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Fall 2001

# Journal of Special Operations Medicine

A Peer Reviewed Journal for SOF Medical Professionals



Dedicated to the Indomitable Spirit & Sacrifices of the SOF Medical Professionals

# From the Surgeon



## United States Special Operations Command

Hello again from USSOCOM. Col. Yevich is now long gone, a civilian and thriving in the land of the big PX. Drop him a note once in a while at the VA Medical Center in Durham, NC 27705.

Since September 11, we are re-evaluating the requirements we have placed on our medical providers through the Joint Special Operations Medical Training Center (JSOMTC) training piece. When the CINC (Gen. Wayne Downing) advocated to Congress for the JSOMTC he did so to build interoperability in equipment and training of our SOF medics, be they Army, Air Force, or Navy. The intent was to build interoperability, not to disrupt that which was combat proven (18D, Ranger Medic, PJ, SEAL Corpsman, Army Aviation Medic, AFSOC Medics, etc.). Originally we selected the National Registry of Emergency Medical Technicians-Paramedic (NREMT-P) as a standard. We wanted the NREMT support should litigation issues ensue, and by selecting that credential it guaranteed that the people with the funding dollars would appreciate and fund the Continuing Education requirement—no-one originally wanted Paramedic because they balked at the sustainment funding.

Over the years, that decision has been sound and our medics have performed superbly when called upon. However, since Somalia things have changed. The NREMT-P has done as the civilian sector requires—moved heavily toward ACLS, PALS, geriatrics and the skills required to accomplish any civilian response. The SOF requirements now have come to look more like what the heroes of Somalia faced. They had casualties that couldn't be evacuated rapidly, the fighting was urban and the issue of helicopter "dust-off" evacuation was lost. Since September 11, 2001 the ballgame has really changed.

So what you say! Well, I have asked our folks to really scrub the MEDTRUTH data and we are asking operators in the field how we are doing. They are saying they have training, skills and equipment they don't need and they lack training, skills and equipment they do need for today's combat medic. We have a fix in mind, and we are asking the field to comment.

We are told by the Department of Transportation that we (SOF) can become a State Licensing Agent. We will define a Special Operations Combat Paramedic and the requirements for those skills and build the training to meet those requirements.

Our Army, Navy, and Air Force folks will show up at JSOMTC and take our Paramedic program (hopefully no more than 15 weeks or so) and once successfully completed and tested, will be credentialed by USSOCOM as

a Special Operations Combat Paramedic. Then they can proceed with their service unique needs that are quite different for each. Those to become 18D will proceed to the SFSMC training and learn that which is exclusive to 18D. PJs can go back to Kirtland AFB and get on with their distinctive skills (they don't require "sick-call" skills). SEAL Corpsmen can do as much of ADSOCM as they require developing their unique skills, and so on to include Rangers, Army Aviation, AFSOC Medics, etc.

We license our Paramedics and we work with ride-along programs for their needs. The Service SG's are developing trauma surgery programs around the country for training our military folks and we will "latch on" to that initiative. We will also continue the JSOM and the SOFMSSP program for sustainment.

Finally, what about those who want to retire and be an NREMT-P in their hometown Fire Department? We will work with the NREMT-P to build a bridge course of instruction that takes credit for SOF-Paramedic and adds the ACLS, PALS, geriatrics, etc. that they need to sit the NREMT-P exam. It can probably even be funded by the GI Bill benefit.

So, we are "mucking about" in the SOF Warrior business, but the intent is to make the training relevant to the tasks we ask of you and reasonable in the cost in dollars and your time in training and away from your home and families. Please write us, mail us, find us and give us your input. Each of our medics is unique in the capability they bring to get the mission done. We really want to make it easier, better, more relevant and get the mission done and our forces home.

God Bless America !!

**DAVID HAMMER, MD**  
Col, USAF  
Command Surgeon

# Cover

**This picture was created in response to the events of 11 Sep 01 and needs no further explanation!**



The *Journal of Special Operations Medicine* is an authorized official quarterly publication of the United States Special Operations Command, MacDill Air Force Base, Florida. Its 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.

The views contained herein are those of the authors and do not necessarily reflect official Department of Defense position. This publication does not supercede any information presented in other Department of Defense publications.

Articles, photos, artwork, and letters are invited, as are comments and criticism, and should be addressed to Editor, *Journal of Special Operations Medicine*, USSOCOM, SOC-SG, 7701 Tampa Point Blvd., MacDill AFB, FL 33621-5323. Telephone: DSN 968-5442, commercial: (813) 828-5442, fax: -2568; email JSOM@SOCOM.MIL.

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## From The Staff

It continues to be our deep desire to involve our readers in the production of this journal. Your suggestions, submissions, and photos are an integral part of what makes this journal unique. It is a sharing of your missions and your lives as you go forth as instruments of national foreign policy. We can't do it without your input. *You are* what the journal is all about.

This journal is one of the most excellent and righteous tools we have to span all the SOF services, to share medical information and experience unique to this community, is this journal. The *JSOM* survives because of generous but time-consuming contributions sent by clinicians, researchers and former medics from all the services who were SOF qualified and/or who served with SOF units. We need your help. We are always looking for SOF-related articles from current and/or former SOF medical veterans.

We are still interested in finding articles related to our SOF medical Navy brethren. We are coming up short in this area and know there have to be many great exploits that would provide insight and experience unique to the SOF Corpsman perspective to share with all. If you have contributions great or small... fire 'em our way. Thanks. Email- JSOM@SOCOM.MIL

A recent addition to the *JSOM* is the offering of CMEs. We are currently working with USUHS to sponsor CME's for the physicians and PA's starting with this edition. We realize that there are many reserve and guard medics and corpsman who are nurses in there civilian jobs so I am working with the board of nursing to be the contact person for a USSOCOM provider number. We will keep you posted as to our progress, if you have any questions please don't hesitate to email us. At this time *we are* able to provide them to the medics and corpsman. We apologize for any inconvenience this may cause. In this edition you will find CMEs offered on the "Anthrax" and "Preventing Painful Shins Splints" articles.

With the last edition of the *JSOM*, you found a survey. Thank you to the many who filled it out and returned it to us. As we continue to improve the journal to better suit your needs, we ask that everyone assist us by filling out the survey so that we can know how to best serve you.

In this edition of the *JSOM*, we honor our fallen brother, James D. Locker a PJ that perished in the line of duty in Vietnam.

Lastly, our distribution list continues to expand daily. Requests for the journal have come from all services; from medics to physicians, from clinical to operational units as well as from the retired and civilian communities. We are doing our best to see that all that will benefit from the journal receive it.

Enjoy this edition of the journal, send us your feedback, and get those article submissions in to us:  
JSOM@SOCOM.MIL mdd

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Colonel Hammer's military and medical career began in 1958 when he served as a U.S. Navy Combat Medical Corpsman attached to U.S. Marine Corps infantry, artillery, and communication/reconnaissance units. Following discharge, he completed his BS and MD degrees at the University of Michigan in 1967 and 1970 respectively. Following nine years of civilian medical practice in a multi-specialty group in Grand Rapids, Michigan, he reentered military service as a Flight Surgeon at Beale AFB. In 1984, he completed the Air Force Residency in Aerospace Medicine at Brooks AFB, Texas, during which period he earned a Masters in Public Health Degree from Harvard University. Colonel Hammer has spent the

majority of his career in aerospace medicine and direct line support assignments, has commanded three medical groups, and has been assigned to the ARRS/SG, the AFSOC/SG and the USAFA/SG. He is a chief flight surgeon and a master parachutist.

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CPT Anderson enlisted in the Army in 1980. Upon completion of the Combat Medic course, volunteered for Airborne and Special Forces training. Assignments encompassing 13 years as a SF medic include: Team medic- C/3/10<sup>th</sup> SFG(A), Instructor at Med Lab- Ft Bragg, Medic- 1<sup>st</sup> SFOD-D. CPT Anderson was accepted to the Military Physician Assistant program and subsequently commissioned in 1995. Assignments from that time to present include: 1/9<sup>th</sup> INF Regiment, 2/504<sup>th</sup> PIR, 82d Abn DIV, 2/7<sup>th</sup> SFG(A), and currently assigned to the USSOCOM Surgeons Office as the Command PA. Education and qualifications include: B.S. Southern Illinois Univ-'79, B.S. Univ. of Oklahoma-'95, and MPAS Univ. of Nebraska-'97. Jump Master, SERE, HALO, Combat Diver, Dive Medical Technician, Flight Surgeon, Dive Medical Officer.

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Maj DuGuay joined the Army Reserve in 1987 and served as a nurse in a Combat Support Hospital unit for three years before switching services in 1990 to become an Air Force C-130 Flight Nurse. She is currently a reservist attached to the SOCOM/SG office. Maj DuGuay has a BSN and is currently obtaining her MBA with a concentration in management. Her skills include being a flight nurse (both military and civilian), 15 years of critical care and emergency room nursing experience, an EMT and a legal nurse consultant. She also serves as the military liaison to her Disaster Medical Assistance Team (DMAT). Prior to the SG office, Maj DuGuay's experience at USSOCOM includes an assignment in the Center for Force Structure, Resources, Requirements, and Strategic Assessments.

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# Component Surgeon

## USASOC



Rocky Farr, MD  
COL, USA  
Command Surgeon

The USASOC/USASFC surgeon's input is going to be extremely short, because I am busy-there is a war, you know. There was a saying when I was in Vietnam, "*It's not a Great War, but, it's the only one we got.*" Well, this war is a Special Operations war. We are the center of effort for a change. After being a bastard stepchild in several wars, I am happy. It is our kind of war and we need to be up to it. I think we are.

Our political leaders are reading texts on "fourth generation warfare." It is another name for unconventional warfare. If you have not read any of it, you should-the vice president and the secretary of state are. Go to: [http://www.d-n-i.net/FCS\\_Folder/fourth\\_generation\\_warfare.htm](http://www.d-n-i.net/FCS_Folder/fourth_generation_warfare.htm).

Just because there is a war to prosecute, do not let the standard and mundane drop, like immunizations, physicals, day to day army business, and good medicine. Normal functions proceed. Moreover, we are in the slow retribution office; it will be a long war. The USASOC Surgeon's Conference scheduled for the weekend before the Special Operation Medical Conference in December in Tampa is still proceeding. Of course, attendance may be lighter than usual.

In addition, one more thing: OPSEC, OPSEC, OPSEC, OPSEC, and OPSEC.





# NAVSPECWARCOM



Larry Garsha  
CAPT, USN  
Command Surgeon

Comments for this edition are precluded due to sudden increase in operational tempo caused by recent world events. Stay tuned...

# AFSOC



James J. Dougherty  
Col., USAF  
Command Surgeon

# Education and Training

## BLS & ACLS Changes

Bronson White, D.O.

On April 27, 2001, I attended a seminar covering the recent changes to the BLS and ACLS guidelines. I wanted to take a few minutes to pass the more important changes along to everyone. There were many changes made to the way the courses are taught, but I will limit this to clinically significant applications.

BLS changes are mostly focused at making the steps easier for people to remember and use.

### A. Airway/Breathing changes:

1. Longer inspiratory phase
  - a. 1-2 seconds when using oxygen
  - b. 2 seconds when using rescue breathing with room air - this reduces gastric distension and therefore, the risk of aspiration.
2. Smaller tidal volume
  - a. 6-7 cc/kg when using oxygen
  - b. 10 ml/kg without oxygen - this yields the same level of oxygenation with lower risk to the patient, and amounts to just enough ventilation to see the chest begin to rise.

### B. Compression:

1. Ratio for adult rescue is 15:2 for one rescuer and two rescuer CPR.
2. Intubated patient ratios are unchanged.
3. The recommended rate in adults is increased to 100/minute.

The clinically significant changes to ACLS are as follows.

- A. **Amiodarone:** There has been much discussion about this change. The ACLS guidelines do not tell providers to use amiodarone in place of lidocaine. The option is available and the provider is encouraged to use the

medication with which they feel more comfortable. Some research has shown improved survival in the pre-hospital setting with amiodarone. This same research does not show any advantage in overall patient survival or outcomes.

The administration of amiodarone is more complicated as it requires the medication be drawn up with a filtered needle from two separate vials and mixed with saline. If one plans to use this medication, then *amiodarone packs* with each vial, saline, and filter needle (all taped together) should be utilized.

The American Heart Association strongly recommends *against* mixing anti-arrhythmic agents. When mixed they can become pro-arrhythmic.

Amiodarone is listed in all the tachycardia algorithms as useful.

- B. **Vasopressin** is listed as an alternative to epinephrine in the treatment of VF/Pulseless VT. This medication has a 10-minute half-life; therefore it is considered a “one time only medication” eliminating the repeated dosing necessary with epinephrine.
- C. **Magnesium** use is discouraged except in cases of known hypomagnesemia and Torsades de Pointe.
- D. **Alternating abdominal/chest compressions** are encouraged with ACLS providers. The recommended rate is 100 (each)/minute. I suggest you practice this before you try it on a patient; it is tougher than it looks.

# Efficacy of a Dry Fibrin Sealant Dressing for Hemorrhage Control After Ballistic Injury

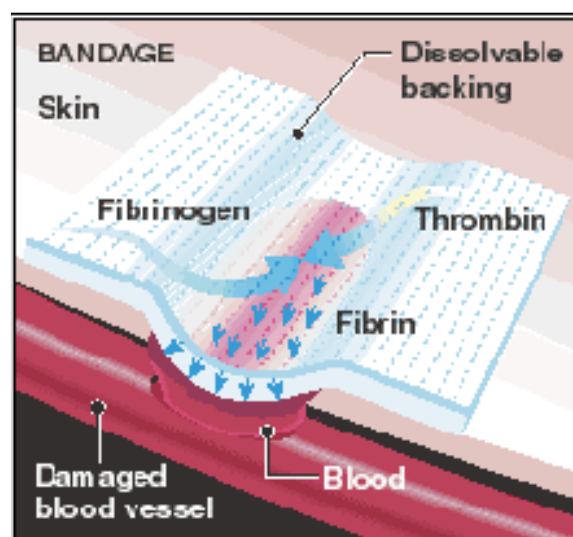
John Holcomb, MC; Martin MacPhee, Ph.D.; Stephen Hetz, IMC; Richard Harris, VC; Anthony Pusateri, MS; John Hess, MC; Robert Clayton, SVERDRUP

Article reprinted by authorization from Dr. John B. Holcomb, extracted from the Archives of Surgery, Vol 133, Jan 1998.

The Control of hemorrhage is a critical step in first aid and field trauma care. Unfortunately, the materials and methods available to stop bleeding in prehospital care (gauze dressings, direct pressure, and tourniquets) have not changed greatly in 2000 years. Even in good hands, they are not uniformly effective and the occurrence of excessive bleeding or fatal hemorrhage from an accessible site is not uncommon.

The dry fibrin sealant dressing (DFSD) was developed to overcome these difficulties. It consists of dry, powdered human thrombin and fibrinogen compressed into a removable backing. When pushed into a wound it coagulates on contact. A prototype was demonstrated to be effective in controlling hemorrhage from a linear incision in exposed femoral arteries.<sup>3</sup> However, it was not known if the DFSD would be effective in the face of a more complex ballistic injury. The wounding process creates a large, open complex wound associated with extensive bleeding and shock. We measured the ability of the DFSD to reduce bleeding and shock when compared to conventional treatment with a gauze bandage; both applied with equivalent direct pressure. This randomized, prospective study was conducted to determine if the DFSD was superior to standard gauze for maintaining blood pressure and decreasing blood loss after ballistic extremity injury.

A total of 18 goats were used in this study, with 9 goats in each treatment group. All animals sur-



vived in the study period without difficulty. A large exit wound (>10 cm) was present in 8 of 9 goats in each treatment group. Pressure was held on the entrance and exit wounds for two minutes. Because the DFSD was designed to stop bleeding from accessible sites and the intent of the study was to induce injuries with large exit wounds, the 2 animals with exit wounds smaller than 4 cm were removed from further consideration in the analysis of the study. A necropsy of the ballistically injured thighs revealed the following: the femoral artery was lacerated in all goats, a comminuted fracture of the femur was present in 7 of 8 goats in each group, and the femoral vein was lacerated in 7 of 8 goats in each group. After one hour blood loss was significantly decreased in DFSD treated animals. The complete article to include graphs and data relating to blood loss can be found on the Special Operations Computer Assisted Medical Reference System (SOCAMRS 2001).

## DFSD update:

As this Journal is being published the Medical Research and Materiel Command, The American Red Cross (ARC) and the Food and Drug Administration (FDA) are preparing the protocols to move the production and distribution of the DFSD for field applications under an Investigational New Drug (IND). The DFSD will now be referred to as the Hemostatic Dressing (HD). As a result of Homeland Defense and Operation Enduring Freedom initiatives, this program has accelerated the development and fielding of this capability.

The primary recipients of the DFSD during the initial protocols will be USSOCOM units. Information and training literature is being developed. All SOF personnel will be required to complete an informed consent form to participate in the protocols. The informed consent allows medical personnel to apply the DFSD to stop the bleeding of severe trauma injuries, which might otherwise result in loss of life or limb.

A complete copy of the protocols will be sent to each USSOCOM Component once the FDA approves them. Only human blood products will be used to manufacture the DFSD. The DFSD will be packaged in a soap dish-like plastic container and sealed,

then sealed again in a foil wrapper so that it might not be confused with a standard battlefield dressing. From the Department of Surgery (Drs Holcomb and Hetz) and Clinical Investigation (Drs Harris and Pusateri), William Beaumont Army Medical Center, El Paso, Tex; the American Red Cross Holland Laboratory, Rockville, MD (Dr MacPhee); and the Blood Research Detachment, Walter Reed Army Institute of Research, Washington, DC (Dr Hess).

**References**

1. LarsonMJ,BowersoxJC,LimRC, et al, Efficacy of a fibrin hemostatic bandage in controlling hemorrhage from experimental arterial injuries. Arch. Surg. 1995;130:420-422.



# U.S. Army Special Forces Diving Medical Technician Training

James D. Grady, MD

The U.S. Army Special Forces Underwater Operations School in Key West, Florida trains special operations medics in the medical care of combat divers. The course is academically challenging and includes instruction in relevant anatomy and physiology, neurological physical exam skills, pre-participation screening, recognition and treatment of diving injuries, hyperbaric chamber operations, hyperbaric oxygen therapy for non-diving conditions and a review of pertinent invasive medical procedures.

Military combat diving is an advanced special operations skill with unique risks. Medical personnel supporting combat dive operations require specialized training in the field of diving medicine in order to mitigate these risks and to provide prompt recognition and treatment in the event of injury. The U.S. Army Special Forces Diving Medical Technician Course conducted by C Company 2D Battalion 1<sup>st</sup> SWTG(A) USAJFKSWCS, Key West, Florida provides just such specialized training. Applications for Diving Medical Technician Training are accepted from Army MOS 18D, select 91B (soon to be 91W1W), Navy NEC of HM 8492, HM 5326, or Air Force AFSC 4N0X1.

Medical participation in all phases of special operations, from planning to recovery, is essential to mission success. This is especially critical in diving operations. Diving Medical Technicians (DMTs) are trained in pre-dive planning and preparation, dive operation support, and post-dive assessment and recovery.

Training in pre-dive planning and preparation is extensive. DMTs learn how to assess medical fitness to dive and how to administer diving duty physical examinations. They learn recovery and evacuation procedures and the need for pre-dive coordination with a manned hyperbaric chamber and a Diving Medical Officer. DMTs are trained to consider environmental factors such as temperature extremes, chemically or bio-

logically contaminated water, sonar hazards, and marine life and assess their impact on diving operations.

During diving operations a DMT's primary role is to monitor and react to hazardous situations and injuries. DMTs are trained in the diagnosis and initial treatment of all diving related injuries. They also receive instruction on lifesaving, victim recovery, and evacuation techniques.

Post-dive DMT training focuses on physical assessment of the diver and medical equipment recovery and resupply.

Upon completion of training a DMT understands the anatomy and physiology of the cardiopulmonary system and how it is effected by increased hydrostatic pressure. He can conduct a thorough neurological examination and determine the extent and treatment of injuries associated with pulmonary over-inflation syndromes and decompression sickness. Other diving related injuries the DMT is trained to diagnose and treat include hypothermia, inert-gas narcosis, hypercarbia, oxygen toxicity, carbon monoxide poisoning, arterial gas embolism, submersion incidents, and underwater blast injuries.

DMTs are trained in recompression chamber operations and learn to perform duties as inside tender, outside tender, and timekeeper. They receive instruction in hyperbaric treatment algorithms tables as outlined in FM 20-11-1 and FM 20-11-2 (U.S. Navy Diving Manual). DMTs also receive instruction on the indications of hyperbaric oxygen treatment for non-diving related medical disorders. In addition, they are also provided information outlining the steps required to obtain further civilian hyperbaric medical technician certification if desired.

Combat diving operations are hazardous and require specialized operator training and medical support. Combat Diving Medical Technicians provide the lion's share of this support.





James Grady, MD

Major Grady is currently assigned as the Diving Medical Officer, U.S. Army Special Forces Underwater Operations in Key West, Florida. He is board certified in Family Practice and is a 1995 graduate of the Uniformed Services University of the Health Sciences.

**References**

- Army Regulation 611-75 Management of Army Divers
- USASOC Regulation 350-20 C1 USASOC Dive Program
- FM 20-11-1&2 (U.S. Navy Diving Manual)
- U.S. Army Special Forces Diving Medical Technician Handbook



# Research and Development

## Biomedical Research and Development Update:

Mr. Robert Clayton, SVERDRUP

The USSOCOM Biomedical Initiatives Steering Committee (BISC) is funding biomedical research projects to assist in improving or enhancing mission performance. One of the strong points of the BISC is the direct link to the Component Surgeons. Each Component has a representative that provides operational concerns or mission needs of their respective organization at each quarterly meeting.

The first edition of the *Operation Medicine* (OpMed) CD-ROM was just released as was the *Special Operations Medical Handbook* (SOFMHB). Please note that on page A-50, of the handbook there is a point of contact for comments or suggestions. The intent of this page is to improve the future editions of the SOFMHB. If you have not received either the OpMed CD or the handbook contact your Group or Regimental Senior Medic.

The next program update will be in the Spring 02 Edition of the Journal.

### USSOCOM MEDTECH FY02 Funded Project Descriptions

#### Continuing Projects

##### ASDS/UBA

The lack of a DMO, Dive Supervisor, or Master Diver in the pressurized compartment of the *Advanced Seal Delivery System* (ASDS) will not allow the use of the NSW Dive Planner in its current format, so alternative means of calculating decompression obligation must be explored. The use of higher PPO<sub>2</sub>s in the breathing mix should be considered. The lack of a boat air option makes the presence of an emergency open-circuit air capability in the Underwater Breathing Apparatus (UBA) an important feature. This study will formally address these issues and new diving UBAs and techniques will be established as necessary.

##### BREATHING GAS MIXTURES EFFECTS ON DCS WITH AC-130H AND CV-22

This project documents the impact on SOF mission performance due to *decompression sickness* (DCS) symptoms resulting from oxygen regulator 'normal' setting on extended AC-130H/MV-22 operational missions. The study recommends DCS protection strategies for SOF aircrew.

##### CAPRINE ANALGESIA STUDY

Extensive soft tissue combat trauma injuries in remote locations may require a regimen that keeps wounded individuals pain free, or experiencing no more than minimal pain for five to seven days while allowing for second intention healing following extensive soft tissue trauma. Ideally, the pharmacological agents used will be shelf stable and can be administered in a field environment with a minimal amount of specialized equipment. This study will develop an animal model (caprines) to determine recommended protocols.

##### EFFECTS OF INJECTABLE HEMOSTATIC DRUGS

Optimal hemorrhage control represents the single greatest area where SOF medics can influence the traditionally high killed in action (KIA) rate. These hemorrhagic deaths can be divided into truncal and extremity type wounds. Extremity wounds are amenable to direct pressure, tourniquets and new improved hemostatic dressings. Truncal hemorrhage accounts for up to 90% of all hemorrhagic deaths on the battlefield. New methods of hemorrhage control for truncal wounds are required. This study will evaluate the effects of rFVIIa (injectable hemostatic drug) after severe soft tissue trauma.

##### LASIK IN SPECIAL OPERATIONS BUD/S

This project determines the effects of laser in-situ keratomileusis (LASIK) on SOF visual performance and determines the integrity of LASIK-treated corneas. This study will develop recommendations regarding LASIK and relative effects on SOF mission performance for BUD/S prospective candidates.

##### OPERATIONAL MEDICINE CD-ROM

The conventional training of some medical providers assigned to operational billets is insufficient to fully prepare them for their operational role. Due to limited resources, time constraints, and unexpected changes in billet assignments, conventional training commands are unable to fully train all medical providers in all aspects of operational medicine, nor can they

provide complete, standardized refresher training to all those who require this training. This project develops a CD-ROM consisting of clinical text materials, photographs, video clips, sound files, reference materials, and a testing feature (correspondence course) to evaluate competence.

### **SPECIAL OPERATIONS MEDICAL HANDBOOK (SOFMHB)**

The SOFMHB was published in June 2001. Distribution should be complete. It is very comprehensive and designed to address most medical situations. It is bound with rings so pages can be added or removed as necessary. The paper is waterproof and tear resistant. There have been some reports that the ink on the cover runs when wet. NOTE: a pen and ink change on page 5-151, table 5-9, column 1, row 1; Intoxication should read *Withdrawal*. There will be an electronic version of the SOFMHB, which includes a diagnostics and patient encounter-recording module. This is scheduled to be completed and distributed in December 2001.

### **ORAL FLUOROQUINOLONE PROPHYLAXIS IN COMBAT TRAUMA**

A number of potential issues for improving battlefield care for combat casualties were raised following Mogadishu. One of these issues was the need for antibiotics to be administered as soon as possible after wounding. This was not done in Mogadishu and there was a high incidence of wound infection that followed the prolonged evacuation time for the casualties in this engagement. The fluoroquinolone class of antibiotics offers the advantage of good bioavailability following oral administration combined with excellent spectrum of action. This study will make specific recommendations regarding the use of oral fluoroquinolones in both penetrating abdominal trauma and penetrating extremity trauma with associated fracture.

### **PROTECTIVE BARRIER SUBSTANCES FOR COELENTERATE ENVENOMATION**

Coelenterate envenomation (Jellyfish) is a frequent hazard during Special Operations combat swimmer missions. The injury to an unprotected diver may range from minor skin irritation to cardiovascular collapse and death depending on the species of coelenterate involved and the extent of the envenomation. Wet suits and dive skins offer substantial protection against envenomation, but there have been recent concerns about heat injury from diving in very warm water in the Persian Gulf. This study will address the option of us-

ing a barrier substance that would protect the skin from nematocyst contact.

### **SOF MEDICAL SKILLS UTILIZATION STUDY**

The study describes the frequency and distribution of SOF medical disorders encountered, prescribed medicines, and laboratory tests performed by SOF medics while deployed. This study develops a database of SOF operational medical requirements by unit type and evaluates SOF medical training based on collected data.

### **SPECIAL OPERATIONS COMPUTER ASSISTED MEDICAL REFERENCE SYSTEM (SOCAMRS)**

SOCAMRS converts medical reference data pertinent to *Special Operation Force* (SOF) missions from hard copy to a self-contained, user-friendly multiple CD-ROM set. Updates to the SOCAMRS are through the research transformation of hard-copy biomedical data to optical media for USASOC, AFSOC, and NAVSOC. SOCAMRS provides a method for Special Operations medical personnel and medics to access relevant biomedical reference documentation during remote deployments.

