

# Journal of Special Operations Medicine

A Peer Reviewed Journal for SOF Medical Professionals



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Dedicated to the Indomitable Spirit & Sacrifices of the SOF Medic

# Report Documentation Page

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# From the Surgeon



SOF colleagues,

Greetings again from the USSOCOM Headquarters. Another quarter has passed, we are into a new fiscal year, and the Medics, Corpsmen, Pararescuemen (PJs), Squadron Medical Element (SMEs), Forward Surgical Teams (FSTs), Critical Care Air Transport Teams (CCATTs), etc. all continue to perform superbly in support of our Soldiers, Sailors, Airmen, Marines taking it to the "bad guys." From the point of illness and injury, through the CASEVAC and MEDEVAC, to the OCONUS hospitals and then to CONUS hospitals, our medical support structure is performing superbly.

Since the last journal several important medical milestones have occurred;

-The BISC funded a meeting at HQ, USA Institute for Surgical Research in San Antonio, TX and we brought together several frontline medical providers (all components were represented) to meet with the scientists there and bring the realities of combat medicine to these folks first hand. These medical colleagues defined the medical experiences from the past year of combat and field medicine and "watered the eyes" of the scientists. This very smart and dedicated scientific community is committed to bringing "fixes" to our needs, but we need to tell them "face to face" the realities of the situations, so the fix matches the need -- this forum allowed that to happen and may have been one of the most beneficial applications of BISC funds to date. There is a whole new energy at the Medical Research and Materiel Command (MRMC) and the leadership there is committed to our requirements. Hooah!

-The BISC also funded the first meeting of the Tactical Combat Casualty Care Panel. This is an accumulation of medical experts from DOD and civilian agencies to change how we do combat medical training and equipping for the future. They are looking at the relevance of old ATLS guidelines versus state-of-the-art "realistic" combat trauma life support (e.g. Hemostatic Dressings use, Hypotensive Resuscitation, Tactical Antibiotic use, Tourniquet use, Airway Maintenance, Interosseus access for giving fluids and medications, new Analgesia, etc, etc.) The goal is to make the ruck-sack lighter and the capability more effective. Hooah!

-Advanced Technology Applications for Combat Casualty Care (ATACCC 2002) met in early September. We had a full week of presentations and interface with manufacturers addressing the concerns of our medical folks. Once again, we had combat medical veterans brief the issues they encountered "out front" so the fixes will match the issues-what a concept! The meeting was great and the results can be "real" solutions to "real" issues and SOF will benefit across the board. Hooah!

So, as we enter the holiday season, rest assured that there are folks committed to your needs so that you can continue to care for the SOF operators, these national treasures that we medical folks are sworn to serve. Keep on making us proud and don't hesitate to communicate your needs our way for we are only here to make your job easier and better.

GBY/GBA,  
dhammer



SENIOR ENLISTED MEDICAL ADVISOR (SEMA), MSG  
Michael A. Brochu

### **From the ROAD DOG in the BIG HOUSE**

Another quarter has flown by so let me keep you updated on where we stand at the publishing of this journal:

1. Paramedic Bridge Program: The program, as it has been conducted, will, (with all probability) be going away. The exception will be a possible class in Jan 03. There will be some kind of Paramedic bridge program in the future, only this time, the Joint Medical Enlisted Advisors Council (JMEAC) would like it to be conducted through the Joint Special Operations Medical Training Center (JSOMTC.)
2. Lessons Learned in Operation Enduring Freedom (OEF): A panel of Docs and medical operators convened at Fort Sam Houston, Texas to learn from the actions on the ground. What worked / didn't work. Tactics, Techniques and Procedures (TTPs) that were employed and how effective they were or were not. The panel will likely have the tabulated reports by mid Dec 02.
3. Tactical Combat Casualty Care Panel (TCCC): When the OEF lessons learned was conducted the TCCC panel convened in Pensacola, Florida. This panel will be one of the driving forces to effect positive change to the SOF medical TTPs of the future. This panel will have two more meetings to discuss the TTPs before any suggestions are made to any further change.
4. Critical Task Review Board (CTRB)- USSOCOM Directive 40-2 gives the JMEAC the charter to conduct a Special Operations Combat Medic (SOCM) CTRB annually. During the last JMEAC meeting the members developed the following course of action:
  - a) Make recommendations for medical disciplines and subject matter experts to be members of the board.
  - b) Develop a survey to pass to the medics to gather their input.
  - c) Provide operator data input at future meeting.
  - d) Have the SOCM CTRB before the Special Forces Medical Sergeant (SFMS) CTRB.
5. Health Surveillance System (HSS): The SOCOM surgeon's office has conducted a Mobile Training Team (MTT) session on how the HSS device will be employed to all the major SOF medical units. We have distributed all of phase one devices. We have purchased and have started to run the public relations on the phase two program Battlefield Medical Information System (BMIS) to the JMEAC.
6. Long range dates for future JMEACs-
  - a) 2 Dec 02, USSOCOM will host at the SOMA Conference.
  - b) 25-26 Feb 03, NAVSPECWARCOM will host.
  - c) 27-28 May 03, AFSOC will host.
  - d) 26-27 Aug 03, USASOC will host.
  - e) 1-2 Dec 03, USSOCOM will host at the SOMA Conference.

If you have suggestions, concerns and or recommendations for the JMEAC pass them along to your SEMA and it will be addressed. But you have to.... "SEND IT"

# COVER

The picture on the cover depicts a SOF medic providing aid to an Afghan soldier with a blast injury.



The Journal of Special Operations Medicine is an authorized official quarterly publication of the United States Special Operations Command, MacDill Air Force Base, Florida. It is in no way associated with the civilian Special Operations Medical Association (SOMA). Our mission is to promote the professional development of Special Operations medical personnel by providing a forum for the examination of the latest advancements in medicine.

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; e-mail JSOM@socom.mil.

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## From The Staff

We bid farewell to CPT Steve Anderson who has gone back to Fort Bragg. We wish Steve well -- he will be greatly missed by the staff of the JSOM.

We continue to need your article submissions and photos, they are what makes this journal so unique. It is a sharing of your lives and missions 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!

The JSOM is one of the most excellent and righteous tools we have to span all the SOF services and to share medical information and experience unique to this community. The JSOM survives because of generous but time-consuming contributions sent in 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! Get published in a peer-review journal NOW! We are always looking for SOF-related articles from current and/or former SOF medical veterans. If you have contributions great or small... fire 'em our way. Our E-mail is: JSOM@socom.mil.

Don't forget, the JSOM is now offering CMEs to physician's, PA's and nurses, as well as our medics in concurrence with the Uniformed Services University of Health Sciences (USUHS), our CME sponsor. In this edition, you will find CMEs offered on Part Two of Going Beyond Thin Air and Soft Tissue Infections. In this edition of the JSOM, we honor our fallen brother, Senior Airman Jason Cunningham, killed in support of Operation ENDURING FREEDOM .

Please continue to submit the surveys in the JSOM, they help us to determine what types of articles you would like to see. The following types of articles are still our biggest request for future JSOMs:

Tricks of the Trade...anything from simple more effective bandaging to doing more with less (supplies, meds), keeping IVs warm, treatment of hotspots and blisters, Colloids vs. Crystalloid fluid replacement, IV infusion in extremities vs. intraosseous fluid infusion; Poor-man's Gatorade recipe, improvised laxatives or antidiarrheals or anything improvised for that matter; herbal medicine...any relevance or uses that are legitimate; articles dealing with trauma, infectious disease processes and/or environment and wilderness medicine type articles; more photos accompanying the articles or alone to be included in the photo gallery associated with medical guys and/or training.

The fact is most everybody that has read an article on a technique or concept knows of another way of doing the same thing that's perhaps faster, easier, or dare I say...better. Just like any patrol or observation of a target...the more eyes the better. If you, the readers, have knowledge of such things or at least know where to find info on a particular subject...let us know. We'll hunt down where you think you saw that information and see if we can't either re-print it for the rest of the readers or at the very least pass along where information of interest can be found. OK, enough said...keep your eyes open and let us know. Thanks.

Please remember, if you want to continue to receive the JSOM when you PCS, send us your new address as soon as possible so we can make the changes in our distribution database. We are losing a lot of money in returned postage; you can help prevent this. Either fill out a change of address form and mail it to us or send it to JSOM@socom.mil. Enjoy this edition of the journal, send us your feedback, and get those article submissions in to us!

mdd

# Journal of Special Operations Medicine

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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, CA. 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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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 an IMA reservist attached to the SOCOM/SG office. Maj DuGuay has a Bachelor's in Nursing and a MBA/Management. Her career includes being a flight nurse in both the military and private sector, 15 years of critical care and emergency room nursing experience, an EMT and a legal nurse consultant. She also served 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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6. Remember that your audience is inter-service, civilian, and international.
7. Every article has a point to make, which is traditionally stated in the introductory paragraph and restated in the closing or summary. Subtlety is not usually a virtue in a medical publication.
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12. Again, the JSOM is your journal. It is a unique chance for you to pass your legacy to the SOF medical community.

**Take advantage of the opportunity.**



## USASOC



Rocky Farr, MD  
COL, USA  
Command Surgeon

SOF medicine, lead by our medics, continues to support Army Special Operations Forces (ARSOF) soldiers who are at the center of the war on terrorism, on point, throughout the world-from Afghanistan to the Philippines. I am currently writing this at the "Advanced Technology Applications for Combat Casualty Care" (ATACCC) meeting. Last week we had our Special Operations Medical Indoctrination Course (SOMIC) for our new physicians and physician assistants.

Some updates:

**SOF medics-** You all are performing magnificently! I just wish there were more of you-and I am working on that. All the forward deployed surgeons are coming back telling me stories on how great your capabilities are and how wonderful the care is that you are providing. It is not news to me, but sure seems to be to them. I have talked to both forward surgical team commanders in particular. We held a 2-day meeting at the Institute of Surgical Research at Fort Sam Houston where medics could tell their experiences to researchers who can help us. An amazing number of folks want to help us all of a sudden. The JSOMTC 18D class in July 2002 performed both draw over gas anesthesia and recovery from anesthesia procedures. I saw a dramatic improvement in postoperative nursing care and documentation. COL Keenan is making a difference.

**SOF medical officers-** Special Operations Medicine continues to rapidly progress toward an all residency trained, board certified, medical corps force. I only selected one general medical officer (GMO) the Summer 2002 assignment cycle. The transition to residency-trained officers has resulted in greater stabilization and unit presence and increased tour length. GMOs routinely departed after two years for specialty training. This change to longer assignments has resulted in commanders being willing to spend the time, effort and money to further train their medical officers. SOF physicians are attending or have successfully completed in ever increasing numbers: Airborne School, Army Flight Surgeon Course, Ranger School, Combat Diver Qualification Course, Special Forces Qualification Course, and Survival, Evasion, Resistance and Escape (SERE) School. SOF Medicine, although not associated with a formalized residency-training program, should, like operational medicine, be a second specialty common to all Army physicians. With a growing number of complicated missions and a widening scope of military operations, now more than ever the need to ensure that our physicians are well-educated and trained as "military physicians" becomes vital to our future success. One of the critical elements is the early career familiarization and experience within Table of Organization and Equipment (TOE), either conventional or SOF units. As SOF units are

dependent on conventional Army medical units for medical echelons above level 1, knowledge of ARSOF medical capabilities is required for all military medical officers. In addition, with our SOF medical officers having residency training, their medical care and services to our soldiers are of higher quality at Troop Medical Clinics (TMCs) and they have enhanced readiness and medical training within the command. Commanders and senior leadership have greater confidence in their docs and a positive experience usually takes place for these young physicians, which will contribute to their retention.

**Refractive Eye Surgery-** ARSOF continues to lead the way in maximizing the warrior laser eye surgery program instituted first at Womack Army Medical Center at Fort Bragg, and now at several other locations where we have units. This program is an overwhelming success. It has engendered much favorable comment at the general officer level. Photorefractive keratectomy (PRK) continues to be the ARSOF standard for eye surgery for career management field (CMF) 18 soldiers. There are serious concerns and some significant injuries in laser in situ keratomileusis (LASIK) eyes in our non-CMF 18 soldiers. We are cautiously investigating LASIK in a joint Special Forces-SEAL research protocol but are not currently accepting it outside the study group. We have determined that LASEK (note: that isn't LASIK) is also a viable procedure that we are also accepting. LTC Scott Banks has moved on to a fellowship at Harvard, we owe him much.

**Army Transformation-** Initial Brigade Combat Team (IBCT): Our 1st Special Forces Group (Airborne) at Ft. Lewis, WA and its surgeon, MAJ Mullan, have been working closely with the first IBCT to transform and will accompany the IBCT to conduct its first Joint Readiness Training Center (JRTC) rotation (validation) in May 2003. As Special Forces soldiers may be the individuals standing on the beach welcoming the IBCT ashore, this interface is essential.

**USSOCOM BISC-** Various U.S. Special Operations Command (USSOCOM) Biomedical Initiatives Steering Committee (BISC) medical research efforts are continuing, including fibrin and chitosan dressings, substitute oxygen carriers, and physiologic aspects of the CV-22 Osprey aircraft. Mr. Joe Marak in my office has been working hard on new ideas.

**Medical Logistics-** The first new medical equipment sets are now in the hands of the 5th SFG(A), SOSCOM & USAJFKSWCS. We all owe a debt to MAJ Hank Sully. I seem to have made permanent enemies of most orthopedic surgeons by starting to field and train external fixation. I came back from Afghanistan convinced that exfix should be a technique available to SOF medics. It should not be used all the time but could make a great difference some of the time.

**91W Transition-** All active component SOF units with medics that are not 18D are 91Ws as 91W\_W1 Special Operations Combat Medics (SOCM) were qualified through EMT-P for quick conversion. We are successfully sustaining them. Programs are on schedule for implementing 91W for our reserve component medics in the US Army Civil Affairs and Psychological Operations Command (USACAPOC).

**New medical officers & physician recruiting-** SOF medicine is not a GME specialty. Incoming medical corps officers from all medical AOCs attend airborne school, the Army flight surgeons course and serve in 61N-flight surgeon on ARSOF TO&Es. It provides the necessary skills to not only provide health care for ARSOF aviators in task force configurations but also for our numerous combat divers and military free fall parachutists. We continue to recruit more widely than FORSCOM which recruits only from the ambulatory care specialties. We continue to have problems training enough Diving Medical Officers through the Naval Diving and Salvage Center. When the Department of the Army releases the new edition of AR 611-75, Army diving, I will submit the paperwork for establishment of an ASI for DMO for both docs and PAs.

Special Forces and Special Operations units and their medics and medical officers were in high demand throughout the world this year, worldwide. Subsequent to 11 September 2001, ARSOF has decisively engaged in all theaters. All peacetime CINC engagement missions continue in addition to the wartime OEF missions. Almost all SOF battalions, groups, and regiments, medics and surgeons, both active and reserve component SOF units, have already or are currently serving abroad in OEF, many on Combined Joint Special Operations Task Forces. Various others are actively engaged in the war zone or are deeply involved in future operations plans. Keep up the great work!



## NAVSPECWARCOM



Larry Garsha, MD  
CAPT, USN  
Command Surgeon

Navy has no input this edition.



AFSOC



James Dougherty, MD  
Col, USAF  
Command Surgeon

## THE CONTINUUM OF FORWARD COMBAT CASUALTY CARE

You might ask yourself how casualty care in the forward environment can be a continuum. Surely, we don't load a trauma hospital into our backpacks to provide definitive surgery in forward staging areas. Alternatively, we can't make every medic a brain surgeon. So, how is it possible to bring every tool and skill to bear, way out on a limb? Our wounded deserve the same expert care that every citizen gets on the streets of metropolitan USA: an ambulance with life-sustaining paramedics on board, followed by trauma specialists—all within minutes of injury.

So the problem is how to telescope the care and the availability of care when hours and thousands of miles separate the battlefield from the hospital?

As the operators say, "It's all about time and distance."

In the early nineties, AFSOC redesigned its squadron medical element (SOFME) training and equipment to become modular, and to adopt a standard for care that would best serve to be successful in the early resuscitation of the injured. At the same time the Pararescue community began to gravitate toward the EMT-P as the standard for care on the ground. This gave the command the ability to bring its medical assets very far forward to do initial life-saving and life-sustaining actions immediately after wounding. This worked very well for half a decade in operations around the world.

But in order to keep the casualty alive, the period over which those life-sustaining efforts were maintained had to be kept short. Historically, from Vietnam to Bosnia, the next link in the chain—a surgical team or hospital—was not far away by air. A casualty treated on the field by a Pararescueman could be moved by air, under the care of the squadron medics, to the "rear" where definitive care was available in a very short period of time—ideally in less than an hour.

Every one of us knows the importance of the "golden hour," that grace period that gives us the opportunity to intervene to save most casualties that otherwise would have died, and which we should not exceed in order to give those casualties the best chance to live.

But history marches on and the battlespace evolves. With an expeditionary air and space force it is necessary to project power over large distances. The distance from the "rear," or Main Operating Base, to the forward staging area has grown enormously. In some cases this can be thousands of miles, and hours of in-flight time ("time and distance"). So, this now becomes the weakest link in the "continuum" of casualty care.

As I said before, we can't put a trauma hospital in our backpacks. But what we could do, is take the smallest surgical Mini Forward Surgical Team (MFST) and Critical Care Air Transport Team (CCATT) that could operate comfortably, take away all the equipment they normally have to have, except

the minimum essentials to be able to accomplish a handful of case-man-portable, ideally-prepare them to be able to operate in a hanger, in a tent, or on an airplane, and bring them far forward with the other medical elements. The surgical team would do "damage control" surgery, ideally within the Golden Hour, and hand off to the critical care team who would serve as an airborne ICU on opportune combat platforms, back to where the conventional medical support and Aeromedical evacuation could take over for more definitive care.

This concept had been fleshed out, and the teams formed on paper, but never exercised, when 911 occurred, and time to prepare had run out. The teams were given just-in-time training and pushed

out the door in support of OEF. In practice all the elements were in place to match the level of care that could be achieved on the streets of the USA; a Level I trauma center stretched over thousands of miles, that linked PJs, SOF Medical Elements, SOF MFSTs, and CCATTs in a continuum that, once launched, never allowed the casualty to go unattended or suffer morbidity from delayed treatment.

In summary, the lifeline of casualty management had to be stretched forward to reach and care for the wounded in a way that matched expeditionary force employment. Future missions may be to areas where the "time and distance" problem is minimal, but whether stretched out, or contracted back, the medical pieces are now in place to adapt to either extreme.





## **PREVENTIVE MEDICINE**

### **DIGITAL IMAGE RUNNING INJURY PREVENTION PROGRAM**

Shari Tomasetti

Mark Jacobs, MA

Russell Henderson

Hundreds of thousands of soldiers who run as a part of their unit or individual physical training regimen incur injuries. This is often due to wearing the incorrect type of shoe for their running gait. The TeleShoe project was initiated to decrease and prevent running related injuries by diagnosing running gait, prescribing running shoes based on biomechanics and bodyweight information, and training education. The TeleShoe program uses a secure, password protected website with a store-and-forward web-enabled database to diagnose and prescribe running shoes to patients nationwide.

The operation of the TeleShoe consists of four segments: Online Patient Registration, an initial Interview, digital video gait analysis (DVGA), and the Running Report. The Interview process is completed online by a trained technician once participants register with the TeleShoe web site. The interviewer collects information on past running related injuries or pains, and on details of the runner's training regimen such as the frequency, duration, speed and distance of running, strength training, cross-training and agility/flexibility training sessions. This informative running history helps the technician to modify any training errors that may contribute to a runner's pain. If the individual presents with multiple training errors recommendations can be made that will potentially prevent the injury from reoccurring. Education on these training variables is addressed at the end of the visit to help maximize injury-free running. All data is recorded into the TeleShoe database, along with information gained at the actual visit, where shoe wear patterns, the height of the arch, and the shape of the foot is examined. Additional data consisting of body weight, estimated degree of pronation, and foot shape all will correlate with the type of shoe that needs to be worn.

The actual running gait analysis involves making two digital video recordings of the runner's gait on a treadmill, first barefoot and then in running shoes. Running gait is determined by examining the posterior view of the bare leg, foot, and ankle joint during the support phase at the midstance position of running. Each individual's running gait can be described as: (a) overpronation, (b) neutral, or (c) underpronation/supination. The neutral position is known as the most efficient gait, with the least amount of stress placed upon joints of the lower extremity. Malalignments at the subtalar joint place stress along the kinematics of the lower extremity especially during running and are commonly diagnosed as overpronation or supination. After running gait is determined, the correct shoe is prescribed. This shoe should be comfortable to the wearer, fit correctly, be functionally correct, and have the appropriate construction for the individual's needs and running gait.

Up to twelve digital clips from the video may be stored in the TeleShoe database during the Interview portion. Once the Interview is completed, an e-mail stating that a patient record has been submitted to the TeleShoe program is automatically sent to an Exercise Physiologist or medical professional at the Pentagon. The Health Provider accesses the patient's record, diagnoses the running gait, and prescribes a type of running shoe for the patient. Both barefoot and running shoe recordings are analyzed from the digital clips and stored in the patient's online medical record.

