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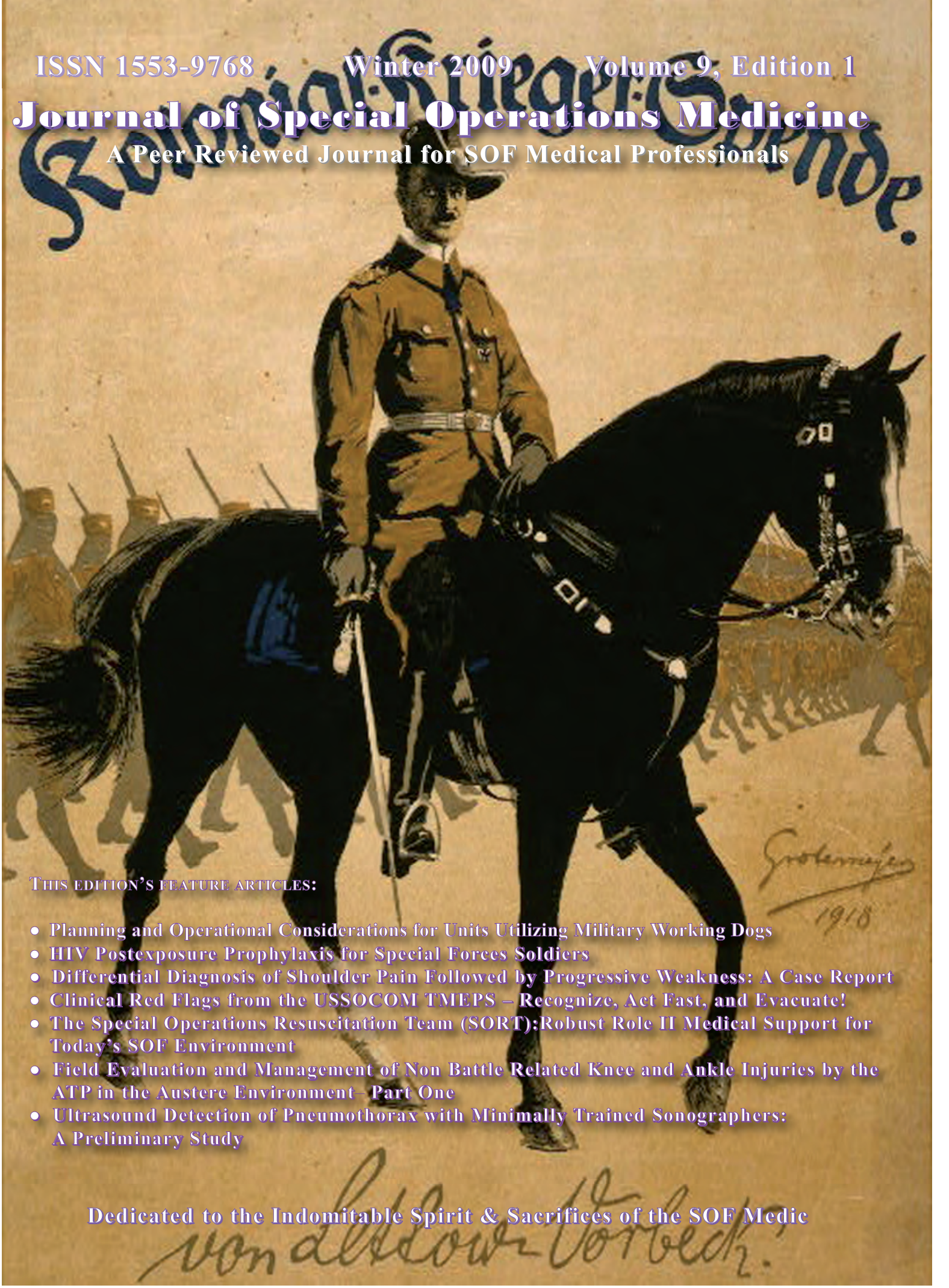
A Peer Reviewed Journal for SOF Medical Professionals



THIS EDITION'S FEATURE ARTICLES:

Dedicated to the Indomitable Spirit & Sacrifices of the SOF Medic

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Journal of Special Operations Medicine

COVER

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Poster of German General Paul von Lettow-Vorbeck, World War I guerrilla leader in Africa. See article on page 93.

From the Editor

The Journal of Special Operations Medicine (JSOM) is an authorized official military quarterly publication of the United States Special Operations Command (USSOCOM), MacDill Air Force Base, Florida. The JSOM is not a publication of the Special Operations Medical Association (SOMA). Our mission is to promote the professional development of Special Operations medical personnel by providing a forum for the examination of the latest advancements in medicine and the history of unconventional warfare medicine.

 Articles, photos, artwork, and letters are invited, as are comments and criticism, and should be addressed to Editor, JSOM, USSOCOM, SOC-SG, 7701 Tampa Point Blvd, MacDill AFB, FL 33621-5323. Telephone: DSN 299-5442, commercial: (813) 826-5442, fax: -2568; e-mail JSOM@socom.mil. The JSOM is serial indexed (ISSN) with the Library of Congress and all scientific articles are peer-reviewed prior to publication. The Journal of Special Operations Medicine reserves the right to edit all material. No payments can be made for manuscripts submitted for publication.

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To qualify for 1 CME, it must take 60 min to both read the article and take the accompanying test. To accomplish this, your articles need to be approximately 12 ─ 15 pages long with a 10 ─ 15 question test. The JSOM continues to survive because of the generous and time-consuming contributions sent in by physicians and SOF medics, both current and retired, as well as researchers. We need your help! Get published in a peer-review journal NOW! See General Rules of Submission in the back of this journal. We are always looking for SOF-related articles from current and/or former SOF medical veterans. We need you to submit articles that deal with trauma, orthopedic injuries, infectious disease processes, and/or environment and wilderness medicine. More than anything, we need you to write CME articles. Help keep each other current in your re-licensure requirements. Don't forget to send photos to accompany the articles or alone to be included in the photo gallery associated with medical guys and/or training. If you have contributions great or small… send them our way. Our e-mail is: JSOM@socom.mil.

Lt Col Michelle DuGuay Landers

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Dedication

HM2(FMF/DV/FPJ) Charles "Luke" Milam

HM2 Charles "Luke" Milam was born in 1981 in Albuquerque, New Mexico. He graduated from Columbine High School, Littleton, CO, in May 1999. He enlisted in the Navy June 1999 with a guarantee of Hospital Corpsman "A" School.

HM2 Luke Milam was a Special Amphibious Reconnaissance Corpsman (SARC) for over five years. During this short period HM2 Milam made three combat tours in Iraq and was on his fourth combat tour, this time in Afghanistan, when he was killed while conducting a combined joint operation with Afghan National Army forces and United States Army Special Forces in the Helmand Province.

Despite already being a highly decorated and combat tested Special Amphibious Reconnaissance Corpsman, he sought more specialized training to become a more technically and tactically competent warrior. He attended and graduated from a variety of both physically and mentally demanding courses, which included: Military Freefall School (MFF), Marine Multi Mission Parachute System (MMPS), Diver Propulsion Device course (DPD), Special Operations Forces Medical Skills Sustainment Program (SOFMSSP), and Dynamic Assault and Special Reconnaissance course (DASR). In addition, he qualified as Combatant Diver Supervisor and a Tactical Combat Casualty Care (TCCC) Course Instructor.

HM2 Milam transitioned with 2d Force Reconnaissance Company into 2d Marine Special Operations Battalion (2d MSOB), Marine Forces Special Operations Command (MARSOC) in Feb 2006. He was assigned to Golf Company, 2d MSOB and immediately began pre-deployment work-ups in preparation for his fourth combat tour. The work-up included a full TCCC course instructed by HM2 Milam to over 100 Marines. He spent countless after-hours preparing the company for the deployment and managed a full immunization program to include anthrax, ensuring all physical exams were fully up-to-date. His company deployed 100% medically and dentally ready.

In September 2007, HM2 Milam was conducting a combined joint operation with Afghan National Army forces and United States Army Special Forces. HM2 Milam's position came under sustained enemy mortar, RPG, and small arms fire. Milam quickly maneuvered his vehicle to an advantageous position where he could provide suppression of the enemy and allow the Marine snipers to displace. He selflessly exposed himself to enemy fire to allow the Marine snipers to break contact safely and displace to positions with more adequate cover. HM2 Milam's suppressive fire was so effective that the enemy began to concentrate their efforts on his position. An enemy round impacted his gun position and inflicted a fatal wound on HM2 Milam.

HM2 Milam was selected as Marines Forces Special Operations Command “Operator of the Year” for 2006. He always went above and beyond in his duties as Platoon Corpsman and has set the standard for future MSOC operators. His flawless performance, technical and tactical proficiency, excellent leadership, and supreme courage under the most demanding combat situations made him most deserving of the recognition as Special Operations Combat Medic of the Year.

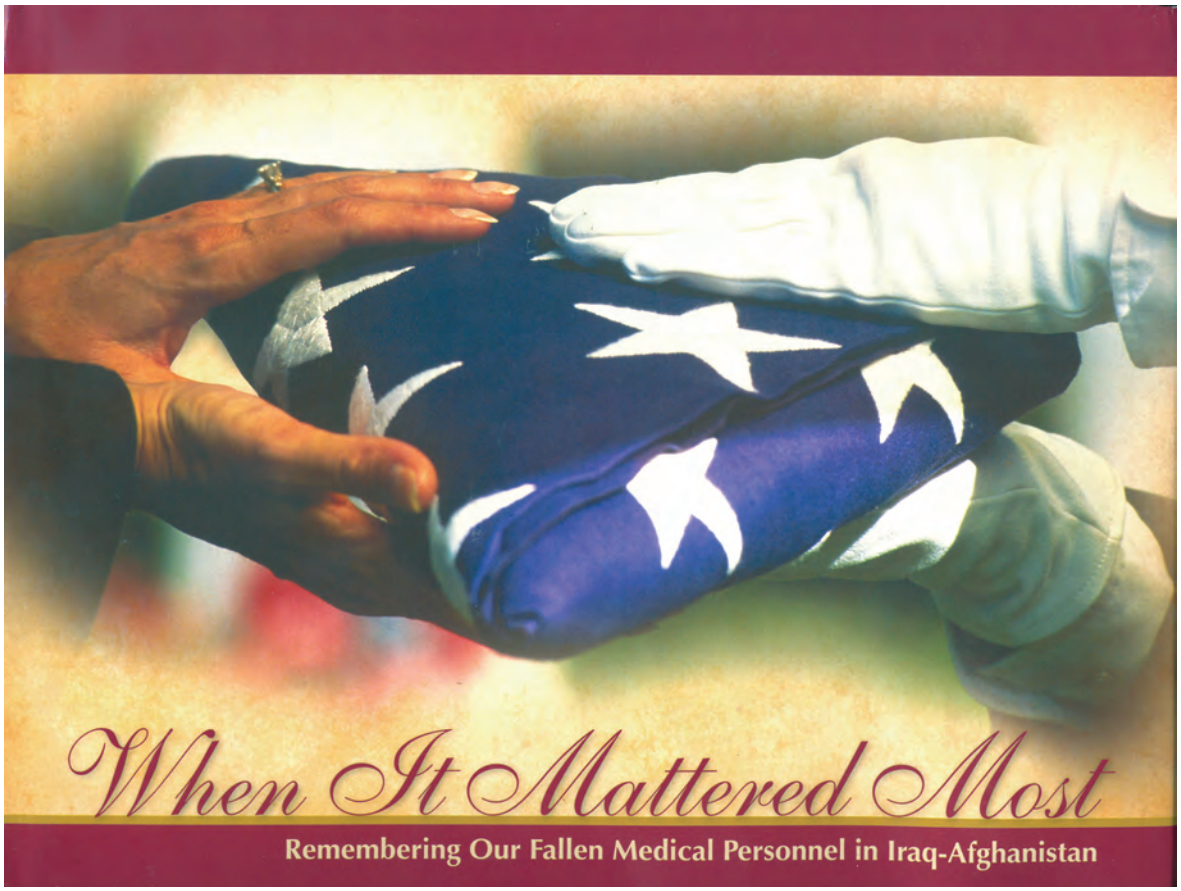
Luke was awarded his second Bronze Star with combat "V" and also received a second Purple Heart for his actions on 12 Nov 2004 in Iraq.

HM2 Luke Milam is survived by his parents, Michael and Rita Milam; a sister, Jaeme, and two brothers, Keith and Andrew.

When It Mattered Most – Remembering Our Fallen Medical Personnel in Iraq-Afghanistan

Casscells, S. Ward. Office of the Assistant Secretary of Defense for Health Affairs, Government Printing Office: Washington, D.C., 2008. ISBN: 978-0-16-08 1852-3. Hardback. 438 pages.

A book review by COL Warner D. (Rocky) Farr



When It Mattered Most is the first accounting of the sacrifices of medical personnel from all Services in the Global War on Terror (GWOT). It chronicles the deaths of medical Soldiers, Sailors, Airmen, and Marines from 2001 to 30 June 2008. Clearly, the compilation of this book is the idea of Dr. Casscells, a colonel in the U.S. Army Reserve who was deployed to Iraq in 2006 as the liaison from Multinational Force – Iraq to Ambassador Zalmay Khalilzad and who is the ranking physician in the Department of Defense. The book is well executed by Mary Sarnecky, John Greenwood, and many others. Our own Lt Col Duguay-Landers gets a nod in the preface as she cross-referenced our Journal of Special Operations Medicine (JSOM) Medic dedication pages with the author's sources.

The first Soldier profiled, the only medical Soldier death in GWOT 2001, is our own Master Sergeant Jefferson D. (Donnie) Davis, USA, who was killed in Afghanistan on 5 December 2001. Master Sergeant Jefferson D. (Donnie) Davis was a great Special Forces Medical Sergeant (18D) that I knew when he was the senior instructor at the Joint Special Operations Medical Training Center at Fort Bragg while I was assigned to USASOC. Having walked with his surviving teammates on the exact ground he died on less than a month after his death, I remember this first death well.

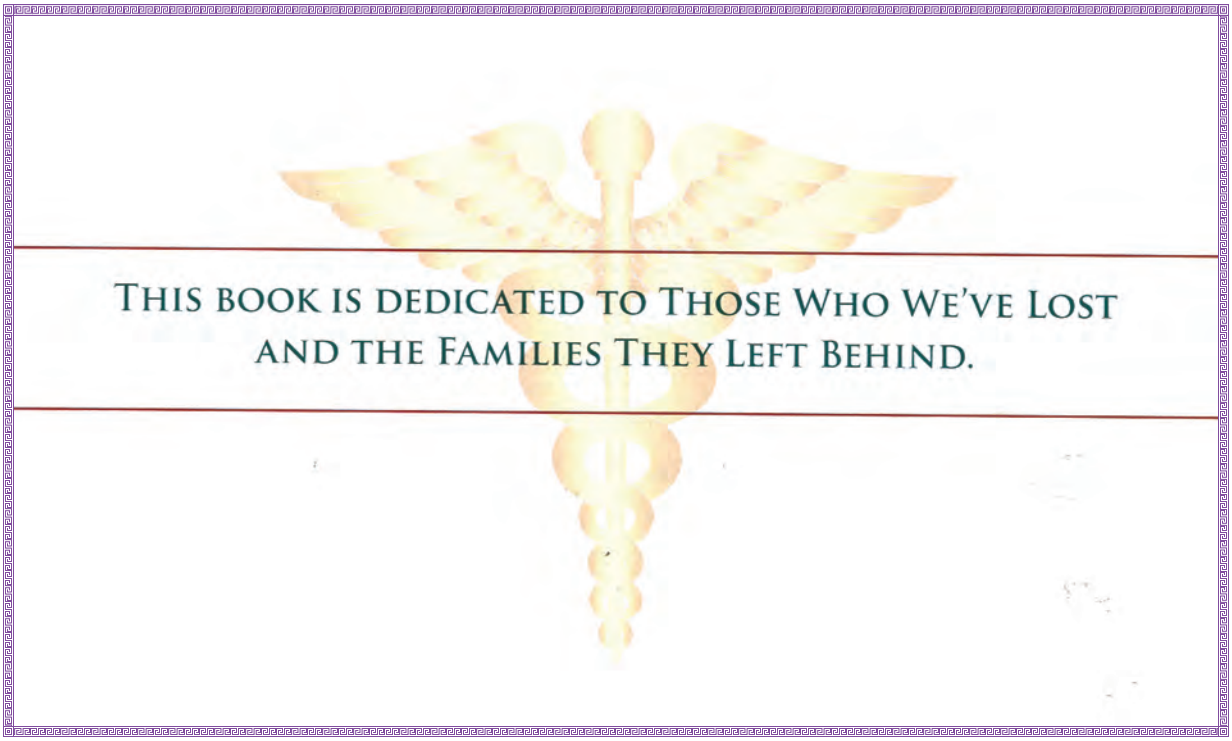
Turn the page and the second GWOT SOF Medic death is CPO Matthew J. Bourgeois, a SEAL, killed 27 March 2002. The entire book examines the stories of these great Medics who died in the service of their Country: from **USASOC Command –** Christopher J. Speer and Richard J. Herrema; from **1st SFG –** Michael J. Tully and Nathan L. Winder; from **3rd SFG** – Tony B. Olaes and Peter P. Tycz II; from **5th SFG** – Dustin M. Adkins,

William M. Bennett, Jefferson D. Davis, Gary R. Harper Jr, Aaron N. Holleyman, Kevin N. Morehead, and Justin R. Whiting; from **7th SFG** – Allen C. Johnson, Thomas D. Maholic, Timothy P. Padgett, Jeffrey M. Rada Morales; from **20th SFG** – Roy A. Wood; from the **160th SOAR(A)** – Marcus V. Muralles; from **SEAL Team Ten** – Jeffrey S. Taylor; from MARSOC – Charles Luke Milam; from **USACAPOC** – Lawrence E. Morrison; Charles R. Soltes, Jr, Anton J. Hiett, Meredith L. Howard, and Nathan J. Vacho.

Missing from this edition are **AFSOC** PJs Jason D. Cunningham, Scott E. Duffman, Michael Maltz, and Jason Plite; all lost their lives in Afghanistan. Their loss will be acknowledged in the upcoming second edition.

There are several nurses, physicians, MEDEVAC pilots, and Medical Service Corps officers — one is shown in her West Point uniform as she was killed as a 2nd lieutenant — a true cross section of America. The highest ranking seems to be colonel and the lowest ranks I saw were private first class, Hospital Corpsman, and senior airman.

Obviously they did not get them all. It is especially true in our SOF community that some will be missing or unsung. Plus, in our community, the "Medic" is more the shooter next to us than the guy or gal with the big red cross. A second edition is already planned. If you get this book, which I recommend, and you see any other missing medical comrades, please let our JSOM editor know at jsom@socom.mil. In summary, a great first effort, a task that needs continuing, a tribute to our fallen medical comrades, well done!



Planning and Operational Considerations for Units Utilizing Military Working Dogs

Joseph Royal, DVM; Charles L. Taylor, MD

Abstract

Military working dogs are rapidly becoming integral to military operations. While they bring many valuable capabilities to the battlefield, it is important that Special Operations leaders consider canine team capabilities and requirements when planning missions. Careful logistical and operational planning can optimize the health, performance, and readiness of the working dog while protecting the safety and well-being of the team members working with them. We also offer recommendations for medical treatment of dog bites.

Figure 1: MWD used in clearing operations. Photo courtesy of http://www.uswardogs.org.

Introduction

Military working dogs (MWDs) play an increasingly important role in Special Operations. Canine teams bring valuable capabilities to the Special Operations unit.[1] MWDs can be used in reconnaissance, cordon and search, checkpoints, roadblocks, explosives detection, narcotics detection, crowd control, tracking and apprehension of enemy combatants, clearing buildings, and other activities. (Figure 1) They can provide a field-expedient alarm and security system. MWDs have been used to inspect suspicious packages, rapidly screen large amounts of cargo, and to search gear and equipment belonging to detainees. Canines endow the team with acute senses in light and dark settings, provide a show of force as a visible deterrent to enemy activity, and can maneuver rapidly and close quickly with the enemy in a highly compact environment. Canine teams bring many of the above capabilities, and others, to the battle in support of SOF operations.

As the use of MWDs is relatively new to much of the Special Operations community, most unit leaders have little experience integrating MWDs into their operations. The fielding, maintenance, and utilization of MWDs is not a self-sustaining process. MWDs, like all military personnel, require certain conditions and support elements to maintain maximal effectiveness. To gain the maximum benefit from canine units, teams that work with dogs must take factors into consideration relating to canine health, handling, and safety.

Transportation and Housing

Transportation of dogs in the operational environment requires certain provisions. Dogs are often transported in kennels or shipping crates while in aircraft or ground vehicles.[2] Depending on mission duration, dog handlers may transport significant amounts of equipment and dog food, which is usually not procurable in a deployed environment. Space allocation for kennels and equipment should be included in any plans involving MWD movement.

Transport in the confined spaces of vehicles and kennels greatly increases the risk of heat injuries to canines. This risk can be exacerbated by dehydration, a thick fur coat, tight muzzles that inhibit panting, or lack of airflow. These conditions may result in heat injury in the dog well before any of the human occupants are affected. Vehicles used to transport dogs in hot weather

should be air conditioned or well ventilated.[3] Kennels should be placed in the vehicle so that there is maximal airflow through and around the kennel. Dogs should never be left in a vehicle or any other enclosed, non-ventilated space in warm or hot weather without adequate ventilation or air conditioning.

Housing of the dog can have a great effect on health and readiness. In the past, teams have housed dogs with the handler inside their living unit, in temporary crates or transport kennels, or in dedicated kennels constructed on site. Regardless of the housing type utilized, all canine housing should be well ventilated. Enclosed kennels in extreme environments require climate control (e.g., air conditioning in summer in Iraq) to maintain the ambient temperature between 45 and 85°F.[4] Outdoor kennels should have shade and airflow, especially in hot weather, and protection from wind, rain, and snow in cold weather.[3] Kennels should never have persistent moisture or standing water in or around them.[1] Regardless of housing methods used, all teams housing and working with dogs should consult with a veterinarian for guidance on housing arrangements.

HEALTH HAZARDS

Combat operations pose many traumatic and non-traumatic health risks to the working dog. A typical mission may involve the dog running several miles. This level of exertion can increase the risk of heat injuries, especially in hot or humid weather. Such conditions may necessitate frequent work-rest cycle implementation, which should be integrated into mission planning.

Certain environmental hazards (hot tarmac, broken glass, concertina wire, chemicals in the environment, etc.) may put dogs at risk for injuries while on missions. Lacerations and abrasions to the paw are common and can be painful enough to impair or disable the working dog. Some dogs will tolerate protective covering on the feet, but most paw injuries can best be prevented by avoiding surfaces that might damage the exposed paw. (Figure 2) Planning for such factors can minimize such injuries and their impact on the mission.

Dogs present a particular difficulty in the presence of chemical, radiological, or biological threats. No safe, effective personal protective equipment (PPE) is currently issued for use by MWDs. Therefore, avoidance and shelter may be needed to protect them. Furthermore, a dog that is fearful or in pain may bite team members, compromising their PPE and increasing the risk for exposure to harmful agents.[5,6] The dog may not recognize otherwise familiar individuals — including the handler — who are wearing protective gear. It would, therefore, be beneficial to conduct training in PPE with the MWD, both for familiarization and to assess the dog's reaction, in a controlled environment. Decontamination and medical treatment and prophylaxis guidelines for MWDs exposed to chemical, radiological, or biological agents have been published.[5,6]

Figure 2: Canine booties are sometimes used to protect paws on hazardous or abrasive surfaces.
Photo courtesy of http://www.uswardogs.org .

Some canine toxic hazards can be found in and around the SOF team housing area. Most of these are non-toxic to humans and are easily overlooked. Some items that can be toxic to dogs include chocolate (especially dark chocolate), antifreeze, prescription medications, over-the-counter medications (e.g., acetaminophen, ibuprofen), xylitol chewing gum, and grapes or raisins.[7] Dogs should always be supervised, and such items should be stored out of their reach.

In combat theaters, indigenous dogs are sometimes utilized for base security. However, without proper healthcare these animals can put the health of servicemembers and MWDs at risk. They can be a source of infectious and parasitic disease for MWDs and pose a high risk of wounds if they fight with MWDs. Ideally, teams working with MWDs would not employ indigenous force protection dogs. However, if these are used, certain measures must be taken to protect military-owned animals. Indigenous dogs should never interact directly with MWDs. They should also have limited or no indirect contact with MWDs (e.g., shared bedding, food and water dishes, leashes, living areas etc.).

Because strict separation may not be practical in all situations, additional measures should be used to protect MWD well-being. To mitigate the risk of infectious disease, the team Medic, under the auspices of his team leader/commander and with guidance of a veterinarian, should ensure that all force protection dogs receive appropriate vaccinations (rabies, distemper, parvovirus, adenovirus, leptospirosis) and antiparasitic treatment. Teams should provide for adequate nutrition, record keeping, and medical care for these dogs, and not allow them to mingle with the local feral dog population. In

certain locations, with proper authorization, force protection canines are authorized treatment (including surgical sterilization) at theater veterinary treatment facilities.[8]

Veterinary Medical Treatment

Veterinarians are rarely, if ever, present at the point of injury on the battlefield, and in almost all cases, Medics and handlers will provide first aid and often higher level care to injured or sick MWDs. For this reason, teams that work with dogs need to ensure their Medics are adequately trained in veterinary medicine. With their background and training in trauma medicine, SOF Medics are well equipped to handle many types of canine trauma. The presence of veterinary trained SOF Medics on the battlefield is an extremely efficient way to greatly enhance our ability to care for canine patients in the field.

Teams should set aside time for their Medics to do veterinary training while in garrison, and Medics should actively seek this training. Unit veterinarians will readily provide training and hands-on experience to SOF Medics as well as reading material on canine medicine.

Most canine handlers carry veterinary first aid kits, and team Medics should become familiar with their contents and how they should be used. Prior communication with handlers on a specific dog's health related issues (e.g., prior heat injuries, aggressive behavior, allergies, etc.) will enable better care and safety when treating in the field.

Medics should also be versed in medical evacuation procedures for dogs. For example, they should know veterinary facility locations in theater for evacuation, and they must understand that when the dog is injured and evacuated, the handler must accompany the dog, and will thus be temporarily taken out of the fight.

Figure 3: MWD bite training.
USAF photo by Robbin Cresswell

Team leadership should alert their unit veterinarian, medical staff, and chain of command any time a dog is evacuated for medical reasons. Team Medics and dog handlers should establish relationships with their nearest theater veterinary assets and seek out contingencies for veterinary care (e.g., civilian, coalition force, or civil affairs veterinarians).

Safe handling of MWDs

The use of working dogs entails some risks. Their aggressive disposition and attack training occasionally result in inappropriate bites. (Figure 3) Extreme caution is needed when handling injured MWDs because fear, pain, and stress can greatly increase the risk of a bite. (Figure 4) Ensure handlers properly restrain and muzzle dogs for all medical procedures or any other time there is an increased risk of indiscriminant biting.

Figure 4: MWD aggresssion.
USAF photo by Meredith Canales

Pre-mission familiarization and socialization of dogs with team members, including training with them in garrison, may also decrease the likelihood of an inappropriate bite during operations. However, Operators should always remain vigilant, since pain or fear may cause a dog to bite even a familiar individual. All team members must know where the handler carries his dog muzzle, and handlers should train team members on how to apply the muzzle and make a field expedient muzzle. (Figure 5)

Treatment of Dog Bites

A bite from a military working dog is treated the same as any other dog bite. An examination of the wound is performed to evaluate for injury to vital structures: nerves, tendons, joints, or vascular structures. The wound should be cleansed with soap and water. A topical antibiotic and sterile dressing can then be applied. Bites should not be closed because of the in-

Figure 5: A field expedient muzzle made using the dog's leash.

creased risk of infection. If vital structures are injured, a surgeon should be consulted. The dog handler should examine the MWD's mouth for missing or broken teeth which may be left in the wound.

Approximately five percent of dog bites become infected.[9] Hand wounds become infected more often than wounds elsewhere. The wound infection rate can be decreased by copious irrigation.

Antibiotic prophylaxis is a reasonable course of action if follow-up cannot be assured. For adults without a penicillin allergy, 875mg of amoxicillin – 125mg clavulanate PO bid for seven days is the antibiotic of choice. For the penicillin allergic, 300mg clindamycin PO qid with a fluoroquinolone for seven days is a reasonable alternative. Trimethoprim-sulfamethoxazole is used for children rather than a fluoroquinolone.[10]

All dog bite cases must be evaluated by a medical provider. Medical providers (to include SOF Medics) should immediately consult with local area preventive medicine and veterinary officers for evaluation of rabies risk and to coordinate veterinary examination of the animal involved in the biting incident. These communications should be documented on DD Form 2341, *Report of Animal Bite – Potential Rabies Exposure*. This form is filled out for all animal bite cases and forwarded to the appropriate veterinary and preventive medicine officers for evaluation.[11]

In MWDs, the immunization status of the dog is known, and rabies post-exposure prophylaxis is rarely indicated. However, tetanus immunization is advised. Having the handler carry antibiotics for disseminating in the event of a dog bite is a sound practice as the unit Medics are unlikely to carry them on combat missions. Carrying tetanus vaccine is not advised because of the requirement for refrigeration. Tetanus immunization schedules vary based on the previous level of immunization. The incompletely immunized should receive tetanus immune globulin and begin the usual immunization schedule. The most conservative regimen would be to immunize all who have not received a booster within five years.

Conclusion

MWDs can increase operational efficiency, enable mission success, and protect the lives of servicemembers. To optimize MWD performance and to protect the health and safety of all troops, unit leadership needs to understand the requirements and capabilities of MWDs when planning for canine-assisted missions. Awareness of and planning for the logistical and operational requirements of working with canine units will ensure we maintain an effective canine force.

Photo courtesy of http://www.uswardogs.org

Photo courtesy of http://www.uswardogs.org

Key points

- **MWDs are susceptible to heat injury.**
- **Protect MWDs from environmental hazards.**
- **Avoid MWD contact with indigenous dogs.**
- **Familiarize MWDs with team members and tactics.**
- **Know veterinary medical theater footprint.**
- **Injured MWDs may bite; use proper restraint and muzzling when treating or handling them.**
- **Train team Medics on veterinary medicine.**
- **All dog bites must be evaluated by a medical provider.**

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CPT Joe Royal graduated from Brigham Young University in 2001 and from Washington State University as a Doctor of Veterinary Medicine, he entered active duty service in 2005 and he is currently assigned to the 10th Special Forces Group (Airborne).

Dr. Charles Taylor is an emergency medicine trained physician assigned to 10th Special Forces Group. His previous assignments include staff physician at Womack Army Medical Center and battalion surgeon at 2 Bn 75th Ranger Battalion. He has served in both Iraq and Afganistan.

HIV Postexposure Prophylaxis for Special Forces Soldiers

Robert H. Lutz, MD, FS; Darrell Carlton, MD, FS, DMO; Shawn F. Taylor, MD, FS

Abstract

Exposure to human immunodeficiency virus (HIV) is a recognized occupational hazard to healthcare personnel. The virus also presents an operational hazard to deployed Special Operations Forces (SOF) personnel. Management guidelines for work related exposure to HIV mainly deal with healthcare workers in a first world hospital environment. Formal guidelines for postexposure prophylaxis (PEP) regarding potential HIV exposure in third world environments have not been established. SOF personnel deploy to regions such as sub-Saharan Africa with a reported HIV prevalence of 35% or higher. This article examines the case of a SOF servicemember exposed to HIV in a confrontation with host nation personnel, the problems with trying to utilize current CDC guidelines and host-nation healthcare capabilities, and a proposed solution devised to ensure appropriate PEP in future cases.

Introduction

Human immunodeficiency virus (HIV) is a known occupational hazard to personnel who work in a medical setting.[1,2,3,4,5,6,7] The United States Centers for Disease Control (CDC) has published guidelines for the management of worker exposures to HIV and recommendations for postexposure prophylaxis (PEP).[8] These guidelines are designed for the management of healthcare worker exposures to HIV that occur in the U.S. The guidelines are designed for use in the hospital setting where the source patient is often known and easily available for assessment. In these cases treatment providers have a known source, the medical history is available, and the patient can easily be assessed for HIV risk factors, testing, and follow-up.

Members of U.S. Military Special Operations Forces, particularly the U.S. Army Special Forces, are often involved in training exercises and other operations in third world countries where medical care is substantially below U.S. standards. Many of these countries, specifically those in sub-Saharan Africa, have a high prevalence of HIV in the population.[9,10,11] Currently the CDC guidelines provide a starting point for planning the medical response for Soldiers who sustain a significant exposure to blood and/or body fluids while working in these areas of endemic HIV disease.

Case

A 35 year-old U.S. Army Special Forces Soldier sustained a deep human bite in an altercation with a criminal in a sub-Saharan African country. The injured Soldier was traveling in a car with two other Special Forces Soldiers when they were stopped by armed criminals, who demanded the Soldiers' money and passports. The Soldiers were involved in a physical altercation during which the injured Soldier was able to disarm the criminal. However, in the process he was bitten deeply on his left forearm. At the time of the bite the criminal had blood on his face and in his mouth from wounds he had sustained during the fight. The bitten Soldier detained the criminals until the police arrived. Subsequently (approximately two hours after the bite) he went to the U.S. Embassy and had his wound cleaned by the embassy nurse. The Soldier contacted his unit medical officer (UMO) for recommendations. The UMO then consulted with his Group Surgeon. Due to the unknown nature of the source patient, HIV post-exposure prophylaxis was recommended. The U.S. Embassy had a supply of Combivir (300mg zidovudine and 150mg lamivudine) available. He was started on Combivir approximately eight hours post-exposure and then evacuated to the U.S. Upon his return he was started on a six-week treatment course of Indinavir in addition to the Combivir. He also received a baseline

HIV test (negative) and hepatitis panel. Prior to deployment, the patient had been immunized for hepatitis B and upon return tested negative for hepatitis C. Host-nation officials subsequently reported that the criminal who bit the U.S. Soldier was HIV positive. The Soldier has completed his course of HIV post-exposure prophylaxis and has remained sero-negative on follow-up testing.

TABLE 1. Recommended HIV postexposure prophylaxis (PEP) for percutaneous injuries

Exposure type	Infection status of source: HIV-positive, class 1*	HIV-positive, class 2*	Source of unknown HIV status†	Unknown source§	HIV-negative
Less severe¶	Recommend basic 2-drug PEP	Recommend expanded ≥3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings in which exposure to HIV-infected persons is likely	No PEP warranted
More severe§§	Recommend expanded 3-drug PEP	Recommend expanded ≥3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings in which exposure to HIV-infected persons is likely	No PEP warranted

* HIV-positive, class 1 — asymptomatic HIV infection or known low viral load (e.g., <1,500 ribonucleic acid copies/mL). HIV-positive, class 2 — symptomatic HIV infection, acquired immunodeficiency syndrome, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of PEP should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.
† For example, deceased source person with no samples available for HIV testing.
§ For example, a needle from a sharps disposal container.
¶ For example, solid needle or superficial injury.
** The recommendation "consider PEP" indicates that PEP is optional; a decision to initiate PEP should be based on a discussion between the exposed person and the treating clinician regarding the risks versus benefits of PEP.
†† If PEP is offered and administered and the source is later determined to be HIV-negative, PEP should be discontinued.
§§ For example, large-bore hollow needle, deep puncture, visible blood on device, or needle used in patient's artery or vein.

TABLE 2. Recommended HIV postexposure prophylaxis (PEP) for mucous membrane exposures and nonintact skin* exposures

Exposure type	Infection status of source: HIV-positive, class 1†	HIV-positive, class 2†	Source of unknown HIV status§	Unknown source¶	HIV-negative
Small volume**	Consider basic 2-drug PEP††	Recommend basic 2-drug PEP	Generally, no PEP warranted§§	Generally, no PEP warranted	No PEP warranted
Large volume¶¶	Recommend basic 2-drug PEP	Recommend expanded ≥3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP†† for source with HIV risk factors§§	Generally, no PEP warranted; however, consider basic 2-drug PEP†† in settings in which exposure to HIV-infected persons is likely	No PEP warranted

* For skin exposures, follow-up is indicated only if evidence exists of compromised skin integrity (e.g., dermatitis, abrasion, or open wound).
† HIV-positive, class 1 — asymptomatic HIV infection or known low viral load (e.g., <1,500 ribonucleic acid copies/mL). HIV-positive, class 2 — symptomatic HIV infection, AIDS, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of PEP should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.
§ For example, deceased source person with no samples available for HIV testing.
¶ For example, splash from inappropriately disposed blood.
** For example, a few drops.
†† The recommendation "consider PEP" indicates that PEP is optional; a decision to initiate PEP should be based on a discussion between the exposed person and the treating clinician regarding the risks versus benefits of PEP.
§§ If PEP is offered and administered and the source is later determined to be HIV-negative, PEP should be discontinued.
¶¶ For example, a major blood splash.

The CDC Guidelines

In the Morbidity and Mortality Weekly Report, September 30, 2005 (Vol. 54, No. RR-9), the CDC published "Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HIV and Recommendations for Postexposure Prophylaxis." The guidelines are based on available literature, which shows that postexposure prophylaxis (PEP) can prevent infection after a significant exposure to HIV infected blood or body fluids.

The reported risk for HIV transmission after percutaneous exposure to HIV positive blood is 0.3% (95% confidence interval = 0.2% - 0.5%). The reported risk after a mucous membrane exposure is 0.09% (95% confidence interval 0.006% - 0.5%). There are three factors associated with an increased risk for infection, and all are related to the volume of blood or body fluid from the source. First, a device (such as a needle) visibly contaminated with the source blood is associated with an increased risk. Second, a procedure that involved a needle being placed directly in a vein or artery is associated with an increased risk. Finally, a "deep" injury (no definition of how deep was reported) was associated with increased risk.[12]

The guidelines are represented in the form of two tables that divide exposure types into "Less Severe" and "More Severe" categories for percutaneous injuries, and "Small Volume" and "Large Volume" exposures for mucous membranes and non-intact skin. These categories are then cross-referenced against the status of the source – "HIV Positive Class 1" (asymptomatic or low viral load), "HIV Positive Class 2" (symptomatic HIV or known high viral load), or "Source of unknown HIV status."[13] (See Tables 1 and 2.)

By plugging in the variables mentioned above, the tables can be used to generate a postexposure prophylaxis recommendation. There are four categories: "No PEP warranted," "Consider basic 2 drug PEP," "Recommend basic 2 drug PEP," and "Recommend expanded > /= 3 drug PEP." The CDC recommends four weeks of therapy for HIV PEP.

The Problem

In many third world countries the medical system lacks the capability to easily determine whether the source patient is class 1, class 2, or HIV negative. Source patients may be unavailable for testing and risk-assessment or may have no knowledge of an existing infection. The logistics of arranging for a host nation hospital HIV test

for the source are often problematic, or the test may be unavailable. In addition, the source may be reluctant to consent for testing because of the social stigma surrounding the diagnosis. In certain sub-Saharan African nations the HIV prevalence is reported to be up to 35%, with some sub-groups of the population have reported rates of up to 68%.[14] Based on the high prevalence rates one should assume when in sub-Saharan Africa that the HIV status of the source patient is positive if testing is unavailable. In other areas of the world, the unit medical officer must know the HIV rates and decide whether or not to assume source personnel are at increased risk for HIV disease.

Incorporating these circumstances into the guidelines, several types of exposure should be considered for HIV PEP with the basic or expanded regimen. These exposures include blood or body fluids on mucous membranes or non-intact skin, percutaneous exposure with a solid or large bore hollow needle with visible source patient blood on it, or percutaneous exposure to a needle used in the source patient's artery or vein. Another potential exposure that could be faced by Special Forces Soldiers in a third world setting is the receipt of blood or blood products for medical purposes.[15] A review of the Armed Forces Medical Intelligence Center "Medical Environmental Disease Intelligence and Countermeasures" CD-ROM demonstrates that no sub-Saharan African countries have safe blood supplies. However, a severely ill or injured Soldier may have to rely on local blood or blood products to survive. There are no studies done on the efficacy of HIV PEP in this situation, but it is not unreasonable to offer it to the patient.

Over the last several years the FDA has approved several rapid, easy to perform, and inexpensive HIV tests that can be done on whole blood (the Uni-Gold Recombigen HIV Test, the Clearview HIV 1/2 Stat-Pak, and the Clearview Complete HIV 1/2 Test) or whole blood and oral fluid (the OraQuick Advance Rapid HIV 1/2 Anitbody Test). If available to the medical personnel treating the exposed patient, the use of one of these tests can provide more information that can aid in the decision making process. See http://www.cdc.gov/hiv/topics/testing/rapid/rt-comparison.htm for a complete list of their complexity and costs.

A Solution

Many units conduct training and operations in Africa and other geographic areas that have high rates of HIV infection. Due to the close associations between Special Forces Soldiers and the host-nation military and civilian populations of many countries, there is concern for potential occupational exposures to HIV infected blood or body fluids. Occupational exposures can occur in many different scenarios. While doing host nation medical training, the unit Medic could be exposed by an inadvertent needle stick. Both medical and non-medical Soldiers could be exposed while caring for injured civilians or host nation soldiers. The potential for exposure to blood or body fluids is high while conducting humanitarian demining missions or explosives training due to the nature of blast injuries. The case presented was the result of an altercation during a robbery attempt.

The United States Special Operations Command has published Tactical Medical Emergency Protocols (TMEPs) for use by Special Operations Advanced Tactical Practitioners (ATPs). One of the TMEPs specifically addresses HIV post exposure prophylaxis. This is a good starting point when no other guidance is available, however, it fails to address the availability of a rapid HIV test and the recommendations for therapy while appropriate, are dated.[16] Currently, the TMEP for HIV post exposure prophylaxis is under revision in order to provide more treatment options. For units training and conducting operations in high risk areas, an expanded discussion is presented below.

One solution to mitigate the risk of exposures occurring in the deployed environment is a program in which each Medic deployed to a high risk area carries a supply of an expanded three-drug post-exposure prophylaxis. Anywhere from a five to fifteen day supply for one patient, dependent upon the ease of evacuation or repatriation, should be considered. As the number of drugs for the treatment of HIV has expanded, so have the recommendations for different drug combinations for post-exposure prophylaxis. The simplest is Atripla (emtricitibine/ tenofovir/efavirenz), which contains three drugs in one pill that is administered once a day. This combination has a high (52%) incidence of CNS side-effects, so even though it is the only 3-in-1 drug combination, consider it cautiously. Other potential three drug combinations include Combivir (AZT + lamivudine) one tablet PO bid + tenofovir 300mg PO qd or Truvada (emtricitabine/tenofovir) one tablet PO qd + AZT 300mg PO bid.[16] The unit medical officer planning on implementing an HIV post-exposure prophylaxis protocol should carefully look at the drugs available and their side-effect profiles (which are considerable). In addition, because new anti-retrovirals are regularly introduced, it is highly recommended that an infectious disease specialist be consulted during the development of a protocol. The Medics should be instructed verbally and in writing (on a reference sheet issued with the medications) on the indications, dosage, and side-effects of the PEP medications. Once a drug regimen is selected, if the side-effect profile

includes nausea, vomiting, or diarrhea, a supply of antiemetics or anti-diarrheals should be offered to control the side-effects of the HIV PEP medications. The protocol for the Medic should be to start HIV PEP within one hour of (or as soon as possible after) a significant exposure and to initiate the evacuation of the patient to the United States for four weeks of continued therapy. Evacuation of the patient back to the United States is recommended because the considerable side-effect profiles of these medications will likely make the patient non-mission capable. In addition, compliance with the regimen will likely be better if the patient is in a more supportive environment (home vs. deployed). If the source patient can be identified and tested using a rapid HIV test, the results can be used to determine whether or not to initiate therapy. Once the test sample is taken, the test itself only takes 20 – 40 minutes to produce a result. The initiation of HIV PEP for a significant exposure should not be delayed in the event it takes longer than one hour to locate and test the source patient. The Medic "reference sheet" should also direct universal precautions when providing medical care and should encourage immediate scrubbing and irrigation of wounds with soap and water.

Discussion

While implementation of an HIV PEP program is important in maintaining the health of our Soldiers, it should be done in a deliberate fashion. In the case of U.S. Army Special Forces Soldiers, the HIV PEP medications are likely to be administered by a Special Forces Medical Sergeant. Special Forces Medical Sergeants (MOS 18D), Civil Affairs Medics (MOS 68WW1), Special Operations Aviation Regiment Medics (MOS 68WW1), and Ranger Regiment Medics (MOS 68WW1) are currently trained to Advanced Tactical Provider (ATP) standards at a minimum. This is the United States Special Operations Command equivalent to a NREMT-P; however, their training goes above and beyond that of an EMT-P. A Medic should have the ability to start the treatment under a strict protocol, and often in the absence of a physician. The unit protocol should be designed to ensure that there are adequate controls on the issue of the medications and that the medics, battalion surgeons, and battalion physician assistants are fully educated on their indications, contraindications, and side-effects.

There are several issues that need to be addressed when developing a protocol. The first is to ensure that the medications are used only for indicated significant exposures. This involves training the providers on the definition of what constitutes a significant exposure. Casual contact with HIV positive individuals and exposure to animal blood or body fluids do not pose a risk for HIV transmission. While unprotected sexual contact with host nationals is a risk for HIV transmission, it can be mitigated by education and condom distribution. This does not constitute an occupational exposure. The second issue is the side-effect profile of the medications. Patients frequently discontinue HIV PEP due to the gastrointestinal side-effects that include nausea, abdominal pain, cramping, and diarrhea. Medical providers need to be made aware of these side-effects and available treatment options. They should also be prepared to counsel their patient on the expected symptoms and methods of treatment to ameliorate the side-effects. Efforts should also be made to educate the patient's co-workers to reinforce the fact that though potentially exposed, the patient is not a transmission risk via casual contact. The third issue to be considered is the use of HIV PEP in the situation where the exposure is to blood/body fluids from a suicide bomber or bomb victim. In this situation, the prevalence of HIV disease in this population, as well as the availability of remains that could be used as a source for a rapid HIV test, should be considered when making the decision to initiate HIV PEP. Decisions will have to be made on a case by case basis, but in general, the CDC assessment of risk in this situation is that it is very low.

Issues to be Addressed in the Development of a Standard Operating Procedure:

- The level at which the HIV PEP medications and the Oraquick Rapid HIV Test Kit will be maintained. Team Medic, company Medic, or battalion Medic/ PA/sSurgeon should each be considered based on the pre-mission planning.
- Identification of those exposures that will initiate an assessment of the need for HIV PEP.
- Development of a risk assessment that includes exposure type and status of the source. Include the availability of the rapid HIV test kit, but also must address those situations where the source patient is unavailable or refuses to be tested.
- Identification of the drugs to be used to initiate HIV PEP. At the least a three drug regimen should be considered and an infectious disease specialist with experience in treating HIV disease should be consulted to help select the drugs. Once the drugs are selected, consideration should be made for including drugs that will help treat the side-effect profiles of the HIV PEP regimen selected.
- The SOP should also include a plan for evacuation or repatriation of the exposed patient, and a plan for follow-up testing.

FDA-Approved Rapid HIV Antibody Screening Tests

February 4, 2008

	FDA Approval Received	Specimen Type	CLIA Category*	Sensitivity** (95% CI)	Specificity** (95% CI)	Manufacturer	Approved for HIV-2 Detection?	List Price Per Device^	External Controls
OraQuick ADVANCE Rapid HIV-1/2 Antibody Test	Nov 2002	Oral fluid	Waived	99.3% (98.4-99.7)	99.8% (99.6-99.9)	OraSure Technologies, Inc. www.orasure.com	Yes	$17.50	Sold Separately ($25 each)
		Whole Blood (finger stick or venipuncture)	Waived	99.6% (98.5-99.9)	100% (99.7-100)				
		Plasma	Moderate Complexity	99.6% (98.9-99.8)	99.9% (99.6-99.9)				
Uni-Gold Recombigen HIV	Dec 2003	Whole blood (fingerstick or venipuncture)	Waived	100% (99.5-100)	99.7% (99.0-100)	Trinity Biotech www.unigoldhiv.com	No	$15.75 *$8.00•*	Sold Separately ($26.25 each)
		Serum & Plasma	Moderate Complexity	100% (99.5-100)	99.8% (99.3-100)				
Reveal G-3 Rapid HIV-1 Antibody Test	Apr 2003	Serum	Moderate Complexity	99.8% (99.2-100)	99.1% (98.8-99.4)	MedMira, Inc. www.medmira.com	No	$14.00	Included
		Plasma	Moderate Complexity	99.8% (99.0-100)	98.6% (98.4-98.8)				

•*"Public health" price for public health programs that are recipients of CDC funds for expanded HIV testing*

* Clinical Laboratory Improvement Amendments: CLIA regulations identify three categories of tests: waived, moderate complexity, or high complexity

** Sensitivity is the probability that the test result will be reactive if the specimen is a true positive; specificity if the probability that the test result will be nonreactive if the specimen is a true negative. Data are from the FDA summary basis of approval, for HIV-1 only. For HIV-2 information, see package inserts.