### **WARM WATER DIVING STUDIES**

This study collects and analyzes data selected from SOF community norm to assure accuracy in future studies in comparisons between performance of research subjects and the community norm, as well as between pre- and post-intervention scores in the Mission Related Performance Battery. It provides recommendations regarding thermal exposure limits, appropriate hydration/rehydration strategies, and clarification of storage limits of Sofnolime for SOF divers in warm water and hot air environments. This study determines relative effects of SOF diver dress in relation to warm water and extreme heat environments.

## **NEW STARTS**

### **2001-1 IMMERSION PULMONARY EDEMA**

This studies incidents of *immersion pulmonary edema* (IPE) that are reported sporadically in the medical literature, but are being seen with increasing frequency in SEAL training. Medical personnel at the Naval Special Warfare Center estimate the current incidence rate at approximately 30 cases per year, with the preponderance of cases occurring in phase one of BUD/S. This incidence exceeds any other series reported in the medical literature. Affected indi-

viduals present with dyspnea, cough, rales, and hemoptysis. Chest radiography shows the classical picture of pulmonary edema and pulse oximetry demonstrates decreased hemoglobin oxygen saturation. The condition typically resolves without sequelae but may progress, especially during Hell Week. Some individuals have been dropped from BUD/S training because of recurrent episodes and the possibility of permanent injury to the students must be considered.

#### **2001-2 PULMONARY O<sub>2</sub> LIMITS**

This study looks at the feasibility of extending the daily maximum oxygen exposure limit of SDV Teams from four hours to six hours. This request stems from their desire to conduct two 3-hour dives per day during the Combat Swimmer portion of SEAL Tactical Training. This extension would significantly enhance the quality of Combat Swimmer training.

#### **2001-3 TREATMENT STANDARDS FOR DCS/AGE**

Special Operations are often conducted in remote areas where there may be a significant delay in access to recompression facilities for the victims of decompression sickness and gas embolism (DCS/AGE), with an accordingly higher probability of severe or refractory disease as a result. This study forms a standing *Undersea Hyperbaric Medical Society* (UHMS) committee to review the literature on treatment of decompression sickness and gas embolism and make recommendations for therapy based on the best clinical series, case reports, and animal studies available. Special emphasis in this review will be placed on the pre-recompression phase of treatment, which may be prolonged in Special Operations and recommendations for specific animal trials that will study the most promising new treatment modalities or otherwise enhance SOF ability to treat dysbaric disorders will be provided.

#### **2001-4 MISSION RELATED PERFORMANCE MEASURES UPGRADE**

A microprocessor supported standard battery of tests to measure these factors was constructed and named the SOF *Mission-Related Performance Measures* (MRMP). The SOF MRMP was then validated in field-testing. It has since been used to measure changes in performance resulting from a variety of physical stressors and physiological enhancements. The equipment and software used in the SOF MRMP is now in need of upgrading. There is also a need to enhance the exportability of this system to other labora-

tories that are performing studies in support of SOF. This study upgrades the marksmanship weapons and controlling system, the central data acquisition software, the individual cognitive battery laptops, the cognitive battery software and employs an individual who will be available to take the MRMP battery to other labs and field locations where required.

#### **2001-5 COLD WEATHER CONFERENCE**

Special Operations Forces operating in cold climates face significant additional challenges in the execution of their mission. Operators must have special equipment, clothing, nutrition/hydration strategies, and casualty management techniques. While the military routinely conducts training and equipping of forces for cold climates, the equipment and physiological strategies employed do not necessarily reflect the latest developments in the civilian sector. A workshop will be conducted to review the state of the art of military operations in cold climates. The workshop will include an invited panel of experts in cold-weather operations and medicine.

#### **2001-6 IMPROVING SOF MISSION PERFORMANCE (MSN COMMANDER TRAINING PACKAGE)**

This conducts a review of the medical literature and material in the Special Operations Computer-Assisted Medical Reference System (SOCAMRS) and prepares a concise set of specific recommendations regarding techniques for SOF units during operations. The recommendations address a number of SOF Specific operations, and for each type of SOF operation, provide a list of recommendations regarding strategies to optimize SOF operator performance. The results will then be made available to SOF mission commanders in a format suitable for training at the unit level.

#### **2001-7 ANTIBIOTIC PROPHYLAXIS**

Same as Oral Fluoroquinolone Prophylaxis in Combat Trauma. This study will be comprised of an expert panel and should convene within the next three months.

#### **2001-8 TELECONSULTATION IN SOF**

With SOF units deployed worldwide, SOF physicians, PAs, and combat medical personnel often find themselves in remote locations with little medical support. Should a SOF operator become critically ill or injured, difficult decisions regarding diagnosis, treatment, and evacuation of the casualty must at present be made without access to medical specialists and sub-

specialists who could provide valuable guidance concerning the management of the patient. The presence of worldwide satellite communications and DOD medical specialists who can be reached through a pager make it possible to overcome this shortfall. This study provides specific recommendations on the feasibility and desirability of establishing this capability for SOF and develops a presentation suitable for briefing SOF Commanders on the results of this project.

### **2001-9 SOF PERFORMANCE ENHANCING DRUG PROTOCOL**

Various drugs have been proven to enhance the performance of the personnel during extended operations but they require an extended amount of time to recuperate post mission. Commanders are reluctant to authorize the use of this class of performance enhancing drug due to “the payment at the other end” ; the extended recuperation time at the end of the mission profile. This study reviews the medical literature and material to determine the best drugs to meet the requirement of mission enhancement with the minimum of side effects and recuperation at the end of the mission profile to enhance the performance of Special Operation personnel.

### **2001-10 OPERATIONAL USE OF ADRAC (ALTITUDE DECOMPRESSION SICKNESS RISK ASSESSMENT COMPUTER) FOR CV-22**

Alternative methods to prevent DCS, other than pre-oxygenation at ground level have been published, but lack a body of experience to validate proposed procedures. A means to record, organize, and accumulate this experience is needed, especially in SOF aircraft which expose aircrew and passengers to high altitude. To fully exploit the operational capabilities of these aircraft, the capability is needed to document and assess DCS events while in the operational setting in order to refine the efficacy of planned DCS prevention strategies. In addition, the capability is needed to enable operators to predict DCS risk in order to permit enroute mission planning. This study develops methodologies of using ADRAC to record the flight exposures experienced by SOF aircrew and passengers, index when DCS symptoms appear and resolve, and sense/record the percent oxygen presented in the breathing gas on a real-time basis to develop treatment protocols for DCS for SOF.

### **GRADUATE RESEARCH STUDY**

This project encourages future involvement in SOF medicine and medical R&D by providing funding to graduate students conducting research in areas that could enhance SOF medical operations. Results of the graduate studies are then applied to focus future direction of SOF medical R&D efforts.





## Relieving Painful “Shin Splints”

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### Abstract

Shin splints, or more precisely, medial tibial stress syndrome (MTSS), are painful and troublesome. Despite treatment or activity modification, they often recur. Distinguishing MTSS, the most common running overuse injury, from other overuse injuries, can help focus treatment, which starts conservatively. Recommending activity modification, ice massage, NSAIDs, and stretching is a good first step. Patients who do not respond to treatment may need additional diagnostic workup and more restrictive activity guidelines.

**Editors Note:** This article was previously published on the Special Operations Computer Assisted Medical Resource System (SOCAMRS) Disc .

The running boom of the 1970s and early 1980s may have leveled off, but millions of runners still hit the pavement everyday. Overuse injuries, especially medial tibial stress syndrome (MTSS), are common among runners and are seemingly an inevitable part of the sport.<sup>2,3</sup> Participants in any sport that involves running and jumping can develop MTSS, but this injury is most common among runners. For example, 35% of the runners in a one-year study by Koplan et al incurred a musculoskeletal injury that was severe enough to require a mileage decrease.

Most overuse injuries in runners are sustained to the lower extremity.<sup>5</sup> Injuries include various types of tendinitis, stress fractures, chronic exertional compartment syndromes, plantar fasciitis, patellofemoral syndrome, and iliotibial band syndrome. However, shin splints are the most common running injury, with incidences ranging from 13% to 19.5% of injured runners.<sup>6-8</sup>

Running injuries are understandable, considering that with each stride, the runner’s leg absorbs two to three times his or her weight, and it takes more than 1500 strides just to cover a mile.<sup>9</sup> The accumulated impact of repetitive microtrauma, rather than a

single traumatic event, generally causes MTSS and other overuse injuries.

### Defining Shin Splints

The public uses the term *shin splints* to describe any type of anterior or medial pain in the lower leg. In early medical literature, shin splints was similarly used to mean pain and discomfort in the anterior part of the patient’s lower leg from repetitive overuse conditions.<sup>10</sup>

This definition, however, is too broad. To clarify and standardized the definition, the American Medical Association subcommittee report on the classifications of sports injuries described shin splints as pain and discomfort in the lower leg from repetitive running on hard surfaces or forcible, excessive use of the foot dorsiflexors. The group states that clinician should limit the term “shin splints” to musculotendinous inflammations and exclude fractures and ischemic disorders.”

The term that better defines the injury is *medial tibial stress syndrome*, which encompasses pain not associative with a stress fracture or compartment syndrome.

Most authors agree that a stress reaction of the fascia, periosteum, bone or a combination of these

along the posterior medial aspect of the tibia causes the syndrome. Periostitis of the posterior tibial muscle can develop along its attachment on the posterior tibia,<sup>13</sup> and periostitis of the soleus muscle and its investing fascia can develop along the posterior medial tibia. Pain results from soft-tissue damage with the resulting inflammation from continued activity.

### Diagnosis by Degree

The presenting symptom of a patient with MTSS is pain along the medial aspect of the distal third of the tibia, as opposed to anterior tibialis muscle pain from stress fracture, which is more proximal and lateral to the tibia. Patients usually describe MTSS pain as a dull ache with varying intensity. Often, they first notice a discomfort when beginning their workout. As with many overuse injuries, the pain may disappear during activity and return after the workout. As a patient's injury becomes more severe, the discomfort lasts longer into the run; it eventually persists through the cool down and into daily activities and can localize to become point tenderness.

Obtaining a thorough history from the runner can help determine the factors that contributed to the injury. Areas to assess on a workup of an athlete with suspected MTSS are:

1. Physical characteristics, such as the athlete's age, gender, body build, and foot alignment; for example, excessive pronation of the subtalar joint at heel strike;
2. Training habits, including distance, speed, form, and stretching; and
3. Running environments, including terrain, weather, time of day, and the type of shoes worn.<sup>15</sup>

**Physical examination.** On exam, there is an area of tenderness several centimeters square over the posterior medial edge of the patient's distal tibia. Palpation may indicate mild induration and/or swelling; however, the exam usually reveals only tenderness and no other physical findings. It is important to distinguish pain on the tibia itself from pain of the surrounding soft tissue. Pain localized to the tibia suggests a stress fracture, whereas pain in the surrounding soft tissues suggests MTSS.

**Differential diagnosis.** The differential diagnosis of MTSS includes stress fractures and chronic exertional compartment syndrome. Stress fractures arise when repetitive muscle action or mechanical impact loading causes repeated subthreshold injury, over-

whelming the bone's ability to repair itself. A stress fracture of the tibia often presents with greater induration and MTSS along with erythema, warmth, and point tenderness. Percussing the proximal tibia away from the painful area evokes pain when a stress fracture is present, but pain from percussion is not as common when the patient presents with MTSS. The relationship between stress fracture and MTSS is not clear, and radiographic differences can be hard to distinguish. (see Case History).

Chronic compartment syndrome has symptoms that are similar to claudication. Exercise raises the pressure in the close compartment enough to decrease perfusion, which produces leg pain, paresthesia, and muscle weakness.<sup>13,17</sup> Tissue perfusion in a normal patient is 8 to 10 mm Hg. Exercise may acutely raise the pressure to 50 mm Hg, which returns to normal within five minutes after exercise. Patients who had exertional compartment syndromes show elevated pressures that can sometimes exceed 75 to 100 mm Hg. Pressures may remain elevated above 30 mm Hg after exercise; persistent pressures above 40 mm Hg may require surgical decompression. Most instances of chronic exertional compartment syndrome of the lower extremity involve the anterior tibial compartment. Neurologic or vascular abnormalities that occur with a chronic compartment syndrome will essentially rule out MTSS as a primary concern.

**Diagnostic workup.** As a general rule, diagnostic evaluation is warranted if symptoms persist despite conservative treatment. Initially, x-rays may reveal some stress fractures. An x-ray can show a fracture line or a callus from a stress fracture within two weeks of injury. However, even when stress fractures are present, x-rays are often normal. The radiologic diagnosis of stress fractures is best made by noting increased uptake on a bone scan. According to McKeag and Dolan, by the time a patient experiences pain, the bone scan is positive 75% to 95% of the time. However, uptake will also be increased with a major musculotendinous inflammation and periostitis, in addition to bone microtrauma.

When a patient has MTSS, the bone scan reveals a fusiform, longitudinal area of variably increased tracer uptake at the posterior tibial cortex that involves one-third or more of the bone length. Tracer uptake varies in intensity along the length of the lesion. Shorter areas of more intense radiotracer uptake typify the appearance of stress fractures.

## Pain Relieving Strategies

The goal of treatment for patients who have MTSS is to functionally rehabilitate the lower leg while avoiding the repetitive stresses that caused the injury. Classifying overuse injuries like MTSS helps organize diagnosis and treatment.<sup>9,20</sup> Puffer and Zachazewski<sup>20</sup> group the injuries into functional pain categories according to when the pain occurs and how it restricts activity. Each group has a specific treatment plan that includes rest, therapeutic modalities, medications, and rehabilitation.

Initially, treatment is conservative. Patients who don't experience pain while running may continue to run. Advise these patients not to overlook warm-up and cool-down activities if their condition allows them to continue running. These measures may help prevent muscle strains. Ten to 15 minutes of easy running before a workout or at the start of a long run is one good warm-up strategy. The same activity is also a good cool-down exercise. However, any running is painful for many patients who have MTSS.

*Switching activities* until the athlete can resume running without pain allows time for the injury to heal. Non-impact, symptom-free exercises such as exercise cycling, using a stair climber, or swimming are good options. As symptoms decrease, alternate activities can include treadmill running or running on flat, even surfaces. If running elicits pain, advise switching to another activity until the patient is pain free.

*Symptom-free stretching* of both the anterior and posterior musculature is very important for recovery. Stretching not only maintains or improves joint mobility, but also can increase muscle and tendon strength, enhance coordination, and adapt the musculoskeletal system to the demands of a specific sport. Stretching exercises for a patient who has MTSS should target the gastrocnemius, soleus, anterior and posterior tibial muscles, and the peroneus brevis and longus. Instruct the patient to slowly move the ankle to the end of its range of motion, but within the area of pain tolerance, then hold the position for 5 to 60 seconds. The patient should do 10 repetitions of each exercise several times a day. Strengthening can be accomplished by adding resistance to the range of motion exercises with surgical tubing, elastic bands, or with a partner's help.

*Icing and anti-inflammatory medications* can reduce inflammation and relieve pain. We asked patients to massage the painful and tender area with ice for 8 to 10 minutes, two to three times per day,

particularly after a work out. Because of the inflammatory nature of muscular strain syndromes, we usually prescribe nonsteroidal anti-inflammatory medications (NSAIDs) for our patients who present with pain from MTSS. The NSAID regimen typically lasts two weeks to one month.

*More aggressive measures* are needed to relieve muscle stress if a runner has not responded to the initial conservative treatment after one month or if symptoms are present during the patient's daily activities. No running is allowed, and the patient should only perform activities that don't cause pain or discomfort; for example, cycling or swimming. If the patient develops point tenderness, further diagnostic evaluation, such as a bone scan, is warranted.

Immobilization may be needed to prevent injury recurrence and to prevent the patient from performing weight-bearing activities too soon or too rapidly after injury. The simplest way to avoid these problems is to ask the patient to wear a walking boot on the affected leg, which allows him or her to walk without crutches while eliminating stress on the lower leg. Specify that the patient refrain from any weight-bearing exercise and that he or she must be free of symptoms before resuming exercise.

## Starting Running Again

If the athlete tolerates alternate activities and rehabilitation within four to eight weeks, he or she can ease back into a running routine, perhaps every other day, alternating with non weight-bearing exercise for two to three weeks. During rehabilitation, runners may become frustrated about the impact of MTSS on their training schedules. Physicians and trainers can help athletes fill the void by giving them a written treatment and rehabilitation prescription and asking them to keep a detailed logbook of their activities and progress.

Tell patients that their goal should be to remain pain free while starting slowly and gradually increasing their mileage and intensity. Speed and mileage increases are variable and depend on how much an athlete was running before the injury. Asking a runner to run for a set time will prevent him or her from thinking about specific speed and distances.

Runners should know that injury recurrence is common, so explain the factors that caused the injuries and let them know how they can modify their training habits. When talking to athletes about their training habits, it may be useful to remind them about

“the rule of toes”: don’t run too much, too soon, or too fast, and make sure your shoes are not too old. Instruct them to examine their shoes for breakdown on the medial side and for abnormal wear patterns. Often, runners continue training in worn-out shoes. How long a shoe retains its shock absorbing abilities is not known, perhaps as little as 300 miles. Shoes with holes in the uppers or worn soles have clearly outlived their use.

Alternating two pairs of shoes, perhaps two different brands, will help shoes last longer and prevent the feet from taking the same stresses on every run. Runners who severely pronate may need orthoses; however, newer shoes have good motion-control features. Simply changing shoes may be sufficient. Many runners with MTSS have pes planus, which puts extra stress on the posterior tibial muscles and the flexor digitorum longus tendons.

### Keep a Simple Approach

It is not always necessary to do an exhaustive diagnostic workup when the patient presents with the first signs of MTSS. A simple protocol involves treating MTSS like other overuse injuries with rest, NSAIDs, ice massage, non-impact exercises, and a controlled return to pre-injury activity. Most of these injuries will resolve with initial conservative treatment, which saves the patient effort, time away from running, and money. But some patients will have more severe forms of the syndrome and will benefit from extra interventions.

## Case History

A 20-year-old male collegiate runner presented with bilateral medial shin pain. The pain had been present for about one week and began when he started training on the indoor track. Before the onset of pain, he ran about 60 miles per week on grass and roads. The pain occurred early in his run and prevented him from completing his workouts. The athlete told us he had had a similar episode two years prior to this one.

The physical exam initially revealed diffuse tenderness on the distal medial aspect of both tibiae that was not localized to bone or soft tissue. No erythema or swelling was present, and he had normal alignment, full range of motion, and normal foot strength.

X-rays of the patient’s lower legs were normal. His bone scans from two years earlier were

positive. We ordered a bone scan again because his condition progressed to point tenderness and activity restriction. The bone scan was positive, and radiologists identify bilateral increased uptake that suggested periosteal involvement, but the uptake amount wasn’t as great as usually found in stress fractures.

It was unclear if he had MTSS, stress fracture, or combination of both, so he was treated as if he had soft tissue and bone involvement. Treatment and rehabilitation followed a conservative course (see *pain relieving strategies* in article) of relative rest with alternate activities, ice, stretching and strengthening, and medication. We advised the patient not to run for three weeks. During that time, we suggested he ride his mountain bike, run in the pool, and use a stair climber. On our recommendation, he iced his leg after workouts, took a nonsteroidal anti-inflammatory medication, and stretched and strengthened his lower leg muscles with resistive range of motion exercises.

The first week the patient resumed running, he ran one to two miles per day on grass. The second week he ran on five days for a total of 20 miles and continued stretching, strengthening, and icing his leg. Over the next two weeks he maintained pain free running by slowly increasing his mileage to about 40 miles per week. He was back to his regular mileage and intensity in about 10 weeks.

During the final phase of treatment, we reviewed his training log and helped him develop a strategy to prevent injury recurrence at the start of the next year’s indoor track season. His injuries were probably caused by switching too quickly from a soft grass surface to a harder, synthetic indoor track that has sharper turns. The athlete plans to slowly incorporate indoor running as the outdoor cross-country season winds down. He will keep his distance to a minimum when he begins training on the indoor track.

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# Primer on Army SOF Deployment Medical Surveillance

Mitch Meyers, MD, MPH.

## ABSTRACT

**In recent years the US Armed Forces have begun a concerted campaign to improve the accountability and record keeping used for the medical surveillance of military forces deployed overseas. Now that the technology is in place and reporting policies approved, the responsibility for learning and implementing the new requirements for deployment medical surveillance rests upon the military health care provider. The standards for USSOCOM personnel differ significantly from other military units. This article was written to familiarize SOF HCPs with our somewhat unique requirements for deployment medical surveillance.**

## Introduction

In the early 1850s, cholera was a little understood yet greatly feared disease in Victorian England that caused the death of a great many people. Many prominent British physicians attributed the disease to “Miasmata” arising in the air near the River Thames. This belief was challenged by John Snow whose surveillance and epidemiologic study of cholera cases in London allowed him to characterize the epidemic in terms of person, place, and time. His investigation led him to the conclusion that there was something in the water taken from the Broad Street pump that was responsible for the illness. His active surveillance efforts following the removal of the pump handle showed a dramatic decrease in cholera incidence.

The cause of this outbreak, *Vibrio cholerae*, would not be discovered by Robert Koch until 1883, but Snow’s efforts undoubtedly saved many lives in the interim. His efforts also set the stage for a medical revolution that resulted in modern epidemiology and helped supplant the dominant miasma theory of disease with the germ theory popularized by Pasteur and others one decade later.

Today we are still surrounded by invisible and as yet unidentified threats in the form of microbes, chemicals, radiation, etc. In many ways we are just as ignorant as John Snow was when he started his investigation, for despite years of use, we still know very little of the long-term risks posed by routine exposure to many common vaccines, medications, foods, cosmetics, pollutants, household and industrial chemicals, etc.

Consider that just a few decades ago it could have been hard to convince many military commanders and even scientists that there were significant health threats presented by associations between:

- Smoking and numerous life threatening health effects
- Asbestos and mesothelioma in mechanics and ship builders
- Firing ranges and high frequency hearing loss
- Lead paint and CNS disorders
- Military deployments and poorly understood “post-deployment syndromes”

It has only been 32 years since the US Surgeon General made the premature statement that it was time to “*Close the book on infectious diseases*”. Since then we have seen the emergence of new diseases and multi-drug resistant organisms, and we have lived under the threat of NBC warfare and terrorist CB actions. We have seen that the causes of disease may be very complex and multifactorial. Increasingly, we find that identifying their etiology requires the use of more sophisticated epidemiological studies and active surveillance methods than were previously available to us before the computer revolution.

Many of the tragic harmful health effects from environmental exposures our service members have been subjected to in the past may have been averted much earlier if only we had more effective health surveillance systems in place. Realizing this, military leaders are now taking a very proactive position on medical surveillance and several new directives have been issued to our service members on this subject in the last two years. As our organizational surveillance structure and technology is being established, it is now time for military healthcare providers to actively participate in the system.

The purpose of this paper is to familiarize Army SOF healthcare providers with the concept and importance of medical surveillance, and to discuss current reporting practices mandated in the recently published USSOCOM Directive 40-4.

### **Deployment Medical Surveillance**

Surveillance is generally considered to be the foundation of public health disease identification and control efforts. It helps us to identify disease outbreaks and evaluate disease control interventions. It is a vital component of casualty prevention, which is one of the three pillars of our Force Health Protection program. Medical surveillance can be defined as:

“The regular or repeated collecting, analyzing, and disseminating uniform health information for monitoring the health of a population, and intervening in a timely manner when necessary. It is defined by the Centers for Disease Control and Prevention as the ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link of the military medical surveillance system is the application

of these data to disease and injury prevention and control.” (DODI 6490.3)

The term “Deployment Medical Surveillance” (DMS) is often used interchangeably with the term “Deployment Health Surveillance” (DHS) among the services. These terms expand on the previous definition in that they include “enhanced methods of systematically and continuously collecting information on personnel before, during and after a military operation, to include the full cycle of pre-deployment, deployment, employment, and post deployment activities, encompassing “cradle to grave” service member record keeping to reflect health events as well as potentially adverse health exposures.” (USSOCOM Dir 40-4)

Currently, for most service members DMS is initiated while participating in a deployment resulting from a JCS/unified command deployment order for 30 continuous days or greater to a land-based location outside the United States that does not have a permanent US military medical treatment facility. (MCM-251-98) Usually this will only occur during major deployments identified by the Chairman of the Joint Chiefs of Staff.

Most OCONUS SOF missions are not performed in conjunction with major deployments, and US MTF’s are usually not available. Due to our small signature, high operations tempo and often clandestine missions in underdeveloped third world countries where exotic diseases may be highly endemic and environmental contamination extensive, SOF operatives are likely to find themselves at greater risk for exposures than their conventional counterparts.

Perhaps for these reasons, DMS requirements for USSOCOM personnel are somewhat more stringent than for regular units. Per USSOCOM Directive 40-4, deployments that require medical surveillance include all principal special operations missions and all special operations collateral activities that are outside the United States regardless of length of stay. This could include exercises and individual deployments. Aircraft and naval deployments, however, may be exempt if the mission does not involve landfall or potential significant exposures.

The likelihood of having a significant exposure is influenced by many factors such as military occupation, location, duration, season and number of personnel present. Based on analyses of health risk to deploying soldiers, commanders and health care providers must determine in advance how extensive their surveillance efforts should be.

Basic to extensive DMS efforts can include:

- Identifying the population at risk (through, but not limited to, pre- and post-deployment health assessments)
- Recognizing and assessing hazardous exposures (medical, environmental, and occupational)
- Employing specific countermeasures
- Monitoring health outcomes (through weekly DNBI reporting)

Required actions for soldiers and HCPs may be best addressed in a chronological sequence divided into three phases: pre-deployment, deployment, and post-deployment.

### **Pre-deployment**

The pre-deployment phase is the ideal time to assure that soldiers are medically prepared prior to departure. SRP health record and medical readiness screening using DA Form 8007-R or USASOC Form 1026-1-R should be performed.

TB skin testing with PPD should be done within 12 months prior to the deployment. TB converters are exempt, but assure that they have the date and results of their last negative and positive TBST along with any therapy they may have received properly documented in their medical records. Soldiers who are recent converters and still undergoing a standard regimen of INH or Rifampin may deploy with their remaining course of medication. A copy of their last liver function test (LFT) should be in their medical records. Soldiers undergoing multiple drug regimens for active TB are probably not contagious, but it is not recommended for them to be sent on routine deployments.

Soldiers should have a HIV test taken as per AR 600-110 (Identification, Surveillance, and Administration of Personnel Infected with Human Immunodeficiency Virus). However, it usually must be taken within 12 months of deployment rather than the 24 months or less stated in AR 600-110 and on DD Form 2795 (Pre-Deployment Health Assessment). After being tested for HIV antibodies, the remaining blood drawn for this test is automatically sent off for storage at the DoD Serum Repository (DoDSR) where it may be used later for clinical and seroepidemiologic investigations.

Pregnancy testing with a serum HCG is required for female service members processing for deployment. To assure the greatest possible validity, it should be drawn within 48 hours of the actual deployment. Females should ideally be asked if they

have any concerns about birth control, and if they are taking BCPs, whether they have an adequate supply to last the expected duration of the deployment.