The ultimate goal of the gait analysis is to prescribe the type of running shoe that will correct biomechanical abnormalities such as overpronation and allow for a neutral running gait. There are three main types of running shoes that can be selected:

"cushioned"; "stability"; and "motion control." The different types of shoes are categorized according to their midsole construction. Digital video gait analysis for prescribing the proper running shoe and correcting biomechanical errors is beneficial in reducing or eliminating pain associated with running injuries.

Injuries also can be attributed to a combination of training errors and the incorrect running shoe. The running history and the diagnosis are collated into a report, which details for the patient the information gained from the running gait analysis and includes a list of running shoes best suited to that gait. When training errors are indicated as a contributor to an injury, recommendations for a modification of the exercise program are made. The original installation that interviewed and digitally recorded the patient's running gait may view and print out the patient's final reports immediately after a diagnosis is made and submitted.

Running gait analysis has been utilized in military health clinics across the country to encourage safe training and injury prevention by providing proper equipment to soldiers. An unpublished study conducted by Tomasetti<sup>1</sup> reported that 83% of injured runners bought the recommended running shoe after an initial evaluation and 56% had a decrease in running pain (n=36) was observed. This suggests that wearing the correct running shoe leads to a decrease in pain. Providing access to these systems through telemedicine technology will provide a convenient, reliable and cost-effective method of extending the benefits of an injury prevention program via DVGA to service members, dependants, and civilians around the world.

The TeleShoe project is a joint effort of the Walter Reed Army Medical Center's Department of Telemedicine, the Army's Telemedicine and Advanced Technology Research Center and the DiLorenzo TRICARE Health Clinic situated in the Pentagon.

#### **REFERENCES**

1. Tomasetti, S.M. (2002). Effects of running shoes on correcting and preventing running injuries. Unpublished raw data.





The Special Operations Medical Association (SOMA) convenes its annual Special Operations Medical Conference December 2-5 at the Tampa Hyatt Regency Hotel. This year the theme will be Medical Support of Anti-Terrorism Operations from Humanitarian Assistance to Guerrilla Warfare to Weapons of Mass Destructions. Call the hotel at 813-225-1234 during normal week-day business hours for reservations no later than 4 November. Do not call the 800 number-they will not recognize the SOMA room block. Consult the SOMA website, [www.soma.org](http://www.soma.org) for further details.

For more details, contact:  
 MSG Brochu  
 USSOCOM  
 Office of the Command Surgeon  
 Senior Enlisted Medical Adviser  
 Comm- (813) 828-5049  
 DSN 299-5049

SOMA vice-president, MSG Michael Brochu presented the Superior Academic Award. The top guys from SOCM class 3-02 that graduated 4 Oct 02 are both Rangers.

**SOMA Challenge Event**

This event will be held on Tuesday, 3 Dec, starting at 1200hrs. It is open to individuals as well as two-person teams, military or civilian, SOMA or non-SOMA members. Details are intentionally sketchy to emphasize the usual atmosphere of uncertainty found in SOF!

**THE EVENT IS MEANT TO TEST CONTESTANTS RIGHT OFF THE STREET - WITH NO PREPARATION OR BEFOREHAND KNOWLEDGE OF THE EXTENT OF THE EVENT.**

The event will run over a five hour window, and will encompass running and boating (kayaks provided), with a few interspersed SOF-peculiar events, and medical scenarios along the route.

**Running shoes/shorts/shirts (or swim suits), gloves (for paddling), high energy race snacks, and other personal race items are your responsibility.**

Even if a contestant does not score well in the mental and special-skills events, it is still possible to win the overall event. **COMPLETION, with minimal-to-no preparation IS THE TRUE HONOR!** The event is intended to showcase the versatility and spontaneous physical and mental preparation and adaptability of the SOF Medic. There will be T-shirts for all entrants, and prizes will be given out at the Banquet that evening for several categories - e.g. Best Overall, Best Individual (Male, Female), Best Team (all-Male, all-Female, and mixed Male/Female), Oldest Team, etc.



Distinguished Honor Graduate:  
 SGT Merwin Severtson



Honor Graduate:  
 SPC Joshua Hatch

This is the first time in a while that the rangers have taken the top slots. These medics are on top of their game!!!

**USSOCOM BIOMEDICAL R&D UPDATE**

Robert Clayton

The USSOCOM Biomedical Initiatives Steering Committee (BISC) held the 4th Quarter FY02 meeting in conjunction with the Advanced Technology Applications for Combat Casualty Care (ATACCC). The U.S. Army Medical Research and Materiel Command sponsors ATACCC, one of the primer DOD scientific meetings that address issues related to combat casualty care. One of the highlights of the ATACCC was the emerging data and information that has been forthcoming from a BISC initiative to document medical lessons learned from experiences in Operation Enduring Freedom (OEF). Special Operations Medics provided the audience a synopsis of their experiences.

Last August, the first lessons learned meeting was held at the Institute of Surgical Research (ISR), in San Antonio, Texas. Over twenty SOF medics, Physicians and Physician Assistants attended the meeting. The information which they provided will be used to improve medical equipment, capabilities, training and doctrine. One of the key aspects of this meeting was having a very large audience of scientist and principal investigators being able to interact with the operational personnel. This was a two day event, another meeting is planned to be held after the first of the year, at MRMC. Each Component will be asked to send SOF Medical Personnel that have returned from recent operations to share their experiences.

Another BISC project which will impact on how SOF medicine is practiced is the SOF Tactical Combat Casualty Care Panel. The panel is composed of over twenty physicians and medics charged with comparing how SOF tactical medicine compares with Pre-Hospital Trauma Life Support (PHTLS) protocols. Based upon this review, recommendations will be provided to modify protocols that will support a military oriented PHTLS curriculum.

Hemostatic Dressing (HD) Update. The Investigational New Drug (IND) protocols have been submitted to the Food and Drug Administration

(FDA) for approval. Once the protocols are approved the HD will be available for use in SOF. It is anticipated that the release date will be 15 December 2002. FDA protocols require that all SOF personnel that volunteer to enroll in the IND study must fill out an informed consent document. Those personnel that elect not to volunteer can be enrolled at any time during the study, simply by requesting to be enrolled and filling out the informed consent forms. Personnel can withdraw from the study at any time, by informing their medical personnel. A team will be visiting all SOF units to teach the proper procedures for using the HD and to brief each member on the IND protocols and to obtain the informed consent.



Hemostatic Dressing, without foil wrapper.

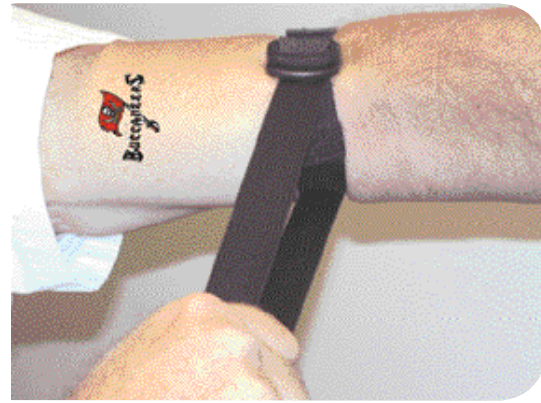
Since the last edition of the Journal, the Chitosan Dressing (CD) development has been expedited. Documentation for a 510-(K) approval was submitted to the FDA in early October 2002. MRMC has petitioned the FDA for an expedited review, based upon the need to support the War on Global Terrorism. Under normal protocols the FDA has 30 days in which to review and approve or disapprove the submission. The 510-(K) provides for a review of a device, in this case an external use bandage, intended for the temporary control of severely bleeding wounds. The FDA will compare this device to several others similar devices that are currently on the market, based upon early trials conducted at the ISR; this device should pass the FDA criteria and be approved for use. Compared to the HD this device is more durable and considerably cheaper.



HemCon (tm) (Chitosan) Bandage, Prototype shown. NOTE: The FDA approved the HemCon (tm) Bandage for use on 4 November 2002. Indications for use: "HemCon (tm) Bandage is a hemostatic dressing for the external temporary control of severely bleeding wounds intended for emergency use. In addition, the HemCon (tm) Bandage also controls bleeding in patients following hemodialysis."

Both of the above mentioned bandages offer a significant increase in capabilities to control severe hemorrhage far forward. Both are running neck in neck at the FDA for approval. There is a very large investment of time and money in both products and both are very effective, to select one over the other before the FDA approves either on is risky. Once this edition of the Journal is printed we will either be conducting an IND on the HD or using the CD or both.

The one handed tourniquet has been produced and shipped to the Component Surgeons for distribution. This particular design was developed by a SOF medic. We are funding further research to



Tourniquet applied to extremity. Note plastic "D" rings against skin.

develop the next generation of tourniquet. Currently there are two Small Business Innovative Research (SBIR) grants being awarded to develop prototype devices. If you have ideas or comments regarding improvements or suggested devices contact your Component Surgeons Office.

Hemoglobin Based Oxygen Carriers (HBOC) has gained a lot of support with in the DOD Medical Community. With the recent high level interest the funding and research will be expedited. This will be another giant step in for forward care and increased trauma management for SOF medics. The next edition of the Journal will include more details on what the timelines and program milestones will look like.

Some of the other areas of interest that they BISC will be addressing in the near future, based upon the results of the lessons learned include improved methods of pain management, fluid resuscitation and methods to assess patient status/vital signs in far forward settings.



One Handed Tourniquet, note the red handle at top of picture, double loops go around the wounded extremity with the plastic "D" rings and rubber surface against the limb. Vigorously pulling the red handle, continue to tighten straps until bleeding is controlled.

# Going Beyond the “Thin Air” An Understanding of Physiologic Acclimatization and The Pathogenesis of High-Altitude Related Injuries Part Two of a Two Part Series

Eric D. Martin, DO  
Douglas M. Duncan, PA-C

## ABSTRACT

This is part two of a two part series that discusses High Altitude acclimatization and pathogenesis. Military operations at high altitudes have existed for centuries and are currently being conducted now in parts of the world. This paper reviews a brief history, physiological changes leading to acclimatization, types of injuries and the use of adjunctive treatment modalities to better conserve the human component combat weapons system.

## OBJECTIVES (FOR PARTS 1 AND 2)

1. Explain the compensatory mechanisms that take place in the physiologic adaptation and acclimatization process as it relates to high altitude.
2. Be able to recognize the signs and symptoms of high altitude illness and render the appropriate treatment modalities.
3. Discuss indications and contraindications along with side effects of the Gamow Bag.

**Complete test on page 45--Answer sheet on page 49**  
**Completion of this article and test offers 1.0 CME and 1.2 CNE/CEH**

**DISCLOSURE:**The presenters have indicated that, within the past two years, they have had no significant financial relationship with a commercial entity whose products/services are related to the subject matter of the topic they will be addressing or a commercial supporter of this educational activity.

## HIGH-ALTITUDE ILLNESS

Since extensive literature already exists on the signs and symptoms along with the respective prevention and treatment options of acute mountain sickness (AMS), high-altitude cerebral edema (HACE), and high-altitude pulmonary edema (HAPE), this section provides just a brief overview of the signs and symptoms. This writing will focus mainly on the etiology of the diathesis of high-altitude illness and its pathogenesis.

The term high-altitude illness is used to describe cerebral and pulmonary syndromes that can

develop in unacclimatized individuals. High-altitude illness provides a useful model for studying the pathophysiologic process of hypoxia.

## AMS AND HACE

### DEFINITION AND CLINICAL PRESENTATION

Acute mountain sickness is a syndrome of non-specific symptoms. AMS is defined as the presence of a headache in an unacclimatized person who has recently arrived at an altitude above 7,000 feet plus the presence of one or more of the following: gastro-intestinal systems (e.g. anorexia, nausea, or

vomiting), insomnia, dizziness, and lassitude.<sup>28</sup> Symptoms normally develop within six to ten hours after ascent, sometimes as early as one hour. There are no pathognomonic diagnostic physical findings for AMS.

On the other hand, high-altitude cerebral edema is a clinical diagnosis defined as the onset of ataxia, altered consciousness, or both in someone with acute mountain sickness. The pathophysiology of HACE is thought to involve a hypoxia-induced increase in permeability of the blood brain barrier (vasogenic edema), or the hypoxia-induced alteration of cellular fluid regulation with an intracellular fluid shift (cytotoxic edema) or some combination of the two mechanisms. The incidence of HACE is lower than that of AMS or HAPE, occurring in only about 1% of individuals making rapid ascent. While HACE can occur as low as 10,000 ft., the vast majority of HACE occur above 12,000 ft. High-altitude cerebral edema is the end stage of acute mountain sickness both from a clinical and pathophysiological perspective. Associated findings of high-altitude cerebral edema may include papilledema, retinal hemorrhage, and cranial nerve palsy as a result of elevated intracranial pressure. High-altitude cerebral edema is characterized by global encephalopathy rather than focal findings.<sup>28</sup> Seizures are rare, and the cause of death is the result of brain herniation. The illness is progressive over a period of hours or days.

There exists a differential diagnosis of high-altitude illnesses. A health care provider should suspect other mimicking conditions if the patient's symptoms fail to abate after treatment with fluids and rest. The absence of a response to descent, oxygen, diamox, or dexamethasone all suggest other diagnoses. The differential includes the following:

- Arteriovenous malformation
- Brain tumor
- Dehydration
- Central nervous system infection
- Diabetic ketoacidosis
- Hypoglycemia
- Hypothermia
- Migraine headache
- Cluster headache
- Stroke
- Ingestion of toxins, drugs, or alcohol
- Transient ischemic attack (TIA)
- Seizures

## **PATHOPHYSIOLOGIC PROCESS OF AMS AND HACE**

Hypoxia elicits neurohumoral and hemodynamic responses that result in the overperfusion of the microvascular beds, elevated hydrostatic capillary pressure, capillary leakage, and consequent edema. The exact etiology of AMS is unknown.

Two theories exist to possibly explain the symptoms complex found in patients with AMS. The first theory is a hypoxia-induced cerebral vasodilation due to nitric oxide production, which produces the headache found in AMS. The headache itself can cause other symptoms such as nausea and fatigue. An alternative hypothesis is that early acute mountain sickness is due to mild cerebral edema and a person's inability to compensate for swelling in the brain.

The Monro-Kellie Doctrine depicts an understanding of intracranial compensation for an expanding mass in the cranium, which is essentially a nonexpansile container. The volume of the intracranial contents should remain constant. The normal intracranial contents consist of venous volume, arterial volume, brain parenchyma, and cerebrospinal fluid. If the addition of a mass or swelling occurs in the brain, there is a resultant outpouring of an equal volume of cerebral spinal fluid (CSF) in venous blood in order to maintain a normal intracranial pressure (ICP). However, when this compensatory mechanism is exhausted, there is an exponential increase in ICP for even a small increase in the volume of the mass or edema in the brain.<sup>29</sup> Those with the greater ratio of cranial cerebrospinal fluid to brain volume are better able to compensate for swelling through the displacement of the CSF, and may, therefore, be less likely to have acute mountain sickness.

Magnetic resonance imaging techniques have demonstrated vasogenic edema as a culprit in high-altitude cerebral edema.<sup>30</sup> High-altitude hypoxemia increases sympathetic activity, activates endothelial cells, and alters hemodynamic function in the brain to include sustained vasodilatation and impaired cerebral autoregulation. The increased sympathetic activity decreases urinary sodium excretion by activating the renin-angiotensin-aldosterone cycle. This causes an increase in capillary hydrostatic pressure leading to vasogenic edema. The endothelial activation is part of the inflammatory cascade and results in the synthesis of platelet activating factor (PAF) and eicosanoids derived from arachidonic acid. The eicosanoids are not

stored in cells but are rapidly synthesized by cells in response to a variety of stimuli. They have potent effects on vascular and bronchial smooth muscle including vasodilatation, vasoconstriction, bronchodilation, and bronchoconstriction. In addition, they directly regulate vascular permeability. PAF exerts a variety of biological effects that are platelet independent. PAF synthesis and eicosanoids production are coordinately regulated. PAF is a stimulatory agonist for many inflammatory cells, as well as for smooth muscle cells, vascular endothelium and others.<sup>31</sup> The net result of the endothelial activation is an increase in capillary permeability resulting in vasogenic cerebral edema.

Hemodynamic alterations promote vasodilatation causing an increase in cerebral blood flow and blood volume. The increase in cerebral blood flow causes impaired autoregulation. The phenomenon of autoregulation tends to maintain a fairly constant cerebral blood flow between mean systolic blood pressures of 50 and 160 mm Hg. Below 50 mm Hg, the cerebral blood flow declines steeply, and above 160 mm Hg, there is passive dilatation of the cerebral vessels and an increase in cerebral blood flow. The impaired autoregulation leads to overperfusion causing an increase in capillary pressure leading to vasogenic edema. The increased cerebral blood volume overwhelms the buffering system by the cerebral spinal fluid. All this contributes to high-altitude cerebral edema.

## **HIGH-ALTITUDE PULMONARY EDEMA**

### **DEFINITION AND CLINICAL PRESENTATION**

HAPE is a non-cardiogenic pulmonary edema occurring in unacclimatized individuals following a rapid ascent to high altitude. HAPE accounts for most deaths from high-altitude illness. The incidence of HAPE, just like AMS, is related to the rate of ascent, the altitude reached, individual susceptibility, and the degree of exertion. Accepted risk factors for HAPE include moderate to severe exertion, cold exposure, young age, and male gender. Cold increases pulmonary artery pressure by activating the sympathetic nervous system. High-altitude pulmonary edema commonly strikes the second night at a new altitude and rarely occurs after more than four days at a given altitude owing to adaptive cellular and biochemical changes in pulmonary vessels.<sup>28</sup> HAPE can occur as low as 8,000 ft.; however, HAPE most commonly occurs between an altitude 10,000 and 12,000 ft.

Symptoms and signs of HAPE are related to progressive pulmonary edema and the resultant worsening hypoxemia. Early in the course, manifestations are often subtle, nonspecific, and are frequently accompanied by symptoms of AMS.

Early diagnosis is critical. Decreased performance and a dry cough should raise suspicion of HAPE. Only late in the illness does pink or blood tinged sputum respiratory distress develop. Early hypoxemia may be manifested by dyspnea on exertion, fatigue, and an increased time needed for recovery after physical activity. Resting tachycardia and tachypnea become more pronounced as HAPE progresses. Orthopnea is uncommon as is hemoptysis. Fever (101° F) is common as well as a mild increase in white blood cell count. According to Hackett and Roach 50% of those afflicted with HAPE have AMS, and 14% have HACE. Of those whose condition deteriorates and who die, 50% have high-altitude cerebral edema at autopsy.

As the pulmonary edema progresses, rales become more numerous, bilateral, and wide spread. Wheezing may develop as well. Upper respiratory track infection or bronchitis may be precipitating factors.

EKG demonstrates sinus tachycardia, right ventricular strain, right-axis deviation, right bundle-branch block, and P-wave abnormalities. Chest X-Ray typically reveals a normal-sized heart, full pulmonary arteries, and patchy infiltrates, which are generally confined to the right middle and lower lobes in mild cases and are found in both lungs in severe cases. Arterial blood gas analysis reveals severe hypoxemia (a partial pressure arterial oxygen approximately 30-40 mm Hg) and a respiratory alkalosis. The alkalosis is due to the tachypnea, which decreases carbon dioxide levels. The differential diagnosis of HAPE includes:

- Asthma
- Bronchitis
- Pulmonary embolus
- Pneumonia
- Heart attack
- Heart failure
- Hyperventilation syndrome

### **PATHOPHYSIOLOGIC PROCESS OF HAPE**

High-altitude pulmonary edema in unacclimatized individuals is a function of both the magnitude of the hypoxic stress and the pulmonary hypertension and elevated pulmonary capillary pressure

that occurs on ascent to high altitude. Hypoxic stress is a function of speed of ascent and elevation gained. It can also be worsened by Cheyne-Stokes breathing (periodic skip breathing characterized by alternating episodes of hyperventilation followed by brief apnea during sleep), which can lower the oxygen-hemoglobin saturation levels by 10%. The pulmonary hypertension occurs as a result of exaggerated hypoxic pulmonary vasoconstriction.<sup>32</sup> The mechanisms for this response include sympathetic overactivity, endothelial dysfunction, and greater toxemia resulting from a poor ventilatory response to hypoxia. In addition, the increased sympathetic activity probably raises capillary pressure as a result of pulmonary venous constriction.<sup>33</sup> Recall briefly that the physiology unique to the pulmonary system illustrates that in order to cause a reduction in alveolar dead space, regions of the lung that are poorly oxygenated at the alveolar level undergo pulmonary vasoconstriction in order to minimize a ventilation-perfusion mismatch.