^ Actual price may vary by purchasing agreements with manufacturers

Note: Trade names are for identification purposes only and do not imply endorsement. This information was compiled from package inserts and direct calls to manufacturers.

HRET

Prepared by Kali Stanger & Frances Margolin at HRET; Margaret Lampe, Jill Clark, and Bernard Branson at CDC.

CDC

FDA-Approved Rapid HIV Antibody Screening Tests

February 4, 2008

	FDA Approval Received	Specimen Type	CLIA Category*	Sensitivity** (95% CI)	Specificity** (95% CI)	Manufacturer	Approved for HIV-2 Detection?	List Price Per Device^	External Controls
MultiSpot HIV-1/HIV-2 Rapid Test	Nov 2004	Serum	Moderate Complexity	100% (99.94-100)	99.93% (99.79-100)	BioRad Laboratories www.biorad.com	Yes – differentiates HIV-1 from HIV-2	$25.00	Included
		Plasma	Moderate Complexity	100% (99.94-100)	99.91% (99.77-100)				
Clearview HIV 1/2 STAT-PAK	May 2006	Whole Blood (finger stick or venipuncture)	Waived	99.7% (98.9-100)	99.9% (99.6-100)	Inverness Medical Professional Diagnostics www.invernessmedicalpd.com	Yes	$17.50 *$8.00•*	Sold Separately ($50/set)
		Serum & Plasma	Non-waived	99.7% (98.9-100)	99.9% (99.6-100)				
Clearview COMPLETE HIV 1/2	May 2006	Whole Blood (finger stick or venipuncture)	Waived	99.7% (98.9-100)	99.90% (99.6-100)	Inverness Medical Professional Diagnostics www.invernessmedicalpd.com	Yes	$18.50 *$9.00•*	Sold Separately ($50/set)
		Serum & Plasma	Non-waived	99.7% (98.9-100)	99.9% (99.6-100)				

•*"Public health" price for public health programs that are recipients of CDC funds for expanded HIV testing*

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Conclusion

The issue of HIV postexposure prophylaxis is important in the civilian management of occupational exposures to contaminated blood and body fluids.[2,7,8] The guidelines published by the CDC are intended for healthcare workers in the U.S. who have the resources of a highly developed medical system to draw upon. In contrast, U.S. Special Forces Soldiers operate in third world countries with rudimentary medical systems and high HIV prevalence. The potential for occupational exposure (even to non-medical personnel) is high. Medial officers in units that deploy to high-risk areas should strongly consider developing a protocol or standard operating procedure (SOP) that ensures that their medics are aware of and have access to the latest recommendations involving HIV PEP. By doing so, we will continue to "conserve the fighting strength" of our nation's most highly trained Soldiers.

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Differential Diagnosis of Shoulder Pain Followed by Progressive Weakness: A Case Report

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ABSTRACT

Upper extremity weakness can be the result of a myriad of conditions ranging from contractile tissue injury, joint injury, or injury to central or peripheral nervous system components. Accurate diagnosis is important in establishing an optimal treatment regimen and sound prognosis. This report provides an overview of the diagnosis and treatment of Parsonage-Turner Syndrome, a relatively rare cause of upper extremity weakness and dysfunction.

OBJECTIVES

1. Distinguish between Parsonage-Turner Syndrome and other causes of neurological upper extremity weakness.
2. Recognize key subjective findings of Parsonage-Turner Syndrome.
3. Recognize appropriate ancillary tests to aide in the differential diagnosis of Parsonage-Turner Syndrome.

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Accurate diagnosis of acute onset of upper extremity weakness can be a diagnostic enigma. In the SOF community musculoskeletal conditions involving the shoulder girdle are frequently encountered. Neurological conditions may mimic non-neurological conditions and clinicians must be aware of these less frequently encountered but equally impacting conditions. The combination of a thorough subjective and objective examination will enable the medical provider to develop accurately a list of possible diagnoses. Appropriate selection of ancillary tests will often aide in correctly diagnosing the injury. Specific diagnosis of acute upper extremity weakness will help guide appropriate management and avoid unnecessary utilization of medical resources as well as optimize practitioner and patient time.

CASE REPORT

SUBJECTIVE HISTORY

A 32 year-old healthy active duty U.S. Navy servicemember presented to the physical therapist three days following the onset of right medial scapular border and glenohumeral joint pain. The shoulder discomfort awoke him from his sleep. Aside from a six-hour flight three days prior to the onset of pain he reported no antecedent trauma or aggressive workout routine. In the 72-hour period from the onset of pain until reporting to the medical department he noted a gradual reduction in shoulder pain and new onset of, and progressively worsening, weakness in the right upper extremity.

His past medical history included a few episodes of "stingers" while playing rugby in college over 10 years ago. He had occasional neck pain over the past few years without any episodes of radiating pain from the cervical region into the shoulder or distal upper extremity. He denied any family history of similar conditions. There was no history of viral or bacterial illness in the past six months, nor immunizations during this period.

Physical Exam and early intervention

Upon exam he was afebrile with normal vital signs. His cervical mobility was normal in all directions with central lower cervical pain produced at the end range of cervical extension. Active mobility assessment of the right upper extremity demonstrated shoulder flexion and abduction limited to 100 degrees with medial scapular border winging. Full active mobility was present for shoulder internal and external rotation as well as all upper extremity joints distal to the shoulder. Deep tendon reflexes of the upper and lower extremities were intact and bilaterally symmetrical. Babinski and Hoffman reflexes were absent. Gross manual muscle testing demonstrated 3-/5 serratus anterior, 4-/5 external rotation, 4/5 shoulder abduction, and 4+/5 pronator teres. He had 5/5 strength in the right triceps brachii, biceps brachii, wrist flexion and extension, and hand intrinsic muscles. Spurling's test produced neck pain but no radicular symptoms into the shoulder girdle or distal upper extremity. Manual cervical traction produced no change in the patient's symptoms. Given the patient's history and physical exam, the differential diagnosis included C5 radiculopathy, long thoracic mononeuropathy, and Parsonage-Turner Syndrome (acute brachial neuritis). Initial management, following consultation with a dive medical officer included prednisone 50mg daily for five days followed by Naprosyn, 500mg twice a day, for 10 days. Additionally, physical therapy was performed consisting of active assisted range of motion exercises and isometric shoulder girdle exercises.

Ancillary tests

To further assist in the diagnosis, x-ray and MRI assessment of the cervical spine was conducted in addition to electrophysiological examination. X-rays showed multi-level degenerative disc disease. MRI exam demonstrated multi-level spondylosis, which was worst at C5-6, but no evidence of nerve root compression. Four weeks following the onset of weakness the patient underwent the electroneuromyogram (ENMG).

During the physical examination prior to the ENMG the patient reported intermittent paresthesias in the lateral volar aspect of the right forearm which did not extend distal to the wrist. The patient reported the onset of altered sensation which began about one week after the onset of shoulder pain. Electromyography (EMG) of the right serratus anterior muscle demonstrated positive sharp waves (1+) and a markedly reduced interference pattern. EMG exam of the cervical paraspinals, deltoid, rhomboid, infraspinatus, biceps brachii, triceps brachii, pronator teres, extensor carpi radialis, flexor carpi radialis, first dorsal interosseous, and left serratus anterior muscles was normal. Motor nerve conduction studies of the suprascapular and axillary nerve were normal. Sensory nerve conduction studies of bilateral median (to digits I and II) and superficial radial nerves were normal. Lateral antebrachial cutaneous (LABC) nerve conduction study demonstrated normal distal latencies but a 65% reduction of the sensory nerve action potential (amplitude) on the right upper extremity.

Subacute management

Six weeks following the onset of shoulder pain the patient reported full resolution of the shoulder pain, continued difficulty raising the arm overhead, and minimal change in right arm strength. Active flexion and abduction of the right shoulder was limited to 140 degrees and serratus anterior muscle atrophy was visible. He was provided guidance in strength training of the right upper extremity to enhance scapular stability, rotator cuff strength, and avoid stretching of the proximal neural structures. At three months following onset of symptoms the patient reported noticeable improvement in arm strength and mobility, but continued winging of the scapula. Shoulder flexion and abduction had returned to normal. Aside from 4-/5 serratus anterior muscle strength, all other isolated manual muscle testing of the right upper extremity demonstrated normal (5/5) strength. Rehabilitation instruction consisted of exercises focused on the posterior shoulder girdle muscles (e.g., rowing, pull downs, external and internal rotation, prone scapular retraction, and supine push plus). Six months post onset the patient had resumed his usual workout routine but still noted mild winging of the scapula. Exercises were progressed to include push up exercises on a physioball and push plus exercises with any pressing exercise (e.g., military press, incline press, and bench press). One year post onset of shoulder pain the patient reported full return of right arm strength and absence of scapular winging. Physical exam at this time showed 5/5 strength throughout the right upper extremity.

Discussion

Acute shoulder girdle pain and weakness can be the result of numerous conditions (Table 1). The distinguishing factors in the clinical diagnosis of Parsonage-Turner Syndrome (PTS) are sudden onset of shoulder pain, that often awakens the patient, which gradually subsides over the course of days to weeks, only to be replaced by painless weakness.[1] The severity of pain often leads patients to seek emergency medical care and may result in investigation for myocardial infarction.[2] As the pain recedes, weakness and sometimes atrophy develop. Weakness may be limited to muscles innervated by a single peripheral nerve or any combination of peripheral nerves or the brachial plexus.[1,2,3]

Table 1.
Differential diagnosis of acute upper extremity weakness

Neurological	Cervical radiculopathy Peripheral nerve injury Mononeuritis multiplex Tumors of the brachial plexus Traction injury of the brachial plexus Parsonage-Turner syndrome Hereditary neuralgic amyotrophy Monomelic amyotrophy Central nervous system pathology Trauma Stroke Tumor
Musculoskeletal	Rotator cuff injury Acute calcific tendonitis Glenohumeral or acromioclavicular sprain

Upon initial examination the possibility of musculoskeletal injury as the primary cause of symptoms was ruled out based upon no preceding trauma, weakness of the arm not accompanied by pain, and absence of localized tenderness of the shoulder. Central nervous system involvement was ruled out based upon the patient's localized symptoms as well as the absence of hyper-reflexia, clonus, cranial nerve involvement, diffuse sensory complaints, and normal mobility (gait and distal upper extremity). Cervical radiculopathy (CR), isolated peripheral mononeuropathy, and PTS were therefore the primary considerations at the initial visit.

Cervical radiculopathy, involving the C5 nerve root, was considered a possibility given the patient's history of stingers, occasional neck pain, and pain with cervical extension; however, the Spurling's test was unremarkable. While acute, intense upper extremity pain is possible in the initial presentation of CR, the more common presentation is a gradual progression from the onset of neck pain to varying degrees of peripheral manifestations including upper extremity pain, paresthesias, and weakness. Radiological assessment also supported CR as a possibility. MRI evaluation, while demonstrating multi-level spondylosis, did not indicate nerve root compression. Magnetic resonance neurography, not utilized for this patient, has been recently reported as the preferred imaging modality for the diagnosis of PTS.[2,4] The patient's rapid progression of painless upper extremity weakness, absence of paresthesias or numbness, and normal Spurling's test were not consistent with CR.

While isolated long thoracic mononeuropathy would manifest with scapular winging, there are no nerve fibers to the glenohumeral region to produce the shoulder pain reported by this patient. Furthermore, the diffuse weakness noted on initial examination, in muscles innervated by branches from the upper trunk of the brachial plexus, indicates this was not an isolated mononeuropathy. Electroneuromyography results also supported involvement beyond the long thoracic nerve.

Electroneuromyography (ENMG) is commonly used in the evaluation of upper extremity weakness or sensory deficits. The ENMG should be performed no earlier than three weeks following the onset of symptoms in order to provide ample time for axonal degeneration (muscle denervation) to manifest and be recordable during the exam. The abnormal LABC sensory nerve amplitude corresponded to the region of intermittent paresthesias reported by the patient. Isolated muscle denervation of the serratus anterior muscle indicated partial injury to the axons of the long thoracic nerve. Patients with PTS most commonly present with weakness in muscles innervated by the long thoracic or suprascapular nerves.[1,2] Sensory complaints most commonly involve the LABC or median nerve fields.[2] Absence of electromyography abnormalities in other muscles of the right upper extremity, to include the cervical paraspinals, further ruled out CR.

Early treatment with corticosteroids, as utilized for this patient, has been reported to potentially improve the time course for recovery of strength.[2] Additional early management consisted of isometric shoulder and upper extremity exercises to minimize disuse atrophy without imparting utilization of dyskinetic movement patterns by performing active movement of the shoulder

above 90 degrees elevation. Modalities (e.g., therapeutic ultrasound and electrical stimulation) were not utilized as there is no evidence supporting acceleration of axonal regeneration or gross muscle strength with application following PTS. As the patient's mobility improved, strengthening exercises were progressed, focusing on scapular stabilizing muscles, within the available range of uncompensated active motion. The patient was educated on trying to use the scapular muscles to control scapular winging and to avoid exercises which produced scapular winging.

Recovery of strength commonly begins within the first two months following the onset of shoulder pain. Return of full strength is not always obtained. A protracted recovery of more than a year for return of strength is not uncommon.[1] Patients with primary involvement of the long thoracic nerve have been noted to have more complete strength recovery than patients with primary involvement of the suprascapular nerve.[1]

Summary

Diagnosis of acute onset of shoulder pain with accompanying muscular weakness can be challenging. Parsonage-Turner Syndrome, although relatively uncommon, should be considered in the differential diagnosis of acute onset of shoulder pain and weakness. The presentation of sensory and muscular deficits is variable in both in distribution of involvement and severity of axonal injury. Ancillary testing such as magnetic resonance neurography in the acute phase or ENMG at one month post onset may prove helpful in diagnosing PTS. Return of strength usually begins within the first couple of months following the onset of symptoms, but maximum recovery can take over a year and does not always result in 100% return of strength and functional ability. Incorporating a progressive submaximal strengthening program focused on the uninvolved scapular stabilizing and rotator cuff muscles is recommended to enhance functional recovery.

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Clinical Red Flags from the USSOCOM TMEPS – Recognize, Act Fast, and Evacuate!

Scott Gilpatrick, APA-C

Abstract

Military medical practitioners working in active duty clinics are known for seeing lots of people in a short amount of time. If you've ever seen what goes on every morning at a troop medical clinic on a training post or base you know what I mean. The goal of morning sick call is to find that one really sick person among the many not so sick standing in line for your services. What you learn from working in that setting is how to recognize the red flag – the sign or symptom that clues you in to a potentially dangerous condition. When at war, the ability to recognize the red flag is extremely important. In the austere or unsecure environment, the SOF Medic needs to be the one who knows what the red flags are and what to do about them once spotted.

The USSOCOM Medical Critical Task List (CTL) requires that the SOF Medic be able to recognize, treat, and determine a disposition for many common medical conditions. Some of these conditions are life threatening, yet can present in a subtle and insidious fashion. The SOF Medic often works in an austere and extreme environment. This factor, coupled with the oftentimes non-friendly or unsecure area of operations, necessitates that SOF have an astute clinician assigned who can recognize red flag (life threatening) conditions early on in their evolution. If a red flag is seen, the decision to evacuate, or hold and treat, will have to be made based upon the tactical environment as well as the type and severity of the medical condition. Weighing the risks of evacuating or not evacuating, and then explaining the risks or possible consequences to your commander, is one of the toughest parts of the SOF Medics job.

When you and your element depart for an unsecure area of operations, it is the Medic's job to ensure that everyone in the element understands that medical emergency contingencies could affect your mission. Prior to every mission, you plan for casualties during infil, actions on the OBJ, and during exfil. You rehearse those contingencies during the rock drill or brief-backs. Why not do similar planning for actions at the FOB, safe house, or while in the hide-site when you encounter a medical emergency. Pathogens nowadays progress towards sepsis and tissue destruction at an alarming rate. Early recognition and treatment, or evacuation for some conditions certainly affect morbidity and mortality. The more time you have – the better, when trying to make a timely and informed decision regarding the disposition of a sick teammate.

There are enormous tactical consequences and considerations when evacuating someone who is sick. What does the sick teammate do? Is he a unique and one-of-a-kind guy? Who's going to carry his equipment? Is the area of operations safe enough to call in a MEDEVAC helicopter for evacuation? What are you risking by driving a sick teammate for an hour through bad guy territory to a hospital that has a working lab, CT, or X-ray machine that works? These are all questions you should ask yourself prior to being put into these situations.

Do the medical rock drills and rehearse or at least talk through medical contingencies. Know the red flags for common life threatening conditions so you are able to recognize them early and make a thoughtful and informed decision on your patients' disposition with the least amount of effect on your mission.

Prior to missions or movement to a new area, ask yourself the following questions and be prepared to deal with each. Solutions should have the least amount of mission impact as possible.

1. Where is the closest friendly medical treatment facility? What is the best route for routine or medical emergency evacuation? You will need to balance transit time against the level of danger you are assuming on every possible route? The shortest route might not be the safest.
2. Will you have to navigate through bad neighborhoods, negotiate bad terrain, or endure weather extremes? Do these conditions out-weigh the risk to your patient's health?
3. When is the best time of day (look at the tactical environment) to evacuate sick team mates or to send someone for lab tests and radiology studies beyond your capabilities (if you think you saw a red flag)?
4. What risk to your mission or the safety of the rest of your team are you assuming by making a call to evacuate someone with a red flag condition?
5. What air and ground evacuation capabilities do you have available and what is the response time for them to your location?

Starting on page 22, I have listed a few of the conditions and their associated TMEPS that have the potential for bad outcomes if the red flags are not seen early. Some of these conditions might require evacuation for convenience due to the strain on personnel and resources. These TMEPS are some of the new ones for 2009, soon to be published. Highlighted in red are the aspects of each TMEP that must be recognized to allow for fast decision-making and action. I've added some discussion below each as well. There are many more conditions that are common and have red flags, but I just chose the few we see most often.

ABDOMINAL PAIN

Special Considerations:
1. Common causes in young healthy adults include appendicitis, cholecystitis, pancreatitis, perforated ulcer, and diverticulitis.
2. Consider constipation/fecal impaction as a potential cause of abdominal pain.

Signs and Symptoms Suggestive for Continued Observation:
1. Epigastric burning pain
2. Present bowel sounds
3. Nausea and/or vomiting
4. Absence of rebound tenderness
5. If diarrhea is present, treat per *Gastroenteritis Protocol*

Management:

1.  Antacid of choice
2.  Ranitidine (Zantac) 150mg PO bid **OR** Rabeprazole (Aciphex) 20mg PO qd **OR** Proton Pump Inhibitor of choice
3. PO hydration

Disposition:
1. Observation and re-evaluation.
2. *Priority* evacuation if symptoms not controlled by this management within 12 hours.

Signs and Symptoms Suggestive for Urgent Evacuation:
1. Severe, persistent or worsening abdominal pain is the key sign
2. Rigid abdomen
3. Rebound abdominal tenderness
4. Fever
5. Absence of bowel sounds
6. Focal percussive tenderness
7. Uncontrollable vomiting
8. Presence of bloody vomitus or stools
9. Presence of black tarry stools
10. Presence of coffee ground vomitus

Management:
1. Start IV with normal saline (NS), 1 liter bolus, followed by NS 150cc/hr. Keep NPO except for medications or PO hydration.
2.  Ertapenem (Invanz) 1gm IV qd
3.  **OR** Ceftriaxone (Rocephin) 1gm IV qd. plus Metronidazole (Flagyl) 500mg PO q8h
4. Treat per *Pain Protocol*
5. Treat per *Nausea and Vomiting Protocol*

Disposition:
Urgent evacuation to a surgical facility.

Discussion: ***Abdominal pain comes with a long list of possibilities in its differential. Don't forget a rectal examination with a stool guiac check if possible. A testicular examination can also assist in narrowing the list of culprits. Send your findings with the patient if he is evacuated. Eventually, abdominal pain, or the narcotics that go into lessening it, can turn your ambulatory patient into a litter patient; be prepared for a litter evacuation. The abdominal cavity also has the potential space to hold lots of fluid from a ruptured, perforated, or infected organ. Be prepared for massive fluid loss if this happens.***

ANAPHYLACTIC REACTION

Signs and Symptoms:

1. Wheezing (bronchospasm)
2. Dyspnea
3. Stridor (laryngeal edema)
4. Angioedema
5. Urticaria (Hives)
6. Hypotension
7. Tachycardia

Management:

FOR PATIENTS WITH SIGNS AND SYMPTOMS OF AIRWAY INVOLVEMENT AND/ OR CIRCULATORY COLLAPSE:

1.  Epinephrine is the mainstay of therapy.
   A. Administer Epi-Pen
   B. **OR** Epinephrine 0.5mg (0.5ml of 1:1000 IM). **DO NOT USE INTRAVENOUSLY.**
   C. Repeat epinephrine q 5 minutes prn.
2.  Diphenhydramine (Benadryl) 50mg IV/ IM/ PO/ SL.
3. IV Normal Saline TKO (saline lock).
4.  Dexamethasone (Decadron) 10mg IV/ IM.
5. Oxygen
6. Pulse oximetry monitoring.
7.  Ranitidine (Zantac) 150mg PO bid.
8.  If severe respiratory distress exists, aggressive airway management with bag-valve-mask and airway adjuncts (oral and nasopharyngeal airways). Intubate early if no response to epinephrine.
9. Administer 1 – 2 liters Normal Saline bolus for hypotension; then titrate to establish systolic blood pressure > 90mmHg or palpable radial pulse if BP cuff not available.

Disposition:

1. *Urgent* evacuation.

Discussion: ***Oftentimes, a simple allergic reaction (urticaria or hives) can rapidly lead to full shock with circulatory or respiratory collapse. Any allergic reaction in a tactical environment needs to be dealt with promptly and aggressively. If a patient suffering from an allergic reaction starts to get better with the administration of medicines, you still have to watch for a possible latent phase reaction for at least 8 hours.***

BRONCHITIS / PNEUMONIA

Special Considerations:
1. Consider high altitude pulmonary edema (HAPE) at high altitudes.
2. Consider pulmonary embolism (PE) and pneumothorax (fever and productive cough are atypical for these).

Signs and Symptoms:
1. Fever
2. Productive cough, especially with dark yellow, red tinged, or greenish sputum
3. Chest pain
4. Rales may be present and breath sounds may be decreased over the affected lung.
5. Dyspnea may be present in severe cases.

Management:
1.  Azithromycin (Zithromax) 500mg PO first dose then 250mg qd for 4 days **OR** Moxifloxacin (Avelox) 400mg PO qd for 7 days.
2.  If unable to tolerate PO intake, Ertapenem (Invanz) 1gm IV/ IM **OR** Ceftriaxone (Rocephin) 1gm IV qd.
3.  Albuterol (Ventolin) by metered dose inhaler 2 to 4 puffs q 4 – 6h.
4. Treat per *Pain Management Protocol.*
5. If febrile, acetaminophen 1gm PO q6h.
6. Pulse oximetry monitoring.
7. Oxygen prn.
8. If at high altitude, see *Altitude Illness Protocol* and treat for HAPE.

Disposition:
1. *Urgent* evacuation for severe dyspnea or hypoxia.
2. *Observation or Routine evacuation* as necessary.

Discussion: ***Several dangerous conditions can mimic bronchitis or pneumonia as they are associated with chest pain and/or cough as well. If someone has been immobile for a long period (long flight or in a hide site), a pulmonary embolus (PE) is a possibility. PE's usually originate from a patient's calf as a DVT (see DVT TMEP). A patient with pneumonia and low oxygen saturation needs continuous monitoring. How much time do you have to devote? How low is their oxygen saturation and when do you evacuate?***

CELLULITIS/CUTANEOUS ABSCESS

Special Considerations:
1. Superficial bacterial skin infection
2. Generally begins about 24 hours following a break in the skin, but more serious types of cellulitis may be seen as early as 6 – 8 hours following animal or human bites. If abscess formation occurs, only attempt I&D in the tactical setting IF:
   a. The abscess is clearly well demarcated and superficial.
   b. Local anesthesia is available.

Signs and Symptoms:
1. Painful, erythematous, swollen, tender area.
2. Fever may or may not be present.
3. Typically, erythema spreads without treatment.
4. Rapidly spreading and very painful infections suggest the possibility of necrotizing fasciitis, a life-threatening infection of the deeper tissues that should be treated per *Sepsis/ Septic Shock Protocol.*
5. Fluctuant, tender, well-defined mass indicates abscess formation.

Management:
1.  Moxifloxacin (Avelox) 400mg PO qd for 10 days **OR** Amoxicillin/Clavulanic Acid (Augmentin) 875mg PO bid
2.  **PLUS EITHER** Trimethoprim-Sulfamethoxazole (Septra DS) 1 tab PO bid **OR** Rifampin (Rifadin) 600mg PO bid for 10 days.
3. Clean and dress wound and surrounding area.
4. Use a pen to mark the demarcation border of the infection and re-evaluate in 24 hours.
5. Limit activity until infection resolves.
6.  Add Ertapenem (Invanz) 1gm IV/ IM qd if worsening at 24 hours or no improvement at 48 hours of treatment.
7. **IF ABSCESS IS PRESENT:**
   A. Incise and drain (I&D) if the environment permits:
      1) Establish sterile incision site with Betadine.
      2)  Local anesthesia using Lidocaine.
      3) Incise the length of the abscess cavity, but no further.
      4) Incision should be parallel to skin tension lines if possible.
      5) On initial treatment, leave wound open and pack with iodoform or dampened gauze, if available. On subsequent dressings, wick the wound. **DO NOT SUTURE THE SITE.**
   B. Bandage site and perform wound checks daily.
8. Treat per *Pain Management Protocol.*

Disposition:
1. Re-evaluate daily and watch for progression of erythema while on antibiotics.
2. Cellulitis in critical areas (head, neck, hand, joint involvement, perineal) requires *Priority* evacuation.
3. Use of IV antibiotics requires *Priority* evacuation.

Discussion: ***Cellulitis or an abscess that involves a joint, or requires IV antibiotics, will certainly be a strain on you and your resources. In this situation, consider early evacuation. The spread of MRSA and other drug resistant strains of infection causing pathogens make abscess and cellulitis a condition that can quickly necessitate evacuation as a red flag condition.***

HEADACHE

Signs and Symptoms:

1. If the headache is atypical for the patient, check elevated blood pressure (if possible), fever, neck rigidity, visual symptoms, mental status changes, neurological weakness, and hydration.

Management:

1. If the patient has fever, nuchal rigidity, photophobia, petechial rash, or nausea and vomiting, treat per *Meningitis Protocol.*
2. Treat per *Pain Management Protocol.*
3. If headache is accompanied by nausea and/ or vomiting, treat per *Nausea and Vomiting Protocol*.
4. Oxygen if other therapies are ineffective.
5. If dehydration is suspected, treat per *Dehydration Protocol*.
6. If at altitude, treat per *Altitude Illness Protocol.*

Disposition:

1. Evacuation is usually not required if the headache responds to therapy.
2. Acute headache in the presence of fever, severe nausea and vomiting, mental status changes, focal neurological signs, or preceding seizures, loss of consciousness, or a history of "it's the worst headache in my life" constitutes a true emergency and requires *Urgent* evacuation. Also consider *Urgent* evacuation for anyone without a prior history of headaches if their pain is severe.

Discussion: ***Knowing what is normal and not normal is extremely important when dealing with a headache. The consequences of misdiagnosing a malignant cause of a headache for something routine will be catastrophic.***

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The Special Operations Resuscitation Team: Robust Role II Medical Support for Today's SOF Environment

Jamie Riesberg, MD

Abstract

Special Operation Forces (SOF) have historically relied upon conventional medical assets for Role II and higher medical support. Over the last five years, the need for SOF-specific medical teams and surgical support was identified and addressed. Several Special Operations based Role II assets are now available to support operations, each with unique personnel and capabilities. The Special Operations Resuscitation Teams (SORT) have been engaged in several joint deployments in the last year, demonstrating the mission readiness and lifesaving trauma support for which the teams were designed. The future of SOF Role II has many unique challenges, including personnel resourcing, training, and joint operational planning.

Objectives

Provide a historical perspective on the evolution of SOF-specific Role II medical support.
Review current SOF-specific Role II capabilities and employment.
Discuss unresolved issues related to SOF-specific Role II capabilities and employment.

"9-line MEDEVAC incoming. 4 urgent surgical, 2 urgent, and 1 priority inbound to your location, ETA – 15 minutes. Injuries include 2x gunshot wound (GSW) to chest and abdomen, 1x GSW shoulder/chest, 1x multiple GSWs to lower extremities, tourniquets applied, 1x gunshot wound to head – GCS 14, and 3x multiple fragmentation wounds to extremities – hemorrhage controlled with tourniquets and pressure dressings. Further information is unavailable at this time."

This is no scenario, but a real 9-line from OEF.... Do you have the required personnel, training, and equipment to take this MEDEVAC? Is the forward surgical asset prepared to not only offer surgery, but critical care, prolonged patient hold, and evacuation for these patients?

Historical Perspective: Development and Capabilities of SOF-specific Role II Medical Support

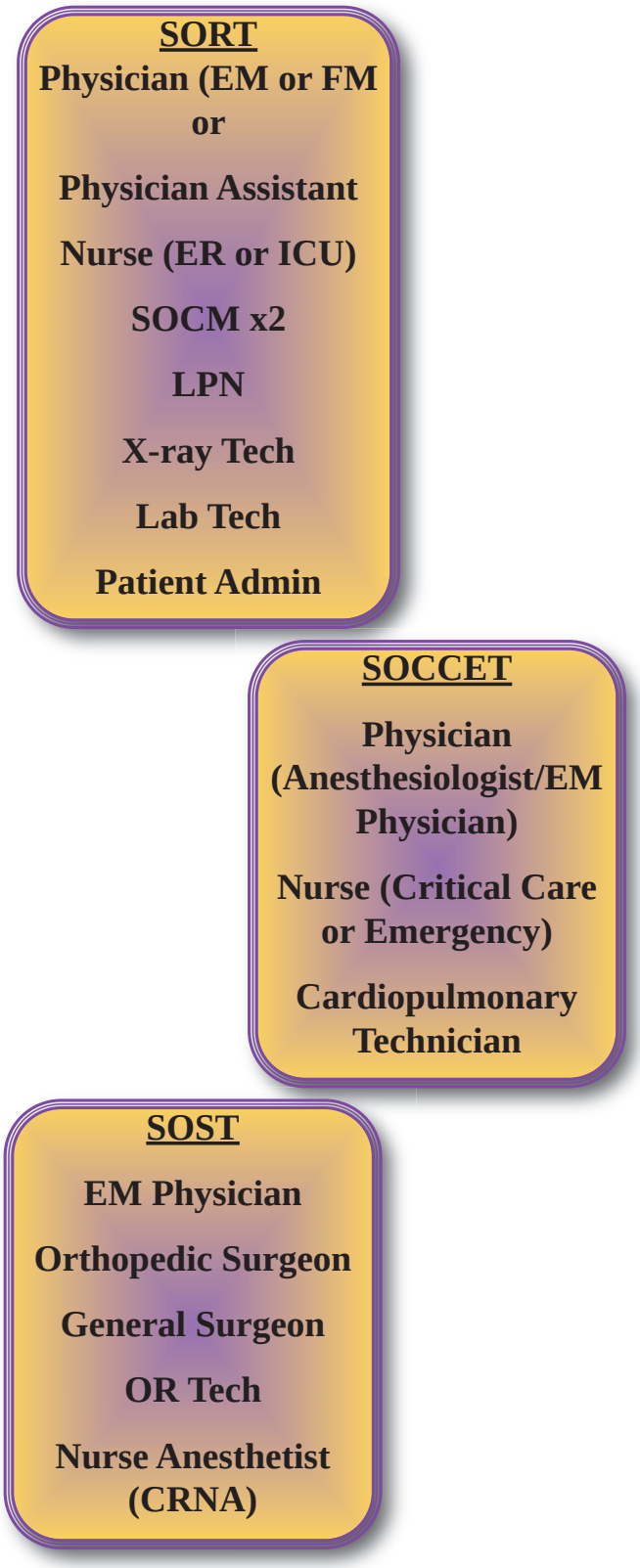
At the July 2003 U.S. Special Operations Command (USSOCOM) Medical Lessons Learned Conference, Special Operations Forces (SOF) medical leaders and medical operators identified the need for expeditionary, short-term, SOF-specific Role II medical support for initial entry operations into immature theaters or remote locations of mature theaters. Role II capability includes trauma resuscitation, critical care holding, and en route medical care. The current NATO term "Role II" includes resuscitative surgery. For clarity in this article, resuscitative surgical capability in addition to traditional Role II functions will be identified with a "b" – Role IIb. The SOF medical community has extensively discussed how best to provide the *resuscita-*

tive surgery component of Role IIb. The community is less familiar with a unique SOF asset that provides the underpinning of Role IIb care – trauma resuscitation, critical care holding, and en route medical care. In this article, I will discuss the evolution, capabilities, and current employment of the Special Operations Resuscitation Teams (SORTs); a low-footprint, flexible SOF asset specifically designed and trained to provide robust Role II medical support to SOF Operators in austere or remote environments.

Following the 2003 Lessons Learned Conference, the Army Medical Department (AMEDD), which owns all Army medical assets, agreed to create three 8-pax teams capable of providing Role II capability for SOF. These Role II teams, now known as Special Operations Resuscitation Teams (SORTs), were created with billets assigned to the 528th Special Operations Support Battalion. At the time, the 528th came under the command of the Special Operations Support Command, which is now the 528th Sustainment Brigade (Airborne) - 528th SB(A). Currently, SOF has three SORTs: two active component teams in the 528th SB(A) and one National Guard team in the newly formed 197th Special Troops Support Company. This third team was previously in the Reserve Component but history showed that resource and training requirements prohibited this team from ever reaching mission ready status.

The SORTs do not have organic surgical capability, primarily because the 528th did not have any assigned billets for general or orthopedic surgeons. The initial plan was to integrate SORTs with co-located surgical assets, such as an Army Forward Surgical Team (FST). However, this proved unrealistic for several reasons. The FST has a large footprint (20-pax) and is often unable to deploy within SOF-required time frames. They are not specifically trained to meet the needs of SOF. Because there are a limited number of FSTs in the Army's inventory, it is not possible to establish a habitual training relationship with an FST and they are often not available for SOF deployments or contingency operations.

By May 2004, a proposal was developed for a Joint SOF Role IIb package with robust Role II capability and a "plug-and-play" surgical component. The Army SORT teams would provide the Role II capability: Coalition sick call, trauma resuscitation, X-ray, lab, medical regulation, critical care patient hold, and en route care. The "b" component of the Role IIb package would be provided by an Air Force Special Operations Command (AFSOC) Special Operations Surgical Team (SOST) with resuscitative surgical capability and an AFSOC Special Operations Critical Care Evacuation Team (SOCCET) with the ability to provide en route critical care during flights to higher roles of care. The complete Role IIb package could provide care for up to ten urgent surgical patients in the first 24 hours. Additional assets from the 528th SB(A),



such as preventive medicine, veterinary support, medical logistics, and biomedical repair, would augment the capabilities of the Role IIb package as needed. This package could be transported on three pallet positions on a C-130. The capability would ideally function under the command and control of a Special Operations Task Force (SOTF) or Combined Joint Special Operations Task Force (CJSOTF). This C2 structure would allow the maximal potential from the team, encouraging Local National care and other "unconventional warfare" missions in which the team specializes. The boxes on the previous page show the personnel assets in each team. On the teams, the Officer in Charge (OIC) is typically the nurse. Each SORT team member is also tactically trained to be able to augment the ground force for missions well outside the Role II facility. The figure below shows the personnel assets in various teams.

The capability of the proposed Joint SOF Role IIb package was tested at two joint field training exercises in December of 2004 and 2005 and during a combined rotation at the Army Trauma Training Center in Miami, FL, in 2006, where the full Role IIb team completed over 50 trauma resuscitations. Throughout the validation process, the teams performed well when faced with continuous operations for over 48 hours, including simulated mass casualty incidents (MASCALS), rotary and fixed wing evacuation followed by ongoing critical care transport, and "nation-building" medical operations.

The concept and capabilities of the Joint SOF Role IIb package was also validated in several joint deployments during 2008. The next section provides more detail of the teams' employment during these deployments.

In December 2007, a panel discussion on "Current Controversies in SOF Medicine" was held at the Special Operations Medical Association (SOMA) Conference. The panel discussion was moderated by LTC Jim Czarnik, Office of the Command Surgeon, U.S. Army Special Operations Command (USASOC). Although a Joint SOF Role IIb package was already in existence and validated by field training, the panel yet again raised the need for SOF-specific Role IIb support in a light, fast, modular package. Follow-on discussion highlighted the far-forward surgical capabilities of the AFSOC SOST but did not fully outline the robust Role II capabilities of the SORT, an integral component of the full Role IIb package proposed in 2004. This situation highlights the need to educate our community about all resources available for the medical support of SOF missions.

The table below lists the capabilities of selected medical teams that can serve as components of a full Role IIb package:

	Army FST	AF SOST/SOCCET	SORT
# of Personnel	20	8	8
Maximum Caseload/24 hours	10	10	10
Operating Tables	2	2	Supported
Postoperative Care (up to 8 patients)	6 hours	48-72 hours	72 hours
Critical Care Evacuation	No	Yes	Yes
Independent Medical Logistics	No	Yes	Yes
Special Operations Tactical Training	No	Yes	Yes
Sick Call/Primary Care UW Mission Support	No*	Yes	Yes
Patient Evacuation / Administration	No*	Yes	Yes
X-ray	No*	No	Yes
Blood	Yes- 50 units	Capable	Yes- 20-40 units
Ultrasound	No (per TOE)	Yes	Yes
General Surgery/Orthopedic Surgery	Yes/Yes	Yes/Yes	No/No

* relies on supporting medical company

References: FM 4-02.25 Employment of Forward Surgical Teams, March 2003

Employment of Special Operations Resuscitation Teams in Current Operations

To clarify the capabilities of the SORT, one must examine how these teams have been employed in recent years in several theaters of operation. One team is currently deployed in support of Combined Joint Special Operations Task Force – Afghanistan (CJ-SOTF-A). SORT #1 deployed to the austere environment of western Afghanistan in April, 2008. In four months, they resuscitated more than 80 trauma casualties. The team also provided Special Operations Combat Medic (SOCM) MEDEVAC/CASEVAC flight support, with medics logging over 30 combat missions in the first few months. The ability to provide lab support (including blood banking), X-ray, and ultrasound

Photo 1

Photo 2

Photo 3

diagnosis enhanced the quality and timeliness of interventions.

After two Special Operations Independent Duty Corpsmen assigned to the Marine Special Operations Teams (MSOT) became mission incapable due to battle injuries, SOCMs from SORT #1 augmented the MSOTs during patrols (see photo #1). The SORT members were also an integral part of base operations, including logistics and base defense, and provided sick call for all Afghan workers on the firebase.

In addition to providing medical care to Coalition forces, the SORT #1 participated in activities that supported the development of the local Afghan health sector. They treated more than 2,000 patients per month at the Special Operations Task Force Unconventional Warfare clinic (see photos #2 & 3); provided mentorship while supervising over 20 elective and emergent surgeries performed by Afghan physicians; and provided Advanced Obstetrics Emergency Certification to 16 Afghan midwives. It is hard to quantify the non-kinetic gains of these activities, but the efforts were repeatedly recognized by local Afghan leadership as beneficial to the advancement of healthcare in this region.

SORT #2 was employed in an unspecified operation last year, and went on to provide valuable healthcare and veterinary support to 10th SFG(A) during their summer 2008 operations. In addition to covering trauma resuscitations, they actively engaged in MEDCAPs, VETCAPs, and mentorship of local national healthcare providers. The team, while deployed in support of the fall SOFFEX in Europe, had a dramatic effect on the life of a man who arrived at their location in prolonged cardiac arrest due to electrical injury. Following a successful resuscitation and hospitalization, during which the team employed their patient hold capabilities, this gentleman walked out of the hospital.

Unresolved Issues: The Future of the Special Operations Resuscitation Team

The ever-changing face of SOF operations cannot afford to leave the medical aspect of planning behind. Today's Special Operations are often more prolonged and more resource intensive than ever and require organic, adaptable, SOF-trained medical support teams to provide the highest level of care as far forward as possible. We need teams that can enter an austere theater and then build systems for successful transition to conventional medical resources. In the future, SORTs must be able to provide robust Role II capability to an increasingly dispersed force. This requires transitioning SORT #3 from the National Guard to active duty in the 528th SB(A) to meet minimum operational require-

ments: one team deployed, one team training, and one team ready.

Planning for SOF Role IIb support must look beyond just "resuscitative surgery" and embrace the many other de facto requirements of Role IIb support: en route care, blood components beyond packed red blood cells (including plasma, Factor VIIa, and possibly platelets), prolonged patient hold while awaiting theater or strategic patient evacuation, coordination and regulation of patient evacuation, host nation medical cooperation and development, and medical logistics. While these roles are accomplished by a myriad of resources in the *mature* theater, the responsibility for them in an *immature* or *austere* theater must fall upon a SOF Role IIb team. This might also include unconventional warfare missions like host nation development. For example, the mission might include host nation clinic and healthcare provider mentorship in order to deny the enemy the opportunity to exploit local lack of medical resources or skills. If the people feel their health needs are met, they are less likely to turn to an enemy insurgent for those needs, which builds a sense of goodwill for the local government.

It is an Army service component responsibility to provide FSTs to ARSOF. However, experience has proven that it is difficult to establish any habitual training relationships with designated FSTs. In order to provide highly trained medical teams to ARSOF, the requirement exists to establish a habitual training relationship between 528th SB(A) and designated FSTs. If the AMEDD cannot meet these requirements perhaps the best future solution is one that provides ARSOF with the *organic* medical force structure required to meet this challenge. In the meantime, joint training must be pursued with any available assets that could fulfill the SOF Role IIb mission. Service component differences become less relevant once the teams have trained together and know each other's equipment and capabilities. Joint training will be time and resource intensive; however, and will demand that the Role IIb team's personnel are available for training and are able to quickly set aside duties at their home station medical facility. The greatest advantage of joint training may lie in the familiarity with resources and capabilities that it provides to higher medical planners. As planners become more familiar with "who brings what" they will be able to more effectively leverage the SOF-oriented Role IIb capabilities to the mission at hand. Currently, the SORTs may be requested for missions via the USASOC G-3 Operations office.

The future of SOF Role II medical support holds many challenges. The present capability has proven proficiency and exhibits immense potential. Surgical support remains an issue, one which the AMEDD will no doubt continue to wrestle with for years to come. In an era in which joint operations are considered the norm, joint medical support should continue to be explored, enhanced, and streamlined. AFSOC's SOST has a proven battle-tested Role IIb experience that will continue to ensure successful surgical intervention far forward. The SORT provides robust, field-tested Role II capability. The SORT can integrate with surgical teams from both the Army and the Air Force to increase to Role IIb capability. The SORT can also serve as a stand-alone team in areas where rapid evacuation (using SORT's organic en route care capability) to surgical assets in the rear is possible. Due to their unique training, SORT also brings an unconventional warfare mindset to operations. Their ability to interface with the local healthcare system as trainers, mentors, facilitators, and negotiators contributes to improvements in the local healthcare sector and provides value added to SOF teams on the ground. Just as Special Operations personnel are constantly adapting to the changing needs of their environment, the Role II capability must adapt to future SOF medical needs. Let us work to meet the Role II challenge head-on, so that critical medical support to our Special Operations Forces remains unsurpassed.

ACKNOWLEDGEMENT

The author would like to thank LTC Kathleen Dunn Farr for her extensive editing and feedback. Her expertise and vision are instrumental in looking ahead to the challenges of Role II support in SOF.

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SOCM Perspective of Flight for the SOF Role II

Antujuan Brown, SOCM

As a member of the first and only Role II medical team in USASOC, a Special Operation Combat Medic often does not experience all of the front line combat trauma action like our brothers in the Ranger Battalions do. At times we find ourselves stuck inside the wire waiting to get elbows deep in some trauma, doing some sick call for the local nationals, listening to some lectures by the Docs, or just sitting down and writing an article for the JSOM. But there are times when we actually do get outside the wire and experience the battle firsthand. Recently, with the help of having an Army MEDEVAC team co-located with the Role II Team, our out-of-the-wire experience became reality. The SOCM Medics, or Flight ATPs, of the Role II Team are specifically trained and equipped to provide en route care from point of injury on rotary winged aircraft and to sustain multiple critical post-surgical patients during fixed wing flights to facilities such as Landstuhl, Germany. Role II Flight ATPs are not only graduates of the Special Operations Combat Medic Course, but also complete the Army Flight Medic Course, the Joint En route Care Course, and the Air Force Critical Care Aeromedical Transport Team (CCATT) Course. There are few places in USASOC, besides the 160th SOAR, where SOCMs have the opportunity to fly with a MEDEVAC/CASEVAC team to pick up and stabilize the sick and injured.

I have had the opportunity to work with the Army MEDEVAC Team here at our location and have already provided en route casualty care on over a dozen combat flight missions. The flight crew, especially the conventional flight medic, are happy to have us on board to assist with the patient load, and the teams on the ground are confident handing their ill or injured teammate off to an ATP. Having a MEDEVAC crew co-located with the Role II not only provides the SOCMs an opportunity to fly, but it also increases our overall capability. Having reliable air assets, in an area where they were previously nonexistent, definitely lets the war fighter on the ground know that if something happens, somebody will be there to pick them up. In the event where the Medic on the ground gets wounded and requires evacuation, having this flight capability allows us to instantly infill a new SOF Medic to the team on the ground. Being a part of the Role II team is an honor, not only because it is the first and only in USASOC, but for the unique opportunities to train and then implement the training in a combat zone in a manner unlike any other SOCM.

SGT Antujuan Brown is a Special Operations Combat Medic with the first Special Operations Resuscitative Team, working as the team's Flight Medic and CCAT Medic. He has been an ATP for two years, and has one tour of duty in Afghanistan.

Field Evaluation and Management of Non-Battle Related Knee and Ankle Injuries by the Advanced Tactical Practitioner in an Austere Environment Part One

JF Rick Hammesfahr, MD

Editor's Note: The following article will be published in three parts due to its size and amount of pictures.
Part One will consist of evaluation of knee injuries;
Part Two will be in the Spring 09 edition and will consist of taping procedures for the various knee injuries;
Part Three will be in the Summer 09 edition and will consist of ankle injury evaluation and taping.

What are the options that you, as an advanced tactical practitioner (ATP), have when you're in an austere situation in the field carrying out a mission, and one of your teammates comes to you complaining of either a twisted ankle, a twisted knee, a locked knee, or some type of non-battlefield related lower extremity injury? These types of injuries are going to compromise the mission because of that Soldier's inability to bear weight and remain functional. Basically, you're in the middle of nowhere, your teammate can no longer walk, and your team leader wants to know if this person needs to be evacuated, thereby compromising the mission and any other follow-on missions. Is there anything that can be done to make him at least marginally functional?

The diagnoses pertinent to the knee that will be discussed are collateral and cruciate ligament injuries of the knee, patellar dislocation, and locked knee due to a torn meniscus. In addition, the importance of being able to distinguish between a bursitis and an effusion, and why this is important, will be addressed. Finally, the evaluation and treatment of an ankle sprain will be discussed.

There are several assumptions that need to be made: The treating ATP:

- has the knowledge of the anatomy of the joint.
- knows enough to ask the questions necessary to define the mechanism of injury. In other words, was this a twisting injury? Was there a blow to the lateral aspect of the knee? Did the ankle go into a position of plantar flexion and inversion? Were there pops associated with this injury? Did the symptoms come on gradually or suddenly? Was this a result of a fall or a compressive injury? Did the knee buckle, and if so, in which direction?
- understands the different types of pathology that may occur given the history of injury and pertinent physical findings.

In addition, assume that you are in an austere environment situation with no diagnostic equipment, no additional or higher medical authority, and basically, your treatment supplies are limited to what you are carrying. This series of three articles will discuss how to evaluate and treat these injuries with taping techniques using any type of adhesive tape you have handy, even duct tape.

The goals of these procedures are to return the injured teammate to an ambulatory status or enough of an ambulatory status to continue the mission. At the very least you need to be able to give your team leader increased options for continuing the mission. Please note that everything in this article reflects temporary measures only — not definitive treatment. No matter what the patient says or how good the patient feels, additional medical care will be required once the mission is completed and the patient is returned to base.

