toward deeper analyses of our Family Resiliency Enterprise (FRE) assessments, which are completed by our service members and their families. We're optimistic we can take our COSC Programs to the next level, and in doing so, continue to lead USSOCOM in building resiliency, mitigating stress, while identifying and treating stress injuries.

By the time this article is published, we will have completed our annual NSW Medical Conference in Tampa, FL, in association with the Special Operations Medical Association Conference. We've gone to great lengths to make our conference a beneficial educational experience, while we also roll-out several new programs. This year at our conference, two experts will present on sleep disorders and discuss how NSW deployers can optimize sleep patterns to maximize rejuvenating rest, which is a pervasive problem across NSW and SOF. Additionally, we will receive an update on dietary supplements, and other hot topics related to our "tactical athletes." We're also spending time updating our deployable medical supplies ("AMALs" for the Navy readers), which is of significant interest to our deploying medical experts. We're always looking for interested personnel who want to join important working groups such as the "NSW Medical After Action Report Working Group," rolling out at our conference. Please contact my office if you want more information or would like to contribute.

Until next time, always remember, we're only a phone call away. We always appreciate hearing the issues facing our operators and combat support personnel on the "pointy edge". To our NSW medical personnel; don't forget to submit after action reports through the chain of command after every deployment. We look forward to making continued strides in developing NSW Medicine in 2011. Thank you for all you do and keep up the great work!

Special Forces Surgeon

USASFC

LTC Andrew Landers, MD
COL, USA
Command Surgeon

Spring greetings from Ft. Bragg, NC. As we transition out of the wonder winterland of snow and ice that has graced our presence at Ft. Bragg, I pause to thank everyone who participated or presented at the SOMA Conference this past December. The event continues to grow and flourish with outstanding topics and speakers. I am constantly amazed at the professionalism and selfless service that our SOF Warriors continue to display on daily basis. The ARSOF Medic Conference continued to grow in its second year and participation was greater than expected. I appreciate everyone's feedback and hope that if you have suggestions for next year's conference, please do not hesitate to let us know. The purpose of the conference is to give you up to date medical information as well as hands on instruction. I want to thank all of the instructors who volunteered their time to make the conference a success.

As we enter 2011, our roles in global security, counter terrorism, and COIN continue to grow. We must not let ourselves become complacent. We need to constantly challenge ourselves to think of better ways to do business. We need to remain medically up to date and not get "locked in" to the status quo, or a mindset of "I have been there, so I know what to do".

Continue to emphasis the importance of your predeployment site survey (PDSS) and pre-mission training (PMT). If able, take your PDSS prior to PMT so that you can incorporate any changes found into your training. Look at your medical footprint and make sure that you have all the assets needed for your mission set, and if not, pass your needs along to your Battalion, Group, and then Senior Command level (it never hurts to ask). Make sure that you have a system in place to document lessons learned; this is the only way to make sure that we correct changes in equipment, training, and SOP's. If your Battalion or Group has not been able to schedule ultrasound training, make sure to contact CPT Bill Vasios at USASFC(A) to set it up.

Lastly, I want to thank you again for your outstanding service and dedication to the United States of America. Remember to stay current and never accept the minimums.

Look after yourself and your team members; the best aid is self and buddy aid, and it starts with you. We cannot turn a blind eye to the increasing Behavioral Health issues, so be alert and be willing to ask for and accept help. There is no stigma for reaching out, only for failing to do so.

De Oppresso Liber!

USSOCOM Psychology

LTC Craig A. Myatt, PhD
HQ USSOCOM Psychologist

Commentary on Information Requirements and Rapid Response Planning

How many Commander's Critical Information Requirements (CCIRs) in your unit require reporting on adverse behavioral events such as suicide, domestic violence, DUIs (driving under the influence of alcohol or abused substances), etc? A recent informal and unpublished review in the Command Surgeon's Office of different unit CCIRs showed the average is two. Regardless of whether a particular unit has one or two CCIRs that require reporting on adverse behavioral events, the principal concern is that most team leaders and unit commanders want to know when an adverse behavioral event has occurred. They also want to know how the sum total of adverse behavioral events impacts their units' ability to meet mission requirements. Therefore, CCIRs reflect what they want to know to sustain mission capability. Other mechanisms available to the SOF community that assist leaders in estimating how the sum total of adverse behavioral events affects their units are: (1) the recently formed Pressure on the Force Tiger Team Focus Groups and (2) the incorporation of human factors analysis in deliberate planning. The deliberate planning process (e.g., Rapid Response Planning Process, R2P2) is an enabling capability that allows units to remain responsive versus reactive in addressing "Pressure on the Force".

The strategic applications of USSOCOM used to address "Pressure on the Force" are SOF peculiar applications that would be difficult to replicate outside of the SOF community. The Pressure on the Force Tiger Team (POTFTT) is focused on working directly with SOF leadership on the long-term health and well-being of SOF. The POTFTT provides a mechanism for enabling mission capabilities and program leadership applications.

The driving force for successful program implementation is found in the use of multi-disciplinary teams designed to address unit-specific aspects of "Pressure on the Force". Strategies and tactics developed to mitigate "Pressure on the Force" are dependent on the synchronization of subject-matter expertise in SOF from diverse career fields. The synchronization starts with focus on the SOF operator. Others involved in the synchronization include mission planners, supervisory elements, behavioral health specialists (psychologists, social workers, and behavioral health technicians), and chaplains. Each is uniquely capable of analyzing human factors risks in support of the Five SOF Truths.

The Five SOF Truths

"Humans are More Important than Hardware" (HMITH)
"Quality is better than quantity"
"Special Operations Forces cannot be massed produced"
"Competent Special Operations Forces cannot be created after emergencies occur"
"Most Special Operations require Non-SOF assistance"

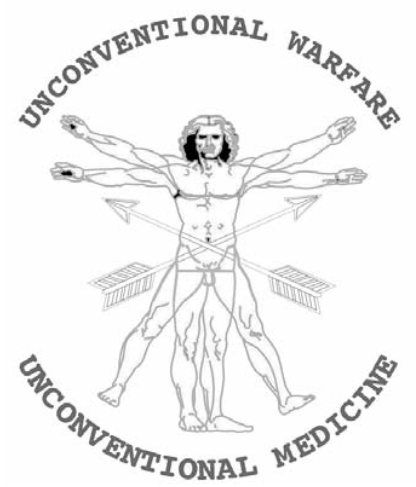
As the first of the Five SOF Truths reinforces the relevance that humans are more important than hardware (weapons, equipment, etc), the strategic focus in addressing "Pressure on the Force" is most effective when the strategic message conveyed from the Headquarters USSOCOM is applicable at every subordinate level, right down to any SOF two-man team deployed anywhere in the world. The use of deliberate planning, such as R2P2 at the team and small unit level, and other small unit planning processes (e.g., Army Troop Leading Procedures), allows team leaders and unit commanders to engage in planning processes diverse enough to include human factors analyses. The span of decision making in the SOF community often crosses the boundaries of strategic, operational, and tactical. The formulation of mission planning as a strategic application is best defined doctrinally as responsive, not reactive. Doctrinally, mission planning tools guide all units (from HQUSSOCOM to two-man teams deployed) through formulated decision-making processes. Mission planning tools can be used as a mechanism for enabling leadership awareness on how human factors might, from one situation to the next, influence mission success.

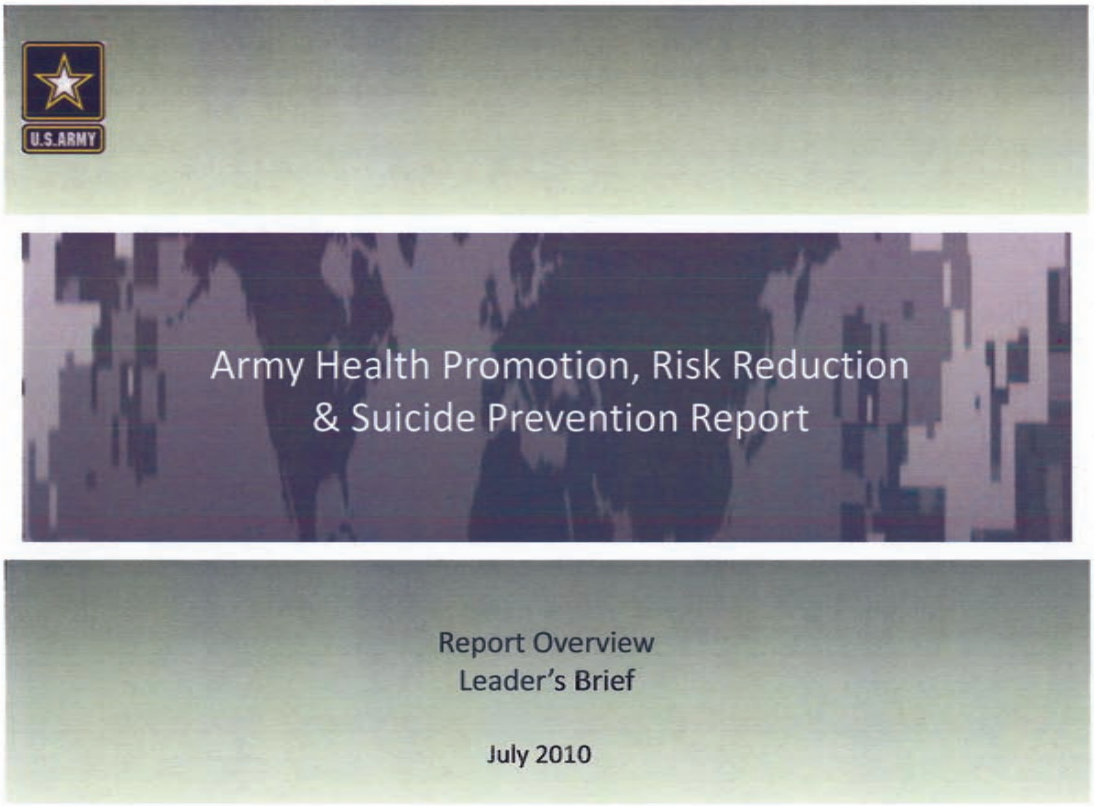
Human factors analysis incorporated in the mission planning process is a mechanism that supports the SOF Truth HMITH. The tactical or operational use of R2P2 as a planning tool that is less exhaustive than the more-detailed, and full-scale, Marine Corps Planning Process is a technique that also accommodates the inclusion of human factors analysis in

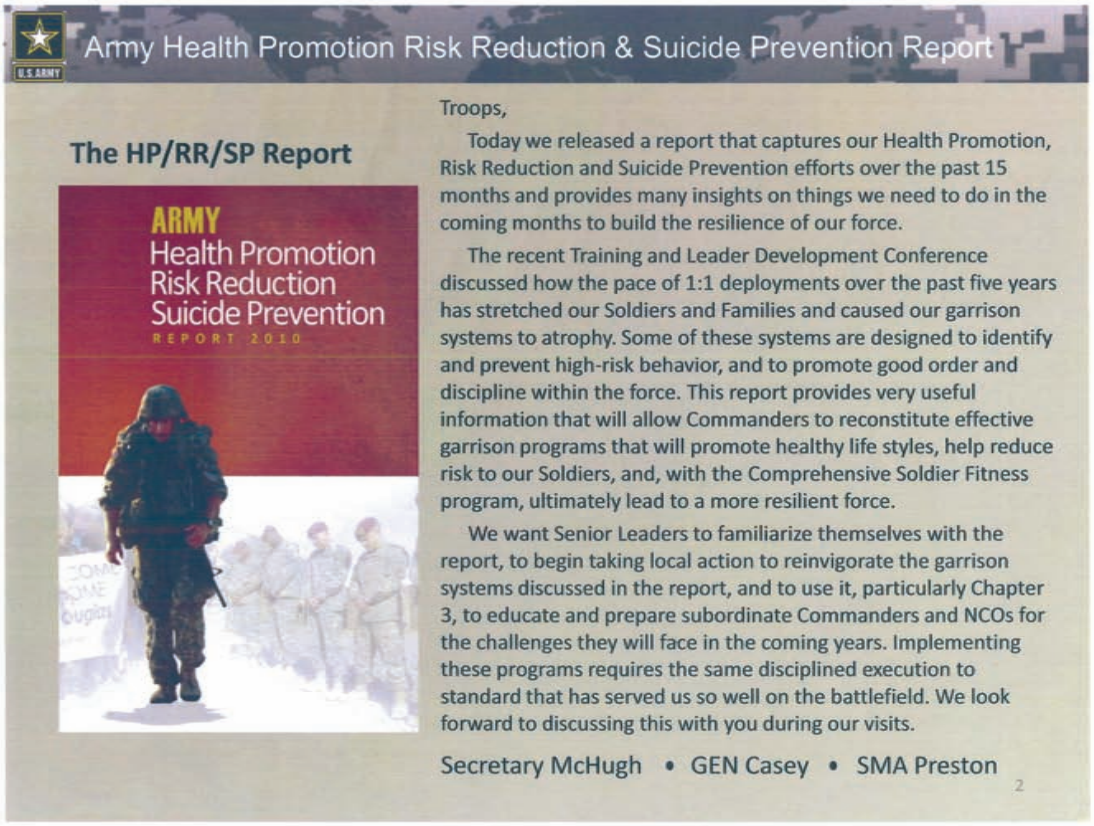
support of the SOF Truth HMITH. Strategically, the creative use of pre-existing Services programs and mission planning procedures in operational and tactical units is an enabling SOF peculiar application designed to mitigate “Pressure on the Force”.

The POTFTT efforts are consistent with the Department of Defense 2007 Task Force on Mental Health. The POTFTT efforts differ from the Task Force efforts in that the Tiger Team focuses on more than behavioral health. The POTFTT efforts look at other mission-focused issues in SOF units that affect effectiveness throughout the professional lifecycle of the SOF Warrior.

The outcomes of POTFTT efforts combined with the implementation of human factors analyses in the deliberate planning process will provide SOF units with greater success in leveraging the use of pre-existing Services programs for SOF personnel and their families. The use of POTFTT Focus Groups and human factors analysis in the deliberate planning process are only two mechanisms among several in the strategic and programmatic efforts available for enabling leadership capabilities in support of the Five SOF Truths. The endstate use of those mechanisms is enduring operational effectiveness in SOF personnel and their families. That endstate increases the probability for SOF leadership to project adequately that the mid-career SOF operator in 2011 will be as functionally capable of supporting U.S. strategic interests in 2020 as he, or she, is today.