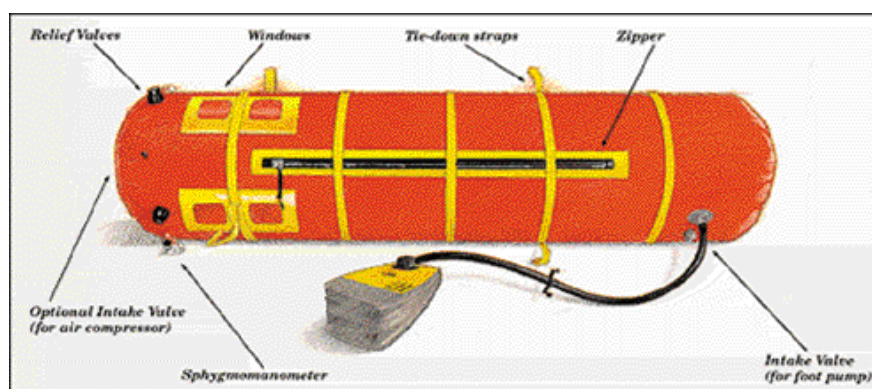
Another possible explanation for elevated capillary pressure is the uneven hypoxic pulmonary vasoconstriction. Current research has proposed that within the pulmonary microcirculation in vasoconstricted areas protection occurs minimizing capillary pressures. This allows for overperfusion to occur in regions that are less constricted causing elevated pulmonary capillary pressure and capillary leakage.<sup>34</sup> This concept was supported by results from radioisotopes perfusion studies in patients with HAPE.

The presumed final process leading to extravasation of plasma and cells from the intravascular space is the result of high microvascular pressure causing a stress failure of pulmonary capillaries.<sup>35</sup> Recent research has indicated that the inflammatory process reported in high-altitude pulmonary edema is due to a stress-induced failure of capillaries and alveolar flooding. Bronchoalveolar fluid contains a high protein content and increased numbers of white blood cells, leukotrienes, and evidence of complement activation. Hackett and Roach illustrate that the dramatic response to oxygen therapy can be explained by the findings that the microcirculation rapidly returns to normal when capillary pressure drops.<sup>28</sup> Finally, a new concept has been proposed in the pathophysiologic process of HAPE, which

includes the inability of the body to clear fluid from the alveolar air sacs.<sup>36</sup>

## Epidemiology of HAPE

Current discoveries regarding susceptibility in individuals who may develop HAPE help to identify at-risk groups prior to ascent in order to minimize the risk of developing HAPE at altitude. In a recent article by Hackett and Roach entitled "Current Concepts in High-Altitude Illness," the authors point out several recent discoveries. Persons with a prior episode of HAPE may have a 60% recurrence rate if they abruptly ascend to an altitude of approximately 14,000 ft. Individuals in this group had a reduced ventilatory response to hypoxia coupled with an exaggerated pulmonary pressor response to hypoxia and exercise. In addition, endothelial function might be impaired with overexpression of constrictors or an underexpression of vasodilators (such as nitric oxide), or both, in response to hypoxia. Individuals with increased susceptibility to HAPE may have a genetic difference in the amiloride-sensitive sodium channel, which reduces the ability to transport sodium and water from the alveolar space. Susceptible persons also have a higher incidence of major histocompatibility complexes including HLA-DR6 and HLA-DQ 4 antigens, suggesting that there may be an immunogenetic basis or susceptibility to HAPE. This work was supported by Hanaoka, Kubo, and Yamazaki, et al in 1998.<sup>28</sup>



## THE GAMOW BAG

Until the advent of the Gamow Bag and like-devices, the only treatment options for AMS, HAPE, and HACE were descent and/or oxygen therapy. In many instances, aeromedical evacuation times are prolonged due to operational considerations (air defense artillery [ADA] threat and altitude of landing zone), while ground evacuation can be restricted by the terrain (avalanche threat) and limited by the num-

ber of available personnel to transport the patient. Additionally, a manual rescue poses the risk of inducing high-altitude injuries in the rescuers. It is not unusual for patients with high-altitude injuries to consume multiple resources (personnel/equipment) in their treatment and evacuation. Often times, immediate evacuation and descent are not a viable option. However, the Gamow Bag provides flexibility in the time window required for evacuation, which lessens the need for heroic rescue efforts. As previously stated, there is a curvilinear reduction in the ambient barometric pressure with increasing altitude. In practical terms, the lower the altitude, the higher the partial pressure of oxygen. The Gamow Bag provides an extremely useful adjunct in the management of high-altitude injuries. It is designed as a portable device to increase the atmospheric pressure around a patient thereby supplying an increased partial pressure of oxygen. In effect, it lowers the patient in altitude without requiring any change in physical location. AMS treatment usually requires two hours in the Gamow Bag, HAPE takes around four hours to relieve symptoms, and HACE treatment usually requires approximately six hours. A significant point remains: HAPE and HACE casualties should descend to lower altitudes. 3/10 SFG(A) routinely operates in environments where the potential exists for high-altitude injuries. The Gamow Bag has proven extremely useful in conserving assets and maintaining soldiers as far forward as possible. The following table shows the altitude that is simulated when using a Gamow Bag that is pressurized to 2 psi (103 mm Hg). It can be seen that the maximum possible descent would be from the top of Everest at about 9000 m (29,529 ft) to about 6198 m (20,334 ft); a descent of about 2800 m (9195 ft):<sup>28</sup>

**AMBIENT CONDITIONS INSIDE GAMOW BAG**

FEET	MmHg	FEET	MmHg	Change (ft)
0	760	-3353	863	3353
984	731	-2464	834	3448
1969	705	-1624	808	3593
2953	679	-761	782	3714
3937	654	78	757	3859
4921	630	945	733	3976
5906	607	1755	710	4151
6890	584	2618	687	4272
7874	562	3458	665	4416
8859	541	4298	645	4561
9843	522	5102	626	4741

FEET	MmHg	FEET	MmHg	Change (ft)
10827	503	5922	607	4905
11812	484	6736	588	5076
12796	466	7543	570	5253
13780	449	8347	553	5433
14765	433	9144	537	5621
15749	417	9935	521	5814
16733	401	10772	505	6011
17717	387	11500	491	6217
18702	372	12274	476	6428
19686	359	13042	463	6644
20670	345	13800	449	6870
21655	333	14555	437	7100
22639	320	15303	424	7336
23623	309	16044	413	7579
24608	297	16776	401	7832
25592	286	17504	390	8088
26576	276	18223	380	8353
27560	266	18935	370	8625
28545	256	19640	360	8905
29529	246	20334	350	9195

The Gamow Bag weighs 14.9 pounds (carrying pack/air pump included) and possesses a volume of 17 cubic feet. It is constructed out of non-permeable nylon and requires approximately two minutes to inflate and ten to twenty pumps per minute to maintain pressure and ventilate carbon dioxide. Four windows are integrated into the bag, which allows for patient monitoring, reduced claustrophobia, and entrance of light. It is effective in the treatment of AMS, HAPE, and HACE. It is lightweight and reusable. High-altitude injuries treated solely with oxygen require amounts that are prohibitive due to the weight and transportation requirements. Disadvantages of the Gamow Bag include: propensity to tear on sharp objects, potential claustrophobia, and an inability to perform procedures while the patient is enclosed in the bag.

The only absolute contraindication for utilizing the Gamow bag is patients who require emergent stabilization for associated injuries. A relative contraindication includes patients with upper respiratory infections. The potential exists for barotrauma resulting from unequal pressure equilibration across the tympanic membrane. Pulmonary Over Inflation Syndrome (POIS) is possible but quite rare. Similar to diving scenarios, a patient must be breath holding simultaneously with rapid decompression (Gamow Bag loses pressure suddenly).



Carbon dioxide toxicity is a major safety consideration. Patients inside the Gamow Bag are enclosed inside a rigid barrier and are expiring carbon dioxide. Carbon dioxide toxicity will develop with inadequate venting. Symptoms suggestive of carbon dioxide toxicity include: shortness of breath, headache, tachycardia, progressive mental status changes, and unconsciousness.

Prevention is always preferred rather than treatment. However, many operational factors may dictate less than ideal mission parameters. It is not unlikely that high-altitude injuries will result from rapid introduction to high altitudes. The Gamow Bag provides a diagnostic and therapeutic intervention that quite literally can be life saving and limit consumption of critical resources.

#### SUMMARY

Rapid insertion of a military unit into a high-altitude environment causes a cascade of physiologic events in unacclimatized personnel. This cascade is triggered by hypobaric hypoxia and can develop into pathologic conditions requiring medical intervention. The manifestations of these high-altitude illnesses present in distinct syndromes such as AMS, HACE, and HAPE and are unique to a high-altitude environment. The impact of these high-altitude illnesses ranges from mild self-limited discomfort to death. In order to accomplish the primary medical mission of conserving the human component combat weapons system, medical personnel should have sufficient knowledge of altitude illnesses, a comprehensive understanding of physiologic acclimatization, and the use of adjunctive treatment modalities such as the Gamow Bag.

Mountain medicine is seldom taught during formal medical training. This article provides medical officers and medical personnel with an understanding of the human physiologic response to a hypobaric hypoxic environment unique to high-altitude exposure. Hypoxia-related illnesses are explained in a brief overview of the signs and symptoms with emphasis on the pathophysiologic process of each of the three respective altitude illnesses, AMS, HACE, and HAPE. Finally, the article discusses the use of the Gamow Bag, its indications for treatment, and side effects from using the bag. It is the hope of the authors that readers will gain an appreciation for and a better understanding of mountaineering medicine after reading this article.

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Gamow Bag in use.  
Photo credited to  
V. McKiel

# Portable Emergency Recompression Therapy In Special Operations

James D. Grady M.D.

## ABSTRACT

Special Operations missions such as combat diving, freefall parachuting, and flying carry a risk of decompression illness. These operations may be executed in remote and austere environments. Medical evacuation requiring ascent to altitude can exacerbate symptoms and delayed recompression therapy can result in poor clinical outcomes. Such problems can be averted with the use of lightweight, durable, air transportable hyperbaric treatment systems. This article will describe one such system; highlight its strengths and weaknesses and advocate its utility in the special operations medical armamentarium.

**Disclaimer:** The views contained herein are those of the author and do not necessarily reflect the views of the Department of Defense.

*"No-one who has seen the victim of compressed air illness, gravely ill or unconscious, put back into a chamber and brought back to life by the application of air pressure, will forget the extraordinary efficiency of recompression, or will be backward in applying it to a subsequent case of illness."*

*Robert Davis, 1935*

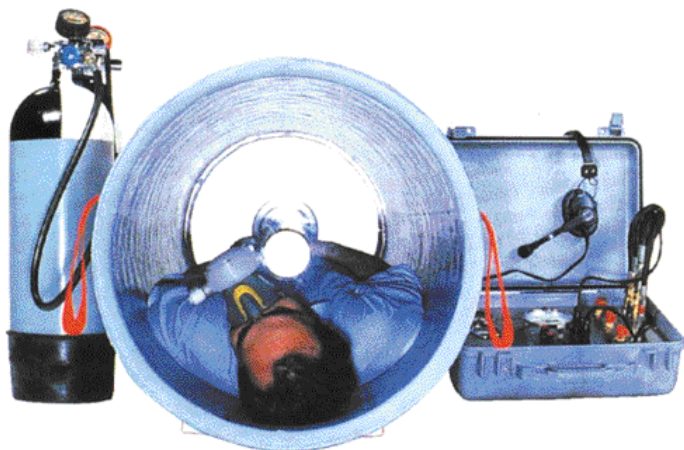
Having treated a few dramatic cases of arterial gas embolism with immediate recompression therapy I could not agree more with the words of Mr. Davis. Fortunately, for the cases in which I was involved, immediate recompression therapy was available and all patients experienced complete resolution of their neurological deficits. Immediate recompression therapy can reverse the acute effects of bubble formation. If recompression therapy is delayed, endothelial leukocyte adherence, platelet deposition, fibrin clot formation, and neuronal damage or death may occur. Diver's Alert Network statistics indicate that individuals with decompression illness treated early have a better prognosis than those treated after a delay. Unfortunately special

operations missions do not always occur in close proximity to a hyperbaric chamber. Army Special Forces Combat Dive Teams are required to coordinate with a recompression chamber, and establish an evacuation plan prior to conducting diving operations. These chambers however, can be a considerable distance from the dive site and may be staffed by personnel who are not able to provide immediate therapy. Foreign chambers are often not



maintained to the standards of U.S. Military chambers and are in some cases quite hazardous.

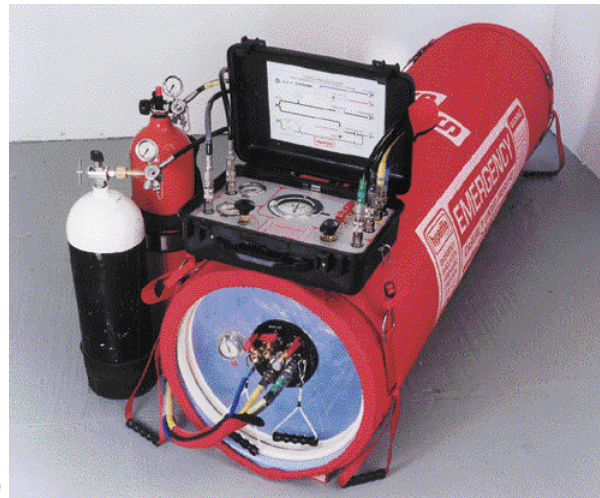
The benefits of an effective portable hyperbaric treatment system are apparent: decreased time to treatment, decreased reliance on often sub-standard host nation support, less immediate demands on evacuation assets, and ability to evacuate under pressure. The SOS Hyperlite Emergency Evacuation Hyperbaric Stretcher and Treatment System (EEHS) is an example of a system that can provide these benefits. The Hyperlite



has been adopted by the Department of Defense as a result of a foreign comparative test program. The U.S. Air Force, Navy, and Coast Guard have obtained units for emergency use. It can be positioned at or near a dive site for rapid treatment of diving injuries. As an organic asset it decreases reliance on host nation hyperbaric support and is capable of transfer under pressure. The system is small enough to pass directly through the open door of most chambers. The total system weight in cases is 209 pounds and it fits in two pelican-like cases measuring 28" x 28" x 23" and 26" x 26" x 19". Pressurization can be accomplished using



standard 80 cubic foot aluminum scuba cylinders. Approximately 40 standard cubic feet of gas ( 1/2 of an aluminum 80 scuba tank) are required to pressurize the system to 60 FSW. Extra gas should be available to maintain depth and provide venting. Oxygen can be supplied by a variety of standard "hospital" oxygen cylinders as well as standard



LAR V (Drager) oxygen cylinders. The main control box has only three main controls, two for controlling pressure and one for alternating treatment gas. The system has a built in breathing mask (BIBS) and an overboard dump. The BIBS supply to the Hyperlite can be switched from oxygen to air with a valve on the control box that allows the operator to independently change the BIBS gas. This allows the patient to continue to use the BIBS during air breaks. The overboard exhaust from the BIBS prevents the accumulation of carbon dioxide and oxygen within the chamber. The maximum working pressure of the Hyperlite is 2.1 bar or 69 FSW and it is capable of completing a U.S. Navy Treatment Table 6. The system while not considered a "certified chamber" by the U.S. Navy is built to standards for U.S. Navy Diving and Manned Hyperbaric Systems Safety Certification Manual and Safety Standards for Pressure Vessels for Human Occupancy. There exist some problems with semantics when referring to recompression chambers in the military. While many people consider the Hyperlite to be a recompression chamber it does not meet the U.S. Navy Diving Manual requirement for a recompression chamber as is needed on site for decompression surface supplied diving operations to depths greater than 130 FSW. The Hyperlite can however be used for emergency recompression therapy and is well suited for combat

diving operations in which a "certified chamber" may be some distance away.

While the Hyperlite certainly has its benefits it is not without some drawbacks. Being a single occupancy chamber it cannot accommodate an insider tender. This is obviously of concern in the seriously injured patient. Worsening of a patient's clinical condition requiring hands-on medical interventions such as intubation require returning to ambient pressure. As a result, patients with impending respiratory failure or airway compromise should generally not be placed in the chamber. There may be cases in which an experienced provider may elect to treat an obtunded patient with a secure airway in the chamber. There is presently no ventilator capability with this system. There is no internal environmental control system so temperature control must be accomplished externally and with venting. Although this system is made from fire retardant materials with low fire, smoke and toxicity properties there is no fire suppression system such as those found on larger fixed chambers. The risk of fire greatly increases if oxygen is allowed to leak around the BIBS mask thereby increasing the percentage of oxygen in the chamber air. While 209 pounds is considered light for a recompression chamber it may be unrealistic for missions with limited airlift resources. While the Hyperlite is only able to pressurize to 2.8 ATA there is little evidence to support improved outcomes with deeper depths. Leitch et al. have shown that there is no advantage of Table 6A over Table 6 in the treatment of dogs given an intracarotid injection of air. Leitch and Green examined the records of 14 divers with decompression sickness who had not satisfactorily responded at 2.8 ATA and were then compressed to greater pressures. The authors concluded that further compression rarely altered clinical course or significant improvements.

I have primarily covered the use of portable recompression systems in diving injuries. However, such systems are also suitable for treating other pressure related illnesses experienced by submariners, miners, pilots, astronauts, mountaineers, and tunnellers. The U.S. Navy recently deployed 9 hyperbaric chambers and diving medicine personnel to support the rescue of 9 trapped miners in Pennsylvania. In addition such systems may be suitable for administering hyperbaric oxygen therapy to treat acute trauma, acute blood loss, burns, gas gangrene, carbon monoxide poisoning, and smoke inhalation. The Hyperlite is not appropriate for pro-

viding routine clinical hyperbaric oxygen therapy.

As a relatively new tool in military diving medicine there are presently no regulations addressing personnel authorized to operate emergency evacuation hyperbaric stretchers. Given the characteristics of the hyperlite, which preclude immediate patient access, it would be prudent to limit its use to medical personnel with hyperbaric medical training. Operators should have thorough training in the system and understand its inherent risks and limitations. If emergency evacuation hyperbaric systems gain acceptance in the Special Operations medical community training and qualification guidelines will likely be established.

Portable, transferable, recompression systems while not perfect, in trained hands can save lives and prevent permanent injury. They can permit special operations teams at risk for decompression illness to conduct missions in remote locations while ensuring that those injured receive rapid definitive.

Additional detailed information on emergency evacuation hyperbaric stretchers is contained in the Navy Experimental Dive Unit Technical Report 5-99. Copies of this report can be obtained from the Navy Experimental Dive Unit Technical Library.

*Images of the hyperlite EEHS have been reproduced with permission from SOS Limited.*



Major Grady is currently assigned as the Diving Medical Officer, U.S. Army Special Forces Underwater Operations in Key West, Florida. He completed a residency in family practice at Dewitt Army Community Hospital and is a 1995 graduate of the Uniformed Services University of the Health Sciences.

**Editors Note:** I am glad to see the Army Special Forces community take interest in the EEHS, as I believe it would be well suited for many situations. I am very glad that you noted the problem of airway compromise. This has been one of my major concerns. If an unskilled attendant puts an unconscious patient without a secure airway into an EEHS, he could very well cause his demise from airway obstruction. I also strongly recommend always using a pulse oximeter. This message needs to be continually stressed, but it also needs to be noted that the number of cases where the stricken diver is unconscious is very low, so the Hyperlite is useful in well over 90% of diving casualties. Gary W. Latson, CDR, MC



## Soft Tissue Infection

Steven G. Folstad

### ABSTRACT

Soft tissue infections are a common complaint in any clinic. Given the fact most all-Special Operations missions are in environments that promote and facilitate skin infections it's important SOF health care providers ensure prompt recognition and treatment. This article reviews a wide variety of common skin infections, their likely clinical picture and treatments. Delayed recognition and non-aggressive treatment in a relatively secure and clean environment often times results only in delayed infection resolution. Taking this approach in the operational environments and lack of back up SOF finds itself, can rapidly lead to loss of life or limb.

### OBJECTIVES

- 1) Identify presenting signs and symptoms of Gas Gangrene, and summarize the evaluation and treatment of this life threatening disease.
- 2) Summarize the differences in presentation, pathology, evaluation, and treatment of primary cellulitis and erysipelas.
- 3) Describe the different cutaneous abscess syndromes typically encountered in the emergency department and their unique presentation, pathology, or treatment.
- 4) Describe the often overlooked clinical presentation of sporotrichosis. Summarize the different clinical syndromes, their significance, and treatment.

**Complete test on page 47-Answer sheet on page 50**

**Completion of this article and test offers 1.0 CME and 1.2 CNE/CEH**

**DISCLOSURE:** The presenter has indicated that, within the past two years, he has had no significant financial relationship with a commercial entity whose products/services are related to the subject matter of the topic they will be addressing or a commercial supporter of this educational activity.

### GAS GANGRENE

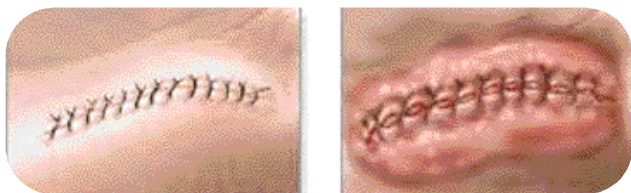
Gas gangrene or clostridial myonecrosis is a rapidly progressive and serious life-and-limb threatening soft tissue infection caused by one of the spore-forming clostridial species of organism. Severe myonecrosis with gas production and sepsis are the hallmarks of this disease, and early diagnosis and aggressive management are needed to prevent the high risk of mortality associated with this infection.

### EPIDEMIOLOGY

Clostridium species are ubiquitous organisms found throughout our environment. It is estimated that a full 30 percent of traumatic injuries are contaminated with one or more of the Clostridium species. There is approximately 1000 cases of gas gangrene reported to the Centers for Disease Control and Prevention (CDC) each year in the United States.<sup>1</sup> The incidence of disease secondary to these organisms is decreasing, presumably due to better

wound management and more effective antibiotic therapy. For example, the incidence of gas gangrene in battle-related injuries was 5 percent during World War I; this dropped to 0.2 percent during the Korean war and to 0.01 percent during the war in Vietnam.