Prophylaxis determination and administration must be planned and coordinated. Vaccines should be ordered and given in a timely manner, especially if booster doses are necessary. Malaria prophylaxis with Mefloquine should start one to two weeks before deploying to an endemic area. Chemoprophylaxis with Doxycycline should begin two days before arrival. To increase compliance, soldiers should be briefed thoroughly on the importance of taking the pills, how to recognize adverse reactions, and for doxycycline, avoidance of excessive sun exposure. Soldiers who will need to take Primaquine for terminal prophylaxis can be tested for glucose-6-phosphate deficiency. Non-pharmaceutical interventions such as permethrin treated uniforms and bed netting must also be purchased and issued.

This phase marks the beginning of the medical threat analysis that should continue throughout the deployment since surveillance will be an ongoing process. Conducting a pre-deployment site survey may be indicated at this time to help preventive medicine personnel anticipate health risks and prepare countermeasures. These measures will then be presented in the pre-deployment health threat briefing that they give.

Completion of the DD 2795 Pre-deployment Health Assessment Form within 30 days prior to deployment is now required for all USSOCOM members or personnel deployed outside the US for any duration of time. Understandably, SOF medics won't like the extra paperwork, but they could be doing their soldiers an injustice if they fail to perform these required duties. It is important that this form be filled out as clearly as possible, using block letters since a copy of it must be sent to the USSOCOM HQ where it will be scanned and sanitized before being forwarded to its final destination at the USACHPPM. The original will be placed in the SM's permanent health record.

### **Deployment**

This phase requires a great deal of coordinated activity in order to assure that health risks are identified and minimized. Preventive measures may include monitoring and enforcement of:

- Field sanitation and hygiene measures
- Rodent and pest surveys
- Food Service inspections
- Combat and non-combat stress control actions

- Prophylaxis use (all kinds)
- Medical intelligence gathering and dissemination

Medical surveillance specific measures may become quite complex depending on the characteristics of the mission. If so, unit surgeons may request the formation or assistance of a deployment health surveillance team to assist in tasks such as environmental monitoring for possibly contaminated air, soil, or water and radioactive waste products, or conducting industrial exposure surveillance for the Special Operations Debriefing and Retrieval System. (SODAR)

For most SOF deployments basic surveillance measures should suffice. Completion of the following forms and duties is required during USSOCOM OCONUS deployments.

SF 600s should be used to document all patient encounters. Originals are placed in the SM's deployment medical record and should be transferred to their permanent record upon their return.

USCINCPAC Form 6200/1 (Figure 1) is the Weekly DNBI Reporting Form for Joint Deployments. It is used to quantify and identify trends in injury and illness rates. Completed forms should be forwarded to the USSOCOM HQ on each Monday of a deployment.

The Reportable Medical Events System Data Collection Form should be used to document all cases of illness or injury specified in the Tri-Service Reportable Medical Event List (Figure 2). The Army Medical Surveillance Activity will subsequently enter the information into the Defense Medical Surveillance System database that is utilized by all the services for further analysis and reporting.

DD 2796, the Post-deployment Health Assessment Form must be completed while service members are still deployed, yet within a five day window of returning to their duty or processing stations. The form must be reviewed by health care personnel and followed up by a medical examination if indicated by the responses on it. The original completed form is to be placed in the permanent health record (HREC), and a good copy forwarded to USSOCOM HQ within 30 days.

### **Post-deployment**

In this phase the deployment may be over, but the surveillance and paperwork isn't.

Preventive medicine personnel should distribute medical information sheets and perform a debriefing to determine known medical threats encountered

during the deployment and countermeasures that may need to be continued after the deployment such as malaria prophylaxis with primaquine.

Unit surgeons should ensure that:

- All patient encounters were documented on SF 600s and get placed in the SM's permanent medical record at home station
- Appropriate malaria chemoprophylaxis is continued
- TBSTs are performed after deployment to highly endemic areas. *Mycobacterium tuberculosis* has a latency period of up to 70 days, so testing is ideally performed between 12-24 weeks after redeployment
- DoDSR serum sampling is performed if required by the CINC, because of expected or known disease threats. HIV testing is somewhat limited by resource constraints, and there is no specific requirement for post-deployment HIV testing. Proactive surgeons, however, may encourage high-risk behavior personnel to seek medical screening for this or other STDs during the debriefings.
- All suspected or confirmed environmental exposures are documented in the AAR
- Medical lessons learned are forwarded to the appropriate Lessons Learned system

### **Future Trends**

Our surveillance systems have come a long way since Dr. John Snow did his cholera outbreak investigation a century and a half ago which earned him a reputation as the father of modern epidemiology. As we are constantly learning more about environmental health threats, better technology is increasing our ability to send, receive, store and analyze health surveillance data. Used appropriately, this data can play a significant role in reducing the excess morbidity and mortality associated with many preventable illnesses and exposures encountered in the field.

John Snow would never have envisioned the great advances we have made in health surveillance and disease prevention. Fortunately for us, the DoD has the goal of establishing the most advanced and comprehensive military health surveillance system in history. Its vision is perhaps best explained in this excerpt from DODI 6490.3. Implementation and Application of Joint Medical Surveillance for Deployment:

"In the future, several new systems and procedures will be required to initiate a comprehensive medical surveillance program for monitoring mental

and physical health status, the occurrence of illness, injury, and disease as well as the identification and assessment of potential hazards and actual exposures to environmental contaminants and stressors. Innovative technology shall be used, such as an automated medical record device for documenting field and fixed-facility patient encounters (inpatient and outpatient) that can archive the information for local recall and format it for an injury, illness, and exposure surveillance database. Included, as innovative technologies to be developed and used, will be better inpatient and outpatient electronic medical records; devices, systems, and procedures to monitor mental and physical health status; devices, systems, and procedures to identify and assess potential hazards and evaluate and document actual exposures; and the electronic transmission and fusion of medical surveillance data to produce the minimum information for command and medical decisions in near-real time. Surveillance information shall be made available in a timely fashion to JTF surgeons and field medical facilities and shall be transmitted to central data repositories. Devices used and the format of data collected shall be compatible with the medical data system used by fixed-facility units. A geographical information system shall be used to conduct the necessary spatial analyses of environmental and disease exposures of company-sized and larger units, and shall be capable of being linked to individual service members' medical records."

Since this instruction was published in 1997, we have made great strides in achieving these goals. The development of more robust and operational information systems such as MEDPROS / MODS, GIS and CHCS II should play important roles in the near future for DMS and cradle-to-grave medical record keeping.

### **Summary:**

Medical surveillance is a good thing. It is an essential component of casualty prevention and our Force Health Protection program and we need more of it. Realizing this, our leaders have taken aggres-

sive actions to exploit our rapidly advancing technological capabilities to develop what will be the premier military medical surveillance system in the world.

No matter how sophisticated our technology and health surveillance systems become, though, basic things will still apply. If the system is not fed enough information it will weaken and become ineffective. If garbage information is put into it, only garbage information will come out of it. Without good info, the best surveillance system can be rendered useless. Therefore, the greatest burden for DMS will fall on the grunt-in-the-grass, gumshoe healthcare provider who must gather and disseminate quality surveillance information in a timely manner.

Several new requirements for DMS reporting have been mandated recently. Most military HCPs have little experience in DMS reporting, but the process has been simplified by the development of standardized forms. All HCPs in deployable units should familiarize themselves with these forms. SOF medical personnel in particular should gain a working knowledge of the new DMS requirements mandated in USSOCOM Directive 40-4.

The future is here, and it is up to us to help meet the DMS challenge of the 21<sup>st</sup> century.

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**Unit/Command:** \_\_\_\_\_ **Troop Strength:** \_\_\_\_\_

**Dates Covered:** \_\_\_\_\_ (Sunday 0001) Through \_\_\_\_\_ (Saturday 2359)

**Individual Preparing Report:** \_\_\_\_\_

**Phone:** \_\_\_\_\_ **E-Mail:** \_\_\_\_\_

CATEGORY	INITIAL VISITS	RATE	SUGGESTED REFERENCE RATE
DAYS OF FLIGHT DUTY	LOST WORK DAYS		ADMITS
Combat/Operational Stress Reactions			0.1%
<b>Dermatologic</b>		0.5%	
<b>GI, Infectious</b>		0.5%	
<b>Gynecologic</b>		0.5%	
<b>Heat/Cold Injuries</b>			0.5%
Injury, Recreational/Sports			1.0%
<b>Injury, MVA</b>		1.0%	
<b>Injury, Work/Training</b>			1.0%
<b>Injury, Other</b>		1.0%	
<b>Ophthalmologic</b>		0.1%	
<b>Psychiatric, Mental Disorders</b>			0.1%
<b>Respiratory</b>		0.4%	
<b>STDs</b>		0.5%	
<b>Fever, Unexplained</b>			0.0%
All Other, Medical/Surgical			
<b>TOTAL DNBI</b>		4.0%	
<u>Dental</u>			
Misc/Admin/ Follow-up			
<u>Definable</u>			
<b>Definable</b>			
<b>Problems Identified:</b>			<b>Corrective Actions:</b>

Figure 1  
Weekly DNBI Reporting (USCINCPAC Form 6200/1) Form for Joint Deployments



## *TRI-SERVICE REPORTABLE MEDICAL EVENT LIST*

Amebiasis	Listeriosis
Anthrax	Lyme Disease
Biological Warfare Agent Exposure	Malaria (All)
Botulism	Malaria, Falciparum
Brucellosis	Malaria, Malariae
Campylobacter	Malaria, Ovale
Carbon Monoxide Poisoning	Malaria, Unspecified
Chemical Agent Exposure	Malaria, Vivax
Chlamydia	Measles
Cholera	Meningococcal Disease
Coccidioidomycosis	Meningitis
Cold Weather Injury (All)	Septicemia
Frostbite	Mumps
Hypothermia	Pertussis
Immersion Type	Plague
Unspecified	Pneumococcal Pneumonia
Cryptosporidiosis	Poliomyelitis
Cyclospora	Q Fever
Dengue Fever	Rabies, Human
Diphtheria	Relapsing Fever
E. Coli 0157:H7	Rheumatic Fever, Acute
Ehrlichiosis	Rift Valley Fever
Encephalitis	Rocky Mountain Spotted Fever
Filariasis	Rubella
Giardiasis	Salmonellosis
Gonorrhea	Schistosomiasis
H. Influenzae, Invasive	Shigellosis
Hantavirus Infection	Smallpox
Heat Injuries	Streptococcus, Group A, Invasive
Heat Exhaustion	Syphilis (All)
Heat Stroke	Syphilis, Congenital
Hemorrhagic Fever	Syphilis, Latent
Hepatitis A	Syphilis, Primary/Secondary
Hepatitis B	Syphilis, Tertiary
Hepatitis C	Tetanus
Influenza	Toxic Shock Syndrome
Lead Poisoning	Trichinosis
Legionellosis	Trypanosomiasis
Leishmaniasis (All)	Tuberculosis, Pulmonary
Leishmaniasis, Cutaneous	Tularemia
Leishmaniasis, Mucocutaneous	Typhoid Fever
Leishmaniasis, Unspecified	Typhus Fever
Leishmaniasis, Visceral	Urethritis, Non-Gonococcal
Leprosy	Vaccine, Adverse Event
Leptospirosis	Varicella, Active Duty Only
	Yellow Fever

Figure 2



Major Meyers entered the army in 1982 and completed infantry training and jump school at Fort Benning, GA. He subsequently completed the Special Forces Qualification Course as a Light Weapons NCO and served as a Combat Diver on a 10th SFG(A) ODA at Fort Devens until 1986. After leaving the regular army he joined the Nevada Army National Guard where he served as a Combat Medic and Medical NCO. In 1990 he joined the Army Reserve under the Health Professional Scholarship Program while attending the University of Nevada School of Medicine. He completed a medical internship at Tripler Army Medical Center before becoming a Brigade Surgeon for the 101<sup>st</sup> Airborne Division at Fort Campbell, KY. After earning a Master of Public Health Degree he completed his preventive medicine residency at Madigan Army Medical Center. MAJ Meyers is currently serving at Fort Bragg as USASOC's Chief of Preventive Medicine.

# United States Army Rangers in Somalia: An Analysis of Combat Casualties on an Urban Battlefield

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**Editors Note:** This article was previously published in the Journal of Trauma. Permission to reprint in the JSOM was granted by Lippincott, Williams & Wilkins. Since this article was written by SOF medical personnel performing their duties under combat conditions, we felt the need to share this with our target audience, you, the special operations medic. We wish to express our sincere appreciation to the authors, the Journal of Trauma, and Lippincott for their use of this material. Please note that this article was written prior to the recent world events of 11 Sept. 01.

## INTRODUCTION

**Background:** This study was undertaken to determine the differences in injury patterns between soldiers equipped with modern body armor in an urban environment compared with the soldiers of the Vietnam War.

**Methods:** From July 1998 to March 1999, data was collected for a retrospective analysis on all combat casualties sustained by United States military forces in Mogadishu, Somalia, on October 3 and 4, 1993. This was the largest and most recent urban battle involving United States ground forces since the Vietnam War.

**Results:** There were 125 combat casualties. Casualty distribution was similar to that of Vietnam; 11% died on the battlefield, 3% died after reaching a medical facility, 47% were evacuated, and 39% returned to duty. The incidence of bullet wounds in Somalia was higher than in Vietnam (55% vs. 30%), whereas there were fewer fragment injuries (31% vs. 48%). Blunt injury (12%) and burns (2%) caused the remaining injuries in Somalia. Fatal penetrating injuries in Somalia compared with Vietnam included wounds to the head and face (36% vs. 35%), neck (7% vs. 8%), thorax (14% vs. 39%), abdomen (14% vs. 7%), thoracoabdominal (7% vs. 2%), pelvis (14% vs. 2%), and extremities (7% vs. 7%). No missiles penetrated the solid armor plate protecting the combatants' anterior chests and upper abdomens. Most fatal penetrating injuries were caused by missiles entering through areas not protected by body armor, such as the face, neck, pelvis, and groin. Three patients with penetrating abdominal wounds died from exsanguination, and two of these three died after damage-control procedures.

**Conclusion:** The incidence of fatal head wounds was similar to that in Vietnam in spite of modern Kevlar helmets. Body armor reduced the number of fatal penetrating chest injuries. Penetrating wounds to the unprotected face, groin, and pelvis caused significant mortality. These data may be used to design improved body armor.

**Key Words:** Urban warfare, Combat, Casualties, Trauma, Military personnel, Body armor, Kevlar, Gunshot wound. *J Trauma*. 2000;49:515-529,

Urban warfare is not new to the trauma surgeon. Examples are seen every day in Level I trauma centers. Organized crime, the drug trade, and domestic and international terrorist activity have given criminals access to modern military weapons, training, and protective gear. No longer is urban warfare confined to distant places such as Beirut, Northern Ireland, or the former Yugoslavia. When military tactics and arms are used in densely populated urban areas, mass casualties can be produced in minutes. A good example is a 1997 bank robbery in North Hollywood, California, where two assailants, each armed with an assault rifle and wearing body armor, engaged 20 to 30 police officers in a gun battle that left two people dead and more than a dozen people injured. The terrorist bombing incidents at the World Trade Center in New York City and the Alfred P. Murrah Federal Building in Oklahoma City killed and injured hundreds in seconds.<sup>1</sup> Therefore, it is important that the surgeon caring for patients with trauma, whether assigned to the military, the International Committee of the Red Cross, Doctors Without Borders, or a trauma center in a large metropolitan area, understand the injury patterns associated with combat in an urban environment.

United States military planners have recognized that in today's rapidly urbanizing, post-Cold War world, punctuated with increasing ethnic, tribal, terrorist, and organized criminal violence, tomorrow's battles will not be fought in the open, unpopulated areas seen during Operation Desert Storm but in cities.<sup>2-5</sup> Such a battle, known as the Battle of the Black Sea, was fought by United States military forces in the streets of Mogadishu, Somalia, in 1993. This battle, which was named for the area of South Mogadishu in which it was fought, is the largest and most recent discrete firefight involving United States ground forces since the Vietnam War and demonstrates the intense, violent, and close-quarter nature of combat in cities.

This study examines the casualty data from the Battle of the Black Sea, with the goal of identifying injury patterns associated with modern urban warfare compared with historical controls. Only through this type of critical analysis will all surgeons, both civilian and military, be prepared for the victims of the next urban conflict.

## BACKGROUND

On October 3, 1993, a United States Army special operations task force, Task Force Ranger (TFR), conducted a raid into a heavily armed and densely populated region of Mogadishu, Somalia, to capture sup-

porters of warlord Mohamed Farrah Aidid. During the raid, Aidid's forces shot down two TFR helicopters with rocket-propelled grenades (RPGs). The downing of the helicopters rapidly changed the focus of the mission from a combat assault to a rescue. The Rangers fought house to house and street to street through the city to secure and safeguard the crash survivors from armed crowds of Somali militiamen. In the ensuing 15-hour battle, 18 United States soldiers were killed and more than 100 were wounded in what would later be described as the longest and most intense firefight involving American forces since the Vietnam War.<sup>6</sup>

The casualties were sent to the United States Army's 46th Combat Support Hospital (CSH), located just a few kilometers from the battlefield. The 46th CSH was equipped with four operating rooms (ORs), one Level-I infuser, 12 intensive care unit beds, and 40 ward beds. This element was only part of the full CSH, and, although it had a 52-bed capacity, it was only staffed for 32 beds on October 3, 1993. Basic laboratory and radiologic capabilities, including a computed tomographic scanner, were available, as well as a blood bank stocked with approximately 100 units of packed red cells and fresh frozen plasma.

This 52-bed field hospital admitted a total of 70 patients between October 3 and October 5, 1993. On the morning of October 3, before the battle, four trauma patients were admitted after the explosion of a land mine. Two of these patients underwent operations for their injuries that lasted into the early afternoon. At 1530 TFR launched the raid from its base at the Mogadishu airport. Two hours later, after the ambush of a TFR convoy, the first wave of 24 battle casualties began to arrive at the 46th CSH. Seven of the 24 underwent operations on the evening of October 3 at the 46th CSH. This first wave was part of a larger group of 36 casualties who had been triaged at a casualty collection point (CCP) near the ranger base and were then flown by helicopter on a 2 to 3 minute flight to the 46th CSH. No surgical capability was available at the CCP.

A second wave of 36 casualties began to arrive by helicopter at the 46th CSH at 6:00 AM on October 4, just as the cases from the previous evening were finishing. This latter group had been triaged and evacuated from a hastily assembled CCP located in a sports stadium near the battlefield and was part of a larger group of 76 injured patients. Most of them had fought their way to one of the helicopter crash sites the day before and had been pinned down there for more than 14 hours before a large, multinational, armored convoy could fight its way to their location. Most had been injured the previous afternoon and had been cared for

**TABLE 1 Surgical Procedures Performed on October 3-5, 1993, at the 46th Combat Support Hospital, Mogadishu, Somalia**

<b>Surgical Procedures</b>	<b>Procedures Performed (n)</b>
Fracture washout	13
External fixation	1
Incision & debridement of open wounds	13
Flexor tendon repair	1
Fasciotomy	2
Exploratory celiotomy	6 (2 nontherapeutic)
Bowel repair	1
Splenorrhaphy	1
Gastric repair	1
Liver & portal vein repair	1
Aortic cross-clamp	1
Sternotomy & celiotomy	1
Total hepatic exclusion	1
Vena cava repair	1
Tube thorcotomy	1
Neck explorations	2 (1 nontherapeutic)
Carotid artery repair	1
Tracheostomy	1
Scalp laceration closure	1
Burn debridement	1
Completion of hip disarticulation	1
Above-the-knee amputation	1
Closed reduction of fracture	1
Examination under anesthesia	1
Total	56

Surgical patients (31), operative cases (34), & postoperative deaths (3) in Somalia

overnight in the field by medics. Twenty-one of these 36 patients were operated on, and three were operated on twice.

Four patients with orthopedic injuries (three operative cases) were triaged to a nearby Swedish United Nations military hospital. A collegial relationship had previously been established between the Swedish physicians and the 46th CSH during weekly joint medical conferences. Additional support was provided by a contingent of German physicians who arrived at the 46th CSH at around 1200 on October 4. This group was stationed outside Mogadishu and had arranged helicopter transportation on its own initiative after word of the ongoing battle spread.

As a result of the combat operations on October 3 and 4, 1993, two general surgeons and one orthopedic surgeon at the 46th CSH would participate in 34 cases involving 56 procedures over a 48-hour period (Table 1). A third general surgeon assigned to the

46th CSH was not present during the battle. He and a respiratory technician had been required to accompany a patient, who had been severely injured a few days earlier during a shark attack, on the aeromedical evacuation flight to Germany.

The non-surgical patients were evaluated by 12 medical officers, including general medical officers and specialists in emergency medicine, family practice, internal medicine, radiology, and anesthesiology, as well as nurse anesthetists, a psychologist, and a dentist. These physicians were assigned to the 46th CSH and nearby military units.

A total of 55 patients were evacuated to Landstuhl Army Medical Center, Germany, on October 4 and 5 aboard two United States Air Force C-141 aircraft. One of the general surgeons assigned to 46th CSH accompanied the second planeload of casualties. Laboratory and radiographic results remained at the patients' bedsides and later accompanied the patients

during aeromedical evacuation. After stabilization and additional surgery, as needed, these patients were flown from Germany to military medical facilities in the United States for additional care or convalescence.

## MATERIALS AND METHODS

From July 1998 until March 1999, data was collected for retrospective review of all United States casualties incurred during the Battle of the Black Sea. Data sources included hospital admission logs, medical evacuation flight manifests, OR logs, patient medical records, and postmortem examination reports. Involved unit records, as well as historic, eyewitness, and news media accounts, were also reviewed. After review of all available sources, data was entered into a computerized database.

Patients were divided into four categories using commonly accepted definitions: killed in action (KIA), defined as those who died on the battlefield before reaching a medical facility; died of wounds (DOW), defined as those who died after arriving at a medical facility staffed by a physician; wounded in action (WIA), defined as those who were injured severely enough to require admission to the hospital for at least 24 hours; and carded for record only (CRO), defined as those with minor injuries who were treated and returned to duty the same day.<sup>7, 8</sup> This study follows the recommendation of Bellamy<sup>9</sup> and does not include the CRO patients in the calculation of the KIA and DOW rates. The inclusion of patients in the CRO category, many of whom required little or no treatment, would cause significant distortion of the KIA and WIA rates.

Postmortem examination reports were reviewed with a forensic pathologist at the Office of the Armed Forces Medical Examiner (OAFME), Armed Forces Institute of Pathology, Washington, DC. Involved surgeons were questioned about operative cases and patients who died of their wounds. Medics and other participants of the battle were asked about prehospital presentation, care of the injured in the field, wounding agents, and the circumstances of the injury. Because of their significantly increased morbidity and mortality, penetrating injuries to the head, neck, thorax, and abdomen were classified separately from non-penetrating injuries to the same anatomic region, as suggested by Carey.<sup>10</sup>

Several patients suffered multiple wounds. These were the result of mixed mechanisms (i.e., blunt force injuries and fragments or multiple injuries caused

by a single mechanism, such as multiple fractures from a helicopter crash, multiple fragment wounds from a grenade, or multiple gunshot wounds). In previous reports of battle casualties, patients with multiple wounds were either excluded or simply classified as multiple injuries.<sup>11</sup> In an effort to present as much information as possible regarding surgical care and demands on material resources, each wound that required medical attention was noted. For example, if a soldier were struck by fragments from an RPG that caused an open fracture of the tibia, an amputation of a digit, and a major soft-tissue wound of an extremity requiring OR debridement, then all three of these injuries were noted separately. With the relatively small numbers of casualties examined here (125 compared with almost 8,000 cases in the United States Army Wound Data

**TABLE 2 Total United States Casualties, Battle of the Black Sea**

Casualty Category	Casualties (n)	Percent
Killed in Action (KIA)	14	11.2
Wounded who died (DOW)	4	3.2
Wounded in Action (WIA)	58	46.4
Carded for record only	49	39.2
Total	125	100
KIA rate=KIA / (KIA+DOW+WIA)		18.4
DOW rate= DOW / (DOW+WIA)		6.4

KIA and DOW rates do not include the CRO category.

and Munitions Effectiveness Team in Vietnam [WDMET] study<sup>12</sup>), excluding these patients or simply classifying them as multiple injuries would have resulted in the loss of a significant amount of relevant wound data.

## RESULTS

There were 125 total United States casualties sustained during the Battle of the Black Sea (Table 2). In seven instances, the initial hospital admission records documenting injuries did not match the medical record or records from the involved units. These inconsistencies usually related to whether fragments or bullets caused wounds. Because the 52-bed 46th CSH admitted a total of 70 patients (including 65 trauma patients) and evacuated 55 of them to Landstuhl Army Medical Center in Germany within 48 hours, the inpatient medical record was thought to be more accurate than the initial admission log. These

kinds of discrepancies are not unusual in the collection of casualty data<sup>7,13</sup>, and are believed to have little impact on the overall findings.

Seventy-six casualties sustained injuries resulting in death or hospitalization (KIA, DOW, or WIA). Wounding mechanisms for these casualties were bullets (55%), fragments (31%), blunt trauma (12%), and burns (2%).

Gunshot wounds caused 12 of the 14 deaths from penetrating trauma. The other two deaths from penetrating trauma include a soldier struck by an unexploded RPG round (which acted more like a bullet than an exploding rocket) and one death from fragment injury after an almost direct hit by an RPG. Most of the fragment injuries were the result of exploding RPGs.

### **Killed in Action**

Gunshot wounds to the head caused 5 of the 14 (36%) battlefield deaths. Single wounds caused three deaths. The other two fatalities sustained multiple gunshot wounds, with head wounds as the likely fatal injury. Four bullets penetrated the brain and one bullet penetrated the cervical spinal cord. In four instances it appeared that bullets entered from a frontal or frontal oblique angle through an area not protected by the Kevlar helmet. In the remaining instance, multiple rounds struck a soldier with a fatal injury to the parietal-occipital area of the head from what witnesses described as a ricochet bullet. The soldier was not wearing a Kevlar helmet at the time of injury.

Multiple blunt force injuries from helicopter crashes resulted in 4 of the 14 (29%) fatalities. In both crashes, RPGs hit the helicopters while flying at low level. In the first instance, the aircraft landed on its left side. The two pilots sustained severe blunt force injuries and were killed on impact, but, amazingly, the six passengers riding in the back of the aircraft all survived the crash. In the second instance, the pilot executed a controlled crash and landed the aircraft upright. Both pilots survived the crash with fractures to the lumbar spine and lower extremities, but the two crew chiefs riding in the rear were killed, one with a cervical spine fracture that severed the spinal cord and the other with multiple internal injuries.

Penetrating injury to the chest resulted in 2 of the 14 (14%) fatalities. One soldier was shot in the upper back, just left of the midline. He went into shock and died within minutes, according to witnesses. The bullet presumably struck the heart or great vessels. Another soldier was struck in the left chest with an RPG that severed his left arm and penetrated the chest

cavity but did not explode. This soldier presented to the triage area a short time later with agonal respirations. A physician then discovered the live, unexploded round during his primary survey. By this time the patient had no pulse, spontaneous respirations, or blood pressure, so his body was removed to a protected area, and an Explosive Ordnance Disposal technician later disarmed the unexploded warhead.