U.S.ARMY
Army Health Promotion, Risk Reduction
& Suicide Prevention Report
Report Overview
Leader's Brief
July 2010


U.S.ARMY
Army Health Promotion Risk Reduction & Suicide Prevention Report
The HP/RR/SP Report
ARMY
Health Promotion
Risk Reduction
Suicide Prevention
REPORT 2010
Troops,
Today we released a report that captures our Health Promotion, Risk Reduction and Suicide Prevention efforts over the past 15 months and provides many insights on things we need to do in the coming months to build the resilience of our force.
The recent Training and Leader Development Conference discussed how the pace of 1:1 deployments over the past five years has stretched our Soldiers and Families and caused our garrison systems to atrophy. Some of these systems are designed to identify and prevent high-risk behavior, and to promote good order and discipline within the force. This report provides very useful information that will allow Commanders to reconstitute effective garrison programs that will promote healthy life styles, help reduce risk to our Soldiers, and, with the Comprehensive Soldier Fitness program, ultimately lead to a more resilient force.
We want Senior Leaders to familiarize themselves with the report, to begin taking local action to reinvigorate the garrison systems discussed in the report, and to use it, particularly Chapter 3, to educate and prepare subordinate Commanders and NCOs for the challenges they will face in the coming years. Implementing these programs requires the same disciplined execution to standard that has served us so well on the battlefield. We look forward to discussing this with you during our visits.
Secretary McHugh • GEN Casey • SMA Preston
2

Purpose and Scope of the Report

- Purpose: This report captures the Army's efforts to understand the cause of the increasing rate of suicides and high risk behavior. It provides background into the problem, describes the Army's actions and recommends the way ahead.
- Scope: This report addresses the full range of issues related to Health Promotion, Risk Reduction and Suicide Prevention (HP/RR/SP) including ways to promote well-being and mitigate high risk behavior among our Soldiers and Families. The data is based on existing data availability and is scoped accordingly (data sets = FY01 – 09, FY04 – 09, FY06 – 09).
  - This report is intended to:
    - Inform Leaders at all levels about the consequences associated with high risk behavior
    - Provide an honest, transparent and balanced review of HP/RR/SP issues
    - Document the Army's actions to date to improve HP/RR/SP programs/services
    - Integrate governance, policy, structure and process across HQDA
    - Recommend solutions to improve HP/RR/SP and reduce gaps and redundancies
  - This report is not intended to:
    - Provide a panacea for high risk behavior but rather provoke action at all levels
    - Usurp normal staffing and decision processes – recommendations will be staffed via the Health Promotion Council and HQDA forums
    - Recommend any action that conflicts with current statute/policy

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Army Health Promotion Risk Reduction & Suicide Prevention Report

Report Overview

- The HP/RR/SP Report represents over 15 months of work by the ASPTF and ASPC to promote health, reduce risk and prevent suicide
- The HP/RR/SP Report is comprised of 10 chapters
  - Chapters 2-4 present the problem
  - Chapter 5 outlines what the Army has done
  - Chapters 6-10 lays out recommendations for the way ahead
- Each Chapter builds on a set of themes to present a holistic approach to HP/RR/SP:
  - Chapter 1: HP/RR/SP Introduction (Report summary and how to use this document)
  - ✓ Chapter 2: Reality of Suicide (complex factors involved in suicide / high risk behavior)
  - ✓ Chapter 3: Lost Art of Leadership in Garrison (increase of an at-risk/high risk population)
  - ✓ Chapter 4: The Composite Life Cycle (Unit, Soldier and Family transitions and stressors)
  - ✓ Chapter 5: The Army Suicide Prevention Campaign (past and current HP/RR/SP efforts)
  - Chapter 6: Program Governance for HP/RR/SP (applies enterprise governance modeling)
  - Chapter 7: Managing HP/RR/SP Program Portfolio (applying business processes)
  - Chapter 8: Investigations and Reporting (realigning investigations and notifications)
  - Chapter 9: Information Sharing and Retrieval (data sharing via net-centric environment)
  - Chapter 10: HP/RR/SP Research (applying governance/business processes to research)

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Army Health Promotion Risk Reduction & Suicide Prevention Report

Chapter 2: The Reality of Suicide

- Description:
  - This section captures the complexity of the suicide as a personal, social, behavioral health and medical issue
  - It places the Army's increased suicide rate in the context of national and service trends across a wide range of contributing factors
- Impact:
  - Suicide/equivocal deaths are complex with many factors including life transitions, high risk behavior outcomes, comorbidity, polypharmacy, behavioral health, etc.
  - Suicide is an indicator of the larger problem of stress comprised of preexisting conditions, OPTEMPO, Family separation, combat fatigue, behavioral health, etc.
  - There are no universal solutions found in any community; suicides must be addressed from a holistic and multidisciplinary approach
  - It is an enduring problem requiring an enduring commitment
  - Prevention of suicide/equivocal deaths requires a dedicated effort to develop *resiliency*, *coping skills*, *help-seeking behavior* and *leader intervention*, in that order

"The stigma attached to seeking mental health treatment is not just an Army problem…this is a societal problem that we all have to wrestle with…" *- CSA, 10 Nov 2009*

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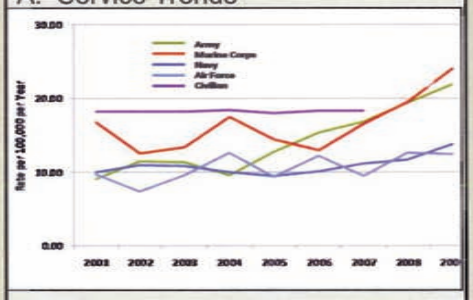
Army Health Promotion Risk Reduction & Suicide Prevention Report

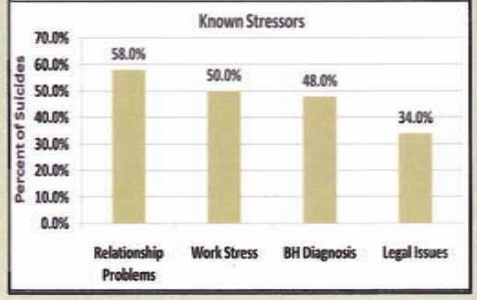
The Reality of Suicide (cont'd)

- Differences/similarities in Service trends may be due to variances in known stressors
  - Comparison of Service trends may assist in isolating aggregate or individual stressors
  - Known stressors are similar across all Services and within civilian populations
- Service Trends (Figure A)
  - Army and USMC have experienced increased rates over past 3-5 years
  - USN and USAF have had a minor increase in rate over past 2-3 years
- Known Stressors (Figure B)
  - The most frequently identified stressor is failed relationships, however many reasons exist for relationship failure
  - Additional research is required to fully understand the complex societal, medical and individual interactions

A: Service Trends



B: Known Stressors



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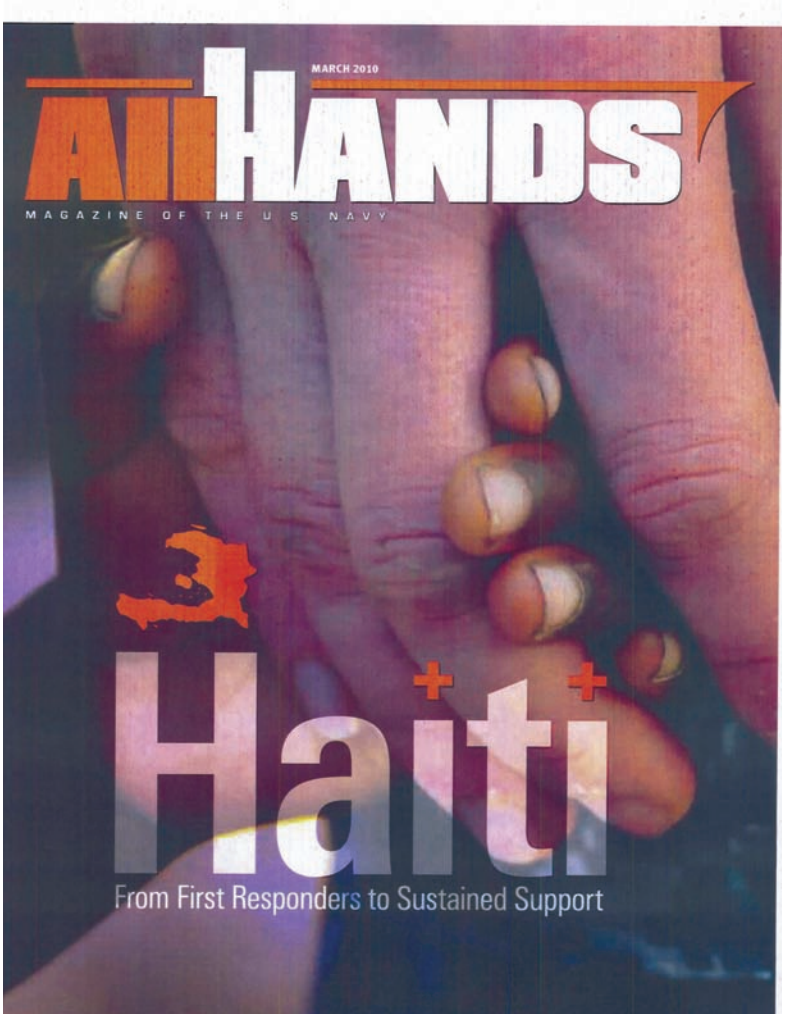


Operational Stress Control

3M for the Mind

In this day and age, stress is an unavoidable part of daily life, and in today's Navy, it's all about how you handle it.

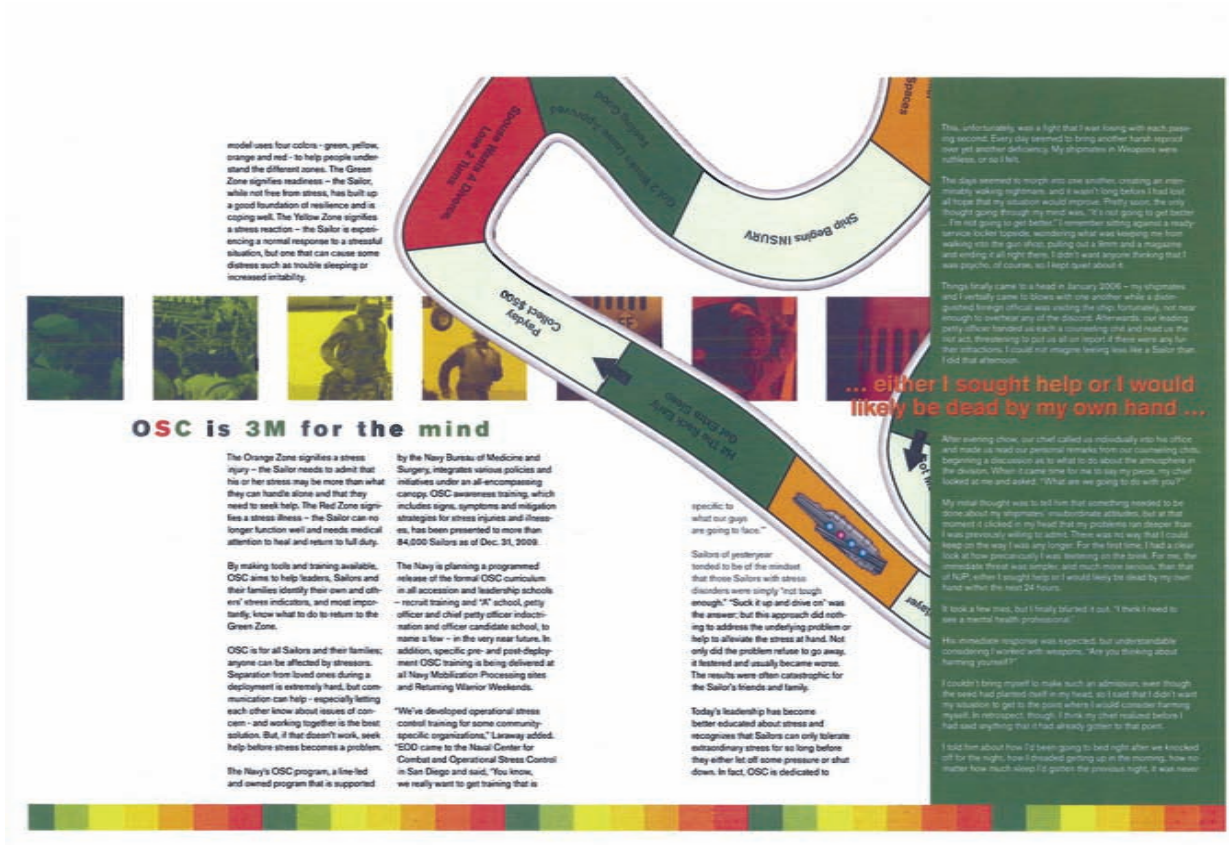
Story by MC2(SW) Elisabeth Wahoo

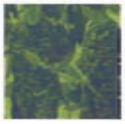
Technically speaking, stress is the way we respond to challenges to the body and mind. Stress is not necessarily a bad thing; in fact, it's necessary for health. Stress often leads to quick, clear thinking and heightened energy. It's a normal and expected response to demanding circumstances, and it can push us to higher levels of performance when used to our advantage.

When stress piles up or reaches extreme levels, though, it becomes a liability rather than an asset. It can chip away at our job performance, threaten our relationships at home and at work and put our mental and physical health in jeopardy. Left unchecked, it can lead to stress injuries, post-traumatic stress disorder (PTSD) or other serious mental health issues.

The Navy is committed to reducing stress injuries and ensuring the psychological well-being of its Sailors by focusing on building their ability to bounce back from stressful times. To this end, the Navy's Operational Stress Control (OSC) program was launched.


A Sailor On The Brink:
The Importance of Seeking Help
How the chain of command acts can mean the difference between life and death for a Sailor in distress. While the Navy releases official statements and drafts policies about the importance of ensuring Sailors' psychological well-being, nothing speaks louder than the actions of the leaders on the deckplates or at the scene. Whether it is the leading chief petty officer or the department head, front-line leaders have the power and responsibility to make a difference. I know, because I've been to the brink – and had it not been for them - I'm not sure I would have made it back.
Operational Stress Control
OSC focuses on prevention, or building psychological resilience. Resilience is defined as the human capacity to prepare for, recover from and adjust to life in the face of stress, adversity or trauma. In a nutshell, resilience is the ability to bounce back from stressful times.
Graduate "A" School Collect $100
Auto Breaks down Pay $500 For Repairs
Payday Collect $500
Join MWR Softball Tournament
Caught Skylarking Take Challenge Card
"[OSC is] about promoting psychological health. It's about leaders taking care of Sailors and their families," said Capt. Lori Laraway, head of the Navy's OSC program.
The concept of operational stress control is a little broader than combat stress control. It addresses the fact that not only combat action, but also other day-to-day stressors might permanently harm an individual. Many sailors operate in an inherently hazardous environment.
Shore-based Sailors may not be involved in hazardous duty, but are often juggling the demands of work, family, school and other stressors. Operational stress is a fact of life throughout the Navy.
Laraway is quick to point out that stress is often a good thing – to a point.
"Stress challenges us to do our best. That little bit of anxiety before the physical readiness test or advancement exams helps to get the adrenaline and the endorphins going. It gets you keyed up to perform well. But, too much stress starts to overload the system," said Laraway.
"If you start to notice there's a problem, deal with it early. Don't wait for that rattle in the engine to be a blown transmission. You do the personal qualification standard and take care of preventive maintenance up front so that you don't have problems down the road," she said. "We have it figured out for our ships and our planes. Now it's time to figure it out for our people, and that's what our program's really about."
Think of OSC is a preventive maintenance system - 3M - for the mind.
"Sailors know what 3M is," Laraway continued. "They know how to do the quals to keep things up to standards. It's almost inbred by the time you get out to the fleet, but we aren't as quick to know we have to take care of our people the same way.
"Good leaders know this. We're building upon what has been working in the Navy for 200-plus years, which is good leadership. We're trying to provide more awareness, more tools to help leaders know what to look for so that they can identify potential stress related problems early. If it's an engine, we've got the checklists so we know what to do; we go through and we figure it out. We've got to provide the same checklists and skills for leaders so they know how to intervene with their people."
OSC has adopted a model that recognizes that stress reactions occur across a continuum, or stress zones. The


model uses four colors - green, yellow, orange and red - to help people understand the different zones. The Green Zone signifies readiness – the Sailor, while not free from stress, has built up a good foundation of resilience and is coping well. The Yellow Zone signifies a stress reaction – the Sailor is experiencing a normal response to a stressful situation, but one that can cause some distress such as trouble sleeping or increased irritability.
Ship begins INSURV
Payday Collect $500
... either I sought help or I would likely be dead by my own hand ...
OSC is 3M for the mind
The Orange Zone signifies a stress injury – the Sailor needs to admit that his or her stress may be more than what they can handle alone and that they need to seek help. The Red Zone signifies a stress illness – the Sailor can no longer function well and needs medical attention to heal and return to full duty.
By making tools and training available, OSC aims to help leaders, Sailors and their families identify their own and others' stress indicators, and most importantly, know what to do to return to the Green Zone.
OSC is for all Sailors and their families; anyone can be affected by stressors. Separation from loved ones during a deployment is extremely hard, but communication can help - especially letting each other know about issues of concern - and working together is the best solution. But, if that doesn't work, seek help before stress becomes a problem.
The Navy's OSC program, a line-led and owned program that is supported by the Navy Bureau of Medicine and Surgery, integrates various policies and initiatives under an all-encompassing canopy. OSC awareness training, which includes signs, symptoms and mitigation strategies for stress injuries and illnesses, has been presented to more than 84,000 Sailors as of Dec. 31, 2009.
The Navy is planning a programmed release of the formal OSC curriculum in all accession and leadership schools – recruit training and "A" school, petty officer and chief petty officer indoctrination and officer candidate school, to name a few – in the very near future. In addition, specific pre- and post-deployment OSC training is being delivered at all Navy Mobilization Processing sites and Returning Warrior Weekends.
"We've developed operational stress control training for some community-specific organizations," Laraway added. "EOD came to the Naval Center for Combat and Operational Stress Control in San Diego and said, 'You know, we really want to get training that is specific to what our guys are going to face.'"
Sailors of yesteryear tended to be of the mindset that those Sailors with stress disorders were simply "not tough enough." "Suck it up and drive on" was the answer; but this approach did nothing to address the underlying problem or help to alleviate the stress at hand. Not only did the problem refuse to go away, it festered and usually became worse. The results were often catastrophic for the Sailor's friends and family.
Today's leadership has become better educated about stress and recognizes that Sailors can only tolerate extraordinary stress for so long before they either let off some pressure or shut down. In fact, OSC is dedicated to



helping Sailors navigate the minefield of stress so that, should the steam under the collar reach the critical point, Sailors know where to turn to bleed the excess pressure.