**Pathophysiology**  
 There have been seven *Clostridium* species identified as causing gas gangrene. *Clostridium perfringens* is attributed to 80 to 95 percent of cases, with *C. septicum* being the second most common etiology.<sup>2</sup> The clostridial organisms are large, gram-positive, spore-forming anaerobic bacilli normally found in the soil, gastrointestinal tract, and female genitourinary tract. They produce several exotoxins that are responsible for the cellular destruction as well as the rapid progression and systemic toxicity of the disease. Bacteremia is rare. Secondary toxic effects may be caused by the release of myoglobin, creatine phosphokinase (CPK), and potassium from tissue breakdown.



Clean Wound

Gangrene

There are two potential mechanisms for infection with clostridial organisms. The first and most common is through direct inoculation from an open wound. Similar to tetanus, clostridial species thrive best in contaminated wounds with crushed or ischemic edges that tend to offer a favorable anaerobic environment. The second mechanism for infection is via hematogenous spread. Nearly all these patients are relatively immunocompromised from some form of underlying disease such as diabetes mellitus, peripheral vascular disease, alcoholism, drug abuse, or hematologic or gastrointestinal malignancies. Almost a third of these cases of "spontaneous gas gangrene" are caused by *C. septicum*, with an even higher incidence in cases related to malignancies.

**CLINICAL FEATURES**

The incubation period is short, usually less than three days. The most common presenting complaints in early gas gangrene are pain out of proportion to physical findings, as well as a sensation of "heaviness" of the affected part. On examination, the

area may demonstrate a brawny edema with crepitation. The skin will develop a bronze or brownish discoloration with a malodorous serosanguineous discharge, and bullae may be present. Systemic manifestations include a low-grade fever with tachycardia out of proportion to the fever. The patient may be confused or irritable and have a rapid deterioration of the sensorium. Laboratory evaluation may reveal any or all of the following: metabolic acidosis, leukocytosis, anemia,



thrombocytopenia, coagulopathy, myoglobine-mia and myoglobinuria, and liver or kidney dysfunction. Gram stain of

the bullae often shows pleomorphic gram-positive bacilli with or without spores, red blood cells, but very few white blood cells. Radiologic studies may demonstrate gas within soft tissue fascial planes and possibly gas within the peritoneal or retroperitoneal space.

**DIAGNOSIS**

Early diagnosis and treatment are essential in this life-threatening disorder. Familiarity with the disease and its clinical features is important to avoid overlooking the subtle early signs of its presentation. Any patient presenting with pain out of proportion to physical findings, with or without low-grade fever, and significant tachycardia, with or without a cutaneous injury, should be carefully evaluated for possible clostridial infection. Crepitus detectable on physical examination may be a later finding, and its absence does not rule out the diagnosis. Plain radiographs of the affected area may reveal gas within the involved muscle and surrounding soft tissue. A Gram stain of exudate or tissue showing gram-positive rods with a relative lack of leukocytes is considered diagnostic. Surgical exploration is also helpful in the diagnosis. In the early stages, the muscles are edematous and pale but still bleed when cut; in later stages, the muscles lose contractility and on dissection appear beefy red without bleeding and



gas bubbles may be evident between the tissues.

The differential diagnosis of clostridial myonecrosis must encompass other gas-forming infections, including necrotizing fasciitis, streptococcal myositis, acute streptococcal hemolytic gangrene, crepitant cellulitis, and synergistic necrotizing cellulitis. The crepitance should be differentiated from other causes of subcutaneous emphysema such as pneumothorax, pneumomediastinum, and fractured larynx or trachea. The edema and pallor, with loss of distal pulses, seen in an affected extremity should be differentiated from vascular thrombosis conditions such as phlegmasia cerulea dolens.

## TREATMENT

Treatment consists of four main phases:

1. *Resuscitation* should begin in the emergency department (ED) immediately on making a presumptive diagnosis. Aggressive fluid resuscitation using crystalloid, plasma, and packed cells is usually needed to replace red blood cells lost due to hemolysis and to correct hypotension due to shock. Volume status should be closely monitored using urine output and central venous pressure readings. Avoid the use of vasoconstrictors when possible due to the possibility of decreasing perfusion to already ischemic muscle.

2. *Antibiotic therapy* using penicillin G 10 to 40 million units per day in divided doses is recommended. Clindamycin, metronidazole, and chloramphenicol are alternative choices for the penicillin-allergic patient. Sodium penicillin is recommended over potassium penicillin to reduce the risk of worsening hyperkalemia in patients with hemolysis and tissue necrosis. Mixed infections with other anaerobes, gram-negative rods, and staphylococci are common. Therefore, multiple-antibiotic therapy using aminoglycosides, penicillinase-resistant penicillins, or vancomycin is recommended. Tetanus prophylaxis should be given as indicated.

3. Surgical debridement is a mainstay of therapy and may include fasciotomy, debridement, or amputation. The borders for debridement are guided by the appearance of the muscle.

4. *Hyperbaric oxygen (HBO) therapy* has been a widely used therapeutic modality since the early 1960s. Although there are no prospective human studies, retrospective data suggest a twofold reduction in mortality in patients receiving concomitant HBO therapy.<sup>3</sup> The timing of its use in relation to surgical debridement remains somewhat controversial.

Standard therapy consists of surgical debridement prior to HBO therapy, partly for confirmation of the diagnosis based on muscle appearance. Some argue that since elevated partial pressures of oxygen are bactericidal in tissues, as well as inhibitory to toxin production, preoperative HBO therapy may allow for sharper demarcation of necrotic tissue at debridement and less loss of tissue to amputation and decreased systemic toxicity. Typical HBO therapy at this time consists of 100% oxygen at three atm of pressure for 90 min immediately following surgery, with three dives in the first 24 h followed by two dives a day for 4 or 5 days.

Wound care at the time of initial evaluation and treatment is the most important factor in preventing clostridial infections. Debridement of crushed or dead tissue and copious irrigation prior to wound closure will help prevent the development of an environment favorable to clostridial growth. Prophylactic penicillin administration may be beneficial in preventing subsequent infection.

## CELLULITIS

Cellulitis is a local soft tissue inflammatory reaction secondary to bacterial invasion of the skin. The classic symptoms of cellulitis have been attributed previously to bacterial invasion and subsequent proliferation within the local tissues; however, new evidence suggests that the majority of symptoms may instead be secondary to a complex set of immune and inflammatory reactions triggered by cells within the skin itself.<sup>4</sup>



## EPIDEMIOLOGY

The term *cellulitis* represents a broad spectrum of disease in both location and severity. Unfortunately, general data on prevalence and incidence of disease are difficult to obtain and interpret. Cellulitis is a common disease in all EDs, affecting the elderly, the immunocompromised, and those with peripheral vascular disease at a much higher rate and severity.

## PATHOPHYSIOLOGY

Cellulitis is a local inflammation of the skin characterized by pain, induration, warmth, and ery-

thema. It is caused by invasion of the tissues with bacteria, most commonly staphylococci or streptococci in adults and *Hemophilus influenzae* in children. In diabetic patients, additional consideration needs to be given to Enterobacteriaceae and rarely clostridia. Lymphangitis and lymphadenopathy are seen occasionally in previously healthy patients, but purely local inflammation is much more common. Systemic involvement with fever, leukocytosis, and bacteremia is seen most typically in patients with underlying immunosuppressive diseases. Traditional thought has been that the symptoms of cellulitis are related to the effects of the bacteria and their proliferation on local tissues. This has been poorly substantiated in that efforts at isolating these organisms from infected tissue have had a very poor yield. Needle aspiration of the leading edge of an area of cellulitis produces organisms in less than 10 percent of cultures, and even punch biopsy from the same area yields organisms in only around 20 percent of cultures. Only areas with suppuration or abscess formation have significantly higher yield. Recent studies now suggest that although bacterial invasion is what triggers the inflammation, the organisms are largely cleared from the site within the first 12 h, and the infiltration of lymphoid and reticular cells and their products is what produces the majority of symptoms.<sup>4</sup> Cells such as Langerhans cells and keratinocytes release the cytokines interleukin-1 and tumor necrosis factor that enhance infiltration of the skin by circulating lymphocytes and macrophages. The net effect of this is much more rapid clearing of bacteria but at the price of a significantly larger inflammatory response. Theoretically, the addition of anti-inflammatory agents to the treatment regime of cellulitis would be beneficial. Further study needs to be done to identify what specific role, if any, such agents should play.

#### **CLINICAL FEATURES**

Patients with cellulitis typically present with localized tenderness, warmth, induration, and erythema. Specific note should be made on physical examination of evidence of lymphangitis or lymphadenitis because this may suggest more serious infection. The presence of high fever and chills suggests bacteremia, especially in patients with underlying medical disorders.

#### **DIAGNOSIS**

In otherwise healthy patients, the clinical presentation is sufficient for diagnosing cellulitis. The high likelihood of typical organisms and the low yield of isolation techniques make further efforts unwarranted. In patients with underlying disease or signs of bacteremia, blood cultures and leukocyte counts are indicated. Local means of isolating the organism are controversial, but in the case of a toxic-appearing patient, they may be worthwhile. Differentiating deep venous thrombosis from cellulitis in the lower extremities is often difficult and may require Doppler studies or venogram.

#### **TREATMENT**

Simple cellulitis in otherwise healthy adult patients can be treated as an outpatient basis with dicloxacillin (500 mg PO q6h), a macrolide (EES 500 mg PO q6h, azithromycin 500 mg PO initial dose then 250 mg PO qd x 4d, clarithromycin 500 mg PO q12h), or amoxicillin-clavulanate (875/125 mg PO q12h), with all treatments lasting for 10 days except for azithromycin. The exception to this is cellulitis involving the head or neck, for which most patients should be admitted for intravenous antibiotics. Appropriate intravenous antibiotics include parenteral first-generation cephalosporins (cefazolin 1 g IV q6h) and penicillinase-resistant penicillins (nafcillin or oxacillin 2 g IV q4h). In diabetics, a parenteral second- or third-generation cephalosporin (ceftriaxone 1-2 g IV qd) should be used or imipenem (500 mg IV q6h) in severe cases.<sup>5</sup>

#### **DISPOSITION**

Patients with evidence of bacteremia and those with underlying diseases such as diabetes mellitus, alcoholism, or other immunosuppressive disorders should be admitted for intravenous antibiotics. Empirical therapy may be started with the antibiotics listed earlier and changed as indicated by culture results.

All patients discharged on oral antibiotics should have close follow-up arranged with their local medical doctor to evaluate the success of treatment. Anti-inflammatory agents for the treatment of cellulitis are experimental at this time, and until further research identifies a specific role, they should be used with caution.

## ERYSIPELAS

### EPIDEMIOLOGY

There has been a dramatic increase in the incidence in erysipelas over the past 20 years, as well as a change in the locations that are infected most commonly. Previously, erysipelas involved the face more frequently, but now it is primarily an infection of the lower extremities.<sup>6</sup>

### PATHOPHYSIOLOGY

Erysipelas is a superficial cellulitis with lymphatic involvement that is caused primarily by group A *Streptococcus*. Atypical infections most commonly seen with other groups of streptococci are also noted. Infection is typically achieved through a portal of entry in the skin, with traumatic wounds, ulcers, and infected dermatoses of the lower extremities being the most common sites. Peripheral vascular disease, especially venous insufficiency, is a local risk factor for infection. Most often erysipelas occurs proximal to the portal of entry into the skin.

### CLINICAL FEATURES

The onset of symptoms is usually abrupt, with a sudden onset of high fever, chills, malaise, and nausea. Over the next 1 to 2 days a small area of erythema with a burning sensation develops. As the infection continues, a red, shiny, hot plaque forms. The plaque has a tense, painful induration that is sharply demarcated from the surrounding normal tissue. Lymphangitis and local lymphadenopathy are common. Purpura, bullae, and small areas of necrosis also are seen. Systemic symptoms continue until antibiotic therapy is initiated. On resolution of the infection, desquamation of the site typically occurs.

### DIAGNOSIS

The diagnosis is based primarily on physical findings. Leukocytosis with an increase in the neutrophil count is common. Performing a needle aspiration of the infection site is rarely successful at isolating an organism, but swabbing the portal of entry, when identifiable, may have a higher success rate. Blood cultures are positive in only around 5 percent of patients.<sup>7</sup> Serologic testing to determine ASO and anti-DNAase B titers may be more specific but is of little use acutely in the ED.

The differential diagnosis includes other forms of local cellulitis. Some believe that necrotiz-

ing fasciitis is a complication of erysipelas infections and should be considered in all cases.

### TREATMENT

Penicillin G (1-2 million units IV q6h) may be used in nondiabetic patients for initial treatment due to the high incidence of streptococcal infection. Penicillinase-resistant penicillins (nafcillin or oxacillin 2 g IV q4h), parenteral second- or third-generation cephalosporins (ceftriaxone 1-2 g IV qd), or amoxicillin-clavulanate (875/125 mg PO q12h) should be used in diabetic patients and those with facial disease. Imipenem (500 mg IV q6h) is recommended in severe cases. Erythromycin, cephalosporins, or a macrolide should be used in patients with penicillin allergy. Essentially all patients with erysipelas should be admitted to the hospital for intravenous antibiotics.

## CUTANEOUS ABSCESSSES

The development of cutaneous abscesses most often is caused by a breakdown in the skin's normal protective barrier followed by contamination with local resident bacterial flora. In most cases involving otherwise immunocompetent patients, appropriate surgical incision and drainage are the only treatment required.

### EPIDEMIOLOGY

Cutaneous abscesses are a common ED presentation, representing 1 to 2 percent of presenting complaints. There has been little recent investigation into the bacteriology or recommended treatment of simple cutaneous abscesses. This is probably secondary to the excellent outcome with simple incision and drainage regardless of the location or etiology.

### PATHOPHYSIOLOGY

Intact, healthy skin usually acts as an excellent barrier to bacterial invasion. Cutaneous factors such as constant desquamation of the epidermis continually shedding bacteria and the lower pH of 3 to 5 of the skin also contribute to the skin's protective function. Host cellular and humeral defenses further protect invading bacteria from developing subsequent infection. When favorable host factors are lacking, or in cases of overwhelming bacterial contamination, a break in the skin's integrity either superficially (abrasion, laceration, or thermal injury) or from deep inoculation (laceration, puncture, or

bite) may lead to colonization and subsequent infection. Infection typically starts as a local superficial cellulitis. Many organisms that colonize normal skin can cause necrosis and liquefaction with subsequent accumulation of leukocytes and cellular debris. Loculation and subsequent walling off of these products of infection lead to abscess formation. As the infection progresses and the area of liquefaction increases, the abscess wall thins and ruptures spontaneously, draining either cutaneously or into an adjoining tissue compartment.

The bacterial etiology of soft tissue abscesses often can be predicted by knowledge of the normal flora colonizing specific areas of the body. Environmental factors such as temperature, humidity, and the general hygiene of a patient play a role in the likelihood of infection, but only by increasing the number of bacteria colonizing the skin. In abscesses involving the scalp, trunk, and extremities, staphylococcal species are the most common infecting organism. *Staphylococcus aureus*, the least common of the staphylococcal species isolated on normal skin, is the most common species causing infection. *S. epidermis* and *S. hominis* are also seen frequently. Streptococci commonly colonize the oral and nasal mucosa and can be seen in abscesses involving the adjoining soft tissues. The intertriginous and perineal areas often are colonized by the gram-negative aerobes *Escherichia coli*, *Proteus mirabilis*, and *Klebsiella* species. Abscesses involving the axilla are most often infected with *P. mirabilis* for reasons that are not clear. Abscesses in the perirectal and genital areas are most commonly mixed anaerobic and aerobic in nature, with *Bacteroides* species being the most common anaerobe.

In abscesses secondary to foreign bodies, *S. aureus* is the most commonly isolated species. Bite injuries, especially by cats, are at risk for infection with *Pasteurella multocida* but also can involve *S. aureus*, as well as *Streptococcus viridans* and *Eikenella corrodens*. Human bites are less likely to involve *P. multocida* but have a high incidence of involvement with the anaerobe *Bacteroides fragilis* and the gram-positive *Corynebacterium jeikeium*, as well as the usual staphylococcal and streptococcal organisms. In infections associated with intravenous drug abuse, "mixed" infections prevail, with anaerobic bacteria predominating.<sup>8</sup> The most common anaerobic organism is the *Peptostreptococcus* species, with *Staphylococcus* and *Streptococcus* species being the predominating aerobic organisms.

Interestingly, a significantly higher percentage of anaerobic infections have been noted in patients injecting cocaine. This has been attributed to the relative anaerobic environment created by the vasoconstrictive effect of the cocaine.

#### CLINICAL FEATURES

Patients present with an area of swelling, tenderness, and erythema. Inspection of the area may reveal fluctuance, induration, or active drainage. Lymphadenitis, localized lymphadenopathy, or fever may indicate systemic involvement of the infection, but in otherwise healthy patients, cutaneous abscesses tend to remain localized. A careful history should be obtained, with special attention given to underlying immunocompromising illnesses, steroid or other immunosuppressive drug use, and alcoholism. Close inspection of the area for evidence of predisposing injury or foreign body is important. Radiography may be indicated to evaluate for certain radiopaque foreign bodies, and ultrasound may be useful in identifying nonradiopaque objects. Ultrasound can accurately identify many small foreign objects or at least a small fluid collection representing surrounding abscess. The limiting factor in the use of ultrasound is that because of the superficial location of most of these objects, a very high frequency ultrasound transducer is required (7.5-10 MHz). Specific abscesses that may be encountered in the ED are discussed below.

#### BARTHOLIN GLAND ABSCESES

Bartholin gland abscesses are seen primarily in sexually active women. Another diagnosis should be considered in postmenopausal women. The Bartholin or vestibular glands are located at the 5 and 7 o'clock positions of the vaginal vestibule. The glands are secretory in nature, and obstruction of the ducts can cause retention of secretions leading to cyst and eventually abscess formation. The patient presents with a unilateral painful swelling of the labia and with a fluctuant 1-2 cm. mass at the location of Bartholin's gland. *Neisseria gonorrhoea* and *Chlamydia trachomatis* are often isolated in these abscesses, and cervical cultures are recommended in all patients with Bartholin's gland abscesses. Treatment is not recommended routinely, except in patients with a high clinical suspicion for sexually transmitted disease. Anaerobes, especially *Bacteroides* species, are also common, as are the

gram-negative organisms typically colonizing the perineal region. Treatment involves incision and drainage along the vaginal mucosal surface. There is a very high incidence of reinfection if more definitive steps are not taken to form a permanent fistulous tract. This can be done by using a Word catheter, a small catheter with a balloon on the distal end used to hold the abscess cavity open during healing, or by marsupializing the abscess walls.

### **HIDRADENITIS SUPPURATIVA**

Hidradenitis suppurativa is a recurrent, chronic infection involving the apocrine sweat glands. Blockage of these glands by keratinous material leads to inflammation, local cellulitis, and subsequent abscess formation. Multiple areas of infection develop in different apocrine glands and coalesce to form chronic draining fistulous tracts. These tracts tend to occur in the axilla and groin, where the apocrine sweat glands predominate. Hidradenitis suppurativa is more common in women and blacks, and there appears to be a genetic factor involved in its development. Obesity, shaving, and poor hygiene also contribute. The causative organism is usually *Staphylococcus*, but *Streptococcus* also can be involved. In the groin, gram-negative organisms and anaerobes also may be seen. Patients often will present with multiple lesions in different stages of development and healing but with an acute exacerbation in one or a few areas. ED treatment is directed primarily at incision and drainage of the acute infection with referral to a surgeon for further definitive treatment. This often requires wide excision of the affected area. Oral antibiotics should be used in patients with significant areas of cellulitis.

### **INFECTED SEBACEOUS CYSTS**

Sebaceous glands occur diffusely throughout the body. Blockage of the duct of a sebaceous gland may lead to development of a glandular cyst that may exist for a long period of time without becoming infected. Once bacterial invasion occurs, abscess formation is common. These patients typically present with an erythematous, tender cutaneous nodule that is commonly fluctuant. Simple incision and drainage are the appropriate ED treatment. The cyst always contains a capsule that must be removed to prevent further infection. This is usually best done at a later

follow-up visit when the initial inflammation has improved or resolved. Occasionally, the wall of the sac can be grasped with a forceps and removed at the time of drainage.

### **PERIRECTAL ABSCESES**

Most, if not all, perirectal infections are felt to arise from mucinous glands located within the anal crypts. Blockage of the ducts to these glands leads to bacterial invasion, infection, and commonly, abscess formation. The location of the subsequent abscess depends on the direction in which the infection



spreads. The most common area of infection is the perianal abscess that is located superficially below the anal ring. Ischiorectal abscesses, supralelevator abscesses, and intersphincteric abscesses all are caused by spread of infection into deeper perirectal tissues. Perirectal abscesses are more common in middle-aged males with other risk factors, including inflammatory bowel disease, diabetes, and other immunocompromising illnesses. The bacterial etiology of these infections is primarily the normal fecal flora. Mixed anaerobic and aerobic infections predominate, with *B. fragilis* being the primary anaerobe. Perirectal abscesses can represent serious, life-threatening infections, and only the most superficial should be treated with local anesthesia and incision and drainage in the ED.