Another soldier died from a gunshot wound to the groin that lacerated his femoral artery and vein. A medic attended to the soldier within moments. The wound was too proximal to apply an effective tourniquet, so it was packed with gauze, and continuous direct pressure was applied by the medic and nearby soldiers. This soldier could not be evacuated from the battlefield because of the tactical situation. Although approximately 6 L of intravenous crystalloid solution was given, he died after worsening shock and cardiopulmonary arrest approximately 2.5 hours after injury.

Two battlefield deaths were the result of multiple gunshot wounds. Decompositional changes in the bodies present at the time of recovery made precise assessment of fatal injuries difficult, but it seems that one probably sustained a lethal GSW to the abdomen and the other a lethal GSW to the neck.

The above findings are on the basis of external and radiographic examinations only. Complete autopsies were not conducted on the fatalities.

### **Died of Wounds**

Four patients died after reaching medical facilities. The first three general surgery cases from the mass casualty on October 3 all died acutely as a result of hemorrhage while in Somalia; all three casualties presented to the 46th CSH in extremis. There was one late death in another casualty after evacuation to Germany.

One of the casualties had sustained a gunshot wound to the abdomen. The bullet entered the right flank, injuring the liver, portal vein, and spleen. The patient required aortic cross-clamping to sustain blood pressure. With the triage area full of surgical patients and scarce personnel, time, and resources, this patient was triaged expectant on the table and moved out of the OR. He died almost immediately after the aortic clamp was removed.

The next two patients underwent damage control surgery,<sup>14-16</sup> consisting of ligation of major bleeding vessels and abdominal packing, but both died in the intensive care unit. One had a massive injury to the



**Table 3 Percentage of Wounded who Died, by Conflict (DOW)**

Conflict	Wounded (n)	Wounded who Died (%)
Spanish American War	1,600	7
WWI (excluding ga)	153,000	8
WWII	599,724	4.5
Korea	77,788	2.5
Vietnam	96,811	3.6
Desert Storm (7th Corps)	143	2.1
British in Northern Ireland	1,700	4.8
Somalia	62	6.4

Adapted from Carey ME. An analysis of US Army combat mortality & morbidity data. Mil Med. 1987; 152:6-13. US Army only

left hip from an RPG blast that resulted in a near-complete traumatic amputation, with injuries to the left iliac artery and vein and the descending colon. He underwent an exploratory celiotomy with ligation of the left iliac artery and vein and completion of the hip disarticulation. The patient survived for approximately 12 hours. He regained consciousness briefly after the application of military antishock trousers but died a short time later. The other patient had a gunshot wound to the pelvis, which shattered the sacrum and disrupted the presacral soft tissues and neurovascular plexus with injury to the colon, small bowel, and right internal iliac artery. The right common iliac artery was ligated, and the pelvic and sacral fracture was packed with gauze. The patient survived for 7 hours after his injury. Of note, during this case the

**Table 5 Hospital Bed Days for Wounded in Action (WIA) Patients**

Number	<3	3-7	7-30	>30
Bed Days				
Patients	16	12	15	11
Hospital stay in days				
Average			22	
Minimal			1	
Maximum			190	
Total bed days for WIA patients	1,184			

Hospital data was not available for 4 of the 58 WIA patients.

electrical generator failed, temporarily necessitating operating by flashlight.

The final patient who died of wounds had a right thoracoabdominal gunshot wound with a retrohepatic laceration of the inferior vena cava and a right hemothorax. He was the first patient operated on during the second wave of casualties on the morning of October 4. His evacuation from the battlefield was delayed because of the tactical situation, but he remained conscious and hemodynamically stable with bilateral breath sounds while awaiting transport. The interval from time of injury to surgery was 5 hours. In the OR he underwent an exploratory celiotomy and median stemotomy. Total hepatic exclusion was performed after the administration of 4 units of fresh whole blood with subsequent repair of the retrohepatic inferior vena cava. The patient remained hemodynamically stable postoperatively and was transferred to Germany the next day, sedated and on a ventilator. He died after arrival in Germany.

At 6.4%, the DOW rate in the Battle of the Black Sea is higher than that seen in other modern con-

**Table 4 Distribution of Injuries for Wounded in Action**

Anatomic Area	Gunshot	Fragments	Blunt	Burn	Total (by Anatomic Area)	Percent
Head/face	1	5	3	0	9	9.9
penetrating	0	1			1	1.1
Neck	0	1	0	0	1	1.1
penetrating	1	1			2	2.2
Thorax/back	2	0	4	0	6	6.6
penetrating	0	0			0	0
Abdomen	1	0	1	0	2	2.2
penetrating	0	1			1	1.1
Genitalia	1	0	0	0	1	1.1
Extremities	32	30	4	2	68	74.4
Total	38	39	12	2	91	
Percentage	41.7	42.9	13.2	2.2		100

Injuries of the head, neck, chest, and abdomen are penetrating if they violated the skull, platysma, chest cavity, or peritoneum.

flicts (Table 3). Three factors influence the DOW rate: speed of evacuation, quality of hospital-level care, and method used to calculate the DOW rate. The high DOW rate in this case is likely attributable to the fact that three of the four patients who died from their wounds were part of the group that was ambushed in a vehicle convoy and was able to be rapidly evacuated from the battlefield. All three patients sustained significant injuries and presented to the hospital in hemorrhagic shock. Two of the four deaths were from pelvic injuries that resulted in exsanguination despite gauze packing. This comparatively high DOW rate may also be related to the relatively small number of casualties examined in this study. For this reason, care should be taken when comparing data from a single battle with that derived from wars or longer campaigns.

### Wounded in Action

Fifty-eight patients were classified as wounded in action, sustaining 91 injuries (Table 4). Their average hospital stay was 22 days (Table 5). Twenty-five patients had more than one isolated injury: 12 patients had multiple or combined injuries; 11 had multiple fragmentation injuries to more than one anatomic area (i.e., injury to the trunk and extremity, to two or more extremities, etc.); and 2 patients had multiple fractures from blunt trauma. One of the latter was the pilot of a downed helicopter with an open femur fracture, vertebral fracture at the L-2 level, and multiple facial fractures. The other was the first casualty of the battle, a Ranger who fell approximately 40 to 70 feet from a helicopter during the insertion phase of the mission. He sustained a closed head injury, skull fracture, retroperitoneal hematoma, multiple rib fractures, and fractures of the femur and humerus.

Penetrating trauma was the result of gunshot wounds (GSWs) in 38 instances and fragments in 39 instances. The vast majority of these injuries were from AK-47 assault rifles and Soviet Bloc RPGs.

There was only one patient with a penetrating head injury in the WIA category. A Ranger was hit in the forehead by a 3-mm fragment from an RPG. The fragment lodged 3 to 4 cm between both frontal lobes of the brain, causing no apparent neurologic deficit. The soldier thought nothing of his injury at the time and continued to fight. Immediately after the battle, he was evaluated and found to have a 2- to 3-mm laceration on his forehead and a normal neurologic examination. He was subsequently returned to duty. The next day he experienced a headache and noticed clear fluid leaking from the wound, both of which resolved the

Injury	Number
Soft tissue, minor	31
Soft tissue, major	11
Burns	2
Long-bone open fracture	11
Open fracture (wrist, ankle, hand, or foot)	5
Closed fracture	3
Complete or partial amputation of digits	4
Major amputation (above the knee)	1
<b>Total</b>	<b>68</b>
Required basic wound care only; Required operating room management.	

same day without medical advice or intervention. He presented for reevaluation 2 days after the injury; the fragment was then discovered on roentgenography and computed tomographic scan of the head. At that time he was asymptomatic with a normal neurologic examination. He was placed on antibiotics and anticonvulsants and evacuated to Germany. After arrival in the United States, he experienced a generalized seizure and 10 days later developed an intracerebral abscess. He recovered fully after a craniotomy, antibiotic therapy, and a 2-month hospitalization.

Another Ranger sustained a non-penetrating GSW to the occiput. The round penetrated his Kevlar helmet, causing a scalp laceration, brain contusion, and momentary blindness, but it neither penetrated nor fractured the skull. The patient survived without complication. There are several other anecdotal instances where bullets or fragments impacted helmets but caused little or no injury. Other injuries to the face and head were the result of lacerations from fragments or facial fractures from blunt trauma.

A GSW to the neck resulted in one casualty with injury to the spinal accessory nerve, a cervical spine fracture, and carotid artery injury that required repair with a greater saphenous vein patch and a tracheostomy. Also, there were two patients with fragment wounds to the neck; one penetrated the platysma and was explored, but no additional repair was required. All neck injuries were in Zone II, between the angle of the mandible and the clavicles.

There were no penetrating injuries to the chest among the WIA, and there was only one penetrating abdominal injury. This patient was a young soldier, evaluated almost 12 hours after his injury, who was found to have some small puncture wounds to his back and flank, no abdominal tenderness, and normal vital signs. Upon exploratory celiotomy, approximately 1 L of blood was

**Table 7 Wound Infections**

Wounding Mechanism	Injury	Time to Surgery (h)	Hospital Bed Days	Complications
GSW	III-B fracture of the tibia & fibula	Unknown, but <6	119	Polymicrobial infection, malunion; Ilizorov fixation
RPG blast	Large soft tissue defect to popliteal fossa	6.5	86	Skin graft necrosis, scar fibrosis, seroma
GSW	Open femur fracture, testicular avulsion	22.5	87	Pseudomonas
GSW	Near amputation of thumb	Unknown, but >6	80	Flap necrosis, extensive reconstruction
GSW	Open wound to forearm with neurovascular injury	No surgery in Somalia	54	Forearm contracture, nerve injury
GSW	III-B tibia fracture	19	52	Polymicrobial infection, Ilizorov fixation
GSW	III-B tibia fracture	17	48	Malunion, peroneal nerve injury
GSW	III-B tibia and fibula fracture	5	>11 days; total unknown	Postoperative infection
Helicopter crash	Open femur fracture	11 days	22	Pseudomonas; held as prisoner for 11 days
GSW	Soft-tissue injury of upper arm	No surgery in Somalia	9	
GSW	Open wound to flank with fracture of ilium	18	8	Retained foreign body
GSW	Major soft-tissue injury to wrist	14	6	Retained foreign body
RPG fragment	Soft-tissue injury of knee and patellar tendon	No surgery in Somalia	6	
GSW	Open fracture of ankle	25	5	Wound abscess, cellulitis
Multiple RPG fragments	Multiple soft-tissue injuries, open fracture of metatarsals	21	5	Wound abscess, cellulitis
GSW	Soft-tissue wound to back	No surgery in Somalia	2	

GSW=gunshot wound; RPG=rock-propelled grenade.

found in the abdomen secondary to a fragment injury to the spleen and stomach. Both were repaired without complication.

As in all other modern battles, the vast majority of survivable injuries (74%) seen among the WIA in Somalia were to the extremities (Table 6). Nearly half of the extremity injuries were uncomplicated, minor soft-tissue injuries requiring only basic wound care. Individually, many of these small fragment wounds could have been placed in the CRO category. However, the wounds were often associated with other, more severe injuries, large areas of the body were often peppered

with dozens of these small wounds, or the wounds required evaluation for possible joint space penetration.

GSWs caused seven of the major soft-tissue injuries requiring operative management. One particularly severe soft-tissue injury was seen in a Ranger whose vehicle was hit by an RPG during an ambush. The blast left a large tissue defect in the popliteal fossa that exposed the popliteal artery and destroyed the posterior tibial and peroneal nerves. On presentation to the 46th CSH, his dorsalis pedis and posterior tibial pulses were palpable. The injury was washed out and packed in Somalia, and he was transported to Germany the next day. In Germany, a skin graft was placed over the de-

Injury	Number
Fragment wounds	23
Ruptured eardrums	3
Contusions	2
Minor burn	2
Grazing gunshot wound	1
Corneal abrasion	1
Broken teeth	1
Sprain	1
Abrasion	1
Total	35

fect to cover the exposed nerves and vessels before a permanent procedure could be done. The patient was then transferred from Germany to the United States where, approximately one week after the injury, the skin graft was found to be nonviable and was subsequently removed. The posterior tibial nerve was then found to be grossly burned and contused, and the peroneal nerve was found to be severed. The possibility of an amputation was discussed at the time, but the patient adamantly refused. The wound was subsequently covered with a latissimus dorsi flap. After rehabilitation, he was medically discharged with a left foot drop, left leg atrophy, and an essentially insensate leg below the knee. Presently, he ambulates well but still requires a brace.

There were 11 open fractures of long bones and one open fracture of the ileum secondary to gunshot and fragment wounds. Fractures of the lower extremity as a result of GSW were associated with some of the longest hospital stays and the most complications. Five patients had fractures of the tibia secondary to GSW. Two of these had associated injuries to the

peroneal nerve, four became infected, and nonunion or malunion complicated three. The average hospital stay for these patients was 74 days (hospital data were only available for four of the five patients.) Two of these patients, each with initial bone loss greater than 8 cm, underwent Ilizarov fixation and bone grafting. The large soft-tissue wounds were covered with pedicled muscle flaps.<sup>17</sup> Both of these patients underwent lengthy rehabilitation, but they have since returned to full active duty and are presently serving in physically demanding infantry and special forces assignments. The other three patients with GSW to the tibia have left military service.

An RPG blast to the lower extremity resulted in the only major amputation (above the knee). The patient's leg was partially amputated at the knee by an almost direct hit from an RPG. He and another soldier immediately applied an effective tourniquet, stopping what was described as severe bleeding from the injury. The amputation was later completed at the 46th CSH. Presently, the patient is still on active duty and has continued to maintain a rigorous physical fitness regimen with his prosthesis.

Another patient's thumb was partially amputated secondary to a GSW. Although he had a severe associated neurovascular injury that required an extensive reconstruction complicated by thrombosis and infection of his initial graft, his thumb was salvaged and partial function was restored with a neurovascular island graft from his ring finger. Eleven patients in the WIA category subsequently developed wound infections (Table 7).

### Carded for Record Only

The vast majority of patients in the CRO category were not seen at the hospital but were cared for by the medics, physician assistants, and physicians from

Wounding Mechanism	Conflict					
	World War II <sup>a</sup>	Vietnam <sup>12</sup>	Northern Ireland <sup>23</sup>	1982 Lebanon <sup>b</sup>	Desert Storm <sup>26</sup>	Somalia
Bullets	38	30	45	18	5	55
Fragments	58	44	33	65	95	31
Other	4	26	22	17	0	14

<sup>a</sup> Beebe GW, DeBakey ME. Effectiveness of weapons. In: *Battle Casualties*. Springfield, IL: Thomas; 1952: Chapter 9, Table 68.  
<sup>b</sup> Bessar Y. *Military Operations in Urban Terrain, Medical Aspects, Lebanon War 1982: A Case Study*. Bethesda, MD: Uniformed Services University of the Health Sciences; 1985.

their respective units. Many of these individuals did not seek medical attention until one or two days after the battle. Data on wounding agents and anatomic location of injuries were available for all but 15 of the 49 lightly injured patients who were CRO. The unit surgeon who evaluated most of the 15 patients stated that the majority of these individuals sustained minor fragment wounds of the extremities or soft-tissue lacerations, abrasions, and contusions (Dr. Thomas Larkin, written communication, 1999). This pattern of injury is thought to be consistent with that of the other CRO patients with documented injuries (Table 8). Most of these soldiers were immediately returned to duty.

## DISCUSSION

The incidence of bullet wounds in the Somalia engagement is high in comparison with other conventional battles but is similar to other military actions in urban areas. Combatants in urban warfare fight in streets and along walls, where they are particularly vulnerable to machine gun and sniper fire, often at very close range. The masonry and concrete construction of roadways and buildings do not absorb fired bullets as do trees and earth. Ricochets travel alongside these structures for some distance. Although ricocheting causes projectiles to lose some kinetic energy, it also causes them to fragment and produce secondary missiles from impacted concrete and masonry.<sup>18</sup>

The nature of injuries on any battlefield reflects the predominant weapon or weapons used by the combatants. In the Battle of the Black Sea, the AK-47 assault rifle was the most common weapon of the Somali soldiers, followed by RPGs. The distribution of injuries among TFR soldiers certainly reflects this. Large fragment-producing bombs and artillery shells, the most significant casualty producers in modern warfare, were not used by either side during the Battle of the Black Sea and thus were not a factor. The high incidence of bullet wounds is similar to the British soldiers' experience in Northern Ireland, where small arms predominate, but is in contrast to the Israeli soldiers' experience while fighting in urban areas during the 1982 Lebanon War, where most of the Israeli soldiers' injuries were the result of RPGs (Table 9). Used at close range in an urban environment, as they were in Mogadishu, RPGs tended to produce multiple, simultaneous casualties when they struck buildings, vehicles, or aircraft where troops were clustered.

The unexploded RPG found imbedded in the chest of the patient at the CCP highlights a little known but highly emotional event in combat casualty care: how

**Table 10 Comparison of Anatomical Distribution of Fatal Penetrating Injuries from Somalia and Vietnam**

Body Area	Vietnam <sup>12</sup> (%)	Somalia (%)
Head	35	36
Neck	8	7
Chest	39	14
Abdominal	7	14
Thoracoabdominal	2	7
Pelvis	2	14
Extremities	7	7

to deal with unexploded ordinance. If these casualties arrive alive, the round can be removed with minimal risk of explosion. Agonal or dead casualties should be removed from the patient care area, and the EOD should be notified. Certain precautions before transport or removal must be observed, which are nicely outlined by Lein, et al.<sup>19</sup>

Blunt trauma accounted for the remaining deaths and some severe injuries. The majority of blunt injuries were the result of helicopter crashes, which are associated with significant mortality and unique injury patterns.<sup>20</sup> Aircraft crashes are not discussed additionally in this analysis. Blunt force injuries do occur during urban warfare. It is probable that in future urban conflicts, individuals will be killed and injured in vehicle crashes and falls that produce injuries similar to those seen in a typical civilian trauma center. Buildings and other man-made structures will be targeted by exploding munitions, producing blast injury, crush injury, burns, and penetrating trauma. The Marines killed in their Beirut barracks<sup>21</sup> and the victims in the bombings of the Oklahoma City Federal Building<sup>1</sup> and United States embassies in Kenya and Tanzania provide examples of the types of injuries and casualty evacuation problems that may be encountered in future urban warfare or terrorist attacks. Locating, extracting, and evacuating casualties trapped in vehicles, aircraft, or destroyed buildings while under fire on an urban battlefield is both difficult and dangerous.

Penetrating wounds to the head remain a significant cause of mortality on the battlefield. Although the head represents only 9% of the exposed body, it accounts for 34% to 46% of deaths.<sup>4</sup> In Somalia, head wounds caused 36% of deaths from penetrating injury, a figure that lies between values predicted by two Vietnam studies, 34% in the WDMET study<sup>12</sup> and 39%

documented by Maughon,<sup>22</sup> who analyzed 988 Marine deaths. Bullets caused all fatal wounds to the head in this population of casualties in Somalia. Remarkably, in every instance, according to witnesses and postmortem examination reports, the bullets entered through areas not covered by the Kevlar helmet. Given the added protection of the Kevlar helmet (not available in Vietnam), one would reasonably expect a lower incidence of fatal head wounds, but such was not the case. This high rate of GSWs to the head may have been the result of well-aimed sniper fire, which is a common and significant threat when fighting in built-up areas.<sup>23-25</sup> Also of interest are the anecdotal accounts of projectiles striking helmets and causing little or no injury, particularly the one individual shot in the back of the head who sustained only a scalp laceration and brain contusion. Had he not been wearing his helmet, he almost certainly would have been killed. Conversely, the one individual who was hit in the head by a ricochet bullet may have survived had he been wearing a Kevlar helmet. The head and face are preferred targets for well-aimed fire in a close-quarter urban battle such as this, especially when fighting against troops that are known to use body armor. It is likely that the head was targeted more often than other anatomic areas by the Somali forces during this battle. If United States forces in Somalia had not been wearing the Kevlar helmet; the morbidity and mortality of penetrating injuries to the head would have been greater. Future body armor research should be directed at protecting the vulnerable face and anterior head. This statement is supported by Maughon's<sup>22</sup> study of fatal injuries in Vietnam, written almost 30 years ago. He states, "A large proportion of these casualties were fully and properly clothed in protective armor, yet the small vulnerable parts of the face and neck were hit. Most of the missiles entered anteriorly, causing one to wonder about the protective effect of a suitable face and neck shield, in addition to the present head and body armor."

The Ranger who developed a brain abscess after being struck in the forehead with the small fragment highlights two important points concerning combat-related penetrating head injuries. First, patients can initially present with a normal neurologic examination and innocuous-appearing injuries. Carey<sup>26</sup> describes a similar patient, injured during Operation Desert Storm with "a small fragment wound to the brain who was talking on hospital admission." All wounds in proximity to major structures should prompt radiographic evaluation at a minimum. Second, penetrating head injuries associated with CSF fistulas or leakage from the wound are cited in numerous studies as a major risk for infec-

tion and should be managed accordingly.<sup>27</sup>

The relatively low rate of penetrating chest wounds deserves mention. Historically, the chest and abdomen are predicted to be the locations of major wounds 12.5% and 10% of the time, respectively.<sup>17</sup> In one Vietnam study,<sup>22</sup> 37% of the casualties who were KIA died of thoracic injuries, and 9% died of abdominal injuries. In the Somalia group, two (14%) of the KIAs with penetrating injuries had chest wounds and two (14%) had fatal abdominal wounds; yet all four of the casualties who DOW had penetrating injuries to abdominal organs (two had wounds to the pelvis, one had a thoracoabdominal wound). Had evacuation been as delayed for the patients in the ambushed convoy as it was for those around the crash site, it is likely that three of the four DOW patients with penetrating abdominal wounds would have died on the battlefield.

The distribution of injuries in these casualties is interesting in that no projectiles entered through the region of the anterior chest or upper abdomen where a solid armored plate, in addition to the soft-body armor, was worn by the combatants. In all of the penetrating injuries to the chest and abdomen, bullets or fragments entered through the relatively softer areas of the body armor protecting the back and flanks or passed inferior to the body armor in the area of the waistline, groin, or pelvis. In one soldier who was KIA, the front plate stopped an exiting bullet that had entered through the back, traversed the mediastinum, and exited through the anterior chest.

Body armor seems to have reduced mortality from injuries to the chest (Table 10). This statement is additionally supported by the comments of TFR soldiers. There are at least a dozen anecdotal accounts of soldiers whose armor was hit by bullets and fragments, some of which were recovered from the damaged body armor after the battle. One individual was hit in the flank by an AK-47 bullet that first struck a wall he was standing near. His only injury was a severe flank hematoma that eventually extended around to his groin a few days later. His urine tested negative for blood, and he was returned to duty during the battle. One of the authors (R.L.M.) was a participant in the battle and witnessed a Ranger shot in the center of the armored chest plate. The soldier was knocked over, looked down at his chest, then got to his feet and returned fire. The bullet had hit his chest and ricocheted off his armored plate into his arm, causing only minor soft-tissue injury.

In addition to directly saving lives, one of the most significant contributions made by body armor is the prevention of small fragment wounds to the abdomen, where any evidence of penetrating injury, no matter



how innocuous appearing, must be assumed to represent a penetrating intra-abdominal wound.<sup>28</sup> The widespread use of body armor prevented these injuries; eliminating the need to perform additional diagnostic studies, serial examinations, and surgical exploration required by such casualties, thus significantly reducing the surgical workload.

Timely exploration of questionable wounds is a sound military surgical principle and should not be ignored. During the Battle of the Black Sea, three surgeons managed a large number of surgical casualties with minimal support personnel and material resources. Evacuation times to the receiving hospital were long, and a surgeon was not always available to accompany casualties on the evacuation aircraft. These are all circumstances commonly encountered during military mass casualty situations. Therefore, serial observation or non-operative therapy was not used. All casualties with possible penetrating cervical or abdominal wounds underwent exploration in Somalia before aeromedical evacuation.

The injuries sustained by the United States casualties in Somalia are similar to those seen by surgeons in previous conflicts.<sup>29</sup> Fortunately, the two general surgeons at the 46th CSH were equally comfortable treating vascular, thoracic, and abdominal injuries. As surgical training programs become more specialized, case loads decrease, and military general surgeons are denied vascular and thoracic operative privileges at military treatment facilities. It is the authors' concern that future deployed general surgeons may be performing vascular and thoracic procedures for the first time in several years. The solution to this problem is to allow military surgeons the opportunity to perform elective vascular and thoracic cases at the military treatment facilities. This would allow the same surgeons, who will be doing these complex cases in tents under adverse conditions while deployed, the opportunity to perform them electively on a scheduled basis.

One aspect of combat surgery not emphasized in recent writings but clearly stated in Beecher's<sup>30</sup> World War II text is the value of a brief but positive discussion with the injured soldier in the immediate preoperative period. In contrast to elective surgery, there is no need for elaborate counseling sessions replete with diagrams and all of the potential poor outcomes. However, there is a need to reach out emotionally to the patient, touch him, and tell him he will be okay and that he will be taken care of. The authors found that

even brief words of encouragement before surgery were extremely valuable to all of the patients.

The two patients who underwent damage control procedures both died. Patients undergoing these types of procedures consume enormous quantities of blood, time, material, and personnel resources. In Level I trauma centers, these patients have at best a 50% chance of survival.<sup>31</sup> Because manpower and material resources are often limited during large military mass casualty events, it is questionable whether traditional damage control procedures should be performed. It is important to note that both of these patients presented early in the sequence of events on October 3. Damage control procedures were already underway before the 46th CSH was notified of the scope and intensity of the ongoing battle. If these patients had been received later, in the middle of the patient flow, they may have been declared expectant.

Missile injuries to the pelvis and groin were particularly severe in this battle, as elsewhere. All casualties with pelvic fractures or injuries to the large vessels secondary to penetrating trauma in that region died. Mattox et al.,<sup>32</sup> in their study of civilian cardiovascular injuries, found that vessels in the lower abdomen and groin were more vulnerable to gunshot wounds than vessels in other locations. In another civilian study, gunshot wounds to the groin above the inguinal ligament with associated arterial injuries have a perioperative mortality rate of 39%, even with fairly rapid surgical intervention (20-90 minutes).<sup>33</sup>

Although most studies concerning battle casualties do not classify wounds to the pelvis and groin separately, it may be reasonable to do so in the future, as these injuries are a source of significant mortality. In fact, with improvements in body armor of the head, chest, and abdomen, the relative percentages of severe groin, pelvis, urogenital,<sup>34</sup> and proximal extremity injuries may increase in future conflicts.

The experience in Somalia is consistent with analyses of most other modern military conflicts in that open extremity wounds represented the largest fraction of survivable injuries.<sup>29, 35-37</sup> Fragment injuries to the extremities were more numerous but were typically less severe, whereas GSWs, especially when associated with open fractures or nerve and vessel damage, were the most morbid injuries, requiring the longest hospital stays and recuperation periods.

Tourniquets were used liberally at the CSH and at least once on the battlefield on casualties with severe extremity wounds, thus significantly decreasing blood loss before surgery could be performed. Small, uncomplicated fragment wounds, not associated with other injuries, were managed with daily wound inspection, dressing changes

as needed, and antibiotics given by medics and physician assistants in the troop living area while under the supervision of the task force medical officers. This conservative approach, used successfully in other conflicts with few complications,<sup>38,39</sup> saved a tremendous amount of hospital time and resources. It also ensured that lightly injured soldiers were available for additional combat operations, if needed.