The goal of the entire OSC program is to move Sailors, families, and commands toward the ready Green zone.

for the fifth day in a row. You address stress up front. Our focus is psychological health, wellness and resilience, and we can prevent a lot of these other issues. Oh, and by the way, if they do creep up, address them early!"

Master Chief Petty Officer of the Navy (MCPON) (SS/SW) Rick West

Going – And Staying – Green

Moving toward Green is a shared responsibility of Sailors, family members and command leaders, as well as medical personnel, chaplains and other caregivers.

Laraway compares the importance of monitoring one's psychological health and operational stress control to one's cardiac health.

"The time to think about your heart health isn't when you're in the back of the ambulance and somebody's pumping on your chest," she said. "It's about adjusting how you live every day.

"It's taken the American Heart Association 50-some years of a concentrated ad effort to get the general american public to this point in time.

"That's where we need to be with psychological health. We need to get people to realize that you don't address stress when you're in a crisis, having flashbacks or you haven't slept

issued a challenge to the fleet to take care of those in distress, and to seek help if they themselves are feeling the pressure.

"I want each and every one of you to knock down the barriers that discourage our people from seeking help early, before the stressors end up in injuries, illness, or in the worst case scenario, death. Shipmates, there's a stigma out there, and it is preventing a lot of our people from seeking help."

According to Capt. (Dr.) Paul Hammer, NCCOSC director, part of eradicating the barriers that often prevent Sailors from seeking psychological health care, is approaching stress injuries as one would physical injuries.

"Let's say two Sailors are down at the naval station," said Hammer. "They meet each other and they're walking along, and one says, 'Where are you going?' 'I'm going to my therapy appointment.' 'Occupational therapy?'

'No, no, my psychotherapy.' 'Oh, okay. See you at 1500 when you get back.' No big deal.

"I want people to think, 'I need to go talk to somebody about this. I need to work this out.' That's what I want."

Hammer's goals are echoed by West who summed up his expectations to the fleet.

"We need to get rid of that barrier," said West. "The bottom line is, we are not alone, and we are here to help each other. Lives depend on it, and I am depending on you." ★

Wahos is assigned to Defense Media Activity – Anacostia, Washington.

That day, my life turned around for the better!

enough. He told me that he recognized what I had told him as the classic signs of depression, and then said he would meet with our division officer and department head the following day.

The next morning, I felt how I imagined a surgical patient in a morphine haze would feel. I was dazed, but in no real pain. Early that afternoon, I was called into combat information center. When I got there, my department head pulled me into a side room, where my chief, our division officer, the ship's independent duty corpsman, and our CMC were waiting.

The CMC informed me that they were pulling me from Weapons until further notice, but he made it clear that I was not being punished – they were just looking out for my well-being. He then informed me that I was being reassigned to Medical to help our independent duty corpsman with records, patients' vital signs, PMS and other duties. I understood that they weren't concerned about whether or not I ever fired another weapon; they just wanted me to get better and thrive again.

That day, my life turned around for the better! Naturally, I hit a bump every once in a while, but for the most part I was saner, happier, and healthier than I was in Weapons. Even working out of my rating, I still made second class off that exam cycle. I finally came to the same realization that my chain of command did – I had potential to thrive in the Navy, but not in my current rating.

Once I acknowledged this, and made peace with my limitations, I started pushing for a conversion to a different rating, one that I originally wanted when I joined the Navy.

Our command career counselor helped me put together a conversion package. It took me three tries during the course of that year, but one year and four months after I was transferred from Weapons, my hard work paid off when I was approved for a direct conversion to my new rating. You couldn't manufacture a drug, legally or illegally, that could get you as high as I felt when I got the news – I felt like the weight of the world had been lifted off my shoulders. Also, once I converted, I was able to qualify on the ship's small arms and stand watch again, so my removal from Weapons did not mean the permanent end to my qualification to operate a firearm.

My story has a happy ending because my chain of command cared enough about me to throw me that lifeline when they saw I was drowning. That said, I didn't ask for help until it was almost too late, and I likely suffered needlessly in the process. I tried to "buck it up" and "tough it out," to where it almost cost me my life. I was clearly in the Orange Zone but didn't have the capacity to see it. Today, the Navy's Operational Stress Control program is working hard to educate all Sailors about the effects of operational stress and about the resources available to them to find help.

DO NOT BE AFRAID TO REACH OUT FOR HELP. Getting help will not kill your career, I know, because the help I received saved my career – and my life. ★

The author's name has been withheld for privacy reasons.

2010 SOMA UPDATE

LTC Robert Harrington, SOMA President

The 23rd annual Special Operations Medical Association (SOMA) Convention was held from 13-16 December 2010 at the Tampa Marriott Waterside, with the theme this year of "Medical Lessons from the Long War". Key Note speaker for this year's conference was Lieutenant General Fridovich from USSOCOM and the featured speaker for the highly attended Mess Night was Medal of Honor Recipient Drew Dix.

One of the highlights of the conference was the Tuesday morning presentation on "SOF Medic Lessons Learned". This very popular session featured SOF medics providing their medical lessons learned from overseas missions that in some cases occurred within a few weeks of this year's conference. This session has been held for the past five years and is a symbol of the type of program SOMA is trying to present – the emphasis on providing a forum for the SOF medic to share their real world experiences with others in the SOF medical community.

Another group of sessions always popular with SOMA attendees were the hands-on demonstrations and practical review sessions held on the last two days of the conference. This year these sessions included airway management and the practical use of portable ultrasound in the field.

Final numbers for 2010 show that over 1900 people attended the 2010 conference, a dramatic increase over last year's record breaking attendance of 1400 and the slightly over the 1000 that attended in 2008. Since our main hall at the Tampa Marriott Waterside only holds 1200, we have clearly outgrown our present site. Fortunately, our SOMA Board of Directors had the foresight to move the 2011 Convention across the street to the Tampa Convention Center.

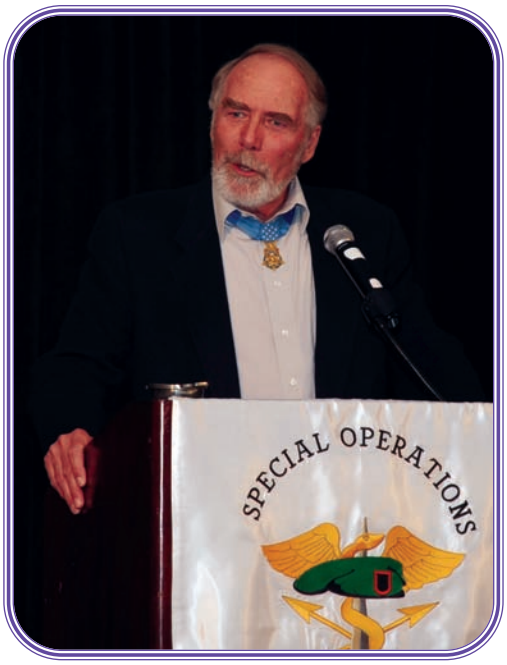
Using the Tampa Convention Center for 2011 will give the SOMA planning committee almost quadruple our present meeting space to plan an expanded educational program. We will continue to have general lectures for the first few days but will now be able to provide a greatly expanded program of breakout sessions that will concentrate on enhancing the practical hands-on skills of the SOF medical community. Having a larger space will also enable us to bring back the perennially popular "SOMA Challenge".

The dates for the 2011 SOMA Convention will be 10-13 December 2011. Since we will only be moving across the street from our present location at the Marriott Waterside, we will continue to use the Marriott as our headquarters hotel and will continue to hold our Mess Night program there.

In addition to our move the Tampa Convention Center, we will also have a new management company for the 2011 conference. We look forward to this new relationship, but realize the real strength of our organization is in our membership. We will be looking to our dynamic membership to help us grow and bolster our efforts to help educate the SOF medical community.

We are presently working on a new and enhanced web site which should be operational by mid-February. Through this portal, we hope to better tap into the talents of our members when we plan our program for 2011. Please check in regularly since we will be looking for your input.

LTG David Fridovich,Deputy Commander, United States Special Operations Command, was the Keynote speaker for the 2010 SOMA Convention.
Photo by TSgt Larry Carpenter Jr.



MOH Recipient Drew Dix was main speaker at the annual SOMA Mess Night.
Photo by Sophia Rodroguez

MSG Oscar Ware, USASOC, posthumously presents the USASOC Medic of the Year plaque to the wife and mother of SGT Jonathan Peney, 1st Ranger Battalion, at SOMA's Annual Mess Night 14 Dec 2010. In this picture, MSG Ware is presenting a memorial plaque that he made to SGT Peney's mother. SGT Peney's wife is holding the USASOC Medic of the year plaque.

Photo by SrA Anna-Marie Wyant

Sean Mulvaney, MD teaching Advanced Portable Ultrasound Lectures and Hands on demonstrations to class of over 40.
Photo by Sophia Rodroguez

Vendor Exhibit Hall
Photo by Sophia Rodroguez

Special Operations Veterinary Medicine: Global Year in Review" K9 TCCC — Review of current research.
One of the many breakout sessions held on the last two days of SOMA.
Photo by Sophia Rodroguez

Lectures and hands on training in airway management for SOF Operators by COL. Andy Pennardt, MD SOCOM and Bob Hesse RN, CFRN, FP-C .
Photo by Sophia Rodroguez

Working Dog Medicine and Canadian Border Patrol Dog Demo Breakout session on Day three.
Photo by Sophia Rodroguez

Hands on Demos and Displays of new SOF Medical Equipment.
Photo by Sophia Rodroguez

Tactical Combat Casualty Care (TCCC) Guidelines and Updates Dec 2010

1. Tactical Combat Casualty Care (TCCC) concepts were developed in 1996 as a Special Operations initiative. The Committee on Tactical Combat Casualty Care (CoTCCC) was established in 2001 to ensure the lessons learned from the modern day battlefield were analyzed and incorporated into the TCCC guidelines. TCCC has been identified as one of the reasons that U.S. military operations have experienced the highest casualty survival rates in history. Members of the CoTCCC represent all services and the civilian sector to include highly experienced Navy corpsmen, U.S. Army medics, Air Force pararescuemen, Special Forces medics, trauma surgeons, emergency medicine and critical care physicians, research scientists, and medical educators who meet 3-4 times a year to discuss topics in casualty care, including techniques, procedures, equipment, and drugs/agents. The CoTCCC developed new guidelines, based on operational experience and service lessons learned, and briefed the Defense Health Board (DHB) and Asst Secretary of Defense Health Affairs (ASD HA). ASD, HA requested services review the newly published guidelines and implement as appropriate (ref a).

2. Summary of TCCC guideline changes:

a. Additional guidelines on the prevention of hypothermia.

b. Additional guidelines on fluid resuscitation.

3. TCCC guidelines reflecting the above most recent updates are posted on the military health system website under TCCC at http:/www.health.mil.

4. Effective immediately, the most recently approved TCCC guidelines will become the standard to which training efforts are to be focused and evaluation will be based. These changes will affect numerous training programs and courses. Efforts are underway to update training standards and will be accomplished through the normal staffing process. A key element of the TCCC guidelines is their applicability to medical personnel, combat lifesavers, and individual deploying combatants.

5. The revised Pre-Hospital Trauma Life Support Manual (PHTLS) 7th edition, military version as mentioned in MARADMIN 0645/09, has been published and is now available for purchase in bookstores and on various websites to include but not limited to www.amazon.com and www.emergencystuff.com.

6. This message is applicable to the Marine Corps total force.

7. Release authorized by Maj Gen Raymond C. Fox, Commanding General, Training and Education Command.

Committee on Tactical Combat Casualty Care Meeting Minutes

16-17 November 2010
New Orleans, LA

Tuesday 16 November 2010

CoTCCC Public Session

Administrative Remarks presented by Dr. Frank Butler
Dr. Butler called the meeting to order and reviewed the agenda for the meeting. The next CoTCCC meeting is planned for 8-9 February 2011 in Tampa, FL. Dr. Butler recognized Ms. Danielle Davis, Mr. Dom Greydanus, and Dr. Steve Giebner for their outstanding efforts in setting up the CoTCCC meetings.

Combat Medic presentation by SrA Lucas Ferrari, a Pararescueman from the 48th Rescue Squadron.

On 09 June 2010, the 66th Expeditionary Rescue Squadron launched two HH-60's to evacuate a wounded British soldier. Each had a standard flying crew; in addition, there were two Pararescuemen (PJs) and a Combat Rescue Officer in the lead aircraft (Pedro 66) and three PJ's in the trail aircraft (Pedro 67). The casualty was reportedly a single Category Bravo with a broken arm that was upgraded to an Alpha due to a possible neurological deficit. This was the first mission of the day and in every way seemed to be normal. The threat, though constant, was believed to be low.

Approximately 30 minutes after launching, we were "eyes on" and approaching the landing zone. The Trail aircraft was poised for the pick-up and following the Lead aircraft when Pedro 66 began spinning out of control. Pedro 66 impacted the ground within seconds just outside the wire and almost immediately caught fire. The trail aircraft assumed an aggressive flying posture (one in which the good aircraft places itself between the perceived threat and the troops on the ground or, in this case, the crash site) and immediately landed nearby to deploy their 3-man Pararescue Team. We were unable to reach anyone via secure or open communications. Once the team exited the aircraft, trail took off to provide cover for the personnel on the ground.

Initial assessment in a TCCC environment indicated one survivor trapped in the aircraft. Within minutes, a coalition ground team took up security and we assessed that there were a total of 3 casualties and four souls lost. The back of the aircraft was crushed and on fire. The gunner was alive and trapped in the aircraft with his legs burning. The flames were causing rounds in the helicopter's weapons boxes to cook off. There was confusion about whether the crash had been a hostile shoot-down. (It was later confirmed that this was in fact the case.) There were numerous coalition forces and Afghan National Army troops milling around.

Casualty One, the pilot, was still seated upright in the aircraft. His helmet was in two separate pieces. He had a large, open skull fracture with exposed brain matter. He was found to be breathing. He was removed from the aircraft, his head was wrapped with a large compression bandage and his airway was secured via a cricothyroidotomy performed by two coalition force medics. He was placed on a Talon litter and moved to a waiting helicopter.