### **PILONIDAL ABSCESES**

Pilonidal abscesses are located along the superior gluteal fold. It is thought that a pilonidal sinus forms along the gluteal fold possibly at the time of embryogenesis, although others believe it to be secondary to local soft tissue trauma. These sinuses are lined with squamous epithelium and hair. It is blockage of the sinus tract with hair and other kerati-

nous material that leads to bacterial invasion and infection. The causative organisms typically are normal skin flora, with *Staphylococcus* species being the most common. Contamination with peritoneal and fecal organisms is also possible. Patients tend to develop symptoms in their late teens and early twenties, and without definitive surgical treatment, they tend to have recurrent infections, sometimes developing a chronic draining fistulous tract. Patients typically present to the ED with a tender, swollen, and fluctuant nodule located along the superior gluteal fold. Systemic symptoms are rare. The appropriate initial treatment includes incision and drainage using care to remove all excess hair and debris from the abscess cavity. The cavity should be packed with iodoform gauze, and the patient should return in 2 to 3 days for advancement of the packing. Antibiotics generally are not needed. Surgical referral is recommended for more definitive treatment.

## **STAPHYLOCOCCAL SOFT TISSUE ABSCESSSES**

*Staphylococcus* species are ubiquitous throughout the skin and have a particular affinity for hair follicles, where infection is common. Inflammation of a hair follicle caused by bacterial invasion is known as *folliculitis* and is best treated noninvasively with warm soaks. A deeper invasion into the soft tissue surrounding a hair follicle can lead to a localized abscess formation called a *furuncle* (boil). These are most commonly found on the face, neck, back, axilla, and inner thigh. Unless severe, warm compresses usually are adequate to promote spontaneous drainage. In the thick skin on the back of the neck, several furuncles may coalesce to form a large area of infection containing many interconnected sinus tracts and abscesses. This is known as a *carbuncle* and often requires surgical wide excision for complete resolution. Carbuncles are seen much more commonly in diabetics and may demonstrate signs of systemic involvement.

### **DIAGNOSIS**

Most simple cutaneous abscesses in otherwise healthy patients are local infections without need for further evaluation. Clinical presentation of a tender, swollen, often erythematous nodule strongly suggests infection. A palpable area of fluctuance is typically enough for the diagnosis of abscess. Notice should be made of the admitting vital signs,

with particular attention to temperature and heart rate. Fever or tachycardia suggests systemic involvement of the infection and may indicate the need for further laboratory testing. In patients with diabetes, alcoholism, and other immunocompromising conditions, the threshold for further diagnostic studies should be lower. A complete blood count and in certain situations (such as possible osteomyelitis) an erythrocyte sedimentation rate usually are all that are needed to evaluate for possible systemic involvement. Diabetic patients routinely should have blood glucose checked.

In simple abscesses involving otherwise healthy patients, a routine culture and sensitivity is not needed. If it is felt that antibiotic treatment is indicated, the causative organisms usually can be predicted by the general location of the abscess. If further certainty is required, a Gram stain of the abscess aspirate most often will lend the required information, and results can be obtained while the patient is still in the ED. Gram-positive cocci in clusters suggest infection with *S. aureus*, whereas many different organisms suggest a mixed anaerobic and aerobic infection. In patients in whom possible deep or chronic infection may complicate the course, early wound cultures with sensitivities may prove useful. Immunocompromised patients demonstrating systemic signs of infection also should have blood cultures drawn. In patients in whom foreign body involvement is a potential issue, plain radiographs or possibly ultrasound should be used to assist in identification.

### **TREATMENT**

Incision and drainage are the only treatment necessary in most cases of superficial and localized abscesses. Often it is difficult to determine clinically if an area of fluctuance is present within an area of induration and swelling. Needle aspiration of the most likely area of induration often can help in the diagnosis. When pus is encountered with aspiration, incision and drainage should be performed. When no pus is located, a trial of antibiotic therapy and warm compresses is appropriate initially. These patients should have a follow-up evaluation scheduled because many will need incision and drainage in the future.

Consideration must be given to the best location for abscess drainage. Abscesses well suited to ED treatment are those which are superficial, well localized, and not in close proximity to nerves or

vascular structures. Fluctuant masses should be examined for pulsations or bruits if near vascular structures. Patient comfort is also an important consideration. Infiltration of a local anesthetic most often gives poor pain relief. The lower pH of infected tissue typically greatly reduces the effectiveness of a local anesthetic. Injecting additional fluid into an already swollen and tender area also increases pain. Regional or field blocks can be used effectively at times, and digital blocks to assist in the drainage of a large paronychia or felon are usually all that are needed. Patients with evidence of deeper tissue infection, as in many cases of perirectal abscess, and those in whom adequate analgesia cannot be obtained in the ED should be taken to the operating room for appropriate surgical drainage.

Nitrous oxide has been used with good success in many EDs for years. The parenteral use of rapid and ultra-short-acting sedatives and analgesics for conscious sedation in the ED has been shown to be both safe and effective when they are used appropriately. They are best suited for procedures that are very painful and short in duration. Incision and drainage seem ideal in this regard. Many agents have been used effectively, with the combination of fentanyl and midazolam being one of the more common and effective. Both these agents have a short time to peak effect (3-5 min for midazolam and <1 min for fentanyl) and a short duration of action (each 1 to 1 1/2 h), which allows the patient to be discharged at his or her pre-sedation mental status baseline without a prolonged recovery period. Furthermore, the patient benefits from the analgesic effect of the fentanyl as well as the sedative, anxiolytic, and amnesic effects of the midazolam. Fentanyl, with less than 1 min to peak effect, is very well suited to titration for desired effect during the procedure.

Prior to any sedation or analgesia, the procedure should be explained to the patient, including any possible complications. With most superficial abscesses, the risks involved are relatively few. The possibility of severing a cutaneous nerve with residual local numbness, as well as the risk of injury to deeper nerves and blood vessels, should be discussed. The possibility of poor or delayed wound healing should be discussed in patients with diabetes or peripheral vascular disease. Some estimate should be made of the residual scarring that may be anticipated, especially in areas of cosmetic significance. As with all elective and invasive procedures, informed consent should be obtained in all patients.

Although the risk of complications is low, informed consent prior to the procedure ensures that the patient has been appropriately educated concerning the risks and benefits, as well as optimizing medicolegal coverage for the clinician. Informed consent in patients receiving conscious sedation is also important and should cover the risk of respiratory depression requiring endotracheal intubation.

The patient should be positioned to ensure appropriate access to the abscess and in the most comfortable position possible. The area should be prepared with Betadine and draped in a sterile fashion. After appropriate anesthesia, the abscess should be opened widely over the area of greatest fluctuance, using a No. 11 or 15 scalpel blade to ensure adequate drainage. As much pus as possible should be expressed by gentle compression. Hemostats are then used to break up any loculated areas within the abscess cavity. The cavity is irrigated with saline and packed loosely with gauze tape to hold it open to promote drainage while the infection resolves. The packing should be left in place long enough for the cavity to heal from the inside out, preventing recollection of the abscess. Patients are discharged with instructions for warm compresses or soaks 3 to 4 times a day. A follow-up visit should be scheduled in 2 to 3 days for recheck and advancement or replacement of the packing. Wounds that continue to actively drain at the time of follow-up should have the packing replaced. Replacing the packing performs some degree of debridement of the abscess cavity, as well as providing fresh packing for absorption of pus and debris. Wounds that are not actively draining can have the packing advanced as needed to allow for internal healing while keeping the incision open to promote drainage.

The use of antibiotics in patients with cutaneous abscesses is somewhat controversial. The risk of systemic infection following local incision and drainage appears to be low. A recent ED study demonstrated that in 50 afebrile patients in whom blood cultures were drawn 2 and 10 min after incision and drainage of cutaneous abscesses, none of the cultures was found to be positive.<sup>9</sup> There are no good data suggesting that antibiotic treatment following incision and drainage speeds infection resolution in otherwise healthy patients. Generally, it is felt that in patients without underlying immunocompromising conditions or signs of systemic infection, antibiotics are not indicated following incision and drainage of superficial cutaneous abscesses. With a

lack of hard scientific data pointing to clear-cut guidelines for antibiotic therapy, clinical judgment needs to be exercised. In patients with diabetes, alcoholism, or other underlying immunocompromising illnesses, or in those on immunosuppressant medications such as steroids or chemotherapeutics, the threshold for antibiotic use should be much lower. Furthermore, patients who present with signs of systemic disease such as fever and chills and those with cellulitis extending beyond the abscess borders also should be considered for antibiotic therapy. Abscesses involving the hands or face should be treated more aggressively with antibiotics because of the higher morbidity associated with prolonged infection or complications. The specific antibiotic used should be chosen according to the most likely pathogen involved. This can be somewhat predicted by the location of the infection. Duration of therapy should be directed to some degree by the severity of infection but typically should continue for 5 to 7 days.

Of separate concern are patients with underlying structural heart disease at risk for bacterial endocarditis. Certain structural cardiac conditions lead to a higher incidence of bacterial endocarditis. Furthermore, the severity of disease and morbidity are increased in patients with certain underlying cardiac diseases who develop bacterial endocarditis. The American Heart Association recently has updated its guidelines for patients at increased risk for developing bacterial endocarditis.<sup>10</sup> Table 1 outlines the cardiac conditions considered to be at high and moderate risk based on predicted outcomes if endocarditis does occur. Note that several types of patients frequently encountered in the ED, namely, patients after coronary artery bypass grafting, those with pacemakers, and those with mitral valve prolapse without valvular regurgitation, are not recommended for endocarditis prophylaxis. Despite the apparent low risk of transient bacteremia following incision and drainage of a simple cutaneous abscess, the American Heart Association recommends prophylactic antibiotics for those patients in the high- and moderate-risk categories prior to the procedure. No mention is made of postprocedure treatment. The antibiotic selected should be directed at the most likely organism causing the abscess. Table 2 outlines suggested antibiotic treatment by organism for soft tissue infections and should be used for preprocedure prophylaxis for endocarditis. An intravenous or intramuscular antistaphylococcal penicillin, clindamycin, or first-generation cephalosporin is appro-

priate for patients not able to take oral medications. In patients with known methicillin-resistant *S. aureus* infection, vancomycin is recommended for prophylaxis.

## DISPOSITION

Most patients can be discharged following incision and drainage of a cutaneous abscess. Again, clinical judgment plays an important part in this decision. Patients with severe underlying disease or those with immunocompromising conditions may benefit from admission and intravenous antibiotics. Furthermore, patients with signs of systemic infection or deeper infection such as osteomyelitis should be considered for admission. Appropriate follow-up within 2 to 3 days for those discharged is important.

**TABLE 1 Cardiac Conditions at Risk for Endocarditis**

Endocarditis prophylaxis recommended:

High Risk category:

Prosthetic cardiac valves

Previous bacterial endocarditis

Complex cyanotic heart disease (e.g., single ventricle, transposition of the great vessels, tetralogy of Fallot)

Surgically constructed systemic pulmonary shunts or

Moderate-Risk category:

Most other congenital malformations

Acquired valvular dysfunction (e.g., rheumatic heart disease)

Hypertrophic cardiomyopathy

Mitral valve prolapse with valvular regurgitation and/or thickened leaflets

Endocarditis prophylaxis not recommended:

**Negligible-risk category (no greater risk than general population):**

**Isolated secundum atrial septal defect**

**Surgical repair of ASD, VSD, or PDA**

**Previous coronary artery bypass grafting**

**Mitral valve prolapse without valvular regurgitation**

**Physiologic, functional, or innocent heart murmur**

**Cardiac pacemakers**

*Abbreviations:* ASD, atrial septal defect; VSD, ventricular septal defect; PDA, patent ductus arteriosus



## SPOROTRICHOSIS



Sporotrichosis is a mycotic infection caused by the fungus *Sporothrix schenckii* commonly found on plants and vegetation and in soil. Infection is caused by traumatic inoculation and usually remains within the local soft tissues and lymphatics. Disseminated forms, although more rare, do occur.

### EPIDEMIOLOGY

The organism responsible for sporotrichosis occurs worldwide and is found most commonly in soil, sphagnum moss, and decaying vegetable matter. Inoculation into the host most commonly occurs from a spine or barb on a plant puncturing the skin during handling. It is a common disease among florists, gardeners, and agricultural workers. Transmission from infected animals, especially cats, has been documented, and veterinarians and animal handlers are also at increased risk. The largest outbreak of sporotrichosis in the United States involved 15 states and 84 persons, all of whom handled conifer seedlings shipped in sphagnum moss contaminated with *S. schenckii*.<sup>11</sup>

### PATHOPHYSIOLOGY

*S. schenckii* is a thermally dimorphic fungus that changes from its mycelial form to its yeast form on entering a body-temperature environment. Local infection occurs in most cases, with disease limited to cutaneous or lymphocutaneous areas.<sup>12</sup> Osteoarticular involvement including osteomyelitis, septic arthritis, bursitis, and tenosynovitis occurs and may be related to a local cutaneous infection or secondary to hematogenous spread. Systemic forms, including pulmonary, meningeal, and disseminated forms, are much more rare.

### CLINICAL FEATURES

The incubation period averages three weeks from the time of initial inoculation but varies from a few days to several weeks. After the fungus enters the body through a break in the skin, three types of localized infections may occur. The fixed cutaneous type is characterized by lesions restricted to the site of inoculation and may appear as a crusted ulcer or verrucous plaque. Local cutaneous-type infections also remain local but present as a subcutaneous nodule or pustule. The surrounding skin becomes erythematous and may ulcerate, resulting in a chancre. Local lymphadenitis is common. The lymphocutaneous type is the third and most common type. It is characterized by an initial painless nodule or papule at the site of inoculation that later develops subcutaneous nodules with clear skip areas along local lymphatic channels. The local reactions in all three types of infections tend to be relatively painless but show no signs of improvement without treatment.

### DIAGNOSIS

History and physical findings are the key to diagnosis. Histopathologic stains are of little help because the organisms are scarce in tissues. Fungal cultures are the best way to isolate the fungus, and tissue biopsy cultures often are diagnostic. Routine laboratory tests are nonspecific, but an increased white blood cell count, eosinophil count, and erythrocyte sedimentation rate may be noted. The differential diagnosis includes tuberculosis, tularemia, cat-scratch disease, leishmaniasis, staphylococcal lymphangitis, and nocardiosis.

### TREATMENT

The treatment of choice for cutaneous sporotrichosis until recently was potassium iodide (SSKI) 3 to 4 g three times a day to be continued for at least 1 month beyond resolution of clinical symptoms. This was a cumbersome treatment and was associated with a high incidence of side effects such as metallic taste, anorexia, and swelling of the salivary glands. Recently, itraconazole (100-200 mg qd for 3-6 months) has been shown to be a highly effective and much better tolerated treatment for localized as well as many systemic forms of sporotrichosis.<sup>13</sup> Fluconazole has been shown to be less effective than itraconazole and should be reserved for those few patients not tolerating itraconazole. Ketoconazole has shown even poorer results than fluconazole. Intravenous amphotericin B is effective, but adverse reactions usually limit its use to disseminated forms.

**TABLE 2 Antibiotic Recommendations for Soft Tissue Infections (Oral)**

*Staphylococcus Aureus*

Dicloxacillin 250-500mg q6h  
 Amoxicillin-clavulanate 500/125mg q8h or 875/125mg q12h  
 Cephalexin 250-500mg q6h  
 Clarithromycin 150-450mg q12h  
 Azithromycin 500mg first day, then 250mg qd x4d

*Streptococcus species*

Penicillin V 250-500mg q6h  
 Amoxicillin-clavulanate 500/125mg q8h or 875/125mg q12h  
 Cephalexin 250-500mg q6h  
 150-450mg q6h  
 Erythromycin 250-500mg q6h  
 Clarithromycin 500mg q12h  
 Azithromycin 500mg first day, then 250mg qd x4d  
 Ciprofloxacin 500-750mg q12h  
 Ofloxacin 200-400mg q12h  
 Cephalexin 250-500mg q6h

*Bacteroides fragilis*

Amoxicillin-clavulanate 500/125mg q8h or 875/125mg q12h  
 Clindamycin 150-450mg q6h  
 Metronidazole 500mg q6h

*Pasturella multocida* (animal bites, esp. cats)

Penicillin V 250-500mg q6h  
 Amoxicillin-clavulanate 500/125mg q8h or 875/125mg q12h  
 Ciprofloxacin 500-750mg q12h  
 Ofloxacin 200-400mg q12h

**DISPOSITION**

Essentially all patients with a cutaneous form of sporotrichosis can be treated on an outpatient basis. Discharge instructions should include basic wound care for open lesions, and close follow-up with a local medical doctor should be arranged. Patients who are acutely ill or have evidence of systemic disease should be admitted to the hospital initially for possible treatment with intravenous amphotericin B.

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# An Approach to the Special Operations Trainee with Altered Mental Status

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## ABSTRACT

Disorders of consciousness span a wide range of presentations, from mild alterations in mental status to coma. Altered mental status in special operations trainees (such as those in BUD/S, Marine Reconnaissance, Army Special Forces, and Air Force Pararescue training) is usually the result of one of a small number of causes. Initial management of a patient with altered mental status is essentially the same, regardless of etiology.

## THE SCENARIO

- \* 22-year-old BUD/S student on 30 minute open-circuit training SCUBA dive
- \* Water temperature 59° F, student wearing 6 mm full wetsuit
- \* Makes uncontrolled ascent to surface and hits head on ladder on side of boat
- \* Upon arrival at the surface, reports running out of air on the bottom and panicking
- \* Five minutes after surfacing, becomes confused, then quickly loses consciousness

Disorders of consciousness span a wide range of presentations, from mild alterations in mental status to coma. Altered mental status (AMS - do not confuse with the AMS of acute mountain sickness) can present a significant challenge to the physician or other medical provider because rather than suggesting a specific diagnosis, it can be the primary presentation for a myriad of medical conditions. Altered mental status in special operations trainees (such as those in BUD/S, Marine Reconnaissance, Army Special Forces, and Air Force Pararescue training) is usually the result of one of a small number of causes. First responders should be familiar with these conditions, as well as their initial evaluation and management, until the patient can be transferred to an appropriate medical treatment facility.

## INITIAL EVALUATION AND TREATMENT

Initial management of a patient with altered mental status is essentially the same, regardless of etiology. If a medical officer is not already at the scene, one should be consulted immediately. Evaluation of the ABCs (airway, breathing, circulation/C-spine stabilization) should be paramount. The airway must be patent and secure. If the patient needs airway assistance, place a nasopharyngeal or oropharyngeal airway. If this is insufficient for breathing or ventilations of the patient, endotracheal intubation or other definitive airway measure should be considered. Breathing should be assessed by examining the patient for the presence of midline trachea (tracheal deviation could herald a tension pneumothorax) and bilateral breath sounds. Circulation should be assessed by pulse, blood pressure, and capillary refill. Cervical spine immobilization should be insured until a cervical spine injury can be ruled out, and a core temperature (preferably rectal) should be obtained.

First responders to the patient should ask any witnesses about significant trauma or exertion, hyperbaric exposure, or any other environmental exposure. The patient should be placed on 100% oxygen via a nonrebreather mask, and intravenous access should be obtained, preferably with two catheters of 16 gauge or larger. A screening neuro-

logic examination should be performed to assess the degree of altered mentation, as well as to elicit any focal findings that could suggest a cause for the alteration in mental status. Intravenous glucose (50 mL of 50% dextrose) should be considered in patients with altered mental status. Ideally, measurement of fingerstick glucose should be performed. In the absence of head trauma, glucose should be administered: this will be both diagnostic and therapeutic.

## **TREATMENT OF SPECIFIC CAUSES OF AMS**

### **HEAD TRAUMA**

Head trauma is a major cause of altered mental status. Significant head injury can cause a subdural or epidural hematoma, or subarachnoid hemorrhage. If head injury is known or suspected and Glasgow Coma Scale is 8 or less, the patient should be intubated (if possible) to protect the airway. Glucose administration in head-injured patients can cause cerebral lactic acidosis<sup>1</sup> and therefore is avoided unless history suggests hypoglycemia or capillary glucose indicates it. Cervical spine immobilization in head trauma patients is especially important, as patients with head trauma often have concomitant cervical spine injuries.

### **DIVING INJURIES**

If the individual has been diving or exposed to a hyperbaric environment, his altered mental status should be assumed to be due to arterial gas embolism (AGE) until proven otherwise. Patients suffering from gas embolism will usually exhibit symptoms within 10 minutes of returning to the surface. Recompression therapy is definitive, but may not be readily available. While the patient is awaiting recompression, the first responder should evaluate ABCs and place the patient in a neutral (supine) position, not head-down, as this can promote cerebral edema<sup>2</sup>. Administer 100% oxygen by nonrebreather and intravenous fluids.

Mental status changes may also be due to contamination of breathing gases with toxic gases (such as carbon monoxide); this usually occurs if air compressor exhaust is allowed to contaminate the compressor intake. Typically, more than one individual will be affected. However, if AGE cannot be ruled out, the patient should be treated with recompression therapy.