Several of the more serious wounds became infected (Table 7). Most infected wounds were in the group of casualties whose evacuation was delayed for 14 hours. Current United States Army doctrine on prehospital care does not include antibiotic administration by medics in the field. Information on field use of antibiotics in this battle is only anecdotal, but it seems that very few of the casualties received antibiotics before reaching a casualty collection point or hospital. Early administration of antibiotics to combat casualties is recommended in many studies.<sup>40, 41</sup> For example, the *NATO Emergency War Surgery Handbook* suggests that parenteral antibiotics be given as early as possible to all patients with penetrating abdominal injuries, open comminuted fractures, and extensive soft-tissue extremity wounds.<sup>42</sup> Because evacuation to definitive surgical care is likely to be delayed more than 6 hours in future urban conflicts, antibiotic therapy should be initiated by medics in the field, preferably within the first hour of injury.

Delayed evacuation is typical in urban conflicts. Buildings and the close proximity of combatants make helicopter evacuation difficult, if not impossible. In cities, armored vehicles are vulnerable to ambush with antitank rockets and RPGs along narrow streets and alleys. Crossing exposed streets and moving through rubble with casualties on litters is dangerous and manpower-intensive. All of these factors were present in Somalia, where seven medics managed 39 casualties for more than 14 hours before they could be evacuated. The medics formed four or five small casualty collection areas and cared for 4 to 12 patients each. These treatment areas were located in rooms and courtyards of Somali houses near one of the downed helicopters, in some cases just a few feet from the ongoing battle. This experience is in marked contrast to the expectation of timely evacuation that presently guides the training for our conventional military medics. Future urban conflicts will demand medics who are trained for prolonged care in the field. Such training is presently available only to medics serving in special operations units.

Anticipated evacuation times to and from the forward hospitals must be based on the reality of un-

predictability and unavailability. The longest interval from the time of injury to arrival at the CSH for a casualty in Somalia was approximately 14 hours. Aero-medical evacuation flights arriving from Germany took 12 hours to reach Somalia and another 8 to 12 hours to return to Germany. Logistic and personnel plans during training exercises are often predicated upon a 4 to 6-hour evacuation process based on somewhat arbitrary criteria. Evacuation times for future training exercises and combat operations should be adjusted to reflect more realistic contingencies.

In 1993, United States Air Force aircraft used for casualty evacuation were staffed with only nursing personnel. These nurses were not trained to care for critically ill patients. Surgeons or physicians from the forward hospital were required to accompany critically ill patients on aeromedical evacuation flights. These doctrinal problems have been remedied by the United States Air Force's development of critical care air transport teams, comprised of critical care physicians, nurses, and respiratory technicians. These teams are designed to accompany the transport aircraft into the theater of operations and then care for critically ill patients during evacuation, leaving valuable medical personnel and equipment at the forward hospital.

In the post-Cold War era, the majority of future combat operations will likely continue to involve rapidly deployable, light infantry-type forces that can quickly respond to a variety of contingencies without a large amount of logistical support, including large forward medical facilities. In future operations, it is conceivable that an injured soldier will be evacuated directly from the battlefield to a forward surgical team, undergo lifesaving surgery in a tent on some distant airfield, and then be loaded directly onto an aeromedical transport. The patient may still be sedated, possibly on a ventilator, and perhaps have an open abdomen during the long evacuation flight to a fixed medical facility. The rapid deployment of a critical care air transport team will be needed to ensure the survival of the most severely injured combat casualties during air evacuation in this scenario. As the size of forward surgical footprint (surgeons, ORs, nurses, holding beds) in theater decreases, the reliability of dedicated aeromedical evacuation assets with critical care capability must approach 100% if the most severely injured are to survive. Conversely, as the size of the forward surgical presence increases, regular, dedicated, evacuation assets become less critical.

The importance of hospital personnel preparation for mass casualty events cannot be stressed enough. The single most important concept critical to

the successful performance of the 46th CSH during the battle was the recognition by the hospital's senior leadership early on during the deployment that the hospital must care for patients with traumatic injuries on a regular basis. The 46th CSH cared for many injured Somali civilians as well as numerous United States and allied soldiers with combat wounds before the October 3 battle. This ensured that all hospital personnel were ready when the TFR casualties began to arrive. Triage, resuscitation, and OR teams all functioned smoothly because everyone knew and had done their respective jobs multiple times before the battle. This type of preparation is not only a positive local civic action, but, more importantly, it ensures that the hospital will function at peak efficiency during combat operations.

The receiving hospital in Germany had little advance information about the patients and extent of their injuries before the arrival of the two planeloads of patients. They essentially experienced their own mass casualty event. With the ubiquitous use of digital photography, Internet access, and voice communication, a simple, easy system to transfer casualty data to the receiving senior surgeon should now be possible. During the 12-hour evacuation, this would have allowed deliberate planning for the receiving and triage areas, operating rooms, and optimal mobilization and use of appropriate personnel.

As in almost every conflict in which United States military surgeons have been involved since World War 1, uncross-matched, untested, fresh, whole blood transfusions were given after blood bank supplies were depleted. The donors were the hospital personnel and personnel from nearby military units. During the battle, 120 units were drawn and approximately 80 units were transfused. Blood type was determined on the basis of dog tags. These transfusions were required for hypothermic and coagulopathic patients, as neither platelets nor cryoprecipitate were available. The available fresh frozen plasma was stored in bags that fractured one third of the time upon thawing. The operating surgeons were extremely impressed with the ability of fresh, warm, whole blood to stop diffuse coagulopathy. No evidence of acute transfusion reaction was noted, and all survivors were evaluated for viral transmission upon returning to the United States. A rapid card-based system of blood typing and testing would be a valuable addition to the care of these patients. Such a system is used in other countries and should be authorized for use by deployed forces.

While attempting to reverse the coagulopathy in the critically injured patients, the authors encountered the problem, eloquently described by Cannon and Fraser

<sup>43</sup> in 1918, of the detrimental effects of hypothermia during the evacuation chain and in the combat hospitals. Patients who left the operating room in Somalia cold and coagulopathic died just as they did in Cannon and Fraser's<sup>43</sup> era. The United States military does not presently have a coherent plan to prevent and treat hypothermia during the various phases of casualty care. Such planning will be necessary to improve patient survival in the future; especially as more severely injured patients are evacuated longer distances.

In this group of patients, uncontrolled hemorrhage caused 22% of the fatalities. Hemorrhage continues to be a major cause of battlefield death and is the leading cause of combat death when evacuation is delayed for more than 6 hours.<sup>12</sup> The soldier who slowly exsanguinated from a proximal femoral artery and vein injury in spite of the efforts of a medic and others to stop the bleeding is a particularly poignant example. This again illustrates the point made by Bellamy<sup>11</sup> in 1984, when, in his discussion on improving the salvage of combat casualties, he stated, "first and foremost, there is a need to improve the field management of hemorrhage."

Clearly, the management of choice for severe extremity hemorrhage is an effective tourniquet followed by surgical repair or ligation of the injured vessels. But what about injuries not amenable to a tourniquet, such as those to the lower abdomen, groin, axilla, and proximal extremities? What is the optimal management for these patients on the urban battlefield of the future, where evacuation may be significantly delayed? Military antishock trousers, although not indicated as a resuscitation device or for patients with thoracic injury, may tamponade injuries of the abdomen, pelvis, and lower extremities not amenable to a tourniquet.<sup>11,44</sup> They also stabilize associated open fractures of the hip and pelvis, which can be significant sources of bleeding. Should these patients be aggressively resuscitated with intravenous fluids, as the patient in Somalia was? There is increasing evidence that aggressive fluid resuscitation, especially with crystalloid,<sup>45</sup> in the context of uncontrolled hemorrhage may be detrimental.<sup>46,47</sup> The Israeli soldiers, while fighting in Lebanon in 1982, recognized the difficulty in evacuating patients from urban areas and supplied blood to the medical units attached to the forces fighting there.<sup>24</sup> Is there a role for battlefield transfusion if evacuation is delayed? The United States Army should continue to support research directed toward delivering newer hemorrhage control techniques and devices to medics and surgeons in the field, such as the dry fibrin bandage.<sup>48,49</sup> As advances in materials and technologies continue to improve the care of the trauma patient, interaction between the

military medical research and development community and the trauma surgery community should serve to balance new and advanced technologies with the realities of the battlefield.

In traumatic deaths, the importance of the autopsy in assessment of internal injuries, confirmation of projectile pathways, and documentation of complications of injury or medical intervention is well known. Unfortunately, at the time of this operation, the OAFME did not have the legal authority to conduct complete death investigations, including performance of complete autopsies, when soldiers died because of hostile action. Only those procedures required to certify identity, cause of death, and manner of death were allowed under the existing Department of Defense rules. Thus only external and radiographic examinations were performed on the fatally injured soldiers in Somalia. Clearly, useful data were irretrievably lost because autopsies were not performed. Recently passed United States Federal legislation (10 US code, section 1471) has granted the OAFME broader jurisdiction over service members' deaths, allowing performance of complete death investigations, including the performance of autopsies.

Perhaps the greatest lesson learned from this battle is that there continues to be no system in place to capture detailed combat casualty data or the lessons learned by the surgeons, physicians, and medics caring for wounded casualties. A comprehensive combat trauma registry, similar to the civilian trauma registry that is in place at every trauma hospital in the United States, does not exist. Were it not for the authors' personal interest in combat casualty care and, in many instances, direct firsthand knowledge of how casualties in Somalia were managed, this analysis could not have been conducted.

The data presented here were obtained through painstaking retrospective review from multiple potential sources. Despite this exhaustive effort and the availability of many observations from this isolated event, the scenario and current patient data suggest many more questions than conclusions. The immediate effect of military trauma on the casualty and the response to field treatments has only once been documented by a large prospective effort.<sup>12</sup> The evidence upon which military penetrating trauma treatments are based is mostly anecdotal experience and, at best, retrospective analysis of the subgroup of patients that happens to be available to a particular investigator. A critical step in addressing the factors and treatments affecting combat mortality and morbidity is the collection of sets of complete data. Obviously, some military situations will make data collection impossible. However, a

full registry of military trauma with prospective data collection of defined subsets is achievable and would allow evidence-based validation of resuscitative and surgical interventions.

Previous attempts to gather prospective data have lacked the commitment of appropriate authority. (e.g., in Desert Storm and Bosnia). The following quote was found in the *Activities of the Surgical Consultants*\* "Clinical and laboratory investigation should have been considered an integral part and function of the medical department during service in a foreign theater.... One ranking medical officer in the theater Chief Surgeon's office bitterly opposed 'research in the jungle.' A base surgeon of equal rank was insistent that such an organization would deprive the wounded of proper care. Such attitudes were relics of the dark ages and they delayed progress." This sad observation was reiterated in the final report of the casualty data assessment team's Letterman Army Institute of Research Report #469<sup>9</sup> after an analysis of casualty data from Operation Desert Storm. During Operation Desert Storm, casualty data collection teams were not allowed into the theater of operations.

Only the military itself has the access and resources to accomplish a military trauma registry. The benefits of documentation of injury and effects of treatment have been well established in other areas of civilian trauma care.<sup>50</sup> The United States soldier, sailor, airman, or Marine deserves the benefit of this same analysis of military trauma.

\*Glen F. Chapter 17, Sixth U.S. Army. In: Carter N, McFetridge EM, eds. *Activities of the Surgical Consultants: World War II*. Vol. 1. Washington, DC: Office of the Surgeon General, Department of the Army; 1962:504.

## CONCLUSION

Military planners have recognized that in the future, armed conflict in urban terrain is likely to be the predominate form of war. It is an extremely violent form of combat conducted at close quarters and produces unique hazards and patterns of injury. Evacuation of casualties during urban conflict will often be delayed requiring exceedingly well-trained medics and corpsmen to manage multiple casualties for prolonged periods.

In the Battle of the Black Sea, members of the United States military wore body armor reinforced with solid armored chest plates, which reduced the number of fatal chest wounds, but the face, neck, pelvis, and groin remained vulnerable to severe injury. Improved

protective gear for the military and law-enforcement should be designed- analysis such as this make clear the need for specific improvements in equipment and training to prepare our armed forces for the urban battles of the future.

The formation of a combat trauma registry similar to the trauma registries in place at civilian trauma centers would be an invaluable asset in improving the care of our wounded patients. The beneficiaries of this data collection would be the military services and, ultimately, the casualties.

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# Anthrax and Special Operations

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## Abstract

**The microorganism *Bacillus anthracis* causes anthrax, a devastating and ubiquitous zoonotic killer. The cultural, economic, and agricultural impact of anthrax on mankind is impossible to estimate but may rival malaria. Anthrax poses a real risk to the members of special operations forces deployed into hyperendemic regions. Anthrax also significantly impacts the indigenous population in nations where the United States conducts operations other than war, foreign internal defense missions, and unconventional warfare. This article reviews the taxonomy, biology, clinical and natural history, pathogenesis, epidemiology, prevention and treatment of anthrax. Weaponization and bioterrorism threats are briefly discussed. Strategies to minimize the impact on special operations are recommended.**

**Editors Note:** Please note that this article was written prior to the recent outbreak of Anthrax around the country.

The microorganism *Bacillus anthracis* causes anthrax, a devastating and ubiquitous zoonotic killer. The cultural, economic, and agricultural impact of anthrax on mankind is impossible to estimate but may rival malaria. Only since the middle of this century has widespread vaccination slowed the assault of this slayer. Throughout history its ravages on livestock and feral food sources have afflicted man. The indirect effect of famine, cultural disruption, and forced migration must be considered in addition to the direct infection of man with its concomitant morbidity and mortality. Anthrax is referenced in many classical historical documents. Among these are the Bible, The Koran, and the writings of ancient Greece and Rome. One source alleges that anthrax may have caused the "plague" that led to the Diaspora of the Jews from Egypt. Although there are many effective controls available, anthrax remains a fiscal scourge of both developed and underdeveloped nations. One cannot overestimate the economic and societal impact of this bacterium.

Of historical scientific note, anthrax was the primary disease that led to the development of modern microbiology and infectious disease theory. In 1876 the German physician Robert Koch began experimenting with a disease of cattle that occasionally infected humans. Koch was able to subsequently pass

the disease, anthrax, to cattle by in vitro and in vivo methods because of *B. anthracis*' nature. He developed the "Koch's postulates" on the basis of these experiments. Those postulates continue to influence and direct infectious disease policy and investigations.<sup>1,2</sup> Pasteur also worked with anthrax and developed what may have been the first vaccine against disease, although others argue that English physician W. S. Greenfield's work predated the Pasteur trials.<sup>3</sup>

## TAXONOMY & BIOLOGY

*B. anthracis* is a 1 - 1.5 µm by 4 - 10 µm, square-ended, nonmotile, aerobic, gram-positive rod. The cells from long chains and virulent forms will develop a capsule in vitro. Capsulation occurs both on agar plates and in vivo. Its preferred growth temperature is 35°C, but it willingly divides between 12°C and 45°C. Optimal fission is realized between pH 7.0 and 7.4. This bacterium will grow quite readily on culture plates, in soil, and in the tissue of dead and living animals. Biochemically, *B. anthracis* can be differentiated by the absence of hemolysis on blood agar, absence of salicin fermentation, positive gelatin hydrolysis, and inhibition by antibiotics on various treated agar plates.<sup>4</sup>

Sporulation, the most basic reason that anthrax survives in the environment, requires oxygen. Spore

maturation, however, may occur in anaerobic conditions. Spores are highly resistant to environmental factors. *B. anthracis*' resistance to drying, boiling, and most disinfectants is well documented. Temperatures of 120°C for 15 minutes are normally used to destroy spores.<sup>5</sup> Recent reports from the former Soviet Union (FSU) demonstrate this organism's incredible resistance to disinfection with bleach combinations.

## **CLINICAL & PATHOLOGICAL NATURAL HISTORY**

Human and animal anthrax is divided into four common presentations. Classically, the clinical presentation is related to the mechanism of exposure. The most statistically common anthrax infection involves the skin followed in frequency by gastrointestinal disease. A rarely seen form of inhalational anthrax exists and is the basis for a bioweapon. Anthrax meningitis and oropharyngitis is well documented but its contribution to worldwide mortality is insignificant.

Cutaneous anthrax in man and animals occurs when *B. anthracis* is introduced to the integument by injury or inoculation. Spores rapidly germinate and multiply producing their toxins. The signs of the infection, rapid progression of massive edema and necrosis, are clearly visible in four to five days. Initial lesions frequently produce small and usually painless papules. Commonly, these eruptions cause pruritus and contribute to the spread of the bacterium through mechanical abrasion. About 24 hours later the papules enlarge, becoming very edematous, and the systemic symptoms begin. Systemic effects are severe. These including fever, malaise, and regional lymphadenopathy. Within one week, a large ulcerated black eschar is produced that will slough in two to three weeks. Cutaneous anthrax is almost never fatal if treated, but untreated cases will rapidly progress to septic shock and death.

Gastrointestinal anthrax occurs after the consumption of uncooked or undercooked meat contaminated with the bacterium. *B. anthracis* rapidly reproduces once in the alimentary canal, invades the intestinal wall, and translocates to the mesentery lymph nodes. This process is probably actively assisted by macrophages. The disease rapidly progresses after achieving the lymph nodes and disseminates throughout the system. This form usually presents at about 5 days from exposure. Nonspecific signs and symptoms include abdominal pain, ascites, hematemesis, hematochezia, and fever. Septic shock rapidly occurs, and misdiagnosis is frequent. Although treatable, any

significant delay in treatment is usually fatal. Mortality rates with this form of anthrax are exceedingly high given the normal physician's low index of suspicion.

Patients with oropharyngeal disease complain of severe sore throats, oral or tonsil ulcers, and are frequently quite ill in appearance. Fever, toxicity, and swelling of the neck are almost always present.<sup>6</sup> Submandibular node swelling and edema may lead to difficulty swallowing with airway compromise.<sup>7</sup> Mortality in both forms may be as high as 50%, especially in the gastrointestinal form.<sup>4</sup>

Inhalational anthrax occurs when an adequate dose of spores are inhaled into the lower airways. The Department of Defense estimates that the minimum infectious dose begins at 8,000 spores in humans.<sup>4,5</sup> Once inhaled the spores are quickly transported to the hilar and mediastinal lymph nodes by pulmonary macrophages. Incubation is usually six days, but initial symptoms may begin as soon the fourth day. Typically, these present as muscle pains, fatigue, nonproductive cough, fever, and vague chest pain. Frequently there is a short respite before the second stage. Sudden onset of respiratory distress, sepsis, and death occur about one day later. Chest radiography frequently demonstrates large pleural effusions and a widened mediastinum. [Editor's Note. Mortality is universal in non-immunized, untreated patients.]

Meningitis may occur following bacteremia as a complication of any of the other clinical forms of the disease. Meningitis may also occur, very rarely, without a clinically apparent primary focus. It is very often hemorrhagic, which is important diagnostically, and almost invariably fatal.<sup>4</sup>

Blood and wound cultures will rapidly confirm the diagnosis of anthrax in any infected patient. This is not a subtle disease, and bacteremia is common. Biochemical confirmation testing is used to differentiate *B. anthracis* from *B. cereus*, a common gastrointestinal and foodborne pathogen. A microhemagglutination test also exists. Chest roentgenographs are valuable, as the associated mediastinitis is almost pathognomonic for inhalational anthrax. PCR and other DNA homology techniques are commonly used in outbreak investigations.

## **PATHOGENESIS**

*B. anthracis* has at least three toxins and probably several virulence factors. The toxins are the protective antigen (PA), the lethal factor (LF), and the edema factor (EF). These factors are genetically encoded on the two large plasmids found in all patho-

genic strains. Both plasmids are required for virulence. The pathogenesis of the anthrax infection is dependent on successful production of the three toxins. These toxins first act to cause an incredible amount of localized edema and then exploit macrophages and polymorphonucleocytes to prevent the oxidative burst with eventual autolysis of these protective cells.

PA was discovered first and named for its ability to induce a protective antibody response in the host system. Animals and humans inoculated with the protective antigen will produce IgG. In experimental animals this antibody will bind with the protective antigen and protect the host against the harmful effects of the infection. Animals challenged with anthrax toxins after immunization survived without difficulty. Further study elucidated that, in the absence of the protective antigen, large purified doses of both the LF and the EF could be administered to animal models without evidence of toxic effects. This discovery demonstrated that both the LF and EF were PA-dependent toxins. Additional testing showed that PA alone had no toxic effects. In 1989, Blaustein, et al., discovered that PA interacted with a host cell membrane receptor and induced a selective channel in the phospholipid bilayer to mediate translocation of EF and LF into the target cell's cytosol. They also discovered that EF and LF lacked any intrinsic auto-translocation activity.<sup>8</sup> These conclusions are supported by the demonstrated lack of toxicity in EF and LF when dosed in their pure forms.

EF is an enzyme, and its effects are caused by corruption of the host's intracellular second messenger system. EF is a calmodulin-dependent adenylyl cyclase that converts adenosine triphosphate to cyclic adenosine monophosphate (cAMP).<sup>5</sup> The intracellular concentrations of cAMP increase about 200-fold above normal.<sup>9</sup> Hoover, et al., using EF and monocyte cell cultures conducted assays for the production of cytokines associated with edema production and bacterial host defense.<sup>10</sup> Their research demonstrated that EF negatively effects paracrine secretion of the hosts defensive signaling system from immune cells. The effect down regulates the chemoattractant signaling of injured cells. EF then plays a significant role in *B. anthracis*' ability to avoid destruction during infection. EF itself, however, cannot induce a lethal effect in vitro or in vivo. Although commonly called a toxin, EF may be better classified as a virulence factor by the inhibition of immune response.

LF is the sharp end of the anthrax infection. Several studies have shown that LF, with PA, will kill host models quickly and effectively at low concentra-

tions. Initial lethality studies in Fisher rats and Hartley guinea pigs suggest a lethal dose 50% (LD50) of 2.5 micrograms in animal between 250 to 300 grams. This correlates to an LD50 of approximately 8.3 micrograms/kilogram of body weight.<sup>11</sup> Another group authenticated a dose response curve in Fisher rats based on times to death by varying bacterial burdens.<sup>12</sup> It was also determined that LF followed the classic model of enzyme second order kinetics. A saturation point was observed where target cells' time to death could not be quickened with increasing doses. (11) LF is a zinc-metalloprotease that disrupts normal homeostatic functions.<sup>13</sup> LF stimulates the activity of the cellular phospholipase C and protein kinase C. These cells then suffer a rapid rise in inositol triphosphate concentration.<sup>14</sup> LF causes the vast destruction seen with the infection.

Generalized destruction of tissue occurs once adequate concentrations of LF are reached, followed quickly by shock and sudden death. LF has several effects within the cell. First, it stimulates and causes the overproduction of reactive oxygen intermediates. Second, it induces the production and release of tumor necrosis factor and IL-1. Third, it stimulates both cytolysis and apoptosis. Macrophages and polymorphonucleocytes are exquisitely sensitive to LF. Perhaps the most significant factor associated with the pathogenesis of *B. anthracis* is its ability to survive and multiply within host macrophages. This capability may far outweigh any of its other virulence factors and is related to the capsular proteins. Apparently hijacking the host defenses, the bacterium rapidly and aggressively spreads through the lymph channels causing widespread injury. The macrophages rapidly, within seconds of exposure, translocate the spores from the alveoli to the mediastinal nodes in an inhalational exposure. The combination of these effects leads to expeditious immune cell death.

## **EPIDEMIOLOGY**

Animals, mostly herbivores (sheep, cattle, horses, and goats), serve as the domestic reservoir for *B. anthracis*. A broad sylvatic cycle also exists among wild ungulates. Birds appear resistant to infection, but vultures may act as a fomite vector in some areas.<sup>15</sup> Infection with the disease is usually terminal. Dying animals frequently bleed from the oropharynx and bowels spreading the bacterium through the range of the animal's travel. Herds attacked by anthrax may spread the contamination across hundreds to thousands of acres dependent on their migration velocity and terrain preferences. *B.*

*anthracis* will multiply once in the soil and increase the potential infectivity of the environment. Localized concentration of spores may occur through various mechanisms. One well described geographically dependent phenomena takes place in draws and valleys with streambeds and waterholes. During the rainy season when vegetation is plentiful, the herds graze all over the valley, become infected and contaminate the soil before eventually dying. As the rains continue, the bacillus is washed from the higher elevations to the low-lying streambeds and consequent riparian zones. These riparian zones become grossly contaminated with spores. Once the rainy season passes, vegetation dies off except for the moist area surrounding the remaining water sources. The herbivores are naturally concentrated there to feed and water, and a second anthrax "season" usually follows due to this intense bioconcentration.<sup>16, 17</sup>

Animals are typically exposed via grazing behavior but may become infected with cutaneous anthrax secondary to bedding, kneeling, or rolling in contaminated soil. Anthrax lesions often occur on the lips, knees, and abdomens of these creatures. Open lesion exposure is likely, but inoculation injuries from plants and cacti probably also have roles. Anecdotal and experimental evidence exists for transmission of *B. anthracis* by several species of filth flies, biting flies, and mosquitoes.<sup>18, 19</sup> The blowfly of North America has also been implicated in a sylvatic cycle of white-tailed deer.<sup>20</sup>

Soil studies indicated that the bacterium favors ground with pH greater than 6.0 and rich organic components. Therefore, local outbreaks represent a combination of environmental factors that include the host animal biology, the soil microenvironment, and the regional weather patterns. Proper conditions may produce "anthrax zones" when there are favorable and sudden changes in local climate. Today, in the United States, these areas closely resemble the cattle drive trails of the Mexico, Texas, Oklahoma, and Kansas routes.<sup>21</sup> Similar "anthrax zones" exist on every continent except Antarctica.

Human transmission occurs through a variety of mechanisms. Primarily, human anthrax is a disease of occupational exposure. Malignant pustule, malignant edema, woolsorter's disease, and ragpicker's disease are common names for occupationally acquired anthrax. Workers become exposed during the processing of contaminated carcasses, goat hair, bone products, and/or wool. Veterinarians, agricultural workers, and wildlife workers are also exposed.<sup>22</sup> Various and sporadic reports of outbreaks

documented during the last 50 years follow the typical pattern: usually a small outbreak in the animal population will occur with sporadic human cases from secondary exposure. As an example, Parvizpour, in 1978, performed a retrospective case review of 468 patients admitted to an Iranian hospital over the previous 13 years. The author's review showed 59.83% of cases were male and 40.17% female. Over 74% of patients had contact with animal products while 20.73% contracted the disease directly from sick animals. Of those cases, 27.86 percent were occupational exposures.<sup>23</sup>

In contrast, Zimbabwe is an example where large anthrax outbreaks in humans have resulted, probably because of limited veterinary care. More than 6,000 cases (mostly cutaneous) occurred between October 1979 and March 1980.<sup>24</sup> In 1996, Mwenye, et al., found a case fatality rate of 26% in several villages in Zimbabwe. The investigators confirmed several risk factors significantly associated with the disease including cutting or skinning a diseased animal, eating contaminated meat, and processing contaminated meat for sale.<sup>25</sup>

Animal anthrax continues to impact worldwide agricultural practices and animal husbandry programs. Epizootic outbreaks of *B. anthracis* can devastate local herbivore production and result in the wholesale slaughter and internment of food herds. In North America the organism remains endemic in Texas, Mississippi, and Oklahoma. An animal outbreak in 1997 included a swath of 22 counties in southwestern Texas that spread from Del Rio to Corpus Christi. The outbreak investigation revealed a hyperendemic situation among the deer population that spread into domestic animals. Some deer herds were completely wiped out. Curiously, no human cases were reported despite the broad scale of this outbreak. This may relate to a low level of out-of-season hunting when this summer epidemic occurred outside of peak deer harvesting season.<sup>20</sup> Another epidemic presented in North Dakota in 1998. At least six herds of cattle were affected and 27 animal deaths were reported, but no cases of human anthrax were discovered. Other states with sporadic outbreaks in the last ten years include South Dakota, Nebraska, New Mexico, Oklahoma, California, Kansas, and Mississippi. Canada is likewise sporadically afflicted.