Casualty Two, the co-pilot, was in his seat, was conscious but confused, and was attempting to evacuate the aircraft. Once he was removed, he became unconscious and was moved by coalition forces to a waiting helicopter without treatment. In the helicopter, he experienced decorticate posturing and trismus. He was exhibiting Kussmaul-type respirations while attempting to breathe through his teeth with a large amount of secretions noted. His airway was secured via cricothyroidotomy and he was placed on an auto-vent with 100% oxygen breathing at 15 times a minute. No other injuries were noted.

Casualty Three, the trapped gunner, was alert and oriented. A full set of extrication gear was present but ultimately was not needed to free the casualty. Extrication efforts were hampered by the need to simultaneously fight the fire that was present. He was finally extricated from the burning wreckage after removing his personal protective equipment and pulling him out through the window. He was then moved to the helicopter waiting approximately 150 meters away. His injuries included a 7-inch chin laceration, a fractured jaw, six broken ribs and blunt trauma to the right chest with suspected pulmonary contusion. There were third-degree burns to both legs at greater than 9% per leg.

The trail aircraft left the scene with all three casualties, one PJ, and one Navy corpsman approximately 25 minutes after the crash. In-flight treatment was limited due to numerous factors. The primary concerns were Casualty One and Two's airway and respirations. Casualty One's breathing began to deteriorate and he required bagging, which the corpsman did at one breath every three seconds without supplemental oxygen. During this time, Casualty Three was still alert and oriented and maintaining his own airway. His vital signs were all within normal limits. His boots and his pants were cut off to help stop the burning process and mitigate the heat he was still experiencing. Prior to landing at Bastion after a 25-minute flight, we were able to pass all the pertinent information to higher care in order to ensure an expedient and

smooth handover. SrA Ferrari also gave a verbal turnover to the Navy corpsman and receiving physician, reiterating his casualty severity order, casualty status, injuries, treatments undertaken, and concerns.

All three casualties were taken rapidly into surgery. All three were transported back to the United States through the theater hospitals and evacuation system. Casualty One underwent several operations during his three weeks at Bethesda National Naval Medical Center, but showed little improvement. He was taken off life support on 2 July 2010 and died as a result of his wounds shortly thereafter. Casualty Two is currently at James A. Haley Veterans' Hospital in Tampa, FL. He has undergone several neurosurgical procedures. A large portion of his skull has been removed and a surgical implant is planned in the near future. He has improved dramatically since the accident, but he still has severe left-sided neurological deficits. His speech is also impaired, but is reportedly improving. Casualty Three is still in the process of healing, but is expected to make a full recovery. He was intubated for some time and had a chest tube on the right side for a hemopneumothorax. His chin laceration and jaw are both healed. He underwent several skin grafts to his legs, but has already begun to walk.

Senior Airman Ferrari's comments, observations, and lessons learned from this casualty scenario included:

1) Dismount the aircraft with all necessary casualty treatment gear.
2) There should be a contingency plan for establishing communications when signals jamming is present.
3) Establish a security perimeter as soon as possible in casualty scenarios to reduce civilian activity at the site and protect against threats to the evacuating assets and personnel.
4) Carry necessary personal equipment at all times.
5) All medics should carry or wear fire rescue gloves.
6) Stronger medical continuity should be established among all service medics.
7) Speed is security.
8) Fight against complacency.
9) Always ADAPT to your conditions.
10) Talon IIs are the preferred litters.

The question and answer period following his presentation revealed that:

1) The evacuation aircraft did not carry blood products.
2) The burn casualty did not request pain medication.
3) SrA Ferrari strongly believes that the medical training using animals that he received within 30 days of his deployment was a major factor in his being able to successfully perform a surgical airway in a very challenging tactical setting.
4) When asked about using the LMA, SrA Ferrari replied that British forces in the area liked this option, but that he did not think that it is a definitive airway for casualties such as the ones described.
5) Some units in his area of operations have noted that they would like to have Talon II litters, but do not have the funds to purchase them.
6) It is very important for a medic or PJ in such a situation NOT to do things for his casualties that do not really need to be done.

TCCC Update presented by Dr. Frank Butler

A brief on the Joint Theater Trauma System (JTTS) was conducted by COL George Costanzo for the Defense Health Board (DHB) on 14 July 2010. There was no vote on supporting permanent DoD funding for the JTTS at that meeting. A site visit to the JTTS was planned for DHB Core Board members after the brief. In the interim, however, a Force Health Protection (FHP) Council brief on the JTTS was scheduled by Dr. Taylor and held on 8 Sept. Support for long-term funding for the JTTS was approved by the FHP Council. Discussions on resourcing issues have been conducted between the JTTS and the service medical resource managers. Service Surgeons General review is pending.

A brief on the proposed changes in the TCCC Guidelines on hypothermia prevention was conducted for the DHB on 18 Aug 2010. The proposed change was approved by the Core Board of the DHB and will be incorporated into the TCCC Guidelines and the TCCC training curriculum.

A TCCC brief was done at the Military and Civilian Emergency Medicine Conference in Birmingham, UK on 12 Sept 2010. UK forces presentations on prehospital care at the conference indicated that they are using the following techniques and technologies with success:

- Celox Gauze
- Tranexamic Acid (TXA)
- IV Ketamine for analgesia

- MERT Team evacuations
    Packed Red Blood Cells and plasma in a 1:1 ratio
    Rapid Sequence Intubation
    Thoracostomies with aortic cross-clamping

Other items of note are that the London EMS system began using both tourniquets and Celox after the July 2005 bombings. There is interest in the UK in fielding a lyophilized plasma product for fluid resuscitation in the field.

The results of the CRASH-2 study on tranexamic acid use on mortality in patients at risk of death from hemorrhage were discussed at the last CoTCCC meeting. This study was discussed further at a teleconference meeting of the Army Medical Research and Materiel Command Hemorrhage Control Steering Committee on 27 October 2010.

Points from that meeting included:

- CRASH-2 is an important study with significant implications that cannot be ignored.
- Major research questions remain to be answered, especially for patients that do not have a diagnosed hyperfibrinolytic state.
- A JTTS Clinical Practice Guideline (CPG) on TXA use is currently being written. The CPG development should be oriented toward patients with a suspected hyperfibrinolytic state, as indicated by laboratory parameters, injury pattern, or other parameters that the CPG may specify. The TXA CPG should include collection of data on patients treated and outcomes.
- The committee will establish a working group that will meet to delineate research requirements and work-out details of proposed studies. Simultaneously, funding for this research will be sought.
- Additional research on TXA needs to be better focused, needs to include clotting parameter measurements, and needs better adverse events reporting.

CAT tourniquets have been added to the USMC Individual First Aid Kit per the Marine Corps Systems Command message of 4 Oct 10 .

A letter from the Air Force Surgeon General on 21 Aug 2010 noted that TCCC is the military counterpart to PHTLS and that changes to the TCCC Guidelines are proposed by the CoTCCC and approved through the DHB. Once approved, the updated TCCC Guidelines are posted on the Military Health System and USAF websites. The letter directed that "Effective immediately, all applicable Air Force training courses and programs will incorporate the most current TCCC guidelines consistent with their level of knowledge and proficiency instruction related to battlefield medical care. "

The TCCC input to the Seventh Edition of the PHTLS Manual (Military Version) has been completed and submitted to Elsevier. PHTLS Seven was delivered to the printer on 13 Oct 2010.

A brief on the proposed changes in the TCCC Guidelines on fluid resuscitation was conducted for the DHB by CAPT Jeff Timby on 1 November 2010. CAPT Timby's thorough documentation of the levels of evidence involved in the different aspects of change was very well received by the Board. The proposed change was approved unanimously by the Core Board of the DHB and will be incorporated into the TCCC Guidelines and the TCCC training curriculum.

The Holbrook NEJM paper documenting the association of effective early analgesia in reducing post-traumatic stress disorder was discussed at a previous CoTCCC meeting. Oral transmucosal fentanyl (OTFC) has proven very effective at treating combat trauma on the battlefield, but its use is currently limited by concerns over the FDA warning that limits its approved use to opioid-tolerant cancer patients. Previous discussion has noted that the FDA Black Box warning is not well supported by the published literature for the doses recommended by TCCC. The military experience documented to date has shown OTFC to be safe and effective in relieving pain on the battlefield. The CoTCCC has contacted the FDA and requested the adverse events reports submitted to the FDA on OTFC. The OTFC (Actiq) Adverse Events Report for 2007 was forwarded and reviewed. The year 2007 was noted to have had most adverse events (61 events with 9 deaths) reported in a single year to date. Overdoses were reported in 52% of cases (50% of those were intentional and 25% were in children). Drug dependence and dental caries were the most commonly reported other adverse effects. Seven of the nine deaths were associated with known overdoses of OTFC – the other two fatalities had an indeterminate cause of death. The median daily dose of OTFC for patients reporting adverse events was 3900mcg in 2007 (range 400-15,500). Note that the TCCC-recommended dose is 800mcg. The following observations were made regarding OTFC use on the battlefield:

- The FDA warnings refer to *prescribing* information.
- The reported adverse events reflect experience with OTFC prescribed for patient use in unmonitored settings. TCCC use of OTFC is a one-time administration of the medication under the immediate supervision of a skilled combat medic
- There are multiple published reports that document the safety of OTFC use for non-breakthrough cancer pain indications in civilian setting.
- There are multiple reports of OTFC efficacy and safety as used by combat medics to date in Iraq and Afghanistan.

- The evidence at hand continues to support the TCCC-recommended use of OTFC for pain relief on the battle field. The CoTCCC will continue to monitor this item.

Publications

The CoTCCC maintains a Journal Watch to ensure that current publications relating to TCCC are reviewed. Recent publications of interest include:

Needle Decompression Outcomes as a Function of Catheter Length
Ball et al - Canadian J Surg 2010

- Grady Hospital study on needle length and needle thoracostomy (NT) failure
- 4 year study period – 101 blunt trauma patients
- Helicopter service: 14 ga 5 cm (2“) needle with 4.5 cm sheath (75)
- Ground ambulances: 14 ga 3.5 cm (1.4”) needles with 3.2 cm sheath (26)
- Implies NT done at the midclavicular line at the second intercostal space
- Success: EFAST exam results showing residual pneumothorax
- Failure rates: 65% with 3.2; 4% with 4.5 (p=0.001)
- Patients with penetrating trauma were excluded
- Clinical results at time of NT not described
- Mortality?
- Authors suggested an axillary approach for NT because of the thinner chest wall at that location, the location being further from heart, and better access for patients wearing personal protective equipment

Ultrasound Determination of Chest Wall Thickness
McLean – Am J Emerg Med 2010

- University of New Mexico
- 51 subjects evaluated with ultrasound at the midclavicular line at the second intercostal space – also at the lateral chest wall
- No attempted NT
- Males - mean chest wall thickness was 2.1 cm; females - 2.3 cm
- Most patients will have chest wall thickness < 4.5 cm
- Lateral chest wall thickness was greater at 2.36 cm for males
- Chest wall thickness may not be the cause of failed NTs
- Consider kinking or obstruction

TACEVAC Skills Sets Calderbank - BMJ 2010

- MERT-E is a high-value asset which makes an important contribution to patient care
- Physicians were present on 283 of 320 missions (88%)
- There were relatively few (approximately 25%) of the missions that required interventions beyond the capability of a paramedic
- There were 62 physician-level interventions • RSIs (28)
- Analgesia, sedation, blood products (21)
- Chest drain/thoracostomy (3)
- Pronouncing death (4)

Outcomes of Extremity War Injuries presented by COL Jim Ficke

COL Ficke is a orthopedic surgeon stationed at the Brooke Army Medical Center in San Antonio, Texas and the Army Surgeon General’s Consultant on Orthopedics. He presented a synopsis of the complex extremity war injuries that members of our Armed Forces are sustaining and the care that is being provided for these injuries. To date, there have been over 17,000 evacuated casualties in the two current theaters with 1097 major limb loss patients as of October 2010. Blast injury predominates as a mechanism of injury and creates devastating wounds that are difficult to manage. Improvements in personal protection equipment, battlefield trauma care, and evacuation times have enabled many polytrauma casualties to survive their injuries. Battlefield tourniquet use to date has saved lives without causing amputations due to ischemia. Additional points made by COL Ficke include:

- Current injury severity scales are poor predictors of viability and functional outcomes for injured limbs.
- The concept of Damage Control Surgery (sequential, prioritized procedures) applies in Orthopedics as well as General Surgery.

- Debridement, reperfusion, stabilization, and fasciotomies, if needed, are early priorities. Temporary vascular shunts have saved many extremities in the war and should be in the skill set for general surgeons in theater.
- Principles of management of war-related extremity injuries include: 1) war wounds are contaminated and should not be closed primarily; 2) longitudinal incisions; 3) excise foreign material and devitalized tissue; 4) low-pressure irrigation; 5) IV antibiotics; 6) ex-fix or splint for transport/comfort; 7) multiple debridements as required; 8) vacuum-assisted closure; 9) do not do circular amputations – save whatever tissue that you can; and 10) aggressive fasciotomies when indicated.
- The goals of Damage Control Orthopedic procedures are: 1) stop the bleeding; 2) remove the contamination; 3) restore blood flow; 4) stabilize fractures; and 5) don't burn bridges.
- Absolute indications for amputation include a non-reversible vascular injury, a complete tibial nerve transaction, and a tourniquet time greater than six hours (although COL Ficke notes that the six hour tourniquet time is not supported by data and that there is a report of one limb survival with good function after a tourniquet time of 14 hours.
- Extremity injury issues for TCCC include decisions about systemic antibiotics, antibiotic beads, and combat medic use of ex-fixes. If ex-fixes are to be included in the combat medic skill set, then this skill must be adequately trained and sustained.
- Current challenges include segmental bone loss, massive muscle defects, and expectations of the wounded for a very high level of function after treatment and therapy.
- Post-traumatic arthritis causes a great deal of morbidity and loss from active duty. Not every amputee is boarded out, but among casualties who survive, extremity injury causes the most loss from active duty with 64% of "unfit for duty" findings caused by extremity injuries with post-traumatic arthritis being the most common diagnosis.

Surgical Airway Training presented by Dr. Brad Bennett

Dr. Bennett noted that both Joint Theater Trauma System (JTTS) and Armed Forces Medical Examiner System (AFMES) reports have noted some episodes of surgical airways being performed incorrectly, including at least two episodes of airways being performed superior to the thyroid cartilage. In response to these events, Dr. Bennett led a working group that reviewed the cricothyroidotomy teaching methods in the 4-day TCCC course taught at Naval Medical Center Portsmouth. This working group identified five training gaps in the instruction provided on this topic in the course: 1) limited airway anatomy instruction; 2) lack of "hands-on" human laryngeal anatomy demonstration; 3) non-standardized technique for the surgical airway procedure; 4) inferior anatomic detail in the cricothyroid membrane region on mannequins used to teach the cricothyroidotomy procedure; and 5) lack of standardized refresher training frequency. One proposed improvement was to replace the current TCCC clinical video on cricothyroidotomy with that produced by the *New England Journal of Medicine* and published in 2008. This video teaches a vertical incision technique in order to reduce potential damage to vascular structures and the recurrent laryngeal nerve. In Dr. Bennett's initial conversations with the Senior Permissions Coordinator at the *New England Journal of Medicine*, his request to use this video in the TCCC files was favorably received.

Additional modifications to the training included the use of an anatomical model for hands-on anatomy familiarization, having the students use a skin marker to mark the proposed cricothyroidotomy incision site on other students, and use of a SIMULAB Trauma Man procedure as the final step to confirm that this skill has been mastered. Dr. Bennett noted that the Trauma FX mannequin may be a better device for use in teaching this procedure in that it has better representation of the anatomy. Dr. Bennett closed by emphasizing that there must be improved teaching of the pertinent anatomy for this procedure and that this skill should be sustained annually.