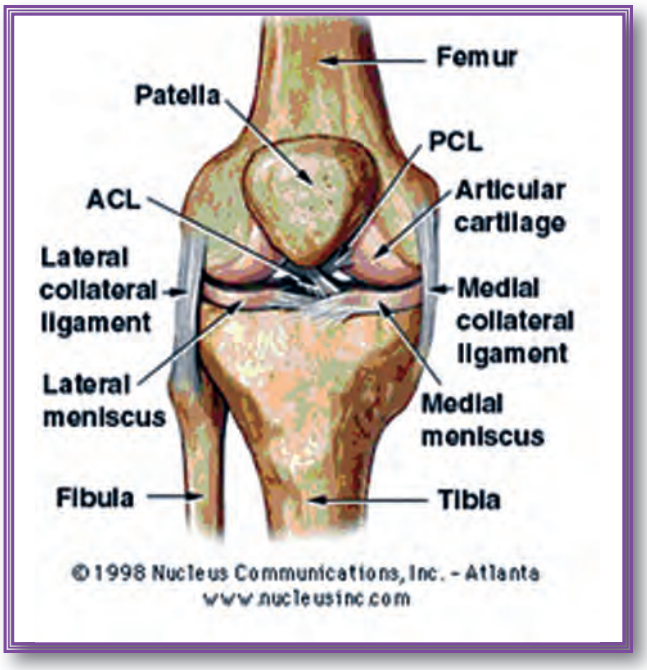


Figure 1: Knee anatomy, right knee (ACL=anterior cruciate ligament; PCL=posterior cruciate ligament)

KNEE

Anatomy

The knee is made up of four bones: the femur, the tibia, the fibula, and the patella.

The medial collateral ligament and the lateral collateral ligament are the ligaments on the medial and lateral sides of the knee. The medial collateral ligament (MCL) connects the femur to the tibia while the lateral collateral ligament (LCL) connects the femur and fibula (Figures 1 and 2).[1] They provide stability for the knee in a medial to lateral (sideways) direction.

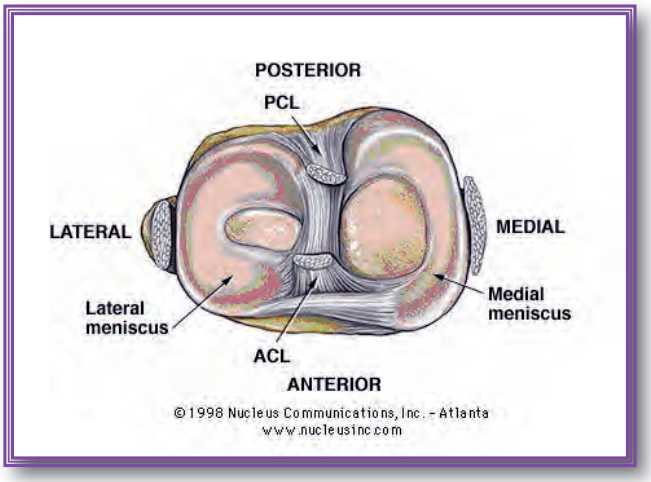


Figure 2: Right knee, cross sectional anatomy (ACL=anterior cruciate ligament; PCL=posterior cruciate ligament)

The medial and lateral menisci cartilage are c-shaped pieces of tissue that sit inside the joint. They are located on the peripheral aspect of the joint and act as a buffer between the tibia and femur (Figures 1 and 2).[1]

Two cruciate ligaments pass through in the center of the knee joint: the anterior cruciate (ACL) and the posterior cruciate (PCL) ligaments. These are the major stabilizing ligaments of the knee. In Figure 3,[1] in the lateral view, the posterior cruciate ligament prevents the femur from sliding forward on the tibia (or the tibia from sliding backward on the femur). In the medial view, the anterior cruciate ligament prevents the femur from sliding backward on the tibia (or the tibia sliding forward on the femur). Most importantly, both of these ligaments stabilize the knee against rotation in the horizontal plane (OR: around the vertical axis). Thus, if one of these ligaments is significantly damaged, the knee will be unstable when planting the foot of the injured extremity and pivoting, causing the knee to buckle and give way.

Overlaying the anterior aspect of the patella, between the patella and the skin is a potential sack called the bursa. At times this will become inflamed and swollen. When evaluating the knee, the examining ATP must be able to accurately determine the presence of a swollen bursa (bursitis) as opposed to localized soft tissue swelling or an effusion.

Effusion

An effusion represents a collection of an abnormal amount of fluid inside the joint. This fluid may be due to sepsis and be pus; it may be due to a fracture and be a lipohemarthrosis or hemarthrosis; it may be

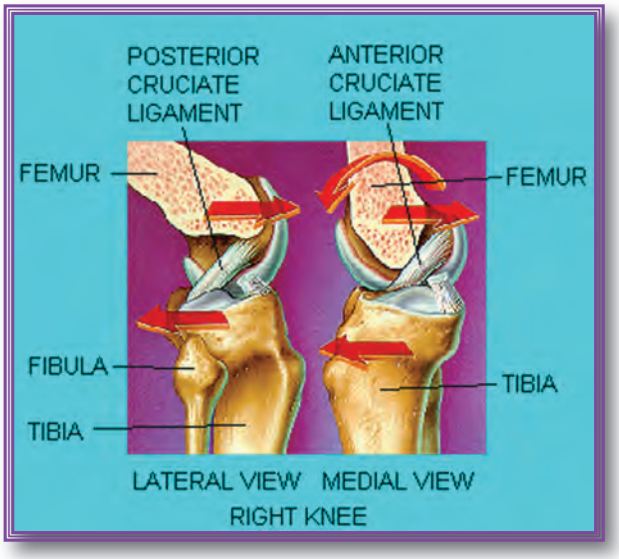


Figure 3: Cruciate ligament function

Figure 4: Normal appearance of a knee. The knee skin depressions adjacent to the patella are the "knee dimples" which disappear with the development of intra-articular swelling (effusion).

Figure 5: Above - Left knee with effusion
Red line: *Approximate extent of superior aspect of knee joint.* ***Black circle:*** *Patella*

due to a torn anterior cruciate ligament and be a hemarthrosis; or it may be due to a torn meniscus or a loose body and be a collection of serous fluid.

The importance of distinguishing the effusion from the bursitis is that an effusion represents a significant intra-articular disorder, requiring a more thorough examination and treatment regimen.

When evaluating a knee for the presence or absence of an effusion, examine the front of the knee joint. Since an effusion represents an accumulation of fluid inside the joint, as the joint becomes swollen (distended), the dimples on each side of the kneecap will disappear.

By comparing the effusion photograph (Figure 5) to the normal photograph (Figures 6), one can see that there's been a loss of the dimples in the knee with an effusion. This indicates an accumulation of an effusion (fluid inside the joint space) which displaces the overlaying skin in an outwards direction, causing the "knee dimples" to disappear.

In addition, since the joint also extends about four inches above the knee, any collection of fluid inside the joint will give a bulging above the kneecap (Figure 5). This is most noticeable at the superior lateral aspect of the patella. By pushing on the lateral as-

Figure 6: Below - Normal knee

pect of the knee, the examiner may actually detect a transient bulging sensation on the medial aspect of the knee if there is a significant accumulation of fluid. This is known as a fluid wave.

The field evaluation and treatment of an effusion is to initially determine the origin of the effusion and begin appropriate treatment for the underlying disorder. Temporarily, after addressing the causative injury, NSAID (non-steroidal anti-inflammatory drug) medication should be started. Upon return to base, further evaluation is absolutely required.

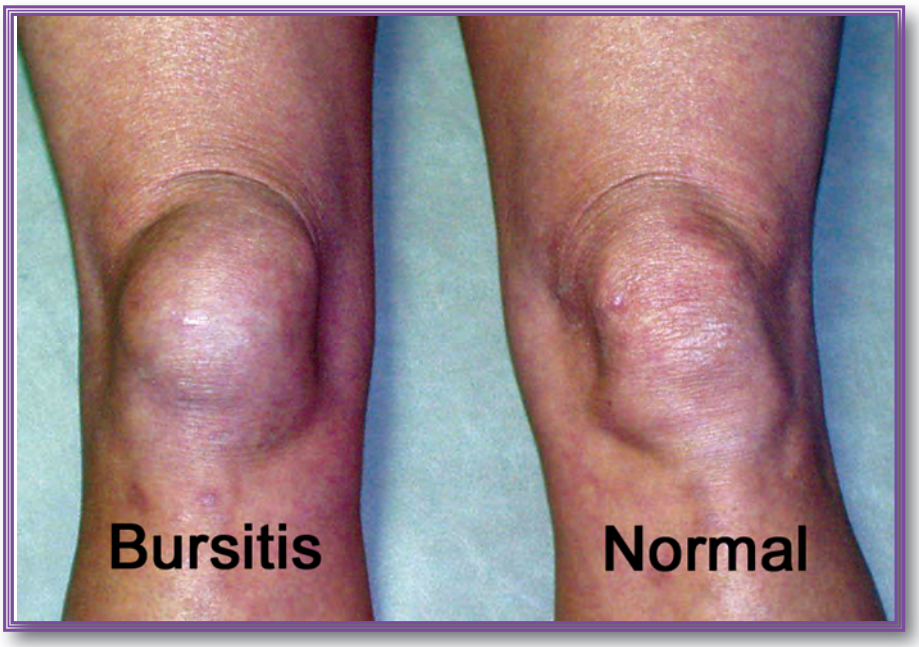


Figure 7: Notice the taut skin on the anterior surface of the knee with bursitis, as opposed to the presence of flexion creases on the anterior aspect of the normal knee. Both knees have "knee dimples" present.

With respect to evacuation possibilities, and mission continuation possibilities, this depends on the injury. Typically an effusion does not require evacuation unless sepsis occurs, a fracture occurs, or there is complete loss of function which prevents further ambulation.

In trying to distinguish between these diagnostic possibilities, sepsis will almost always require some sort of penetrating injury to the knee joint. There will be the typical signs that are associated with infection including erythema, exquisite increasing pain which is not responsive to pain medication, progressive increase in effusion and loss of motion, possible lymphangitis, and swollen, tender groin nodes. The presence of a septic knee constitutes a surgical emergency requiring evacuation.

In trying to determine the differential diagnosis of a fracture, without having any diagnostic equipment, the mechanism of injury comes into play. If a significant compressive force occurred across the joint, then the probability of a fracture to the proximal tibia or distal femur is increased. The very rapid accumulation of an effusion should also make the examiner worry about the presence of a fracture.

Finally, percussion or palpation of the bones of the proximal tibia or distal femur is normally not tender. If the examination shows an angular deformity at the joint, exquisite pain on attempted manipulation of the joint, or pain on percussion or palpation of the bones around the joint, then a presumptive diagnosis of a fracture must be considered.

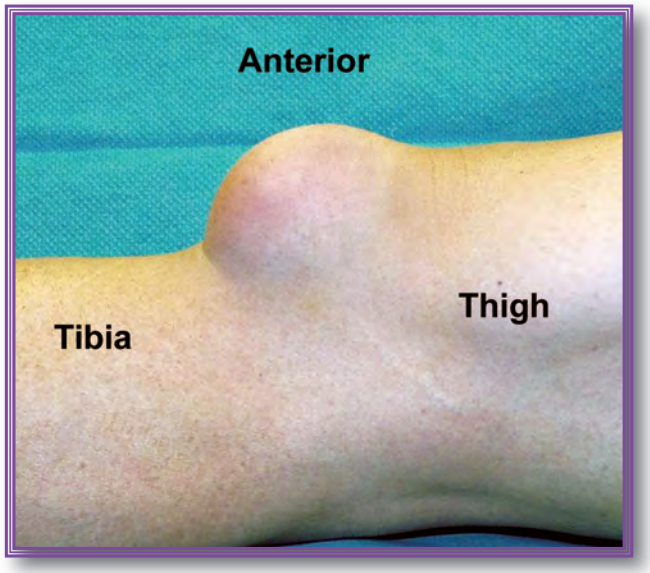


Figure 8: Lateral view of prepatellar bursitis

A torn anterior cruciate ligament is often associated with a pop and the rapid onset of swelling. Typically this injury does not prevent a patient from being ambulatory. However, it does make the knee somewhat unstable, especially with pivoting activities, while carrying heavy loads, and on uneven ground.

Figure 9: Anterior view of prepatellar bursitis. Note the taut anterior skin with loss of anterior knee creases.

In essence, anything that leads to complete loss of function of the joint with an inability to achieve an ambulatory status will require evacuation.

Bursitis

It is important to distinguish the potential mission-ending development of an effusion from the relatively benign pre-patellar bursitis. The bursa is essentually a flat sac that sits between the skin and the anterior aspect of the kneecap. When this sac becomes traumatized, it develops bleeding inside the sac, but extra-articular, which then causes a swollen, tender area on the anterior aspect of the knee joint. However, there is no development of an effusion. Typically the patient remains fairly functional although they do have some tenderness when attempting to kneel.

It is important to distinguish between the development of bursitis and the development of an effusion, because bursitis rarely interferes with the completion of a mission. With bursitis, the dimples on each side of the kneecap remain present (Figure 7). However, a tense swollen area is present that looks a little like a golf ball sitting on the anterior aspect of the kneecap (Figures 8 and 9). In the photos of the bursal swelling, close examination of the knee reveals that the flexion creases at the anterior aspect of the patella have disappeared due to the bursal swelling (Figures 7 and 9), as opposed to the normal knee. However, when examining the knee laterally, the swollen bursa becomes obvious (Figure 8).

In contradistinction to this, with the development of an effusion, the skin is not elevated off of the patella. However, the dimples around the kneecap are lost secondary to the outward pressure of the fluid that develops inside the knee joint.

In summary, with an effusion, both dimples will disappear; and with bursal swelling, the dimples remain, but the swelling is localized to the anterior aspect of the joint over the patella.

The treatment for bursitis is NSAID medication, kneepads, and limited kneeling and crawling. Once the person returns to base, further medical evaluation is required.

With respect to mission completion and evacuation, typically bursitis does not require evacuation unless infected. However, a septic pre-patellar bursitis is usually associated with some sort of penetrating injury to the anterior aspect of the joint. It will have the typical signs of infection including erythema, warmth lymphangitis, and tender swollen groin nodes. If septic, the person will most likely need to be evacuated.

It is important that the ATP understand that an acute, non-septic bursitis will often have the clinical presentation of swelling, warmth, and tenderness also. The major distinctions are that the septic bursitis has a penetrating injury and tender, swollen groin nodes whereas a non-septic bursitis (traumatic bursitis) has intact skin, and no tender, swollen groin nodes.

Motion

During evaluation of a knee, it is necessary to check for motion. Typically, loss of extension is secondary to an intra-articular block such as a torn meniscus or loose body. A swollen knee (secondary to an effusion) will normally have loss of flexion and occasionally loss of extension.

Collateral Ligaments

In looking at the medial collateral ligament and lateral collateral ligament injuries of the knee, these two ligaments stabilize the tibia relative to the femur in a side-to-side, medial-to-lateral direction. Typically, these ligaments are torn because there is a blow to the side of the knee or the patient jumps and lands on an uneven surface causing a buckling of the knee. The typical history is that of a tearing sensation, onset of pain, which is localized to the involved collateral ligament, onset of soft tissue swelling over the involved ligament, and then decreased motion secondary to the soft tissue swelling.

For example, if the patient receives a blow to the lateral aspect of the knee, they may have pain at the lateral aspect of the knee, but the deforming force will result in a tearing of the medial collateral ligament which then results in additional pain and swelling over the medial collateral ligament (Figure 10).

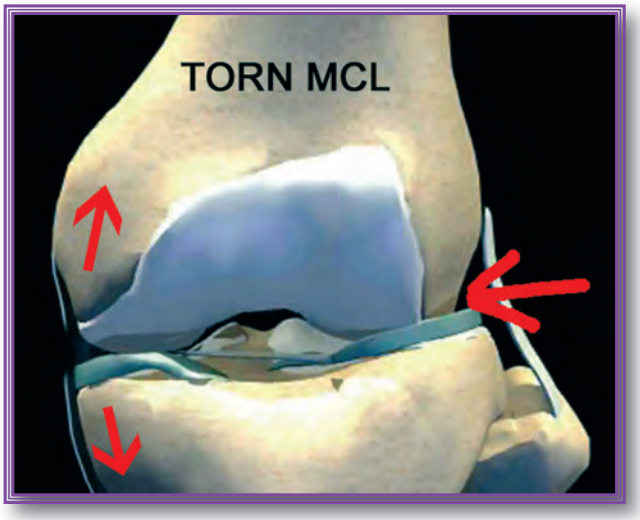


Figure 10: Lateral deforming blow resulting in a torn medial collateral ligament: When examining collateral ligaments, it is necessary to perform stress testing of the involved ligament. The stress testing for the medial collateral ligament is performed by stabilizing the distal femur and then applying a valgus or outward force to the knee joint (Figures 11 and 12).

Figure 12: When the MCL is torn. The valgus force at the ankle allows the tibia and femur to separate. Compare the angle of the tibia relative to the femur in Figure 11. The inset diagrams the tibia and femoral separation in the presence of a torn medial collateral ligament.

Figure 11: Stabilize the distal femur with one hand and apply a valgus force to the ankle to stress the medial collateral ligament. The inset shows the effect of the stress test on the tibia and femur if the medial collateral ligament is intact.

Figure 13: Stabilize the distal femur with one hand and apply a varus force to the ankle to stress the lateral collateral ligament. The inset shows the effect of the stress test on the tibia and femur if the lateral l collateral ligament is intact.

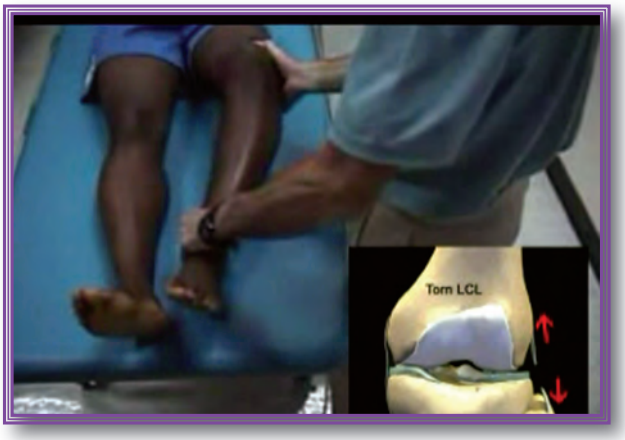


Figure 14: When the LCL is torn, the varus force at the ankle allows the tibia and femur to separate. Compare the angle of the tibia relative to the femur in Figure 13. The inset diagrams the tibia and femoral separation in the presence of a torn lateral collateral ligament.

If there is ever any question as to whether or not the patient has stability or instability, the opposite knee may always be tested. In looking for the presence or absence of swelling, there is usually swelling over the associated damaged ligament. If the swelling is significant enough, the dimple on the injured side of the knee will be lost due to soft tissue swelling, whereas the dimple on the uninjured side of the same knee will remain.

This action stretches the medial collateral ligament and if the medial collateral ligament is torn, instability will be appreciated as the tibia separates from the femur (Figure 12).

In a similar fashion, in testing the lateral collateral ligament, the distal femur is stabilized (Figure 13) and a varus-producing force (inwards) is applied to the distal tibia (Figure 14). If the lateral collateral ligament is torn, the tibia and femur will separate (Figure 14).

For example, if the medial collateral ligament is torn, in examining the dimples, the lateral dimple will remain because there is no effusion since the medial collateral ligament and associated soft tissue swelling is extra-articular. Hence, the medial dimple will disappear due to the accumulation of soft tissue swelling medially.

In a similar fashion, if the lateral collateral ligament is damaged, the lateral dimple adjacent to the patella may disappear whereas the medial one will not. In addition, there will be no accumulation of fluid above the kneecap in the suprapatellar pouch of the kneecap.

The treatment of a collateral ligament sprain is protective splinting or taping. Anti-inflammatory medication is also prescribed. Even though the taping may aid in making the knee stable and restoring function to the injured Soldier, it will be necessary to do protected weight bearing. This means that the Soldier's ruck and other weight will need to be re-distributed among the remaining members of the team so the weight of the ruck becomes minimal. It may be necessary to find a tree limb, if possible, to use not as a crutch, but as a walking stick much as hikers use poles when hiking. This gives the patient a little more stability with walking and redistributes the weight bearing load. A walking stick reduces the joint reactive forces of the hip and knee. By reducing the weight of the ruck and using the walking stick, the stress load across the injured ligament is also further significantly decreased. By doing these things and by taping the joint, it is usually possible to keep the patient at least semi-functional.

The ATP should recognize that it may be necessary to re-tape the knee as the tape will loosen with time. As the tape loosens, symptoms will gradually increase and this is a good indicator that taping needs to be reapplied. Once the patient returns to base, they absolutely will need further evaluation regardless of how they feels.

With respect to evacuation and mission completion, the ATP certainly needs to speak with the team leader and determine the demands of the terrain and the mission ahead and then give the team leader a realistic expectation and appraisal of how functional the patient will be. Most likely, the patient will be able to continue the mission although this depends in large part on the terrain requirements and the amount of medial and lateral stresses or twisting stresses that will be applied to the joint.

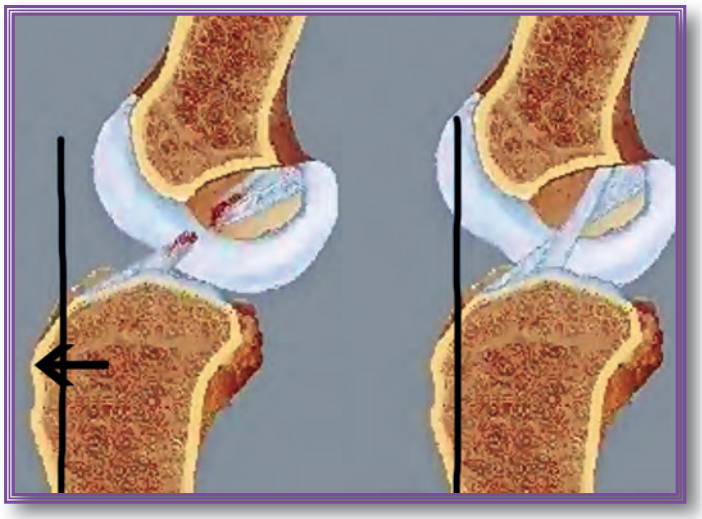
Anterior Cruciate Ligament

The anterior cruciate ligament is an intra-articular ligament of the knee. It stabilizes the tibia relative to the femur in an anterior to posterior direction (Figure 15). When torn, an (intra-articular) effusion rapidly develops; this is unlike tears to the extra-articular collateral ligaments, which do not result in the development of an effusion, but do cause soft tissue swelling.

The mechanism of injury is usually some sort of twisting or pivoting force to the knee that is accompanied by a popping sensation, a buckling sensation, the rapid development of an effusion and occasionally decreased flexion secondary to the effusion.

When performing the exam, the most reliable tests for this injury are to determine the presence or absence of an effusion (presence or absence of dimples), and then to perform the Lachman and anterior drawer tests.

When performing a Lachman test, the knee should be flexed to approximately 20 degrees and the



Torn ACL Intact ACL

Figure 15: Comparison of tibia position in the knee with an intact ACL and one with a torn ACL. Notice how the anterior aspect of the tibia lines up with the anterior aspect of the femur on lateral examination when the ACL is intact.

Figure 16: Lachman test. Insets show the anterior subluxation of the tibia, relative to the femur, when the ACL is torn.

femur stabilized. An anterior force is then applied to the proximal tibia. If the ACL is torn, then the tibia will sublux anteriorly relative to the femur as depicted in the drawing (Figures 16 to 18).

When performing the anterior drawer test (Figure 19), the knee is flexed to 90 degrees. The examiner will usually sit on the foot and then with the thumbs on the joint line, an anterior directed force is applied to the tibia. If the anterior cruciate ligament is intact, there is no motion or translation of the tibia anterior relative to the femur (Figure 20). However, if it is torn, then the tibia will sublux anterior to the femur (Figure 21).

The treatment for this particular type of ligament injury is non-steroidal medication and taping. Again, the load of the rucksack needs to be re-distributed among the remaining members of the team so that the injured Soldier is carrying as little weight as possible. In addition, home-made equivalents of walking sticks are also helpful for decreasing the amount of stress across the joint.

Upon return to base, this condition will again require a medical evaluation. Mission completion with a team member having this injury, would depend on the mission requirements. However, the probability of the injured soldier being able to complete the mission although with some decrease in function is fairly high.

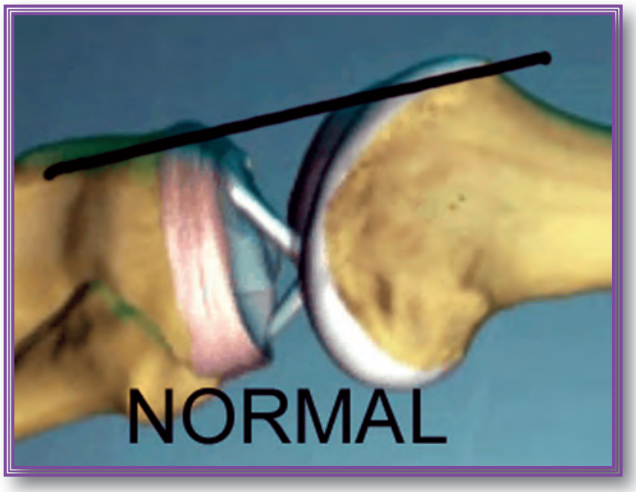


Figure 17:Above - Normal tiba-femoral relationship

Figure 18: Below - Anterior tibial subluxation

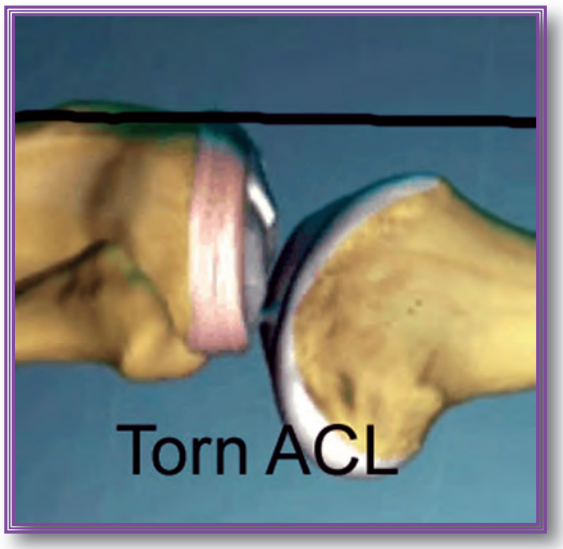


Figure 19: Anterior drawer test

Figure 20: Normal exam with the inset showing the relationship of the tibia to the femur.

Figure 21: Torn ACL with anterior tibial subluxation

References
1. Figures 1 to 3 were obtained from http://www.arthroscopy.com.

This completes Part One of this article. Part Two of this article will appear in the Spring 2009 edition and will consist of taping procedures for the various injuries discussed in Part One.

JF Rick Hammesfahr, M.D. graduated from Colgate University in 1973 and the College of Medicine and Dentistry of New Jersey in 1977. He was Chief Resident in Orthopaedics at Emory University from 1980-1982. In addition to receiving numerous surgical awards, he has been on the speaking faculty of numerous medical and orthopaedic meetings serving as the co-director of several courses on knee surgery. His publications have focused on tactical medicine, arthroscopy, calcaneal fractures, abductor paralysis, wound healing, running injuries, meniscal repair, septic knees, and sports medicine. He has written two book chapters, one book, published 22 articles, serves on the editoral review board of multiple medical journals, is the editor of the "Ranger Medic Handbook", and has presented over 120 CME lectures and talks on orthopedics and sports injuries.

He has served as president of the largest regional orthopaedic association, the Southern Orthopaedic Association. Currently, Dr Hammesfahr is the Director of the Center for Orthopaedics and Sports Medicine and serves as the Chairman of the USSOCOM Curriculum and Examination Board.

ULTRASOUND DETECTION OF PNEUMOTHORAX WITH MINIMALLY TRAINED SONOGRAPHERS: A PRELIMINARY STUDY

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KEYWORDS
ultrasound, pneumothorax, military

ABSTRACT

Background: Prompt recognition and treatment of a tension pneumothorax is critical to reducing mortality in both military and civilian settings. Physician assistants, Special Operations Forces (SOF) and conventional force Medics are often the first medical providers to care for combat trauma patients with penetrating chest trauma and frequently have limited diagnostic capabilities available to them due to mission constraints. The purpose of this study is to examine the potential for non-physician providers to determine the absence or presence of a pneumothorax in a porcine model, with the use of a portable ultrasound machine, after receiving minimal training. **Methods**: Physician assistants, SOF and conventional force Medics, veterinary technicians, and food service inspectors, all naïve to ultrasound, were recruited for this study. Participants underwent a brief presentation on detection of a pneumothorax by ultrasound and were then asked to perform a thoracic ultrasound examination on euthanized, ventilated swine. Some of the swine were induced with a pneumothorax prior to these examinations, and all participants were blinded to the absence or presence of a pneumothorax. **Results**: Twenty-two participants examined a total of 44 hemithoraces. A total of 21 out of 22 pneumothoraces were correctly identified with one false-negative. All 22 normal hemithoraces were correctly identified for a sensitivity of 95.4% (95 % CI 0.75-0.99), and a specificity of 100% (95% CI 0.81-1.00), with PPV of 100%, NPV of 95.6%. **Conclusions**: Non-physician healthcare providers can accurately detect a pneumothorax with portable ultrasound after receiving minimal focused training.

BACKGROUND

Penetrating chest trauma and complications due to tension pneumothorax have historically been, and continue to be, leading causes of preventable death on the battlefield.[1-2] Prompt recognition and treatment of tension pneumothorax is critical to reducing mortality.[3] Traditional methods of detection of pneumothorax include plain radiography and computed tomography (CT). However, these capabilities are rarely available at far-forward locations. Multiple studies have determined that thoracic ultrasound is more sensitive than plain radiographs in detection of pneumothorax, with sensitivities approaching that of CT.[4-9] However, each of these studies have involved physicians formally trained and experienced in ultrasound.

In a forward-deployed setting, physician assistants, Special Operations Forces (SOF) and conventional force Medics often operate independent of direct physician supervision. They are often the first medical providers to care for combat trauma patients with penetrating chest trauma and frequently have limited diagnostic capabilities available to them due to mission constraints. The purpose of this study is to examine the potential for non-physician providers to determine the

absence or presence of a pneumothorax in a porcine model, with the use of a portable ultrasound machine, after receiving minimal ultrasound training.

Methods

Physician assistants, SOF and conventional force Medics, veterinary technicians, and food service inspectors were recruited for this study. Participants were screened to ensure they had received no prior formal ultrasound training and specifically had no experience with the ultrasound detection of pneumothorax. Each participant underwent a brief slideshow presentation (approximately 10 minutes in length) on the detection of pneumothorax. The presentation, given by a physician assistant, addressed the "sliding lung sign" (Figure 1), "comet-tail" artifact (Figure 2), and "seashore" and "stratosphere" signs (Figures 3 and 4 respectively), and included video clips of each of these diagnostic findings, as well as an orientation to the machine.

Adult swine were shared with another ongoing study, after approval by Madigan Army Medical Center's Institutional Animal Care and Use Committee, and were maintained in accordance with the *Guide for the Care and Use of Laboratory Animals* published by the National Research Council / Institute of Laboratory Animal Research (ILAR).[10] A total of eight swine were used in this study. Upon completion of data collection for the other ongoing study, the swine were humanely euthanized but remained ventilated. Pigs were placed in the sternal recumbency position. Thoracentesis was then performed on one side of the pig's thorax, and air was infiltrated into the thoracic cavity until the "sliding lung" sign was obliterated. An average of 4.3cc/kg was required to obliterate the "sliding lung" sign. Findings were confirmed by a trained sonographer prior to participant scanning.

Upon completion of the presentation, participants were told that the pig may have normal lungs bilaterally, pneumothoraces bilaterally, or a single pneumothorax on either side. Participants, using a Sonosite Vet™ ultrasound machine (Sonosite 180™ equivalent) with 10-5MHz linear transducer, scanned the lateral thorax bilaterally, and asked to interpret their findings at bedside. Data was recorded and entered into a spreadsheet for analysis and then compared to the actual absence and presence of pneumothorax as confirmed by study staff.

Results

Twenty-two participants examined a total of 44 hemithoraces. A total of 21 out of 22 pneumothoraces were correctly identified with one false-negative. All 22 normal hemithoraces were correctly identified. The sensitivity of finding a pneumothorax by ultrasound in this study was 95.5% (95% CI 75% to 99%). The specificity in this study was 100% (95% CI 81%-100%). The positive predictive value (PPV) was 100%; the negative predictive value (NPV) was 95.6%.

Discussion

After a brief training session, participant's naïve to ultrasound detection of pneumothoraces were able to detect a pneumothorax with excellent accuracy (sensitivity [95.4%]) as compared to the actual presence or absence of pneumothorax. This sensitivity surpasses that of plain radiographs and approaches that of the gold standard of computed tomography. This sensitivity was also roughly equivalent to a study involving surgical residents and attending physicians who had undergone formal ultrasound training.[11] This supports our hypothesis that minimally trained users can accurately detect a pneumothorax with ultrasound. This data has obvious applications for military medical providers operating independently with limited diagnostic capabilities available to them.

Rapid detection of a pneumothorax with portable, handheld ultrasound may lead to life-saving interventions and/or evacuation to a higher echelon of care. Prevention of an unnecessary high-risk aerial or ground evacuation might also be avoided. Furthermore, the identification of a normal lung would allow the provider to safely avoid needle or tube thoracostomy, thus avoiding an unnecessary procedure and the associated morbidity and mortality associated with it. Ultrasound machines are now widely available in highly portable platforms. In addition to portability, ultrasound machines offer the advantages of being non-invasive, non-radiating, and useful in a loud environment when auscultation of breath sounds may be difficult or impossible.

The authors recognize that there is no role for emergency thoracic ultrasound in the setting of tension pneumothorax. If tension physiology exists or is suspected, there should be no delay in intervention by a trained medical professional. The authors also recognize that there is no role for emergency ultrasound while providing care under fire on the battlefield. The tenets of tactical combat casualty care should be adhered to at all times, and at no time should ultrasound evaluation be performed while directly engaged by enemy forces.

Conclusions

Despite these advantages, the use of portable ultrasound on the battlefield continues to be limited. Likely

factors for their limited use include 1) prohibitive cost and, 2) inadequate training of far-forward providers in its various emergency applications. These potential applications include the extended focused assessment with sonography for trauma (EFAST), central venous access, regional nerve blocks, abscess evaluation, emergency ocular ultrasound, and endotracheal tube placement.

Providing physician assistants and independently operating Medics with training in the various emergency ultrasound applications would greatly enhance these providers' ability to care for their patients at far-forward locations. As this study demonstrates, extensive formal ultrasound training may not be required for these providers to safely and accurately use such applications. Future studies with a larger sample size, particularly in austere conditions (ie. rotary wing aircraft) may be useful to further validate this hypothesis. Future studies validating the accuracy of non-physician providers in other emergency ultrasound applications such as the EFAST, ultrasound detection of long-bone fractures, and confirmation of endotracheal tube placement may also be useful. Considerations should be made for incorporating concise ultrasound training into the Interservice Physician Assistant Program and Special Forces Medical Sergeant or Special Operations Combat Medic courses. A case could also be made for the addition of portable ultrasound machines to the medical equipment sets (MES) of conventional forces battalion aid stations, forward support medical companies, and Special Forces A-Team medical equipment sets.

Finally, this study has obvious implications for rural medicine, where a myriad of healthcare providers may be called upon to make interpretations of emergency ultrasound images. This study demonstrates that even individuals who are uncomfortable making diagnostic decisions can effectively acquire such images, which can then be transmitted to an available emergency physician assistant, emergency physician, or radiologist for interpretation.

LIMITATIONS

This was a preliminary study and therefore, the sample size is small. Further studies which include a larger sample size may be useful. The amount of air introduced to induce pneumothorax was not uniform, which may have resulted in various sizes of pneumothorax between models. The anatomy of swine, al-

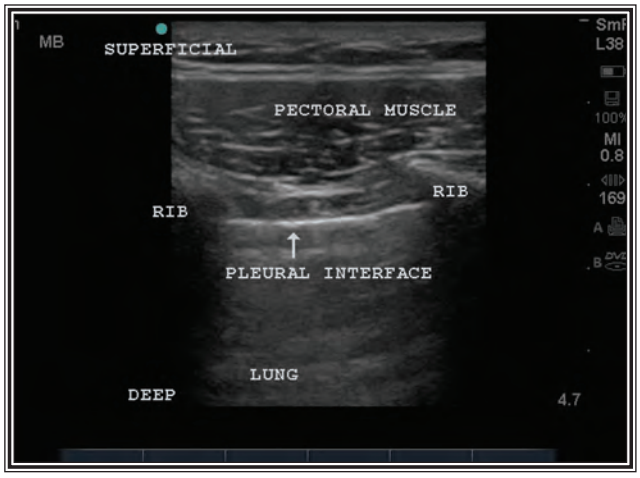

Figure 1: Still image depicting the anatomy of the pleural interface/intercostal space and presence of sliding lung artifact indicative of normal lung without presence of pneumothorax.

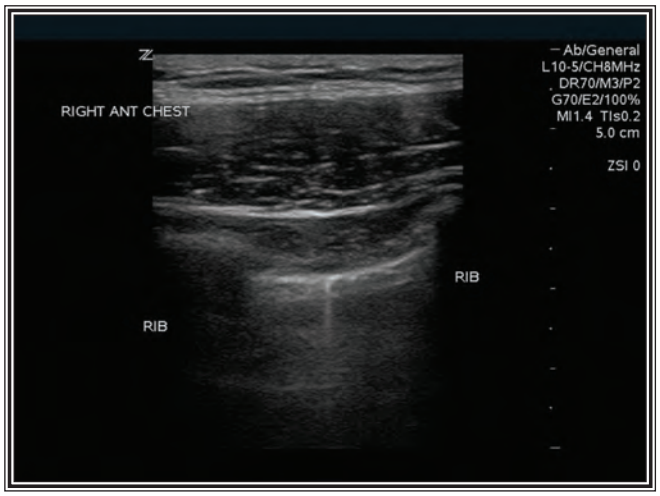

Figure 2: Still image depicting presence of comet-tail sign which, when present, indicates absence of pneumothorax.

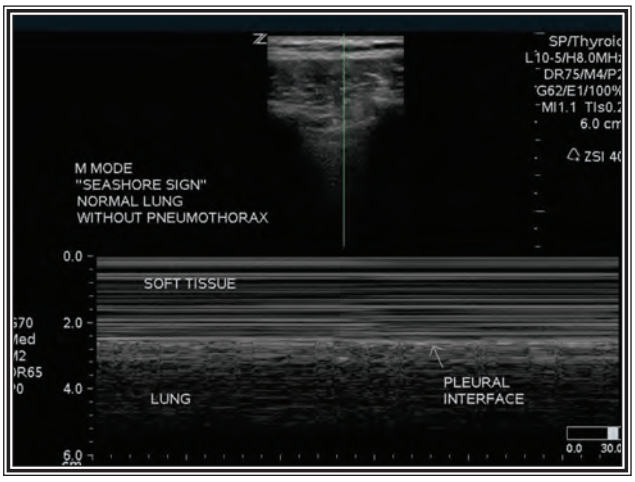

Figure 3: Still image in M-Mode depicting "seashore sign" indicating absence of pneumothorax.

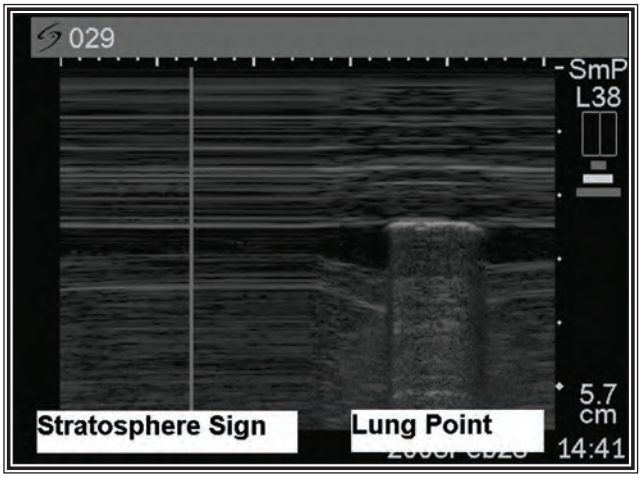

Figure 4: Still image in M-Mode depicting both the "stratosphere sign" and "lung point," indicating the presence of pneumothorax.

though similar, is not identical to that of humans; therefore, the scanning technique was slightly different. There was no direct comparison to any other imaging modalities in this study. Rather, the standard for comparison used was the actual presence or absence of pneumothorax as confirmed by study staff.

Acknowledgements

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MAJ Bradley Younggren has been the associate program director of the Madigan-University of Washington, now Madigan Program in Emergency Medicine for over four years. He is currently the acting Medical Director, Andersen Simluation Center, Vice Chair of the Army Central Simulation Committee, and serves as the specialty advisor in simulation for emergency medicine. He is also very involved in the use of emergency ultrasound having lectured at the national level on various applications of emergency ultrasound.

Dr. Robert Blankenship is a board certified emergency physician. He did his emergency medicine residency at Carl R. Darnall Army Medical Center. During his 11 years of active duty he served as an Emergency Medicine Assistant Residency Director, Ultrasound Director, and the Transitional Year Program Director at Madigan Army Medical Center. Dr. Blankenship also developed the Army's First Tactical Ultrasound Course in 2007 after returning from Iraq where he was awarded the Bronze Star for his service with 1-66 Armor, 4th Infantry Division, Fort Hood Texas.

ABSTRACTS FROM CURRENT LITERATURE

Effect of Carbohydrate Administration on Recovery from Stress-Induced Deficits in Cognitive Function: A Double-Blind, Placebo-Controlled Study of Soldiers Exposed to Survival School Stress

Morgan III, Charles A. MD; Hazlett, Gary PysD; Southwick, Steven MD; Rasmusson, Ann MD; and Lieberman, Harris R. PhD
Military Medicine, 174, 3:000, 2009
AMSUS - Association of Military Surgeons of the U.S.

ABSTRACT

Objective: The goal of this project was to evaluate the effects of energy supplementation, as liquid carbohydrate (CHO), on facilitating recovery of cognitive function in Soldiers who have been exposed to sustained psychological and physical stress during survival school training. **Project Design:** A double-blind, placebo-controlled design was used. Healthy, male volunteers attending survival training were recruited for participation in the study. At the conclusion of the mock captivity phase of survival training and before a recovery night of sleep, subjects participated in cognitive testing. After this, subjects were randomly assigned to one of three treatment groups. Subjects received either a 6% CHO (35.1 kJ/kg), 12% CHO (70.2 kJ/kg), or placebo beverage in four isovolemic doses. In the morning of the following day, all subjects participated in a second assessment of cognitive functioning. **Results:** Compared to subjects who received placebo, those who received supplemental CHO beverages exhibited significantly improved performance on a complex cognitive task (i.e., Stroop Test) involving concentration effectiveness associated with selective attention and response inhibition. No differences were observed on a variety of cognitive tasks of lesser complexity. **Discussion:** These data suggest nutritional interventions enhance the rapid recovery of complex cognitive functions impaired by exposure to significant or sustained stressful conditions. In addition to enhancing speed of recovery of function between operational intervals, the current data suggest that dietary supplement strategies may hold promise for enhancing field performance and a capacity to assist in sustaining operations by military personnel over time.

Current and Future Cooling Technologies Used in Preventing Heat Illness and Improving Work Capacity for Battlefield Soldiers - Review of the Literature

O'Hara, Reginald; Eveland, Ed; Fortuna, Sarah; Reilly, Patricia; Pohlman, Roberta
Military Medicine, Volume 173, Number 7, July 2008, pp. 653-657(5)
AMSUS - Association of Military Surgeons of the U.S.

ABSTRACT

Objective: The goals were to review the effectiveness of current cooling technologies used on the battlefield to reduce or to prevent heat illness in Soldiers and to discuss possible alternative or improved cooling methods. **Methods:** A search of the literature for 1990-2007 was performed by using the Air Force Institute of Technology and Air Force Research Laboratory search engines. **Results:** Several current cooling technologies are modestly effective in attenuating brain and core body temperatures, but the cooling effects are not sustained and the devices present operational problems. This review indicates that some current cooling devices are effective in lowering perceived efforts and lengthening maximal exercise time but are incompatible with current demands. **Conclusions:** Many of the cooling methods and devices detailed in the literature are impractical for use in the field. Future research should focus on cooling technologies that are practical in the battlefield and have sustainable cooling effects.

Inhalational Diesel Exhaust Exposure in Submariners - Observational Study

Duplessis, Christopher A; Gumpert, Barton
Military Medicine, Volume 173, Number 7, July 2008, pp. 671-676(6)
AMSUS - Association of Military Surgeons of the U.S.

ABSTRACT

Objective: An observational study was performed with a convenience sample of 38 submariners exposed to diesel exhaust for 9 hours to assess the development of reactive airways dysfunction syndrome (RADS) after prophylactic corticosteroid treatment. **Methods:** Twenty-four subjects were available for baseline physical examinations, pulmonary function tests, and chest radiographs, and 16 more subjects were available for interviews; 30 subjects were available for 6-month follow-up surveys. Subjects were treated on the basis of presenting symptoms; 19 subjects were treated with a 10-day course of orally administered prednisone, accompanied by 30 days of inhaled fluticasone/salmeterol therapy. **Results:** There were no cases of RADS diagnosed at 6-month follow-up evaluations. **Conclusion:** There were no cases of RADS diagnosed at 6-month follow-up evaluations in submariners with uncontrolled, isolated, heavy diesel exhaust exposure, despite many initial symptoms that portended the diagnosis. To our knowledge, this is the largest reported case study of corticosteroid treatment initiated with an expressed intention to prevent the development of RADS after an isolated diesel exhaust exposure. Although we cannot prove that early intervention with corticosteroids prevented RADS, we think that the implementation of prompt prophylactic treatment expedited symptom resolution and might have prevented RADS development, on the basis of previous historical control data. RADS resulting from diesel exhaust may be an important public health issue, and our hope is to promote increased recognition of the diagnosis, which often is not suspected upon initial presentation but is delayed by up to several years. Increasing awareness may prompt pursuit of more-aggressive interventions with acute and protracted corticosteroid treatment and execution of the necessary controlled trials to establish treatment efficacy in mitigating the severity and/or circumventing the development of RADS.

Suspected Pulmonary Tuberculosis Exposure at a Remote U.S. Army Camp in Northeastern Afghanistan, 2007

Nevin, Remington L; Silvestri, John W; Hu, Zheng; Tobler, Steven K; Trotta, Richard F.
Military Medicine, Volume 173, Number 7, July 2008, pp. 684-688(5)
AMSUS - Association of Military Surgeons of the U.S.

ABSTRACT

Military personnel serving at remote camps in the border regions of northeastern Afghanistan may experience crowded living conditions and may have frequent interaction with local national (LN) workers, increasing the risk of exposure to multiple endemic diseases including tuberculosis (TB). In January 2007, pulmonary TB was clinically suspected in a LN worker who had close contact with a company of 92 U.S. Army personnel at a remote camp in Konar province, Afghanistan, over four months. This report describes the results of the contact investigation conducted by the U.S. Army, in which four U.S. personnel were found to have evidence of TB exposure. This investigation raises concerns arising from the high prevalence of drug-resistant TB in the region and in neighboring North West Frontier Province, Pakistan, and demonstrates the challenges of conducting contact investigations and using LN workers in deployed wartime environments.

Regional Anesthesia for the Management of Limb Injuries in Space

Silverman, GL; McCartney, CJ
Aviat Space Environ Med 2008; 79:620-5

Abstract

Traumatic injuries continue to present a threat to the success of current and future spaceflight missions. The magnitude of this threat will grow as the frequency of extravehicular activities is increased and missions venture beyond low Earth orbit and further away from terrestrial medical support. The capability to render definitive treatment to crewmembers who suffer a serious traumatic injury while in space is relatively limited at present. While some research has focused on the development of specific surgical techniques for the microgravity environment, little attention has been given to how one might practically provide anesthetic care for injured crewmembers expected to undergo these procedures. While many logistical and practical obstacles exist to the provision of general anesthesia in microgravity, regional anesthesia could be used to overcome many of these problems. A regional anesthetic capability for spaceflight missions could be developed with minimal modifications to existing terrestrial techniques and would provide the ability to manage a wide range of potential injuries while in orbit. The capability to provide reliable regional anesthesia could be further augmented and improved using a range of imaging technologies currently in development; it is expected that these devices would have a range of terrestrial applications, including the ability to provide immediate, safe, and reliable anesthetic care to patients in remote locations, or under austere conditions such as the combat environment.

The Resuscitative Fluid You Choose May Potentiate Bleeding

Brummel-Ziedins, Kathleen PhD; Whelihan, Matthew F. BS; Ziedins, Eduards G. MD; Mann, Kenneth G. PhD
Journal of Trauma-Injury Infection & Critical Care. 61(6):1350-1358, December 2006.