Among the "economically advanced" nations, Russia appears particularly bad since 1991. One death occurred and eight people were infected in Tambov, a city just outside Moscow, in 1995. In 1996 a small city just north of Tambov suffered an outbreak with 23 infections, one death, and 1500 individuals vacci-

nated. The states of Georgia and Azerbaijan also suffered outbreaks in 1996. Multiple human cases in Krasnodar, Stavropol, Kalnynya, and Sanatov were reported between 1996 and 2000.<sup>20</sup> It is the author's opinion that these outbreaks are due, without doubt, to a socioeconomic interruption of normal veterinary services, an increased demand for meat products, and a lack of basic food surveillance and inspection programs.

Spain is the leader in human anthrax cases of the industrialized nations. In 1990 they reported 152 cases of the disease, and in 1996 they reported 50. The other European countries report sporadic outbreaks with 1-2 human cases per year. China reported 898 cases in 1996 and 1210 cases in 1997. Clearly this disease has not been conquered.

Effective and accurate evaluation of the state of anthrax is probably impossible among nonindustrialized nations, but the number of animal vaccinations purchased may be used as a relative indicator of anthrax presence. In excess of one billion animals are inoculated per year in nonindustrialized nations based on country reports and the various vaccine manufacturers' statements. Combining reported anthrax infections along with vaccine use, the following countries are considered hyperendemic: El Salvador, Guatemala, Haiti, Peru, Georgia, Azerbaijan, Kazakhstan, all of west Africa, Niger, Ethiopia, Chad, Spain, Greece, Turkey, Mongolia, Cambodia, and Vietnam. The list of countries with an endemic or sporadic status is too vast to report here.<sup>20</sup>

## **PREVENTION**

The key to the prevention of animal and human anthrax is vaccination of domestic animals. Many nations of the world are now reported to be anthrax "free" due to aggressive animal vaccinations. Historically, anthrax was the first disease for which immunity was developed due to inoculation. This vaccine was first produced by Pasteur in 1881. The animal vaccine in use today was developed from a live, toxin-producing, unencapsulated form of the bacterium. It is used as a single dose with an annual booster. The animal vaccine is not used in humans. The vaccine is effective in halting and preventing further outbreaks.<sup>26</sup>

The FSU, the United States, and the United Kingdom have all manufactured anthrax vaccines. Currently these vaccines are only being used in occupational settings and the military. The US vaccine, produced by Bioport (an offshoot of the Michigan De-

partment of Public Health) is a 0.5ml multi-dose intervention. The immunization is given subcutaneously at 0, 2, and 4 weeks followed by additional doses at 6, 12, and 18 months. Yearly boosters are also recommended.<sup>27</sup> Obviously, the economic and administrative impact of inoculating can be overwhelming.

Basic public health measures are also effective in preventing human anthrax. Proper and thorough cooking of meat by the consumer will kill the bacillus. Other measures include culling the herd of infected animals and deep burying destroyed carcasses to prevent fly and scavenger carnivores spreading the contamination. Quicklime saturation of burial sites and kill fields is also recommended. Frequent decontamination of hands, clothing, and cutting instruments with hot, soapy water will decrease the incidence of infection for personnel in endemic countries exposed during work in rendering plants or slaughterhouses. Food animals should undergo both pre- and post-slaughter inspections by trained personnel. This is especially important in the manufacture of ground meat and sausage since a single infected animal can contaminate tons of product. Hair and hide products should be routinely sanitized by either curing or chemical cleansing. Bone and bone meal products should be thoroughly cooked before packaging and shipping.

## **TREATMENT**

Treatment with either oral fluoroquinolones or doxycycline is currently suggested for post-exposure prophylaxis in adult humans. Three doses of the human vaccine are added concomitantly at 0, 2, and 4-weeks. Antibiotic prophylaxis should continue for at least four weeks post-exposure or until three doses of vaccine are given, whichever is longer.

For individuals with confirmed anthrax infection, intravenous antibiotics of the fluoroquinolone class and admittance to an intensive care unit are currently recommended by the United States Center for Disease Control. The 1995 edition of the Control of Communicable Disease in Man states that penicillin is the drug of choice with tetracycline, erythromycin, and chloramphenicol as effective alternatives.

## **BIOWARFARE & BIOTERRORISM**

Anthrax poses a significant threat as a bioweapon on urban population centers. *B.*

*anthracis* is an ideal organism for a weapon of mass destruction given its biological stability, environmental resistance, and potential routes of infection. It is easily obtained and purified from the soil in endemic regions and rapidly grows on several types of media. Although culturing and producing does require a small amount of technical sophistication, the process is not beyond the capability of most college graduates. Unlike many other bioweapons, anthrax requires no environmental hardening to keep it viable and infective during an aerosol release. As a spore, it is also resistant to explosive driven dispersal mechanisms.

A well-documented anthrax outbreak produced undisputed evidence that the FSU manufactured bioweapons. This investigation also demonstrated the efficiency of an aerosol release in causing disease. Sixty-six people died of anthrax in 1979 near a Soviet Military Bioweapons Facility in the town of Sverdlovsk. Although reported as an outbreak associated with contaminated meat, later investigations, including autopsies, demonstrated unequivocally that aerosolized *B. anthracis* spores from an atmospheric release caused this epidemic. It became clear once the distribution of the cases was determined that the pattern of infection matched the expected wind dispersal bloom. The northeast end of the affected zone originated at the military microbiology lab, and the downwind infections terminated at the city limits.<sup>28-30</sup>

This is not the only report of weaponized anthrax. In June of 1999 a report surfaced describing the destruction of anthrax stockpiles in Russia. According to various sources hundreds of tons of anthrax spores were “destroyed” in a bleach solution and transported in 24 rail cars to Vozrozhdeniye Island in Uzbekistan. The rail cars contained over 100 tons of anthrax based on US intelligence service estimates. The containers were dumped into pits upon arrival and covered with soil. Later, an American team determined that soil samples from 6 of the 11 sites tested were positive for live cultures of anthrax.<sup>31</sup> In Iraq, site inspectors from the United Nations concluded that 8,500 liters of concentrated anthrax had been produced and some 6,500 liters were filled into munitions.<sup>34</sup>

The economic breakdown of the FSU with the destabilization of international borders is of further concern. Cash poor nations of the FSU are selling massive amounts of military hardware. This glut of weapons is flowing out the FSU and into the hands of whoever can afford the purchase price. The potential for outright sale of bioweapons and the sale of biopharmaceutical equipment easily adaptable to weapon production exists. Both terrorist groups and nation states that

formerly lacked the technical ability to propagate a bioweapons program now can simply purchase one at their leisure.

In the years between 1997 and 1999, approximately 6000 people throughout the United States have been threatened by bioterrorism in the form of anthrax.<sup>32</sup> Among the institutions threatened were government offices, private industry, abortion clinics, and private residences. While all of these threats have been hoaxes, the economic and psychological impact of these hoaxes should not be underestimated. Most of the 6000 thousand people threatened were temporarily quarantined or underwent decontamination. A significant number of “exposed” individual underwent post-exposure prophylaxis with chemotherapeutic agents. The threat is almost as good as an actual attack in obtaining press coverage and pushing forward a political agenda.

Imagine the release of a non-virulent form of *B. anthracis* that would “culture positive” until confirmatory testing was completed in subsequent days. In this setting an “exposed” population of 100,000 people would require “decontamination.” This situation alone would require over 3000 man hours from emergency medical personnel and the transportation and mixing of over 250,000 gallons of hypochlorite solution.<sup>32</sup> [Editor’s Note. Hypochlorite solution is unnecessary to “decontaminate” personnel exposed to aerosolized anthrax. Simply shower and change clothes.] Widespread panic and confusion would reign once the situation evolved. There would be hundreds of deaths and injuries from accidents. If a true “hot” strain was used to potentially expose 74,000 people at a football game, one paper proposed that over 20,000 would be infected and 4000 would die.<sup>33</sup>

## **IMPACT ON SPECIAL OPERATIONS**

Anthrax is still a disease of significance. Although it has almost been wiped out in industrialized nations and only sporadic livestock outbreaks with rare human infections still occur in these places, this success has overshadowed and diminished our awareness of the disease’s hyperendemic presence in many developing nations. Its destruction of livestock and food source species as a natural pathogen continues to plague a large part of the world. Anthrax and many other diseases will continue to plague man until effective public health measures are adopted worldwide. This disease poses a tremendous economic burden in the hyperendemic regions that plagues governments only barely able to function. Anthrax epidemics may have sudden and swift consequences on population dispersal, forced migration, and refugees. Whole villages may suddenly

move from one area to another to escape contamination. The impact of starvation, fear of infection, and death are lethal combinations when American forces are attempting to enforce national borders, buffer zones, and treaty agreements.

Special Operations forces operating in hyper-endemic areas should be acutely sensitive to the risk of anthrax exposure. Aggressive adherence to protocols of field sanitation should prevent most exposures and infections. Reliance on indigenous food sources, particularly meat, should be minimized. All locally procured animals should be inspected alive prior to slaughter. Every effort should be made for a veterinarian or the most senior medical provider to participate in the slaughter and inspection of carcasses before cooking and consumption. All meat products should be thoroughly cooked. Rare meats are a high-risk adventure in deployed settings. The United States Army Veterinary Corps produces excellent reference manuals for food inspection.

Special Operations forces deploying to hyper-endemic countries should insist on and obtain a medical intelligence briefing. The Armed Forces Medical Intelligence Center will provide a broad range of medical intelligence products. In many cases, unclassified intelligence is available to the end user from the AFMIC web site. Classified intelligence can usually be obtained through the organization's Intelligence Officer.

Units on patrol can avoid exposure by many simple measures. Kneepads and elbow-pads will reduce the risk of pressure injuries and kneeling directly onto contaminated soil. Avoiding herding animal migration paths and staying out of streambeds during dry seasons will also reduce potential exposure. Avoid travel through animal paddocks, corrals, and offal collections. As always, avoid any animal that seems unafraid of human contact or behaves in an unusual manner.

Medical personnel supporting Special Operations forces should familiarize themselves with the prevention, diagnosis, and treatment of anthrax prior to deployment. Adequate supplies of oral and intravenous fluoroquinolones and doxycycline should accompany deploying sections. A comprehensive medical evacuation plan should always be prepared and tested. Providers should remember that due to fluctuations in Department of Defense policy not all service members have completed their vaccine series. Others may have not received their annual booster. This situation should be remedied before deployment. An adequate stock of the vaccine should also accompany the deploying asset since the first three doses are also a part of the treatment protocol for previously unimmunized

personnel. One must remember that the vaccine must be refrigerated. Most importantly, all medical personnel should maintain a very high index of suspicion for anthrax.

## CONCLUSION

Despite its existence as an animal disease, *B. anthracis* remains a real and consequential pathogen of mankind. The threat of anthrax cannot be ignored even in the United States. Anthrax poses a real and significant impact on the nations that Special Operations forces typically deploy into. Operations other than war, foreign internal defense missions, and unconventional warfare operations can all be impacted by the direct effects of anthrax or the political upheaval and socioeconomic cascade of this ubiquitous disease. The well-trained operator knows and understands the risks and potential pitfalls of anthrax.



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## From the Continuing Education Staff

The staff of the *Journal of Special Operations Medicine* Continuing Education Department welcomes medics and corpsmen to earn up to two (2) continuing education hours in this edition. Read the articles on Anthrax and Relieving Painful Shin Splints then take the following tests. Submit them via email to JSOM@SOCOM.MIL. In the subject area type “test submission” and the name of the article. Include your license or certification number. Direct any questions to our POC for JSOM Continuing Education: MSgt Bob McCumsey at DSN 299-5043 or email [mccumsr@socom.mil](mailto:mccumsr@socom.mil).



# CONTINUING MEDICAL EDUCATION TEST

## NO. 2

### Relieving Painful Shin Splints



1. Medial Tibial Stress Syndrome (MTSS) refers to a stress reaction of the fascia, periosteum, bone or combination of these along the posterior medial aspect of the tibia. T or F
2. Stress fractures or compartment syndrome of the anterior tibia is another name for MTSS. T or F
3. Pain from MTSS results from:
  - a. Microscopic fissures in the anterior tibia
  - b. Tibia cortical wall thinning
  - c. Soft tissue damage with resulting inflammation
4. During the patient interview (history), inquiries into running surface/terrain, shoes worn and training habits give important insight as to the cause of the injury. T or F
5. Upon physical examination, typically pain associated with MTSS lies along the:
  - a. Entire anterior tibial border
  - b. Medial tibia, typically distal 1/3
  - c. Proximal anterior/lateral tibia
6. Differential diagnosis includes:
  - a. Stress fractures
  - b. Chronic exertional compartment syndrome
  - c. Shin splints
  - d. a & b only
  - e. All of the above
7. Neurologic or vascular abnormalities that occur with chronic compartment syndrome will essentially rule out MTSS as a primary concern. T or F
8. Radiologic diagnosis of MTSS is best made by noting increased uptake on a bone scan. T or F
9. Initial treatment is conservative, these include:
  - a. Doubling your running milage
  - b. Alternate activities (i.e. swimming, cycling)
  - c. Stretching
  - d. Icing and NSAIDS
  - e. b, c & d only
  - f. All the above
10. Replacing worn shoes at regular intervals and/or mileage can prevent MTSS. T or F

**T**HE  
**JOURNAL OF**  
**S**PECIAL OPERATIONS MEDICINE

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USSOCOM/SOCS-SG

ATTN: Msgt Bob McCumsy

7701 Tampa Point Blvd.

MacDillAFB, FL 33621-5323

or submit them via email to JSOM@socom.mil

**Relieving Painful ‘Shin Splints’**

Please include

Name \_\_\_\_\_

Specialty & License or Certification # \_\_\_\_\_

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State \_\_\_\_\_

Zip \_\_\_\_\_

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Signature \_\_\_\_\_

# CONTINUING MEDICAL EDUCATION TEST NO. 1

## ANTHRAX and Special Operations

### **T**HE **J**OURNAL OF **S**PECIAL OPERATIONS MEDICINE



1. What is the most prevalent form of human anthrax infection in poorly developed nations?

- a. Meningitis
- b. Gastrointestinal
- c. Pulmonary
- d. Cutaneous

2. "Second season" cattle epidemics may be caused by bioconcentration of anthrax spores. Where are these highly contaminated areas usually found?

- a. Wide, gently sloping valleys
- b. Saddles
- c. Low-lying streambeds
- d. Ridges

3. What is the most effective and efficacious method for preventing and halting anthrax epidemics in domesticated herbivores?

- a. Lyme pit destruction of infected animals
- b. Broad scale use of antibiotics in animal feed
- c. Filth fly eradication
- d. Vaccination

4. What is the primary ingredient the United State's current anthrax vaccine?

- a. Protective antigen
- b. Edema factor
- c. Lethal factor
- d. Unencapsulated live anthrax bacillus

5. What is the United States Department of Defense estimated minimum infectious dose begins for inhalational anthrax in humans?

- a. 4000 spores
- b. 8000 spores
- c. 16000 spores
- d. 32000 spores

6. What pathognomonic feature of chest roentgenographs is associated with inhalational anthrax?

- a. Mediastinitis
- b. Pleural effusion
- c. Pneumothorax
- d. Lobar consolidation

7. How long should post-exposure antibiotic prophylaxis be continued after a suspected anthrax bioweapon exposure?

- a. 4 weeks or until the first vaccination is given
- b. 6 weeks or until the first vaccination is given
- c. 4 weeks or until the third vaccination is given
- d. 6 weeks or until the third vaccination is given

8. What is the most likely impact of anthrax on Special Operations Deployments?

- a. Direct infection of team members
- b. Inability to acquire suitable meat from local sources
- c. Team member post-exposure antibiotic prophylaxis
- d. Population dispersal, forced migration, and refugees

9. What precautions must be taken when there is an unavoidable requirement to locally acquire meat.

- a. Purchase sides of beef to minimize processing
- b. Provide samples to local veterinarian for inspection
- c. Provide rare and medium rare entrees
- d. Inspect the animal before slaughter

10. Which type of anthrax toxin allows its other toxins to enter the host cell.

- a. Protective antigen
- b. Edema factor
- c. Lethal factor
- d. Calmoudlin factor

<b>THE JOURNAL OF SPECIAL OPERATIONS MEDICINE</b>	<b>ANTHRAX</b>
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# SOMA Update



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*Registration can be accomplished on site in Tampa. A registration fee of \$20.00 for physicians and \$10.00 for all others is payable at the sign-in desk in Galleria B, which will be manned Sunday afternoon and evening and daily thereafter. All attending must register although speakers and exhibitors are exempt from registration fees.*

## **ACCOMMODATIONS**

*A special room rate of \$89.00 single or double, and \$109.00 triple or quadruple, has been provided for the conference. However, the room block is limited. When it is filled, the rate may be higher. Also, the **cutoff date for this rate is November 13<sup>th</sup>**. The number to call for reservations is 813-225-1234 which should be called 8:00-5:00 days. The Hyatt 800 number will not be able to access the SOMA room block.*

## **Ground Transportation**

***Dollar Rent-A-Car** has been selected as the official car agency for the conference. Their special group rates are good for 1 week before the conference, and include unlimited mileage. Economy cars are \$24.00 per day or \$120.00 per week, with similar discounts on larger sizes. Our Group name is "SOMA" and the central reservation number is 1-800-237-8396. The Tampa Airport Dollar booth is 813-396-3640.*

*An Airport Limo will be offering transportation to/ from the Airport on a 24-hour basis at a charge of \$9 from the airport and \$7 from the hotel to the airport. Advanced reservations can be made by calling 1-800-282-6817, or you can present yourself to the Limo check-in desk at every baggage claim area.*

## **Uniform Requirements**

*The appropriate uniform for wear is the class B uniform for Army and Air Force personnel, khakis or working blues for Navy personnel, and business casual for civilians. **However, Due to recent events, business casual attire is encouraged for all military attendees. Check with your component command to be sure . EMT duty uniforms, BDUs, jeans, collarless shirts or athletic attire are not permitted in the conference rooms.** Mess dress or formal attire for Mess night is neither expected nor encouraged.*

### **Mess Night**

*This year's Mess Night following the close of the Monday program, is hosted by Mr. Bill Clark of Aventis Pharma. This is an excellent opportunity to meet informally with speakers and exhibitors while enjoying a first class buffet. The musical portion of the program will be provided by the world champion City of Dunedin Pipe band. The bar will open after the head table is seated.*

### **Operation Aeromedical Problems Course**

*For the first time we are able to offer the Operational Aeromedical Problems Course- a 3 day conference for flight surgeons. It is presented by the School of Aviation Medicine and the Society of US Army flight Surgeons. It will run Tuesday- Thursday and be held in the Buccaneer Suites immediately across from the Exhibitor Hall. Participants should register for this at the SOMA desk and will pay the SOMA registration fee. The OAP faculty have graciously invited SOMA attendees to audit any lectures they might find interesting- space permitting.*

### **General Membership Meeting**

*A general membership meeting will be held Monday afternoon after the last lecture for the purpose of electing new officers, reporting board actions to the membership, hearing the Treasurer's report and any new association business. Everyone attending the conference is a voting member for 1 year and is encouraged to attend. Nominations for officers can be made from the floor, but be prepared to describe the fitness of your nominee for the office and be sure he will accept it if elected.*

### **Golf Tournament**

*The Bayer Pharmaceutical Company and their representative, Mr. Ron Snider, invite all registered attendees to participate in the Special Operations Warrior Foundation Golf Tournament which will be held at the Bay Palms South Course at MacDill Air Force Base on Monday morning. All fees are waived, but players must bring a check for at least \$25.00 made out to The Special Operations Warrior Foundation. Reservations and team assignments must be made prior to November 11<sup>th</sup> by emailing Bob Clayton at claytor@socom.mil. Soft spikes and appropriate golf attire are required. **Day & time TBA.***

### **Continuing Medical Education Credit**

*Registrants will be issued CME certificates at the SOMA desk at the close of the conference or on the last day you attend. None will be available after the conference. Please make sure your departure day plans includes a few minutes at the SOMA desk to pick up your certificate.*

*The U. S. Army Medical Command is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians. The U. S. Army Medical Command takes responsibility for the content, quality, and scientific integrity of this CME activity.*

*The U. S. Army Medical Command designates this educational activity for a maximum of 32 hours in category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.*

*The planning committee for this activity has determined that an important need exists to provide continuing medical education to SOF assets in the 3 services, federal and civilian tactical EMTs, and our allied counterparts.*

*This educational activity is designated for military SOF personnel and their civilian counterparts. No special prerequisites are required to attend this educational activity.*

### **Learning Objectives**

*At the conclusion of this activity, participants should be able to:*

- Describe physiological response to cold and treatment of cold injury in a tactical environment.*
- Perform rapid trauma assessment and management of multi-system trauma.*
- Understand the position of the military in operations other than war.*



- Describe and manage operational aeromedical problems
- Describe medical unconventional warfare doctrine for the 21<sup>st</sup> century
- Manage diarrhea, skin problems, anesthesia, and foot problems.
- Describe the special operations capabilities of other services and in other countries.

### **Policy on Disclosure**

As a sponsor accredited by the ACCME, it is the policy of the Army Medical Command to require the disclosure of the existence of any significant financial interest or any other relationship a faculty member or a sponsor has with the manufacturer(s) of any commercial product(s) discussed in an educational presentation. Detailed disclosure will be made in the course handouts.

### **Acknowledgment of Commercial Support**

The U. S. Army Medical Command gratefully acknowledges the unrestricted educational grants provided by our exhibitors. They will be listed in the conference program.

### **The SOMA Boutique**

Check out the new SOMA Boutique for all kinds of shirts, hats, coins, and membership plaques – all bearing the distinctive SOMA logo. These will be available at the registration desk at fire-sale prices. The Boutique urgently needs someone to take over its management for the next year. Contact LTC Hamilton for details.

## ***SOMA 2001 AGENDA HIGHLIGHTS***

### **Friday, Saturday, Sunday 7-9 December**

Component Surgeon's meetings

#### **Sunday, 9 December**

**SOMA Board of Director's Meeting & Dinner**  
(invitation only)

#### **Monday, 10 December**

**Registration**

**Exhibitors**

**USCINCSOC'S Welcome (Invited)**

**General Session, Administrative Remarks**

COL David L. Hammer, M.D.

Command Surgeon, USSOCOM

MacDill AFB, FL

**SOMA President's Remarks**

R. L. Leitch, COL (Ret)

Casualty Care Research Center

Bethesda, MD

**Army Medicine: Integrated Across the Spectrum**

Lt Gen James B. Peake

Surgeon General of the Army

Falls, Church, VA

**Recruiting and Retaining the Next Generation**

The Honorable P.T. Henry

Former Assistant Secretary of the Army

Burke, VA

**Global Engagement: Light, Lean and Life-Saving.**

**What the Air Force Learned from Special Ops**

Lt Gen Paul K. Carlton

Surgeon General of the Air Force

Bolling AFB, D.C.

**SOCOM Surgeon's Lunch** (Invitation only)

**Disaster & Humanitarian Assistance Medicine:**

**A Mission in a Mine Field?**

Craig H. Liewellyn, MD, MPH

Director, Center for Disaster and Humanitarian Assistance Medicine

USUHS, Bethesda, MD

**Thanks for My Everything**

1/Lt. Jim DeVoss, USAF (Ret)

Grand Rapids, MI

**NGO's and Armed Forces:**

**Marching Separate- Fighting United**

COL Reinhard Eroes, M.D.

Military Medical Academy, German Armed Forces

Munich, Germany

**Protecting Those We Send in Harm's Way**

Raymond F. DuBas, Jr

Deputy Undersecretary of Defense

Pentagon, Wash DC

**METT-T Military Medical Operations In The Balkans**

BGEN Bill Fox

Commanding General, 44<sup>th</sup> Medical Brigade Ft. Bragg, NC

**SOMA General Election & Membership Meeting**

**Aventis Pharma Mess Night Banquet**

## **Tuesday, 11 December**

### **Registration**

#### **Exhibitors**

#### **Medical Unconventional Warfare Doctrine for the 21<sup>st</sup> Century: Guerrilla & Resistance Medicine & Hospitals**

#### **Introduction-Mission For the Day: New Ideas, New Medical Doctrine for the 21<sup>st</sup> Century**

COL Warner D. Farr

Command Surgeon, USASOC

Ft. Bragg, NC

#### **Those Who Cared Before Us- Historical Examples of Guerrilla Medicine in the Unclassified Literature**

COL Warner D. Farr

Command Surgeon, USASOC

Ft. Bragg, NC

#### **U.S. Guerrilla Warfare Doctrine 1941-2000: From FM 31-21 1951 to Draft FM 3-05.200 1999**

MAJ Hal Abner

Chief, Medical Operations, USASOC

Ft. Bragg, NC

#### **U.S. Medical Guerrilla Warfare Doctrine 1941-2000: From "G" Hospitals to Black Helicopters**

MAJ Mitch Meyers

Chief, Preventive Medicine, USASOC

Ft. Bragg, NC

#### **Emerging 21<sup>st</sup> Century U.S. Unconventional Warfare Doctrine: Urban, Joint, and Coalition**

MAJ Hal Abner

Chief, Medical Operations, USASOC

Ft. Bragg, NC

#### **Medical Personnel in Unconventional Warfare: What! Who, Me?**

COL Kevin Keenan

Dean, JSOMTC & Surgeon, USAJFKSWCS

Ft. Bragg, NC

#### **Emerging Principles Outside the Ordinary: Surrogates, Allies, and National Infrastructure**

Mr David Passaro

Medical Intelligence Section, USASOC

Ft. Bragg, NC

#### **Panel Discussion: 21<sup>st</sup> Century Unconventional Warfare Medicine**

#### **Continued Panel Discussion & Audience Comments**

SOMA Board meeting with new officers (Invitation only)

## **Wednesday, 12 December**

### **Registration**

#### **A Training Strategy for Today**

COL Cliff Cloonan

Interim Chairman, Dept. of Military & Emergency Medicine  
USUHS, Bethesda, MD

#### **Medical Support for the 101<sup>st</sup> Airborne In World War II**

R. L. Leitch, COL (Ret)

Casualty Care Research Center

Bethesda, MD

#### **Performance Medicine: Power Sleeping and Napping**

LCDR Paul T. Anthony, MD, MPH

Flight Surgeon, HMX-1

Quantico, VA

#### **Collapse From Exertional Heat Illness:**

#### **Subsequent Decisions**

A. M. W. Porter, MD (Ret)

Camberley, Surrey. UK

#### **Evolution of the Military Medic**

CPT Daniel Irizarry, M.D.