Animal Use for Medical Training presented by COL Annette Hildabrand

COL Hildabrand is the Deputy Director for DoD Animal Use Programs. She presented an overview of the interactions between animal rights groups and the DoD regarding the use of animals in medical training programs. Animal rights groups continue an aggressive political and legal campaign aimed at eliminating the use of live animals in training and research, while many in the DoD believe that medical training using animals is critical in preparing combat medical personnel to be ready to treat combat trauma on the battlefield. Animal use for medical training is governed by both law and DoD policies and regulations.

COL Hildabrand notes that there is a very high casualty survival rate at present and that improved battlefield trauma care has been an important facet of this success. The DoD uses a mixture of training modalities in medical education venues. L ive animal use is a significant component of combat medical training in some combat units. A recent DoD survey noted that among the skills that medics and corpsmen need to master are surgical airways, tourniquet use, hemostatic agent application, needle decompression of tension pneumothoraces, and chest tube placement. Recently proposed legislation would limit or eliminate the ability of the DoD to use animals in medical training.

In response to concerns over animal use in medical training in the DoD, the Department chartered the "Use of Live Animals in Medical Education and Training" Joint Analysis Team. Its mission was to evaluate the use of animals and state

of technology maturity in military medical training programs. The Joint Analysis Team found that: DoD programs use an integrated methodology that includes alternatives teaching modes, as well as live animals; that there is wide variation in student levels; that there were no programs in need of immediate change to alternative modality; that there is a lack of validated alternatives; and that a standardized mechanism is needed to integrate alternatives into curricula. The team made nine recommendations as noted below:

ASD(HA) will lead a DoD-wide effort to:

1) Establish policy to standardize core attributes (e.g., objectives) of medical training.
2) Establish policy to standardize the use of animals and alternatives in medical training.
3) Establish a plan to validate medical simulation technology and direct technology integration into training curricula.
4) Establish a standing work group (e.g., IPT) to provide persistent monitoring of simulation technology ready for adoption.

DDR&E will lead a DoD-wide effort to:

5) Establish a process for senior leadership review of Institutional Animal Care and Use Committee decisions.
6) Establish DoD Component Management Plan for DoD Directive 3216.1 compliance.
7) Develop a portfolio of studies comparing different training modalities.
8) Research metrics for measurement of training outcomes.
9) Establish a process to periodically identify gaps in medical simulation technology for future development.

Although medical training using animals is the best currently available model for teaching life-saving interventions to combat medics, this conflict between optimizing casualty survival and animal rights will continue, and the DoD will continue to aggressively pursue alternatives to the use of live animals in medical training and is currently funding a research effort to evaluate training effectiveness and measure outcomes.

Observations on Prehospital Trauma Care from the Deployed Director of the JTTS presented by LTC Marty Schreiber

LTC Schrieber recently returned from a tour as the Deployed Director of the JTTS. He discussed the importance of trauma systems in reducing trauma mortality and noted that the JTTR is now the largest combat injury database in history with records on over 17,000 casualties. The JTTS Vision is that every Soldier, Sailor, Airman and Marine injured on the battlefield or in the theater of operations has the optimal chance for survival and maximal potential for functional recovery.

LTC Schrieber presented descriptive statistics on both the casualties and the performance of the system. IEDs are currently the most frequent mechanism of injury in OEF, followed closely by gunshot wounds. To date, 31 JTTS Clinical Practice Guidelines (CPGs) have been developed to address specific elements of casualty care based upon opportunities to improve identified by the system. These CPG both provide an evidence-based metric for care and enable new trauma personnel arriving in theater to have the benefit of lessons learned from their predecessors.

He noted that more than 90% of casualties currently arrive at MTFs by MEDEVAC. The “Dustoff” MEDEVAC platforms are staffed by 68W (EMT basic) flight medics.

As described in the paper by Borgman, the JTTS practice of recommending a plasma to PRBC transfusion ratio of 1:1 based on the observed decrease in mortality (19% vs 65%) of massive transfusion patients who receive a high ratio of these products (> 1:1.4) versus a low ratio (1:8). This ratio is now used in many civilian trauma centers as well.

LTC Schreiber’s observations on prehospital trauma care included:

- There is a need for a central authority in the deployed JTTS structure to create standardization of clinical capability on all extraction platforms.
- Hextend is being used much less than normal saline based on his experience with casualties arriving at the MTF.
- Hypotensive resuscitation is being used and is working well.
- Lyophilized plasma holds great promise as a prehospital resuscitation fluid. The Germans are using it at present. It is alkalotic and must be reconstituted with an acidic solution to counter this.
- He noted a number of unsuccessful surgical airways during his time in theater and believes that alternatives such as sit-up and lean forward positioning, the King LT, the LMA, and the Combitube may be underutilized at present. He emphasized the importance of adequate training if surgical airways are to be done in the prehospital phase of care.

Additionally, LTC Schreiber noted that studies in his lab in Portland have found that when Combat Gauze, Celox, and kerlix are compared in a swine bleeding model in which the agents are NOT applied with accompanying direct pressure, that kerlix performed better than the two hemostatic agents as measured by blood loss. He also noted that all animals survived in this model.

USASOC TCCC Issues presented by COL Peter Benson

COL Benson is the Deputy Chief of Staff/Surgeon for the United States Army Special Operations Command (USASOC). He started by reviewing the USASOC structure from both the Army and Special Operations perspectives. He described the command structure which includes over 28,000 Soldiers. USASOC currently has forces present in 57 countries around the world and its medics are frequently the only medical personnel present in remote areas of these countries. These medics practice their skills in an environment that has been called "the dark side of the moon."

COL Benson then briefly reviewed Army Special Operations Forces (ARSOF) medical history going back to World War II, including the adoption and spread of TCCC starting with the 75th Ranger Regiment. TCCC is now seen as a standard across ARSOF, the Army, the other Services, and coalition forces. Casualty response in tactical situations requires an organizational response; it is not a purely medical event. The Rangers have led the way in developing concepts and training for unit-based casualty response.

The current medical and team structure were reviewed for each of the major organizations within USASOC along with the TCCC training that each receives. The units have varying structures, unique cultures, and different training cycles. Training TCCC across these all of these units is a complex task and there is no standard field manual for TCCC. Nevertheless, user-appropriate TCCC training is provided to all combatants, 68W medics, Special Forces medics, and licensed providers within USASOC. The training requirement to cover TCCC training for all of these user levels is very significant.

The following prehospital trauma care initiatives are of interest to USASOC: rFVIIa, tranexamic acid (TXA), freeze-dried plasma, fresh whole blood transfusion, and emerging technology/devices.

The audience briefly discussed the lack of a coherent policy regarding TCCC training across all of the services and the significant variations in TCCC training and education methodologies. There are still reserve medical personnel deploying into theater with no training at all in TCCC. LTC Schreiber noted that he got no formal training in TCCC or the JTTS CPGs before going into theater. Mr. Parsons also noted that there is no consultant to OTSG in the field of battlefield medicine. COL Hildabrand added that only medics get combat trauma training that includes medical training using animals.

USAISR Prehospital Interventions Study presented by Major Julio Lairet

Major Lairet presented preliminary data from a USAISR triservice observational study looking at prehospital trauma care interventions in OIF and OEF. The study was designed to answer such questions as: whether or not an intervention was indicated when it was done; if an intervention was indicated, but not done; and how well the intervention was performed. Fourteen specific interventions are being tracked along with morbidity and mortality data out to 30 days after injury. Physician investigators at Bagram, Shank, Gazni, Kandahar, and Dwyer are enrolling the patients in this study. As of September, 2010, data had been collected on 524 casualties who had undergone 678 prehospital interventions. Preliminary findings include:

- 5% of casualties had an airway intervention with 9 cricothyroidotomies.
- Two of the nine cricothyroidotomies were incorrectly performed.
- 2% of casualties had a needle decompression for suspected tension pneumothorax.
- Normal saline was used for fluid resuscitation in 71% of the casualties with Lactated Ringers used in 16% and Hextend used in 10%.
- 83 of 192 casualties had only a wool blanket for hypothermia prevention.
- A TCCC casualty card was filled out on only 14% of casualties. (Major Lairet notes that medics might have filled out TCCC cards for other casualties, but the cards may not have made it to the CSH.)
- Twelve of 88 tourniquets were incorrectly applied, including two that were placed <u>below</u> the injury.
- There was one burn that resulted from an HPMK being placed directly on the skin.
- There were 112 interventions that were judged to have been indicated but not performed, including 23 airways (nasopharyngeal airways or cricothyroidotomies), 10 breathing interventions (needle decompression or chest seal), 18 hemorrhage control interventions (tourniquet, hemostatic agents), 15 hypotensive fluid resuscitations, 39 IV/IO placements, and 7 hypothermia prevention interventions.

Major Lairet's goal for the study is to enroll 1400 casualties and to link the interventions to outcome data from the JTTR. There was considerable positive response from the group on Major Lairet's presentation and the study in general.

PHTLS TCCC Courses presented by Mr. Mark Lueder

Mr. Leuder reviewed the progress of the PHTLS-sponsored TCCC program. New teaching sites were added this year in San Francisco, Las Vegas, Dodge City, Roanoke, New York City and a number of other locations. The State Department is currently working with PHTLS to have TCCC courses taught for their personnel. International courses have been conducted or are planned in Germany, Peru, Mexico, Israel, Austria, Canada and Spain. Demand is growing rapidly.

TCCC for Tactical EMS presented by Dr. Peter Pons

Dr. Pons noted that the demand for TCCC training as developed by the CoTCCC is growing rapidly. The PHTLS

TCCC program teaches from the CoTCCC curriculum, which is written for military audiences. To create a civilian version of TCCC for use by civilian law enforcement, the language, documentation, situations (scenarios), and illustrations would have to be revisited and "civilianized." Another issue is the nature of the potential user systems; there are many potential customers for civilian tactical TCCC, with both law enforcement agencies and emergency medical services, each under their own medical director. Consensus building among these numerous organizations will be difficult and time-consuming, but a good core course would probably address the greatest needs of most of these organizations, and would, therefore, be highly desirable.

There was agreement that the CoTCCC should continue to coordinate on this issue and participate in the development of a civilian tactical TCCC course with PHTLS, the FBI, the Center for Operational Medicine at the Medical College of Georgia, and other major stakeholders.

Combat Ready Clamp presented by Dr. Mel Otten

Combat trauma data indicate that hemorrhage from injuries to junctional areas may contribute to as many as 20% of combat deaths. Combat Gauze is currently TCCC's only effective intervention for bleeding in these areas. There is a need for an effective emergency truncal tourniquet (ETT). An ETT must be accurately placed to be effective and must not affect blood flow to the contralateral limb. Historically, these devices date back to the 1850s, but were out of use by the early 1900s. There is, however, some current research in the area. It takes approximately 120 pounds of correctly-positioned pressure to occlude a common iliac artery. The Combat Ready Clamp™ is the latest ETT. The FDA approved the Combat Ready Clamp™ in August, 2010, as a device for use over the common iliac artery. The current price is $300.00 per unit. The Combat Ready Clamp™ is well-designed to minimize weight and cube for the medic; the device would have to be deployed in a manner that would make it available to treat casualties at or near the point of wounding in order to optimize the device's lifesaving potential. At this time, however, there is very limited research data and no clinical data on the efficacy of this device. As with all ETTs, positioning is critical, and proper training will therefore be essential to using this device effectively. The presence of pelvic fracture is a major concern when using this device.

Dr. Otten recommended that the CoTCCC wait and watch as field testing continues and clinical data accumulates before considering this device for inclusion in the TCCC Guidelines. The Committee agreed with this plan.

Pyng FAST-X presented by HMCM Eric Sine

This new intraosseous (IO) device does not have 10 introducer needles like the FAST-1™; it has only one introducer needle, and a foot that helps to ensure insertion perpendicular to the sternum. This foot replaces the adhesive-attached guide patch used with the FAST-1™.

The initial shipment of this new product was recalled by the manufacturer due to an unspecified issue. HMCM Sine recommended that the CoTCCC wait for resolution of this issue to continue evaluation of this device.

TCCC RDT&E Priorities presented by Dr. Frank Butler

The CoTCCC last reviewed its prehospital trauma research, development, test and evaluation (RDT&E) priorities in April 2009 with the results published in the minutes from that meeting. The committee revisited this list of proposed research efforts in the light of new developments and observations since April of 2009. The research priorities list as endorsed by the committee is included as Appendix (1).

DMMPO TCCC Update presented by LTC Jim Fulton

MAJ Fulton presented an update on an ongoing project of the Defense Medical Materiel Program Office (DMMPO), which tracks the contents of the service IFAKs and Combat Medical Sets as compared to the TCCC recommendations on equipment and skill sets for individual combatants and combat medical personnel. There has been some progress since the last report in April 2010, but there are still a number of unfielded TCCC equipment items noted in the equipment overview charts. Some of the discrepancies shown are due to the logistical challenges of medication handling; others may be due to delays and inaccuracies in capturing updates to the equipment lists from the services.

Wednesday 17 November

Administrative Remarks presented by Dr. Frank Butler

A conflict exists between CoTCCC language calling for clean packaging for some items for which the Committee has developed lists of preferred characteristics and the sterile packaging required for FDA approval for these items. "Clean" was preferred because sterility wasn't a clinical imperative on the battlefield and "sterile" carries a expiration date. The need to avoid expiration dates does not outweigh the need for FDA approval, so the Committee elected to remove "clean" from the preferred characteristics lists and continue the requirement for FDA approval.

The issue of the black box warning on OTFC was revisited. The evidence at hand documenting safety and efficacy as well as the fact that this medication is not prescribed for self-use in TCCC settings but administered by a trained combat medic make use of OTFC as a battlefield analgesic a good option.

The DMMPO review of Combat Medical Sets and IFAKs was discussed. Level 1 care in combat belongs to the line, so the discrepancies in the kits must be addressed by line commanders. This issue will be included in the next brief to the Defense Health Board as will the fact the DoD is still deploying senior and junior physicians (especially from the reserves) who are not trained in TCCC. This is an important audience that must be reached.

Combat Medic Presentation Review discussion by the Group

Points of interest from the PJ combat casualty case presentation:

- Extrication and airway intervention were the two most important interventions.
- In a multiple casualty scenario, there is a real need for analgesia that is not delivered via IV.

With multiple casualties, there will be a significant delay before the medic gets around to starting an IV on anyone.

TCCC Update Review discussion by the Group

The Committee discussed potential future changes to the TCCC guidelines:

- King LT for unconscious patients with traumatic brain injury
- Additional criteria for surgical airways in unconscious patients without airway trauma
- Ketamine
- Recommended TACEVAC provider levels and skill sets
- TXA for non-compressible hemorrhage with/without shock
- An axillary site for needle thoracostomy

With respect to airway interventions (the King LT, surgical airways, etc), a comprehensive airway algorithm has not yet been developed because the available data from the JTR has not yet well-reviewed. After prolonged discussion, the committee asked LTC Bob Mabry to develop an airway algorithm for its consideration.

There was insufficient data at present to address the use of ketamine or TXA. The Committee elected to make no guideline change with respect to an axillary site for needle thoracostomy since it is currently mentioned in the text (in the military version of the PHTLS manual) as an alternative site.

TCCC RDT&E Priorities Review presented by Dr. Frank Butler

The CoTCCC reviewed the battlefield trauma care research priorities list from yesterday and made some modifications. The battlefield trauma care research priorities list as endorsed by the committee is included as Appendix (1).

TACEVAC Skills Level and Outcomes presented by LTC Bob Mabry

In civilian Helicopter Emergency Medical Services (HEMS) systems, care rendered is determined by the nature of the patient's injuries (patient-centric). In military HEMS systems, the provider present on a given platform is determined by the manning assigned to the platform (platform-centric). In Operation Enduring Freedom, HEMS involves a mixture of patients; it is not only combat trauma. 62% of the casualties transported require EMT-P level care, but many casualties are transported with a 68W medic (EMT-B) in attendance. In the civilian sector, a flight nurse or a flight paramedic would be the standard of care for transport. LTC Mabry noted that it requires three to five years of paramedic experience to become a flight paramedic, while in the military, it is possible for a flight medic to have never touched a patient before flying in evacuation platforms in combat. Civilian air ambulance systems are also under the oversight of a trained emergency physician or trauma surgeon; this is not true in the military at present.