Abstract

Background: Trauma is the leading cause of death in the younger population in the United States, frequently from the development of hemorrhagic shock. Controversy exists over the type of volume resuscitation for restoring hemodynamic stability that should be used in hemorrhagic shock. Little is known about how various resuscitative paradigms affect the coagulation cascade, which is essential to controlling hemorrhagic shock. **Methods:** We studied the effect of various resuscitative formulas on blood coagulation using a new model of whole blood in a controlled setting with corn trypsin inhibitor and a 5-pM stimulus of tissue factor. We investigated thrombin generation, fibrin formation, and platelet activation with four diluents: 0.9% NaCl (NS), lactated Ringer's solution (LR), 6% hydroxyethyl starch (HES), and 3% NaCl (HS), each from 0% to 75% blood dilution. Thrombin generation was measured periodically during a time course of 20 minutes in its complex with antithrombin III. Platelet activation and fibrinopeptide A (FPA) release were monitored in serum at a 20-minute time point. Fibrin clots were collected and weighed. **Results:** The coagulation markers (thrombin generation, platelet activation, and FPA release) were significantly different by dilution ($p < 0.001$ in all) and diluent by dilution ($p < 0.001$ in all). Thrombin generation, platelet activation, and FPA release decreased the least with the diluents NS and LR. LR caused the least amount of variation in thrombin generation over the dilution course. HS produced the most dramatic change in all of the markers; no coagulation was seen between 30% to 75% dilution ($p < 0.05$). HES produced greater decreases in thrombin generation and FPA release than NS and LR. Fibrin clot mass decreased with a 10% to 20% dilution for NS and LR, whereas stable fibrin mass did not decrease with the diluents HES and HS at 10% to 20% dilutions. At >30% dilutions, HS produced no stable clots and HES dramatically decreased clot formation by 61% and maintained this level. **Conclusions:** LR and NS had the least effect on thrombin generation, clot formation, and platelet activation at various concentrations compared with HES and HS. This observational data suggests that volume expanders such as HES and HS may be detrimental in treatment of hemorrhagic shock.

Trauma System Development in a Theater of War: Experiences From Operation Iraqi Freedom and Operation Enduring Freedom

Eastridge, Brian J. MD; Jenkins, Donald MD; Flaherty, Stephen MD; Schiller, Henry MD; Holcomb, John B. MD
Journal of Trauma-Injury Infection & Critical Care. 61(6):1366-1373, December 2006.

ABSTRACT

Background: Medical lessons learned from Vietnam and previous military conflicts led to the development of civilian trauma systems in the United States. Operation Iraqi Freedom represents the first protracted, large-scale, armed conflict since the advent of civilian trauma systems in which to evaluate a similar paradigm on the battlefield. **Methods:** Collaborative efforts between the joint military forces of the United States initiated development of a theater trauma system in May 2004. Formal implementation of the system occurred in November 2004, the collaborative effort of the three Surgeons General of the U.S. military, the United States Army Institute of Surgical Research, and the American College of Surgeons Committee on Trauma. One trauma surgeon (Trauma System Director) and a team of six trauma nurse coordinators were deployed to theater to evaluate trauma system component issues. Demographic, mechanistic, physiologic, diagnostic, therapeutic, and outcome data were gathered for 4,700 injured patients using the Joint Theater Trauma Registry. Interview and survey methods were utilized to evaluate logistic aspects of the system. **Results:** System implementation identified more than 30 systemic issues requiring policy development, research, education, evaluation of medical resource allocation, and alterations in clinical care. Among the issues were transfer of casualties from point of injury to the most appropriate level of care, trauma clinical practice guidelines, standard forms, prophylactic antibiotic regimens, morbidity/mortality reporting, on-line medical evacuation regulation, improved data capture for the trauma registry, and implementation of a performance improvement program. **Conclusions:** The implementation of a theater trauma system demonstrated numerous opportunities to improve the outcome of Soldiers wounded on the battlefield.

Guidelines for the Prevention of Infection After Combat-Related Injuries

Hospenthal, Duane R. MD, PhD; Murray, Clinton K. MD; Andersen, Romney C. MD; Blice, Jeffrey P. MD; Calhoun, Jason H. MD; Cancio, Leopoldo C. MD; Chung, Kevin K. MD; Conger, Nicholas G. MD; Crouch, Helen K. RN, MPH; D'Avignon, Laurie C. MD; Dunne, James R. MD; Ficke, James R. MD; Hale, Robert G. DDS; Hayes, David K. MD; Hirsch, Erwin F. MD; Hsu, Joseph R. MD; Jenkins, Donald H. MD; Keeling, John J. MD; Martin, R Russell MD; Moores, Leon E. MD; Petersen, Kyle DO; Saffle, Jeffrey R. MD; Solomkin, Joseph S. MD; Tasker, Sybil A. MD; Valadka, Alex B. MD; Wiesen, Andrew R. MD, MPH; Wortmann, Glenn W. MD; Holcomb, John B. MD
Journal of Trauma-Injury Infection & Critical Care. 64(3) Supplement:S211-S220, March 2008.
Prevention and Management of Combat-related Infections: Clinical Practice Guidelines Consensus Conference.

ABSTRACT

Management of combat-related trauma is derived from skills and data collected in past conflicts and civilian trauma, and from information and experience obtained during ongoing conflicts. The best methods to prevent infections associated with injuries observed in military combat are not fully established. Current methods to prevent infections in these types of injuries are derived primarily from controlled trials of elective surgery and civilian trauma as well as retrospective studies of civilian and military trauma interventions. The following guidelines integrate available evidence and expert opinion, from within and outside of the U.S. military medical community, to provide guidance to U.S. military health care providers (deployed and in permanent medical treatment facilities) in the diagnosis, treatment, and prevention of infections in those individuals wounded in combat. These guidelines may be applicable to noncombat traumatic injuries under certain circumstances. Early wound cleansing and surgical debridement, antibiotics, bony stabilization, and maintenance of infection control measures are the essential components to diminish or prevent these infections. Future research should be directed at ideal treatment strategies for prevention of combat-related injury infections, including investigation of unique infection control techniques, more rapid diagnostic strategies for infection, and better defining the role of antimicrobial agents, including the appropriate spectrum of activity and duration.

Vasoactivity of Bovine Polymerized Hemoglobin (HBOC-201) in Swine With Traumatic Hemorrhagic Shock With and Without Brain Injury

Rice, Jennifer MS; Philbin, Nora MS; Handrigan, Michael MD; Hall, Carrie MD, LT, USN; McGwin, Gerald PhD; Ahlers, Stephen PhD, CAPT, MSC, USN; Pearce, L B. PhD; Arnaud, Francoise PhD; McCarron, Richard PhD; Freilich, Daniel MD, CDR, MC, USN

Journal of Trauma-Injury Infection & Critical Care. 61(5):1085-1099, November 2006.

ABSTRACT

Background: We previously reported that bovine polymerized hemoglobin (HBOC- 201) improved outcome in swine with hemorrhagic shock (HS) with and without traumatic brain injury (TBI). Herein, we add analyses of blood pressure (BP) responses, associated physiologic data, and HS fluid infusion guidelines. **Methods:** HBOC-201 versus standard fluid resuscitation was compared in four anesthetized invasively monitored swine models: moderate controlled HS, severe controlled HS, severe uncontrolled HS (liver injury), and severe uncontrolled HS/TBI (liver/parietal brain injuries). Pigs received fluid for hypotension and tachycardia, and were followed up to 6 (HS alone) or 72 hours (HS/TBI). The change in mean arterial pressure ([DELTA]MAP) response severity was stratified and analyzed based on infusion number and HS severity, using Student's t and Fisher's exact tests. **Results:** HBOC-201 vasoactivity resulted in higher MAP in all studies. Among HBOC-201 pigs, [DELTA]MAP responses were significant for the first two infusions and inversely related to HS severity. Among controls, [DELTA]MAP responses remained significant through the fourth infusion in controlled HS models, and through the first in severe uncontrolled HS/TBI; none were significant in severe uncontrolled HS. [DELTA]MAP was higher with HBOC-201 through the first infusion in moderate controlled HS, the fifth in severe uncontrolled HS, and the second in severe uncontrolled HS/TBI; there were no group differences in severe controlled HS. No severe MAP responses occurred. Higher [DELTA]MAP severity did not impact outcome. Hypotension satisfied fluid reinfusion criteria less consistently than tachycardia. Overall, HBOC-201 improved physiologic parameters and survival without causing hypoperfusion; in severe HS, perfusion improved. **Conclusions:** In swine with HS +/- TBI, HBOC-201 had mild to moderate vasoactivity, resulting in significant [DELTA]MAP responses mainly after initial infusions, no severe/adverse responses, and improved outcome. Our data suggest that use of physiologic parameters (e.g., tachycardia), in addition to hypotension to guide fluid reinfusion during HS resuscitation with HBOC-201, will minimize hypoperfusion risk and maximize potential benefit.

A Large Animal Fatal Extremity Hemorrhage Model and Evaluation of a Polymeric Dressing (Fatal Extremity Hemorrhage)

Walters, Thomas PhD; Baer, David G. PhD; Kauvar, David S. MD

Journal of Trauma-Injury Infection & Critical Care. 61(5):1107-1112, November 2006.

ABSTRACT

Background: Extremity hemorrhage is a contributor to preventable battlefield mortality. The Army has liberalized tourniquet use guidelines in an attempt to prevent these deaths. To evaluate wound hemostatic agents that might allow for early tourniquet removal while maintaining hemorrhage control, a model of lethal extremity hemorrhage in the goat (Capra hircus) was developed and a polymeric dressing agent (BioFoam) tested. **Methods:** After administration of a spinal block, animals were placed in lateral recumbancy with a head-up tilt of 6 degrees, 500mL crystalloid was injected and 600 u/Kg of heparin was administered. After tourniquet application to the thigh, a soft tissue and vascular injury was created by transecting muscles and the femoral artery. The polymeric wound dressing was applied and the tourniquet was released. **Results:** In testing, the primary endpoint was mortality within the first hour after tourniquet release. None of the control animals survived the full hour. Two out of five (40%) of the treated animals survived. With survivors' survival time calculated as 60 minutes, survival time was found not to differ between treated (34 +/- 19 minutes) and untreated (29 +/- 18 minutes) animals ($p = 0.77$). **Conclusion:** The physical characteristics of tissue injury, need for anticoagulation, and manipulation of blood pressure are vital factors contributing to the lethality of a large animal fatal extremity hemorrhage model. BioFoam was successful in preventing fatal

arterial extremity hemorrhage after the release of an effective tourniquet in some cases. An agent that can reliably allow for safe tourniquet removal and restoration of collateral circulation is a potential solution to tourniquet-associated morbidity in traumatic extremity injury. The model developed will serve as a rigorous test for such agents.

Nonoperative Management of Severe Blunt Splenic Injury: Are We Getting Better?

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ABSTRACT

Background: Most minor splenic injuries are readily treated nonoperatively but controversy exists regarding the role of nonoperative management for higher-grade injuries. The infrequency of these injuries has made evaluation of factors critical to their management difficult. **Methods:** Through the National Trauma Data Bank, 3,085 adults sustaining severe (Abbreviated Injury Scale score >=4) blunt splenic injury from 1997 to 2003 were retrospectively reviewed. Patient management, demographic information, physiologic data, procedures performed, and outcomes were analyzed. **Results:** Nonoperative management was attempted in 40.5% of patients but ultimately failed in 54.6% of those. Failure of nonoperative management was associated with increased age, low admission systolic blood pressure, higher injury severity score, and increased hospital and intensive care unit length of stay. Mortality associated with failure of nonoperative management (12.3%) and successful observation (13.8%) was similar. **Conclusions:** Nonoperative management of higher-grade splenic injuries is associated with a high rate of failure and prolonged hospital stay. Careful judgment must be exercised in applying nonoperative management to patients with severe splenic injuries.

The Potential Utility of Fibrin Sealant Dressing in Repair of Vascular Injury in Swine

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ABSTRACT

Background: A previous study in which fibrin sealant dressing (FSD) secured hemostasis in major arterial hemorrhage for 96 hours suggested the applicability of this dressing in damage control operations after severe trauma. The objective of this study was to determine the effective duration of FSD hemostatic function in vivo and to examine its potential utility for definitive repair of a major arterial injury in swine. **Methods:** High pressure bleeding in an infrarenal aortotomy was controlled by placing FSD on the wound with 4-minute compression (n = 15). If hemostasis was achieved, the abdominal cavity was closed. Surviving animals were killed at 2, 4, 6, and 8 weeks and aortotomy sites collected for histology. **Results:** FSD stopped arterial hemorrhage after 4-minute compression in 14 of 15 (93%) pigs. Dressings failed in two pigs at 36 and 53 minutes after treatment. Twelve (80%) animals recovered and resumed normal activities. Of the remaining 12, two developed rebleeding at the aortotomy site on days 8 and 11 and were killed; another was killed because of idiopathic low hematocrit on day 10. Nine pigs survived until scheduled to be killed, maintaining hemostasis with stable hematological values. In the surviving animals, serial computed tomography scans showed formation of a pseudoaneurysm at the aortotomy site, which resolved after 2 to 3 weeks. The initial vascular defect and pseudoaneurysm were filled with fibroblast-myoblast collagen rich tissues covered by endothelium. **Conclusion:** FSD can seal an arterial injury, stop high pressure bleeding, and prevent rebleeding for at least 7 days. The dressing may be most beneficial in damage control operations. If combined with an elective interventional radiologic procedure (e.g. embolization or stenting), it may also offer an alternative to suture repair of vascular injuries in cases where profuse bleeding obstructs visualization.

Rural Motor Vehicle Crash Risk of Death is Higher After Controlling for Injury Severity

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ABSTRACT

Background: Motor vehicle crash (MVC) mortality rates are inversely related to population density. The purpose of this study was to analyze if there is a regional variation in the risk of MVC death after controlling for injury severity. **Methods:** The study utilized the Crash Outcome Data Evaluation System (CODES) data set in Nebraska. All fatal or injury-related crashes during a 4-year period (1996 through 1999) were analyzed. Injury Severity Scores (ISSs) were calculated from the CODES listed International Classification of Diseases diagnoses. Logistic regression analysis was performed to analyze the odds ratio for death in three rural county groupings compared with urban locations. **Results:** During the 4-year period, 56,727 people were injured and 1,237 were killed in 38,493 MVCs. Of these, 45,222 (78%) records had complete information on variables of interest. In addition, 28,859 (50%) records had enough information to calculate an ISS. A total of 22,181 (39%) records had complete information on the variables of interest and ISSs. After adjusting for the effects of speed limit, age, and alcohol involvement (but not ISS), the odds of death were 1.24 (1.01-1.53) higher in the large, non-adjacent and 1.38 (1.14-1.66) small, non-adjacent rural counties. After adjusting for the effect of ISS, the odds of death were 1.98 (1.18-3.31) higher in the small, non-adjacent rural counties. **Conclusion:** After controlling for ISS, the risk of MVC death is nearly twice as high in the most rural counties in Nebraska. This finding suggests that variation in medical care may contribute to this regional variation.

Unrecognized Misplacement of Endotracheal Tubes by Ground Prehospital Providers

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Prehospital Emergency Care 2007;11 :213-218

ABSTRACT

Objective: Endotracheal intubation by emergency medical services (EMS) is well established. Esophageal misplacement is a catastrophic complication that has until recently been studied by using methods that have called into question the accuracy of the reported data. The purpose of our study was to determine the incidence of unrecognized endotracheal tube misplacement, reasons for deferred intubations in the field, and to report outcomes in those patients with unrecognized misplacement. **Methods:** This was a prospective observational study with a consecutive sample. All arriving with an endotracheal tube or in whom endotracheal intubation was performed within 10 minutes of arrival were included, and a physician immediately determined placement. Hospital records were reviewed to determine outcome of those patients in whom the tube was misplaced. Unrecognized esophageal misplacement triggered communication to the medical director of the transporting agency. **Results:** During the enrollment period, 192 patients were evaluated. Overall, 132 of 192 (69%) were intubated in the prehospital environment, and 60 were intubated within 10 minutes of arrival in the emergency department. Among prehospital intubation attempts, 12 of 132 (9%; 95 CI 5.3-15.2), 11 esophageal, and 1 hypopharyngeal were misplaced. Right mainstem intubation occurred in an additional 20 of 132 (15%; 95 CI 10.0-22.3). Among patients arriving with unrecognized esophageal misplacement of the endotracheal tube, one patient survived to hospital discharge. **Conclusion:** The rate of esophageal misplacement of endotracheal tubes in the prehospital environment in our urban setting and the poor clinical course of patients with unrecognized misplacement is consistent with previous reports, suggesting that the benefit of prehospital airway management does not clearly supercede the potential risks.

Paramedic Perceptions of Challenges in Out-Of-Hospital Endotracheal intubation

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ABSTRACT

Objective: Paramedics often perform endotracheal intubation (ETI), insertion of a breathing tube, on critically ill out-of-hospital patients. Recent studies highlight important paramedic ETI shortcomings including adverse events, errors, and poor outcomes resulting from this procedure. Little is known about workforce perceptions of these events. We sought to identify paramedic and physician perceptions regarding the challenges and pitfalls of out-of-hospital ETI. **Methods:** We conducted a qualitative study involving paramedic focus groups sessions and individual interviews with emergency medical services (EMS) physician medical directors. We recorded and transcribed all sessions. We used inductive theory construction to examine, organize, and classify thematic patterns. **Results:** Fourteen paramedics and 6 physicians participated. Although paramedics and physicians recognized problems with paramedic ETI, all participants strongly felt that paramedics should continue to perform the procedure. Physicians and paramedics disagreed about the ability of paramedics to perform neuromuscular blockade-assisted intubation. Both groups identified aspects of paramedic education, skills acquisition, and maintenance as core issues. Participants also identified broader factors about the structure of emergency services, the role of the medical director, and workforce culture and professionalism. **Conclusion:** Paramedics and EMS physicians attribute paramedic ETI performance to a myriad of factors involving EMS education, organization, oversight, retention, and professionalism. Efforts to improve ETI must include strategies to address multiple aspects of EMS operations and culture.

The Finnish Forward Surgical Team: Lessons from the European Union Forces Operation République Démocratique du Congo

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ABSTRACT

The European Union Forces Operation République Démocratique du Congo in the Democratic Republic of the Congo in 2006 was the first operation planned and conducted solely by the European Union Forces. The Finnish forward surgical team (FST) was deployed for 4 months in Kinshasa, the capital of the Democratic Republic of the Congo. Because of the peacekeeping nature of the operation, the surgical workload was light and the total number of patients treated by the FST was 12. However, there is an obvious need to establish similar surgical assets in future operations. The lessons and experiences regarding the variables in the composition of the FST (mobility, surgical ability, staffing, patient care, physical stability, environmental adaptation, and independence) are discussed in the present article. The major future challenges are to resource the FST units optimally to remain light and easily deployable and to maintain the effectiveness of the unit during nonclinical periods.

Pregnant Women Injured in Terror-Related Multiple Casualty Incidents: Injuries and Outcomes

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Abstract

Objective: To characterize the injuries incurred by involvement in terror-related multiple casualty incidents (TR-MCIs) during pregnancy and describe the maternal and fetal outcomes. **Methods:** Retrospective (January 1, 2001-December 31, 2003), descriptive, multicenter study of **Results:** Twelve pregnant women (singletons, gestational age 20.6 +/- 10.5 weeks) who were injured during the study period. One victim was intubated on location of the event; another was hemodynamically compromised upon arrival. All women survived. Seven women required surgical intervention with general anesthesia. Four of the five women with viable pregnancies required cesarean delivery within minutes to hours of arrival. Three of these fetuses were delivered in extremis and one died. **Conclusions:** Women with a viable pregnancy who have been injured in TR-MCIs have a high incidence of surgical procedures and a high likelihood of undergoing cesarean delivery within minutes to hours of injury. Fetal outcome may be poor under these circumstances.

The Effect of Recombinant Activated Factor VII on Mortality in Combat-Related Casualties With Severe Trauma and Massive Transfusion

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Abstract

Background: The majority of patients with potentially survivable combat-related injuries die from hemorrhage. Our objective was to determine whether the use of recombinant activated factor VII (rFVIIa) decreased mortality in combat casualties with severe trauma who received massive transfusions and if its use was associated with increased severe thrombotic events. **Methods:** We retrospectively reviewed a database of combat casualty patients with severe trauma (Injury Severity Score [ISS] >15) and massive transfusion (red blood cell [RBCs] >=10 units/24 hours) admitted to one combat support hospital in Baghdad, Iraq, between December 2003 and October 2005. Admission vital signs and laboratory data, blood products, ISS, 24-hour and 30-day mortality, and severe thrombotic events were compared between patients who received rFVIIa (rFVIIa+) and did not receive rFVIIa (rFVIIa-). **Results:** Of 124 patients in this study, 49 patients received rFVIIa and 75 did not. ISS, laboratory values, and admission vitals did not differ between rFVIIa+ and rFVIIa- groups, except for systolic blood pressure (mm Hg) 105 +/- 33 and 92 +/- 28, p = 0.02 and temperature ([degrees]F) 96.3 +/- 2.1 and 95.2 +/- 2.4, p = 0.03, respectively. Interactions between all vital signs and laboratory values measured upon admission, to include systolic blood pressure and temperature, were not significant when measured between rFVIIa use and 30-day mortality. Twenty-four-hour mortality was 7 of 49 (14%) in rFVIIa+ and 26 of 75 (35%) in rFVIIa-, (p = 0.01); 30-day mortality was 15 of 49 (31%) and 38 of 75 (51%), (p = 0.03). Death from hemorrhage was 8 of 14 (57%) for rFVIIa+ patients compared with 29 of 37 (78%) for rFVIIa- patients, (p = 0.12). The incidence of severe thrombotic events was similar in both groups. **Conclusions:** The early use of rFVIIa was associated with decreased 30-day mortality in severely injured combat casualties requiring massive transfusion, but was not associated with increased risk of severe thrombotic events.

Previously Published

Tourniquets for the Control of Traumatic Hemorrhage: A Review of the Literature

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The use of tourniquets for the control of hemorrhage from traumatic injury has been long debated. Opinions on the utility and safety of their use in this setting have alternated between strong endorsement and outright vilification of the device, with each of the camps backing up their contentions with varying levels of anecdotal evidence. The debate is largely fueled by experiences of military surgeons during wartime and the results have changed with changing times, differing systems, and circumstances in which they have been utilized. Review of the evidence available in the English language medical literature seems to indicate that while neither camp is entirely correct, neither seems to be entirely without merit. The preservation of life – even at the potential expense of a limb – should without a doubt take precedence, but this should not lead to the abandonment of all possible efforts to minimize the length of time that the tourniquet is in place and thereby reduce the attendant risk of complications.

The literature regarding tourniquets, their use, outcomes, and complications was collected by a literature search of various pertinent databases. These included PubMed/ MEDLINE, Ovid, EBSCOHost, and CINAHL utilizing keywords including, but not limited to, "tourniquet," "extremity," "hemorrhage," "bleeding," "combat," etc. The retrieved articles were assessed for pertinent information and the references they cited were accessed and reviewed to minimize the chance of pertinent sources being overlooked.

Extremity hemorrhage remains a common and significant cause of preventable trauma fatalities, both in the civilian world and the military theater, accounting for approximately 9% of fatalities in military actions.[1-7] Dorlac et al. reported on preventable fatalities involving isolated extremity wounds presenting to two civilian trauma centers, and found that they occurred as 0.02% (N = 14) of the traumas seen at the facilities, with 50% caused by gunshot wounds and the remainder due to lacerations or stab wounds. Eight of the patients in this group had injuries that would have potentially benefited from management with a tourniquet.[8] Rocko et al. reported on similar injuries, discussing eight cases where earlier attempts as hemorrhage control might have resulted in patient survival.[9]

The frequency of significant vascular injury from penetrating trauma among military personnel has been reported by Rasmussen et al. as 6.6% (N = 209). These were casualties from Operation Iraqi Freedom treated at the Air Force Theater Hospital at Balad Air Base, Iraq with 79% (N = 166) of those cases involving the vasculature of the extremities, with the majority of these patient reaching definitive care in under an hour.[10] This is in stark contrast to many of the previous experiences with tourniquets, which indicates why an understanding of these circumstances is important in comprehending why the opinions that are held about tourniquets exist and what they mean for the current practitioner.

The first use of a tourniquet to attenuate hemorrhage from injury is not known with absolute certainty but the existence of similar devices has been described back to at least the Greeks.[11] Galen, the best known of the Roman surgeons, criticized the use of tourniquets as simply forcing more blood from a wound and this opinion was still repeated many years, even centuries, later by other authors.[12] This is likely based upon observation of patients with tourniquets that are applied with insufficient pressure to compress the artery while restricting the venous drainage of the affected limb. Famous medieval physician de Chauliac described constricting bands for the reduction of pain and control of hemorrhage during amputation in 1586 and Ambrose Pare was noted to employ a similar technique.[13]

The use of a triple band tourniquet system during amputations was attributed to Leonardo Botallo in the 16th century, and the use of tourniquets under similar circumstances was described by von Gersdoff in his *Feldtbuch der Wundtartzney* "Field Manual of Wound Medicine" published in 1517. Wilhelm Fabry first described the basis for what most envision today as a "tourniquet," namely a device employing a windlass in 1593.[14]

A French surgeon at the Siege of Besancon in 1674 by the name of Etienne Morel was described as employing a rudimentary tourniquet during combat medical care.[15,16] A "screw compressor" was pictured in Johannes Scultetus' surgery text during the 17th century, but this design was apparently limited in its utility due to issues with slippage and other factors.[17] The problem with slipping was reduced by Petit with his improved design that was introduced in the early 18th century and allowed it to be utilized further up on the limb.[18] Petit is also the source of the term "tourniquet" which he derived from the French verb for "to turn" (tourner).[19]

Much of the early criticism of the use of tourniquets stemmed from the delayed access to definitive care on the battlefield in many conflicts. MacLeod's treatise on the Crimean War questioned the benefit of tourniquets due to the seemingly insignificant number of vascular injuries that were seen in that conflict. This is more likely the result of those who would have benefited exsanguinating on the field while the battle was still ongoing and therefore, never being seen by a surgeon, as he himself more or less stated.[20] This is a major issue with many of the early writings that contributed to attitudes towards tourniquet use in that lack of effective evacuation of wounded soldiers proved to make the statistics provided and outcomes cited, at best, of dubious value and, at worse, useless as a reference for decision making. In effect, the tourniquet bore more than its fair share of the blame for negative outcomes stemming from multiple factors including poor planning, lack of education of troops about the proper care of wounds, and the marginal medical logistics that all conspired to yield less than optimal results.

The American Civil War provided even more evidence of the dire consequences of failing to prepare for massive numbers of wounded soldiers. Surgeons were often seriously lacking in any experience dealing with traumatic injuries, let alone that of a recent nature sufficient to maintain skills. The variability of entry level training of physicians was also so great as to make broad characterizations of it is nearly impossible,[19] and the lessons of prior combat surgeons — as questionable as some of them may be from our current perspective on the European continent — seldom was known to the average military surgeon during the Civil War. The appreciable lack of medics was also a contributing factor, despite Letterman's establishment of an Union military ambulance system on the Napoleonic model, leaving men with minimal, if any, first aid training laying for hours, or even days in a few cases, on a battlefield. Gross addressed this in his 1861 text, where he implied that the supplies for a crude tourniquet should be part of the kit for every soldier, and the instructions on their use be provided, lest the soldiers "perish simply from their own ignorance."[19] Both in the *Manual of Field Surgery* and his later work *A System of Surgery*, Gross was highly critical of his fellow surgeons and laid the blame for the demise of many soldiers squarely at their feet: "I do not envy the man his feelings who, through ignorance, inattention, or indecision, allows his patient to perish from loss of blood when he ought to have saved him."[21]

The use of tourniquets, both improvised and those of professional design (most notably that of Petit) under circumstances where surgical intervention, and admittedly a crude form by modern standards, could not be counted upon for hours or longer proved to be less than desirable from the standpoint of limb salvage. Even in the face of severe pain associated with prolonged limb ischemia, many of the soldiers were loathe to loosen or remove a tourniquet for fear of further bleeding: "Very many of these wounded came into the hospital with extemporaneous tourniquets tightly applied, and their hands and forearms swollen and livid in consequence. This dread of hemorrhage is simply another proof of the inexperience of the troops."[22] Similar fear of recurrent bleeding is still common among troops today although the issue could likely be lessened through better education of soldiers about the nature of war wounds.

The excessive and inappropriate use of tourniquets by insufficiently trained and frightened soldiers on the battlefields of the Civil War led many surgeons to decry their use altogether. This included such extreme stances as that it was "far safer to leave the wound to nature, without any attempt to arrest the flow of blood than depend upon the common army tourniquet" as was attributed to one surgeon who was present at the Battle of Bull Run (Manassas).[23] This attitude of course is the result of the frequent amputations that followed such battles and the use of tourniquets. However it is also the opinion of someone who fails to taken into account the role the system in which tourniquets were being utilized played in the development of gangrene and ischemic complications. Given that after the first battle, some wounded men were left on the battlefield for days before evacuation few modern parallels can be drawn. The outcome of both battles, a poorly structured ambulance corps, and other factors that provoked a disastrous outcome for the casualties led to the reform of the medical operations of both sides. The improvements were demonstrated at the Battle of Antietam later that same year which is considered by most historians to be the turning point of the Civil War in regards to medical care.[24]

While the overwhelming opinion of surgeons towards the use of tourniquets was negative, little evidence beyond anecdotal opinions exists on which to judge the rate of tourniquet induced complications resulting in amputation that would have not have otherwise occurred.[21] The few sources that do cite data rely upon the questionable statistics that were included in MacLeod's Crimean War history, thereby grossly underestimating the frequency of vascular injury. Confederate Surgeon General Chisolm admitted in his text, while attempting to discourage the use of tourniquets that when vascular injuries do occur, the patient often exsanguinates so quickly that intervention is "of little avail."[25] Thus, he blatantly disregarded the most obvious, and probably least debatable, indication for the use of tourniquets, that being the attempted preservation of life at any cost, including the sacrifice of an extremity.

The "disasters" that stemmed from such hindrances even provoked knee-jerk reactions that may well have cost soldiers their lives for little benefit, such as that proffered by Tuffier who was a respected surgeon with the French Army during the First World War. He recommended that as soon as ambulance crews encountered a patient with a tourniquet in place that it be removed.[26] Given that the patient most likely had been laying in "no man's land" for many hours with the tourniquet in place, the likelihood of the immediate removal of the tourniquet offering any improvement in the outcome for the limb is highly suspect and the possibility of provoking further hemorrhage would more likely be the result.

One of the most dramatic, and retrospectively shortsighted, denunciations of tourniquets can be found in *Injuries and Diseases of War*, which was a British manual that was reprinted in the United States in 1918:

"The systematic use of the elastic tourniquet cannot be too severely condemned. The employment of it, except as a temporary measure during an operation, usually indicates that the person using it is quite ignorant both of how to stop bleeding properly and also of the danger to life and limb caused by the tourniquet. If an orderly has applied a tourniquet, it is the

duty of the medical officer who first sees the patient to remove it at once, and to examine the limb so as to ascertain whether there is any bleeding at all, and if there is, to use proper measures for its arrest."

Once again, the admonition never to allow a tourniquet to be left in place beyond the prehospital phase of care was repeated due to the risk of pain, infection, and amputation.[27] While immediate conversion to less aggressive measures of hemorrhage control are optimal, such across the board advice is most likely the source of the modern day hesitancy to utilize tourniquets in any manner. One must question whether this belief arose as the product of a seriously flawed system of medical care, as obviously existed, rather than an inherent flaw in the idea behind the use of tourniquets.

More useful information regarding tourniquets, still largely applicable, was provided by Tuttle:[28]

1. Never cover over or bandage a tourniquet.
2. Write plainly on the emergency medical tag the word 'tourniquet.'
3. If the injured man is conscious, he should be instructed to tell every medical officer with whom he comes in contact that he has a tourniquet on.

Tuttle also emphasized the use of arterial "pressure points" to "buy time" in which other methods of control can be employed, including the application of a tourniquet.

Bailey in his seminal text on war surgery, published during the Second World War, gave a great deal of attention to the subject of tourniquets and indicated that tourniquets have a place in management of arterial bleeding that fails to respond to other interventions. He also suggested the preemptive application of a loosely applied tourniquet in cases of secondary hemorrhage and their use to provide a bloodless surgical field.[29] The latter use has become commonplace in hospitals around the world today, through the application of pneumatic tourniquets in orthopedic procedures.

The text also reinforced the need for proper and early identification of those patients with tourniquets in place, through proper labeling. Increased bleeding from insufficient pressure, as mentioned above, was also pointed out as a potential hazard of the use of tourniquets, while at the same time the use of excessive pressure was discouraged due to the risk of local skin damage and other complications. A quote from Bailey is one of the best summations of the subject matter found anywhere, stating that a tourniquet should be "regarded with respect because of the damage it may cause, and with reverence because of the lives it undoubtedly saves. It is not to be used lightly in every case of a bleeding wound, but applied courageously when life is in danger."[29]

During the preparations for the invasion of Normandy in 1944, the Allied Forces medical personnel were provided with a text that included instructions for the care of vascular injuries. Part of this advice was a statement that any limb requiring a tourniquet that remained in place during evacuation would most likely require amputation but that any suspected or known injury to the blood vessels was sufficient reason to send a tourniquet along with the patient during transport should the need for it arise.[30]

One of the best articles with the sole purpose of examining issues related to tourniquet use in a large group was written during WWII by Wolff and Adkins which looked at a series of over 200 wounded servicemen who had tourniquets applied. The authors were critical of the strap and buckle tourniquet issued by the Army, due to its inadequate occlusive pressures and the tendency to dig into tissues. They also described occlusive times of up to six hours with no clinically significant damage depending on which extremity was involved and the environmental conditions; anecdotal reports from cases occurring during the wintertime indicated that cold temperatures and resultant cooling of the affected limb might lead to minimal negative effect on the limb despite prolonged ischemic times. Wolff and Adkins rank among the staunchest advocates of the use of tourniquets in combat casualty care during WWII. They firmly denounced the fears of damage stemming solely from the use of the tourniquet, finding not a single case of gangrene directly attributable to the use of such a device alone, nor were thromboembolic events, skin damage, excessive edema, or nerve damage reported during the postoperative management of any of their patients.[31]

The United States Army Medical Department in a review of the medical services of World War II stated that soldiers frequently misused tourniquets, failed to alert staff at aid stations of their presence, and otherwise contributed to negative outcomes stemming from the use of tourniquets. This was such a widespread problem that their use was restricted in one unit that the senior surgeon ordered that the only reason for the use of such a device was for the control of "active spurting hemorrhage from a major artery." The directive was also issued to reinforce the proper documentation of the placement of a tourniquet to allow rapid notification of upper echelon personnel.[3,32] The early advice to loosen the tourniquet every 30 minutes to allow perfusion of the limb via collateral circulation due to the fact that the practice put a patient at risk of bleeding to death by slow degrees was also replaced with orders that a tourniquet that should only be removed by a medical officer. This opinion continues to be common practice today.[26,33]

It should be noted, for the sake of full disclosure, that perhaps not all of the blame for poor outcomes should be trained at the tourniquet or the men applying them, or the system in which they functioned, although admittedly the delays in access to operative intervention undoubtedly played a role as did the inappropriate battlefield care of the wounded. The operative techniques employed by military surgeons for vascular trauma suffered, secondary to both the case volume and a failure of the military medical system to learn the lessons of prior conflicts. Ligation of arteries was a common practice especially during the early stages of the war, and one that produced a high rate of gangrene as documented in the literature.[34,35] This is in no way a condemnation or an attack on the skill and dedication of the surgeons who served the militaries of all the combatant nations, but rather another sad example of history repeating itself when appropriate lessons are either not learned or not applied. This is supported by the fact that as the war progressed, amputation rates decreased as surgeons gained experience with the injuries common on the battlefield, in which they were not well educated prior to their deployment due to oversight on the part of their commanders.

One of the most notable military surgeons deployed to Korea was Dr. Carl Hughes and his publications on combat related vascular trauma provide valuable insight into the progress that was made during the intervening years between then end

of WWII and the start of hostilities in Korea. While he was openly critical of the manner in which many tourniquets during that conflict were applied,[36] he has been quoted as recently saying "I do not recall ever seeing limb loss as a result of a tourniquet. They were important, even life saving, in Korea. Successful use of the tourniquet depends on what it is made of, and how it is applied."[24] The recounted experiences of Jahnke, Hughes, and others during this time also serve to dispel the myth that a tourniquet is invariably associated with amputations, while reinforcing the role that evacuation delays played in amputation following tourniquet application, as more attempts were made at limb salvage through vascular repair techniques.[37,38]

Improvised tourniquets were commonplace during the conflict in Vietnam and their use by medics was deemed to be more judicious by some of the attending surgeons with at least one (JE Hutton) attributing this to the fact that "most of our medics were college graduates, were bright and well trained."[24] Also the preemptive use of fasciotomies became more common as a step in combating compartment syndrome associated with prolonged tourniquet use, which was much less frequent than encountered in any previous war due to the unprecedented use of helicopters as a primary means of casualty evacuation. It has been said repeatedly before that many soldiers wounded in southeast Asia owe their lives to the "Dustoff" crews (that is, United States Army medical evacuation helicopter crews), but perhaps this is better rephrased as many of the wounded owe their lives *and their limbs* to these brave souls.

However, not all surgical authorities serving in the Vietnam War have such uniformly positive assessments of the use of tourniquets. Dr. Norman Rich reported the anecdotal case of an upper arm injury that was bleeding because of the presence of the tourniquet, the removal of which staunched the hemorrhage.[24] He later went on to state that the necessity of the use of tourniquets in Vietnam was an infrequent occurrence.[39] Regardless of their stance on this issue, the dedication, resourcefulness, and talents of the Vietnam medical personnel are largely responsible for the current era of limb salvage that stems from rapid evacuation and early and aggressive operative intervention.[10]

Until recent years, the staunchest supporters of the use of tourniquets were the Israeli Defense Forces (IDF), and widespread use by the IDF yielded some of the best data available on the complications associated with modern battlefield use of tourniquets. Despite what may best be described as overzealous utilization by soldiers, there has been a paucity of complications reported and those that have occurred are most often temporary in nature. The isolated incidents of permanent complications were associated with prolonged use of a tourniquet and serve as further evidence that the opinion of tourniquets as invariably damaging to the limb is misguided.[40]

Despite the methodological misgivings of a few,[41] the Lakstein study- particularly when considered along with other reports that are discussed elsewhere in this paper, shows that tourniquets are an acceptably safe and effective means of hemorrhage control on the modern battlefield where rapid access to definitive intervention is the rule, rather than the exception. The use of tourniquets amongst Special Operations troops has been particularly widespread in the U.S. military for quite some time, and the experiences of the Rangers in Somalia provide additional evidence of the benefits offered by the use of tourniquets by military personnel.[5] Other Special Operations units also encourage tourniquet use for hemorrhage control in combat situations.[42-44]

The aggressive use of tourniquets among trauma patients transported to the Air Force Theater Hospital at Balad led to no cases of serious complication, even when taking into account infrequent cases of inappropriate use (in the setting of no major arterial injury). This is presumably due to the rapid evacuation of casualties and the short time to operative intervention, often less than one hour.[10] Chambers reported even more rapid arrival of patients at facilities with surgical capability in his paper reporting the experiences of the United States Marine Corps' Forward Resuscitative Surgical System.[45] This contrasts with the average time for similar cases in the Vietnam War where the time to operation for a majority of patients was variously reported as 90 minutes for all patients with ballistic injury,[46] up to five and a half hours for injuries to the popliteal artery treated aboard a United States Navy hospital ship.[47] Regardless of which study is relied upon, there was an improvement over the average of 9.2 hours reported in the Korean War.[48]

The data from Balad is comparable to the earlier report based upon patients treated at Walter Reed Army Medical Center,[49] but rate of vascular injury is significantly higher than reports that looked at rates of similar injury among military personnel in Vietnam who survived to be treated at military medical facilities, which routinely reported rates of between 2 – 3%.[50,51] In the report from Iraq, Rasmussen and his colleagues suggested several possible reasons for the disparity, including better documentation of vascular trauma among casualties and increased survival of patients with peripheral vascular trauma due to improvements in body armor lessening mortality from thoracoabdominal trauma.[10]

Walters and Mabry stated that the proper use of tourniquets could potentially prevent seven of every 100 deaths due to combat related injury.[33,52] A similar positive attitude can be found in many of the recent articles dealing with tourniquets. The review by Welling et al. contains several anecdotal statements from experienced military physicians who indicate the utility of the tourniquets in modern combat and the lack of significant complications.[17] The military's *Emergency War Surgery* text explicitly supports the use of tourniquets in combat, encourages risk to benefits assessment in any setting other than active combat but admonishing that no life under should be lost due to hesitance from perceived risks of limb loss.[53] The author of this paper has personal anecdotal experience with the successful prehospital use of a blood pressure cuff to control arterial bleeding while pressure dressings were applied to a combative patient with an amputation of the hand secondary to a lawnmower accident.

The fact that many of those who perish in combat do so rapidly and before evacuation to combat hospitals or aid stations can be accomplished, with the majority being due to hemorrhage with the source of the bleeding in many cases being an extremity wound. As Welling pointed out, the only chance to save these lives rests with the medics and the soldiers themselves.[17] Given the nature of care under fire, the risks to the caregiver, the need for rapid extrication of the wounded to cover, and the frequency of mass casualty events, to express

expectation that direct pressure can be utilized as a first line response under such circumstances is to speak to one's lack of awareness of the circumstances faced by the medic and the wounded alike. It is for this reason that the United States military has emphasized the use of tourniquets during the prehospital care of wounded and sought out a design that was able to be self-applied by a wounded soldier.[43,54] Not only does a properly applied tourniquet control hemorrhage and allow time for the gravely wounded to reach definitive care, they also provide the chance for the medic to render care to other injured.[55-57] Such practices may also facilitate transport of casualties, especially in the case of multiple victims.

The control of hemorrhage in the civilian setting is less fraught with serious risk to the first responder and therefore is much more able to follow the traditional stepwise approach recommended by most authorities. The advice of Rich and Spencer, which includes packing of the wound with associated arterial hemorrhage, direct pressure and pressure dressings[39] is probably the best approach when sufficient manpower and safe circumstances to allow intervention by trained and skilled providers. Outside of situations necessitating expedient evacuation of casualties, the use of a tourniquet will be necessary only infrequently but should be considered in any case where hemorrhage is ongoing and life threatening. This approach is similar to that recommended by Aucar and Hirshberg,[58] as well as that recommended by the Advanced Trauma Life Support manuals,[59,60] as well as the *US Army Survival Manual*[61] which is widely distributed to the general public through a civilian publisher.

However, the safest approach in the case of the marginally trained and inexperienced person with basic first aid training is probably to rely upon simple direct pressure or basic forms of pressure dressing. This is due to a lack of evidence that such persons can effectively recognize the need for a tourniquet and properly apply such a device, especially given the likely need to improvise under such circumstances.[9,62] This last point is illustrated by a case of femoral artery transection by broadhead arrow as the result of a deer hunting accident to which the author responded as an emergency medical technician. The victim's nephew had attempted to place a tourniquet made from the victim's belt prior to going for help. The patient was deceased due to blood loss at the time of the arrival of the author and his coworkers. It was determined that the bystander had improperly placed tourniquet distal to the injury and with insufficient force to be of any utility even if it were in a proper position.

Probably the strongest argument towards the broader use of tourniquets in the field is the experience of the United States military,[63-65] such as in Iraq where the combination of aggressive hemorrhage control and rapid transport has produced minimal complications associated to tourniquet use.[66-69] A few anecdotal reports of deaths that may have been preventable by the timely application of tourniquets for control of bleeding have also emerged from the battlefields of the Middle East and serve to point out that while improvements in care have been made, there are still cases that can be learned from.[70] While the tourniquets can not be given sole credit, their ability to allow those who would have otherwise bled out to receive the full benefit of modern trauma care as was described by the Balad vascular team and others, early thrombectomy and heparin administration along with vascular reconstruction or shunting and fasciotomy when necessary — can not be denied.

The use of tourniquet as a "stopgap" measure in combat[56] with reassessment of the necessity of the tourniquet as soon as situational conditions allow, is part of the Tactical Combat Casualty Care course the United States Army conducts.[71,72] This emphasis on conversion to less aggressive means of hemorrhage control whenever possible may be one reason that reports from the Iraq theater of operations describe the presence of unnecessary tourniquets upon arrival at medical facilities as infrequent. This attitude has been incorporated into the military version of the Prehospital Trauma Life Support (PHTLS) manual,[73] which is widely used in the education not only of military personnel, but also in the education of tactical medics in the law enforcement community as well. Even some staunch opponents of the widespread use of tourniquets admit that the temporary use of tourniquets under tactical conditions or similar circumstances is acceptable to effect the safe extraction of the wounded party.[40,41]

The rapid employment of tourniquets may also provide an opportunity to improve the prognosis for those who might otherwise not receive care due to the severity of their injuries in a mass casualty situation where triage principles are applied. The expedient control of extremity hemorrhage may allow a few of these patients to survive long enough for them to be evacuated even when a medic may be forced to move on to another patient due to prioritization.[74] This is similar to techniques employed in damage control surgery — in both combat and civilian settings — where pneumatic tourniquets have been used in place of vascular clamps to allow the control of more immediately life threatening thoracic and abdominal injuries, as well as in isolated orthopedic cases prior to reconstruction or shunting.[66-67,75-76] It has also been utilized for the control of hemorrhage during ongoing emergency department resuscitation of combat casualties.[77] While the possibility of such a technique being utilized outside of a medical facility is speculative at this point, it might be worthy of further investigation to determine the feasibility and utility of such a recommendation.

The use of tourniquets, while beneficial to many of those wounded in combat or with otherwise uncontrollable bleeding, is not without its hazards and potential complications. Any use of a tourniquet must be with full awareness of the risks involved and to brush these aside would be to abandon one of the basic tenets of evidence based medical practice

Most of the complications stemming from tourniquet use are either the result of direct pressure on underlying tissues or the byproducts of ischemia distal to the site of application. While most of the complications that have been reported in association with their use (both for control of hemorrhage and as an adjunct to surgery) have been localized, there are systemic complications that can result including thromboembolic events,[78] most notably pulmonary embolism, renal failure due to rhabdomyolysis,[79-84] lactic and respiratory acidosis, hyperkalemia, arrhythmias, and shock.[85]

The use of tourniquets during elective surgery has led to reports of cardiac arrest secondary to circulatory overload in patients with poor cardiac reserve resulting from a functional increase in the circulating blood volume. This is likely to not be a factor in a hypovolemic trauma patient but may play a role

in the case of a patient with underlying heart disease who is being fluid resuscitated with a tourniquet in place. Tourniquet removal postoperatively has produced transient increases in end-tidal carbon dioxide levels, and transient decreases in central venous pressure and blood pressure. The former may be of significance in a patient with head trauma, but the effect can be minimized through hyperventilation of the patient. Release of a tourniquet has also been described to induce brief systemic thrombolysis as a result of the stimulation of various anticoagulation mechanisms by ischemia.[86]

Localized complications have included pain, erythema or localized bullous skin lesions, nerve damage[78,87] from paresthesias to paralysis of the affected limb, vascular spasm, fracture of atheromatous plaque, muscle injury,[88] gangrene and other infectious complications, edema, to compartment syndrome.[78] The nerve and muscle injuries may be transient or permanent in nature,[89] although the latter is exceedingly uncommon in most settings today where tourniquets are utilized for hemorrhage control. This is due to a strong positive correlation between the length of time the tourniquet is in place and the rate and severity of complications that result.[39,90] A similar correlation exists with the amount of pressure produced by the tourniquet,[91-92] but this is mainly an issue with improvised tourniquets and those with a width of one inch or less. It should also be noted that patients with preexisting neuropathies, such as those associated with diabetes or alcohol abuse, appear to be at an increased risk of nerve injury,[93] and other factors may also serve to predispose patients to nerve related complications.

Complications of questionable association, due to a lack of corroborating clinical evidence in injured human subjects to support such claims, include the possible affects of inflammatory mediators on the gut mucosa following ischemia of a limb. This assertion was made by persons with a stated distrust of the use of tourniquets and was accompanied by an unsubstantiated claim that the use of a tourniquet in the hypotensive patient places the patient at a "considerable risk" of loss.[41] contentions are largely refuted by the volume of cases that have been recently entered into the literature as a result of current military operations without any indication that serious complications of a systemic or localized nature have been frequently associated with the short term (< 2 hrs) use of tourniquets for hemorrhage control. It is for this reason that until evidence supporting such claims of negative systemic outcomes stemming directly and without question from the use of tourniquets by properly trained and equipped medical professionals, the assertions to that effect must be viewed with a certain degree of skepticism.

Failure of a tourniquet is usually the result of insufficient pressure, but this can easily be prevented by reinforcing during the training of those who will be employing such devices that total arterial occlusion is the goal. There have been isolated cases reported among surgical patients where extreme calcification of the arteries prevented effective use of tourniquets for the establishment of a bloodless field.[94-96] This is unlikely however to be a significant factor in the use of tourniquets for hemorrhage control.