### **HYPOTHERMIA**

Hypothermia (usually defined as a core temperature less than 95° F or 35° C) in special operations trainees is usually, but not always, a result of cold-water immersion. Primary treatment of a hypothermic shivering patient includes removal of wet clothing and covering the body in layers of dry insulation, such as heavy blankets or a sleeping bag (also known as passive rewarming). Active rewarming techniques - warmed IV solution; gastric, peritoneal or bladder lavage should be reserved for a more controlled environment, if available. These techniques are more invasive and higher risk. Additionally, hypothermic patients should be moved and handled in gentle fashion, in order to avoid ventricular fibrillation<sup>3</sup>.

### **HEATSTROKE**

Heatstroke is the most severe manifestation of heat injury and can cause profound mental status changes. Patients will usually have a core temperature >105° F (40.5° C) and are usually, but not always, anhidrotic (i.e., have stopped sweating). The presence of sweating does not exclude the diagnosis of heatstroke. In addition to the basic ABCs treatment discussed above, patients should undergo evaporative cooling: this is done by positioning fans close to the undressed patient and spraying the skin with tepid water. Ice packs can also be placed in the groin and axillae. Cooling efforts should be discontinued when the patient's core temperature reaches 104° F (40° C); continued cooling below this temperature can lead to "overshoot" hypothermia<sup>4</sup>.

Renal failure can occur secondary to rhabdomyolysis from excessive exertion or heatstroke. Urine output in these patients is often brown or rust-colored. Treatment includes aggressive hydration with saline. Once the diagnosis is firm, alkalization of the urine with sodium bicarbonate is necessary.

### **OTHER CAUSES**

Central nervous system infections, such as meningitis or encephalitis, can result in AMS or coma. Onset is usually more gradual, although it may rarely be fulminant. Fever is a good clue, but heat stroke must also be considered. If infection is strongly suspected, early antibiotic administration (such as ceftriaxone 2g IV) may be lifesaving.

Ingestion of excessive amounts of water before or during training (so-called "water intoxication") can cause a significant drop in the serum sodi-

um level, leading to encephalopathy and mental status changes. If water intoxication is known or suspected, aggressive rehydration should be avoided until the patient arrives at a medical treatment facility. (*Several cases of water intoxication occur yearly in the U.S. military due to excessive hydration with tap water.* Editor's note)

Sleep deprivation, such as that seen during BUD/S "Hell Week," can cause extreme lethargy and mental status changes. This, however, must be a diagnosis of exclusion, and more significant causes of AMS must first be ruled out.

Special operations training is highly stressful and demanding, and some trainees might feign mental status changes ("pseudocoma") as a way to "get out" of a challenging portion of the training. This also is a diagnosis of exclusion (*and ammonia inhalants.* Editor's note).

## DISCUSSION

In the case described above, this BUD/S student's altered mental status could be due to several causes. His loss of consciousness after exposure to compressed gas makes arterial gas embolism highly likely; however, he hit his head on ascent, which suggests the possibility that his AMS could be due to head trauma such as an intracranial bleed. Hypothermia is also a possibility due to the low water temperature. It is important to keep in mind that altered mental status is a general presentation for

a variety of physiological disorders, and that there may be more than one etiology of the patient's alteration in consciousness (such as gas embolism plus head trauma).

Once the initial stabilization and interventions have been completed, the patient should be reassessed periodically. The examiner should attempt to obtain a better history and complete a secondary survey. Serial reassessments are necessary until disposition can be made to a medical treatment facility.

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## JOURNAL OF SPECIAL OPERATIONS COMMAND READERSHIP SURVEY

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(Please use the scale to rank the following statements)

Poor	Fair	Satisfactory	Good	Excellent
1	2	3	4	5

How do you rate the Journal of Special Operations Medicine (JSOM)? \_\_\_\_\_  
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How much of the issue do you usually read?

Cover-to-Cover	75%	50%	25%	Less
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What is your favorite section of the JSOM? (Circle one)

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# CONTINUING MEDICAL EDUCATION TEST

## NO.1

### Going Beyond Thin Air: Part 2 A Comprehensive Review for The Special Forces Dive Medical Technician

**JSOM**



1. Theories in the etiology of headaches from AMS are believed to be caused by:
  - a) hypoxia-induced cerebral vasodilation due to nitric oxide production.
  - b) a persons inability to compensate for swelling in the brain due to mild cerebral edema.
  - c) either a or b
  - d) neither a or b
  
2. The differential diagnosis for high-altitude illness includes:
  - a) dehydration
  - b) hypoglycemia
  - c) migraine headache
  - d) a &c
  - e) all the above
  
3. The pathognomonic diagnostic physical findings for AMS are headache and lassitude.  

T or F
  
4. The onset of HAPE is related to the rate of ascent, altitude reached, individual susceptibility, and the degree of exertion.  

T or F
  
5. The following is true of HAPE:
  - a) onset of pink or blood tinged sputum develops early
  - b) Orthopnea and hemoptysis is uncommon.
  - c) HAPE accounts for most deaths from high-altitude illness
  - d) a and c
  - e) b and c
  
6. Differential diagnosis of HAPE includes:
  - a) asthma, bronchitis
  - b) pericarditis, myocardial infarction
  - c) pneumonia, pulmonary embolus
  - d) a and c
  - e) all the above



7. The most recent research in HAPE has indicated that the inflammatory process is due to:
- a) overwhelming response of prostaglandins.
  - b) alveolar flooding
  - c) stress-induced failure of capillaries
  - d) evidence of a breakdown of complement activation
  - e) a and d
  - f) b and c
8. Recent research and articles written in high-altitude illness point out that a prior episode in HAPE can have a 60% recurrence rate if an abrupt ascent is made to an altitude of approximately 14,000 ft.
- T or F
9. Of the high-altitude illness types discussed in this paper the incidence of HACE is higher than AMS or HAPE.
- T or F
10. HAPE most commonly occurs between an altitude of 10,000 ft and 12,000 ft but can occur as low as 8,000 ft.
- T or F

# CONTINUING MEDICAL EDUCATION TEST

## NO.2

### Soft Tissue Infections

**JSOM**



1. Secondary toxic effects from the Clostridium Species may be caused by:
  - a) myoglobin
  - b) creatine phosphokinase
  - c) calcium
  - d) a & c
  - e) a & b
  
2. The most common presenting complaints in early gas gangrene are pain out of proportion to physical findings as well as a sensation of "heaviness" of the affected part.

T or F
  
3. Debridement of crushed or dead tissue and copious irrigation prior to wound closure is considered to be the most important factor in preventing clostridia infections.

T or F
  
4. Patients with cellulitis typically present with:
  - a) warmth and induration
  - b) red, shiny skin plaque
  - c) a only
  - d) b only
  
5. Simple cellulitis can be treated with:
  - a) Penicillin G (1.2 million units IV q6h)
  - b) Dicloxacillin (500 mg PO q6h)
  - c) Z Pack
  - d) a, b and c
  - e) b and c
  - f) b only
  
6. It is uncommon to see lymphangitis and local lymphadenopathy in Erysipelas.

T or F

7. One can predict the bacterial etiology of soft tissue abscesses by knowing the normal flora colonizing on specific areas of the body. Some of these typical predictions are:
- a) streptococci species in oral and nasal mucosa
  - b) staphylococcal species in scalp, trunk and extremities
  - c) pasteurella multocida in perirectal and genital areas
  - d) a and c
  - e) a and b
  - f) a, b and c
8. The preferred treatment of a infected sebaceous cyst is incision and drainage with removal of the capsule to prevent further infection.

T or F

9. Abscesses well suited for treatment in a Emergency Department environment are those which present with:
- a) superficial location
  - b) evidence of deeper tissue infection
  - c) close proximity to nerves or vascular structures
  - d) a only
  - e) a and b
  - f) all the above
10. Cutaneous abscesses are most often caused by a breakdown in the skin's normal protective barrier followed by contamination with regional aerosolized bacteria .

T or F

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**POST-TEST – Answer Sheet**

**Article 1 Going Beyond Thin Air-Part 2 Page 17**

Please circle the letter that corresponds to the correct answer:

1. a b c d

6. a b c d e

2. a b c d e

7. a b c d e f

3. T F

8. T F

4. T F

9. T F

5. a b c d e

10. T F

**Article 2 Soft Tissue Infections Page 28**

Please circle the letter that corresponds to the correct answer:

- |                |                |
|----------------|----------------|
| 1. a b c d e   | 6. T F         |
| 2. T F         | 7. a b c d e f |
| 3. T F         | 8. T F         |
| 4. a b c d     | 9. a b c d e f |
| 5. a b c d e f | 10. T F        |

**Continuing Education Evaluation Form  
Journal of Special Operations Medicine  
Volume 2 Edition 2 Spring 02  
Date of Original Release 31 May 02**

	<b>Article 1</b> Page No.17					<b>Article 2</b> Page No. 28				
	Strongly Agree		Strongly Disagree			Strongly Agree		Strongly Disagree		
	5	4	3	2	1	5	4	3	2	1
<b>Educational Value:</b>										
I learned something new that is important.	-	-	-	-	-	-	-	-	-	-
I verified some important information.	-	-	-	-	-	-	-	-	-	-
I plan to discuss this information with colleagues.	-	-	-	-	-	-	-	-	-	-
<b>Readability Feedback:</b>										
I understood what the authors were trying to say.	-	-	-	-	-	-	-	-	-	-
Overall, the presentation of the article enhanced.	-	-	-	-	-	-	-	-	-	-
My ability to read and understand it.	-	-	-	-	-	-	-	-	-	-

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**Do you think that the article(s) unduly emphasized one company's products?** YES \_\_\_ NO \_\_\_ YES \_\_\_ NO \_\_\_

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**How long did it take to complete Article 1?** \_\_\_ minutes      **Article 2?** \_\_\_ minutes

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## **Medical Data Disclaimer**

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### **BIOLOGICAL TERRORISM CONSIDERATIONS\***

#### **GENERAL GUIDANCE Pocket Guide**

##### **\* Diagnosis: Be alert to the following --**

- \* Groups of individuals becoming ill around the same time
- \* Sudden increase of illness in previously healthy individuals
- \* Sudden increase in the following non-specific illnesses:
  - \* Pneumonia, flu-like illness, or fever with atypical features
  - \* Bleeding disorders
  - \* Unexplained rashes, and mucosal or skin irritation, particularly in adults
  - \* Neuromuscular illness, like muscle weakness and paralysis
  - \* Diarrhea
- \* Simultaneous disease outbreaks in human and animal or bird populations
- \* Unusual temporal or geographic clustering of illness (for example, patients who attended the same public event, live in the same part of town, etc.).

##### **\* Confirmation and technical support**

- \* To confirm cases, contact in-house or consulting infectious disease specialist
- \* Alert local diagnostic laboratory
- \* Department of Justice Domestic Preparedness National Response Hotline (800-424-8802)
- \* If you need further help in clinical diagnosis, call CDC hotline (770-488-7100)
- \* Information about clinical diagnosis and management
  - \* CDC website for bioterrorism: <http://www.bt.cdc.gov>
  - \* Johns Hopkins Center of Civilian Biodefense: <http://www.hopkins-biodefense.org>
  - \* Army Handbook of Medical Management of Biological Casualties (<http://www.usamrrid.army.mil/education/bluebook.html>)

##### **\* Decontamination considerations**

- \* Decontamination of patients usually not required for biological agents
- \* Clothing removal & biosafety bagging is recommended
- \* Handle equipment used according to standard infection control practices (see infection control practitioner or APIC website at [www.APIC.org](http://www.APIC.org)).

##### **\* Institutional reporting**

- \* If reasonable suspicion of biological warfare agent exposure, contact hospital leadership (Chief of Staff, Hospital Director, etc)
- \* Immediately discuss hospital emergency planning implications

##### **\* Public Health Reporting**

- \* Contact local public health office
- \* If unable to reach local public health officer, contact CDC: 770-488-7100
- \* If needed, contact the FBI (for location of nearest office, see <http://www.fbi.gov/contact/fo/info.htm>)

\*The information in this card is not meant to be complete but to be a quick guide; please consult other references and expert opinion, and check drug dosages particularly for pregnancy and children

Disease	Incubation	Symptoms	Signs	Diagnostic Tests	Transmission & Precautions	Treatment (Adult dosage)	Prophylaxis
Anthrax (inhaled and cutaneous)	2-6 days Range: 1 day to 8 weeks	<b>Inhalation:</b> Flu-like symptoms, nausea, vomiting, abdominal pain, fever, respiratory distress <b>Cutaneous:</b> initial itching papule; fever	<b>Inhalation:</b> fever, followed by abrupt onset of respiratory failure, confusion Widened mediastinum on chest X-ray (adenopathy), bloody pleural effusions, atypical pneumonia <b>Cutaneous:</b> initial itching papule, 1-3 cm painless ulcer, then necrotic center; lymphadenopathy fever	Gram stain ("boxcar" shape) Gram positive bacilli in blood culture ELISA for toxin antibodies to help confirm Chest CT	Aerosol inhalation <b>No person-to-person transmission</b> Standard precautions	Mechanical ventilation Antibiotic therapy (inhalation) Ciprofloxacin 400 mg IV q 8-12 hr OR Doxycycline 200 mg IV initial, then 100 mg IV q 8-12 hr PLUS Rifampin 10 mg/kg/d, po (up to 600 mg/day) OR Clindamycin 1200-2400 mg/day IM or IV	Ciprofloxacin 500 mg or Doxycycline 100 mg po q 12 hr ~ 8 weeks Amoxicillin in pregnancy and children (if susceptible) Vaccine if available
Botulism	12-72 hours Range: 2 hrs - 8 days	Difficulty swallowing or speaking (symmetrical cranial neuropathies) Symmetric descending weakness Respiratory dysfunction No sensory dysfunction No fever	Dilated or un-reactive pupils Drooping eyelids (ptosis) Double vision (diplopia) Slurred speech (dysarthria) Descending flaccid paralysis Intact mental state	Mouse bioassay in public health laboratories (5 - 7 days to conduct) ELISA for toxin	Aerosol inhalation Food ingestion <b>No person-to-person transmission</b> Standard precautions	Mechanical ventilation Parenteral nutrition Trivalent botulinum antitoxin available from State Health Departments and CDC	Experimental vaccine has been used in laboratory workers
Plague	1-3 days by inhalation	Sudden onset of fever, chills, headache, myalgia <b>Pneumonic:</b> cough, chest pain, dyspnea, fever <b>Bubonic:</b> painful lymph nodes	<b>Pneumonic:</b> Hemoptysis; radiographic pneumonia -- patchy, cavities, confluent consolidation, hemoptysis, cyanosis <b>Bubonic:</b> typically painful, enlarged lymph nodes in groin, axilla, and neck	Gram negative coccobacilli and bacilli in sputum, blood, CSF, or bubo aspirates (bipolar, closed "safety pin" shape on Wright, Wayson's stains) ELISA, DFA, PCR	<b>Person-to-person transmission in pneumonic forms</b> Droplet precautions until patient treated for at least three days	Streptomycin 30 mg/kg/day in two divided doses x 14 days Gentamicin 3-5 mg/kg/day IV/IM in q 8 hr dosage Tetracycline 2-4 g per day Ciprofloxacin 400 mg IV q 12 hr	Asymptomatic contacts or potentially exposed Doxycycline 100 mg po q 12h Ciprofloxacin 500 mg po q 12 h Tetracycline 250 mg po q 6 hr <b>All x 7 days</b> Vaccine production discontinued
Tularemia "pneumonic"	2-5 days Range: 1-21 days	Fever, cough, chest tightness, pleuritic pain Hemoptysis rare	Community-acquired, atypical pneumonia Radiographic: bilateral patchy pneumonia with hilar adenopathy (pleural effusions like TB) Diffuse, varied skin rash May be rapidly fatal	Gram negative bacilli in blood culture on B/YCE (Legionella) cysteine- or S-H-enhanced media Serologic testing to confirm: ELISA, microhemagglutination DFA for spurtum or local discharge	Inhalation of agents <b>No person-to-person transmission but laboratory personnel at risk</b> Standard precautions	Streptomycin 30 mg/kg/day IM divided bid for 14 days Gentamicin 3-5 mg/kg/day IV in three equal divided doses x 10-14 days Ciprofloxacin possibly effective 400 mg IV q 12 hr (change to po after clinical improvement) x 10-14 day	Ciprofloxacin 500 mg po q 12 hr Doxycycline 100 mg po q 12 hr Tetracycline 250 mg po q 6 hr <b>All x 2 wks</b> Experimental live vaccine
Smallpox	12-14 days Range: 7-17 days	High fever and myalgia, itching, abdominal pain, delirium Rash on face, extremities, hands, feet, confluent with chickenpox which has less uniform rash	Maculopapular then vesicular rash -- first on extremities (face, arms, palms, soles, oral mucosa) Rash with hard, firm pustules ("intra-dermal blisters") Rash is synchronous on various segments of the body	Electron microscopy of pustule content PCR Public health lab for confirmation Rule out chicken pox with DFA	<b>Person-to-person transmission</b> Airborne precautions Negative pressure Clothing and surface decontamination	Supportive care Vaccinate care givers Experimental: cidofovir (useful in animal studies)	Vaccination (vaccine available from CDC)

**CHEMICAL TERRORISM**  
**GENERAL GUIDANCE\* Pocket Guide**

**\*Diagnosis: Be alert to following**

- \* Groups of individuals becoming ill around the same time
- \*Any sudden increase in illness in previously healthy individuals
- \*Any sudden increase in the following non-specific syndromes
  - \*Sudden unexplained weakness in previously healthy individuals
  - \*Dimmed or blurred vision
  - \*Hypersecretion syndromes (like drooling, tearing, and diarrhea)
  - \*Inhalation syndromes (eye, nose, throat, chest irritation; shortness of breath)
  - \*Burn-like skin syndromes (redness, blistering, itching, sloughing)
- \*Unusual temporal or geographic clustering of illness (for example, patients who attended the same public event, live in the same part of town, etc.).

**\*Understanding exposure**

- \*Exposure may occur from vapor or liquid droplets and, less likely, contamination of food or water
- \*Chemical effects are dependent on:
  - \*volatility and amount of a chemical
  - \*water solubility (higher water solubility leads to relatively more mucosal and less deep lung deposition and toxicity)
  - \*increased fat solubility and smaller molecular size increase skin absorption

**\*Confirmation of cases**

- \*Contact your local poison control center
- \*Contact your local industrial hygienist or safety officer
- \*Department of Justice (DOJ) Domestic Preparedness National Response Hotline (800-424-8802)
- \*If you need further help in clinical diagnosis, call DOJ Chembio Help Line (800-368-6498)
- \*Review US Army Chemical Casualty Care handbook (<http://ccc.apgea.army.mil/>)

**\*Decontamination considerations**

- \*Chemical warfare agents usually require removal of clothing and decontamination of the patient with soap and water
- \*Treating contaminated patients in the emergency department before decontamination may contaminate the facility

**\*Institutional reporting**

- \*If reasonable suspicion of chemical attack, contact your hospital leadership (Chief of Staff, Hospital Director, etc)
- \*Immediately discuss hospital emergency planning implications

**\*Public Health Reporting**

- \*Contact your local public health office (city, county, or State)
- \*If needed, contact the FBI office (for location of the nearest office, see (<http://www.fbi.gov/contact/fo/info.htm>))

\* The information in this card is not meant to be complete but to be a quick guide; please consult other references and expert opinion, and check drug dosages particularly for pregnancy and children



POTENTIAL CHEMICAL TERRORISM AGENTS AND SYNDROMES (including biologic toxins)

Agents	Symptom Onset	Symptoms	Signs	Diagnostic Tests	Decontamination	Exposure route and treatment (adult dosages)	Differential diagnostic considerations
Nerve agents	<b>Vapor:</b> seconds <b>Liquid:</b> minutes to hours	<b>Moderate exposure:</b> Diffuse muscle cramping, runny nose, difficulty breathing, eye pain, dimming of vision, sweating. <b>High exposure:</b> The above plus sudden loss of consciousness, flaccid paralysis, seizures	Pinpoint pupils (miosis) Muscle twitching and rippling under the skin (fasciculations) Sweating Hyper-salivation Diarrhea Seizures, Apnea	Red Blood Cell or serum cholinesterase (whole blood) <b>Treat based on signs and symptoms</b> <b>Use lab tests only for later confirmation</b> Collect urine for later confirmation and dose estimation	Rapid disrobing Water wash with soap and shampoo	<b>Inhalation &amp; dermal absorption</b> Atropine (2mg) IV or IM (titrate to effect up to 6 to 15 mg) 2-PAMCI 600mg injection or 1.0 g infusion over 20-30 minutes Additional doses of atropine and 2-PAMCI depending on severity. Diazepam or lorazepam to prevent seizures if >4 mg atropine given Ventilation support	Pesticide poisoning from organophosphorous agents and carbamates cause virtually identical syndromes
Cyanide	Seconds to minutes	<b>Moderate exposure:</b> Dizziness, nausea, headache, eye irritation <b>High exposure:</b> Loss of consciousness	<b>Moderate exposure:</b> non-specific findings <b>High exposure:</b> convulsions, cessation of respiration	Cyanide (blood) or thiocyanate (blood or urine) levels in lab. Treat based on signs and symptoms Use lab tests only for later confirmation	Clothing removal	<b>Inhalation &amp; dermal absorption</b> Oxygen (face mask) Amyl nitrite Sodium nitrite (300mg IV) and sodium thiosulfate (12.5g IV)	Similar CNS illness results from: Carbon monoxide (from gas or diesel engine exhaust fumes in closed spaces) H2S (sewer, waste, industrial sources)
Blister Agents	2-48 hours	Burning, itching, or red skin Mucosal irritation (prominent tearing, and burning and redness of eyes) Shortness of breath Nausea and vomiting	Skin erythema Blistering Upper airway sloughing Pulmonary edema Diffuse metabolic failure	Often smell of garlic, horseradish, or mustard on body Oily droplets on skin from ambient sources No specific diagnostic tests	<i>Clothing removal of Large amounts of water</i>	<b>Inhalation &amp; dermal absorption</b> Thermal burn type treatment Supportive care For Lewisite and Lewisite/Mustard mixtures: British Anti-Lewisite (BAL) or Dimercaprol)	Diffuse skin exposure with irritants, such as caustics, sodium hydroxides, ammonia, etc., may cause similar syndromes. Sodium hydroxide (NaOH) from trucking accidents
Pulmonary agents (phosgene etc)	1 - 24 (rarely up to 72 hours)	Shortness of breath Chest tightness Wheezing Mucosal and dermal irritation and redness	Pulmonary edema with some mucosal irritation	No tests available but source assessment may help identify exposure characteristics (majority of trucking incidents generating exposures to humans have labels on vehicle)	None usually needed	<b>Inhalation</b> Supportive care Specific treatment depends on agents	Inhalation exposures are the single most common form of industrial agent exposure (eg: HCl, Cl2, NH3) Mucosal irritation, airways reactions, and deep lung effects depend on the specific agent
Ricin (castor bean toxin)	18 - 24 hours	Ingestion: Nausea, diarrhea, vomiting, fever, abdominal pain Inhalation: chest tightness, coughing, weakness, nausea, fever	Clusters of acute lung or GI injury; circulatory collapse and shock	ELISA (from commercial laboratories) using respiratory secretions, serum, and direct tissue	clothing removal Water rinse	<b>Inhalation &amp; Ingestion</b> Supportive care For ingestion: charcoal lavage	Tularemia, plague, and Q fever may cause similar syndromes, as may CW agents such as Staphylococcal enterotoxin B and phosgene
T-2 mycotoxins	2-4 hours	Dermal & mucosal irritation, blistering, and necrosis Blurred vision, eye irritation Nausea, vomiting, and diarrhea Ataxia	Mucosal erythema and hemorrhage Red skin, blistering Tearing, salivation Pulmonary edema Seizures and coma	ELISA from commercial laboratories Gas chromatography/Mass spectroscopy in specialized laboratories	Clothing removal Water rinse	<b>Inhalation &amp; dermal contact</b> Supportive care For ingestion: charcoal lavage Possibly high dose steroids	Pulmonary toxins (O3, NOx, phosgene, NH3) may cause similar syndromes though with less mucosal irritation.