Available data (LTC Mabry's is not yet published) indicate that there is a direct relationship between increasing provider level in HEMS and survival. Casualty survival is significantly better when the casualties are cared for by Certified Flight Paramedics (FP-C) during TACEVAC flights.

LTC Mabry proposed that FP-C should be adopted as the new standard for in-theater HEMS, and that military flight medics should train to the same standard as civilian Flight Paramedics. He presented a training pipeline that would support this standard.

The Chairman recommended that when LTC Mabry's data has been fully analyzed and prepared for publication that his recommendations be considered for the Committee's endorsement and presentation to the DHB.

USSOCOM TCCC Issues presented by COL Tom Deal

COL Deal presented a brief history of USSOCOM efforts to obtain a freeze-dried plasma (FDP) product for use by medics in the field. The use of pooled plasma in the U.S. was discontinued in 1968 due to infection hazard. Thawed plasma is not suited for carriage by medics on the battlefield, although it can be used on TACEVAC platforms. FDP was identified

at the January 2010 Fluid Resuscitation Conference sponsored by USAISR as the most promising fluid for damage control resuscitation when SOF medics have to care for casualties in very remote areas where evacuation may be delayed for many hours or even days.

The Germans produce an FDP (LyoPlas) that is typed; type "AB" FDP can be given first if the casualty has not yet been typed. The German product costs $100.00 per unit and must be buffered before administration. Attempts at establishing an IND have been impeded by the announced intention of the manufacturer not to seek FDA approval. The product is screened initially and donors are retested at 4 months for HIV, syphilis, hepatitis B and C, and parvovirus. There is no published data identified at present that documents the efficacy and safety of German FDP in the prehospital trauma setting.

The French field a product that is buffered, universally compatible, and leukocyte reduced. The units are prepared from a 10-donor pool. Donors are tested for infection, the product is held for eight weeks, and the donors are then retested before the product is released. It costs $800.00 per unit. The French product is also not approved by the FDA, but the manufacturer has expressed an interest in offering this product for sale in the U.S.

HemCon is currently developing an FDP product for FDA approval, but their product is still in Phase 1 of clinical trials; the anticipated date of fielding for this product is currently 2015.

COL Deal is working to arrange an initial limited deployment of an FDP product with SOF medics for evaluation. It is important to note that the consideration of this issue should not be limited to the Iraq and Afghanistan areas of operation.

The above discussion indicates a need to initiate a high-priority prospective study in the U.S. using FDA-approved plasma alone as the sole prehospital resuscitation fluid for patients with noncompressible hemorrhage. In order to better translate the findings of this study to the military setting, the study should preferably be done in EMS systems that have relatively long prehospital evacuation times. The prehospital resuscitation fluid choice may be less likely to alter outcomes in patients with only a 10 or 15-minute transport time to the hospital.

Appendix 1
Battlefield Trauma Care RDT&E Priorities

Non-Compressible Hemorrhage Control – Follow-Up Tranexamic Acid Studies: As a follow-on effort to the CRASH-2 study, trials should be performed to determine the benefits and risks of using tranexamic acid for the subset of trauma patients who have non-compressible hemorrhage.

Tactical Damage Control/Hypotensive Resuscitation Studies - German Freeze-Dried Plasma Experience: Documentation of the German experience with this agent in both the prehospital and hospital settings would help to define the potential benefits that might be obtained by the use of this agent in the prehospital setting by U.S. Forces.

Tactical Damage Control/Hypotensive Resuscitation Studies – Prospective Study Using FDA-Approved Plasma Alone for Prehospital Resuscitation Fluid in Patients with Non-Compressible Hemorrhage: This study would provide a basis for judging the benefit to be gained from fielding a freeze-dried plasma product when one becomes available in the U.S. Because the primary use of plasma alone would be in a delayed evacuation scenario, this study would best be done in EMS systems that have relatively long prehospital evacuation times. Innovations in prehospital resuscitation fluids may be less likely to improve outcomes with a short 10 or 15-minute transport time.

Tactical Damage Control/Hypotensive Resuscitation Studies – MERT Team Experience with 1:1 PRBC: Plasma Experience: Training prehospital personnel to administer blood products in Tactical Field Care and Tactical Evacuation Care entails a significant training and logistic cost. With British MERT teams routinely giving PRBCs and plasma in a 1:1 ratio during TACEVAC, the outcomes from their experience should be studied and compared to outcomes using Hextend alone during evacuation.

Improved Battlefield Analgesia – Ketamine: Narcotic analgesia carries the risk of cardiorespiratory depression, while ketamine entails the potential for emergence dysphoria. Additional case series detailing the benefits and risks of using ketamine for prehospital analgesia in trauma patients are needed, to include the experience of the British MERT Teams with this agent.

Pre-Hospital Care Documentation and Databasing: Research and transition efforts are needed to aid in the capture of battlefield trauma care rendered and the transfer of this information to both unit-based Prehospital Trauma registries, such as that pioneered by the 75th Ranger Regiment, and to a trauma system registry, such as the Joint Theater Trauma System's JTTR.

Enhanced Electronic TCCC Training: This topic encompasses enhanced methods for accomplishing combat trauma management skills transfer to deploying personnel for a variety of purposes, to include: presenting tactical medical personnel with complex casualty scenarios to help develop sound tactical decision-making skills, e-training designed to teach physicians

and nurses the principles of TCCC, and information technology to make trauma management informatics available to deployed medical personnel whenever and wherever they need it.

Truncal Tourniquet: A prototype truncal tourniquet designed to assist in controlling external junctional hemorrhage in the tactical environment has recently been approved by the FDA. Studies documenting the efficacy of this device in eliminating distal pulses on extremities as well as the ability of users to apply it effectively are needed. Case series describing outcomes from using this device in prehospital trauma management would also be useful.

Use and Outcomes Data for Individual Elements of TCCC: Studies such as those performed by Kragh on tourniquet use are essential to documenting the success or failure of recommended TCCC interventions and identifying areas for improvement. One such study is currently underway at the U.S. Army Institute of Surgical Research.

Monitor-Driven Prehospital Fluid Resuscitation: Prehospital fluid resuscitation has the potential to do harm as well as good and the data to support specific fluid resuscitation protocols needs to be stronger. There is currently an effort underway at Memorial Hermann Hospital in Houston to evaluate the benefit of using electronic physiological monitors to better define which trauma patients need prehospital fluid resuscitation and to assist in titrating the volume given.

Comparison Testing of Celox Gauze, Combat Gauze, and ChitoGauze: Several new hemostatic agents have become available since Combat Gauze was introduced several years ago. Although there have been good reports from both prehospital and in-hospital use of Combat Gauze, it would be useful to compare the new agents to Combat Gauze in the consensus bleeding model developed at ISR to gain an understanding of their relative efficacy.

Comparison Testing of New Tourniquets: New tourniquets have become available in the years since the 2005 ISR tourniquet study was published. There have also been a number of modifications to the tourniquets that were recommended for use in that study. Although there have been good reports from both prehospital and in-hospital use of the CAT, SOFT-T, and EMT tourniquets, it would be useful to compare the new tourniquets to these currently-fielded devices.

Surgical Airway Training Methods: Surgical airways have been shown in multiple case presentations at COTCCC meetings and JTTS Trauma Teleconferences to be the most technically difficult prehospital trauma skill to train and sustain. Comparison studies of different training modalities used to teach this skill are needed. Medical training using animals should be included in the training modalities evaluated. The proposed Gold Standards for skills mastery are the ability to successfully perform a surgical airway on a human cadaver and the time that it takes to accomplish this task.

Clinicopathological Review of Every U.S. Fatality in Iraq and Afghanistan: Current process improvement efforts in prehospital care suffer from a lack of comprehensive data about the incidence of preventable deaths on the battlefield and how they might have been prevented. A study patterned after the Holcomb Annals of Surgery study in 2007 and the Kelly Journal of Trauma study in 2008 should be undertaken to provide this data. Using a multidisciplinary team that would include trauma surgeons, forensic pathologists, and combat medics, Armed Forces Medical Examiner autopsy records for all fatalities in the current conflicts should be reviewed to determine the causes of death and which deaths were potentially preventable.

Optimal Management of Traumatic Brain Injury in TCCC: Studies that better define optimal airway and fluid resuscitation management for casualties who often have polytrauma in addition to their TBI offer the potential to enhance both survival and the clinical outcomes in survivors.

The Impact of TACEVAC Provider Level and Skill Sets on Survival: There are at least three models of evacuation platform staffing in use in the CENTCOM area of operations at present: the British MERT team model which includes a consultant in Emergency Medicine, U.S. air ambulance platforms with flight paramedics and U.S. air ambulance platforms with 68W (EMT-Basic enhanced) flight medics. Determination of the optimal model for TACEVAC platform staffing requires an analysis of the outcomes obtained to date using these different options.

Hypothermia Prevention Equipment Comparative Studies: Current TCCC Guidelines recommend the Ready-Heat Blanket and the Heat-Resistant Shell for the prevention of hypothermia in combat casualties. New and improved technologies to prevent hypothermia are being developed and there should be an ongoing program to evaluate these technologies as they evolve.

Combat Medic/Corpsman/PJ Equipment Evaluations: Formal data on the experience of seasoned combat medics/corpsmen and Pararescuemen with the battlefield trauma care equipment that they carry is remarkably lacking nine years into the current conflicts. Equipment after-action evaluations conducted through such venues as the biannual refresher training for SOF medics conducted at the Joint Special Operations Medical Training Center and arriving new instructors at the Army Department of Combat Medic Training would allow for quantitative evaluations and specific comments about the merits of currently fielded combat medical equipment to be obtained from individuals who have actually used these items to care for casualties on the battlefield.

Focused Analysis of JTTR Data Regarding Specific TCCC Interventions: Analysis of the information contained in the trauma system trauma registry may yield valuable insights about the success or deficiencies of the current TCCC Guidelines. The pending study by Mabry on surgical airways is an excellent example of how this type of analysis may be successfully undertaken.

Veres Needle for Needle Thoracostomy: The Veres Needle is a spring-loaded needle used in laparoscopic surgical procedures. It has a hollow outer cannula that is ground obliquely at its distal end to a sharp, penetrating point. A protective element is contained in the cannula; the blunt surface of this protective element projects distally forward over the sharp tip of the hollow cannula. Studies using this needle for needle thoracostomy will help to determine if it reduces the potential for iatrogenic injury during needle decompression of tension pneumothorax.

Tactical Suction Devices: Combat medics have voiced the need for improved suction devices for battlefield use. A market survey followed by testing of the currently available devices is the first step toward addressing this need.

Improved TCCC Training Metrics: Better definition of "Gold Standard" metrics to ascertain the relative merits of various training methodologies, to include Powerpoint presentations, buddy practice, simulators, and Medical Training Using Animals is needed for the various interventions and skills recommended by TCCC. The metrics should include decision-making and cognitive training as well as technical skills.

Spinal Cord Protection in Casualties with Suspected Spine Injury in Tactical Settings: The benefit of currently used techniques for spinal cord protection while transporting casualties who have suspected spinal fractures in the prehospital setting are not well supported by data. More information is required about tactically-appropriate techniques for combat medics to use when moving these casualties on the battlefield.

Enhanced Pelvic Protection in Personal Protective Equipment: Deployed forces currently sustain injuries to the pelvic, urogenital, and perineal areas from dismounted IED explosions. Research is needed to identify options to protect this region while minimizing additional weight and discomfort to the combatant. This is not a medical care issue, but is highly recommended for review and appropriate action by those responsible for oversight and development of personal protective equipment.

Appendix 2

TCCC Equipment Overview

DEFENSE MEDICAL MATERIEL PROGRAM OFFICE

Service IFAKs NOV 2010

TCCC Item	USA IFAK	USMC IFAK	USAF IFAK	SOF IFAK
Tourniquet				
CAT				
SOFT-T				
Nasopharyngeal airway		CAP		
Combat Gauze				
Elastic Bandage Pressure				
Chest Seal Dressing	Field Dressing used with tape	CAP		
Rigid Eye Shield				
TCCC Card	Issued When Deploying		DD Form 1380	
Combat Pill Pack				
Tylenol ER				
Moxifloxacin 400mg				
Mobic 15mg				

Legend

- In Assemblage
- Not in Assemblage
- Policy to have available when deploying

Slide 3

DEFENSE MEDICAL MATERIEL PROGRAM OFFICE

Combat Medical Sets NOV 2010

TCCC Item	USA 68W	USMC (CAP)	AFSOC PJ	SOF ATP
Tourniquet				
CAT				
SOFT-T				
Combat Gauze				
Elastic Bandage				
Nasopharyngeal Airway				
Surgical Airway	H&H set	H&H	Individual	H&H
14ga 3.25" needle				
Chest Seal	H&H	Bolin	Asherman	HyFin
Hextend		BAS 636		
IV Catheter Needle 18ga, and supplies				
Saline Lock				
Tegoderm or equivalent				
Intraosseous Device	FAST 1	FAST 1	FAST 1	FAST 1
Hypothermia Prevention	HPMK	HPMK	HPMK	HPMK
Rigid Eye Shield				
Pulse Oximeter		BAS 635		
TCCC Card	Issued when deploying	H&H CC	Issued when deploying	

Legend
- In Assemblage
- Not in Assemblage
- Policy to have available when deploying

Slide 5

DEFENSE MEDICAL MATERIEL PROGRAM OFFICE

Medications NOV 2010

TCCC Item	USA 68W	USMC (CAP)	AFSOC PJ	SOF ATP
Combat Pill Pack				Wound Pack
Acetaminophen 650mg ER (2)	MES BAS		325mg	
Moxifloxacin 400mg				
Mobic 15mg	MES Tactical Combat		**Also Motrin 800mg	
Narcotic Analgesics				
OTFC 800mcg			Issued when deploying	
Morphine 5mg IV/IO	Morphine 10mg IM		Issued when deploying	
Naloxone				
Promethazine 25 MG IV	MES SickCall			
IV/IM ABX				
Ertapenem 1gm	MES Tactical Combat			
Cefoxitin 2gm			915F,K	
Fluid for mixing meds				

Legend
- In Assemblage
- Not in Assemblage
- Policy to have available when deploying

* Ertapenem or Cefoxitin meet the recomm... medication is found in another ground ass...

** Motrin is not recommended for use in the combat theater

Slide 7

Winter 2011 TCCC Abstracts

Damage Control Resuscitation for the Special Forces Medic — Simplifying and Improving Prolonged Trauma Care

COL Gregory Risk MD; Michael R. Hetzler 18D

Journal of Special Operations Medicine Volume 9, Edition 3 / Summer 09

Abstract

Current operational theaters have developed to where medical evacuation and surgical assets are accessible in times comparable to the United States. While this has been an essential tool in achieving the best survivability on a battlefield in our history, the by-product of this experience is a recognized shortcoming in current protocols and capabilities of Special Forces medics for prolonged care. The purpose of this article is to provide a theory of care, identify training and support requirements, and to capitalize on current successful resuscitation theories in developing a more efficient and realistic capability under the worst conditions.

Damage Control Resuscitation for the Special Forces Medic — Simplifying and Improving Prolonged Trauma Care Part Two

Michael R. Hetzler 18D; COL Gregory Risk MD

Journal of Special Operations Medicine Volume 9, Edition 4 / Fall 09

Abstract

Present and future Special Forces missions will require prolonged care of the trauma patient. The Special Forces Medic and Independent Duty Corpsman must be prepared to deal with these situations in the most challenging and austere environments. The implementation of damage control resuscitation for prolonged trauma care can maximize results with minimal support while preventing death, priming the patient for surgical success, and expediting recovery. Establishing this model of care and equipping medics with the essential equipment will have a lasting effect on the survival rate of our casualties, and negate the enemy's political victories when American and allied lives are lost.