There are still several unanswered or only partially answered questions regarding the use of tourniquets and the attendant complications, infrequent as they may be in current practice. These include the role of hypothermia[31,97-101] and agents such as antioxidants in minimizing muscle and nerve damage from ischemia. The former has already been demonstrated to be of benefit on a limited basis, with even a marginal (2 – 3 degrees Celsius) decrease in muscle temperature has been shown to be beneficial.[32] Further research into these aspects of trauma care, and others, are still needed and therefore should be encouraged.

The use of the tourniquet in hemorrhage control is likely to remain controversial for the near future; however, given the best evidence available mandates serious reconsideration of the attitudes that we as a profession hold toward this practice. While there are potential risks involved in the utilization of tourniquets should not be overlooked, expeditious and clinically and/or situation appropriate application in the presence of potentially life threatening hemorrhage is in keeping not only with the standards of the medical professions, but accordingly so with the best interests of the patient.

Based upon the best evidence available from the literature, the following conclusions are drawn:

- Emergency medical personnel, both civilian and military, should be trained in and equipped for the proper use of tourniquets; the focus of first-aid training for civilian populations should continue to deemphasize their use and focus instead on early medical assistance and the use of direct pressure to control hemorrhage.
- No patient should exsanguinate from an extremity wound because of the hesitance of a medical professional to utilize a tourniquet to control bleeding due to fear of potential complications.
- In circumstances such as combat (or the civilian equivalent thereof), high risk of building collapse, fire, or explosions, where expedient movement of the patient is necessary for the safety of the patient and the caregivers, the use of a tourniquet is appropriate to gain control of life threatening hemorrhage.
- The existence of a mass casualty incident may be an indication for the use of tourniquets for temporary control of hemorrhage while the situation is brought under control.
- The need for a tourniquet applied to allow movement of a wounded person or during a mass casualty incident should be reevaluated at the earliest possible time.
- The mere presence of an amputation with hemorrhage does not necessitate the use of a tourniquet; most bleeding from such injuries are controllable through use of direct pressure, elevation, and packing of the wound. If these actions do not achieve hemostasis, then the use of a tourniquet is indicated.

Tourniquets may be placed proximal to the site of uncontrollable bleeding around an impaled object; under no circumstances should the tourniquet be applied over the impaled object.

Tourniquets should not be applied over joints, or over clothing. It should also be at least 3 – 5 centimeters from the wound margins. The rule of the thumb the author used when

teaching was to place it the width of the palm of a hand proximal to the wound whenever possible, as this provides an easy frame of reference.

Any limb with an applied tourniquet should be fully exposed with removal of all clothing, and the tourniquet should never be covered with a form of bandage. The patient should be clearly marked so as the presence of a tourniquet will be know, along with the time it was placed. It may also be advisable to instruct a conscious patient to tell every medical provider they come in contact with about the presence of a tourniquet.

Continued bleeding (other than medullary oozing from fractured bones) distal to the site of the tourniquet is a sign of insufficient pressure and a need to tighten the tourniquet further.

A tourniquet should not be loosened in any patient with obvious signs of shock, amputation that necessitated use of such a device to control bleeding, recurrent hemorrhage upon release of the tourniquet, or any case where the hemorrhage associated with the wound would be expected to be uncontrollable by any other means.

Any tourniquet that has been in place for more than six hours should be left in place until arrival at a facility capable of definitive care.

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An Evaluation of Tactical Combat Casualty Care Interventions in a Combat Environment

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Background: Tactical combat casualty care (TCCC) is a system of prehospital trauma care designed for the combat environment. Although widely adopted, very few studies have reported on how TCCC interventions are actually delivered on the battlefield, from a quality of care perspective. **Study Design:** This was a prospective study of all trauma patients treated at the Role 3 multinational medical unit (MMU) at Kandahar Airfield Base from February 7, 2006 to May 30, 2006. Primary outcomes were whether or not two TCCC interventions were underused, overused, or misused. Interventions studied were needle decompression of tension pneumothoraces and tourniquet application for exsanguinating extremity injuries.
Results: One hundred thirty-four trauma patients were treated at the Role 3 MMU during the study period. Six patients had eight tourniquets applied. Five tourniquets were applied to four patients appropriately and saved their lives. There was one case of misuse where a venous tourniquet was applied. There was one case of overuse where one patient had two tourniquets placed for 4 hours on extremities with no vascular injury. There were seven cases where needle decompression was underused: Seven patients presented with vital signs absent with no needle decompression. There was one case of overuse of needle decompression. There were seven cases of misuse where the patients were decompressed too medially.
Conclusions: Tourniquets save lives. Needle decompression can save lives, but is usually performed in patients with multiple critical injuries. TCCC instructors must reinforce proper techniques and indications for each procedure to ensure that the quality of care provided to injured soldiers on the battlefield remains high.

Abbreviations and Acronyms

ND	needle decompression
Role 3 MMU	Role 3 multinational medical unit
TCCC	tactical combat casualty care

Tactical combat casualty care (TCCC) is a system of prehospital trauma care designed for the combat environment that has been widely adopted by many different military medical organizations.[1-5] The premise of TCCC is that tactical awareness and appropriate performance of simple prehospital interventions will reduce combat deaths. These interventions include needle decompression (ND) of tension pneumothoraces and tourniquet application for exsanguinating extremity injuries.

Many public agencies have lauded TCCC initiatives, citing anecdotal reports where TCCC interventions have prevented combat deaths.[6,7] No study has rigorously analyzed battlefield application of both these devices to determine if they are being used appropriately in the field. We prospectively studied all trauma patients who were treated at a multinational field hospital at Kandahar Airfield Base to determine whether or not TCCC interventions are being appropriately applied on the battlefield.

Methods

This was a prospective study of all trauma patients treated at the Canadian-led Role 3 multinational medical unit (Role 3 MMU) established at Kandahar Airfield Base in support of Operation Enduring Freedom in Afghanistan. This hospital is roughly equivalent to a US Combat Support Hospital with regard to capability. All trauma patients treated at this facility from February 7, 2006 to May 20, 2006 were studied. Inclusion criteria included receiving tourniquet application, ND, or both, in the prehospital setting. Inclusion criteria included patients if they had prehospital indications for either tourniquet application, ND, or both, but did not receive the interventions. These indications were defined a priori, and are listed here. Patients who fulfilled these inclusion criteria were subject to a full chart review by the study investigators.

The Canadian Trauma Registry for this institution was used to identify demographics and injury data. This trauma registry was a pilot project initiated by HT to determine whether or not such a registry could help with quality improvement of trauma care at the Role 3 MMU. The Canadian Trauma Registry contains only information about each patient, including basic demographics, basic injury data (mechanism and injury severity scores), some basic physiologic data on presentation, blood products transfused, and surgical procedures performed. It also lists basic outcomes from Kandahar only, including length of stay, days on ventilator, and alive or dead. It does not have any data on the nationality of the prehospital providers, as often the Helivac team does not present this information. We are unable, as a result to discern any difference between Afghan versus coalition prehospital care providers. Study investigators (HT or JM) reviewed the clinical history of each patient. Trauma-room records, operative reports, radiologic reports, and hospital records were also reviewed. Autopsy reports were not reviewed. Autopsies are not performed on Afghans who die at the Role 3 MMU facility. We are not privy to autopsy reports (if any) of non-Canadian coalition soldiers who die at

the Role 3MMU. All Canadian soldiers who die in Kandahar are autopsied back in Canada. Information about these results, as a rule, is not relayed back to the surgical team at Kandahar. The primary outcomes were the appropriateness of each TCCC intervention, ie, ND, tourniquet application, or both.

Healthcare interventions are appropriate if performed properly for accepted indications. Conversely, inappropriate care occurs when an intervention is misused (improperly performed), overused (performed for an improper indication), or underused (not performed despite proper indications).[8] We then created criteria for evaluating tourniquet application and ND for tension pneumothoraces using this framework. Criteria will be listed here.

Tourniquet application

Prehospital use of tourniquets was considered inappropriate by:

1. Underuse criteria: if a patient arrived with arterial bleeding from an extremity injury without a tourniquet;
2. Overuse criteria: if a patient without major arterial bleeding from an extremity injury arrived with a tourniquet applied for longer than 3 hours; and
3. Misuse criteria: if a patient arrived with arterial bleeding from an extremity injury despite having a tourniquet applied (venous tourniquet).

ND for tension pneumothoraces

Prehospital use of ND was considered inappropriate by:

1. Underuse criteria: if a patient presented with a history of unexplained prehospital hemodynamic instability, respiratory distress, or unilateral or bilateral penetrating chest trauma without having a ND performed. Patients with explained hemodynamic instability were considered to not have criteria for ND;
2. Overuse criteria: if a patient presented with ND without the indications listed previously; and
3. Misuse criteria: if a patient presented with NDs performed for appropriate indications, but in an inappropriate location (>2cm medial to the midclavicular line).

This study was reviewed by our institutional review ethics board and approved for waived consent as no intervention was studied. Patients frequently had altered level of consciousness or spoke different languages, making communication more difficult. This study was also reviewed and approved by the Surgeon General of the Canadian Forces Health Services.

Results

During the 4-month study period, 134 patients were treated at the Role 3 MMU in Kandahar, Afghanistan. Thirty-two percent had suffered penetrating injuries and 22% had blunt injuries. Blast injuries constituted 34% of the total and 12% of the patients had suffered burns. Five patients were women, and the mean age of patients was 26 ($\pm$13) years. Mean injury severity score of these patients was 16.

Tourniquets

During this study period, six patients had a total of eight tourniquets placed. Four patients had five tourniquets placed on injured lower extremities with arterial injuries. All of these had suffered blast injuries. On removal of these tourniquets in the operating room arterial bleeding recommenced. We believe the tourniquets saved their lives.

Underuse criteria

No patients arrived with arterial bleeding from an injured extremity without a tourniquet.

Overuse criteria

One Afghan soldier arrived with one tourniquet on each leg after suffering a penetrating gunshot wound through each thigh. The tourniquets had been on for 4 hours, and each leg was clearly ischemic on initial physical examination. On removal of the tourniquets, both legs regained normal perfusion. On additional assessment, neither leg had any hard or soft signs of vascular injury, and had normal ankle-brachial indices. Fortunately, the compartments of both legs remained soft on repeat physical examination and fasciotomies were not required.

Misuse criteria

One coalition soldier arrived after suffering a partial amputation to the upper limb from an improvised explosive device. The ulnar artery was injured, but the radial artery was intact. A tourniquet had been placed, but Doppler examination revealed ongoing flow to the distal radial artery. No other injuries were identified, and the patient remained hemodynamically stable. The ulnar artery was easily controlled in the operating room.

ND of tension pneumothoraces

Underuse criteria

Seven (two coalition military, five Afghan army) soldiers presented with vital signs absent. One was from blunt trauma, three were from penetrating thoracic injury, and three were from blast injuries. None received NDs in the field.

Overuse criteria

One Afghan soldier fell from standing during a unit physical fitness session. He reported unilateral chest pain but was otherwise stable. He was needle-decompressed twice in the field. Apparently, no "gush of air" was detected after each procedure was performed, so each needle was removed and the puncture sites were covered with sterile dressings. Fortunately, a chest radiograph at hospital revealed no pneumothorax, despite the initial fall and subsequent attempts at ND.

Misuse criteria

Seven NDs were performed on five soldiers for appropriate indications. All of these were Afghan army soldiers. All seven decompressions were performed at least 2cm medial to the midclavicular line. No major complications resulting from the NDs were identified.

Discussion

Bellamy[9] analyzed the causes of death from land combat using historic wound data collected by researchers interested in the effectiveness of different munitions during the Vietnam War. He defined preventable combat deaths as acute

airway obstruction, tension pneumothorax, and exsanguinations from traumatic amputation based on the availability of effective prehospital treatment modalities for these conditions. Subsequently, Bellamy found that 15% of all combat deaths were preventable: traumatic amputations caused 9% of deaths, tension pneumothorax caused 5%, and airway obstruction caused 1%.

Based on this study, and reinforced by an analysis of casualties sustained during the American mission to Somalia in 1993,[10] Butler and colleagues[1] derived a system of prehospital trauma care called tactical combat casualty care. TCCC has replaced Basic Trauma Life Support and ATLS as the basis for the prehospital trauma management of injured soldiers in the tactical environment.[2] Versions of TCCC have now been adopted by the US military,[2] Israeli Defense Force,[3] British Army,[4] and Canadian Forces.[5] The expectation of these agencies is that simple prehospital interventions, such as ND of tension pneumothoraces and tourniquet application, will reduce combat deaths.

Despite widespread use of TCCC in combat care, very little has been reported on how TCCC interventions are actually being applied on the battlefield. This is particularly important as these skills have potential complications, and are being taught to many soldiers with nonmedical backgrounds before overseas deployments.[1,2]

Like other studies,[11] we believe that tourniquets save lives. Tourniquets are being placed appropriately on soldiers suffering traumatic amputations from blast injuries. TCCC courses must reinforce the distinction between venous and arterial tourniquets in patients without amputations. Venous tourniquets do not occlude arterial inflow to an extremity but promote venous congestion. Venous tourniquets increase bleeding from injured extremities and must be avoided.[5]

TCCC courses must also reinforce the need to remove tourniquets to reassess extremity bleeding in patients without traumatic amputations once the patient and caregiver are no longer under effective enemy fire (tactical field phase of care). Although there is some controversy surrounding this issue,[12-15] we believe that the risks of iatrogenic ischemic injury outweigh the risk of increased blood loss, especially in situations where evacuation times to surgical facilities are variable. We believe that pressure dressings need to be considered for replacing tourniquets if no arterial bleeding is observed on reassessment.

We were unable to determine if NDs actually saved lives or if failure to perform NDs (despite appropriate indications) resulted in preventable deaths. Most of these patients suffered severe multisystem injuries. Patients who had NDs performed in the field still presented with ongoing instability at the Role 3 MMU, despite ND. Likewise, patients who presented with vital signs absent also had either accompanying severe brain injury, exsanguinating hemorrhage, or both, which might have accounted for their death, despite the lack of ND. Even so, TCCC courses can reinforce the concept that patients presenting with appropriate indications (especially patients who are vital signs absent) should receive bilateral ND — very little extra harm can arise from such a recommendation.

We were able to identify a consistent trend in technical errors in performing ND in the field. All NDs were performed at least 2cm medial to the midclavicular line, and well within the cardiac box.[16] This error in technique risks inadvertent injury to the heart or great vessels,[17] especially with the growing tendency for using longer needles in the military setting.[18] This finding is consistent with studies of NDs performed in volunteer studies of emergency physicians.[19] TCCC courses must reinforce landmarks for performing ND. Soldiers often have to perform this procedure in the dark and under difficult conditions. They might forget that the clavicle extends into the shoulder apparatus. Soldiers should be cautioned, as an extra precaution, about performing NDs if their landmark appears medial to the nipple line.

Limitations of the study

The major limitation of this study is its small size. The magnitude of the trends noted in this study is unknown because of its size. Nevertheless, larger prospective studies of care delivered on the battlefield are difficult to conduct because of limited resources and personnel at field hospitals. The conclusions of this study are easy to implement, have no additional costs, and risk no additional harm to patients.

Another major limitation is the heterogeneous nature of prehospital training and care provided by the medics involved with this study. Many nations participate or have participated in Operation Enduring Freedom, and medic training and protocols can vary. This report, as such, makes no comment on the TCCC training conducted by any one country.

Another limitation of this study is that we used explicit criteria to assess the appropriateness of care delivered on the battlefield. There are two common methods used to determine "appropriateness of care": implicit review and explicit review.[20]

In implicit review, a reviewing panel determines the "appropriateness of care" for each patient by comparing the actual process of care against his or her own knowledge and opinion of what optimal care is. Implicit review is highly idiosyncratic and reviewer-dependent. We used explicit review, where we compared the actual process of care against a set of criteria that spell out what the elements of adequate process should have been. There can be some debate about the selection of the criteria, but judgments made by explicit review can be almost reviewer-independent.[21] Explicit review also tends to be insensitive to nuances of care.[22] In explicit review, the burden of accuracy falls on the criteria, not on the reviewer.

In this study, we prospectively studied the appropriateness of TCCC interventions being performed on the battlefield. We found that tourniquet application saved lives from exsanguination. We were unable to demonstrate that NDs saved lives. Even so, TCCC instructors must continually reinforce the appropriate indications and techniques for conducting these procedures to avoid systematic errors that detract from the quality of care delivered on the battlefield to injured soldiers.

Author Contributions

Study conception and design: Tien
Acquisition of data: Tien, Acharya, MacDonald
Analysis and interpretation of data: Tien, Jung, Rizoli, Acharya, MacDonald
Drafting of manuscript: Tien, MacDonald
Critical revision: Tien, Jung, Rizoli, Acharya, MacDonald

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The Command of Biotechnology and Merciful Conquest in Military Opposition

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Biotechnology has an increasingly extensive use for military purposes. With the upcoming age of biotechnology, military operations are depending more on biotechnical methods. Judging from the evolving law of the theory of command, the command of biotechnology is feasible and inevitable. The report discusses some basic characteristics of modern theories of command, as well as the mature possibility of the command theory of military biotechnology. The evolution of the command theory is closely associated with the development of military medicine. This theory is expected to achieve successes in wars in an ultramicro, nonlethal, reversible, and merciful way and will play an important role in biotechnological identification and orientation, defense and attack, and the maintenance of fighting powers and biological monitoring. The command of military biotechnology has not become a part of the virtual military power yet, but it is an exigent strategic task to construct and perfect this theory.

Introduction

Science and technology not only lead to profound changes in military power and form of war, but also greatly enriches the strategic thinking and vision field. The military theory of command plays a more and more important role in controlling new spaces or domains effectively. It guides the development of military theories with more motility and foresight and gives an impetus to the military reform. Science and technology always leave imprints of times on the development of military command theory. In the 21st century, biotechnology is no doubt one of the powers with most developmental potential in the science and technological field. It is a practical and crucial issue that the effect of biotechnology on the military theory of command should be studied and the relevant military strategies should be taken. Moreover, the emergence of war based on command of biotechnology will be the most profound change in the history of military medicine.

Command of the war is a right to control the war and also the freedom to initiate, continue, or cease military operations. In a certain sense, the process of war is a process of competing for command.[1] The modern theory of command is a means to ensure that our own elements of battle be fully exerted in a certain space and, at the same time, prevent the corresponding elements of enemies from exertion. Theories like the command of the sea by Alfred Thayer Mahan[2] and the command of the air by Giulio Douhet accelerated the development of military technology in both naval and air battles. The theory of command develops with advances in science and technology, which may be an important basis for military strategy of the 21st century. Meanwhile, the pattern of warfare and the mode of military operation may exhibit evolutionary changes.

The development of the theory of command also impacts that of military medicine. For example, the emergence of military opposition that was based on novel command was followed by the birth of military nautical medicine, military aviation (space) medicine, ergonomics, military operational medicine, ionizing irradiation, and operational environmental medicine. The command of biotechnology is of special guiding importance to military medicine.

The command of biotechnology is a superior dominance of military biotechnological application based on the microcosm of life structure within a certain period of time, including the effective defense and attack through modern biological techniques the monitoring, sustaining, and reinforcement of personal competition in battles, the insurance of the living quality of our people (army men and women and civilian), and the protection of the ecological environments in battlefields. It will bring enormous changes to the style of war and the theories of battles. It brings about brand-new criteria for military medicine in terms of demand of military operation, and also causes evolutionary changes in the connotation and essence of military medicine.

The struggle of biotechnological dominance is a competence in modern science and technology, especially in biotechnology and military medicine. The meanings of the command theory of biotechnology consist of: taking a whole or partial lead in the military application of biotechnology; making biotechnology a real power of defense and attack; maintaining a long-lasting advantage in competition of military biotechnology on a large scale. The concept put forward does not aim at modern wars, but at future military reforms. It is to build a foundation of intellective innovation, system construction, and advance defense with a notion of the command of biotechnology, the research and development of modern biotechnologies, and the effect of military establishment.

Formation of the Command of Biotechnology

Apart from great social benefits, modern biotechnology possesses increasing military values. Some biotechnologies related with military affairs show great advantages in rescuing war injuries, strengthening the power to fight, resisting fatigue, sensing and battlefield monitoring, and manufacturing military materials.[3-5] In fact, many modern biotechnologies will gradually take on a characteristic of attack and will be used directly as means of defense and attack. Biotechnologies will have an all-round and profound influence on the future war. Therefore, the one who leads and dominates the military biotechnological field will achieve success in wars. The future war will be the one based on the

command of military biotechnology. From the connotation of the command theory and the relevant practice of war, we see the following characteristics of the military theory of command.

Change in Cognitive Ability at Higher Level

The human military confrontation is an integration of damage efficiency and cognitive ability. Their conjunct and interlaced development results in a continuous military reform. The change of cognitive ability originated from the development of science and technology driven by the motive of exploring nature. The origin and growth of the command theory of the sea indicate that the advancement of cognition greatly promoted the sea power. The early navigation landmarks, directional compass, orientable astronomical instruments, and the timing and logging techniques built a solid basis of oceangoing operations. The emergence of other command theory of the sea has close relation with the application of seaplane, hydrophone, and telecommunication, and the development of radars on naval ships, mechanical and electrical directors, and other subaqueous detecting devices.[6] Other theories of command are also supported by similar obvious cognitive courses.

The establishment and enrichment of biological informatics embodies the rapid development of modern biotechnology, which is concerned with genes and sequences, structures, and functions of proteins that reveal the mysteries of life. The scale of the top three databases of biological informatics is expanding by geometric series. The development of modern biotechnology is also embodied by the innovation and perfection of many biological techniques and methods, including DNA recombination, gene modification, gene cloning, exogenous gene expression synergy, gene targeting, stem cell technology, and tissue engineering, etc. These technical tools have greatly promoted understanding of life and helped to clarify the relationship between life pattern and military struggle for humans. Therefore, they are possibly to be applied to military purposes.

Multidimensional Expansion

Exploration and cognition expanded from the primitive state and space of living to multidimensional space time. Humans' exploration and cognition of a new space is the most prominent symbol of brand-new technological revolution — the formation of new battlefields or main technical domains. With the advancement of military technology, the command theories have gone across the land and stretched to the sea, the air, and space. Today, the normal physical spaces have been completely dug up and the new battlefields will be found in new technical domains. The command theories in battlefields are still undergoing a displacement with the development of science and technology and the special expansion of human activities. The evolution of the theories symbolizes the center of gravity for subduing in war is changing.

Modern biotechnology opens a new space of exploration complicated and diversified-the microcosm of life. The development of modern biotechnology experiences a process of cognition of vital phenomena from macro to micro levels. The invention of the electron microscope makes it possible for us to observe a life structure less than 1 angstrom. What is more, our exploration for the nature of life has reached the molecular level of a protein or a gene. Now that the military theory of command is to conquer a certain space in battles, either the land, sea, air, or outer space, if technical conditions permitted, the cognitive extension of human beings into the ultramicro space is reasonable and inevitable. That will finally alter the center of gravity in military affairs to obtain an upper hand. Once biotechnology is applied to battles, the more that is known about the ultramicro world of life, the more freedom one will have to take actions. This ensures the ability to take the lead and dominate in military operations.

Upgrade of the Means and Power of Conquest

Rather than annihilation of corporeal destruction, the military theory of command pursues a conquest emphasizing destruction of economic foundation to antagonism and suppression of technology, which is characterized by farther strike, wider injury, more precise attack, and all-round containment. However, "Now war is always the shock of two hostile bodies in collision, not the action of a living power upon an inanimate mass."[7] The object of war is always human beings. Therefore, to win a war is to take initiative in attack, resistance, organization, apperception, judgment, and mental endurance so as to suppress enemies. With the upgrade of the means of conquest, the military theory of command is pointing at the biological characteristics of human beings by divesting their exterior ability of attack and defense.

Revolutionary breakthroughs on biotechnology have been made by the progress of science and technology. It has not only brought a more accurate understanding of life itself, but also the power of regulation. Modern biotechnical development has changed the former attributes of biotechnology in military applications. In the past, biotechnology was mainly used in the prevention, diagnosis, and treatment of injuries and diseases. Now, discoveries made in the exploration of human health through biotechnological methods can clarify the law of life at the molecular level, which makes it possible to regulate and control the functions of human bodies by adjusting its ultramicro structures to gain powers of defense and attack. Since war is an act of violence aiming at annihilating enemies or depriving them of resistant abilities, the modern biological techniques used for attack purposes have a more direct and precise target at humans than other methods, which will play a more important role in future military operations.

Following the Principles of Time-Effectiveness and Benefit

The military theory of command emphasizes obtaining benefits and other advantages. It not only seeks military balance of powers, but also heads for a destination more efficient, economical, and beneficial. For instance, the basic train of thought in the command of the sea was always entangled with traffic efficiency, trade channels, wealth amassment, and expansion of governance.[2] The technical domain in which a command theory appears is often synchronized with the economic rise and fall of national or international interest groups and in accordance with the dominant field of the time in the social development.

On one hand, the driving force of the biotechnological advancement comes from the requirement of promoting

human health and standards of living. It bears motivation to pursue social benefits and has a wide developmental prospect. In the last decade, the international productive value of the biotechnological industry increased by five times every 3 years. In developed countries, the increasing speed is approximately 25% to 30%. In the 21st century, the scale of industries related to biological economy will be 10 times that of the information technology industry, which will dominate in international economic growth.[8] Therefore, an effort made to lead and control in the biotechnological field not only has military significance, but can also cement our comprehensive national strength through the boost of social economy.

On the other hand, as described in *The Art ofWar* by Sun Zi, "Those skilled in war subdue the enemy's army without fighting hard. They capture the enemy's cities without a storming attack and overthrow his state without an excessive and perpetual damage. Their aim must be to take all under heaven intact through strategic superiority."[9] With the participation of modern military biotechnology, the military attack will obtain stronger directivity and deterrence, less casualty, and lighter damage of the civilization, which will be a merciful conquest that can increase the benefit of war.

Trends of Integrated Development

High-technology war is a holistic contest of battle systems, which results in a change of connotation of the command theory. The requirements of different military theories of command mingles with each other and leaves a course that new theories will be built on the basis of the pre-existing ones (either used for reference or extended) and all theories will support each other.

Modern biotechnology itself is an aggregation of the latest technological progresses. For example, the DNA chip is a combined result of research fruits harvested in physics, combinatorial chemistry, mathematics, and informatics.[10] Meanwhile, the invention of biosensor and genetically engineered computers that use DNA to make calculations will be helpful for the command, control, and transference of information. The mutual supplement and penetration of the command of biotechnology and the command of the information, and other theories of command determine a necessity of multidimensional control of the sea, air, outer space, information and biotechnology, etc., to triumph in future military operations.

Aggressiveness of Biotechnology

Biotechnology can be used for aggressive purposes, which is the key factor for command of biotechnology. The new categories of injury that may arise are the focus of interest of military medicine.

Modern biotechnology reveals pathologies about factors that do great harm to people and provides effective means of exploring the hazardous factors in human health.
Meanwhile, the knowledge can be used to bring damages and injuries to individuals in war in a more accurate and effective fashion. Different military biotechnologies can be chosen in accordance with different pathogenic factors to meet different military goals. The attack, therefore, will wound different levels of specific gene, protein, cell, tissue, and organ. It no doubt will be more effective to cause damages than conventional weapons, yet the nonlethal effect will remain to be civilized in terms of postwar reconstruction and hatred control.

With ultrastructural damage, targets are chosen directly from a nucleotide sequence or a certain protein structure. Affecting the structure and function of a gene or a protein as a damaging effect can cause human physiological dysfunction. Precision injury and ultramicro damage are two wounding methods of modern biotechnologies based on genomics and proteomics. They are completely different from the traditional wars that damage tissues and organs directly since they target the primary structure of gene or protein.[11]

Nonlethality

The injuries are completely different from those caused by traditional weapons, including nuclear and chemical weapons. Traditional weapons aim at killing and demolishing in an extreme way. The goal of precision injury is not necessarily to terminate a life, but to choose a degree of injury depending on the purposes of operations and the types of enemies. By means of gene regulation, certain, or a couple of, key physiological functions in a human body — such as learning, memorizing, balancing, fine manipulation, and even the "bellicose" character — can be injured precisely without a threat of life.[11] Although ultrastructural changes also arise in injuries caused by cold or hot weapons, such as gene changes with battle wound or disease, and cancerigenesis, teratogenesis, and mutagenesis, the causativeness, mechanism, and aim of damage are completely different.

Reversibility

After the goal of military operation is achieved or erroneous attack happens, vaccines, drugs, or information about the damaging factor and damaging target can be provided to increase the likelihood of salvage and saving, exhibiting the greatest mercifulness. Therefore, biotechnology aggressiveness gives rise to relatively merciful conquest as compared to other weapons.

Exceeding Traditional Biological Warfare Weapons

Military biotechnology in this theory is to be used specifically and limitedly with its single purpose of attacking military targets or localized targets. Military goal can be achieved with no need of massive killing, thus avoiding injury to nonmilitary objects (civilians) or destruction of ecological environments and human civilization. This is what is expected by warfare profit theory and weapon ethics in the 21st century.

The main difference between military biotechnology and traditional bioweapons is the dismissal of the antihuman massive destruction. Besides, the differences lie in the historic background, research, and development concepts, techniques, injury mechanism and effects, developmental prospects, and application ranges.[12] The significance of distinguishing the modern military application of biotechnology from the traditional bioweapons is to promote a healthy development of modern biotechnology, abide by the Biological and Toxin Weapons Convention more effectively, and strike a blow on the traditional bioweapons, therefore welcoming new military progresses and reforms, and changing the notions and civilization level of war.

Revolution of Fighting Power

The military application of biotechnology will make military medicine a fighting power in addition to a tool of maintaining and strengthening the fighting power of the army — that is, forming an aggression system of biotechnology. Meanwhile, this change is of extensive and profound impact.

Maintaining Health

Some biotechnology can strengthen the fighting power of the army. Medicine is going to promote health, prevent disease, and strengthen the body in addition to treating disease. And the goal of medicine is transforming from "saving oneself and killing the enemy" to "strengthening oneself and controlling the enemy." Military medicine should not only prevent and treat disease and injury, but also maintain and promote the health of military personnel. Even under combating conditions, health protection should be stressed. Fighting power criteria for various conditions should be formulated. A system in which the human body can adjust to and be in harmony with the environment should be created. The emphasis of health is unprecedented, thus scientifically increasing the fighting power of the army.

Biotechnology can provide the army with high titer vaccines to prevent and treat contagious diseases following warfare. Moreover, a biological reserve can be set up for military participants to store DNA, stem cells, blood, and bone marrow samples. This helps battlefield rescue and organ repair, or preparing individualized drugs and vaccines, and formulating plans for disease prevention, nutrition, and training for each army man or woman.[13]

Bioinformation Processing, Monitoring, and Command

The development of modern biotechnology makes it possible to set up new generation command systems by using biocomputing, sensors, or simulated detectors, which greatly elevates the level of the information-based command platform.[5]

A battlefield medical information system based on individual soldiers will monitor and analyze the physical and mental status of soldiers, and transmit relevant information to the commanding and medical personnel in a real-time way. Therefore, the commanding and medical personnel can know the situation of battlefield medical care and assess the fighting power. Meanwhile, the system will help the commander monitor the maneuver of the army, greatly increasing the efficiency of decision making. It will also help the commander and the army to recognize each other.

Innovation of the Attacking Mode

Traditional weapons cause body damage, and the effect should be judged on the battlefield. However, the damage of biotechnology can be predicated before war or even in laboratories. Therefore, the damaging capability, targets, and degree of damage can be determined according to the situation, greatly increasing the controllability of war, and realizing fighting effects-based

Versatile Military Applications of Biotechnology

The combination of information technology and biotechnology gives birth to the biological computer, which has greatly increased performance. Moreover, due to its small size, large storage capability, and low cost, a great platform computer network can be applied to each weapon and each soldier.

In addition, substantial breakthroughs may also occur in the following areas: military biomaterials, such as biosteel, bioceramics; military biosimulation, such as simulated motive power, simulated navigation, and structural simulation; military bioenergy, military food and drinking water, and special military garments.[14]

Conclusion

Military biotechnology renovates health care, fighting power monitoring, command efficacy, and military materials and equipment. Its application tends to be extensive and substantial. In particular, with rapid development of military biotechnology, it transforms from defense to a balance between attack and defense, giving rise to a new concept of warfare, a new balance of military force, and new attacking power. The new attacking power exhibits basic traits such as ultramicro damage, nonlethality, and reversibility. As compared to ordinary war, biotechnology-based warfare can achieve desired goals in a relatively merciful way. As a result, the position of military medicine will be promoted, and the connotation and extensions of military medicine will be widened. Moreover, evolution will occur in the establishment and application tactics of military medical institutions, and the training of military medical personnel.

Biotechnology is completely different from traditional biological warfare weapons in terms of attack, because the latter is based on massive killing and destroying the healthy development of humankind. Nevertheless, in the research and development of military biotechnology, the history of biological warfare weapons should not be repeated. Therefore, the Biological and Toxin Weapons Convention should be consummated and implemented or new restrictive methods should be formulated. The theory of command of biotechnology will regulate the research and development of military biotechnology and stress the biosafety of humankind.

Military biotechnology is not to realize fighting power. In the long run, the theory of command of biotechnology is an extension and addendum to the theory of command. It will combine with various technologies and biotechnology, such as information technology and materials science to become a commanding point in the struggle for the initiative in future military reforms. From the constitution of the command theory of biotechnology, we see changes not only in military technology, but also in the sense of war concept and war civilization. With the advancement of science and technology, in recent unbalanced wars, how to reduce the casualty of the civilian and fighting members of both sides was a key factor restricting the military operations.[15] But this endeavor cannot protect civilization. The command of military biotechnology is hopeful to achieve a maximal reduction of damage to people and the environment, which represents a certain degree of war civilization.

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Tourniquet Use in Combat Trauma: UK Military Experience

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Abstract

Aim: To determine the prevalence of tourniquet use in combat trauma, the contribution to lives saved and the complications of their use in this environment. **Population:** All casualties treated at UK field hospital facilities in Iraq and Afghanistan and meeting criteria for entry into UK Joint Theatre Trauma Registry (JTTR) from 04 Feb 03 to 30 Sep 07. **Methods:** Cases were identified from UK JTTR. Casualties from Permanent Joint Overseas Bases (PJOBs) were excluded. ISS, NISS, TRISS and ASCOT were calculated automatically within JTTR from AIS 2005 (Military) codes. **Results:** 1375 patients met UK JTTR entry criteria for the period specified (excluding PJOBs). 70/1375 patients (5.1%) were treated with one or more tourniquets (total 107 tourniquet applications). 61/70 (87%) survived their injuries. 17/70 (24%) patients had 2 or more tourniquets applied. 64/70 patients received a tourniquet after April 2006, when tourniquets were introduced as an individual first aid item. 43/70 (61%) patients were UK military. **Conclusions:** ISS and TRISS are poorly representative of injury severity and outcome for combat trauma involving isolated multiple limb injuries and cannot be used to discriminate whether a tourniquet is life-saving. The presence of severe isolated limb injuries, profound hypovolaemic shock and the requirement for massive transfusion reasonably identifies a cohort where the use of one or more tourniquets pre-hospital to control external bleeding can be said to be life-saving.

Background

Haemorrhage from limb injuries has been identified as the most important cause of avoidable battlefield death.[1] The treatment paradigm has shifted in the UK military from ABC to <C>ABC to reflect the importance of rapidly controlling external hemorrhage.[2] This concept is firmly embedded in training at all levels of provider in the early management of severe trauma.[3] Commercial tourniquets (Combat Application Tourniquet, C-A-T™, Phil Durango LLC, USA; Figure 1) are issued to individual deploying soldiers as part of their personal first aid equipment with encouragement to use the device for severe limb bleeding during care under fire and to immediately re-evaluate the requirement when the fire-fight is won (tactical field care phase). This is pictorially represented in the haemostasis ladder, an escalator of interventions for uncontrollable haemorrhage.[4]

However, the use of tourniquets on traumatic amputations has been criticized as contributing to unnecessary limb loss.[5,6]

This article examines the UK military experience of tourniquets in combat to determine compliance with guidelines, their efficacy (contribution to saving lives) and their complications (in particular, unnecessary limb loss).

Methods

Cases were identified from UK Joint Theatre Trauma Registry (JTTR) for the period 04 February 2003 to 30 September 2007 covering Operation TELIC (Iraq), Operation HERRICK (Afghanistan) and Operation VERITAS (Oman/Afghanistan).

JTTR is a continual database of all seriously injured casualties treated in deployed UK field hospitals (Role 2 Enhanced or Role 3), with registry entry defined by any patient who meets predetermined Trauma Team activation criteria (UK Service, coalition forces, detainees, local civilians). UK Service personnel who have received treatment in deployed coalition field medical facilities and are evacuated to UK are included. In 2007, registry entry was extended to include all injured UK Service personnel evacuated to UK for inpatient treatment.

Casualties from Permanent Joint Overseas Bases (PJOBs, for example Gibraltar, Cyprus and the Falkland Islands) form part of JTTR, but these were excluded from analysis as Service personnel from these areas are not directly involved in combat operations.

Figure 1: The Combat Application Tourniquet

Unexpected outcomes were assessed mathematically by TRISS[7] and ASCOT[8] methodologies, and by identifying the cohort with injuries which were likely to be unsurvivable whose Injury Severity Score and/or New Injury Severity Score was maximal or near-maximal (ISS and/or NISS 60-75).

Results

1375 patients met UK JTTR entry criteria between 04 February 2003 and 30 September 2007 (excluding PJOBs). 107 tourniquets were used on 70 casualties (5.1% JTTR population).

Outcomes

61/70 (87.1%) of the casualties survived their injuries. Of the 9/70 (12.9%) deaths, 3 were killed in action (KIA, died before entering a medical treatment facility following hostile action); 4 died of wounds (DOW, died after entering a medical treatment facility following hostile action); 2 died on operations (DOP, died before entering a medical facility following non-hostile action).

For the survivors the median Injury Severity Score was 16 (range 1 to 42); the median New Injury Severity was 21 (range 1 to 50). Only 6/9 deaths could be reliably scored, as 3 deaths related to the local population and autopsies are not performed in the deployed setting: for the 6 deaths with autopsy confirmation median ISS was 50 (range 13 to 75) and median NISS was 57 (range 14 to 75). There were no unexpected survivors in this cohort identified by TRISS Ps <50% or ASCOT Pd >50% or ISS 60-75 or NISS 60-75. One case was identified as an unexpected death by both TRISS and ASCOT: this was revised to an expected death following assessment by multidisciplinary expert peer review panel (ISS 50, NISS 57; liver disruption, diaphragm disruption, haemothorax and lung contusion; tourniquet placed for comminuted compound fracture of forearm).

Nationality

43/70 (61%) patients were UK Service; 18/70 (26%) were coalition forces (NATO allies and Afghan National Army); 5/70 (7%) were coalition civilians (Afghan National Police; contractors) and 4/70 (6%) were local civilians.

Use post-CAT implementation

64/70 (91%) patients received a tourniquet after April 2006, when tourniquets were introduced as an individual first aid item. Only 6 patients (9%) are recorded to have received a tourniquet as an early intervention in severe trauma in 3 years of operations in Iraq from 04 February 2003 through to 31March 2006; there were only 3 trauma patients on OP VERITAS for this period and none received a tourniquet.

For patients treated after the introduction of Combat Application Tourniquet, 59/64 (92%) suffered injuries as a result of hostile action; 47/59 were injuries from an explosion (IED 21/59; mortar 7/59; mine 6/59; RPG 6/59; bomb 2/59; rocket 1/59; unspecified 4/59). Of the 5 non-hostile casualties, 3 were injured from weapon discharges; 1 followed a motor vehicle crash; and 1 was the result of a "friendly fire" aerial bomb.

Multiple tourniquet use

17 patients received more than 1 tourniquet. 5/17 needed two tourniquets applied for the same injury (Figure 2, juxtaposed tourniquets). 12/17 had tourniquets applied bilaterally. One patient needed three tourniquets applied to two separate injury sites and one patient needed a total of 4 tourniquets, 2 to each leg injury.

Figure 2: Juxtaposed tourniquets

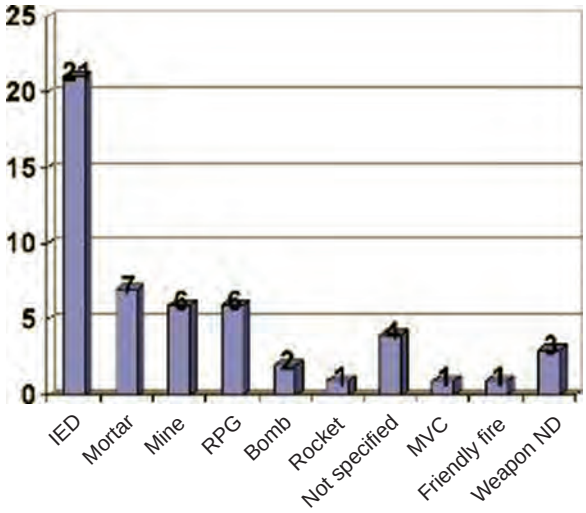

Figure 3: Injury mechanisms for hostile and non-hostile action casualties where tourniquet(s) used in early treatment (RPG = rocket propelled grenade; MVC = motor vehicle crash; ND = negligent discharge)

Injury mechanisms and types

Injury mechanisms are shown in Figure 3. The tourniquet was used to control external bleeding following one or more traumatic amputations (25/70 patients), one or more compound limb fractures (25/70 patients), vascular injury following penetrating trauma (5/70 patients; all gunshot wounds; 1 x femoral artery, 1 x popliteal artery, 1 x radial artery, 2 x ulna artery injuries) and limb soft tissue injury (15/70 patients; 10 as a result of IED, mine, RPG and mortar; 5 resulting from gunshot wounds). Figure 4 summarizes the principal indication for tourniquet application. The anatomical distribution of primary traumatic amputations (amputation occurring at the time of the injury) is shown in Figure 5.

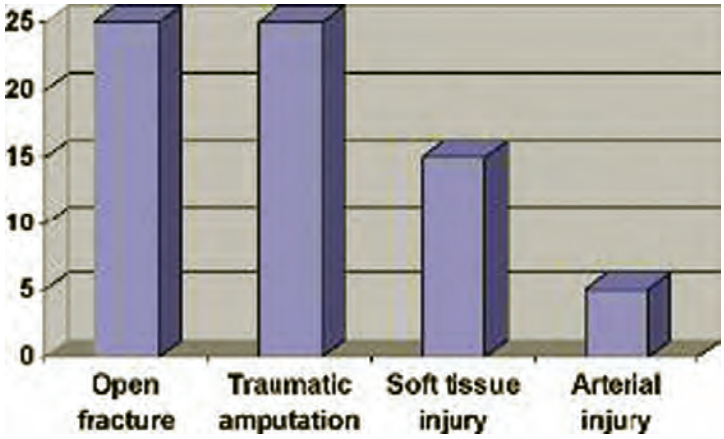

Figure 4: Clinical indications for application of a tourniquet (principal indication for each of 70 patients)

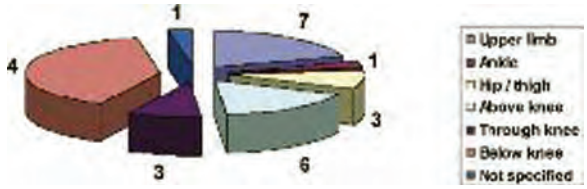

Figure 5: Distribution of primary amputations in casualties managed with a tourniquet.

Secondary amputations

8 patients underwent secondary amputation (where limb amputation was the preferred surgical treatment): all were open fractures with 1 case involving the humerus/radius/ulna, 1 case the femur, 5 cases the tibia (1/5 required bilateral amputations) and 1 case the foot.

Location of application

106/107 tourniquets were recorded to have been applied prehospital: One was applied in the emergency department. 11/107 tourniquets were recorded as having been removed in the emergency department. 3 tourniquets were recorded as having been removed pre-hospital after re-assessment of their need during tactical field care or field resuscitation.[9]

Complications

Three direct complications from the use of the tourniquets were identified. Two were cases of compartment syndrome (one in the thigh; one in the lower leg): The thigh compartment syndrome was attributed by the field surgeon to a venous tourniquet effect from the tourniquet being applied over a trouser pocket containing a book. The underlying mechanism of injury was gunshot wound in both cases. The third complication was ulna nerve palsy from a tourniquet applied to the upper arm: the tourniquet was applied during care under fire for an extensive soft tissue forearm ballistic wound with radial artery injury.

Other haemostatics

HemCon® (chitosan topical haemostatic bandage) was used concomitantly in 10/64 (16%) patients where a tourniquet was applied after the introduction of HemCon® in April 2006. QuikClot® (zeolite powder) was used in 3/69 (4%) patients where a tourniquet was applied after the introduction of QuikClot® in April 2005. No patient receiving a tourniquet is recorded as having HemCon® and QuikClot® used together.

Recombinant factor VIIa (rFVIIa) was used in 7/70 (10%) patients who had received one or more tourniquets and defines a population that is clinically very seriously injured as rFVIIa is used as an adjunct to a massive transfusion protocol: All of these 7 patients survived. 4/7 of these patients had isolated limb injuries. Case A (952), ISS 17, had Grade IV hypovolaemic shock following a below knee amputation; Case B (205), ISS 25, had Grade IV shock following an above knee amputation; Case C (1393), ISS 26, had Grade IV shock following bilateral amputation (one above knee, one below knee); Case D (1396), ISS 26, had Grade IV shock following bilateral amputation (one above knee, one below knee). In these cases the use of tourniquets may be reasonably regarded as life saving.

Discussion

The use of a tourniquet as an early intervention in the management of combat trauma has increased 20 fold since the introduction of the Combat Application Tourniquet as an individual issue first aid item (64 patient uses in 18 months of TELIC 8-10 and HERRICK 4-6, compared to 6 patient uses in preceding 3 years of TELIC 1-7), Figure 6. This probably reflects the availability of such a simple and effective treatment at point of wounding, together with a predeployment training message that has received wide acceptance from individual soldiers.

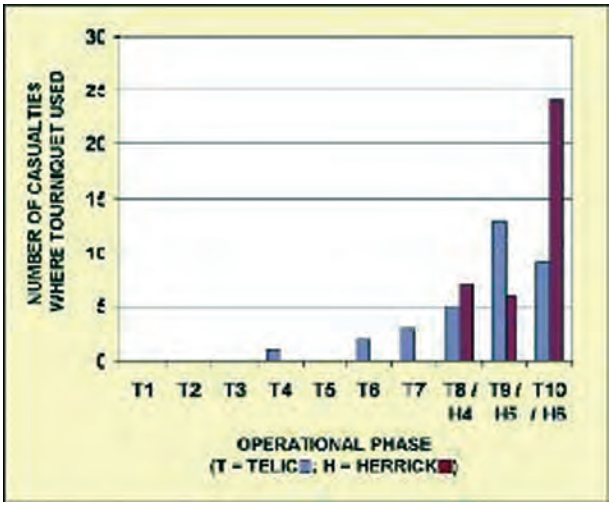

Figure 6: Number of casualties where a tourniquet used by operational phase

The use of tourniquets has been very closely monitored within Defence Medical Services with near real-time feedback via the weekly Joint Theatre Clinical Care Conference (an international telephone conference) if any compli-

cation is identified. The application of a tourniquet over a full trouser pocket led to an immediate training refinement to emphasize the need to check the pocket first. Training has also been central to the concept of early re-evaluation of the need for a tourniquet, should it have been applied during care under fire.

While the content of pre-deployment training is strictly controlled, unwanted and erroneous practice messages from external sources have reached deployed soldiers. An example is the message that a tourniquet must only be applied over a single bone (humerus or femur). This doctrine is believed to have arisen from porcine animal haemorrhage models with nonballistic injuries. The model neither reflects human anatomy, nor the way a limb mangled by ballistic trauma will respond to circumferential compression.

The Injury Severity Score is well recognized to underestimate multiple injuries in the same body region:[10] A single traumatic limb amputation will score the same as a bilateral amputation. This is a weakness of TRISS when predicting unexpected outcomes. The New Injury Severity Score (NISS) provides a more representative injury severity, but NISS is not traditionally used to calculate TRISS. Future tracking of the effectiveness of tourniquets as life-saving interventions cannot rely on TRISS methodology.

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Company Command Building: Combat-Ready Teams — Making Sense of Killing

Previously Published in Army News

To: Company Commanders

From: Company Commanders

Making Sense of Killing

We train our Soldiers to kill, equip them to kill, develop plans for them to kill, and sometimes even give them the lire commands to kill, yet too often we don't help them make sense of the killing they do ... "Prep for combat" and "recovery" should include actions to equip our Soldiers to deal with the moral and psychological aspects of killing in combat.

An Army at peace does everything an Army at war does except for one — kill other human beings. Every day in the Global War on Terror, American Soldiers are killing our enemies, and we are very effective at it. Yet, as we wage our first long-duration war in over a generation, we are learning that we as company-level leaders could do a better job at helping our Soldiers deal with the psychological aspects of killing. You won't find this topic addressed in an AR or FM, but we have found that it's being talked about by leaders as they gather in motor pools, TOCs, mess halls and in the Company Command forum.