Regimental Surgeon

325<sup>th</sup> Airborne Infantry Regiment

Ft. Bragg, NC

#### **U. S. Response to a Terrorist Incident-**

#### **Medical Support Implications: Yemen Case Study**

John H. Hagmann, M.D.

Medical Director

Operational Emergency Medical Support Group

Aqua, VA

#### **Preventive Medicine Initiatives/Opportunities for SOF?**

LTC Ralph L. Erickson, M.D.

Director, Epidemiology & Disease Surveillance

USACHPPM

Aberdeen Proving Ground, MD

#### **Fighting the Capability Curve**

LCDR Joseph A. Decorta

Biosciences Officer

Marine Corps Warfighting Lab

Quantico, VA

#### **Recollections of a Battalion Surgeon from the Mekong Delta**

Byron E. Holley, MD

BN Surgeon, 4/39 Inf

Vietnam, 1968-69 (Ret)

#### **USSOCOM Command Dinner (invitation only)**

## **Thursday, 13 December**

### **Registration**

#### **Performance Medicine: Update on Performance Enhancing**

#### **Dietary Supplements**

LCDR Paul T. Anton

Flight Surgeon, HMX-1

Quantico, VA

#### **Developing and Training Civilian Medical Teams To Function in the Tactical Environment**

James M. Howson

Clinical Coordinator, Mobile ICU

Hackensack University Medical Center, NJ

#### **FASTAID: Tactical Medicine for Nonmedical Firearms**

#### **Officers: A UK Approach**

Dr. John Hall

Emergency Care Physician

North Worcestershire, United Kingdom

#### **The Challenge of Burn Injury & the International Special Training Center**

SSG Stephen Engel

Capt. Frank Schmaehling, M.D.

International Special Training Center

Germany

**Case Studies in Civilian Tactical Emergency**

**Medical Operations**

D. C. Heath, Jr.

Deputy Sheriff, Tactical Medic

Lake County Sheriff's Office

Tavares, FL

**Medical Aspects of Technical Rescues**

Jim Morrissey

Wilderness Medical Associates

Bryant Pond, ME

**The Sniper's Bullet- The Wound Ballistics Consequences  
of Marksmanship Training**

John H. Hagmann, M.D.

Medical Director

Operational Emergency Medical Support Group

Aquia, VA

**Special Operations Medical Handbook**

Telemedicine and Advanced Technology

Research Center

**Physical Therapy: A SOF Combat Multiplier**

MAJ David E. Meyer, MPT, OSC Cert MDT

Physical Therapist

3/75 Ranger Regiment

Ft. Benning, GA

**Common Troop Foot Disorders: Recognition & Treatment**

LTC Melvin Livengood

Surgeon's Office, USSOCOM

MacDill AFB, FL

**ADJOURN**



# Legacy

## When Enough Wasn't

Wayne L. Fisk, PJ (Ret)

### Introduction

The author describes an incident that occurred many years ago, in the early days of Special Operations. It illustrates the absolutely vital need for special ops corpsmen, medics, and pararescuemen to possess a diverse and comprehensive medical capability that may, to many, be perceived as unconventional, and thus unacceptable.

### The Incident

While it wasn't a dark and stormy night, it *was* a hot and humid dog *ca-ca* day, one of those nearly insufferable Southeast Asia periods in which even the slightest exertion drenched one in sweat.

In other words, it was a perfect heat-emergency day in paradise. The humidity index and temperature were nudging fusion—nearly 90 degrees and 90 percent. The thick, gray overcast sky hanging just above the surrounding jungle hilltops seemed to put a lid on an already-simmering basin. Wind would have been a welcome Godsend, but this day it wasn't going to be. Can't have everything too easy.

The year was 1968. My crew and I, accompanied by our wing-mate aircraft, had arrived some six hours earlier at our highly-classified and secretive forward operating location (FOL) deep in the mountainous jungles of northern Laos. Our aircraft were the new HH-53B helicopters known as the "Super Jolly Green Giants." The exploits of combat rescue and the original, smaller HH-3E Jolly Green Giants in the Viet Nam War were already legendary.

Our task was simple: provide covert combat search and rescue (CSAR). We were to launch from the FOL when one of the USAF, Navy, or USMC "golden boys" got shot down, race like banshees to the shoot down site, penetrate the hostile site, and rescue the pilot. Piece of cake? All this from a lumbering, vulnerable, grotesquely huge, slow, lightly armed rescue helicopter hovering near a site that had just shot down a super-sonic, highly maneuverable, sleek fighter jet.

Since we had arrived at the FOL that day—and as we had done every day of our months in-coun-

try—we had been monitoring our antiquated PRC-25 multi-frequency radio for jet strikes going into North Vietnam and communist-controlled areas of northern Laos.

Openly, my three pararescue (PJ) teamies and I were in concert with the rest of the crewmembers that it was good all the strike aircraft going into hostile territory were coming out. Secretly, though, each of us was hoping *someone* would get his butt shot down so we'd get a little excitement. Hell of a deal, but we're *all* somewhere on the food chain. If nothing else, it'd get us airborne where we'd be appreciably cooler than sitting on the ground. Diminishing Ho Chi Minh's NVA war fighting population would be nice; nicest of all would be to do that *and* rescue a downed pilot.

But that day it was not to be. All strike aircraft going in were coming out, although a couple of times it sounded like several were going to get popped. We could always tell when the AA was getting too close for the jet jockeys' comfort. Even over the antiquated field radios we could detect their pucker-factor-accentuated voices clearly indicating the closeness of bursting anti-aircraft shells.

Out of boredom I trudged up to the heart of the FOL, a military command post situated in a small



Lima Site 36, circa 1967. During the dry season (shown here), the site was a dust bowl; during the wet season, a muddy quagmire. Photo from private collection of SMSgt John Pighini, PJ, retired. Courtesy of Wayne Fisk

CIA-controlled Lima (Landing) Site. This particular site, designated LS36, was located in a very strategic plain essential to the communist Laotians, Pathet Lao (PL). The PL were constantly trying to destroy the site. The good guys—the CIA, Air America, and a small contingent of the Royal Laotian Army (RLA)—on the other hand were doing everything in their power to prevent that from happening. So far the good guys were winning—surviving—although the defense of that small but important piece of real estate was exacting an increasingly heavy toll of good guy lives. Even in paradise, freedom isn't free.

The short walk up the dirt airstrip to the CP was exactly that: uphill. Just like in the movie *Air America*, this strip, too, was planted on the side of a small rise of ground; landings were conducted up the hill, while take-offs ran down the hill. The results of not making a good take-off were lasting.



Pathway up to LS36's CP. The ascending trail, in this case, had dried enough to be quite navigable. Personnel in uniform are RLA soldiers: Those in black "pajamas" (top right) are Hmong. *Photo from private collection of SMSgt John Pighini, PJ retired. Courtesy of Wayne Fisk.*

In any event, the incline really wasn't the problem: it was the mud. Walking anyplace except where there was foliage resulted in jungle boots filled with gooey Southeast Asian clay that quickly added pounds to each foot. This was true despite the much touted 'Nam boot's tread-works, designed to prevent that. One had the option of either stopping every dozen steps and scraping off the glob, or letting it accumulate to such a massive amount that eventually gravity would take over.

This sounded good in theory, but the stuff never dropped off in a single piece. Rather, it would do so in clumps causing one to walk unevenly and irregularly. This was no big problem for the most of us because

we typically walked (okay, staggered) that way down the streets of our home base at Udorn, Thailand, whenever we finished these tours in Laos. Of course we couldn't blame copious amounts of Laotian mud on our condition when we were in Udorn; it was more like copious amounts of the local Mekong whiskey. And by the steady illumination of my mental "booze low-level light", I was now overdue for another R&R.

LS36 was a small hilltop fortress that overlooked the airstrip we had landed on and the strategic plain for which so many lives were being forfeited. Actually, the site was more of a large, round knoll, like an overturned bowl. It was totally denuded of all vegetation, results of the RLA burning whatever hardy flora attempted to grow, and mortar attacks by the bad guys. Encircling the base of the knoll was a tangled, serpentine mass of barbed and concertina wire that was constantly added to, especially at those points where the bad guys had probed or gained entry.

Immediately inside the wire was a maze of trenchworks that linked fighting holes, mortar pits, and underground bunkers inter-connecting with each other and the command post. Naturally, the CP was located near the top of the knoll and was readily detectable by a handful of radio antennae sprouting from its sandbagged flat roof.

I entered the base of the fortress through a gap in the wire, a crude swinging gate of logs, barbed and concertina wire. This was manned by incredibly young Hmong boy-warriors who were hardly taller than the M-1 Garand rifles they were struggling to hold upright. Their average age was somewhere around fourteen years old. These boys' leadership were men hardly in their twenties, the result of persistent years of North



Cooking shed and "living quarters". Note squalid, siege-like appearance of site and reutilization of virtually ever scrap of building material. *Photo from private collection of SMSgt John Pighini, PJ, retired. Courtesy of Wayne Fisk*

Vietnamese Army (NVA) annihilation of the Laotian hill tribes. Talk about “population control”: the communists were masters at it.

Climbing upward along the narrow, muddy path that served as the main transportation artery, I passed low-built huts of scrapped pallets, bamboo, tin, and tattered plastic sheeting which served as cooking sheds, sleeping quarters, and observation shelters. Everything had the look of having been broken many, many times and used far beyond reasonable expectation. This was “recycling” at its extreme, and it reeked of desperation. The prevailing impression, though, was one of bravery, courage, and a compelling desire to live.



Soldier’s lodging, constructed of any salvageable material, along perimeter of LS36. Note trench works on right. *Photo from private collection of SMSgt John Pighini, PJ, retired. Courtesy of Wayne Fisk*

I entered the CP a bit winded after the climb, a combination of the mountain altitude and uphill struggle with mud. It was a low-built structure partially dug out of the hilltop, then encircled with sandbags and a thick wall of jungle hardwood logs. The low roof was a crisscrossed network of still more logs capped with layers of sandbags. It had successfully withstood a number of RPG attacks and would continue to, save for the direct breaching of a 122mm Soviet rocket or the dreaded 175mm artillery. Fortunately, the site had not yet become enough of a pimple on the butt of communism to warrant the bad guys moving in the 122s and 130s to eliminate it (LS36 eventually would fall under the weight of a massive NVA onslaught that culminated on 1 March 1969; all inhabitants—soldiers, elderly/infirm, women, children—were unmercifully annihilated).

In the small room illuminated only by the doorway and narrow observation/gun port apertures, I found the resident CIA agent (technically referred to as a CAS—Controlled American Source—officer) hunched over a set of tactical radios, straining to make sense of frantic Laotian conversations streaming out of the small speaker. He irritably waved me into silence as I greeted him and quickly returned his concentration to listening while frequently jotting down particular bits of information. After two or three minutes he turned to me with a worried and vengeance-set face.



Being so remote and surrounded by communist forces, life at sites such LS36 was a constant struggle. Complete families, forced to flee the ever-advancing NVA and PL onslaughts, lived in utter poverty and depravation, supported only by CIA and Air America operations. *Photo from private collection of SMSgt John Pighini, PJ, retired. Courtesy of Wayne Fisk*

It seemed one of his RLA patrols had stumbled into a marauding NVA ambush and had taken heavy casualties. Almost everyone in the patrol was wounded and a number were killed. Unarmed Air America helos, supported by World War II-era T-28 “Trojans” close air support aircraft, were extracting what was left of the patrol and bringing them back to our position.

The CAS officer said, “You know what my medical capabilities are here? Zilch!” His “doc” was an RLA who had been in the beginning years of medical training in the ancient capital city of Laprabang, when the communists began their invasion of northern Laos in earnest. The “doc” had volunteered to be assigned to the Lima site to assist however he could. Even a little knowledge was better than none at all. “I know your birds are on alert,” the agent continued, “but I don’t have any way to work a mess this big. Can you help?”

I knew—just as he knew—“Yes” was the only acceptable answer to his plea. Ever since mid-

1962 when the communists had trashed their part of the Geneva Accords agreement to keep hands off Laos, these indigenous mountain people had been dying mightily in the defense of their mountainous homeland. Communist imperialism and hegemony had swept down from the north and out from the Ho Chi Minh Trail network and decimated all but a few of the ancient Hmong population. Now it was here at our front door.

There was only one acceptable answer that I could give, and I gave it. Now, only one barrier lay in the way.

When Jolly Greens were on CSAR alert—especially at this particular far-north FOL, it was a nearly inviolate rule that Pararescue medical supplies were never utilized save for the exclusive treatment of rescued downed pilots or extracted ground teams. I knew this would be the mind-set and primary consideration of the senior Jolly Green mission commander when I consulted him. Still, when situations in the past warranted, the rule had been thrown out. I needed him to throw it out now.

He did. With minimal pleading or groveling necessary, he concurred, but with the caveat that if a rescue mission arose, I was to immediately break away and respond with the rest of the force. No sweat. At this point of my tour, and having already witnessed first-hand the results of communist actions, my disposition towards the NVA and PL was such that *no* opportunity to decimate their ranks would be passed by, not even if it meant leaving the situation I was about to get myself into.

In the far distance I could hear the *wop-wop* beating of an inbound Air America Huey bearing the results of one of those communist actions.

Grabbing a med ruck I once again labored back up to the fort. Ascending the main muddy path, I branched off at a specific point and walked into the site's dispensary. It was approximately 12 feet by 25 feet with half of it dug into the hillside. The other half was constructed from several thickness' of 55-gallon fuel barrels filled with earth and stacked several layers high. As with the CP, heavy hardwood logs cut from the surrounding jungles formed the ceiling, one layer in one direction then the next layer perpendicular. On top of that were sheets of metal obtained by the RLAs. The soldiers first chiseled off the tops and bottoms of the fuel drums. They next split them lengthwise, then pounded the curved metal into flat sheets. These sheets were placed upon the hardwood logs, then topped with earth and sandbags.

One small door opened into the room. The floor was hard-packed earth supporting jungle cots: crude handmade beds fashioned from bamboo. The legs of the beds were driven into the earthen floor, then lashed with rectangular frameworks of solid bamboo. This, in turn, was layered with narrow strips of sliced bamboo. Mattresses were unheard of. The only light available in the room came through the doorway and from sooty oil lamps. There was a perpetual damp, musty smell about the place that crisscrossed the senses with a mixture of blood and dank earth.

In the dim light I saw the doc, a gentle, sad man who was too burdened with impossible medical crises and too little means to alter their outcomes. His eyes lit up when I began to unroll the med ruck: fluids, bandages, surgical instruments—all common place items to us but incalculably valuable lifesaving treasures to him. While neither of us spoke a common language, his expressions and hand signs told me he felt he was going to win this one.

And then they came. Only subconsciously had I been aware of the increasingly louder *wop-wop-wopping* of the approaching helicopter. The doc ran out, motioning for me to follow. From our vantage point above the dirt strip we watched not one but two Hueys land. Rising out of the ditch along the strip, hunched-over RLA soldiers ran forward and threw back the doors exposing a sight for which I was not prepared: a half-full bay of bloody, tangled human bodies.

The soldiers reached up and started disentangling the upper layers. Those layers, I saw, comprised the wounded; the bottom layers were the dead. Having already been instructed by the doc, the soldiers-now-bearers began ascending the muddy path to our position. The non-ambulatories were passed upward in daisy-chain fashion, from man to man along the chain. Still imprinted on my mind are the looks of anguish, and hatred, as the daisy-chain handlers recognized and called out the names of the wounded friends or relatives they passed up to us. The off-loaded dead remained down on the airstrip, laid out in an ever-lengthening row.

The doc persuasively grabbed my arm and guided me back inside. Now began my personal battle against the true ravages of communism: death. This should not have impacted me quite as soundly as it did: communism and death were utterly synonymous. I had been taught that by my country; but *now* I beheld first-hand the effects of that ravaging, and like the soldiers outside, I was pissed.

The range of injuries caused by blast pressure waves, high-speed projectiles, or shrapnel impacts spanned the gamut of the triage categories; all were further compounded by creepy-crawlies from the mud and crud of the jungles. A parasitologist's heaven, but it was way out of my league.

It didn't take long for me to realize, as the stream of injured filled the small cavern, that this was a classic example of too little for too many. My normally sufficient PJ med ruck—designed for several aviators who had sustained a variety of injuries upon ejection—was woefully insufficient for the range and severity of the casualties who lay before us. It became a matter of improvisation, the life-blood of special operations personnel who *must* have the innate ability to adapt to the ever-changing situations at hand.

Standard medical procedures were reduced to their most basic elements. Sterile fields became “sterile” by a splash of antiseptic or fluid, a swipe of an already-used swab, and a challenging curse for any bacteria to *dare* attempt to grow in the wound. If an instrument, say a scalpel, was free of its intended purpose on one patient, it was used immediately on another. Bandages became dressings when the dressings were depleted, and when the bandages were gone, others were fashioned out of discarded uniform clothing from those who no longer had need for them. Drenched in Betadine solution, their sole purpose was wound protection until more definitive efforts could be rendered. Only in cases of severe shock were IV fluids—normal saline, lactated ringers, dextrose—used. They were used more as an irrigant against bacteria as it was infections that would eventually be the greater killer in the long run. Most of the men would never experience the sanctuary of a hospital because there were so very few men available, and as soon as the wounds were half-healed, the men would be pressed back into action against the bad guys. *Any questions at this point why it's called “dirt medicine”?*

As steadily as the wounded came, so did they depart. The CAS officer and Air America pilots quickly worked out an effective and efficient med-evac system wherein the most severe of the *immediates* were flown to Laprabang and Vientiane, the present-day capital, where at least some form of higher level medical capability existed. The less severe *immediates* were transported to another Lima site where its small hospital would render what we could not. *Delayed-category* wounded received initial treatment then were set aside until the backlog at

Laprabang, Vientien, and the other lima site dwindled enough to permit their transfer. *Expectants* stayed with us, as well as the *minimums* who would help with the final disposition of the expectants when their time came.

The afternoon sped by rapidly, yet it was smothered by the constant knowledge that the doc and I were fighting a losing battle—losing in the sense that men were dying due to an acute lack of supplies and expertise. *Our* expertise. And it was this latter realization that kept body-slammng my brain: I simply did not possess the skills, and had not been trained, to handle the diverse array of seriously injured personnel.

I remember the times I had confronted my USAF medical instructors with hypothetical “*What if...*” questions when I had gone through the med phase of PJ training. Invariably their response would be the shrugged-off answer: “It's beyond your scope of care,” or “The guy's SOL.” It's easy to be so nonchalant when one doesn't have to face the *consequences* of such frivolity. Each time one of those soldiers succumbed to his injuries that day, I found myself eye-to-eye with that beast called Frivolity, and he was kicking my butt.

At one point, soon after the helos began bringing in the wounded and dead, I came across a soldier who had sustained what could only have been an RPG blast. While he suffered innumerable shrapnel wounds, none appeared particularly fatal save those in his upper torso. The signs were classic: cyanosis, severe dyspnea, hypoxemia, hypovolemia, and diminished bilateral breath sounds.

During the short time in which I examined him, he deteriorated rapidly. I knew he had sustained a massive hemothorax. But I hadn't been taught how to treat him, so I couldn't help, even if I had a chest tube—which I didn't. My training had simply been too limited, too narrow in scope, and too inadequate for what I was encountering. The truly frightening realization was that this is what we PJs *were supposed* to be able to handle; what others, US forces, *expected* us to be able to handle. Yet my teamies and I had never been trained for it.

Violating all rules of good triage, I set aside the woefully inadequate remnants of my once mission-ready med ruck, and propped the dying soldier up in my lap. At first he seemed confused as to my actions, but unspeakingly, he looked up into my face and realized I could do nothing for him. After the horror of that realization, he visibly resigned himself



to the inevitable. It took about five minutes for him to die in my arms—struggling, thrashing, and gagging. I guess he never had reason to practice dying before.

The time came that afternoon when there were no more to be treated, save those who were yet to be evacuated, those who were minimally injured and those who wouldn't make it for lack of an on-scene fully equipped definitive care facility. I didn't even worry, didn't give a damn, about recovering any of the salvageable contents of the med ruck. Doc would most assuredly have greater need for them again and again before the site would finally fall.

Dejectedly, I dragged my beaten butt down the hill to the helos and waited in mental solitude until it was time for us to depart to our RON (rest overnight) station farther south in good-guy country. The Beast was never totally excised.

### **The Lessons Learned**

The differences in medical standards and skill levels of today's special operations medics, when compared to those of the era of this event, are as profound as the difference between daylight and darkness. Our SEAL corpsmen, PJs, and SF medics possess such an unparalleled degree of medical expertise and support that non-medically trained team members should be comfortably assured of a successful outcome—at least more so than at any point in our history—were they to become injured. The outcome of this knowledge is that fighting units should be better warriors than ever before.

This is analogous to the feats of US fighter aircrews during the Vietnam War. Because they knew CSAR would do *everything* humanly possible (witness the exploits of the Bat 21 mission of 1972) to bring them back in the event they were shot down, they performed to unparalleled heights of aerial bravery and heroism. They were truly ultimate warriors.

Our special operations teams should feel the same level of confidence and assuredness in their medical teammates. And never has the need of such skills and capabilities been so great.

But therein lies the rub. When we feel we have the Beast under control—when we are *absolutely* certain that current and prescribed methods and procedures of initial and sustainment medical training are the *only* methods and procedures; when the current and prescribed methods and procedures are mandated to be “good enough”; when it is decreed there is only *one* source for training—then that's when we shall, as the foregoing story has demonstrated, once again confront the beast.

### **The question today is**

*Are we conducting our special ops medical training and education in the most beneficial and enlightening manner possible for the operator as opposed to protecting sanctified fiefdoms? Or, are we frivolously misidentifying needs and capabilities and/or delegating dirt medicine programs to some low priority because it fails to fit into the neat mold of conventionality and ready acceptance?*

If it is for any reason other than the medic's professional medical education, then prepare for a repeat of history.





CMSgt Fisk entered the Air Force in March 1966. He was accepted for training and qualification in the elite Pararescue career field. Upon completion of one and a half years of rigorous training consisting of Army airborne operations, Navy SEAL underwater operations, Army Ranger mountain operations, Air Force combat rescue aircrew operations, he was assigned to Udorn Royal Thai Air Force Base, Thailand, flying aboard the famed Jolly Green Giant rescue helicopter. He staged combat rescue missions from classified CIA sites in Laos into North Vietnam, rescuing downed pilots, extracting behind-the-lines covert teams, and recovering aerospace reconnaissance equipment. One year later, he was reassigned to Kindley Air Base, Bermuda, where he was a worldwide recovery member of NASA Apollo missions 8, 9, and 10.

He returned to Southeast Asia, at DaNang Air Base, Republic of Vietnam, flying combat missions in South Vietnam and Laos. He then volunteered for two more consecutive tours of combat duty with his former unit at Udorn. During this time, he was selected for, and participated in, the famed Son Tay POW camp raid near Hanoi in November 1970, receiving his first Silver Star for gallantry in action.

He was assigned to the USAF Pararescue School at Hill AFB, Utah, in March 1972, as an Academic Instructor. He served in this capacity until October 1974 when, as the unit's outstanding enlisted training instructor, he again returned to his former unit in Thailand, participating in the combat evacuation of Phnom Penh, Cambodia. When the steamship *Mayaguez* was hijacked on the high seas by Cambodian communist forces in May 1975, he was a member of the assault force, which successfully recovered the

ship and rescued the crew and entrapped US Marines. He received his second Silver Star for gallantry in action during this operation and was the last American serviceman to engage combat enemy forces in the decade-long Southeast Asia war.

January 1976 he was stationed at Clark Air Base, Republic of the Philippines, holding such key operational, flight, and leadership positions as Pararescue Team Chief, Flight Instructor, Flight Examiner, First Sergeant, and others. He participated in a number of major civilian rescue operations and was personally cited by the President of the Philippines and the Philippines Air Force Chief of Staff. In October 1979, he was ordered to assume duty at Headquarters Aerospace Rescue and Recovery Service, Scott AFB, Illinois, as Pararescue Standardization and Evaluation Flight Examiner for the worldwide Pararescue forces. He retired from Pararescue duty in May 1983.

Upon retirement from Pararescue duty, he applied, and was accepted, for Academic Instructor duty at the USAF Senior Noncommissioned Officer Academy, Gunter AFB, Alabama, in September 1983. He completed the USAF Academic Instructor School at Maxwell AFB, Alabama, in February 1984.

While in his academic capacity at the USAF Senior NCO Academy, he conceived, designed, supervised, and developed the USAF Enlisted Heritage Hall, the first facility totally dedicated to the preservation and dissemination of enlisted contributions to the development of air power. He was director of that institution until his transfer to the Defense Intelligence Agency in March 1989.

# Expedient Medic

Warner Anderson, MD

The SOF medic faces severe limitations in weight and space of equipment not faced by ambulance or helicopter-based medics. In a world where running shoes are advertised by their weight in ounces, and recreational backpacking gear is shaved of every possible nonfunctional corner, the medic must sometimes trust his life and mission to issue gear which is, shall we say, pedestrian at best.

One way SOF medics save weight is by developing, where possible, multiple uses for the same item. This particular art of medicine – fieldcraft - is born of ingenuity, necessity, trial and error. These applications are then passed from generation to generation of medic, sometimes in formal training settings and sometimes in the field.

In looking through the aid bag's contents, some typical medications will be found, many having more than one use. I will mention several classes of medications with more than one use, and give some examples.

Of the narcotics, they are usually represented by acetaminophen with codeine (Tylenol #3®). This controlled substance is one of the medic's most versatile tools. Of course, the major purpose of this formulation is pain relief, and it works very well for moderate to severe pain. However, it is unparalleled as a cough suppressant. When a cough endangers a patrol, a half-tablet of acetaminophen with codeine will usually do the trick without causing much CNS side effect. Similarly, although loperamide (Immodium®) is the standard anti-diarrhea agent carried in the field, acetaminophen with codeine works as well.

Diphenhydramine is a commonly-carried antihistamine, and is carried for anaphylaxis and other allergic reactions. Drowsiness is an idiosyncratic but common side effect which limits its usefulness in SOF, and it's usually labeled with a warning about operating dangerous machinery or driving. This side effect can be turned to good use in treating motion sickness and insomnia. However, diphenhydramine is also the specific treatment for the orofacial or neck spasms often caused by promethazine (Phenergan®). Finally, diphenhydramine can be infiltrated into the skin as a substitute local anesthetic in case of allergy to, or unavailability of, lidocaine.

Speaking of promethazine (Phenergan®), it is generally included as an antiemetic. However, it is closely related to the major tranquilizers (it is a phe-

nothiazine), and causes drowsiness which can be useful in certain circumstances, such as when co-administered with a narcotic for pain. It is also one of the better anti-motion sickness alternatives, although it should not be given prior to an operation or jump. Finally, faced with a delusional psychotic patient and limited resources, I would reach for promethazine before diazepam (except for alcohol withdrawal). That whole *Apocalypse Now* thing could probably have been eliminated with a SOF medic's judicious intramuscular application of phenothiazine into the buttocks of Marlon Brando, Robert Duvall and Martin Sheen.