Early Predictors of Massive Transfusion in Patients Sustaining Torso Gunshot Wounds in a Civilian Level I Trauma Center

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Journal of Trauma. 2010;68: 298–304

Abstract

Background: Early prediction of the need for massive transfusion (MT) remains difficult. We hypothesized that MT protocol (MTP) utilization would improve by identifying markers for MT (>10 units packed red blood cell [PRBC] in 24 hours) in torso gunshot wounds (GSW) requiring early transfusion and operation. **Methods:** Data from all MTPs were collected prospectively from February 1, 2007, to January 31, 2009. Demographic, transfusion, anatomic, and operative data were analyzed for MT predictors. **Results:** Of the 216 MTP activations, 78 (36%) patients sustained torso GSW requiring early transfusion and operation. Five were moribund and died before receiving MT. Of 73 early survivors, 56 received MT (76%, mean 19 units PRBC) and 17 had early bleeding control (EBC), (24%, mean 5 units PRBC). Twelve transpelvic and 13 multi-cavitary wounds all received MT regardless of initial hemodynamic status (mean systolic blood pressure: 96 mmHg; range, 50–169). Of 31 MT patients with low-risk trajectories (LRT), 18 (58%) had a systolic blood pressure <90 mm Hg compared with 3 of 17 (17%) in the EBC group ($p < 0.01$). In these same groups, a base deficit of < -10 was present in 27 of 31 (92%) MT patients versus 4 of 17 (23%) EBC patients ($p < 0.01$). The presence of both markers identified 97% of patients with LRT who requiring MT and their absence would have potentially eliminated 16 of 17 EBC patients from MTP activation. **Conclusions:** In patients requiring early operation and transfusion after torso GSW: (1) early initiation of MTP is reasonable for transpelvic and multicavitary trajectories regardless of initial hemodynamic status as multiple or difficult to control bleeding sources are likely and (2) early initiation of MTP in patients with LRT may be guided by a combination of hypotension and acidosis, indicating massive blood loss.

Testing of Blood Products in a Polytrauma Model: Results of a Multi-Institutional Randomized Preclinical Trial

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Hemostatic Resuscitation Research Group
Journal of Trauma. 2009;67: 856–864

ABSTRACT

Introduction: Trauma-induced coagulopathy, acidosis, and hypothermia form a "lethal triad" that is difficult to treat and is associated with extremely high mortality. This study was performed at three academic centers to evaluate whether resuscitation with blood components could reverse the coagulopathy in a complex polytrauma model. **Methods:** Yorkshire swine (40 $\pm$ 5kg) were subjected to a three-phase protocol: (a) "Prehospital" phase = femur fracture, hemorrhage (60% blood volume), and 30 minutes shock + infusion of saline (3x shed blood) + induction of hypothermia (33°C); (b) "Early hospital" phase = grade V liver injury; and (c) "Operative" phase= liver packing. After liver packing, the animals (n = 60) were randomized to the following groups: (1) Sham instrumentation and anesthesia without hemorrhage/injuries, (2) fresh whole blood (FWB), (3) 6% hetastarch (Hextend), (4) fresh frozen plasma/packed RBCs in 1:1 ratio (1:1 FFP/PRBC), and (5) FFP alone. Treatment volumes were equal to the volume of shed blood. Hemodynamic and physiologic parameters and coagulation profile (thrombelastography, prothrombin time, activated partial thromboplastin time, international normalized ratio, and platelets) were monitored during the experiment and for 4 hours post treatment. **Results:** At the end of prehospital phase, animals had developed significant acidosis (lactate >5mmol/L and base deficit >9mmol/L) and coagulopathy. Post treatment mortality rates were 85% and 0% for the Hextend and blood component treated groups, respectively ($p <$ 0.05). Hemodynamic parameters and survival rates were similar in groups that were treated with blood products (FWB, FFP, and FFP: PRBC). Animals treated with FFP and Hextend had significant anemia compared with the groups that received red blood cells (FWB and FFP: PRBC). Treatment with FFP and FFP: PRBC corrected the coagulopathy as effectively as FWB, whereas Hextend treatment worsened coagulopathy. **Conclusions:** In this reproducible model, we have shown that trauma associated coagulopathy is made worse by hetastarch, but it can be rapidly reversed with the administration of blood components. Impressively, infusion of FFP, even without any red blood cells, can correct the coagulopathy and result in excellent early survival.

CASE REPORT

Cricothyroidotomy on the Scene in a Patient with Severe Facial Trauma and Difficult Neck Anatomy

Sylvia Archan MD; Gerhard Prause MD; Rainer Gumpert MD; Franz Joseph Seibert MD; and Bernhard Kügler MD
American Journal of Emergency Medicine (2009) 27, 133.e1–133.e4

ABSTRACT

We present a case of a patient with severe facial trauma who was treated at the scene by a physician-staffed trauma life support team. Because of massive oropharyngeal bleeding in addition to a difficult neck anatomy in a very obese patient, a cannot-intubate, cannot-ventilate situation occurred. Control of the airway could finally be achieved by surgical cricothyroidotomy. The current literature concerning emergency cricothyroidotomy is discussed.

Comparison of 10 Hemostatic Dressings in a Groin Puncture Model in Swine

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ABSTRACT

Background: The use of mineral (clay) or biologic (chitosan) materials has improved the efficacy of dressings used in the bleeding control of non-compressible areas. A series of novel manufactured products already evaluated in a vascular transection model was further compared in a severe vascular puncture injury model. **Methods:** Ten hemostatic dressings were tested in anesthetized Yorkshire swine hemorrhaged for 45 seconds in a femoral arterial puncture model. Application of these dressings was followed by 5 minutes of compression (about 175mmHg), and at 15 minutes, 500mL resuscitation fluid (Hextand) was infused during a 30-minute period. The animals were monitored for a 3-hour experimental observation period. Primary outcomes were incidence of bleeding after dressing application and animal survival. **Results:** Blood loss was 18.8% $\pm$ 5.2% estimated blood volume (EBV) after 45 seconds of free bleeding. Relative performance of dressings is characterized as groups of dressings that performed similarly. Recurrence of bleeding after application was observed with most dressings and was lower with Woundstat, Celox, X-Sponge, and ACS+ (35% $\pm$ 49%) compared with FP-21, Hemcon,

Chitoflex, and Bloodstop (79% ± 43%; $P < .01$). Blood loss after treatment was 25.3% ± 18.4% EBV for the top four dressings and 53.0% ± 18.4% EBV for the bottom four ($P < .05$). Survival was higher for top four vs bottom four dressings (78% ±12% vs 25% ± 0%, respectively; $P<.01$). Overall performance of these dressings according to survival, incidence of bleeding, and post-treatment blood loss, yielded similar ranking as with a previously tested transection injury model. **Conclusions:** The findings indicated that the efficacy of Woundstat, Celox, X-Sponge, and ACS+ were similar and superior in improving survival, hemostasis, and maintenance of mean arterial pressure in an actively bleeding wound caused in this severe vascular injury model. (*J Vasc Surg* 2009;50:632-9.) **Clinical Relevance:** Major improvements have been made in the development of novel dressings with hemostatic properties to control heavy bleeding in noncompressible areas. Hemostatic dressings offer promise in the military and civilian surgical environment for hemorrhage control in difficult situations. This animal-based study identified dressings with good absorption and good clotting abilities that ranked superior in terms of control of rebleeding. Also, these dressings might be beneficial in well-attended or remote surgical theaters as well as for first aid bandaging in extreme sport.

Incidence and Epidemiology of Combat Injuries Sustained During "The Surge" Portion of Operation Iraqi Freedom by a U.S. Army Brigade Combat Team

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Journal of Trauma. 2010;68: 204–210

Abstract

Background: A prospective, longitudinal analysis of injuries sustained by a large combat-deployed maneuver unit has not been previously performed. **Methods:** A detailed description of the combat casualty care statistics, distribution of wounds, and mechanisms of injury incurred by a U.S. Army Brigade Combat Team during "The Surge" phase of Operation Iraqi Freedom was performed using a centralized casualty database and an electronic medical record system. **Results:** Among the 4,122 Soldiers deployed, there were 500 combat wounds in 390 combat casualties. The combat casualty rate for the Brigade Combat Team was 75.7 per 1,000 Soldier combat-years. The % killed in action (KIA) was 22.1%, and the %died of wounds was 3.2%. The distribution of these wounds was as follows: head/neck 36.2%, thorax 7.5%, abdomen 6.9%, and extremities 49.4%. The percentage of combat wounds showed a significant increase in the head/neck region ($p < 0.0001$) and a decrease in the extremities ($p < 0.03$) compared with data from World War II, Korea, and Vietnam. The percentage of thoracic wounds ($p < 0.03$) was significantly less than historical data from World War II and Vietnam. The %KIA was significantly greater in those Soldiers injured by an explosion (26.3%) compared with those Soldiers injured by a gunshot wound (4.6%; $p = 0.003$). Improvised explosive devices accounted for 77.7% of all combat wounds. **Conclusions:** There was a significantly higher proportion of head/neck wounds compared with previous U.S. conflicts. The 22.1% KIA was comparable with previous U.S. conflicts despite improvements in individual/vehicular body armor and is largely attributable to the lethality of improvised explosive devices. The lethality of a gunshot wound in Operation Iraqi Freedom has decreased to 4.6% with the use of individual body armor.

Pain Management In Current Combat Operations

Ian H. Black, MD; John McManus, MD, MCR

Prehospital Emergency Care 2009;13:223–227

Abstract

Pain management in the U.S. Military, particularly in combat, shares many of the same principles found in civilian heath care organizations and institutions. Pain is one of the most common reasons for which Soldiers seek medical attention in the combat environment, which mirrors the civilian experience. However, the combat environment exacerbates the typical challenges found in treating acute pain and has the additional obstacles of a lack of supplies and equipment, delayed or prolonged evacuation times and distances, devastating injuries, provider inexperience, and dangerous tactical situations. These factors contribute to the difficulty in controlling a Soldier's pain in combat. Furthermore, civilian health care providers have also learned the importance of practicing pain management principles in austere and tactical environments because of recent natural and man-made domestic disasters. Pain management research, education, and treatment strategies have been created to try to achieve adequate battlefield analgesia, and these lessons learned may aid civilian healthcare providers if the circumstances arise. This article presents a brief history and current overview of pain management for combat casualties on today's battlefield. Recent natural disasters and increased threats for terrorist acts have proven the need for civilian healthcare providers to be properly trained in pain management principles in an austere or tactical environment.

CASE REPORT

The Bougie-Aided Cricothyrotomy

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Lauri Montanez, RN, MSN; George Kennedy, MD; and David Grimsley, EMT-P

Surgical cricothyroidotomy is considered a critical skill in emergency airway management, though it is rarely used and fraught with complications. A variety of approaches are taught, including both the standard and rapid four-step techniques. We report a case in which an air medical crew used a gum-elastic bougie (endotracheal tube introducer), a common device in many airway kits, to facilitate surgical cricothyroidotomy in a 58-year-old patient with a pharyngeal mass, respiratory failure, and failed rapid sequence induction. We believe this technique may decrease the time until ventilation, minimize complications compared with other cricothyroidotomy techniques, and allow insertion of a larger-diameter endotracheal tube compared with other techniques.

Experience with Chitosan Dressings in a Civilian EMS System

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The Journal of Emergency Medicine, Vol. 37, No. 1, pp. 1–7, 2009

ABSTRACT

The HemCon® Bandage (HemCon Medical Technologies Inc., Portland, OR) is a hemostatic dressing made of chitosan, a complex carbohydrate derived from chitin. The objective of this study was to determine the effectiveness of the HemCon® Bandage in a civilian emergency medical services system. The HemCon® Bandage was added to the trauma kits of a fire agency and data were collected from June 1, 2005 to August 31, 2006. The dressing was to be used when conventional treatment (pressure and gauze dressings) failed to control external bleeding wounds or for obvious arterial bleeding. Paramedics documented time to cessation of bleeding after HemCon® Bandage application as well as wound characteristics and suspected bleeding type. There were 37 uses and complete data were available for 34 cases. Wound location involved the head, neck, or face in 13 subjects and extremities in 18 subjects. There was one case each involving the chest, abdomen, and axilla. The bandage controlled hemorrhage in 27/34 (79%) cases, 25/34 (74%) within 3 min of application. In 25/34 cases, direct pressure had initially failed to control bleeding and the HemCon® Bandage was effective in 19/25 (76%). The HemCon® Bandage failed to stop bleeding within 10 min in 7 cases. User error was a factor in 6 of the 7 failures. The HemCon® Bandage is an effective adjunct for uncontrolled external hemorrhage when traditional measures, such as pressure and gauze dressings, fail.

Prehospital Spinal Immobilization Does Not Appear to Be Beneficial and May Complicate Care Following Gunshot Injury to the Torso

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Journal of Trauma. 2009;67: 774–778

ABSTRACT

Background: Prehospital spinal immobilization (PHSI) is routinely applied to patients sustaining torso gunshot wounds (GSW). Our objective was to evaluate the potential benefit of PHSI after torso GSW versus the potential to interfere with other critical aspects of care. **Methods:** A retrospective analysis of all patients with torso GSW in the Strong Memorial Hospital (SMH) trauma registry during a 41-month period and all patients with GSW in the National Trauma Data Bank (NTDB) during a 60-month period was conducted. PHSI was considered potentially beneficial in patients with spine fractures requiring surgical stabilization in the absence of spinal cord injury (SCI). **Results:** Three hundred fifty-seven subjects from SMH and 75,210 from NTDB were included. A total of 9.2% of SMH subjects and 4.3% of NTDB subjects had spine injury, with 51.5% of SMH subjects and 32.3% of NTDB subjects having SCI. No SMH subject had an unstable spine fracture requiring surgical stabilization without complete neurologic injury. No subjects with SCI improved or worsened, and none developed a new deficit. Twenty-six NTDB subjects (0.03%) had spine fractures requiring stabilization in the absence of SCI. Emergent intubation was required in 40.6% of SMH subjects and 33.8% of NTDB subjects. Emergent surgical intervention was required in 54.5% of SMH subjects and 43% of NTDB subjects. **Conclusions:** Our data suggest that the benefit of PHSI in patients with torso GSW remains unproven, despite a potential to interfere with emergent care in this patient population. Large prospective studies are needed to clarify the role of PHSI after torso GSW.