In order to give this issue more visibility and generate effective ideas, we asked past, present, and future commanders the following question in a recent CC poll:

Do you have responsibility to equip your Soldiers for making sense of killing in combat?

Yes: 180 No: 11

According to the poll responses, company-level commanders overwhelmingly agree that we have the responsibility to equip our Soldiers to make sense of killing. How, then, do we do it? Here are some of the comments from CC members on how they are equipping their Soldiers to deal with this tough and relevant issue.

Before Killing

Make Killing an Acceptable Conversation Topic

Pete Kilner

OIF

Soldiers are going to think about the morality of killing either BEFORE, DURING, or AFTER combat It's in their, and the Army's, best interests to have them think about it beforehand.

What's important is that we as leaders make the topic of killing and guilt an acceptable topic to talk about. By talking about it with their buddies and leaders, our Soldiers will be much more likely to make sense of killing in their own moral terms We don't need to provide THE ANSWER (there may not be one that works for everyone), but we can do a lot to help our Soldiers find their own answers. As leaders, we can create conditions where our Soldiers can talk about and make sense of killing. Soldiers with clear consciences are better Soldiers and better people, so this is a leadership issue.

Equip Soldiers BEFORE Killing

Bill Rodebaugh

OIF

As a commander, you have to ask Soldiers to consciously make the choice to pull the trigger BEFORE they are even put in the position to kill. If not, they either won't pull the trigger, or they will do it out of instinct, or because they hear an order to do it. Then they won't ever reconcile the act later in life without counseling. I try to communicate to my guys the truth on why we kill and how it is a necessary thing. It is commander business: Combat Stress Teams are good after the fact when commanders fail to do their part on the front end.

Leverage the Whole Team

Nick Ayers

OIF I & II

Preparing Soldiers for the realities of war is difficult, but it is what we get paid to do. I don't think that leaders have to do it alone, though The squad leader, platoon sergeant, or even CO shouldn't feel all of the responsibility is on their shoulders alone. A commander can enlist the help of a variety of resources, including chaplains and Combat Stress Teams. A commander can work to get a guest (subordinate, peer, or superior) to come talk with Soldiers to perhaps share experiences. There are a limitless number of ways and techniques, all of which are derived from the personality and character of the commander and of the unit.

Show Faith in the Cause

Rob Griggs

OPERATION JUST CAUSE, OEF II & OIF

As far as how I tried to prepare my Soldiers to make sense of it all — I was always honest about what I thought they should expect and I relayed to them what I believe-that we are part of the world's greatest fighting force and that our job is an important job that will make a difference in the history of the world. There have been times when I have been challenged by those who cannot make sense of combat on the policy level. At these times, I tell them that while I may have an opinion on policy, as a Soldier I am comfortable un-

derstanding the mission and executing the mission, ensuring that I understand how my mission nests with my higher headquarters' mission. When I deploy I go – knowing and believing that the cause is just and the mission can and will be accomplished.

Understand ROE & Combat Stress

Steve Cunningham

OIF I & IV

Before deployment, our unit regularly conducted combat stress and suicide prevention classes as well as ROE and Law of Land Warfare classes to discuss the mental health and legal aspects of our mission. The combat stress and suicide prevention classes are meant to specifically teach the symptoms of the same to both individuals and peers. First, this lets the Soldier know that combat stress is a real thing, and not something to necessarily be ashamed of. Second, the collective group is taught the symptoms of combat stress in order to identify problems their peers might be experiencing. The legal aspects of the ROE and Law of Land Warfare are used to discuss the difficult situations Soldiers will find themselves in while deployed to Iraq and Afghanistan. These scenarios are purposely difficult and ambiguous in order to replicate the reality of the battlefield. The discussion leader highlights the importance in understanding the reason behind the ROE, and the magnitude of making split second decisions while in these difficult scenarios. We discuss the need to use the ROE in order to meet the desired strategic endstate, and the need to protect the force. Enough Soldiers have been exposed to these scenarios on past deployments to share their experiences with their buddies.

Train to Make Sense of Killing

Jonathan Silk

OIF I & II

During training prior to deployment, you can have Soldiers explain to you or the O/C why they killed.

After an engagement in a training exercise, do not bring the OPFOR "back to life" right away for the AAR. Walk the fire team, squad, or platoon through the engagement area with the OPFOR where they were engaged and destroyed. As you come upon a group of "dead" OPFOR, ask your Soldiers, "Who killed them?" When Soldiers step forward to say they did, then ask, "Why?" Make Soldiers tell you why they killed the OPFOR. They may say something like, "They were maneuvering to the other squad's flank to engage them, so I engaged the group of OPFOR to protect the other squad." Then you tell them they were justified in killing the enemy and they did a good job.

By incorporating this into training you will have the Soldiers think through why it is okay to kill.

While it is impossible to replicate the violence of combat in a training environment, I think incorporating something like I just suggested will help prepare Soldiers to kill and to deal with it after they have killed.

Create a High-Standard, Supportive Climate

Joshua Shrader

OIF III

This question I think has more than just one part. The first is, "Will my Soldier be prepared to take the shot if needed?" secondly, "Will the Soldier be able to take responsibility for it?" If the command climate is one that will train the Soldier to a high standard in both duties and ROE, and on top of that, back his/her decisions, you are much more likely to have a Soldier who is ready to kill in combat. If your Soldiers are not ready to kill in combat, they may be at risk for being killed in the enemy's place.

After Killing: Continuing the Fight

Involve Combat Stress Teams

Dave Polizzotti

OIF I

I found that integrating the Combat Stress Teams into my battle rhythm was a critical part of my success. Those guys were absolute miracle workers. They are capable of handling Soldiers on a one-on-one basis. In some cases where there was a significant part of the company involved in an engagement, I would have them do what they called a Critical Event Debriefing to educate Soldiers on behaviors following a traumatic event. Depending on circumstances, there were times that I mandated that certain individuals or crews go to see the CSTs, and other times I left it wide open. I made a point to have them come to my company area at least once a month, and more if I could afford to do it.

Talk to Your Soldiers

Bryan Carroll

OIF III

As Soldiers, we all want to know that we are fighting the good fight. Talk to your Soldiers about why they are there, what they are accomplishing, how they are keeping their nation safe. A Soldier who believes in what he is doing, rather then just "following my orders to go do something," is a much more lethal weapon.

We had a great Combat Stress Team and chaplain who would come down proactively and intercept small problems before they became big problems. The biggest thing is just talk to your men, however that works for you, but talk to them, and find out what's going on, who's having problems, and who needs to talk to someone.

Share Your Experiences

Ned Ritzmann

OIF I

After killing or another traumatic event, I wanted to ensure that Soldiers would be able to "armor up" for the next mission. I did not look at it as a long-term mental health or "nightmare mitigation" measure — I focused on the near targets, not far. How I addressed it was by talking to Soldiers — guard, pulling security on missions, etc. I used to specif-

ically ask them what was bugging them. When guys said they were scared, I told them that I was, too, and that it was okay and natural. They understood that we had a job to do.

We are currently training National Guard units to go to Iraq, and as part of that, we have OIF vets discuss things that happened to them in theater. When OIF vets in the audience hear us discuss a pretty traumatic event, you can see their reaction — it's kind of like, "Wow, that happened to you, too?" Simply knowing that you are not alone helps. It's kind of like the old adage in school — if you have a question, someone else does, too.

Reinforce the Mission's Purpose

Matt Stapleton

IIF II

I think communicating the long-term purpose for the mission is the best way to help Soldiers make sense of killing. I think the "us versus them" mind-set over the long run is the best approach. I reminded Soldiers constantly that the best defense is a good offense: we are here more than anything to carry the fight to the enemy so IEDs didn't eventually happen in their hometowns ... or further attacks like 9/11.

Stress Communication & Involve Chaplains

Anthony Flood

OEF

When troops have had their first "contact," especially if there was bloodshed (on either side), it's a good idea to get the platoon, squad, etc., together and discuss the incident. Essentially, do an AAR, but try to get everyone to contribute to the discussion. Use it as a tool to see if your troops are handling it well. Having a good relationship with the junior leaders helps, too — that quiet word to a squad leader over a cup of coffee.

I found having a chaplain to be a "force multiplier." I had never expected a tremendous asset. I encouraged our chaplain to be available for the troops: he'd go on patrols, hang out in the motor pool, PT with a section, and so on. Anytime I found out one of the troops was having issues. I'd mention it quietly to the chaplain and he would make a point of checking in with the Soldier to see how he was doing. It really helped defuse some issues.

Sympathize & Support Your Soldiers

Chris Hossfeld

OIF III

When I had Soldiers who were unsure if they did the right thing, if they had doubts about killing, I tried to address it with them from my own personal experiences. When they know that you have had to do it yourself, it gives credibility to you telling them that it's okay. As leaders in combat, we have to be there for our Soldiers. We have to tell them that they did the right things. We have to support them when they make tough decisions. We have to ask them tough questions, and then support them. That is what the Soldier really wants to know. "Did I do the right thing?" If you know the situation, listen to them, and then tell them that you understand what they are going through, and reassure them that you support them. They will go out there and continue to make tough decisions because they know that their leaders care about what happens to them.

After Killing: Making Sense of it All Leaders Actively Engage Soldiers

Matt Benigni

OIF II

During redeployment, we conducted train the trainer to equip each CO with factual information about combat stress and what we called "normal reactions to extremely abnormal experiences." Instead of having psychologists come to our formations and conduct interviews with all of our Soldiers, my Brigade Commander chose to train company commanders so that they and their leaders could interview their Soldiers.

Identifying Soldiers that need professional help is a leader's job, and in order to do that, some stereotypes need to be removed. You can assume that it is extremely difficult for many Soldiers to share the problems they are going through. Their chain of command and peers have shared some of the experiences with them and are in the best position to identify Soldiers that need help.

We were not in the business of treating these Soldiers; we made sure that the Soldiers understood these emotional/physical reactions were normal and gave them an outlet to burden — share or seek help through the chain of command. In a company of 75 tankers, we had about five instances where Soldiers, ranging from E4-E7/O2, came to the chain of command seeking some help. Ensuring that redeploying Soldiers understand they are bound to have some adjustment problems and will not have any stigma attached by asking for help has had immeasurable benefit in my company and brigade. We continue to conduct interviews as part of reintegration six months after redeployment.

Lead By Example

SF Officer (anonymous)

OEF & OIF I

About eight months ago, I received a rapid influx of Soldiers into my unit. All of them came from combat-deployed units. Lately, I've been having a lot of problems sleeping, which I do not attribute to PTSD, but I made no secret at work that I was seeking some assistance from Mental Health. Imagine my surprise when at least four of my Soldiers immediately self-referred to Mental Health for issues they experienced during the war that have been causing them problems at home. I keep learning that I can never underestimate the power of my ability to influence my Soldiers as a commander.

NCO Leadership & AARs
Steve Cunningham
OIF I & IV

In our unit, the chaplain, command sergeant major and first sergeant constantly surveyed Soldiers to get a read on their morale. We had a team of psychologists, chaplains and other leaders who would counsel Soldiers after a catastrophic event. These were mandatory individual and collective bull sessions that seemed more like AARs than mental health sessions. The chain of command took an active role, and we openly discussed our feelings of anger and frustration in front of the men. It was therapeutic to discuss mistakes made, and to identify the things that were beyond our control. The professional unit that conducts AARs for every mission will usually address the issues that cause combat stress, will be able to identify Soldiers who are feeling its effects, and take measures to mitigate them.

CC is Company Commanders.

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Send article ideas to nate.self@us.army.mil.

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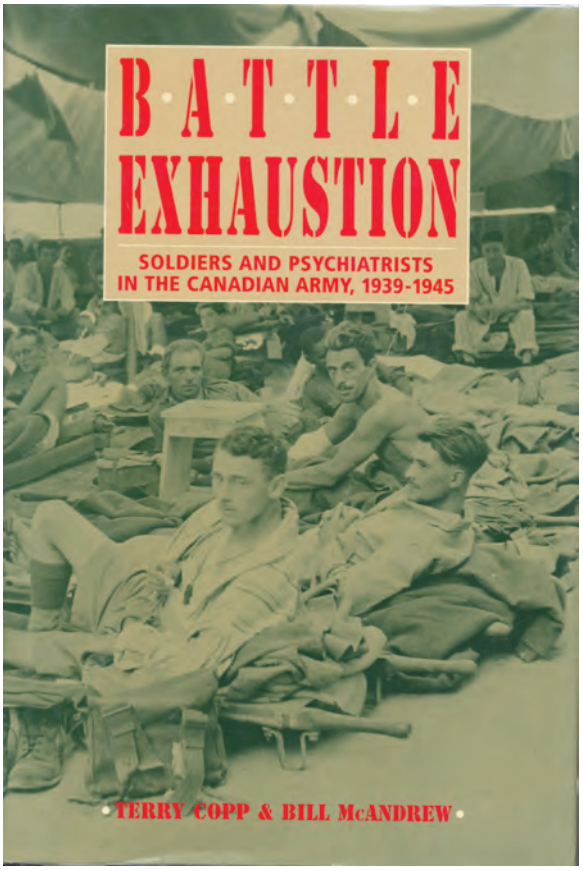
Book Reviews

BATTLE EXHAUSTION: SOLDIERS AND PSYCHIATRISTS IN THE CANADIAN ARMY, 1939-1945

By Terry Copp and Bill McAndrew.
Montreal, Canada: McGill-Queen's University Press. 1990. ISBN: 0-7735-0774-4.

Review by LTC Craig A. Myatt



In a historical account on the development of psychiatric and psychological services provided to Canadian soldiers during World War II, Copp and McAndrew provide a realistic understanding of mental health challenges for wartime personnel. They highlight the importance of careful screening procedures in military personnel selection, but caution the reader that screening alone is not an adequate predictor of how well any soldier can sustain the impact of combat. Focusing more on combat soldiers and less on combat support and combat service support soldiers, Copp and McAndrew discuss how battle exhaustion in the Royal Canadian Army affected soldiers, their leaders, and medical personnel during several major WWII campaigns.

From the early campaigns in Africa and Italy to the later campaigns in Western Europe, the Royal Canadian Army witnessed an evolution of standard practices for the treatment of post-traumatic stress and battle exhaustion. Copp and McAndrew demonstrate clear distinctions between post-traumatic stress and battle exhaustion. They describe post-traumatic stress as a recognizable human response to battlefield exposure. They define battle exhaustion as a psychiatric casualty. With both, they plainly show that for soldiers "leadership was vital."

Commanders and other leaders in the Royal Canadian Army did not enter WWII with an institutional understanding of how to facilitate their soldiers' ability to cope with battle exhaustion. In their preoccupation with the weapons, tactics, technology, and grand strategy they were not encouraged or trained to give adequate attention to the human dimension of battle. Early in the war some commanders and leaders took battlefield behavior for granted, ignoring the challenges of returning soldiers to combat after sustained post-traumatic stress and battle exhaustion. As the war campaigns continued, Canadian commanders and leaders relied more on forward psychiatric services than ever before.

Medical personnel in the Royal Canadian Army drew lessons learned from the contrasting approaches to psychiatric casualties displayed by the United Kingdom and the United States. The British throughout much of WWII were relatively reluctant to commit resources and personnel to treating psychiatric casualties. The United States Army, on the other hand, developed a system of forward psychiatry that helped to improve rates of return to combat. The presence of psychiatrists and medical personnel trained in treating neuropsychiatric casualties helped the U.S. Army treat and return to combat neuropsychiatric casualties that ranged from 16 percent of casualties in less intense combat to 35 percent of casualties in extremely intense battle.

Among the Canadians, Dr Arthur Manning Doyle, a division-level psychiatrist, played an instrumental role in facilitating the use of screening and treatment that paralleled that used by U.S. forces. Similar to the U.S. Army Alpha and Beta Tests developed during WWI, Canadian psychologists developed the M Test, a screening test designed to generate a "mental age" for recruits. Doyle recognized an inherent value in the use of the M Test, but valued effective training, unit cohesion, and leadership above the use of tests for personnel assignment. Drawing from the U.S. Army approach, Doyle exemplified the Canadian push for forward psychiatric services by providing combat units with sufficient medical personnel trained to treat battlefield neuropsychiatric casualties. Doyle routinely projected psychiatric casualties to be 10 to 15 percent of all Canadian battle casualties and provided medical personnel at the division level to meet those projections.

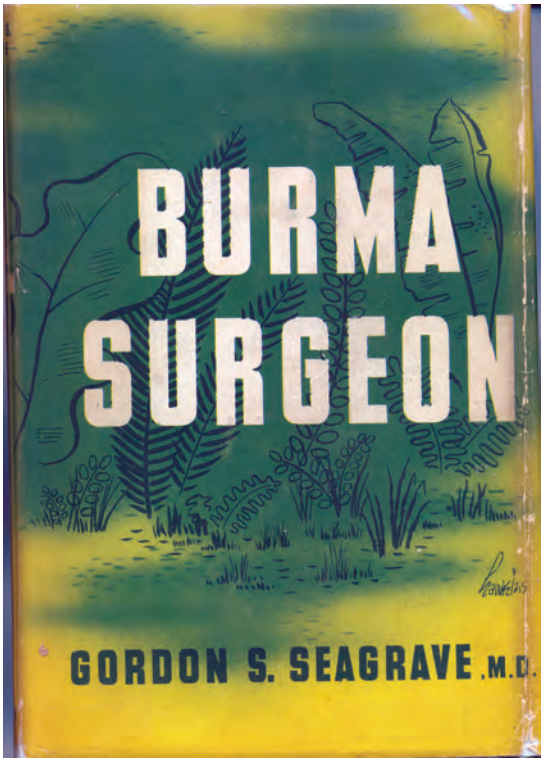
Copp's and McAndrew's historical account of WWII era psychiatric and psychological services concluded with the following: "By the end of the war there was widespread agreement that the soldier's performance during training rather than any predetermined personality profile was the best, if still imperfect, guide to his combat potential." Proximity of neuropsychiatric care and the expectancy that following immediate care, soldiers could return to combat became a standard for the Royal Canadian forces. Achieving that standard on behalf of psychologically wounded soldiers required a growing cooperation among psychiatrists, psychologists, commanders, and other leadership.

The role that Royal Canadian Army psychiatrists and psychologists performed was important in identifying how individual, situational, and organizational factors all played a part in determining when a soldier would break in combat. The Royal Canadian Army Medical Corps learned in WWII that the neuropsychiatric and psychological theory of their era did little to prevent and treat battle exhaustion. The combat-tried solutions and treatment for post-traumatic stress and battle exhaustion led to an evolution of contemporary scientific and organizational ideas about the realities of large-scale psychiatric casualties. That evolution of ideas in addressing the human dimension of battle proved useful in WWII and is genuinely relevant today throughout all components of the military. I recommend this work, especially for aspiring commanders and medical military personnel.

BURMA SURGEON

Gordon S. Seagrave, MD
W. W. Norton & Co., Inc., New York, NY 1943 Hardcover, 295 pages

Review by LTC William Bosworth



Burma Surgeon is the autobiographical story of Dr. Gordon S. Seagrave, MD, (1897-1965), that takes place in the former British colony of Burma up through the events of the Allied retreat from Japanese forces in 1942. This book tells the story of his life as the son of a third generation missionary in Burma, and his later return as a medical missionary to serve the same people as a physician and surgeon. He established a number of hospitals and clinics prior to World War II, and served in the China-Burma-India Theater during the Burma campaign of April-May 1942, during GEN Stilwell's retreat in the face of the Japanese offensive into Burma.

The book begins with a short prologue that describes how the author, at the tender age of five, decides that he'll become a medical missionary as a result of a visit by a doctor working as a medical missionary in northern Burma close to the Chinese border. His mother dismissed the musings of a five year-old with the belief that her son would become an evangelistic missionary much like the past three generations of his family. The rest of the prologue describes his medical training and residency in preparation for his new life as a medical missionary beginning in August 1922, taking along his wife, infant daughter, and a wastebasket of castoff surgical instruments from his residency to bring Western medicine to the Shan States of Burma.

The early years of Dr. Seagrave's medical missionary work began with only his medical skills and the wastebasket of surgical instruments that he brought with him; learning what he needed to know by working on patients, without the benefit of a mentor. He describes traveling throughout the villages of northern Burma, providing medical care to the local populace under austere conditions, much like a medical civic action program. He practiced medicine and performed surgeries with the help of his wife, Tiny. As his reputation grew, he saw the need to train women from the local tribes as nurses to assist with the increasing numbers of patients that he was seeing. He was successful in setting up a government recognized school for training nurses that operated until the Japanese invaded Burma in 1942. During this time, he was also working to build clinics and hospitals throughout the region, and building rapport with the local governments, which in turn supported his medical mission.

In 1937, Dr Seagrave returned from America with a new X-ray kit and new surgical instruments. The area was growing fast; Japan and China were having "incidents." The Burma Road was being built from Kunming, China, to Lashio, Burma, which would allow him to travel farther to treat patients. It also allowed him to expand the number of clinics that he could oversee in the region. As his influence grew, he was able to build more permanent facilities to work out of. As the war drew closer, he became involved with providing care to Americans who were in the border region of China near Burma helping the Chinese build airplanes to help in their efforts against the Japanese.

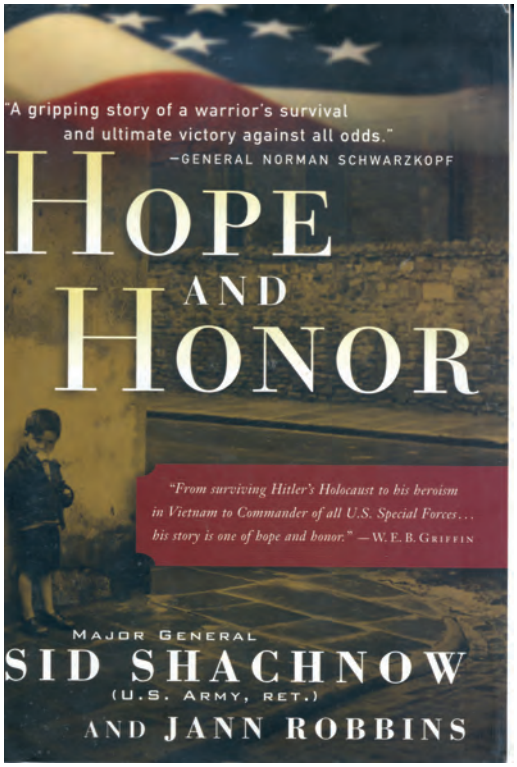
The second half of the book focuses on the 1942 Burma campaign against the Japanese invasion of Burma. Dr. Seagrave (now a major in the Medical Corps) and his regional network of clinics and hospitals became a mobile surgical hospital under General Joseph Stilwell's command in support of the Chinese Fifth Army, which was in action against the Japanese. It recounts his hospital's actions in support of the campaign on a day-to-day basis to include significant enemy actions, in addition to the hardships he and his people encountered on the retreat out of Burma, through the mountains, and into India. It ends with the evacuation to Assam, India, three months of emergency operations under Japanese air attacks while moving in retreat from the Japanese offensive that separated China from its logistics lifeline in India.

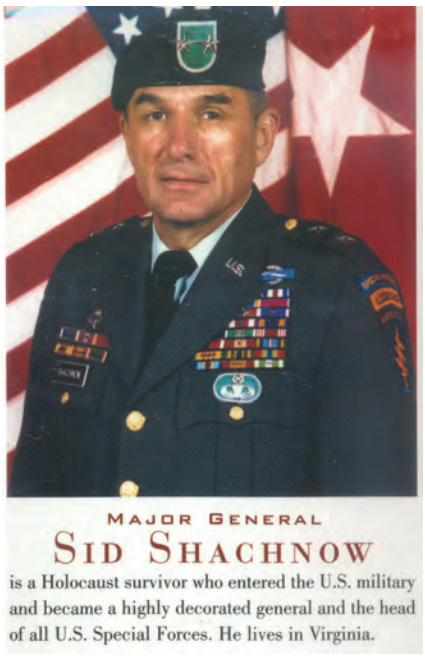
Burma Surgeon is a well written account of one man's work battling tropical diseases, at first with little more than his skills and a few instruments, evolving from a few native huts into a modern hospital system that served the Allied forces in the early days of WWII. He encountered many of the same challenges that SOF sees today in our theater of operations and employed some of the same techniques that Special Forces have used to win the hearts and minds of the local populace since WWII. It is an easy to read, first person account of one theater of the war that is not as well known as the European and Pacific theaters.

HOPE AND HONOR

Major General Sid Shachnow (USA Ret) and Jann Robbins
Forge Press, 2004

Review by Mr. Bob Clayton





Hope and Honor depicts the hardships of being of the Jewish Faith in Europe during World War II. The vivid recollections of Sid Shachnow as a young boy having to survive are hard to imagine without actually having been in the same situation. The story of his youth is an inspiration to all and serves as a reminder that no matter how grim the situation there is always someone else who is worse off. One of the key elements of his early days was to have the perseverance to overcome obstacles and the intuition to rapidly assess the situation and act accordingly. These traits would continue to provide the foundation for his future endeavors.

This book serves as a brief reminder that, like many others of his era, he survived the hardships of WWII and relocated throughout the world. Many immigrated to the United States and joined our Armed Forces and subsequently became U.S. citizens. In the early days of Special Forces a large number of those recruited were displaced persons or DPs. Most came from European countries and already understood the language, geography and cultural morays necessary to conduct operations in the post WWII Europe evolution of the Cold War.

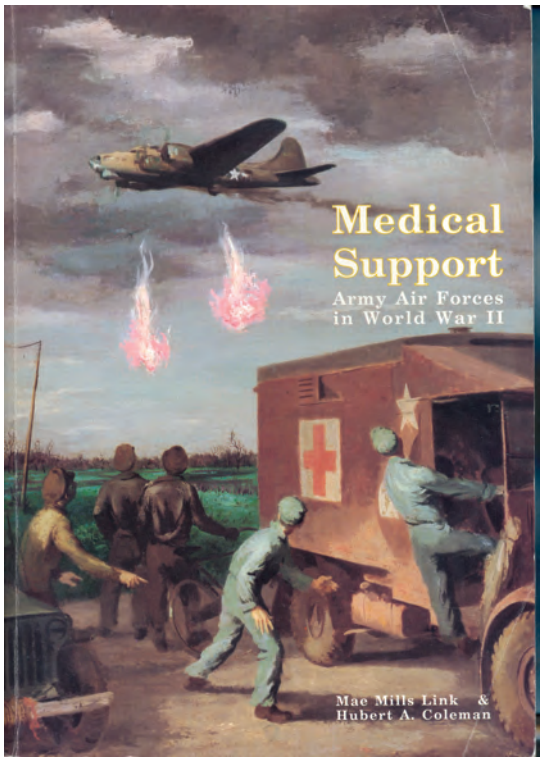
Although not intended as humorous, there was a whimsical side to his story. Being naïve to the ways of the U.S., he tried to understand the colloquialisms and slang terms. His story reveals the early days of the post-war Army, where Soldiers believed in Soldiering hard and drinking harder. It also depicted the culture of the Army, being very rank conscious, and the hierarchy of the Officers Corps, with West Pointers being at the head of the food chain. His story described the dislike for Special Forces by the mainstream Army leadership.

All in all, General Shachnow excelled in life; against all odds, he survived and learned from his experiences. He applied those experiences and rose to greatness through his faith and dedication. He is a great American whose story should have been told long ago.

Medical Support of the Army Air Forces in WWII

Mae Mills Link; Hubert A. Coleman
Published by the Office of the Surgeon General, USAF

Review by Capt Keith Vollenweider



If you are a WWII history buff, with an interest in aviation medicine, and you have a lot of time on your hands, then this might be the book for you. *Medical Support of the Army Air Forces in WWII* is a big book. A two pound tome at over 1000 pages, it gives the impression that it is comprehensive in its treatment of the subject, and for the most part it is. Written in 1955 and published by the Office of the Surgeon General, USAF, this is the definitive book on medical support of the Army Air Forces (AAF) in WWII.

The book is really a compilation of reports and other data that the Air Force SG's Office had accumulated after the war; some of it is only slightly edited by the authors. If you are interested in the rates of specific diseases or injuries during the war, this is a useful source. The same goes for info on specific units, including early Air Ambulance units.

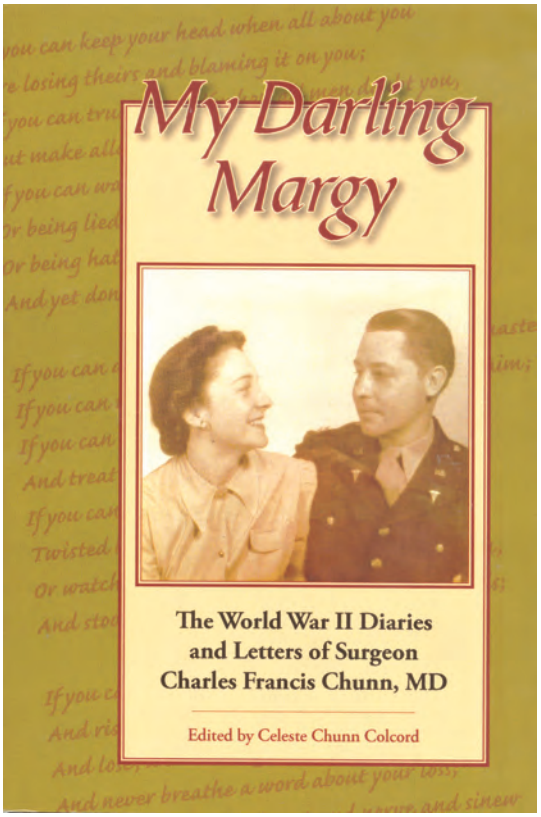
Chapters cover the history of the development of the AAF medical service and its development through the war years, the school house, research and development, air evacuation, chapters on medical support in the North African, Mediterranean, European, Pacific, and China-Burma-India Theaters, as well as special problems of aviation medicine in Europe and the very long range bomber program. Three areas are not discussed. These are the AAF Psychological Program, the history of surgery in the AAF, and the operational details of the many AAF hospitals in the Zone of the Interior (CONUS). The book also has a lot of photos, graphs, maps, and various charts that help make the reading more interesting and easier to understand.

To me this is interesting reading, but I cannot say that all JSOM readers would want to devote a lot of time to this material. If you have an interest in early flight medicine history, activities, and development, or you are doing research, you will find this book worth the time; otherwise, try one of the several books on aviation medicine with narrower scopes. Overall, *Medical Support of the Army Air Forces in WWII* is truly comprehensive in its coverage of the subject and offers a great reference point from which to chart aerospace medicine development and the growth of the Air Force Medical Service relative to today.

My Darling Margy

The World War II Diaries and Letters of Surgeon Charles Francis Chunn, MD
Edited by Celeste Chunn Colcord
The Scuppernong Press, Wake Forest, NC, 2005. Paperback, 183 pages. ISBN 0-9773156-0-6

Review by LCDR Joe Patterson



My Darling Margy is a short collection of diary entries and letters home by surgeon-Soldier Charles Chunn during WWII. An easy read, the book is broken into four basic sections: an introduction by his wife, letters and diary entries, illustrations and photos, and a postscript written by friends and relatives.

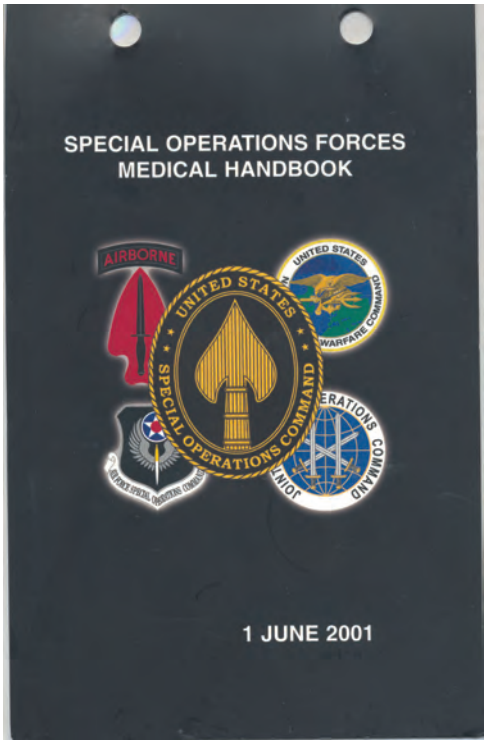
Charles Chunn realistically outlines military wartime life at the field mess, viewing the horrors of war as a surgeon, and enduring family separation. He starts out as an adventurer writing eagerly about anticipated torpedo attacks and air raids, transitions through descriptions of full case loads of depressing combat surgeries, and finishes tired and abruptly with an anticlimactic VE day. Interspersed throughout are anecdotes of barhopping, life in a combat zone, descriptions of the "hurry up and wait" routine, and telling his wife how much he loves and misses her. The photos and illustrations show items like pictures of Chunn and a missing gear statement for a shelter half, canteen, and mess kit.

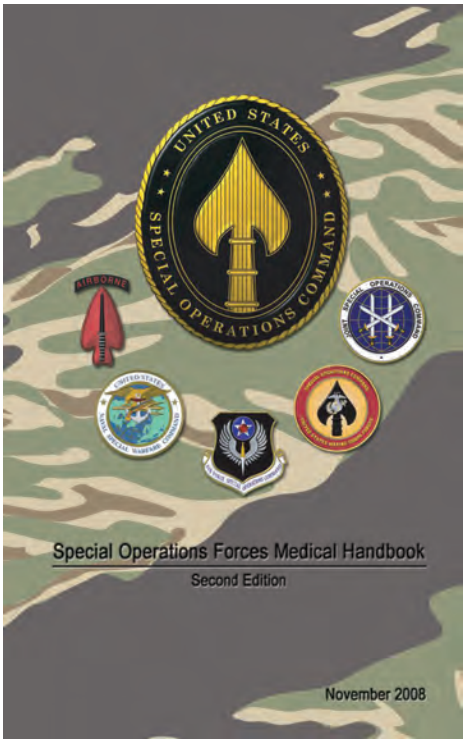
To wrap this book up, it's a personal collection of things from the sea chest of a WWII Army surgeon that someone felt needed publishing. The postscripts are from family and friends and detail his importance on their lives. I'm sure he's an important figure to them, but as a third party, I didn't find it especially impacting or historically revealing. But then maybe that's the point. Dr Chunn serving admirably alongside 16 million other Americans who served in WWII, came home, raised a family, and contributed to his community of Tampa, FL. A portion of the sales from this book even go to the Moffitt Cancer Center in Tampa.

Special Operations Forces Medical Handbook- Second Edition: November 2008

ISBN 978-0-16-080896-8, US Government Printing Office

Reviewed by CPT Scott Gilpatrick





We all know that even in medicine, there are a million different ways to skin a cat. Most of the personalities practicing SOF medicine can tell you every way, as well as ten more that are better, faster, and more tactical. To try and come to an agreement on the best way of doing a procedure or what medicine to give for an ailment (in the normal SOF working conditions) seems daunting to say the least. The authors and contributors of the SOF Medical Handbook – Second Edition certainly came up with the best practice guidelines for doing business – how we should do it in the unique SOF medicine environment.

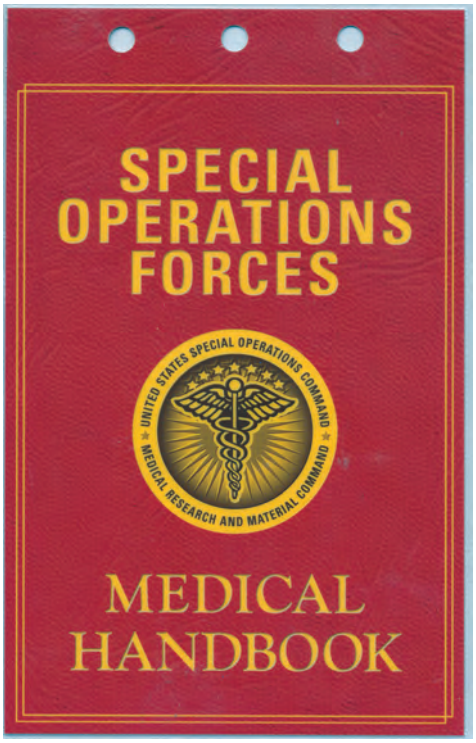
To try and review this book is much like trying to review Tintinalli or Harrison's. It is the one and only "Gold Standard" SOF medical reference. It is filled with evidence based information and procedures, worded and geared towards the SOF Medic. It is not; however, a Chilton's Manual for the 1970–1980 model human. There are a few different flavors of SOF Medic out there, some more trained than others. Some of the advanced techniques and surgical procedures are certainly reserved for the 18Ds, PAs, and doctors. Make sure you know your capabilities and what you are allowed to do before diagnosing and treating anything based on the information contained in the SOF Medical Handbook.

The second edition has a few changes and improvements from the previous. It is an inch taller and wider, with the same thickness. The three steel rings that keep it bound are now on the side instead of the top. The cover has changed from the black with the "SOCOM turtle" to the contemporary ACU pattern with the "SOCOM smile" of component logos. There is also a civilian version out there that has a red cover with yellow writing; the contents are the same as the military version.

Immediately on the inside cover is your "handy-dandy" nine line MEDEVAC request card. Venture a little further past the cover and you'll find the expanded TCCC, UW guerrilla hospitals, counter-insurgency operations, and EPW overviews as part of the Operational Issues section. The meat and potatoes of the rest of the book

is the same solid information with a few new additions like TBI, TCCC, and military working dog care, to name a few. All the pictures, graphs, and drawings are the same excellent quality from the last with several additions as well.

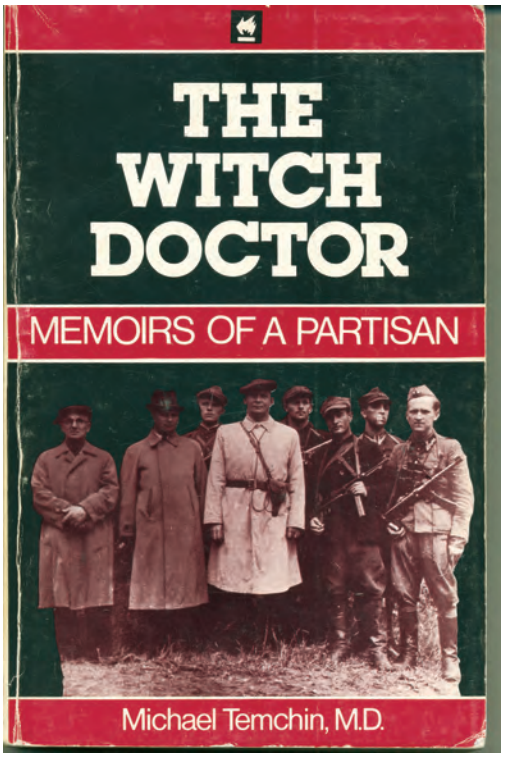
I really don't feel qualified to give a subjective review of this reference as the information it contains is time and battle-tested by SOF Medics since 1969. It was put together by thoughtful practitioners, who understand the difficult and completely autonomous working environment of the SOF Medic. There is a ton of responsibility that goes along with being a SOF Medic, often-times operating with no oversight or safety net. The SOF Medical Handbook is an important part of how the SOF Medic can take his safety net with him.



The Witch Doctor: Memoirs of a Partisan

Michael Temchin, M.D.
New York: Holocaust Library, 1983. ISBN 0-89604-45-3. 185 pages.

Review by LTC Greg Kimm



The Witch Doctor: Memoirs of a Partisan provides a perspective of the conflict in WWII that is seldom demonstrated or documented by the actions of a physician – partisan fighter. During World War II, the struggles of the Polish Jews were felt by all no matter an individual's education or occupation. This biography identifies the struggles and survival of a Polish Jewish physician during the Nazi occupation of Poland during World War II. Before the onset of World War II, all members of the medical profession were held in high esteem. Dr. Temchin portrays the plight of a Jewish physician that ranges from the status as a prisoner of war (POW) released back into the community to an individual escaping from a train bound for a death camp to a lone survivor becoming a member of a band of partisans resisting and fighting the Nazis in Poland.

At the outbreak of the war, Dr. Temchin served as a physician in the Polish 9th Infantry Division. After three weeks of conflict, he became a POW and then assigned to a German front line medical unit treating Polish casualties. Later, he was reassigned as a physician to a transit POW camp with the task of organizing a small infirmary for Polish POWs and civilians working in German factories. Dr. Temchin, along with some other POWs, attempted to escape for the Lithuanian border; however, his capture led to reassignment at the penal compound at Stalag IA. During his stay, the physician suffered from illness due to diarrhea and exposure to scabies and lice. Recognized for his ability to speak several languages, Dr. Temchin was transferred to a Catholic hospital where all the diagnostic and therapeutic facilities were readily available for his use. He provided medical care to French and Polish POWs and civilians doing forced labor in factories, road construction, and farms until his discharge from the army and resettlement to a labor camp in the German-occupied sector of Poland.

Dr. Temchin was eventually released as a POW; however, his plight did not improve and his powers of survival continued to unfold. Due to his ability to avoid the inane existence as a Jewish physician, he did everything within his power to relocate to areas where he could continue to practice medicine. Eventually, he settled and practiced medicine until all Jews were ordered to assemble for relocation. After a forced march to a train station, the Jews were packed aboard trains under horrid conditions. Realizing their potential destination to an annihilation camp, Dr. Temchin and some other passengers determined that escape and possible death at the hands of the Nazis was far better than the conditions on the train and their final destination. Surviving the escape from the train, Dr. Temchin was now merely surviving outdoors in the Polish countryside.

Dr. Temchin evolved from a meager existence as a lone survivor against the elements, armed thugs, and Nazis patrols to becoming a member of organized resistance groups. He established himself initially with a group of partisan Poles and Russians. As a resistance fighter, his role as a physician never stopped. The nickname *Zanachor* (Witch Doctor) was given to him after treating a peasant woman. Diagnosing that the woman was suffering from pneumonia with a fever over several days, his clinical judgment was that since she had survived the

fever, she would recover the next day. Following her recovery, the accurate prediction earned him the reputation as Zanachor and the respect from the local peasants in the area. Dr. Temchin transformed the loosely banded group of "bandiores" previously experiencing a growing coolness among the local populace due to taking from the people to an effective self supporting force of partisan engaging the Nazis and providing support to the people.

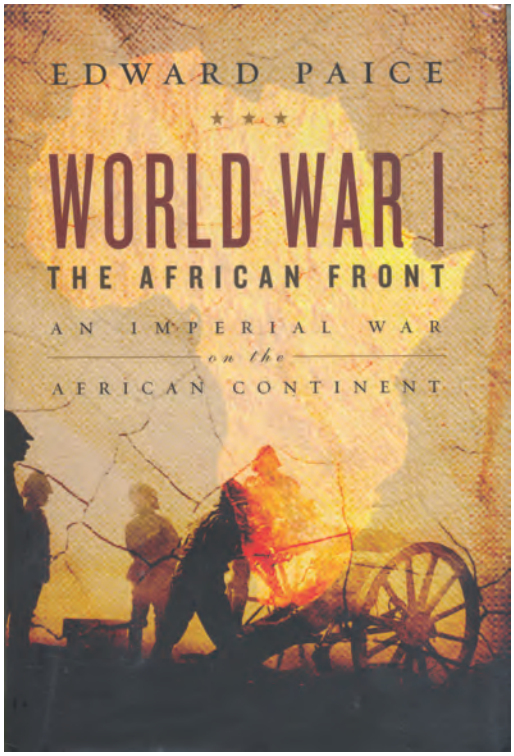
Witch Doctor portrays the role of a physician, partisan fighter, and leader engaged in unconventional warfare that contributed to defeating the Nazi occupation of Poland and the final demise of Nazi Germany. Recognized for his leadership traits and language proficiency in Russian, Dr. Temchin was called upon to assist in transforming refugees recruited in the Soviet Union and former partisan to serving as a Liaison Officer to the Russian Commandant serving in the recently liberated Poland. Due to his underground work and subsequent activities following the post occupation, Dr. Temchin was highly decorated for his contributions.

The Largest Guerrilla War That You Never Heard Of!

COL Rocky Farr

When ones thinks of classic guerrilla wars, the stuff that forms the basis and grounding for the Special Forces core mission of unconventional warfare, World War II's missions to France by the OSE and OSS Jedbergs come to mind first, shortly followed by the Philippines and the Yugoslavia guerrilla experiences. A distant thought may be World War I with T. E. Lawrence's Arab forces against the Ottoman Empire forces in the Middle East.

However, there was another guerilla war fought during World War I, with a handful of officers commanding native, indigenous forces, which successfully held off superior enemy forces for the entire war, becoming the only "victorious" German forces at the armistice in 1918.



This saga happened in Africa, in what was then British and German East Africa, which is now Kenya and Tanzania. The German Commander was General Paul Emil von Lettow-Vorbeck, a Prussian. This was not exactly the teaching strong point of the Prussian Military Academy — unconventional warfare. The cover of this issue of the Journal of Special Operations Medicine features a wartime poster for the "Kolo-

nial-Kreiger-Spende," the war bond fund for German colonies, and shows him on horseback in front of his native forces, called Askari.

Von Lettow-Vorbeck managed to never allow his forces to be captured by the larger, opposing British, South African, Imperial Indian, and Belgian forces. He out-maneuvered, out-thought, and out-fought a superior force for four long years without supplies or reinforcements. General Jan Smuts, a former Boer guerilla warrior himself, ultimately opposed von Lettow-Vorbeck and thought him so worthy an opponent that he befriended him after the war.

I highly recommend some SOF professional reading on this little known but intriguing campaign. I am currently, albeit slowly, reading *Mit Lettow-Vorbeck durch Afrika*. This book is by his surgeon, and combat care tended to consist of asking the wounded man whether he wished to be put out of his misery or left in the jungle with some food and water. This campaign also is the genesis of the movie, *"The African Queen,"* starring Katharine Hepburn and Humphrey Bogart. For all my AFSOC brethren: The Germans tried to resupply their forces by Zeppelin. Perhaps the first aerial resupply of guerrilla forces!

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From the Command Surgeon

WARNER D. "Rocky" FARR
COLONEL, U.S. ARMY
Command Surgeon
HQ USSOCOM

Things finally slowed down at headquarters by about 1400 on Christmas Eve. December was a busy time with me TDY to D.C. for two weeks watching the Pentagon readying answers to every possible question and trying to finish everything before January when the new administration arrives, and the TDY being directly followed by the Special Operations Medical Association meeting here in Tampa.

SOMA broke 1400 attendees this year as it continues to grow and grow. It was great to see all the old friends and fellow warriors and to be caught up on both the latest devices and toys and the tactic and techniques straight from the battlefield. A large thank you to the SOMA leadership (Bob Saum and Bob Harrington) and especially, to all those who presented this year; truly a job well done! At SOMA, the civilian flight paramedics gave their first examination for that civilian certification as the ATP card continues to evolve. The Curriculum Evaluation Board (CEB) leadership and I went and pitched the ATP curriculum and testing methods to the Board of Critical Care Transport Paramedics (BCCTP) and attained eligibility for card-carrying ATPs to be treated just like card-carrying NREMT-Ps and sit for the Flight Paramedic Certification (FP-C; see: www.certifiedflightparamedic.org).

Captain Gilpatrick from this office also went to the Army EMS director at the AMEDD Center and School in October and brokered the deal to allow the JSOMTC students/graduates to sit for the NREMT-P test after the SOCM course. They must have taken and passed the ATP test to sit. Also, the CEB went to the Georgia State EMS coordinators convention and briefed them on the ATP certification, let them go through our requirements and curriculum, and now the ATP is accepted in the state of Georgia for licensure as a paramedic – just like the NREMT-P. Show your ATP card; get a state of Georgia paramedic card. Stay tuned for the annual JSOM training supplement with updated TMEPs.

We had all five Theater Special Operations Command Surgeons at SOMA, as well as LTC Rhett Wallace, the new NATO SOF Coordination Center Surgeon, and eighteen allied SOF forces represented by their medical personnel. We are clearly "training as we fight." I expect the TSOC Surgeons to become major players in how we do SOF medical care, surgical support, and theater evacuation. SOCEUR with LTC Rusty Rowe has the most established TSOC Surgeon structure, as that position has been there the longest. The next oldest is SOCCENT which currently is in transition as LTC Ric Ong is in mid PCS to Africa Command and LTC Lisa Dewitt from 20th Special Forces Group (Airborne) ably fills in. SOCCENT has had several TSOC Surgeons (O'Conner, Noback, and Ong) but always as a short tour; my goal is to have a three-year PCS fill there by this summer to finally get continuity in this most important, at war, TSOC. SOCPAC under COL Frank Newton continues to deal with that enormous theater and the Philippines. Frank is the first SOCPAC Surgeon. CDR Ward Reed, USN, has reported in as the first SOCSOUTH TSOC Surgeon in Miami – this month. He was at SOMA learning the ropes. LTC Ric Ong reports in to SOCAFRICA in January 2009 as the second TSOC Surgeon there. COL Frank Anders was the first.