**TERRORISM WITH IONIZING RADIATION \***  
**GENERAL GUIDANCE Pocket Guide**

**\*Diagnosis: Be alert to following**

- \*The acute radiation syndrome (table 1) follows a predictable pattern after substantial exposure or catastrophic events
- \*Victims may also present individually, as described in table 2, over a longer period of time after exposure to contaminated sources hidden in the community
- \*Specific syndromes of concern, especially with a 2-3 week prior history of nausea and vomiting, are:
  - \*thermal burn-like skin lesions without documented heat exposure
  - \* immunological dysfunction with secondary infections
  - \* a tendency to bleed (epistaxis, gingival bleeding, petechiae)
  - \* marrow suppression (neutropenia, lymphopenia, and thrombocytopenia)
- \*epilation (hair loss)

**\*Understanding exposure**

- \*Exposure may be known and recognized or clandestine through:
  - \*large recognized exposures, such as a nuclear bomb or catastrophic damage to a nuclear power station
  - \*small radiation source emitting continuous gamma radiation producing chronic intermittent exposures (such as radiological sources from medical treatment devices or environmental water or food pollution)
- \*Exposure to RADIATION may result from any one or combination of the following
  - \*external sources (such as from an uncontrolled nuclear reaction or radioisotope outside the body)
  - \*skin contamination with radioactive material ("external contamination")
  - \*internal radiation from absorbed, inhaled, or ingested radioactive material ("internal contamination")

**\*Confirmation of cases**

- \*Contact radiation safety officer (RSO) for help
- \*For help in predicting clinical effects, contact:
  - nuclear medicine physician
  - Medical Radiological Advisory Team (MRAT) at Armed Forces Radiobiology Research Institute (AFRRI) 301-295-0530
- \*Obtain complete blood count
  - \*absolute lymphocyte count <1000 mm<sup>3</sup> suggests moderate exposure
  - \*absolute lymphocyte count <500 mm<sup>3</sup> suggests severe exposure
  - \*acute, short-term rise in neutrophil count
- \* Swab mucosa (all body orifices - each nostril, both ears, mouth, rectum)
- \* Collect 24 hour stool if GI contamination is possible.
- \* Collect 24-hour urine if internal contamination with radionuclides is possible

**\*Decontamination considerations**

- \*Externally irradiated patients are not contaminated
- \*Treating contaminated patients before decontamination may contaminate the facility: plan for decontamination before arrival
- \*Exposure without contamination requires no decontamination (RSO measurement)
- \*Exposure with contamination requires Universal Precautions, removal of patient clothing, and decontamination with water
- \* For internal contamination, contact the RSO and/or Nuclear Medicine Physician
- \*Patient with life-threatening condition: treat, then decontaminate
- Patient with non-life-threatening condition: decontaminate, then treat

**\*Treatment considerations**

- \*If life-threatening conditions are present, treat them first
- \*If external radioactive contaminants are present, decontaminate
- \*If radioiodine (reactor accident) is present, consider protecting the thyroid gland with prophylactic potassium iodide within first few hours only (ineffective later)
- \*Review <http://www.afrrri.usuhs.mil> or <http://www.orau.gov/reacts/guidance.htm>

**\* Institutional reporting**

- \*If reasonable suspicion of a radiation event, contact hospital leadership (Chief of Staff, Hospital Director, etc)
- \*Immediately discuss hospital emergency planning implications

**\*Public Health Reporting**

- \*Contact local public health office (city, county, or State)
- \*If needed, contact the FBI (for location of the office nearest you, see <http://www.fbi.gov/contact/fo/info.htm>)
- \* The information in this card is not meant to be complete but to be a quick guide; please consult other references and expert opinion, and check drug dosages particularly for pregnancy and children

**TABLE 1: ACUTE RADIATION SYNDROME**  
 1 Gray (Gy) = 100 rads 1 centiGray (cGy) = 1 rad

Whole body radiation from external radiation or internal absorption			
Phase of Syndrome	Feature	Sublethal range	Lethal range
Prodromal phase		0 - 100 rad or 1 Gy	800 - 3000 rad >30 Gy
	Nausea, vomiting	200 - 600 rad 1-2 Gy	800 - 3000 rad >30 Gy
		5-50%	75-100%
	Time of onset	3-6 hrs	<1 hr
	Duration	<24 hrs	<48 hrs
Latent phase (sublethal)	Lymphocyte count	Unaffected	Decreases within hours
		Minimally decreased	Decreases within hours
	CNS function	No impairment	Routine task performance for >24 hrs
		No impairment	Simple and routine task performance for >24 hrs
		No impairment	Routine task performance for >24 hrs
Hospitalization	Absence of symptoms	> 2 wks	none
	Signs and symptoms	Moderate leukopenia	Diarrhea, Fever, Electrolyte disturbance
	Time of onset	> 2 wks	2-3 days
	Critical period	none	1-48 hrs
	Organ system	none	GI tract Mucosal systems
Mortality	%	<5%	100%
	Duration	45-60 days	0+ days to weeks
Mortality		Minimal	High
		None	Very high, significant neurological symptoms indicate lethal dose

**TABLE 2: SYMPTOM CLUSTERS AS DELAYED EFFECTS AFTER RADIATION EXPOSURES**

Headache Fatigue Weakness	Partial and full thickness skin damage Eplation (hair loss) Ulceration
Anorexia Nausea Vomiting Diarrhea	Lymphopenia Neutropenia Thrombocytopenia Purpura Opportunistic infections

**TABLE 3: POTASSIUM IODIDE DOSAGES**

Age group	Dosage
Infants < 1 month	16 mg
Children 1 mo - 3 yrs	32 mg
Children 3-18 yrs	65 mg
Adults	130 mg

# *There I Was*

## **The Shoot-Down of Jolly Green 67**

Wayne L. Fisk CMSgt, (Ret) Pararescueman

The decade-long war in Southeast Asia presented many forms of challenges to SOF medical personnel.

The following narrative is an example of such personnel--in this case, USAF Pararescuemen--confronting, overcoming, and surviving those challenges.

\*\*\*\*\*

Tchepone, Laos. It was a name that created an instantly severe "pucker factor" of +10 to all whom knew of it. Long ago it had been a sleepy, rice-producing village in the panhandle of Laos. But after it had been commandeered by the North Vietnamese early in their aggression to place South Vietnam under communist rule, it became a heavily fortified, strategic stronghold along the Ho Chi Minh Trail. Located almost directly west of Hue (in the former South Vietnam), Tchepone (today known as Muang Xepon) was situated at the key junction of the west-east Highway Route 9 that drove directly to Khe Sanh in northern South Vietnam and the major north-south Trail routes of 911 and 912 emerging out of North Vietnam.

It was one of the communists' main supply points for the staging and infiltration of personnel and materiel into South Vietnam, Laos, and Cambodia. And to protect its huge investments, it was ringed with one of the deadliest collections of anti-aircraft (AA) guns found anywhere in the communist world.

Dawn Saturday, 18 January 1969 is not unlike any other morning in the air war against the unrelenting communist aggressors of North Vietnam and their covert "advisors" from China and the Soviet Union. US warplane aircrews roll out of bunks, eat a hearty meal, mission brief, go to assigned aircraft, and launch into the dawning skies.

While radar sentry aircraft and fighter combat air patrols scan those skies for enemy aircraft,

attack aircraft seek out, identify, and destroy assigned ground targets. At lesser altitudes--mere tree-top-levels compared to the higher flying air armada--behemoth HH-53B Super Jolly Green Giant and the smaller HH-3C original Jolly Green Giant rescue helicopters patiently troll far-forward areas waiting to perform combat search and rescue (CSAR) duties when called upon. Escorting and protecting the Jollys are the legendary and highly lethal A-1 Skyraiders, fix-wing, single-seat aircraft reminiscent of World War II fighters. When the multi-role Skyraiders are assigned to CSAR duties, their call-sign becomes Sandy.



HH-53Bs returning from CSAR in North Vietnam. Picture taken over PDJ in Laos--circa 1968.

*Photo from private collection of author.*

Onboard one of the HH-53s, call sign Jolly 67, this day is the PJ team of Tom Pope and D.C. "Surfer" Johnson. Both are seasoned fighters on extended tours of duty, predominately in Laos as participants in the US's "secret" war. Although highly experienced, they take nothing for granted in their jobs. They know Laos, and they know the enemy they are fighting; neither is forgiving.

And they are smack in the middle of both. Their mission order directs them to provide close-in CSAR coverage for air strikes directed against the huge enemy stronghold at Tchepone. It is no piece of cake. Attack aircraft swoop down from high above to bomb and strafe then frantically dart back



PJs mugging at rear staging base (Udorn RTAFB.) DC Johnson, standing forth from right; Tom Pope, kneeling right; author kneeling, left--circa 1968.

*Photo from private collection of author.*

to altitude to avoid being hit by the endless barrages of anti-aircraft fire.

An F-4's luck runs out. The bird is hit by AA, and disintegrates, yet one good parachute is spotted. But "Murphy" confirms himself on scene: The parachute floats down into the midst strong enemy forces. A Jolly and several Sandys fight their way to downed pilot's position. The fighting is intense as the bad guys pummel the CSAR force with every weapon from AK-47s, to 57mm AA guns.

Tom and DC, orbiting nearby on Jolly 67, closely monitor the action aware that anything can happen in a heartbeat. Tension and concern soars as the pick-up Jolly, with two other PJs onboard, provides a second-by-second commentary of its activities in the kill-box. Ground fire is intense, but the two assigned PJs deliver deadly firepower from onboard 7.62mm mini-guns, each capable of spewing 3,000 rounds per minute (RPM). The flight engineer, switching from aerial gunner duties to those of hoist operator, has the survivor in sight and lowers an extraction device known as the jungle penetrator to him. The survivor gets on the penetrator and is hoisted aboard; then, someone yells, "Let's get the hell out of here!", and the Jolly Green beats a path to safety. Within minutes it is learned from the recovered pilot that the chances of his fellow pilot having successfully ejected were nil.

But immediately another crises occurs: One of the Sandys that has been providing close air support for the extracting Jolly takes heavy battle damage and attempts to egress the area but doesn't get far. Just before the aircraft explodes, the pilot ejects, and Jolly 67 rushes in for an immediate extraction.

Tom Pope mans the ramp mini-gun in the rear of Jolly 67. With a 180°-horizontal and 90°-depression field of fire, it is an excitingly deadly weapon; less exciting is the historical fact that the greatest amount of battle damage on Jollies occurs in the ramp area. DC, meanwhile, is rocking and rolling on the aircraft's forward left side gun, takes out a machine gun position, then moves on to individual communists targets.

Jolly 67's, flight engineer swings his right side-mounted mini-gun from its doorway position and quickly lowers the penetrator to the Sandy pilot. Ground fire rips through the helicopter. With the knowing urgency of one who has already participated in numerous CSAR missions, the Sandy pilot is ready for extraction in a fraction of a moment. He's hoisted aboard, and the massive helo turns for egress.

And that's when Jolly 67's world begins to disintegrate. Just inches from Tom's position, a 37mm penetrates the helicopter's thin fuselage, and when it explodes, begins a cascade of catastrophic destruction. Vulnerable flight control systems instantly disintegrate and fling secondary shrapnel into other primary systems such as electronics, fuel, and hydraulics. The huge bird lurches upward, then wallows sideways, barely remaining in the air. It noses downward, then up again, and then from side to side; its like a huge, enraged animal trying to shake off impending death before it collapses to the ground. On the flight deck the pilots are engaged in a titanic struggle against the laws of nature which dictate that the forces of gravity shall inexorably prevail.

In the cargo compartment, the four occupants are being tossed around like the expended 7.62mm mini-gun shell casing on the floor. DC looks aft to see if Tom is all right. He isn't. He's severely wounded, his left leg almost completely blown away below the knee. Driven to the floor by centrifugal force, Tom is being flung about in a slippery concoction of hemorrhaged blood, aviation fuel, and scalding hydraulic oil. The gunner's belt which normally keeps him restrained to secure points at his gun station has been cleaved by the bursting 37mm. Tom desperately claws for handholds to keep from sliding off the ramp, but everything is wet and slippery.

DC dashes to his teamie's aid, but is abruptly stopped: He's forgotten to release his perfectly functioning gunner's belt! Cursing, he releases and lunges for Tom now at the very edge of the ramp. DC latches on and pulls hard while Tom struggles to back-peddle with his remaining good leg. They fall

into a heap on the floor of the dying helicopter. The only things keeping it and everyone still in the air are the pilot's and co-pilot's sheer determination and skills to place as much distance between them and the enemy.

DC pulls Tom farther into the riddled cargo compartment. Pieces of aircraft fall away. The massive ramp hosting Tom's gun position dangles by a few stubborn pieces of structural material, upsetting the airflow of the helicopter. Huge battle damage holes reveal the ground and sky around them; new holes surrealistically appear as deadly ground fire continues to rip away from below. Towards the front of the dying bird, the flight engineer mans the only operational mini-gun, strafing the bad-guys at maximum RpM.



Hot Spot. Battle-damage by 37mm AA detonating in immediate vicinity of HH-53 #3 mini-gun position, December 1969.

*Photo from private collection of author.*

DC cradles Tom and rips a battle dressing from his butt pack to halt the still-uncontrolled bleeding. In addition to the severed leg, he has sustained numerous arms, hip, and leg shrapnel wounds, his flack vest having protected his vital thoracic region. Tom's indeed lucky: The detonation was so close that it blew his flight helmet completely off.

The rescued Sandy pilot leaps to assist DC. DC's intention to improvise a tourniquet by using the tails of the battle dressing and his survival knife as a turnkey fails to cease the massive hemorrhaging. He rushes forward to the larger PJ mission medical ruck that contains IVs, surgical kits, and numerous bandages. He slaps on a real tourniquet and wrenches it down, suffering Tom's intense screams of agony in the process.

Then another scream is even louder: "We're

gonna crash!" yells the flight engineer.

The loss of power and flight control is acute, rapid, and catastrophic. There is no time for the pilots to jettison the left and right external fuel tanks. That makes the chopper a thousand pounds heavier as it plunges nearly uncontrollable to the ground. It's also like crashing with two huge Molotov cocktails ready to detonate upon impact. Enemy ground fire follows them all the way down.

The pilot picks as good an area for a crash landing as possible, and the behemoth Jolly Green smacks down hard and fast. It tries to flip over its nose, but he applies counter-force, and it smashes down on its aft section collapsing the huge pylon tail assembly. It tries to roll over on its left side, but the unexploded external fuel tanks act as out-riggers and the bird rights itself. It gouges a deep jagged furrow in the ground as it gyrates, shreds, and heaves to a stop. While the pilot and co-pilot have remained securely strapped in their heavy throne-like armored seats, the men in the back have been flung about without mercy.

DC and the Sandy pilot throw Tom and his dangling leg on one of the field stretchers and rush him out the rear of the destroyed bird to the collapsed tail assembly. At least some cover can be found there, although if the bird explodes... The other crewmembers immediately assemble at the rally point and prepare for the imminent attack by North Vietnamese and Pathet Lao guerillas of Tchepone.

Tom is visibly displaying the effects of the past several minutes. The trauma to his body and massive blood loss are clearly evident. DC tries to shield him from the ground fire and mentally runs through his options; they're not good: (1) If extraction doesn't arrive soon, they're cooked; there's no way they can repel any sizeable enemy attack; (2) If they're forced from their relatively unsecured position, they're likewise finished for rapid movement with Tom--now completely non-ambulatory--is impossible, thus dooming everyone; and (3) In order to save the others from capture--or worse--they must relinquish Tom to the mercy of the enemy.

DC knows the last consideration is not an option. Everyone knows the fate of Americans captured in Laos, but the capture of a PJ--an injured PJ--is so utterly unthinkable it must be made impossible. It is a pledge the whole PJ team has made to one another.

Tom, as he surfaces to a higher level of consciousness, knows what DC must be contemplating,

and says, "You know what you have to do, man."

"Yeah, I know, bro", replies DC irritably as he scrambles to set up an IV.

Suddenly the pilot leaps over to DC's position and shouts, "A Jolly's coming in! Get ready!"

DC looks up, and there in the distance is their wing mate Jolly Green on final approach. It has become the center of the same lethal attention that had downed Jolly 67. AK-47 and 12.5mm tracers arc into the bird; AA 23mm, 37mm, and 57mm rounds burst high overhead indicating they've missed their point-blank marks. But the bad-guys are still betting on two-in-a-row kills. Sandys whirl in and about at near-collision distances to protect the now-extremely



One of the most gratifying sights of war: A Jolly Green Giant on final approach for CSAR extraction--circa 1968. Photo from private collection of author.

vulnerable helicopter. They know they've got one of their own on the ground, too.

Through the chaos of smoke, noise, and death, the huge Jolly advances; streams of 7.62mm fire hose outwards from its three on-board mini-guns, all at maximum RpM. High over head an OV-10 Nail FAC orchestrates the life-and-death ballet, directing other attack aircraft to keep additional enemy reinforcements at bay. The scene is appears to be in utter disarray, but the Nail pilot is a consummate professional.

The in-coming Jollys lands hard, its ramp mini-gun pointing to the area of greatest enemy concentration. The four crewmembers of DC's bird make a wild dash for the awaiting chopper, leaving DC and Tom stranded. Onboard the newly arrive Jolly, two of DC's other PJ teammates, Dan Galde and Tommy Meyer, gawk in utter shock at the predicament. They are faced with the choice of abandoning their mini-gun positions thus leaving the chopper and crew vulnerable to the attacking enemy

or they risk DC and Tom being exposed to danger-close fire and certain death.

Both men leap to the ground and run like hell to DC and the stretcher. They scoop it and Tom up, and make an equally mad dash back to the bird. It lifts off seemingly before they're completely onboard. Dan has already leapt back to his gun position and immediately opens up literally hamburgerizing three NVA within hand grenade range. Waves of others swarm forward, but Tommy decimates them at full RpM.

Sandys swoop in to blaze a path for the Jolly to egress out. Even still, long arcs of green tracers reach out and stitch the bird; the distinctive "thunks" of 12.7mms adding to pucker factors. While altitude and speed rapidly decreases the effectiveness of small arms fire, the danger is seamlessly replaced by the AA threat. Jolly yanks and banks through puffs of the deadly black stuff, the distinctive odor of AA detonations fills the cargo bay.