Clot-Inducing Minerals Versus Plasma Protein Dressing for Topical Treatment of External Bleeding in the Presence of Coagulopathy

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The Journal of TRAUMA® Injury, Infection, and Critical Care • Volume 69, Number 5, November 2010

Abstract

Background: Previous studies identified WoundStat (WS, smectite) and Combat Gauze (CG, kaolin-coated gauze) as the most effective available agents for controlling arterial bleeding with potential utility in casualty care. Tissue sealant properties of WS suggested its potential advantage over clot-promoting CG for treating coagulopathic bleeding. This study compared the efficacy of CG and WS with a fibrinogen-based (FAST) dressing to control bleeding in coagulopathic animals. **Methods:** Coagulopathy was induced in pigs (n = 55, 35kg) by ~50% isovolemic hemodilution and hypothermia (core temperature, 33°C ± 0.5°C). A 6-mm arteriotomy was made in the femoral artery and free bleeding allowed for 30 seconds. A test agent (n = 13–15 per group) or control product (gauze, GZ, n = 12) was applied to the wounds and compressed with a Kerlix gauze for 2 minutes. Fluid resuscitation was given, titrated to a mean arterial pressure of 65mmHg. Animals were observed for 180 minutes or until death. Angiography using the computed tomography method was performed on survivors, and local tissues were collected for histology. **Results:** No differences were seen in baseline measures. Coagulopathy, confirmed by a 31% increase in prothrombin time and a 28% reduction in clotting strength (maximum amplitude, thrombelastography assay), was similar in all groups before injury. The average pretreatment blood loss was 11.9 mL/kg ± 0.4 mL/kg with no difference among groups. Posttreatment blood loss, however, was significantly different ($p = 0.015$) ranging from 18.2 mL/kg ± 8.8 mL/kg (FAST) to 63.3 mL/kg ± 10.2 mL/kg (GZ controls). Stable hemostasis was achieved in 10 of 13 (FAST), 5 of 15 (CG), 2 of 15 (WS), and 1 of 12 (GZ) animals in each group, resulting in significantly different survival rates (8–77%; $p = 0.001$). The average survival times were 145 (FAST), 119 (CG), 75 (WS), and 74 (GZ) minutes for different groups ($p < 0.002$). The outcomes with the FAST dressing were significantly better than with WS or GZ in this coagulopathic bleeding model. Essentially, no difference was found between WS and GZ control. Computed tomography images showed limited blood flow only through the vessels treated with FAST dressings. Histologic observations of the vessels indicated minimal damage with FAST and CG and greater injury with WS with some residues present on the tissues. **Conclusion:** The tissue sealant property of WS is apparently mediated by clot formation in the wound; therefore, it was ineffective under coagulopathic conditions. CG was partially effective in maintaining blood pressure up to 1 hour after application. FAST dressing showed the highest efficacy because of the exogenous delivery of concentrated fibrinogen and thrombin to the wound, which bypasses coagulopathy and secures hemostasis.

High Plasma to Red Blood Cell Ratios Are Associated With Lower Mortality Rates in Patients Receiving Multiple Transfusion (4 ≤ Red Blood Cell Units < 10) During Acute Trauma Resuscitation

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The Journal of **TRAUMA®** *Injury, Infection, and Critical Care* • Volume 70, Number 1, January 2011

Abstract

Background: Benefits of high ratios of fresh frozen plasma (FFP) to packed red blood cells (pRBC) in massively transfused trauma patients have been reported previously. This study aimed to assess the effect of higher FFP: pRBC ratios on outcome in patients receiving less than massive transfusion during acute trauma care. **Methods:** The multicenter trauma registry of the German Trauma Society (2005–2008) was retrospectively analyzed for patients aged ≥16 years with an Injury Severity Score ≥16 who had received multiple but not massive transfusion between emergency room arrival and intensive care unit (ICU) admission, i.e., at least 4, but less than 10 pRBC units (4 ≤ pRBC units < 10). Patients who died within 1 hour after hospital admission were excluded. Three groups were analyzed according to FFP:pRBC ratio: low (<1:1, LR), balanced (1:1, BR), and high ratio (>1:1, HR). BR was defined as pRBC units = FFP units ± 1 FFP unit. **Results:** A total of 1,362 patients met study criteria (LR = 760, BR = 392, and HR = 210). Patient characteristics were similar among groups. For the three groups (LR, BR, and HR) sepsis was reported in 17.1%, 18.2%, and 17.6% ($p = 0.9$), incidence of multiple organ failure was 49.1%, 47.9%, and 52.4% ($p = 0.6$), whereas mortality was 26.8%, 21.7%, and 15.2% ($p = 0.001$), respectively. Ongoing pRBC-transfusion after ICU admission occurred in 68.1%, 66.7%, and 53.9% ($p < 0.001$), respectively. ICU/hospital lengths of stay were comparable between groups. Multivariate logistic regression identified a high FFP:pRBC ratio as independent predictor for survival (odds ratio, 0.52, p _ 0.013). **Conclusions:** Trauma patients receiving less than massive transfusion might also benefit from higher FFP:pRBC ratios, as these were associated with significantly lower mortality rates and decreased blood product utilization during subsequent ICU treatment, whereas morbidity was comparable among groups. Additional prospective trials are necessary.

Tactical Medical Solutions Inc / SOF Tactical Tourniquet 1.5" (SOFTT-W) / recall / DLA 11-004

1. MFR issued exchange notice on FOL MATL. Reason: Tactical Medical Solutions informed that material used in manufacturing SOF tactical tourniquet between 5 AUG 10 & 27 OCT 10 was not the same as was in original design.
This change of material resulted in tearing of tourniquet, at the point where windlass is attached, when excessive force is applied. DISP: Comply W/MFR/DIST instructions if received. Manufacturer is offering exchange for SOFTT-WS
Manufactured from 5 AUG to 27 OCT 2010. Exchange is required.
Questions, call 864-224-0081, 301-619-9589 or info@tacmedsolutions.com.

NSN: 6515-01-587-9943 UI: EA
NOM: Tourniquet Nonpneumatic Nylon Strap 1.5" Wide Quick Connect Meta
MFR: Tactical Medical
LOT/SERIAL NUMBER(S):
ALL MATL MFD 05 AUG 10
THRU & INCLUDING 27 OCT 10.

2. Pass message to medical log officers, command channels, clinical staff, med staff, supply officers, and supported activities/centers.

3. Authority: DODD 5105.22 and DODD 6025.13. Additionally:

A. Army: See Army Regulation (AR) 40-61, 28 JAN 2005, chapter 4, and the Department of the Army Supply Bulletin (SB 8-75-11) for applicable policies and procedures.

B. Air force: AF activities will take action as prescribed in AFI 41-209, medical logistics support, chapters 3 and 9. For MAJCOMS & NGB—this message has been transmitted to all designated subordinate medical activities.

4. Service specific POCS are as FOLS (fax numbers. Are available 24 hrs);

Army: telephone com: 301-619-4300, dsn: 343, fax: 4468, E-mail: quadservicemmqc@amedd.army.mil

Army members may subscribe to DODMMQC messages and many other topics at the Following website: http://www.usamma.army.mil/assets/apps/nala_qaweb/nala_index.cfm
Click on "subscribe to MMQC messages here."

USAMMCE: telephone com: 011-49-6331-86-7118/7181, DSN: 495-7118, fax: 6218, E-mail: usammce_qa@amedd.army.mil

Air force: telephone com: 301-619-4170, DSN: 343, fax: 6844, E-mail: afmoa.sgalc@detrick.af.mil

Air force members may subscribe to the DODMMQC messages and many other topics at the following website: https://medlog.detrick.af.mil/mlc/site_apps/afmlo/product/cfm/list_dodmmqc.cfm. Go to list server and select the category "DOD medical materiel quality control (DODMMQC)."

Navy: telephone com: 301-619-3085, DSN: 343, fax: 3087, Email: mmqc2@med.navy.mil

Navy members may subscribe to receive DODMMQC messages at http://www.usamma.army.mil Click on "subscribe to MMQC messages."

BOLIN CHEST SEAL (NSN 6510-01-549-0939) SAFETY ALERT NOTICE

The Joint Department of Defense Medical Material Program Office (DMMPO) issued a safety alert on Bolin Chest Seals (BCS). The BCS is a sterile occlusive dressing for treating open pneumothorax and preventing tension pneumothorax that result from gunshots, stab wounds, or other penetrating chest trauma.

1. The triple valve design of the BCS allows air and blood to escape while preventing the re-entry of either, thereby eliminating any unwanted gas or liquid exchange at the trauma site.

2. The DMMPO test and evaluation division performed a medical equipment evaluation on seven BCS used to treat casualties in the field. The evaluation found three BCS were defective. Overlay plastic that has holes cut to lay over valves were not positioned properly on the chest seal device. This defect prevents valves from operating properly.

3. Per the BCS manufacturer's instructions, do not roll the BCS or fold the BCS on the valves to fit into the carrier (i.e., CLS kit and Corpsman Assault Pack). Tests have shown that the adhesive, which hold the valves, will fracture and come loose from their setting if rolled or not properly folded. The BCS can be folded without stressing the valve area by folding the polyurethane disc over the valve area.

4. Inspect all BCS to ensure all valves will align properly with vent holes (see image at the website for proper alignment): http:/usamma.detrick.army.mil/ftp/mmqc_pictures/mmqc-10-1626.pdf).
Realign if needed. Without opening the package, adjust the valves into proper alignment with premade holes using your thumbs. If the BCS valves cannot be realigned properly, replace the BCS.

5. Inspect the BCS prior to use on a patient and ensure all valves are aligned properly. If valves cannot be adjusted, perform needle decompression in event of tension pneumothorax.

6. The BCS is a component in the following Marine Corps authorized medical allowance lists (AMAL) and medical kits.

TAMCN	AMAL/KIT	QTY IN AMAL OR KIT
C86408	AMAL 636	20
C87458	AMAL 645	12
C86568	AMAL 646	12
C53322e	Corpsman Assault Pack	4
C80088	Combat Lifesaver Kit	1

7. Also, the BCS has a shelf life of three years and requires shelf life monitoring. The first two numbers of the lot number on BCS package represent the year of manufacture. Unit stocks of BCS that are defective or expired must be replaced using military standard requisitioning and issue procedures (MILSTRIP).

8. Marine corps units that possess medical material should designate personnel to screen department of defense medical material quality control (MMQC) messages at
Http:/www.usamma.army.mil/assets/apps/nala_qaweb/nala_index.cfm. The primary purpose of MMQC messages is to alert DOD medical personnel of issues and concerns related to medical supplies and equipment. //

Meet Your JSOM Staff

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Prior to becoming the USSOCOM Command Surgeon, COL "Tom" Deal served in staff positions at USASOC, JSOC, 7th SFG, and XVIII Airborne Corps. He has commanded field and stateside hospitals and served as Chief of Surgery in the 86th Evac Hospital in ODSS and at Army and civilian community hospitals.

COL Deal obtained his medical degree from University of Tennessee College of Medicine, Memphis, Tennessee, 1974. He completeted his general surgery residency at Brooke Army Medical Center 1977-1981 and is certified by the American Board of Surgery.

COL Deal competed his Flight Surgeon's Course – 2003, Army War College – 1997, Command & General Staff College – 1994, AMEDD Officer Advanced Course – 1991, Military Free Fall School – 1977, Special Forces Officers Course – 1976, and Airborne School – 1975.

COL Deal has also completed Combat Casualty Care Leadership Course (C4A) –1991, Pre-Command Course, Fort Leavenworth – 1994, Senior Officer's Legal Orientation, Charlottesville -- 1994, Combatant Commander's Surgeons Course – 1996, AMEDD Pre-Command Course, Fort Sam Houston – 1998, Basic Life Support – current, Advanced Cardiac Life Support, Advanced Trauma Life Support, and Pilot, single engine, land, instrument.

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Lt Col Landers joined the Army Reserve in 1987 and served as a nurse in a Combat Support Hospital unit for three years before switching services in 1990 to become an Air Force C-130 Flight Nurse. She is currently an IMA reservist assigned to HQ AF Reserve Command/SG and is attached to the SOCOM/SG office where she has been in charge of management, production, publication, and distribution of the JSOM since its inception in Dec 2000. Lt Col Landers has a Bachelors in Nursing and a Masters in Business Administration/Management. Her 25 year nursing career includes being a flight nurse in both the military and private sector, 15 years of clinical experience in emergency and critical care nursing, as well as being an EMT and a legal nurse consultant. She also served as the military liaison to the FL 3 Disaster Medical Assistance Team (DMAT). Prior to the SG office, Lt Col Landers' experience at USSOCOM includes an assignment in the Center for Force Structure, Resources, Requirements, and Strategic Assessments.

Submission Criteria

1. Use the active voice when possible. This is our most common editorial problem and often requires extensive re-writes. Use the sequence "subject - verb - object."
2. Secure permission before including names of personnel mentioned in your piece. Do not violate copyright laws. If the work has been published before, include that information with your submission.
3. Format articles to be single-spaced, ten point Times Roman font, aligned on the left, and justified on the right. Double space between sentences.
4. **Important:** Include an abstract, biography, and headshot photo of yourself as part of the article.
5. Use a minimum of acronyms; spell out all acronyms when first used. Remember that your audience is inter-service, civilian, and international.
6. Put the point of the article in the introductory paragraph and restate it in the closing or summary. Subtlety is not usually a virtue in a medical publication.
7. We do not print reviews of particular brands of items or equipment unless that brand offers a distinct advantage not present in other products in the field. The author must specify in the article the unique features and advantages the product offers in order to justify an exception to this rule. The author must also specify whether the article was purchased by him or his unit, or supplied for free by the seller or manufacturer. Finally, the author must disclose any relationship with the manufacturer or seller, whether financial, R&D, or other.
8. **DO NOT insert endnotes or use roman numerals**. Cite all references in order of use; the reference number remains the same if used multiple times. Give the full name of the journal, book, or website cited. Use the following style of citation when referencing a **Journal article** - Vogelsang, R. (2007). Care of the military working dog by medical providers. *Journal of Special Operations Medicine*, 7(2)(Spring):33-47. **Newspaper article -** DiRado, A. (1995, March 15). Trekking through college: Classes explore modern society using the world of Star Trek. *Los Angeles Times*, p. A3. **Book article or chapter -** Giger, Urs (2000). Blood typing and crossmatching to ensure compatible transfusions. In John Bonagura Ed. Kirk's *Current Veterinary Therapy XIII Small Animal Practice*. Philadelphia, WB Saunders Co. 2000, p. 140-147. **Website -** Miles, D. (2004, Sep. 3), Military working dogs protect Forces, bases during terror war. Armed Forces Press Service. Retrieved July 1, 2008 from Defense Link website. Website: (http://www.defenselink.mil/news/newsarticle.aspx ?id=25393). If unsure, please contact the editor at JSOMeditor@gmail.com.
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11. Special Operations require sensitivity to natives of host countries, occupied regions, and so on. We feel that patronizing terms generally are inappropriate for our pages. Realistic language of Operators (including some "four-letter" words) may be tolerated in anecdotal and historical articles, especially when used as direct quotes or when such use is traditional among operators. We will delete or change blatantly offensive use.
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13. Send submissions by email to JSOMeditor@gmail.com.

The JSOM is your journal and serves as a unique opportunity for you to pass your legacy to the SOF medical community!

Special Forces Aidman's Pledge

As a Special Forces Aidman of the United States Army, I pledge my honor and my conscience to the service of my country and the art of medicine. I recognize the responsibility which may be placed upon me for the health, and even lives, of others. I confess the limitation of my skill and knowledge in the caring for the sick and injured. I promise to follow the maxim "Primum non- nocere" ("First, thou shalt do no harm"), and to seek the assistance of more competent medical authority whenever it is available. These confidences which come to me in my attendance on the sick, I will treat as secret. I recognize my responsibility to impart to others who seek the service of medicine such knowledge of its art and practice as I possess, and I resolve to continue to improve my capability to this purpose. As an American Soldier, I have determined ultimately to place above all considerations of self the mission of my team and the cause of my nation.

Pararescue Creed

I was that which others did not want to be. I went where others feared to go, and did what others failed to do. I asked nothing from those who gave nothing, And reluctantly accepted the thought of eternal lonliess ... should I fail. I have seen the face of terror; felt the stinging cold of fear, and enjoyed the sweet taste of a moment's love. I have cried, pained and hoped...but most of all, I have lived times others would say best forgotten. Always I will be able to say, that I was proud of what I was: a PJ It is my duty as a Pararescueman to save a life and to aid the injured. I will perform my assigned duties quickly and efficiently, placing these duties before personal desires and comforts.

These things I do,
"That Others May Live."

A Navy Poem

I'm the one called "Doc"... I shall not walk in your footsteps, but I will walk by your side. I shall not walk in your image, I've earned my own title of pride. We've answered the call together, on sea and foreign land. When the cry for help was given, I've been there right at hand. Whether I am on the ocean or in the jungle wearing greens, Giving aid to my fellow man, be it Sailors or Marines. So the next time you see a Corpsman and you think of calling him "squid," think of the job he's doing as those before him did. And if you ever have to go out there and your life is on the block, Look at the one right next to you...

I'm the one called "Doc".

~ Harry D. Penny, Jr. USN

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