The new NATO SOF Coordination Center has stood up and their surgeon, LTC Rhett Wallace, is finding his way. I have high hopes for this integration center and plan to treat Rhett, my former deputy at USASOC, as a TSOC-equivalent (see the TSOC chart with this article). Clearly, we are fighting with various allied SOF forces in the GWOT, coordination and integration is a good thing. This is a great opportunity to set the standard for all NATO SOF forces.

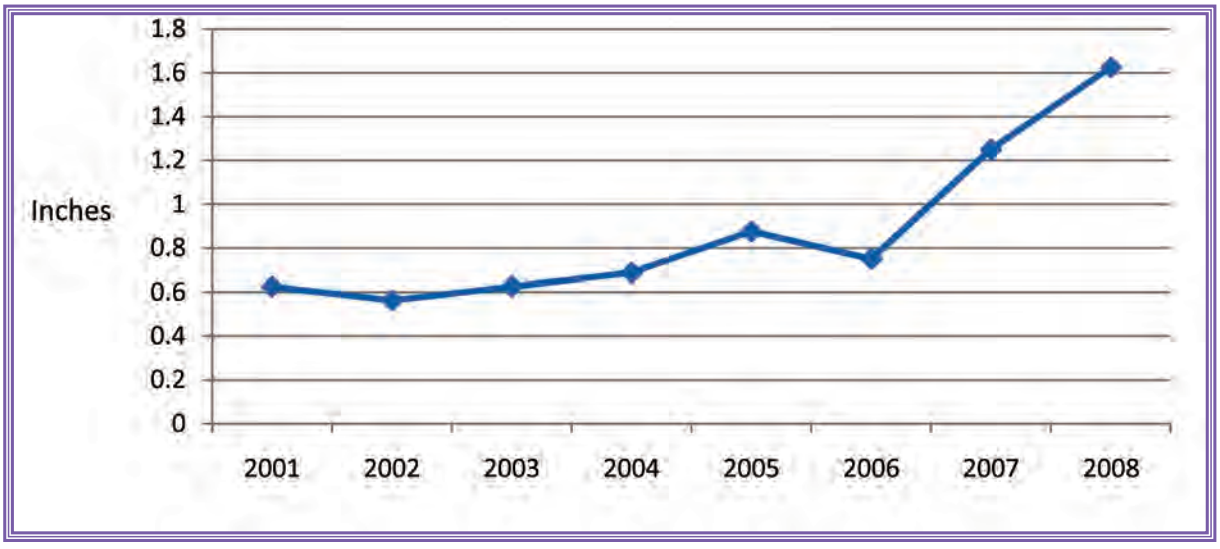
I plan to publish the third annual Journal of Special Operations Medicine's (JSOM) Lessons Learned Supplement in 2009 as well as an updated Training Supplement. If you have not noticed, the JSOM issues grow with each passing issue (I decided to conduct a small study – stacked them up and measured each of the volumes' thicknesses):

JSOM Volume 1	2000-2001	4 issues
Total volume thickness: 0.625 inch		
JSOM Volume 2	2002	4 issues
Total volume thickness: 0.5625 inch		
JSOM Volume 3	2003	4 issues
Total volume thickness: 0.625 inch		
JSOM Volume 4	2004	4 issues
Total volume thickness: 0.6875 inch		
JSOM Volume 5	2005	4 issues
Total volume thickness: 0.875 inch		
JSOM Volume 6	2006	4 issues
Total volume thickness: 0.75 inch		
JSOM Volume 7	2007	6 issues
Total volume thickness: 1.25 inch		
JSOM Volume 8	2008	6 issues
Total volume thickness: 1.625 inch		

Yes, I know that quality is what counts, but quantity is not bad either! Lt Col Duguay-Landers has done an outstanding job of increasing the quality while I have worked on quantity. I encourage all to write more; hence, increasing the quantity and hopefully the quality. We do have a unique resource – the ONLY Special Operations medical journal! I have included as part of my input, all the past JSOM Table of Contents for you to see what all has been published in the past eight years. We have never failed to publish an article written by a practicing Medic in the force. Any NCO who complains that the JSOM is "full of doctor stuff," start your article writing career now.

Admiral Olson stresses care of both our warriors and their families. I have added both a research psychologist, LTC Craig Myatt, and a clinical psychologist, CPT Paul Boccio, to my office to work on such issues. The military is really a family business. My wife, LTC Kathleen Farr, is currently in Afghanistan. My oldest son LTC David Farr will probably deploy by fall, and my youngest son, MAJ Timothy Farr deployed last year. Therefore, as you take care of your teammates and their families, also pay attention to you and yours.

I had two big areas to work on when I arrived here in 2006: TSOC Surgeons and forward resuscitative surgery. The TSOC Surgeons have come to be and we are having a meeting on the forward resuscitative surgery issue in January to propose a structure. It looks like the war fighting will still be busy next year, with plenty to go around. Clearly, there will be changes. I will have been here three years in summer 2009; my predecessors mostly only stayed two.



Theater Special Operations Commands

(As of 05 JAN 2009)

Our trainings section has been working on various plans for ATP card reciprocity with the civilian world. See the letter from the BCCTPC printed below. We plan to move forward with other ways to take our ATP federal certification and get it recognized by others in the civilian pre-hospital community.

BCCTPC
Board For Critical Care Transport Paramedic Certification

BOARD FOR CRITICAL CARE
TRANSPORT PARAMEDIC CERTIFICATION

GRAHAM PIERCE, CHAIRMAN OF THE BOARD — JOHN COLE MEDICAL DIRECTOR

October 30, 2008

COL Warner D. Farr, M.D., MPH
United States Special Operations Command
Office of the Command Surgeon
7701 Tampa Point Blvd
MacDill Air Force Base, Florida 33621-5323

COL Farr:

This letter is in regards to our October 20th, 2008 meeting, at the Air Medical Transport Conference in Minneapolis.

We thank you for the very informative presentation on the background and education of the Advanced Tactical Practioner (ATP), within the Special Operations Forces of the United States Military.

Following this meeting, the Board met to specifically discuss the question of whether the ATP meets the educational requirements, and qualifications to be a candidate for the "Certified Flight Paramedic Exam" (FP-C).

We are very pleased to inform you that the Board unanimously approved your request. Therefore, all Special Operations Forces medics who obtain the certification of ATP are now eligible to sit for the Certified Flight Paramedic exam.

We look forward to working with you in the future. Please contact me directly if we can be of any further assistance, or if you have any questions regarding the process.

GRAHAM W PIERCE BS, MICP, FP-C
Chairman of the Board

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ENLISTED CORNER

SENIOR ENLISTED MEDICAL ADVISOR (SEMA)
SOCM GLENN MERCER

As we begin a new year, the office is commencing a transition in leadership. For the last 2.5 years we have maintained a steady state within the ranks of strategic personnel. That includes planners and functional leaders here in Tampa. As it always does, the Services' rotational rules and polices have started to disassemble this crew and move them on to new missions and experiences. This will serve as my last editorial. As previously announced in the JSOM, my assignment as the SOCOM Senior Medic will conclude shortly. The Command Surgeon is in need of a new Enlisted Advisor.

Unless there is a doctrinal reversal within my community, this also is my last tour within the Medical Elements of SOCOM. As I reflect on those assignments and set the turnover process in motion, I extend thanks to all for both the personal and professional experiences. They have been, and will continue to be, memorable. As always, it feels like this will occur with unfinished business on the table.

I look forward to the potential and anticipated actions of my successors. Predominantly time has been the greatest currency here and it cannot be purchased. It has been my observation that just when results begin to occur, inevitably the DoD will disassemble every team for some greater good.

I would like to close with a salute to the Role 1 Medics who continue to make the difficult appear routine. At the end of every day, someone somewhere far forward was making a difference. In this profession that difference is without exaggeration: life or catastrophic loss. From every perspective to include stats and first person narratives your competence as Combat Medics is illuminated. Quite simply stated, many personnel who would have died in previous conflicts are alive today because you were there. It was my intention when assigned here that those actions would in part be because of, not in spite of, us.

COMPONENT SURGEON

USASOC

Virgil Deal, MD
COL, USA
Command Surgeon

The New Year has indeed arrived and with it a lot of expectations for change in one area or another. The remembrance of absent friends and fallen comrades at the SOMA Conference was a reminder that the dedication of the Special Operations Medics remains a constant. We all took pride in the valor and skill of some of our best as SFC Eric Strand and SPC Rotha Dornes were recognized as the Special Operations Medic of the Year and USASOC Medic of the Year. One can probably also guess that the year ahead will be just as challenging as ever with at least the same optempo.

I noticed in one of the presentations by our log guys, a great pic that showed in one view, all of the equipment in one Special Forces Group's fielding of new equipment – quite an impressive mountain of stuff. Special Ops medicine has come a long ways in getting the right stuff into the hands of the Medics who make a difference in saving lives at the point of injury. That doesn't mean, however, that we can stop asking ourselves every year and for every piece of medical equipment "is this still the best tool for a given task." Hopefully getting ultrasound pushed further downrange this year will extend our diagnostic abilities in some pretty austere settings. Please keep the info coming back to us on what's working, what ain't, and what new stuff can help the Medics at the pointy end of the spear to save lives.

Another area where we're trying to expand our operation a bit is in med intel. With the addition of an environmental science officer to our Force Health Protection staff, LTC Jennifer Caci, we're now getting a weekly update out on what's happening where in terms of infectious disease and environmental medical threats. We appreciate any intel from downrange that you think might be of any interest for anyone else who might be operating in that AO anytime in the future. Likewise, let us know how we can better help you in getting the med intel you need for whatever your mission requirements are. The recent cases from a new "Old World" arenavirus in Africa just show us again that this is a field that continues to evolve in terms of species and emerging resistance.

So far it looks like this is going to be an interesting year ahead with a bunch of initiatives shaping up from SOCOM's developing program in human performance enhancement, to work here at Bragg in Force Design Updates for Psychological Ops medical support, and filling out the expanding force in Civil Affairs with the right Medics. Thanks for all that each and every one of you are doing.

COMPONENT SURGEON

AFSOC

Bart Iddins, MD
Col, USAF
Command Surgeon

During the 1st Special Operations Wing's recent change of command ceremony, the outgoing commander, Colonel Brad Webb, stated, "… this wing [1st Special Operations Wing] is the most relevant wing in the United States Air Force." While this statement represents Colonel Webb's obvious pride in his wing and its accomplishments, it also serves as a representative statement regarding the value of Special Operations Forces (SOF) to the security of all democratic nations in general — and the United States of America in particular.

In this era of fourth generation warfare, persistent conflict, nonlinear battlefields, failed states, transnational terrorists and radical religious extremist groups' use of violence to further their ideologies and political agendas, highly trained and motivated Special Operations Forces are not simply valuable, they are absolutely essential.

As USSOCOM's air component, AFSOC delivers unparalleled combat capability to the Special Operations community. Additionally, AFSOC brings unique medical capability in the form of modular scalable force packages that can be tailored to fit operational requirements. AFSOC's medical teams are engaged worldwide providing levels 1 and 2 combat medical support that includes CASEVAC, TACEVAC, far forward resuscitative surgery, and critical care evacuation. Furthermore, AFSOC's two medical groups are providing home station medical support as well as expeditionary medical forces in support of both AFSOC and conventional air expeditionary taskings.

In order to remain the "relevant" force of the present and future, all SOF components and units must continue to innovate, adapt, and evolve to meet the challenges of a rapidly changing world, asymmetric threats, and thinking, innovative and highly counter-adaptive enemies. This requirement to innovate, adapt, and evolve is especially true for Special Operations medical units. While AFSOC's medical capability is well-developed, much work remains to be done, particularly in the realm of interoperability, modernization, innovation, and adaptation to changing requirements and evolving or emerging threats. AFSOC Surgeon and staff have developed a strategy that includes the following priorities:

1. Improve interoperability with other USSOCOM medical assets
2. Develop, validate, and incorporate an AFSOC medical training pipeline; then embed the medical training pipeline within the Air Force Special Operations Training Center
3. Review current worldwide laydown of AFSOC medical assets
4. Develop an AFSOC healthcare engagement strategy and capability that supports counterinsurgency, irregular warfare, security and stability, and disaster response operations
5. Develop and publish AFSOC medical doctrine, instructions and tactics, techniques, and procedures
6. Review AFSOC's medical organizational structure
7. Improve medical currency for all AFSOC medical personnel
8. Improve tour stability for AFSOC enlisted Medics
9. Forward-base AFSOC surgical and critical care evacuation assets

10. Conduct critical assessment of all AFSOC medical capabilities, programs, philosophies, and paradigms

The Operators supported by USSOCOM medical personnel deserve nothing less than the very best! Consequently, AFSOC medical assets are in the midst of an all inclusive review with the goal of improving overall capability and interoperability. Special Operations medical personnel are the "relevant" medical force; AFSOC intends to leverage, bolster, and exploit its core medical competencies in order to ensure AFSOC's medical capabilities remain "relevant" today and tomorrow.

COMPONENT SURGEON

NAVSPECWARCOM

Jay Sourbeer, MD
CAPT, USN
Command Surgeon

The Naval Special Warfare (NSW) Medical Conference this year was a success, it brought many representatives from the medical community together to discuss their experiences over the past year. We enjoyed meeting all incoming personnel and bidding farewell to those who departed the community. The main topics of the conference were specific to the training and support of the medical Operators and deployment activities. These included Electronic Deployment Health Assessments, the growth of NSW, and the support of the warfighter.

This year the Special Operations Medical Association (SOMA) awarded the Medic of the Year to PO2 John (name withheld) for his outstanding support and operational prowess in support of the Global War on Terror. PO2 John has been in the NSW community for four years; he is an outstanding Medic who epitomizes his ethos and Navy core values. His dedication and hard work led to better training, equipment, and morale throughout the entire community.

PO2 John is a superb leader who consistently displays the highest qualities and is functioning well above his pay grade. He is responsible for working on the research, development, training, and evaluation of products in NSW. He personally tested these items that have been adapted into NSW. He worked with the Tactical Combat Casualty Care (TCCC) curriculum and enhanced it by incorporating the training into waterborne scenarios.

He also developed and implemented a tracking system that monitors all the Medics and incorporated a training program for sustainment of these perishable skills. The program helps monitor all the Medics and enhances their preparation for world-wide deployment. His training also enhances the Tactical Medical Emergency Protocols (TMEP) and keeps this information fresh as they prepare for deployment.

The most impressive part of PO2 John's year was his conduct on the battlefield. During an operation, his unit – for which he was the Medic – was hit by a command detonated improvised explosive device and supporting small arms fire. They aggressively engaged the enemy to suppress the enemy fire. During this aggressive engagement, PO2 John was wounded yet continued to fire in support of his unit. He disregarded his own injuries to render aid to another member of his unit who received major trauma to his upper body. PO2 John was successful in preventing further injury to his teammate and the unit was successful in getting out of the line of fire.

PO2 John's heroic actions demonstrated the superb courage and training of this combat Medic while his technical expertise unquestionably enhanced the Naval Special Warfare community. He is the epitome of leadership and operational capabilities that the combat Medic brings to Naval Special Warfare. We look forward to great things from him in the near future.

The SOMA Medic of the Year award is nominated annually in November of the awarding year and covers the Medic's previous year of accomplishments. We are looking forward to next year's leaders.

COMPONENT SURGEON

MARSOC

Stephen F. McCartney, MD
CAPT, USN
Command Surgeon

MARSOC will have celebrated its third birthday by the time this edition hits the street. It has been an honor to serve as MARSOC's first Command Surgeon. As I write this, my replacement lies out in the Fleet somewhere, having his fate decided by our Council of Corps Chiefs to serve in what is for me, the most rewarding job I have ever had. My desire to stay another year was tempered by the common sense knowledge that MARSOC Medical leadership needs to be viewed from a different angle by a talented and energetic physician with new ideas.

The Special Operations Medical Association (SOMA) Conference last December was a great success, and in my experience over three years, the most enjoyable. Our biggest contingent of 26 MARSOC personnel arrived. My vision for this past year's meeting was to profile the tremendous accomplishments of our battalion enlisted medical operators in the GWOT. We are extremely proud of HMCS Marcucci, HMC Bayliss, HMC Dombroski, and HM1 Torrisi and we're glad to see them share the similarities as well as differences that characterize MARSOC. For many who may, or may have not, have noticed, our recovering HMC "Tony" Shattuck (DV/PJ) was in the audience all week. It was heartening to all of us as well as SOF medicine in general to have a hero present sharing his courage and professional dedication even as he recovers from his grievous wounds.

The new year will also involve tour ending for many of us. Looking back, one particular program we worked hard was the development of the TCCC Increment III, or Theater Special Operations Surgical Team (TSOST) capability. The recent Capabilities Integrated Product Team (translated: A group of very smart and dedicated multitalented professionals) meeting in Tampa began the arduous process of bringing to USSOCOM the ability to save our SOF warriors' lives and limbs in environments where they previously would have suffered for the lack of it. I am optimistic that SOF warriors will engage in future worldwide missions with confidence, because years earlier, their medical and line leadership took the necessary steps to jump through bureaucratic hoops, design, organize, and allocate funds to provide them with the surgical support they needed. Thanks to COL Farr for making this a priority.

I would like to congratulate CDR (sel) Steven Kriss, MC, 2nd MSOB, for being selected for the Navy Sports Medicine Fellowship for 2009. He will be replaced by LT Elliot Ross, (UMO) MC. LCDR Mike Shusko, MC, our plankowner MSOAG Surgeon, is architect of our MEDCAPS ISO, the indirect mission. Mike leaves active duty and fleets over to Selected Reserve status. Thanks Mike, for what you have done for MARSOC and best of luck in your private practice career.

As I close,we send our prayers and comfort to MSOCs India and Delta, currently engaged in OEF-A. Stay safe and may God Bless you all and may God Bless America.

SOCCENT

Lisa DeWitt, DO
MAJ (P) USA
SOCCENT Surgeon

It is with great enthusiasm that I begin my tour with SOCCENT. December in Tampa, our Command's rear headquarters, ain't such a bad place to start! I was fortunate to see many of you at the SOMA Conference here, and was able to ask you questions and discuss your experiences. I have huge shoes to fill and many thanks to give LTC Ric Ong for his service as the previous SOCCENT surgeon. Ric is now taking the reins as the SOCAFRICA surgeon and his knowledge and talents have been, and will be, greatly appreciated.

Although many of you have served repeatedly in the SOCCENT AO, we are at the apex of change in both of our most active theaters. We will be having an increasing presence in Afghanistan, and hope our Command's geographic proximity will be able to better support you, the SOF warrior. There is continued use of the total force in unconventional roles, such as LTC Kathleen Farr, who is doing wonderful things helping support our units in Afghanistan. We are also continuing to integrate Level II support to add flexibility and capability to our fighting units there.

As conventional forces draw down, we all know that our SOF forces will stand strong in Iraq to fill our continued roles. We will work diligently to ensure appropriate health services support for those Special Operators serving in OIF. Both theaters will soon be going through an upcoming RIP/TOA, and I encourage all medical personnel to contemplate what contributions you can give our Lessons Learned.

In closing, please know that I remain always available to you, our Special Operation warfighters, for any questions you may have, or support that you may need. I can be reached at lisa.dewitt@soccent.centcom.mil, lisa.dewitt@soccent.centcom.smil.mil. I will be heading to our forward headquarters, and am excited to serve in this challenging Command.

TSOC SURGEON

SOCPAC

Frank J. Newton, MD
COL USA
Command Surgeon

Medical Seminars – a proven means of persistent engagement and capacity building

Special Operations Medics have always had a vital role in counterinsurgency operations. Commanders know that an important tool in the battle for the hearts and minds of the poor and disenfranchised is the well-being of their children and mothers. In the Global War on Terrorism, a notable success story has been occurring in the Philippines' southern islands of Mindanao and the Sulu archipelago. Without fanfare, but with great talent, Special Forces physicians and Medical Sergeants have multiplied the impact of the Medical Civil Action Program "through, by, and with" Filipino military and civilian counterparts. With a keen eye on the Commander's intent, these Medics have taken the principle of capacity building to new heights by means of medical seminars (MEDSEMs). Instead of reaching the members of one barangay (village) at a time with "Band Aid" medical interventions, 10 to 15 barangays are affected at the same time. By equipping and training indigenous workers, more lasting impacts are made on the community's health. Of greater significance is the effect these MEDSEMs have on bolstering the Filipinos' view of the Philippine government and the Armed Forces of the Philippines (AFP).

Unlike traditional MEDCAPs, MEDSEMs require a large degree of collaboration with stakeholders:

host nation forces
host nation public health officials
local medical providers
U.S. Embassy personnel
USAID workers
U.S. Special Operations Forces

By keeping host nation workers in the lead, the local medical infrastructure is not undermined, and unsustainable medical interventions are avoided.

The MEDSEM is a five-day event that includes three days of classroom instruction and two days of medical programs (small MEDCAPs) in the community. Each of 10 to 15 barangays enrolls three students for this unique training. The curriculum consists of women and children's preventive healthcare and how-to instruction on conducting medical programs in the barangay. Students gain confidence in providing patient education and in the use of over-the-counter medications under the supervision of local public health workers and physicians.

MEDSEMs are an inexpensive means of persistent engagement with the people most susceptible to the negative information operations of the Abu Sayyaf Group. They are an effective counterinsurgency strategy and they bolster a sovereign government's internal defense. MEDSEMs provide commanders access to key geographical areas, and are a valuable source of intelligence gathering.

I would like to thank CPT Shawn Alderman, 2-1 SFG(A) Surgeon, (Special Operations Taskforce – Operation Enduring Freedom – Philippines), for his outstanding work in developing the MEDSEM concept and implementing it in Central Mindanao.

Special Forces Surgeon

USASFC

Peter J. Benson, MD
COL, USA
Command Surgeon

On behalf of the U.S. Army Special Forces Command (Airborne) Surgeon's office I would like to extend our thanks to all the Special Forces group and battalion medical sections that have helped make our office a success. Half-way into our second year, the Surgeon's office has started to consolidate its position in the staff and its role of support of the regiment. We've worked hard to "get inside the loop" of TO&E changes and especially the personnel management programs for medical staff. We appreciate the feedback from the groups on all the issues that need representation at the commanding general's level. Some of the current issues being addressed are: TO&E changes to re-align the GSB medical personnel under the group medical section, the addition of veterinary technicians to support multi-purpose canines and the proper position and role of the clinical psychologist. It is precisely issues such as these that require a medical advocacy at the Regimental level.

The summer 2009 medical professional personnel replacements have been finalized. We appreciate the assistance of those who pointed worthy candidates in our direction. It is our intent to maintain a coordinated plan to fill medical positions with qualified providers, and also to produce successive cohorts of Special Forces medical "alumni" for the future. A battalion surgeon or physician assistant, who "graduates" from a Special Forces group to another assignment, is a valuably trained and uniquely experienced officer. These are the officers with the pedigree required for positions at the group or general staff level. The Command Surgeon's office is establishing a process of recruitment, assignment, and active career management for the regiment's medical personnel. Medical staff with Special Forces experience is too valuable a commodity to the Regiment to leave their management to HRC alone.

MSG Ware, my SEMA, and I had a great opportunity to meet many of you at the SOMA Conference recently. We appreciated the chance to discuss issues and trends in person as well as to impart some the philosophy from the Command Surgeon level. The SOMA Conference is a great venue to cross level information, make personal network connections, and examine the latest equipment and gadgets on the market. It was also great to see how many Special Forces Medical Sergeants and Combat Medics took the opportunity of the hands-on workshops to hone their skills.

The year 2009 will certainly hold new challenges for the Army and the Special Forces Regiment. A new Commander in Chief and changes in SOFAs and ROE down range will undoubtedly have their effects on the GWOT. Regardless of what lies in the future, the Regiment's Special Forces Medical Sergeants and Combat Medics will remain the world's best and continue to be at the sharp end of our National Defense Strategy.

USSOCOM VETERINARIAN

LTC Bill Bosworth, DVM, USSOCOM Veterinarian

Greetings from Tampa!! I'd like to introduce myself as the new SOCOM Command Veterinarian. I have replaced COL Bob Vogelsang who has moved on to become the commander of the DoD Military Working Dog Center Veterinary Hospital. The center is responsible for the medical care of military working dogs, to include those injured in battle. I've been a veterinarian in the SOF community for the past ten years. I started at Fort Bragg with the 7th Special Forces Group and then moved on to the Joint Special Operations Medical Training Center, where I had the opportunity to work with a lot of great SOF Medics and Corpsmen. After a tour in Guam, I joined 20th Special Forces Group, and then had the opportunity to mobilize as the USASOC Command Veterinarian before deploying to Afghanistan prior to my assignment here in Tampa.

One of the hot topics now is Combat Trauma Training (CTT) and the commercial vendors who provide CTT to SOF and the conventional forces. DoD is currently reviewing the use of all training and biomedical research models to determine if DoD is using the most appropriate models for training our medics and medical providers across the services. COL Farr is on the Joint Analysis Team (JAT) looking at the technology maturity and the readiness of medical models and simulators to replace the use of live animals in DoD medical education and training venues. The goal is to develop robust and adaptable medical simulation technology to ensure that the Joint Force has the best medical education and training. Once that process is complete, then I expect that DoD Directive 3216.1, Use of Laboratory Animals in DoD Programs, and AR 40-33/SECNAVINST 3900.38C/AFMAN 40–401(I), The Care and Use of Laboratory Animals in DoD Programs, will be rewritten to reflect the findings of the JAT, and to provide guidelines for commercial vendors who are providing CTT to our SOF and conventional units. We will disseminate that information to the components when the new regulations are approved.

MAJ Steve Baty and CPT Justin Schlanser each gave a great presentation at the USASOC Surgeon's Conference and during the general session at December's Special Operations Medical Association (SOMA) Conference. You can look forward to some articles based on their presentations in future issues of the JSOM. We also held a veterinary breakout session that covered other topics of interest, such as individual canine drug cards and MEDEVAC/CASEVAC procedures. Even though all the presentations at the breakout were military oriented, there were many of the audience who were civilian first responders who work closely with dog teams. I'm hoping that we can get some of their input for the breakout sessions during next year's SOMA Conference. Feedback from the conference indicated that working dog issues were in the top five topics of interest during the conference.

I look forward to working with all of you in the new year, and seeing you at next year's SOMA.

USSOCOM Psychology

LTC Craig A. Myatt, Ph.D., HQ USSOCOM Psychologist

Just three days following my battalion change of command ceremony, I left both command and my family behind to begin what I consider one of the best opportunities the United States Army ever gave me. The charter that I hold as the Command Psychologist working in the USSOCOM Command Surgeon's office is one that I accept with a humble appreciation of what SOF and their families endure. I do not regret for a moment leaving command behind to work as a staff officer in a high speed office with two full bird colonels I highly respect, the Command Surgeon and the Deputy Command Surgeon. Both took me under their wings and set me on course to address the task of supporting our people and their families.

The Command Surgeon and some current data have demonstrated that SOF is "doing quite well." The USSOCOM Commander and the Command Surgeon want to keep it that way. Therefore, as I make the rounds getting smart on the issues at each command, my immediate focus involves establishing partnerships that will support my ability to explore hardiness and resilience among our Soldiers, Sailors, Airmen, Marines, and their family members. The Command Surgeon's Office is committed to doing what we can to support the Warfighters and their families in all phases of the life cycle: pre-deployment, deployment, and post-deployment.

At USSOCOM headquarters, I have the distinct privilege of consulting with several internal directorates essential to our success, such as the Care Coalition and the J-staffs, as we work with the USSOCOM Chief of Staff to define a methodology that will keep us on target. I know from the level of commitment, responsiveness, and innovation that I observe when I interact with our Warfighters and SOF Enablers, that the assistance I need to support efforts to enhance resilience in our Servicemembers and their families will be on time and on target. Likewise, you can expect that the measure of commitment, responsiveness, and innovation that I pledge to our cause will be on time and on target, too.

USSOCOM Education and Training Update

CPT Scott M. Gilpatrick APA-C, DMO
Director of Medical Education and Training

You probably heard the collective sigh of relief from the USSOCOM Surgeon's office as soon as the SOMA Conference adjourned. This year's conference was another great one and we were able to introduce a number of new initiatives that concern the Advanced Tactical Practitioner. We are all looking forward to 2009 and what it holds for SOF Medics. We can now answer those who ask: "What good is this ATP card outside of the military?" A quick recap for those who didn't get to attend the conference and listen to COL Farr or myself when we briefed in the Grand Ballroom:

ATPs are now eligible to sit for the **Board of Critical Care Transport Paramedics (BCCTP) Flight Paramedic Certification (FP-C).** Why is this good? Anyone who studies for and passes this examination is truly prepared to provide critical care at an advanced level of knowledge. If you serve as a Special Operations Flight Medic, the FP-C knowledge requirements will most certainly and appropriately enhance your capabilities. You will need to be a JSOMTC or PJ course grad and have a passing ATP test score on file with the USSOCOM Surgeons Office. Check out: www.certifiedflightparamedic.org.

ATPs are now eligible for a **Georgia paramedic license**. If you are a current ATP, you can apply to the state of Georgia for a Paramedic license. The ATP is now accepted in Georgia as a paramedic level of training and therefore brings eligibility for licensure to work as a paramedic. You will need to be a JSOMTC or PJ course grad and have a passing ATP test score on file with the USSOCOM Surgeons Office.

The JSOTMC students who pass the ATP examination will be eligible to sit for the **National Registry of Emergency Medical Technicians - Paramedic (NREMT-P)** examination. The Army Medical Department Center and School EMS Program Manager COL Patricia Hastings has agreed to grant the JSOMTC a site code for NREMT-P testing. You will need to be a JSOMTC or PJ course grad and have a passing ATP test score on file with the USSOCOM Surgeons Office.

The future of the ATP program is solid and growing stronger. We were recently funded by USSOCOM as a "program of record" out to 2015. We opened our doors to a lot of external scrutiny by the BCCTP, State of Georgia EMS Advisory Council, and Army EMS Department. In doing that, we were rewarded with the above-mentioned opportunities. Attaining acceptance by these three separate prestigious EMS organizations only adds to the validity of our education, curriculum, and testing process, as well as recognition that the ATP is an accepted medical provider. We are going to work even harder in the coming years to ensure that our SOF Medics meet the challenges of an evolving interoperable USSOCOM Combat Medic standard and scope of practice.

Details on these certifications, how the current ATP can apply for them, and how the VA will reimburse you or pay for them is soon to be distributed through your respective component Surgeons and Senior Enlisted Medical Advisors. There will be a process for those already graduated from either of the JSOMTC or PJ course with a current ATP card that will get a National Registry number to test, as well soon to be published. For those who have an ATP card yet have not taken the ATP test, you will need to have a passing score on file with us to take advantage of these opportunities. If you have questions or need to take the ATP test, please contact myself or MSgt Ferguson at atp@socom.mil.

ACKNOWLEDGEMENTS
Special thanks to:

Mr. Graham Pierce, Chairman of the BCCTP: Mr. Pierce is a staunch supporter of SOF medicine. He has gone above and beyond in establishing USSOCOM's current relationship with the BCCTP.
Mr. Courtney Terwiliger, NREMT-P, Chairman of the Georgia EMS Advisory council: Mr. Twilleger is a volunteer in his capacity as chairman and took time out of his already busy schedule to help establish this new relationship with USSOCOM.
COL Patricia Hastings, U.S. Army EMS Programs Manager: COL Hastings' office is the conduit to the NREMT for military applicants. Her guidance and assistance led to the JSOMTC grads being eligible to take the NREMT-P examination

Not even the make-believe tides, waves, and currents can affect this Combat Diver

2008 ATP Survey Results

CPT Scott Gilpatrick, APA-C
USSOCOM Chief of Medical Education and Training

The USSOCOM Command Medic Certification Program needed a way to accurately assess the knowledge requirements of the Advanced Tactical Practitioner. We devised the 2008 ATP Survey as an informal job analysis of the ATP. The data rendered from the survey will be used in constructing and stratifying ATP examination questions as well as composing the overall examination. The 2008 survey got us a solid snapshot or cross-section of what the ATP is doing while at war.

We constructed the survey using the survey monkey website and established a link to mail out to our population of ATPs in our database. A small demographic question section in the beginning helped us validate our data as we compared it to the overall ATP / SOF Medic population. Following the demographic section we had five-point Likert scale charts representing the four major areas of the ATP test: trauma, medicine, operational medicine, special populations, and procedures. The survey concluded with four open-ended questions looking to see how we are doing with the Command Medic Certification and ATP program and what comments respondents had for us.

Once complete and reviewed by the SOCOM Surgeons office, the survey link was sent to the 1600 email addresses from the ATP database – around 600 were returned as non-deliverable. Links to the survey and PDF copies of the survey were sent for distribution through the senior enlisted medical advisors (SEMAs) at each of the components. At the conclusion we had 325 solid respondents either online or hand done and input at our office. The presentation highlighted the top five most common or encountered areas of medicine chosen in each major category of the examination. Listed below are the questions and top five responses of what the respondents saw the most.

CHARTS TO CHOOSE FROM LEAST-TO-MOST LIKELY ENCOUNTERED:

How often did you treat patients with the following medical problems? (List IAW CTL-15 areas.)

1. Gastroenterology – overwhelming the most frequent condition.
2. Eyes / ears / nose / throat conditions – combined, all were seen frequently.
3. Dermatology – as noted in the open questions; need more training in this area.
4. Allergy and immunology.
5. Pulmonary and respiratory conditions.

How often did you treat trauma patients with the following categories of injuries? (List IAW CTL-17 areas.)

1. Soft tissue trauma.
2. Orthopedic / extremity trauma – few comments on the need for more training on management of amputations.
3. Sports medicine – many comments on the need for more sports medicine / therapy / rehab training.
4. Hemorrhage and shock – few respondents asking for more hemostatic agent knowledge and training.
5. HEENT trauma – as well, many comments on the need for more training in OMF injuries and dental.

How often did you encounter the following areas of Operational Medicine? (List IAW CTL-13 areas.)

1. Medical mission planning and planning for CASEVAC – both were all the time events for the majority of respondents.
2. Environmental (hot/cold weather) injuries.
3. Bites / stings / envenomations.
4. Mass casualty incidents – few comments on the need for more formal training to prepare for.
5. Vet and working dog care had a number of respondents in frequent category.

How often did you treat patients from special populations? (List IAW CTL-4 areas.)

1. Psych – few comments on the need for training in: PTSD, post rape / torture.
2. Geriatric – some dealt with elderly civilian population.
3. Pediatric – few comments on the need for more training.
4. OB/GYN – mostly infrequent.
5. All categories had highest percentage in infre--quent or not at all categories.

Have you done any of the below listed procedures while deployed? (23 areas)

1. Laceration repair with sutures – high percentage had done four to five times.
2. Toenail removal – most had done at least one to three times.
3. I & D of abscess – most had done one to three times; many comments on the need for MRSA information and I & D training.
4. Drug dose calculations for IV medicines – many comments on the need for training in pharmacology.
5. Chest tube insertion – 97 ATPs reported that they had inserted a chest tube one to three times.

Open Ended Questions for comment:
Are there areas in medicine you feel you needed more training in prior to your deployment in support of the GWOT? If so, what were they?

1. Sports medicine and orthopedics – back pain and ankle injuries
2. Sick call and internal medicine
3. Dental
4. RSI / conscious sedation / anesthesia
5. Dermatology and a few comments on the weird stuff seen, especially in Africa.

Are there medical or surgical procedures you feel you needed to know or needed more training on that you did not get prior to your deployment in support of the GWOT?

1. RSI and all types of sedation and anesthesia – overwhelming.
2. Dental evaluation and procedures
3. Sports medicine and orthopedic procedures
4. Abscess I & D – toenail removal
5. Emergency airways – cricothyroidotomy

If you have taken the ATP Examination anytime in the past, please provide us with your comments or suggestions for the examinations so we can better assess the SOF Medics' specific requirements.

1. Great test – keep the same.
2. No comment – did not take the test.
3. Bring back NREMT-P.
4. Not enough clinical / too much trauma.
5. Recognition by outside agencies.

If you have seen them, do you have any suggested changes, additions, or deletions to the latest USSOCOM Tactical Medical Emergency Protocols (TMEPs) or the Recommended Drug List (RDL)?

1. KPF / RSI / conscious sedation
2. Method of distribution and info flow related to TMEPs and RDL; how do I get them?
3. Different stuff than what's taught at SOCM
4. Standardize throughout Services, so many to choose from.
5. Ultram

The complete information from this survey and subsequent surveys will be applied to the annual series of ATP examinations. Our goal is to accurately represent the ATP's duties on the battlefield as they are today. Armed with the survey data and lessons learned data we can now adjust the number and type, as well as stratify the level of difficulty of the ATP examination questions. For more information on this survey or surveys we will do in the future please contact us at atp@socom.mil or (813)-826-5065.

LETTER TO THE USSOCOM/SG EDUCATION AND TRAINING SECTION

Please excuse me as I am new to the Special Operations Medical Association (SOMA) and the *Journal of Special Operations Medicine (JSOM)* as well. I am a maxillofacial surgeon and an anesthesia provider (civilian) who works with various agencies (at the state and federal level) providing tactical medical care for SWAT/ERT for their high-risk and no-knock warrants, meth lab take downs, etc …. I read with interest the Summer 08 *JSOM* article by CPT Gilpatrick and LCDR Patterson titled: *USSOCOM Education and Training Update – What Good is This ATP Card Outside the DoD?* I have a few comments from the "other side of the fence" where the grass is not necessarily greener.

Translating the ATP card to civilian use is a great concept and needs to be pushed forward. I am sure you are already aware that it is a states' rights issue in that each state has the right to recognize the credentials of the card holder to be able to practice civilian paramedic medicine. What I can relate to the readers of the *JSOM* and members of SOMA is the environment that is practiced in my state. For a reason that no one can probably remember, EMT-Ps are not allowed to cross county lines and practice para-medicine unless they are transporting a patient from one facility to another. This is extremely archaic and counterproductive, as you can imagine. But, it comes down from the State Office of Emergency Medical Services (OEMS) so, it is written in stone. I and a number of other tactical medical specialist/providers with the state Tactical Medical Association (TMA) are working with OEMS to allow EMT-Tacticals (EMT-T) to cross county lines as long as they are doing so in support of their SWAT/ERT. (Anecdotally, patients have died because of this inane rule, when the closest hospital may be in another county or another state, yet the paramedics are forced to transport to a facility within their county even when it is much farther away. In addition, I am acutely aware of an incident where a sworn officer who is also an EMT-T was involved in a true, full out "fire fight" in the mountains. The perpetrator was struck multiple times with 5.56 and was bleeding out. Because this paramedic was not in his sponsoring county, the local EMS was called to stage close to the house that was being assaulted. The tactical paramedic was not satisfied with the level of care that the local EMT-Is were providing to the perpetrator and stepped in (rightfully so) and made "suggestions" as to how the patient should be treated. Upon returning to his home county, he was disciplined and may lose his license because he was practicing tactical medicine outside his jurisdiction.

As a student, I rotated through Parkland Memorial Hospital in Dallas. The ED was so busy that they utilized suture technicians to close minor wounds. Yet, when EMT-Ps and NREMT-Ps requested an expanded scope-of-practice to allow for suturing of minor wounds, the state medical board struck it down (there was a plastic surgeon on the board). You can see where this is heading and I can go on, but as is evident, the system is broken. There are too many turf battles and failures to work together so that protection of the SWAT/ERT members and the population in general is not being placed at the forefront.

I cut my teeth in an environment that did not allow one to complain without suggestions being offered. Below are some topics that have come up on the local and national level:

1. Create a national standard for EMT-Tactical operators. The standard does not exist and is in dire need of being defined. SOCOM should be asked to assist with this or offer their services in defining EMT-Ts. This would allow the SF Operators that are leaving the service for civilian life to be ensured of obtaining proper vocational opportunities.

2. Create a mechanism to allow civilian EMT-Tacticals to train with or side-by-side with the SOCOM community. In general, we fear what we don't know. From the civilian side, this would allow for familiarization to occur and can help place SOCOM Operators in the appropriate fields of work. From the logistical side, this would allow a smoother transition from the military to civilian work force, where the rules are different. SOCOM, in general, is in dire need for retention of personnel; however, individuals will move on to the civilian world as they become ill, wounded, family life is affected, etc…. These Operators will naturally gravitate to what they know. The closest thing we can offer them is medical school, law enforcement, physician's assistant training, etc… If we are to take care of our family

of Operators, then concern in facilitating a smooth transition to civilian life should be among our priorities. It will also raise the level of care that the civilian EMT-Ts are practicing too. I had the opportunity to train with ATP MARSOC personnel at Camp Lejeune, NC, and loved every minute of it. They were a great bunch of guys and we learned a lot from each other.

3.There has been talk at the national level of creating a branch within the Department of Homeland Security **(**DHS**)** of advanced medical providers / advanced tactical practitioners (ATPs), fire/rescue, and search and rescue (SAR), stationed throughout the country to act as a Quick Reaction Force **(**QRF**)** in the event of disasters both natural (hurricane Katrina) or manmade (attacks on Nord Ost theater, Beslan, 9/11, London train bombings, and now Mumbai). This is not the federal Disaster Medical Assistance Teams (DMATs). This is a separate concept. These SOF (retired) ATP card holders can be assigned to work with local, state, and federal agencies to assist law enforcement (LE) when needed. When not rotating through LE and, with the level of the uninsured population in the U.S., these ATPs can work in clinics to provide day to day sick call for the GP. These are things that the ATPs are doing right now in SOCOM, and it is a natural transition/step toward working in the civilian world. Accreditation is an issue, but the need is there and it won't be long before every SWAT/ERT is mandated to have an EMT-P attached to the unit. The National Tactical Officers Association stands firmly behind EMT-Ts being integrated within advanced LE units and has stated that even Explosive Ordnance Disposal (EOD) personnel should be integrated as well.

I do not claim to be the purveyor of all things in tactical medicine. What I can see is that there is a problem and it needs to be fixed. We can all do better than we are doing now. Please write back with questions, comments, or insults to barne@coastalcarolinaos.com (all are welcome).

Dr. Bruce C. Arne'
Maxillofacial Surgeon
Tactical Medical Specialist
Disaster Medical Specialist

EMAIL TO THE JSOM REGARDING THE USSOCOM/SG ATP PROGRAM

The following letter was submitted from one of our *JSOM* physician editors regarding the previous letter to the E&T section by Dr. Bruce C. Arne. It was written prior to the this editor reviewing the E&T Update by CPT Gilpatrick on page 119. It is followed up by CPT Gilpatrick's response.

We thought we would share the correspondence with our JSOM readers as it may shed some light on an ongoing issue, and to update our readers as to what all is being done behind the scenes by CPT Gilpatrick and the USSOCOM/SG Office. The Education and Training Update by CPT Gilpatrick is exactly the update needed regarding the ATP certification and its recognition by the broader medical community

This letter gives some good advice to help remedy the unfortunate situation where the ATP "certification" is utterly worthless outside the military.

There are several SF Medics that I would love to help get into our local EMS system — or even hire to work directly in our emergency department. However, the ATP "certification" is absolutely worthless in getting any of these incredibly well-trained and highly-experienced Medics an actual job in any place other than the military.

I wish I knew how to go about helping these guys out.

CPT Gilpatrick's responce:

Sir, with all due respect, your comments are completely off the mark. If you want to help those SF Medics (your guys), then pay for them to go to a NREMT- EMT-P course, or PA school. DO NOT blame the ATP program for those guys' ineligibility to come work with you. The ATP program is not for the Guard guy to get a job with you after he is done with the Q-course. It is, however, a tested, scrutinized, and accepted by all of SOF medicine (except by you and your guys), method meant to ensure he is ready and meets the interoperable standard set forth by the medical leadership in SOF medicine today (FOR combat medicine). Have you ever seen an ATP test or investigated the process of the program?

Here is what SOCOM/SG has done for YOUR Guys and their worthless ATP card:

1. I went to the Army EMS director in October and brokered a deal allowing the JSOMTC students to sit for the NREMT-P test after graduating from the SOCM course — they must have taken and passed the ATP test as SOCM course don't have a final exam.

2. We (with the CEB) went and pitched the ATP curriculum and testing methods to the Board of Critical Care Transport Paramedics (BCCTP) and attained eligibility for the ATP to sit for the Flight Paramedic Certification (FP-C). Again, gotta have an ATP card www.certifiedflightparamedic.org.

3. We (with the CEB) went to the Georgia State EMS coordinators convention and told them all about the ATP certification, let them go through our requirements and curriculum, and now the ATP is accepted in the state of GA for licensure as a Paramedic — just like the NREMT-P.

SO ... In conclusion, in less than two years in this thankless job, certifying all these worthless ATPs — this is what I have done for your guys. You can tell them to stand by, and in a month or so if they have passed the ATP test, they can sit for the NREMT-P exam and finally come and work for you in your ER ... Or, if they want to put in a little extra studying and maybe a prep course they can sit for the FP-C exam. And then there's always the state of GA, a mere 60 miles or so north of Camp Blanding, where they can go work as a paramedic / ATP ....

CPT Scott M. Gilpatrick APA-C, DMO
Director of Medical Education and Training

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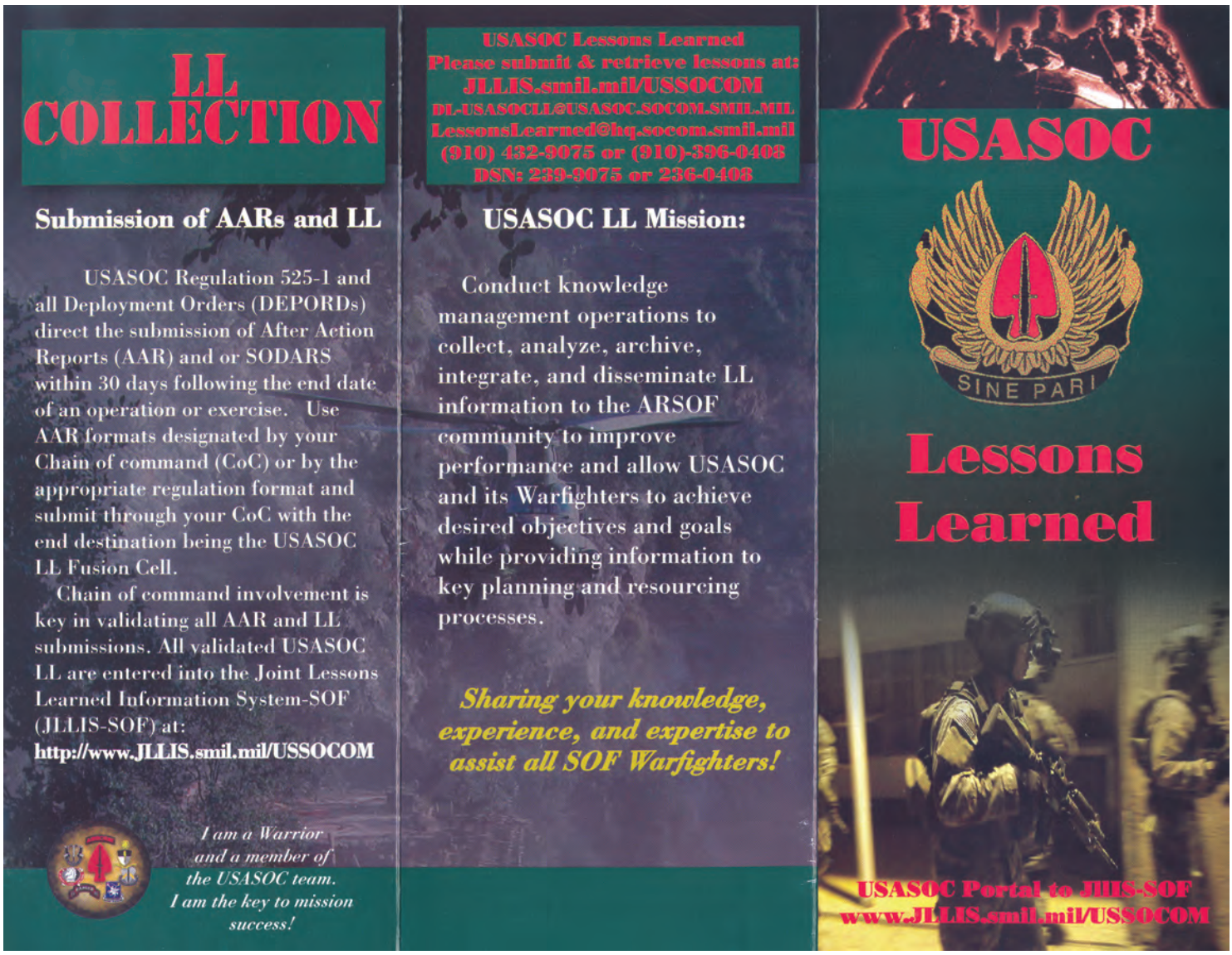
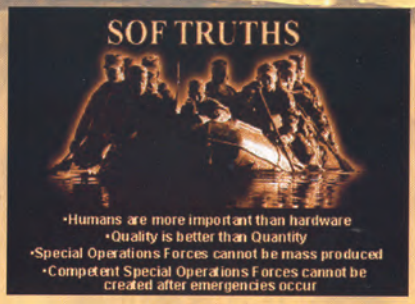
USASOC Lessons Learned



USASOC LL Program What it Can Do for You:

The USASOC LL program features:
- Passive and active collection of LL information
- Account of current information on friendly and enemy TTPs
- A means to document your operational or training issues, capability gaps and short-falls as identified in your reports
- Portal access to the new DoD joint LL database, linking ARSOF, USSOCOM, COCOMS, Service and other LL databases using the Joint LL Information System (JLLIS); JLLIS has a joint search engine- Autonomy IDOL
- Initiatives to ensure that your LL information is integrated into key command processes

The LL Program ensures that ARSOF doctrine, TTPs, SOPs, force structure, training, and capability gap related LL are used to their fullest extent.