Lidocaine, of course, is well-known for its use as a local anesthetic and a cardiac antiarrhythmic. But it also has extreme utility as a premedication in intubating a head-injured patient. Intravenous lidocaine prevents the rise in intracranial pressure associated with passing the tube, at one milligram per kilogram body weight. Lidocaine is useful as a topical spray in the throat for incising a peritonsillar abscess or indirect laryngoscopy with laryngeal mirrors. In painful first and second-degree burns, an application of lidocaine can entirely relieve the discomfort. Five milliliters of lidocaine, preferably with epinephrine as a vasoconstrictor, can assist in passing a nasogastric tube. Finally, if I ever need a Foley catheter, I hope the operator will be humane enough to precede it with a five milliliter squirt intraurethraly.

Epinephrine (Adrenaline®) occupies a key position in every medic's gear, and rightfully so. A subcutaneous dose of 0.3 milligrams in an adult, or 0.001 milligrams per kilogram in children, can stop an anaphylactic reaction in its tracks. In a rapidly-evolving anaphylaxis, it can be given slowly intravenously, down an endotracheal tube, or into the rich vasculature of the bottom of the tongue. The latter route especially makes sense if swelling of the tongue is an issue, as in an intraoral insect sting or reaction to an ACE inhibitor-class antihypertensive. Epinephrine can also be used mixed with lidocaine to infiltrate anesthesia locally and prolong the lidocaine's effect, reduce the risk of lidocaine toxicity (by slowing absorption), and permitting a nearly bloodless field. Another use of epinephrine is to mix it with lidocaine and spray into the nose, or soak into an unrolled cotton ball and place as a nasal tampon to stop serious bleeding. With any of these options, the systemic effects of epinephrine

may cause anxiety and rapid heart rate. Also, epinephrine can be aerosolized and breathed into the lungs for asthma and other reactive airway diseases in place of albuterol.

Aspirin has disappeared from most aid kits, replaced by ibuprofen (Motrin®), naproxen (Naprosyn®, Anaprox®), or the Cox-2 class of NSAIDs. However, considering that one tablet of aspirin at the start of a heart attack can do as much good as thrombolytic drugs, it probably deserves a place. One tablet weighs about one-third of a gram and its effects persist for about three days. And aspirin remains the standard by which all other NSAIDs are judged, no matter how high-tech. I would also be inclined to give aspirin to a frostbite victim, but this remains controversial.

Bacitracin, and its more expensive surrogate triple antibiotic (Neosporin®), are generally considered useful in preventing wound infections and treating minor local ones. The Neosporin® manufacturer

claims it also accelerates healing of minor wounds. However, bacitracin is also as effective as silver sulfadiazine (Silvadene®) as a burn dressing, and won't cause the facial tattooing of silver compounds. Bacitracin is also a useful adjunct intranasally (applied directly to the affected mucous membranes) in recurrent epistaxis. Also, since most cases of serious athlete's foot (tinea pedis) have moved from fungal to mixed fungal-bacterial, bacitracin may have a role in the field treatment of these disabling infections.

Any uses for medications other than their original purposes in the aid kits must be with competent medical direction. However, when looking for a particular agent among a class of pharmaceuticals, SOF medicine should always consider the ancillary uses of the particular agent, as well as the safety and side effect profiles. When weight and space considerations are paramount, the medic must make the most of what he has at hand.



### The Legend of Pararescue Green Foot Print Tattoos

Wayne L. Fisk, PJ (Ret)

It must be remembered there is nothing—absolutely nothing—more rewarding than being a combat Pararescueman who is tasked with the preservation of life at all costs, even to the extent of commanding huge air armadas and mighty land forces to deliver accurate and deadly fire support; of personally decimating enemy forces at close quarters in pursuit of preserving that life; and of garnering heroic and valorous awards more highly rated than those received by the USAF’s golden boys, the “tip of the spear”, its pilots. Yes, it is good being a PJ.



Such was the setting in 1971 in Southeast Asia when the tradition of tattooing Jolly Green Giant footprints on PJ gluteus maximi was established. It was a time of heroic combat missions, good kills, and the most assured realization that it is, indeed, hard to be humble when one is Pararescue.

It all began one rainy monsoon morning when Technical Sergeant Wayne Fisk, had just completed a 48-hour combat alert tour at Nakorn Phanom (NKP)

Royal Thai Air Force Base, Thailand. In those days, the 40th Aerospace Rescue and Recovery Squadron, the famed Super Jolly Green Giants, was fragged to provide—in addition to its standard wartime commitment of combat rescue—continuous around-the-clock ground-alert in the event a DoD resource was downed in enemy territory and needed rescue/recovery. Specific emphasis was placed upon missions in Laos and Cambodia.

Such alert tours were not without excitement and rewards in the form of good combat missions; too bad this could not be said about the one Wayne had just finished. The only excitement he had faced during the previous two days was the prospect and anticipation of going downtown and “extinguishing” his “papa” low-level light once Nakorn Phanom village awoke.

Not so with Staff Sergeant Chuck Morrow who, at 1000 hours, was just returning from the vill’ after having successfully extinguished his low-level light. His stagger and played-out facial expressions told anyone foolish enough to ask that he and she—but most assuredly he—had been good, damn good. Chuck found Wayne in the barracks Jolly Green hootch bar, downing a few prior to heading for the vill’, not that one needed to be bombed in order to enjoy the finer aspects of NKP vill’, but it helped.

Wayne was considered “short” at this time as he was nearing the end of his fourth SEA combat tour, and he was contemplating some sort of personal souvenir for posterity to commemorate the milestone. A permanent dose of the clap had already been ruled out.

Chuck joined Wayne at the bar and liked what he was hearing. Through the haze of his already-inebriated mind and *five continuous* combat tours to *his* score, coupled with Fisk’s likewise rapidly increasing intoxicated state, the two mandated such a souvenir must be long-lasting, elitist, and depictive of valor—if not for the act of acquiring it, then at least for its symbolism. After much deliberation, accentuated by a



number of previously told and retold war stories, they decided: What could be more fitting than the highly revered and prestigious symbol of combat rescue in SEA, the Jolly Green Giant footprint! Yes, but a tattooed footprint!

The concept was born, but where were they to be affixed? Somewhere unusual, somewhere to gain attention—to command awe—when displayed. All standard—and perhaps not-too-standard—locations were quickly ruled out, except the cheeks of the butt. There: Plant them there! A rough sketch was drawn, more booze flowed, and it was off to the main gate that the two sloshed, slipped and slid, a righteous duo bent upon a holy mission.

But wait: Being the medical experts they were, they temporarily diverted to the PJ section to procure a tube of Bacitracin-Neomycin ointment, a number of 4x4s, and some Lidocaine. One cannot be too careful when it comes to the refinements of hygienic techniques, especially in a land ridden with hepatitis. And, too, why suffer too much pain on a holy mission when Lidocaine was readily available, the thought being that the tattoo gun's needles would simply drive the anesthetizing substance deep into the tissue, thus deadening any pain that was sure to be present.

By the time they reach NKP vill' and Jimmy Wong's tattoo "parlor" in a dingy bungalow near the Mekong River, they were well on their way to total inebriation. In other words, it was another typical off-duty Pararescue day.

Inside Jimmy was just completing the finishing touches on another customer. Wayne and Chuck sat down and waited their turn, which was a mistake. As they watched, Jimmy, perspiring mightily in the heavy, humid monsoon air, wiped away with a filthy rag the blood, sweat, and tattoo ink from the chest of the customer he was working on. Then he nonchalantly wiped away the sweat on his own brow. This process was repeated time and again throughout the period of waiting, accentuated by occasional fallings of the rag onto the dirt-strewn floor. Raised eyebrows of concern passed between Wayne and Chuck. Obviously they were not drunk enough to appreciate that which was transpiring before them. It was out the door to the curbside booze vender for a tall bottle of Mekong Whiskey to remedy the shortcoming.

Once back inside, pararescue etiquette was expressed as to whom was to go first. Wayne, acquiescing to cumulative combat tenure, offered Chuck the honor. Chuck, not so drunk that he could not relive visions of Jimmy's hygienic procedures, insisted

that since it was the former's idea to begin with, Wayne should assume the prone position. He did, and the birth of the first Jolly Green footprint tattoo began to take shape.

But it was not without unplanned interruption. Despite copious amounts of Lidocaine having been applied to the tattoo site, when Jimmy, who obviously used his needles in a side business chipping paint from samlors, touched them to Wayne's sensitive behind, a roar of surprise, pain, and anger belled from the room and assailed the peaceful vill' beyond. Chuck, too, roared but with sadistic delight and ridicule of a many-tours-warrior grown impervious to the sights and sounds of pain and suffering. Scratch the theory that tattoo needles are as effective as sub-Q injections for the purpose of localized sedation.

Instead, Wayne was seriously seeking a full systemic sedation affect by way of straight-up chugs from the bottle of Mekong. Even the laughing Jimmy Wong joined in, downing sizeable amounts of the stuff, which most assuredly were to have an affect upon the outcome to the artistic endeavor.



Eventually both sets of tattoos were finished. The Great Quest had been fulfilled: Two bright sets of green footprints, framed by corona of tortured pink skin on pale butts. Both men were certain they sported the greatest symbols of warriorhood and manliness ever beheld.

And they shared the sources of their pride with everyone they met, usually at the slightest provocation or display of interest. Into every bar and dive they went, thrilling perhaps themselves more than others, but undeniably having a great time. Back at the squadron they became the envy of the rest of the PJ team, of the flight engineers, and of the pilots, who likewise rushed out to procure theirs. The aberrant had become the craze.

As the weeks sped by and Jolly Green footprint tattoos proliferated, other fighting flight units on NKP began feeling out done and suffered an acute lack of attention. This was especially evident at the NCO and Officer Clubs where normally club managers became quite upset at the sight of a line of bare-assed GIs flashing the moon. It wasn't long before other squadrons acquired their own squadron logo tattoos, and it soon came to be that hardly no one on NKP RTAFB was afraid to flaunt his ass in public. Jimmy Wong's business began to flourish, and he soon purchased additional instruments to refinish even more samplers.

Thusly did the custom begin. From a humble, inebriated back-room beginning, the Pararescue procurement and flaunting of Jolly Green Giant footprints has spread throughout the world, shocking and delighting millions who have become the objects of—and sometimes unwilling sufferers bearing the brunt of—moon flashes. In some circles—admittedly more often than not in Pararescue circles—it is considered a serious breach of etiquette *not to* display these historic symbols of pride, valor, and commitment.



Today new generations of PJs have proudly carried them into battle. From the jungles of SEA to Panama, the Middle East, Somalia, the Balkans, and now to the worldwide crusade of ferreting international terrorists from their holes, they have left their impressions upon all who have witnessed.

Yes, it is good being a PJ.  
Wayne Fisk

## The Blood-Letting

Steve Andreas

When clearing Vietnam in May 1967, you had to get a blood test to make sure you were not bringing any diseases back to the United States. I went over to the dispensary in Nha Trang to get my test. While I was talking to the medic, a friend of mine, a few new guys came into the lab. He told me he needed to poke me two or three times and fill vials for the blood samples. He suggested he just use one needle. While he was replacing the vial, I would hold the pressure point to keep the blood from spurting. We did a couple of dry runs to make sure I would hit the pressure point. So he stuck the needle in and as the vial filled, the medic said, "Ready?" I pushed on the pressure point with my thumb and missed. Since the medic's back was turned while he got a new vial, he did not see the mess I was causing. When he turned around, there I was getting blood all over the counter. The stuff was spurting everywhere. When we made eye contact, we both started laughing like crazy. The harder we laughed the further the blood spurted. We finished the procedure when we were able to get control and fill all of the vials. When I turned to leave, there were those new guys, eyes wide open, mouth's agape, and looking a little green around the gills. Guess they figured they would have to go through the same thing...

Steve Andreas, 05B4S  
5<sup>th</sup> Special Forces Group  
Republic of Vietnam, 1966-67

# Correspondence

## Letters to the Editor

SOME COMMENTS FROM OUR SURVEYS:

(ALTHOUGH WE WELCOME ALL COMMENTS, WE PREFER THAT THEY BE SIGNED)

The question was asked: What recommended improvements would you make to the JSOM?

None. Get it to all SOF medics.

An 18D-40

Not a one! You are in no need of continuous quality improvement!

An 18D

Ensure my copy is consistently sent. Thanks and great job.

CPT A. Morgan, PA-C

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My compliments on what seems to have good promise as a great publication.

Unsigned

“Liked the Spring issue of the JSOM. Excellent work! Makes reading medical journals fun—as opposed to the *ordeal* often encountered in other such publications! Continued best wishes for the future.”

CMSgt Wayne L. Fisk, USAF (Retired)

“As a former group commander, I think the JSOM has tremendous value to the joint community and it should be something that every commander should read “

COL Bill Davis

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Food for thought...

Brig Gen Pete Sutton

12 FTW Commander

## Note from the ER

I am a doctor specializing in Emergency Medicine in the Emergency Departments of the only two military Level One trauma centers in San Antonio, TX. They care for civilian emergencies as well as military personnel. San Antonio has the largest military retiree population in the world living here, because of the location of these two large military medical centers.

As a military doctor in training for my specialty, I work long hours and the pay is less than glamorous. One tends to become jaded by the long hours, lack of sleep, food, family contact and the endless parade of human suffering passing before you. The arrival of another ambulance does not mean more pay, only more work.

Most of the time, it is a victim from a motor vehicle crash. Sometimes it is a person of dubious character who has been shot or stabbed. With our large military retiree population, it is often a nursing home patient.

Even with my enlisted service and minimal combat experience in Panama, prior to medical school, I have caught myself groaning when the ambulance



brought in yet another sick, elderly person from one of the local retirement centers that cater to military retirees. I had not stopped to think of what citizens of this age group represented.

I saw "Saving Private Ryan." I was touched deeply. Not so much by the carnage in the first 30 minutes, but by the sacrifices of so many. I was touched most by the scene of the elderly survivor at the graveside, asking his wife if he'd been a good man. I realized that I had seen these same men and women coming through my Emergency Dept. and had not realized what magnificent sacrifices they had made. The things they did for me and everyone else that has lived on this planet since the end of that conflict are priceless.

Situation permitting, I now try to ask my patients about their experiences. They would never bring up the subject without the inquiry. I have been privileged to an amazing array of experiences, recounted in the brief minutes allowed in an Emergency Department encounter. These experiences have revealed the incredible individuals I have had the honor of serving in a medical capacity, many on their last admission to the hospital. There was a frail, elderly woman who reassured my young enlisted medic trying to start an IV line in her arm. She remained calm and poised, despite her illness and the multiple needle sticks into her fragile veins. She was what we call a "hard stick." As the medic made another attempt, I noticed a number tattooed across her forearm. I touched it with one finger and looked into her eyes. She simply said "Auschwitz." Many of later generations would have loudly and openly berated the young medic in his many attempts. How different was the response from this person who'd seen unspeakable suffering.

There was another patient along-retired Colonel, who as a young officer had parachuted from his burning plane over a Pacific Island held by the Japanese. Now an octogenarian, his head was cut in a fall at home where he lived alone. His CT scan and su-

turing had been delayed until after midnight by the usual parade of high priority ambulance patients. Still spry for his age, he asked to use the phone to call a taxi to take him home. Then he realized the ambulance had brought him without his wallet. He asked if he could use the phone to make a long distance call to his daughter who lived 7 miles away. With great pride we told him that he could not, as he'd done enough for his country and the least we could do was get him a taxi home, even if we had to pay for it ourselves. My only regret was that my shift wouldn't end for several hours, and I couldn't drive him myself.

I was there the night MSG Roy Benavidez came through the Emergency Department for the last time. He was very sick. I was not the doctor taking care of him, but I walked to his bedside and took his hand. I said nothing. He was so sick, he didn't know I was there. I'd read his Congressional Medal of Honor citation and wanted to shake his hand. He died a few days later.

The gentleman who served with Merrill's Marauders, the survivor of the Baatan Death March, the survivor of Omaha Beach, the 101-year old World War I veteran, the former POW held in frozen North Korea, the former Special Forces medic - now with non-operable liver cancer, the former Viet Nam Corps Commander, I remember these citizens.

I may still groan when yet another ambulance comes in, but now I am much more aware of what an honor it is to serve these particular men and women.

It has become my personal endeavor to make the nurses and young enlisted medics aware of these amazing individuals when I encounter them in our Emergency Department. Their respectful response to these particular citizens has made me think that perhaps all is not lost in the next generation. My experiences have solidified my belief that we are losing an incredible generation, and this nation knows not what it is losing. Our uncaring government and ungrateful civilian populace should all take note. We should all remember that we must "Earn this."

CPT Stephen R. Ellison, M.D.

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## *Apologies & Corrections*

The staff of the JSOM would like to extend its apologies to COL Yevich (Ret) for the error in his picture. In the Summer Edition (inside cover), the picture of the three medics (from the dedication to Edward McIlvain) was somehow imbedded over COL Yevich's picture while at the

printers. Also, we had some problems with color quality and movement of print on page 19. These issues are being addressed with the printer but we wanted to let you know we are aware of them. Thank you for your patience as we suffer through our growing pains.

mdd

## Editorials

Dr. Mabry and his co-authors should be commended for their efforts in recording the medical events that occurred in Mogadishu in 1993. Indeed, the events that occurred on October 3rd resulted in the highest number of casualties sustained by the U.S. Army since the Vietnam War, therefore, a unique experience to review “lessons learned,” again.

Extremity injuries, as in previous conflicts, occurred in 74% of all casualties. Exsanguination and death from single extremity injuries continue to be a challenge. Tourniquets for field use capable of controlling bleeding from femoral vessels are urgently needed. The casualty who remained alive for 2.5 hours after a gunshot wound to the groin clearly illustrates the need of such a type of device.<sup>1</sup>

The non-operative management of penetrating abdominal wounds in patients who present without hemodynamic compromise or abdominal findings is possible if continuous reevaluation is feasible. Such type of care is not possible in a forward military hospital. The findings in the patient who was operated on without clinical symptomology and the two negative laparotomies illustrate the understanding of military medical concepts by the surgeons involved in the management of these patients.

Significant injuries to the lower extremities produced by RPGs occurred in two instances. An immediate amputation in one casualty resulted in a favorable recovery and eventual return to duty. In the second casualty, whose initial evaluation showed transection of posterior tibial and peroneal nerve, and most likely an insensate foot, attempts were made to save

the extremity. When amputation was considered at a later date, the patient refused and currently has an insensate leg. The mechanism of injury (RPG), the magnitude of neurologic damage, even in the presence of palpable pulses, should have resulted in an immediate amputation.

During the Vietnam conflict, blood drawn from servicemen in-country was used to care for patients with dilutional coagulopathies after large volume transfusions. During Desert Storm, the lack of state-of-the-art component therapy to manage post-transfusion coagulopathies was identified before and during the operation. The surgeons’ efforts to control hemorrhage in Somalia were enhanced by the use of in-country servicemen blood donors. The Department of Defense should revisit policies as to how to manage the multiple transfused coagulopathic patients in theater; otherwise appropriate surgical efforts would be unsuccessful.

Operations like the one in Somalia are characterized by their unexpected high intensity and short duration; therefore, the “learning curve” is not an option. While newer communication systems and recognition by the Air Force of their responsibility during transfer should improve the casualties care across different echelons, realistic joint exercises and a chain of command that can immediately react to events such as the one in Somalia are necessary to successfully manage future incidents.

### **Reference**

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**Erwin F. Hirsch, MD, FACS**  
*Department of Surgery*  
*Boston Medical Center*

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The goal of the article “Reliving Painful ‘Shin Splints’” is to train you how to *think* about shin splints. The authors wish to help you develop an algorithm to diagnose and treat the problem, and to identify potentially more serious problems. In this article, as in real life, there are essentially 3 common conditions that can present nearly the same. These are shin splints / Medial Tibial Stress Syndrome (MTSS), stress fracture,

and exertional compartment syndrome. For most of our hard-charging, young troops, this is a pretty good framework. If it gets more complicated than this, start asking for help.

MTSS / shin splints usually presents as pain along the inside of the tibia (medial). We think it results from inflammation of the covering of the bone and the soft tissue attachments of the muscles on the medial

side of the lower leg. Periostitis and inflammation of the attachments of the muscles along the medial tibia leads to MTSS. Inflammatory problems, in general, hurt worse after rest or at the beginning of a workout, and tend to get better as the activity continues. Both exertional compartment syndrome, and stress fractures tend to hurt more as the run continues. Often times, the runner can tell you that symptoms from one of these will come about at a specific time or mileage into the run. This bit of information alone can be very helpful in figuring out what's going on.

Stress fractures usually present with pain medially, but it may be more point tender instead of diffuse. Usually the pain comes on at a specific time or mileage into the run, but as the problem worsens, the pain comes on earlier and earlier into the run. If you find a stress fracture in one of your troops, try the simple stuff first, but if this fails, don't hesitate to refer.

Exertional compartment syndrome also presents with pain, but it is usually pain in the muscles on the front or outside of the lower leg (anterior and lateral). It often has some associated numbness or tingling on the top of the foot. It results from elevated tissue pressure in the tight compartments of the leg. This squeezes the muscles and limits their blood supply, and this hurts. The pressure also squeezes the nerves in the compartment, which leads to numbness

on top of the foot. This often occurs a specific distance or time into a run, and then subsides after rest. If you find one of these bad boys, try the simple stuff first, but refer early.

There are a few other things you should know about. What's overpronation? This is essentially a fancy running term for flat-footed. What's pes planus? This is a fancy medical term for flat-footed. "Pes" is foot. "Planus" is flat. You have to look at the arch of the foot with the person standing up to check because the arch returns when they take the weight off the foot. What is callus? When it comes to diagnosing a stress fracture on X-ray, callus refers to the healing bone we see on the film.

Hard charging troops make the worst patients because keeping them down to allow them to heal goes against their nature. Sometimes you have to immobilize them early to protect them from themselves. When it comes to returning to running, start slowly. This works better if you control the mileage or time, so they don't over do it. Remember recurrence is common. Good running shoes are important. Try to stay off of cement. The worst impact loading occurs on cement, then asphalt, then padded trails, then sand, then grass, then pool running. Have the patient train up slowly, not going for the be run all at once. If you can't fix it, refer.

**Maj Edward Witkowski, MD**  
Suncoast Orthopedics

## History

26-year-old fell while repelling from a helicopter.

## AP PELVIS



**What is your diagnosis?**

## AP Pelvis



## AP Pubis



The obturator ring fractures appear as cortical discontinuities as well as areas of increased density where the bone fragments are overriding.

Did you notice the vertical fracture of the right sacrum? It is a bit subtle, but then, most sacral fractures are. The best way to consistently identify them is to look carefully at the transverse sacral foraminal lines in every patient. Note the appearance of these lines on the normal left side. We don't see smooth, continuous curves like this on the right side. Instead, we see discontinuities and even a bony fragment.

# AP SACRUM



A good rule to apply in the pelvis is the **ring bone rule**. The general form of this rule is: *In a ring bone or ring bone-equivalent, if you see a fracture or dislocation in one part of that bone, look for another.*

To get a feeling for why this might be so, go by a bag of pretzels and try to break a pretzel in only one place. It has been done before but the main thing to remember is that it is *difficult* to do. It is hard to apply just enough force to break one part of the ring without also breaking another part of the ring.

What are some of the ring bones? Obviously the obturator rings of the pelvis count as ring bones. The whole pelvis forms yet another, larger ring. Each of the sets of ribs form a ring with the sternum and spine. Each vertebra has a ring (also known as the spinal canal). The mandible and skull form a ring system, and the zygomatic arch is also considered a ring bone. One could also count the transverse foramina in each of the cervical vertebrae.

What is a ring bone-equivalent? It is a bone that acts like a ring bone, even though it may not be round. The radius and ulna together act like a ring bone, as do the tibia and fibula.

There are two corollaries to the ring bone rule that can be very useful:

The first is what Dr. Lee Rogers calls “the pretzel-bagel spectrum”. Some ring bones, like the obturator rings are fairly stiff. This means that the obturator ring will most always fracture in two places. At the other end of the spectrum are bones that form very flexible rings, such as the ribs. In floppy, more flexible rings like this, it is very common to see only one fracture in the ring.

The second corollary applies to the pelvis. If one draws a horizontal line between both acetabulae, one can use it to divide the pelvis into an anterior and posterior portion of the pelvis. The corollary is that there is a fracture or dislocation in the anterior part of the ring, look for one in the posterior part as well.

These rules tell us to look for two fractures in the greater pelvic ring, which we see in each of the superior rami of the obturator rings. The rule also tells us to expect at least two fractures in each. Therefore, the ring bone tells us to look carefully all the way around each of the obturator rings, which allows us to spot the two fractures in each of these rings.

Since we see fractures in the anterior portion of the pelvis, we must look very carefully in the posterior portion, especially the sacrum. A close inspection of the transverse sacral foramina lines reveals the transforaminal fracture there.

## Answers

1. Fracture of superior and inferior rami of both obturator rings.
2. Transforaminal fracture of right sacrum.



# Photo Gallery



A different version of Lake Placid

An 18 delta training to do his job in NBC mask



PJs train for water rescue of downed crew members

PJs train for rapid assessment and initial care in a rescue of a downed crew member.



## *Dedication...*

JAMES DOUGLAS LOCKER



9 June 1968—Sergeant James D. Locker.

In the middle of an NVA encampment thirty-seven miles west of Hue, Republic of Vietnam (RVN), a USMC fighter pilot lies on the ground with a broken arm and leg. The enemy is using him as bait to lure CSAR aircraft, especially the very vulnerable Jolly Green Giants, within killing range. Air strikes have pounded the area and brutalized the enemy but with little effects. Three times the first Jolly Green has attempted to reach the survivor, but each time it has been repelled by awesome enemy firepower.

When that Jolly Green reaches a critical low-fuel state, it departs the scene. Sergeant Locker's "Jolly Green 23" rushes in to attempt the rescue. Fighting is intense, and the bird is forced to withdraw. It immediately turns round and goes in again, this time surrounded by Army gunships. The force is met with intense enemy firepower. Sergeant Locker and his

crew disregard the deadly fusillade, and continue towards the pilot's position, delivering a hail of M-60 fire upon the entrenched NVA. The pilot of Jolly Green 23 attempted to land in a small clearing, but the helicopter exploded when it hit the ground and burned intensely, killing Jim Locker and all the others on board. Another aircraft flew over the wreckage, but its crew saw no survivors and heard no emergency beeper signals. Because of the intense enemy presence in the area, no ground search was possible. Sergeant James D. Locker, Pararescueman and all other crewmembers were Killed in Action/Body Not Recovered. The pilot they were attempting to pick up was later rescued by another search and rescue (SAR) team.

The Air Force has dedicated two buildings to the memory of Jim Locker, at Keesler AFB, Mississippi and at Wright Patterson AFB, Ohio.



# ***GHOSTS***

Watching on a Hallowed Day  
Wearing Class As and a Green Beret  
Anticipation on his face  
Fearing Ghosts from another place  
Remembering those who gave their all  
Their names engraved in a granite wall  
Hands caressing warm black rock  
Tells of all that we have lost  
Warmth exudes, their presence felt  
He traced their names in hopes to help  
Erase those ghosts from years gone past  
To us a name, but not to him  
A lonesome memory of a long lost  
friend.

SFC Stephen L. Young

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