USASOC Lessons Learned Fusion Cell (LLFC)

The LLFC can assist you in identifying capability gaps and proposing solution sets for your unit. Once the LL reports are received and analyzed, they are used to support your Statement of Operational Requirements (SORs). The LLFC will also disseminate collected and analyzed information to the appropriate organization charged with effecting change in USASOC, the Army or USSOCOM. This system can also serve to quickly disseminate urgent enemy or friendly TTPs or SOPs to your fellow warriors as they prepare for combat.

Any ideas you may have to improve the system are welcome!

Unit LL Analyst

Unit LL Analysts are integrated into USASOC Command Subordinate Commands (CSC) and Command Subordinate Units (CSU) command staffs. Analysts are there to assist the CSC/CSU commander and staff with the following:
- Passive and active collection of current and historical LL information
- Analysis of LL information
- Integration of LL information into key CSC/CSU and USASOC processes
- Dissemination of LL information containing key operational and tactical value in order to enhance mission success

Once received and analyzed, LL reports can be used to support your unit's Statement of Operational Requirements (SOR), aiding in resourcing for your unit.

You are the intellectual capital of this command. We need to know what you know!

Psychological Health, Traumatic Brain Injury Outreach Center Opens

The Department of Defense today announced the opening of a 24-hour outreach center to provide information and referrals to military servicemembers, veterans, their families and others with questions about psychological health and traumatic brain injury.

The new center, which is operated by the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE), can be contacted around the clock, 365 days a year, by phone at **(866) 966-1020** and by e-mail at resources@dcoeoutreach.org .

"We're providing 24/7 support to assist callers with questions regarding psychological health and traumatic brain injury," said BG Loree K. Sutton, M.D., director of DCoE. "Getting the best possible information and tools, hassle-free, will empower and strengthen warriors and their families to successfully manage what can be confusing and disturbing circumstances."

The center can address everything from routine requests for information about psychological health and traumatic brain injury, to questions about symptoms a caller is having, to helping callers find appropriate healthcare resources.

DCoE promotes resilience, recovery and reintegration of servicemembers facing psychological health and traumatic brain injury issues, and works to advance research, education, diagnosis, and treatment of these conditions.

"If we need to research a question, we'll do the legwork and quickly reconnect with callers," Sutton said. "We welcome feedback on how we can better meet the needs of those we are so privileged to serve."

The DCoE outreach center is staffed by behavioral health consultants and nurses, most with master's degrees. In addition to answering questions, staffers refer callers to contact centers in other parts of the Department of Defense, other federal agencies, and outside organizations when appropriate. Other contact centers also refer callers to the DCoE outreach center.

The center serves members, leaders, and healthcare providers of the Army, Navy, Air Force, Marines, Coast Guard, National Guard, Reserve and all uniformed services, along with veterans of all the services. The families of servicemembers and of veterans are also served by the new center.

More information is available at:
http://www.dcoe.health.mil
http://www.dcoe.health.mil%20

Educational Resources

MEDICAL REFERENCES

Administration of Health Care

Disrupted Health Services: http://www.who.int/hac/techguidance/tools/disrupted_sectors/en/index.html
Health Care Management Tools: http://erc.msh.org/toolkit/
Health Information Management Tools: http://www.humanitarianinfo.org/IMToolbox/
Management of Health Care Delivery: http://www.who.int/management/en/

Administration and Contingency Planning

USHHS Health and Disaster Preparedness Tools: http://www.ahrq.gov/prep/
CDC Emergency Preparedness Planning: http://www.bt.cdc.gov/planning/
USDHS Resources: http://www.dhs.gov/index.shtm
Hospital Readiness: http://www.aha.org/aha_app/issues/Emergency-Readiness/index.jsp

Aerospace Medicine, Aviation Medicine and Patient Transport

Aerospace Medical Resources: http://aeromedical.org/Links/avmed_links.html
Medical Evacuation Links: http://usasam.amedd.army.mil/medevac/interest.htm
Aviation Medicine Resources: http://www.nh-tems.com/Aviation_medicine.html
Flight Medic Resources: http://www.flightweb.com/glinks/index.php?category=2

Alternative Medicine

U.S. Center for Complementary and Alternative Medicine: http://nccam.nih.gov/
WHO Center for Traditional Medicine: http://www.who.int/medicines/areas/traditional/collabcentres/en/
U.S. National Library of Medicine Resources: http://www.arctichealth.org/tm.php ;
and http://americanindianhealth.nlm.nih.gov/trad-healing.html
Ethnobotanical Resource Directory: http://www.cieer.org/directory.html
Ethnomedicine Links: http://www.ethnomedico.com/english/links.htm and: http://www.univie.ac.at/ethnomedicine/
Ethnopharmacology Resources: http://medicinus.info/research/areas/ethnopharmacology/
Herbals: http://www.botanical.com/botanical/mgmh/comindx.html
Psychoactive Substances: http://www.ethnopharmacology.com/
and http://www.erowid.org/psychoactives/psychoactives.shtml

Anesthesiology

Anesthesiology References: http://www.asahq.org/Links/refsdb.htm
Anesthesiology Links: http://www.asahq.org/Links/linksOfInterest.htm
and http://www.asra.com/links/index.html#indexes

Chemical, Biological, Radiological and Hazardous Materials

Bioterrorism Emergencies Preparedness and Response: http://www.bt.cdc.gov/bioterrorism/
Chemical Emergencies Emergency Preparedness and Response: http://www.bt.cdc.gov/chemical/
Radiation Emergencies Emergency Preparedness and Response: http://www.bt.cdc.gov/radiation/
CBNRE Information & Analysis Center: http://www.cbiac.apgea.army.mil/
Food Safety, Animal and Plant Health Portal: http://www.ipfsaph.org/En/default.jsp
Hazardous Materials Database: http://www.cameochemicals.noaa.gov/

Poison Control Center: http://www.ipl.org/div/kidspace/poisonsafe/pcenters.html
Poison Plants Database: http://www.cbif.gc.ca/pls/pp/poison?p_x=px
Toxicology Databases: http://www.atsdr.cdc.gov/toxpro2.html

Dental
Dental Emergencies: http://www.webmd.com/oral-health/guide/handling-dental-emergencies
Dental Emergencies and Injuries: http://www.ada.org/public/manage/emergencies.asp
Dental Disease and Trauma Research: https://www.usaccc.org/research/DentalDisease.jsp

Dermatology
Atlas of Dermatology: http://www.brooksidepress.org/Products/OperationalMedicine/DATA/operationalmed/Manuals/GMOManual/clinical/Dermatology/AtlasofDermatology.htm
Dermatology Links and Resources: http://www.hsc.stonybrook.edu/som/dermatology/links.cfm

Disaster Medicine and Management
Centers for Disaster Medicine: http://hsc.unm.edu/som/cdm/index.shtml ;http://www.gwemed.edu/1189844732663.html ; and http://www.mcg.edu/ems/COM/Disaster/
Pre-Hospital and Disaster Medicine: http://pdm.medicine.wisc.edu/home.html
Disaster Medicine Links: http://pdm.medicine.wisc.edu/links.html
Centers for Disaster and Humanitarian Assistance: http://www.cdham.org/ ; http://www.cdmha.org/Resources.htm ; and http://coe-dmha.org/
Disaster Management Toolkit: http://www.hsc.usf.edu/nocms/publichealth/cdmha/toolkit_dm/Index_English.pdf
Disaster and Emergency Management Information Network: http://ccs.tamu.edu/homeland_security/

Diving and Hyperbaric Medicine
Diver's Alert Network: http://www.diversalertnetwork.org/
Diving Medicine Links: http://scuba-doc.com/lnks.html
Diving Diseases Research Center: http://www.ddrc.org/
Diving Medicine Symptoms and Treatment: http://scuba-doc.com/sitemap.html
Navy Diving Manual: http://www.supsalv.org/manuals/diveman5/divManual5.htm
Hyperbaric Medicine Links: http://www.scuba-doc.com/hbolnks.htm and http://www.virtual-anaesthesia-textbook.com/vat/hyperbaric.html

Emergency Medicine
Center for International Emergency Medicine: http://www.iemh.org/
Links and Resources: http://www.acep.org/ACEPmembership.aspx?id=25148

Environmental Health and Medicine
Center for Health and the Global Environment: http://chge.med.harvard.edu/
Environmental Health Links: http://www.sis.nlm.nih.gov/enviro/envirohealthlinks.html
Environmental Health in Emergencies: http://www.who.int/water_sanitation_health/hygiene/emergencies/en/
Environmental Medicine Links: http://www.uib.no/isf/guide/occu.htm
International Union for Circumpolar Health: http://www.iuch.org/
Maritime Medicine Center: http://www.gwemed.edu/maritime.htm
National Institute of Environmental Health Science: http://www.niehs.nih.gov/
Travel Medicine Resources: http://gorgas.dom.uab.edu/geomed/links2.html
Wilderness Medicine Links: http://wms.org/links/interest.asp

Epidemiology
Epidemiological Statistics and Applications for Public Health: http://www.openepi.com/Menu/OpenEpiMenu.htm
Population Health Metrics Online: http://www.pophealthmetrics.com/
Public Health Emergency Countermeasures: http://www.hhs.gov/aspr/ophemc/index.html

Family Medicine
Center for Family Health Information and Technology: http://www.centerforhit.org/
Family Medicine Resources: http://www.aafp.org/online/en/home/aboutus/relatedsites.html
Family and Primary Care Medicine Studies: http://www.graham-center.org

Forensics
Forensic Science: http://www.ncjrs.gov/spotlight/forensic/Summary.html
Forensic Investigation Links: http://www.nlectc.org/links/forlinks.html
Forensic Science Links: http://www.lib.msu.edu/harris23/crimjust/forsci.htm

Geospatial Health Resources
Geospatial Mapping: http://www.cdc.gov/nchs/gis.ht; http://datawarehouse.hrsa.gov/ and http://www.who.int/health_mapping/en/

Humanitarian Assistance
Global Humanitarian Studies Links:
http://www.sipa.columbia.edu/academics/concentrations/ha/ghsi/introduction.html
Relief Web Library: http://www.reliefweb.int/rw/lib.nsf/doc205?OpenForm
UN Humanitarian Information Management Toolbox: http://www.humanitarianinfo.org/IMToolbox/

Improvised Medicine
Improvised Medicine: http://www.paladin-press.com/category/s
Midwives Handbook: http://www.hesperian.org/Publications_and_Resources.php
Where There is no Doctor: http://www.healthwrights.org/books/WTINDonline.htm
Where There is no Dentist: http://www.healthwrights.org/books/WTINDentistonline.htm
Where Women Have No Doctor: http://www.hesperian.org/Publications_and_Resources.php
Where There Is No Psychiatrist: http://www.asksource.info/pdf/30256_wherethereisnopsych_ch3_2003.pdf

Infectious Diseases
Center for Infectious Diseases Research: http://www.cidrap.umn.edu
Communicable Disease Control in Emergencies: http://whqlibdoc.who.int/publications/2005/9241546166_eng.pdf
Disease Control Priorities Project: http://www.dcp2.org/main/Home.html
National Center for the Control of Infectious Diseases: http://www.cdc.gov/ncpdcid/
Outbreaks and Surveillance: http://www.who.int/csr/don/en

International and Cross-Cultural Health
Cross Cultural Healthcare Program: http://www.xculture.org/
Cross Cultural Medicine Resources: http://www.ethnomed.org and ttp://medicine.ucsf.edu/resources/guidelines/culture.html
CDC Global Health Office: http://www.cdc.gov/cogh/index.htm/
Global Health Council Resources: http://www.globalhealth.org/
Global Public Health References: http://www.pbs.org/wgbh/rxforsurvival/resources.html
Global Public Health Institutes (Resource Pages): http://www.ianphi.org /
International Medicine Programs: http://www.gwemed.edu/1189932253869.html
USHHS Global Health Office (Issues & Resources): http://www.globalhealth.gov

Laboratory
Clinical Lab Science Resources: http://members.tripod.com/~LouCaru/index-5.html
Laboratory Links: http://wwwn.cdc.gov/nltn/mltl.aspx

Mass Causalities
Community Based Mass Prophylaxis: http://www.ahrq.gov/research/cbmprophyl/cbmpro.htm
Mass Care and Shelters Guide: http://www.cdsscounties.ca.gov/coplanners/
Mass Causality Resources: http://www.bt.cdc.gov/masscasualties/
National Mass Fatalities Institute: http://www.nmfi.org/

Surge Capacity and Facility Capacity: http://www.bt.cdc.gov/masscasualties/surgecapacity.asp and http://www.bt.cdc.gov/masscasualties/capacity.asp

Maternal-Child Health
Antenatal Guidelines or Crisis Conditions: http://www.icrc.org/web/eng/siteeng0.nsf/html/p0875
Maternal/Child Health Resources: http://www.who.int/making_pregnancy_safer/publications/en/

Medical Anthropology
Global Directory of Medical Anthropology http://www.medanthro.net/directory/submit.asp
Medical Anthropology Web http://www.medanth.org/ and http://vlib.anthrotech.com/Specialized_Fields/Medical_Anthropology/

Medical Geography
http://userpages.umbc.edu/~earickso/Index.html
http://userpages.umbc.edu/~earickso/MGSGRelatedLinks.html

Medical Geology
Medical and Health Geology: http://www.medicalgeology.org/ and http://energy.er.usgs.gov/health_environment/medical_geology/

Mental Health
CDC Mental Health Resources: http://www.bt.cdc.gov/mentalhealth/
Critical Incident Stress Management and Resources: http://www.icisf.org/
Disaster Mental Health Resources: http://www.trauma-pages.com/disaster.php
International Mental Health and Resources: http://www.iop.kcl.ac.uk/international/?project_id=80
Psychological Testing: http://www.guidetopsychology.com/testing.htm and Assessments: http://www.psywww.com/resource/bytopic/testing.html
U.S. Mental Health Information Center: http://mentalhealth.samhsa.gov/

Military Medicine
International Committee for Military Medicine: http://www.cimm-icmm.org/index.html
Military Medicine Links: http://www.au.af.mil/au/awc/awcgate/awc-medi.htm

Morgue and Remains Management
Disaster Victim Identification Guide: http://www.interpol.int/Public/DisasterVictim/guide/default.asp
Disaster Morgue Operations: http://www.winid.com/dmort7/Final%204-WHITE.doc
and http://www.hhs.gov/aspr/opeo/ndms/teams/dmort.html
Management of Human Remains: http://www.icrc.org/web/eng/siteeng0.nsf/html/p0858 and http://www.paho.org/english/dd/ped/ManejoCadaveres.htm

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Reproductive Health Care in Emergencies: http://www.who.int/reproductivehealth/pages_resources/listing_emegency.en.html

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American Academy of Ophthalmology Resources: http://www.aao.org/
Eye Disorders Online: http://www.merck.com/mmpe/sec09.html; http://www.ophthalmologyweb.com/default.aspx; http://www.thehighlights.com/Merchant2/merchant.mvc; and http://www.websightmd.com/

Palliative Medicine
Palliative Medicine Resource Guide: http://www.aahpm.org/physresources/index.html

Pathology
Armed Forces Institute of Pathology: http://www.afip.org/
Pathology Links: http://members.tripod.com/Pathnet/links.htm and http://pathologylinks.com/index.php?title=Eric%27s_Pathology_Links

Peacekeeping and Stability Operations
https://pksoi.army.mil/
http://www.au.af.mil/au/aul/bibs/peaceops06.htm
http://www.carlisle.army.mil/ietcop/index.cfm

Pediatrics
Child Health in Emergencies: http://www.who.int/child-adolescent-health/publications/pubemergencies.htm
Pediatric Immunization Guide: http://aapredbook.aappublications.org/current.shtml
Pediatric Patient Management: http://practice.aap.org/topicBrowse.aspx?nodeID=4000
Pediatric Resources: http://pages2.inrete.it/mbiomed/pedi.htm and: http://www.lib.uiowa.edu/hARDIN/MD/ped.html

Pharmacology
Drug Information Guide: http://www.drugs.com/
Merck's Clinical Pharmacology: http://www.merck.com/mmpe/sec20.html
Orphan Drugs: http://www.orpha.net
Psychopharmacology Resources: http://www.ascpp.org
WHO Essential Medicines: http://www.who.int/medicines/publications/en/

Public Health
Centers for Public Health Preparedness: http://www.asph.org/cphp/cphp_home.cfm
Public Health Links: http://www.sph.emory.edu/PHIL.php
Public Health Association Resources: http://www.apha.org/programs/resources/
Public Health Emergency Countermeasures: http://www.hhs.gov/aspr/ophemc/index.html
Public Health Preparedness Tools: http://www.phpreparedness.info/tools.php

Radiology and Medical Imaging
Med Pix Medical Image Database: http://rad.usuhs.edu/medpix/index.html
Radiology Education Gateway: http://tmcr.usuhs.mil/
Radiology Links and Resources: http://www.radiologyeducation.com/
Public Health Image Library: http://phil.cdc.gov/Phil/home.asp

Refugee Management
Care and Shelter Tools: http://www.cdsscounties.ca.gov/coplanners/default.asp?id=31
Center for Refugee and Disaster Medicine: http://www.jhsph.edu/refugee/

Refugee Decision Support Resources
http://www.unhcr.org/cgi-bin/texis/vtx/refworld/rwmain
UN Humanitarian Aid Links: http://www.unhcr.org/cgi-bin/texis/vtx/reflink/download.htm
UN Refugee Links: http://www.unhcr.org/cgi-bin/texis/vtx/reflink

Surgery
Hospitals for War Wounded – A Guide for Set Up: http://www.icrc.org/web/eng/siteeng0.nsf/html/p0714
Integrated Management Toolkit for Essential and Emergency Surgical Care: http://www.who.int/surgery/publications/imeesc/en/index.html
Practice Guidelines for Surgical Care in Emergencies: http://www.who.int/surgery/en/ESC_in_disasters.pdf
Surgical Care at the District Hospital: http://www.who.int/surgery/publications/en/SCDH.pdf
Surgery for Victims of War: http://www.icrc.org/web/eng/siteeng0.nsf/html/p0446

Tactical Medicine

Centers for Tactical Medicine: http://www.mcg.edu/ems/COM/Tactical/; http://www.gwemed.edu/opmed/tacmed.htm; http://www.gwemed.edu/1193734316069.html; and https://www.usaccc.org/index.jsp

Telemedicine

U.S. Army Telemedicine: http://www.tatrc.org/
US HHS Telehealth: http://www.hrsa.gov/telehealth/
Telemedicine Resources: http://tie.telemed.org/links/
Telemedicine Links: http://www.quasar.org/21698/textfodder/telelink.htm

Tropical Medicine

American Society of Tropical Medicine: http://www.astmh.org/
Global Network for Neglected Tropical Diseases: http://gnntdc.sabin.org/
Institute of Tropical Medicine Library and Resources: http://lib.itg.be/bibhome.htm
International Registry of Tropical Imaging: http://tmcr.usuhs.mil/toc.htm#
Tropical Medicine Links: http://hml.org/WWW/tropical.html and: http://www.astmh.org/links/index.cfm

Veterinary Medicine

Advanced Veterinary Information System: http://www.aviscollege.com/
Animal Disease Alerts, Information and Resources: http://www.oie.int/eng/en_index.htm
Animal/Plant Health Inspection Service and Resources: http://www.aphis.usda.gov/
Bio-security Center for Animal Health Emergencies: http://www.biosecuritycenter.org/
Diagnostic Tests and Vaccines for Terrestrial Animals: http://www.oie.int/eng/normes/mmanual/A_summry.htm
Global Early Warning System for Animal Diseases: http://www.who.int/zoonoses/outbreaks/glews/en/index.html
Veterinary Resources: http://informatics.vetmed.vt.edu/Projects.htm
Veterinary Emergency and Critical Care Links: http://veccs.org/
Veterinary Environmental Health Center: http://www.emc.ncsu.edu/
Veterinary Public Health and Zoonotic Disease: http://www.who.int/zoonoses/vph/en/
World Veterinary Association Links: http://www.worldvet.org/Web_Links.html

GENERAL REFERENCES, GUIDES AND TOOLS:

Alerts & Threats

Bio-security Center: http://www.upmc-biosecurity.org/
Epidemic and Pandemic Alert: http://www.who.int/csr/en/
Medical Threats Briefings (by Topic): http://usachppm.apgea.army.mil/hiomtb/
Relief Web: http://www.reliefweb.int/rw/dbc.nsf/doc100?OpenForm
Security News: http://www.planetdata.net/ and http://www.globalsecurity.org

Basic References

Anatomy Atlases Online: http://www.anatomyatlases.org/
Health and Medical Sites: http://www.lib.uiowa.edu/hardin/md/idx.html
Health Science Libraries: Health Sciences Libraries Online: http://www.lib.uiowa.edu/hardin/hslibs.html
Martindale's Medical References: http://www.martindalecenter.com/Medical.html
Medical Algorithms, Scales, Tools, Assessments & Scoring Systems: http://www.medal.org/visitor/login.aspx
Medical Dictionary Online: http://cancerweb.ncl.ac.uk/omd/
Merck Health Guides Online: http://www.mercksource.com/
Military Medical Resources: http://www.medtrng.com/medicaloperations.htm
National Library of Medicine Gateway: http://gateway.nlm.nih.gov/gw/Cmd
Practice Guides: http://www.fpnotebook.com/; http://www.emedicine.com/; http://www.lib.uiowa.edu/hardin/md/; and http://www.acep.org/practres.aspx?id=30232
USUHS Learning Resource Center: http://www.lrc.usuhs.mil/

Books (Online)
Books for Doctors: http://www.freebooks4doctors.com/fb/special.htm
E-Learning Toolkit for Essential Surgical Care: http://www.steinergraphics.com/surgical/index.html
Environmental Medicine Text: http://www.envimed.com/emb.shtml
Dermatology: http://telemedicine.org/stamford.htm
DSM-IVR: http://psych.org/MainMenu/Research/DSMIV.aspx
First Aid in Armed Conflicts: http://www.icrc.org/web/eng/siteeng0.nsf/html/p0870
Global Health Council Publications: http://www.globalhealth.org/publications
Medical Bookshelf: http://www.ncbi.nlm.nih.gov/sites/entrez?db=books
Military Medicine: http://www.brooksidepress.org/Military.htm; and http://www.bordeninstitute.army.mil/published.html
Military Biodefense Manuals: http://usamriid.detrick.army.mil/education/instruct.htm
Merck Manuals Online: http://www.merck.com
Merck/Medicus Portal: http://www.merckmedicus.com/pp/us/hcp/hcp_home.jsp
Primary Trauma Care Manual: http://www.steinergraphics.com/surgical/manual.html

Courses (Online)
Virology Course: http://web.uct.ac.za/depts/mmi/jmoodie/welcome1.html
Medical Super Courses: http://iier.isciii.es/supercourse/assist/topicsearch.htm
WMD Online Preparedness Education Program: http://opep.usuhs.edu/

Journals (Online)
Federal Medicine: http://www.usmedicine.com/index.cfm
Medical Journals: http://www.biomedcentral.com/ and http://www.plos.org/
Medical and Science Journals: http://www.ispub.com/ostia/index.php?xmlFilePath=journals.xml
Medical and Science Journals for the Developing World: http://www.biomedcentral.com/developingcountries

Training
Advanced Burn Life Support: http://www.ameriburn.org/ablscoursedescriptions.php
Advanced Disaster Life Support: http://www.bdls.com/
Advanced Hazmat Life Support: http://www.ahls.org/ahls/ecs/main/ahls_home.html
Advanced Medical Life Support: http://www.naemt.org/AMLS/default.htm
Advanced Wilderness Life Support: http://awls.org/index.htm
BiodefenseEd.org: http://www.biodefenseeducation.org/
Biochemical Organic Radiological Disaster Educational Response System: http://www.bordersalertandready.com/
Blast Injury Training: http://www.bt.cdc.gov/masscasualties/tiidefacts.asp
Center for Domestic Preparedness: http://cdp.dhs.gov/index.html
Diploma in Remote and Offshore Medicine: http://www.diprom.rcsed.ac.uk/
Disaster Education Extension Network: http://eden.lsu.edu
Disaster Mental Health Institute: http://www.usd.edu/dmhi/
Diver Medical Technician Training: http://www.nbdhmt.com/dmt.html
Emergency Management Institute: http://www.training.fema.gov/EMIWEB/
Health Care: http://www.medweb.emory.edu/MedWeb/SPT—Home.php
Humanitarian Resource Institute: http://www.humanitarian.net/
International Trauma Life Support Course: http://www.itrauma.org/
JEMS Training Links: http://www.jems.com/education_and_training/index.html
NAEMT Training: http://www.naemt.org/educationalPrograms/
Medicine for Mariners: http://www.medicineformariners.com/
Medicine in Challenging Environments: http://www.trueresearch.org/mice2006/
Pre Hospital Trauma Life Support: http://www.naemt.org/PHTLS/
Remote Area EMS: http://www.raems.com/index.html
Remote Medicine Guides: http://www.remotemedicine.org/Guides.htm
Terror Medicine: http://www.terrormedicine.org/
Training in Tropical Diseases: http://www.who.int/tdr/index.html
USMA Terrorism and Counterterrorism Training: http://www.teachingterror.com/

Med Quiz

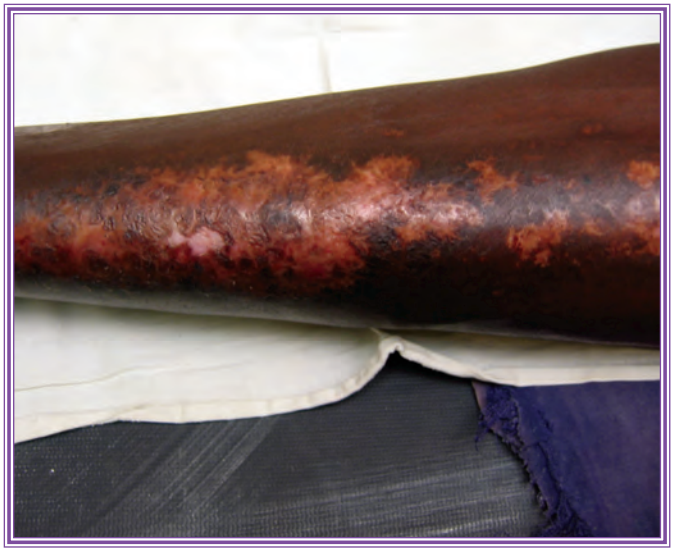
Picture This...

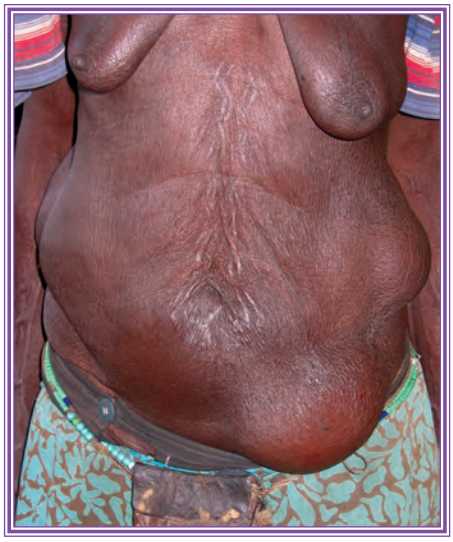
Ryan D. Freeland, USAF, MC, FS

During a MEDCAP in sub-Saharan Africa you see a number of patients in your clinic with seemingly unrelated but unusual pathology.

Using the primary lesion definitions outlined in your SOF Medical Handbook, how would you describe the morphology of this lesion?

What is your differential diagnosis for this lesion (see photos 2-6)?





ANSWER:

Morphology

Primary lesion — Coalescent, nummular, depigmented macules and patches with some scalloped borders isolated over the anterior tibia. Secondary lesion — round scar located in the center of the coalescing depigmentation.

Differential Diagnosis

Onchocerciasis, vitiligo, leprosy, streptocerciasis, eczema, malnutrition, lymphatic filariasis, tinea versicolor, pityriasis alba, post-inflammatory hypopigmentation, hypopigmented mycosis fungoides.

Onchocerciasis is rare in the United States but is commonly seen in western, central, and eastern Sub-Saharan Africa. There are also isolated foci in Latin America and Yemen. Here we review the nematode Onchocerca volvulus as well as its intermediate host, the black fly (genus Simulium). We also highlight the dermatologic spectrum of findings over the disease's long course, current treatments, and promising future treatments.

Onchocerciasis

Onchocerciasis is a debilitating spectrum of multi-systemic disease caused by the parasitic nematode *Onchocerca volvulus*.[1,2] These thread-like worms called filaria[3] have gained notoriety for claiming the world-wide title as the second most common cause of infectious blindness (most common — *Chlamydia trachomatis*).[4] The populations most often afflicted by these worms live along banks of rivers, hence the popular colloquium, "river blindness."[1] More commonly seen in persons infected is the wide range of dermatologic diagnoses primarily caused by local inflammatory responses to dead microfilariae.[1]

Onchocerciasis is rarely diagnosed in the United States. However, this parasitic disease may be contracted by populations spending months to years in endemic areas. Such personnel groups include Peace Corps volunteers, relief and development workers, as well as federal employees, and active duty militants. Importantly, the length of time spent in any of the endemic areas directly correlates to both the individual risk of contracting the parasite and the severity of symptoms.

The World Health Organization (WHO) estimates that more than 17 million persons are affected with the disease worldwide with approximately 270,000 blind and another 500,000 with severe visual impairment.[5] The WHO's expert committee on onchocerciasis also estimates that 99% of persons affected live on the African continent, with the remainder of those affected in Yemen

and Latin America. Thirteen endemic foci have been identified in six different countries in Latin America including Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela placing approximately 500,000 people at risk.[6]

The intermediate host—*Simulium*

Though only one species of *Onchocerca* causes onchocerciasis, literally hundreds of species of *Simulium* can serve as intermediate hosts for the causative nematode. The predominant species complex carrying *O. volvulus* in most of Africa is *Simulium damnosum*.[7] Notably, this species complex is further divided into five subcomplexes – *damnosum*, Ketaketa, Kibwezi, Sanje, and *squamosum*.[1] For Africa, Adler and McCreadie list 15 species of *Simulium* as well as the *damnosum* complex as common carriers of *O. volvulus*.[8] In West African nations the predominant intermediate hosts are *damnosum*, *yahense, sanctipauli*, and *sirbanum*.[9] Besides *S. damnosum* another principal species throughout much of the central Africa is *S. neavei*.[1]

For Latin America, Adler and McCreadie list five species — *callidum, incrustatum, limbasum, quadrivittatum,* and *oyapockense* as well as four complexes — *exiguum, guainense, metallicum*, and *ochraceum* as common carriers of *O. volvulus*.[8]

Figure 1: Black fly (*Simulium yahense*) with parasite, *Onchocerca volvulus*, emerging from the insect's antenna. The image is shown under 100x magnification by scanning electron microscope. (Wikipedia)

The adult *Simulium* is characterized by a small, rounded body, bead-like antennae, an arched thorax, and a pair of wings that span 6 to 10mm with thickened veins near the leading edge.[8] Most flies are black in color but some species may be orange or yellow. The male's eyes are holoptic, meeting along the dorsal length of the head while the female's eyes are dichoptic, separated by an anterior segment called the frons. Ventral on the head is the mouth, a complex structure marked by two maxillary palps attached near the base of the proboscis. The labium forms the back of the proboscis and envelops the other parts of the mouth which include the serrated mandibles and the toothy posterior maxilla called the laciniae.[8] Of note, the color patterns of the legs and thorax are useful in species identification of *Simulium*.

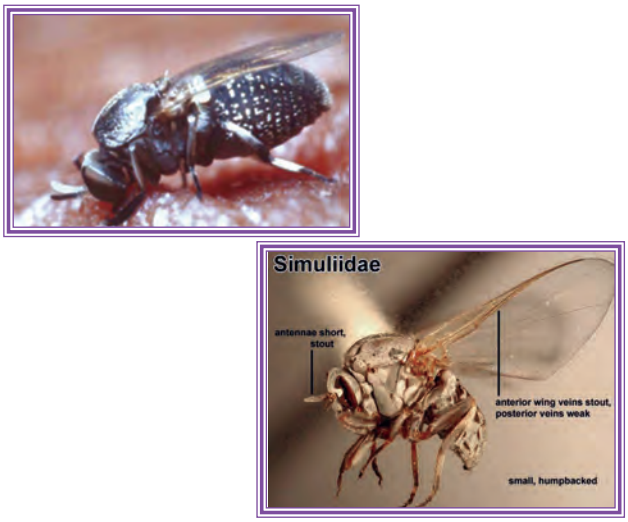


Figure 2: *Simulium damnosum*, the predominant intermediate host of *Onchocerca volvulus*.
Reproduced from WHO/TDR/Stammers.

Simulium are extremely common near rapidly flowing rivers. The female black fly lays several hundred eggs on debris, stones, or vegetation after a requisite blood meal is taken for the development of each set of eggs.[11] Like many types of mosquito, the black fly has egg, larval, and pupal stages in water, "but unlike mosquitoes, the habitats are restricted to highly oxygenized fast flowing turbulent water, containing a readily available source of food."[11]

Figure 3: *Simulium* life cycle

1. Adult female
2. Egg stage
3. Larval Stage
4. Pupal stage
5. Immature adult (pre-imago) stage.

Image reproduced from Barry.[12]

The *Simulium* bite

When the fly begins to bite, the lip-like labella are withdrawn and small teeth and spines from apex of the anterior mouth pull the skin taught so that the serrated mandibles can cut the host flesh, allowing the labrum and hypopharynx to enter the wound.[13,8] The

overlapping mandibles forms a food channel and the biting fly siphons off the meal from the pooling blood. Because of this mechanism for feeding from pooled blood, *Simulium* are considered *telmophages*. Along the anterior surface of the hypopharynx is a salivary groove which deposits saliva directly into the wound which enhances vasodilation, promotes analgesia, and inhibits platelet aggregation.[14] In Latin America, some of the *Simulium* species have a buccopharyngeal armature that limits their uptake of microfilariae and therefore decreases their ability to transmit the parasite.[44]

Notably, adult females require a blood meal to mature the developing eggs, an ovarian cycle that occurs over a time period of two days to two weeks. Males do not bite and therefore do not transmit *O. volvulus*. Since these female adults are determined feeders, they will not leave the host until they are satiated, a process that takes three to six minutes for a fly to take on approximately its own weight in blood.[8]

Black flies typically bite during daylight hours with the majority of *Simulium* species including *S. dam*nosum biting at dawn and dusk[8] in outdoor shaded or partially-shaded areas. A rapid decrease in air pressure coupled with increasing cloud cover increases biting frequency. *Simulium* typically avoid biting indoors or late at night. It is not uncommon for *Siumulium* to fly seven to 10 miles from the breeding sites, or are blown by wind even further to feed on warm-blooded animals and people. Since adult females only live for two to three ovarian cycles flies may only bite during this three to five week timespan.[12,8]

Interestingly, dry season months can account for the high transmission rates. In a quantitative study of onchocerciasis transmission of two separate species of *Simulium* in Liberia, West Africa David Fryauff and Milan Trpis discovered that peak infectivity rates for both *S. sanctipauli* and *S. Yahense* occurred in the dry season (Nov-April).[9] This is in contrast to the much more common scenario for most species of *Simulium* including *S. damnosum* to reach peak transmission rates during the wet season.[8]

Onchocerca volvulus

The *Simulium* inject one or two larvae (microfilariae) into the skin with each bite. These microfilarial worms migrate to subcutaneous tissue and develop over the span of approximately nine to 24 months into adult worms. These adult worms may reside in subcutaneous tissue for 10 to 15 years.[1,16] The larger of the genders, the female adult worm, can grow to lengths of 50cm, and produce millions of microfilariae over the course of her adult life.[16] These immature microfilariae then migrate through the connective tissue, the lymphatics, and the skin. With each bite of the black fly, immature microfilariae are ingested from the blood meal of infected persons, and then migrate from the *Simulium's* midgut to the thoracic muscles where they give rise to mature, infective larvae. These mature larvae then migrate to the biting fly's proboscis where they are loaded to infect another bite victim.[16] Because of the necessity of the adult worms to mate and produce microfilariae in the human that subsequently mature in the *Simulium*,[11] the intensity of infection in humans is exponentially related to the number of bites sustained by infected blackflies.[17] It follows then that severity of patient symptoms is directly related to quantitative filarial load.

Figure 4: Black fly bites. Reproduced from Jarmo Holopainen's Home Page www.uku.fi/~holopain/stt/Simuliidae2.jpg

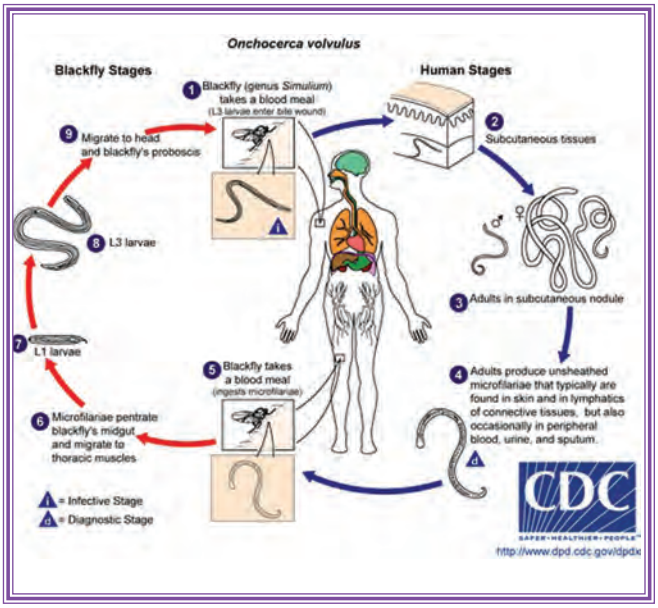


Figure 5: *Onchocerca volvulus* life cycle.

During a blood meal, an infected black fly (genus *Simulium*) introduces third-stage filarial larvae onto the skin of the human host, where they penetrate into the bite wound❶. In subcutaneous tissues the larvae❷develop into adult filariae, which commonly reside in nodules in subcutaneous connective tissues❸. Adults can live in the nodules for approximately 15 years. Some nodules may contain numerous male and female worms. Females measure 33 to 50cm in length and 270 to 400µm in diameter, while males measure 19 to 42mm by 130 to 210µm. In the subcutaneous nodules, the female worms are capable of producing microfilariae for approximately nine years. The microfilariae, measuring 220 to 360µm by 5 to 9µm and unsheathed, have a life span that may reach two years. They are occasionally found in peripheral blood, urine, and sputum but are typically found in the skin and in the lymphatics of connective tissues❹. A black fly ingests the microfilariae during a blood meal❺. After ingestion, the microfilariae migrate from the black fly's midgut through the hemocoel to the thoracic muscles❻. There the microfilariae develop into first-stage larvae❼ and subsequently into third-stage infective larvae❽. The third-stage infective larvae migrate to the black fly's proboscis❾ and can infect another human when the fly takes a blood❶.

Signs and Symptoms of Onchocerciasis

Upon dying, microfilariae may induce intense inflammatory responses which are causal in the majority of clinical symptoms. It is estimated that in a severely infected person, more than 100,000 microfilariae may die each day![1] The most widely known symptom of onchocerciasis is blindness which results after prolonged infection and leads to end-state sclerosing keratitis or optic neuritis. Ocular manifestations also include uveitis, iridocyclitis, chorioretinitis, and punctuate keratitis. Of note, blindness caused by *O. volvulus* may result from either anterior or posterior chamber disease.[42]

In addition to these ocular diagnoses, onchocerciasis is characterized by a wide range of dermatologic findings first classified by Murdoch in 1993 in order to standardize reporting for data collection.[18] Pruritis, typically the initial dermal sign,[42] is often associated or followed by episodes of acute macular and papular eruptions that may appear at any time after infection. These papules may be scattered or confluent. Acute episodes of papular dermatitis give way to more severe and chronic forms of onchodermatitis. According to Murdoch's classification scheme, onchodermatitis is categorized as one of three major types — acute papular, chronic papular, or lichenified.[18,1] Acute papular onchodermatitis (APOD) is characterized by a scattered, pruritic papular rash. Papules must be at least 1mm and may or may not be accompanied by vesicles or pustules. Chronic papular onchodermatitis (CPOD) is typically a scattered, pruritic, hyperpigmented rash with larger papules (>3mm). Lichenified onchodermatitis (LOD) is characterized by discrete or confluent, raised, hyperpigmented papulonodular plaques often associated with pruritis and lymphadenopathy.[18,1] The lichenification leading to rough and hardened skin affords the colloquiums "elephant" or "lizard' skin".[42]

Late skin findings include atrophy with or without fine wrinkles as well as depigmentation . The loss of pigment may be incomplete or complete but typically spares peri-follicular islands. The colloquial term for complete loss of pigment associated with onchocerciasis is "leopard skin" and is seen only in patients with advanced disease.[1] Another late form of dermal pathology seen particularly in Yemen occurs with acute papular rash in a single limb coupled with edema, lymphadenopathy, intense pruritis, and hyperpigmentation. This condition is known as "sowda."[43]

Adult worms remain in subcutaneous fibrous nodules called onchocercomas that are largely protected from the host's immune system. These palpable nodules are typically observed over bony prominences including the scalp, elbows, ribs, iliac crests, greater trochanters, ischial tuberosities, and knees.[1]

There is also a unique condition known as "hanging groin" caused by inflammation of lymph tissues which results in folds of atrophic and inelastic skin that droop over or alongside the genitalia.

Wolbachia

Wolbachia are endosymbiotic bacteria found in most of the filariae affecting humans including *Onchocerca volvulus.* These bacteria are required for worm embryogenesis, development, gender differentiation, and adult survival.[21] Due to concerns over the lack of alternate therapies available for mass distribution as well as a fear of microbial resistance to current treatment, research has been ongoing to discover novel, effective therapies to treat this endosymbiote. Due to its susceptibility to commonly used antibiotics like doxycycline and tetracy-

cline,[24-26] *Wolbachia*, have emerged as the promising new target for treatment. By treating these mutualistic bacteria, adult females will be rendered sterile ultimately decreasing microfilariae populations.[21,22]

Treatment

Ivermectin is a synthetic anti-parasitic drug from a class of macrocyclic lactones known as avermectins that acts as a GABA agonist and causes spastic paralysis and death of microfilariae.[23] It was originally developed as an anti-helminthic drug for veterinary use in livestock.[42] In the late 1970s the drug was found to be extremely effective against *O. cervicalis* in cattle which led to the notion of its utility in treating *O. volvulus*.[45] It is now the drug of choice for microfilaricidal activity against *O. volvulus*. Repeated dosages of ivermectin block embryo release most likely due to paralysis of uterine muscles.[21] Since ivermectin is only weakly macrofilaricidal,[21] dosing schedules require quarterly, semi-annual, or annual administrations to kill the infective larvae.[16] The same is true of diethylcarbamazine citrate (DEC), a drug used to treat lymphatic filariasis. Ivermectin is administered at 150 micrograms/kg (max 12mg) every 3 to 12 months to suppress microfilariae in the eyes and skin.[16]

Since the currently-used, mass-distributed drug, ivermectin, has neither strong macrofilaricidal properties nor permanent sterilizing effects on the adult worm, more effective drugs are needed to complement the use of ivermectin alone.[22] These desired combination therapies would lead to both destruction of microfilariae as well as long-term sterilization of the adult female filariae.[22]

Depletion of adult worms can also be accomplished by surgical removal of onchocercomas.

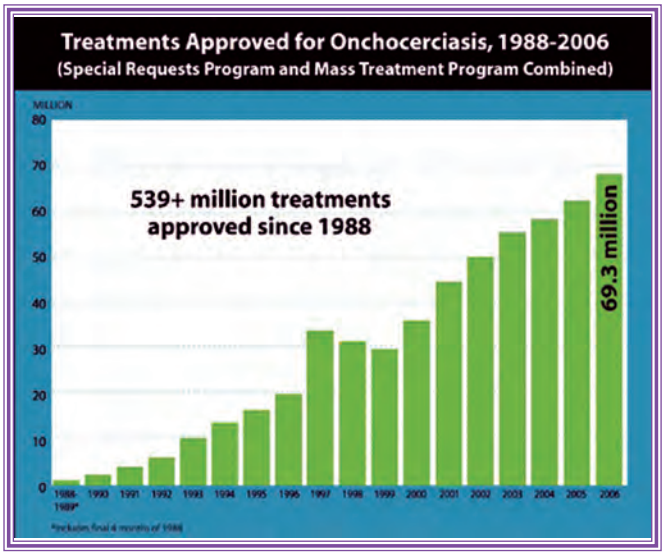


Figure 6: Cumulative treatments for onchocerciasis. Reproduced from www.mectizan.org

Prevention [12, 8]

- Avoid activities in proximity to fast-flowing rivers during the black fly season, especially during dawn and dusk
- Long sleeves, pants, and hats with fine mesh netting extending over the face and shoulders will decrease quantity of bites
- Repellents offer some relief depending on the individual, species of fly, temperature, humidity, time of day, etc.
- The best methods of control are directed toward reducing the number of black fly breeding areas. Removal of vegetation and other objects in streams will cut down the number of larvae.
- Temporary damming of water can reduce populations, as immature stages need swift, running water. Larvae will die in 10 to 24 hours in calm non-running water.

Mectizan Donation Program (MDP)

In October 1987, the pharmaceutical giant Merck launched a global, multi-faceted task force dedicated to the world-wide elimination of onchocerciasis.[27] The Mectizan Donation Program or MDP created by Merck merged an international conglomerate of both public and private organizations including the World Health Organization (WHO), the World Bank, the United Nation's Children's Fund, numerous national ministries of health, and more than 35 non-governmental organizations (NGO).[27] This massive initiative has been overseen by the Merck-appointed Mectizan Expert Committee, an independent group of internationally recognized experts in tropical medicine and public health.[28] In a 20-year review of the MDP, Brenda Colatrella, an employee at Merck, recently reported that since its inception, Merck has donated more than 1.8 billion tablets of Mectizan, providing more than 530 million treatments (this data is detailed by the Mectizan Expert Committee in figure 13 reproduced here from their website). The number of treatments is expected to grow to at least 100 million/year by 2010.[29] However, the impacts of such staggering distributions from this global program are more difficult to quantify. To be sure though, the Mectizan Donation Program can certainly claim a wide range of positive outcomes including the minimization of disease burden world-wide, contributions to a regional economic stability, and strengthened healthcare coalitions. Especially those that have been charged with mobilizing such tremendous resources from a public-private alliances to deliver healthcare to these isolated communities.[27]

Figure 7: Foci in Latin America (OEPA region) where onchocerciasis is endemic and where mass treatment with Mectizan is indicated and ongoing, as of the end of 2005. In Latin America (OEPA region), as of the end of 2005, all onchocerciasis endemic foci were indicated for twice-yearly mass treatment with Mectizan, regardless of endemicity, as a strategy for the elimination of onchocercal morbidity and transmission of infection. This map is reproduced with permission of the *Annals of Tropical Medicine and Parasitology*, 2006, Volume 100, pages 733–46.

If you are DEPLOYED and have concerns about a puzzling skin condition, you can email your clinical photos with a concise morphologic description of the lesion to our Operational Teledermatology site at derm.consult@ us.army.mil or to me directly at Daniel.Schissel@us.army.mil. The lesion you describe just may make its way to the next edition of **Picture This…**

Thanks for all you do.

Figure 8: The 26 countries in Africa where mass treatment with Mectizan is indicated and ongoing for onchocerciasis, as of the end of 2005. Countries are color coded according to their inclusion in the former OCP (green) or APOC (yellow) regions. As of the end of 2005, there were mass treatment programs with Mectizan for onchocerciasis in all 26 African countries where such intervention is epidemiologically justified. These 26 countries, plus Niger and Mozambique, are eligible for Mectizan combined with albendazole for national programs to eliminate Lymphatic Filariasis. This map is reproduced with permission of the *Annals of Tropical Medicine and Parasitology*, 2006, Volume 100, pages 733-46.

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5. Use a minimum of acronyms; spell out all acronyms when first used. Remember that your audience is inter-service, civilian, and international.
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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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