DC scrambles to start an IV on a now-very-critical Tom. A generous hit of morphine is piggy-backed to the procedure, and then DC examines the extent of Tom's other wounds. They're numerous, but none life-threatening.

The Jolly races at full speed to the small USAF and Royal Thai AF (RTAF) jungle air strip of Nakorn Phanom (NKP) deep in the jungles of north-eastern Thailand. There a small USAF clinic awaits Tom's arrival before further evacuation to a larger field hospital at Udorn RTAF base farther west .

At NKP, Tom is prepped to undergo full amputation just below the left knee. DC has a chance to see him before he's taken to surgery.

"How are you?" Tom immediately inquires of DC, his words emerging thick through the narcotic stupor.

DC, replies, "Not bad considering what we've just been through".

"Hey, you want a laugh?" asks Tom.

"Hell, yes", DC says, sad in the knowledge that Tom's combat and PJ careers are finished.

"Two REMF docs just came by to examine my leg. One turned to the other and said, 'Look at that bandaging job: Two tourniquets. This poor guy must have really had a bad medic out there.' I raised up and said, 'I'm alive, ain't I, ass hole?!' Man, war can really f--- you up, but these REMFs will kill ya!"

### **Epilogue.**

Tom Pope went on to Udorn for further medical care. Before being shipped stateside, the Jolly

Green squadron took him on a last flight, but not anywhere near Laos. During his tour he had flown 142 combat missions and helped extract four US aircrew personnel from deep in enemy territory. He was medically retired and resides in the mid-west.



Tom receiving Purple Heart at Udorn.  
*Courtesy Pararescue: 50 Years--1943-1993.*

DC Johnson finished his extended tour and PJ enlistment, then joined the Special Forces as a medic. Two years ago he returned to SEA to attempt to tour the crash-site, but was denied entry by the communists. He's attempting another trip within the next several years. He resides in Hawaii.

All other mentioned participants finished their tours and returned stateside.

Jolly 67, the Sandy, and the F-4 were bombed into rubble later that day, a standard practice to deny the enemy anything viable.

**Author's Notes:** It is my great pleasure to recount this mission from DC's personal notes. I had the honor of participating on earlier combat missions with all the PJs and Jolly Green players mentioned in this story. It is not often in one's life that one encounters the bravery, tenacity, and courage of such men. It is from the legacy of such past SOF warriors that present and future generations emerge.



# *SF Related Book List*

The following is an compiled list of SF related books recommended for your reading by those that were there. The list is complements of Len Blessing with the assistance of all of you. If anyone has other books they would like to add to the list, let us know.

<b>TITLE</b>	<b>AUTHOR</b>
15 Months In SOG	Thom Nicholson
A Concise History of US Army Special Operations Forces, with Lineage and Insignia	Geoffrey T. Barker
Advice and Support: The Early Years	Ronald H. Spector
Airborne and "Special Forces"	Hans Halberstadt
(non-fiction, good quick references, especially for family or civilians)	
Battle for the Central Highlands: A Special Forces Story	George E Dooley
Beyond Nam Dong	Roger Donlon
Blackjack -33: With Special Forces in the Viet Cong Forbidden Zone	James C Donahue
Blackjack - 34 (Previously titled 'No Greater Love')	James C Donahue
Bravo Two Zero	Andy McNab
Break Contact Continue Mission	Raymond D. Harris
(fiction)	
Bunard: Diary of a Green Beret	Larry Crile
Che Guevarra on Guerrilla Warfare	Ernesto Gueverra
Code Name Bright Light	George J. Veith
Code Name:Copperhead	SGM Joe R. Garner(Ret.)
Covert Warrior	Warner Smith
Edward Lansdale: The Unquiet American	Cecil B. Currey
Elite Warrior	Lance Q. Zedric
Fighting Men: Stories of Soldiering	Jim Morris
Five Year To Freedom	James N. Rowe
From OSS to Green Berets	Col. Aron Bank (Ret)
Ghost Soldiers: The Epic Account of World War II's	Hampton Sides
Greatest Rescue Mission	
(Ranger operation to free POWs in the Philippines)	
Green Berets At War	Shelby L. Stanton
Green Berets at War: U.S. Army Special Forces in Asia 1956-1975	Shelby L. Stanton
Green Berets in the Vanguard: Inside Special Forces 1953-1963	Chalmers Archer Jr
Guerrilla warfare: On Guerrilla Warfare	Mao Tse tung
Hard To Forget	Steven M. Yedinak
Hazardous Duty	MG Jack Singlaub (Ret)
Ho Chi Minh: A Life	William J Durker
I Served	Don C. and Annette R. Hall
In The Village of the Man	Loyd Little
Inside Delta Force: The story of America's elite counterterrorist unit	Eric L. Haney
Inside the Green Berets: The First Thirty Years	Charles M. Simpson III
Killing Pablo: The Hunt for the World's Greatest Outlaw	Mark Bowden
(read by current SF medic that knows some of the guys involved in getting Pablo, told him that the book is pretty accurate, except what happened in the actual killing.)	
Laos: War and Revolution	Nina S. Adams (Ed.)
Logistical Support of Special Operations Forces during Operations Desert Shield and Desert Storm	Donald W. Betts
Long Shadows	
(fiction)	Kent White

TITLE	AUTHOR
Lost Crusade: America's Secret Cambodian Mercenaries	Peter Scott
MAC-V-SOG Command History Vol. I & II	Charles F. Reske
Medal Of Honor	Benavidez, Roy P.
Mike Force	Burrus, L. H.
Mobile Guerrilla Force: Wth the Special Forces in Warzon D	James C Donahue
My Secret War	Richard S. Drury
Night Jungle Operations	Thomas B. Bennett
Night of the Silver Stars: The Battle of Lang Vei	William R Phillips
Once A Warrior King: Memories of an Officer in Vietnam	David Donovan
One Day Too Long	Timothy N.Castle
OSS to Green Berets	Aaron Bank
Parthian Shot	Loyd Little
Peoples' War, Peoples' Army	Vo Nguyen Giap
Perilous Options: Special Operations as an Instrument of U.S. Foreign Policy	Lucien S. Vandembroucke
Phantom Warriors, Book II	Gary A. Linderer
Phantom Warriors: LRRPs, LRP's, and Rangers in Vietnam, Book I	Gary A. Linderer
Prairie Fire (fiction)	Kent White
Project Omega: Eye of the Beast	Ernie Acre
Rangers at War: Combat Recon in Vietnam	Shelby L. Stanton
Reflections Of A Warrior	Franklin D. Miller
Rescue Of River City	Drew Dix
SF Bibliography: Collection of articles and other readings with Special Forces topics	Radix Press/Dan Godbee
Shadow War: Special Operations and Low Intensity Conflict	H.T. Hayden
Shadow warriors: Inside the Special Forces	Carl Stiner and Tomy Koltz
Sideshow (the US, Khymer Rouge & Cambodia)	Robert Showcross
SOG and SOG Photo Book	John Plaster
SOG: Volume 1	Harve Saal
Soldier Under 3 Flags	H. A. Gill (PB)
SPEC OPS: Case Studies in Special Operations Warfare: Theory and Practice	William H. McRaven
Special Forces 1941-1987	LeRoy Thompson
Special Forces of the U.S. Army	Ian Sutherland
Special Forces, the U.S. Army's experts in Unconventional Warfare	Caroll B. Colby
Special forces: A guided tour of U.S. Army Special Forces	John Gresham
Special Men and Special Missions: Inside American Special Operations Forces, 1945 to the Present	Joel Nadel and J.R. Wright
Spies And Commandos	Kenneth Conboy
Strategy and Policy Background Umbrella Concept for Low Intensity Conflict	Alex & Hamilton Booz
Street Without Joy (French in Indochidina Good ground work for SF in Vietnam)	author unknown
Talking with Victor Charlie: An Interrogator's Story	Sedgwick D. Tourison, Jr.
Tam Phu	Leigh Wade
The Chindit War (good section on Merrill's Marauders)	author unknown
The Company They Keep	Anna Simons
The Devil's Brigade	Robert H. Adleman
The Dying Place (fiction)	David A. Maurer
The Green Berets	Robin Moore
The Green Berets in Vietnam, 1961-71	Francis J. Kelly

<b>TITLE</b>	<b>AUTHOR</b>
The Last Confucian	Denis Warner
The Making of a Quagmire	David Halberstam
The Montagnards of South Vietnam	Robert L. Mole
The New Legions	Donald Duncan
The Politics of Heroin in SE Asia (essential reference for understanding the Golden Triangle)	author unknown
The Protected Will Never Know	Leigh Wade
The Raid	Benjamin F. Schemmer
The Ravens (the classic about our Bird Dog brothers)	
The Rescue Of Bat-21	Darrel D. Whitcomb
The Road to Arnhem: A Screaming Eagle in Holland	Donald R. Burgett
The Secret War Against Hanoi: The Untold Story of Spies, Saboteurs and Covert Warriors in North Vietnam	Richard H Shultz Jr
The Secret Wars: A Guide to Sources in English, Volume II, Intelligence, Propaganda and Psychological Warfare, Covert Operations, 1945-1980	Myron J. Smith
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War Story	Hans Halberstadt
Who's Who From MACV-SOG	Jim Morris
	Stephen Sherman



Congratulations. The Journal of Special Operations Medicine (JSOM) continues to get better with every issue. Even though the JSOM is for "SOF Medical Professionals" this high-quality publication should be mandatory reading for every commander.

The insights gained from the JSOM will benefit our leaders in multiple ways. The first aspect is an enhanced understanding of the magnificent medical capability that our SOF humans possess. Additionally, this knowledge will help the commander develop a firmer grasp of the training and resource requirements necessary to support and maintain this world-class skill in both combat and peacetime environments. With our continuing global mission, the value of learning more about the prevention and treatment of diseases endemic to an AO and the risks of battle wounds or DNBI (disease non-battle related injury) can only heighten leader awareness, especially during pre-mission/pre-deployment activities.

The other benefit is perhaps the most critical for leaders. The JSOM provides story after story how SOF medical personnel have reacted and responded to the chaos of combat from Vietnam to Afghanistan. The question for commanders will be how will you react and respond when your time comes? For those who have yet to experience the horrific nature of combat, the JSOM can help provide the commander a clear picture into both the mental and physical effects of war fighting and its implements. In past issues, Dr. Peter Bourne has provided excellent examples relating to the stress of combat and its impact on the warrior. The analysis found in such articles as "Combat Casualties in an Urban Battlefield" (Fall 2001) and the "Al Udairi Range Bombing Incident" (Spring 2002) clearly and graphically illustrates the types of casualties resulting from both combat action and the use of combat munitions. Having served as a Special Forces Battalion Commander (2nd Bn, 5th SF) during the Gulf War, I found that understanding these critical medically related facets of warfare was very beneficial in preparing subordinates, interagency partners and coalition counterparts (commanders and medical personnel) for the harsh and violent realities of the fight.

As one lucky human being who has spent over thirty, well-traveled years in our Special Operations community, and having been cross-trained as a medic a long time ago (Thanks Don P & Pete H, I still have my Merck Manual), I laud the JSOM Team for this great effort. Doctor Steve our folks continue to be "righteously right". Keep it up!

" Oppresso Liber"  
Colonel Bill Davis

Thanks, Maj DuGuay, for including my name on your mailing list. Your publication is a superb example of useful, interesting medical literature that I plan to include in my reading list each month. Congratulations for putting together a very slick ,well constructed journal. Your graphics are great! I leave my copies in the hospital surgeons lounge- civilian docs enjoy your mag too!

Thanks again,  
Bob Anderson, MD  
Former Army Orthopedist

Thanks for the great job on the article in this issue of JSOM. I really appreciate the forum your journal provides.

Dave Hamilton

# *Editorials*

## Making a Case for the Combitube

Andrew Mullins, DO

Airway management in the traumatized patient is one of the most important skills that trauma medics must master. Obtaining an airway in a pre-hospital setting in the trauma patient is almost by definition a difficult airway. Many factors, including the need for immobilization, cramped space, chest and facial trauma, as well as laryngeal trauma can make obtaining an airway extremely difficult. Endotracheal intubation has been considered the "gold standard" in airway management; however, the experienced provider must recognize its limitations and be prepared with a backup in case he is unable to intubate. One adjunct for airway management that deserves consideration is the Combitube.

Endotracheal intubation is considered the "gold standard" in definitive airways. The device is placed into the trachea under direct visualization of the vocal cords. Visualization is best achieved when the patient is placed in the "sniffing position" with the neck flexed and the head extended, a position that could be devastating in a trauma patient with cervical spine instability. The inability to place a patient in this position likely contributes to the high incidence of misplaced tubes in the pre-hospital setting. In EMS systems with low patient volume, failure-to-intubate rates are as high as 50%.<sup>1</sup> Even high volume urban EMS systems have failure rates as high as 25%.<sup>2</sup> The safe placement of an endotracheal tube in the pre-hospital environment requires sufficient initial training and more importantly, frequent experience.

The Combitube is an airway device that is composed of two tubes fused together to form a double lumen tube. The tube has two balloons, a proximal 85 to 100mL balloon situated at the level of the pharynx and a distal 12 to 15mL cuff that occludes either the trachea or esophagus depending on placement. Tube number one has a closed distal end with ventilating side holes placed between the balloons. Tube number two is open-ended and can allow direct ventilation through the trachea. The device is inserted without visualizing the vocal cords and the distal

cuff is inflated, followed by the proximal balloon. The tube nearly always enters the esophagus due to the stiffness and curved shape of the tube. Ventilation is begun through tube one. If breath sounds are auscultated, ventilation is continued. However, if unable to ventilate through tube one the device is located in the trachea and the bag should be attached to tube two. Confirmation of tube location is then obtained using auscultation and an end-tidal CO<sub>2</sub> monitor.<sup>3</sup>

The Combitube has many advantages in emergency airway management of the trauma patient. It provides rapid airway control without the need for neck movement, ease of insertion in confined spaces, minimized risk for aspiration, and firm fixation of the device after inflation of the oropharyngeal balloon. The main advantage over the endotracheal tube is ease of training and maintenance of intubation skills and shorter intubation times.<sup>4</sup> Ventilation volumes and oxygenation are similar to those achieved by the endotracheal tube and insertion rates vary from 69% to 100%. Fatal complications may occur with the Combitube if the position in the esophagus or trachea is not properly identified. One study showed that the incorrect port was used for ventilation in 3.5% of cases.<sup>5</sup> Therefore, as with endotracheal intubation, primary identification of placement by auscultation must be supplemented with confirmation by an end-tidal CO<sub>2</sub> or esophageal detector device.

The Combitube is an effective alternative as a primary airway or as a rescue airway for a failed endotracheal intubation attempt. Oxygenation, ventilation, respiratory mechanics during mechanical or spontaneous ventilation, and epinephrine administration with the Combitube are comparable to the endotracheal tube.<sup>6,7</sup> The ease of use and versatility of the Combitube in the pre-hospital setting, especially in providers not performing routine intubations, could make it an important addition to the medics trauma bag.

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## Special Events



The 2002 PJ Reunion was held in Albuquerque NM 12-14 September. It was an action packed few days which started with a social evening that allowed PJs from across several generations to meet and for many, get reunited. On the second day, 13 Sep, the Air Force Cross was presented to the family of Senior Airman Jason Cunningham, who gave his life during Operation Enduring Freedom so *that others may live* (see Dedication on page 61.) The ceremony was followed by a barbeque and the awarding of the Air Force Outstanding Pararescue Airman of the Year 2002 to Senior Airman Jason D. Andrews, Air Force Outstanding Pararescue Non-commissioned Officer of the Year 2002 to James E. Clark, and the Outstanding Pararescue Senior Noncommissioned Officer of the Year 2002 to Senior Master Sergeant David L. Pickering.

Senior Airman Jason D. Andrews deployed with the first Special Tactics UTC in support of Operation ENDURING FREEDOM (OEF) and took part in the first personnel recovery mission in OEF to extract a critically ill Army Special Forces soldier. During the rescue attempt, the lead aircraft on the rescue mission crashed landed in enemy held, high altitude, mountainous terrain. SRA Andrews voluntarily deployed from the second rescue helicopter to effect recovery of his 11 fellow Airmen from the thin-aired, frozen, Afghan mountainside. SRA Andrews remained cool, collected, and immediately administered treatment, rapidly triaged critically injured accident victims and provided advanced trauma medical care. After placing the injured aboard the remaining rescue aircraft, SRA Andrews continued to provide in-flight advanced trauma medical care. His steadfast efforts saved two lives on the spot and stabilized the patients for transfer to advanced trauma care facilities. His extraordinary efforts ensured mission success in what was the largest CSAR operation since the Vietnam conflict. In all, SRA Andrews took part in the execution of 38 combat and combat support missions over Afghanistan coming under engagement

with hostile enemy fire 15 times.

Technical Sergeant James E. Clark was deployed to OPERATION ENDURING FREEDOM (OEF) as the first Special Tactics Combat Search and Rescue (CSAR) team NCOIC, SSgt Clark ensured four CSAR teams under his supervision were alert capable within 12 hours of arrival. SSgt Clark was the CSAR team leader aboard a MH-53 when it violently crashed in an extreme cold weather mountainous environment deep in enemy territory. His superb leadership and coolness under pressure on the ground was singled out by the MH-53 aircrew as "the key" to their successful extraction in what was the largest CSAR operation since the Vietnam War. Despite suffering from a head wound during the crash he immediately took command of the 10 crash survivors. After ensuring accountability and wellness of all survivors he instructed them form a hasty defensive perimeter while he zeroed all sensitive aircraft COMSEC systems. SSgt Clark then organized and led their evasion through treacherous snow covered terrain to a tactical hide site near a landing zone while continuously maintaining contact with friendly forces to facilitate recovery. Chairman of the Joint Chiefs of Staff General Myers lauded SSgt Clark's decisive lifesaving actions and heroism. In all SSgt Clark took part in the execution of 10 combat and combat support missions over Afghanistan coming under engagement by the enemy 7 times.

Senior Master Sergeant David L. Pickering displayed exemplary service as Superintendent Pararescue Standardization and Evaluation Programs, Headquarters Pacific Air Forces (PACAF), Hickam, AFB, Hawaii. Sergeant Pickering leads from the front as PACAF's premier rescue expert providing 125 PACAF and PACAF-gained Pararescuemen with the operational guidance and logistical support required to excel. SMSgt Pickering crafted new Combat Search and Rescue (CSAR) operational checklists that became the blueprint for both Combat Air Forces and Special Operations CSAR forces. The



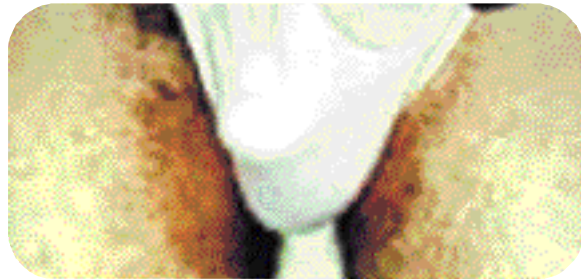


# Med Quiz

Answers on page 71

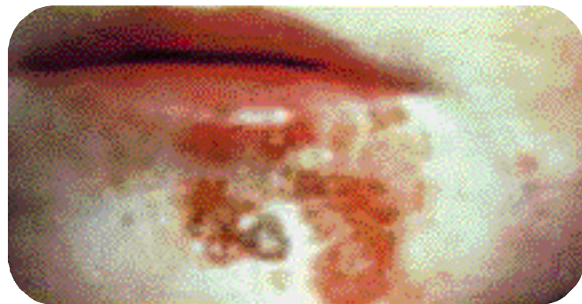
1. Scenario Description-

One of your teammates pulls you aside and tells you his groin itches and feels like it's on fire. It is starting to effect his normal gait as he walks and wants to know what he has and what can he do for it? Based on what you see in the attached photo of the patient, what is your diagnosis?



2. Scenario Description-

A teenage male presents to your clinic with a golden-yellow crusty lesion that appears stuck on his face. What is your likely diagnosis base on the photo attached?



1. Answer-

This skin infection is common and can be either a subacute or chronic dermatophytosis of the upper thigh in males usually caused by *Edipermophyton floccosum* or *Trichophyton rubrum* called Tinea Cruris - AKA Jockitch. Erythrasma should be in your differential as well. Tinea Cruris (as most of you intimately already know) is predisposed by warm, humid environments, tight constrictive clothing, not allowing sufficient evaporation of moisture away from the area of concern.

Treatment includes keeping of the area clean and dry as possible, wearing more loose clothing (a lot of ground pounders won't wear any skivies under their fatigues for this reason). Topicals like azole antifungals i.e. econazole or ketoconazole bid for 2-3 weeks or terbinafine qd or bid for 1-2 weeks if the infection is small. Systemic infections that are uncomplicated like griseofulvin 500 mg PO qd and may take 1-2 weeks of treatment if the infection is very large and widespread. In addition the following oral regimens have been reported in medical literature as effective, but currently are not specifically approved by the FDA for Tinea Cruris: Lamisil 250 mg PO qd for 1 week, Sporonox 100mg bid for 2 weeks, Diflucan 150 mg/ week for 4 weeks.

2. Answer-

Impetigo as pictured, is an acute purulent infection, first vesicular and later crusted due to *Staphylococcus aureus*, group A beta-hemolytic streptococci or a mix. In the early vesicular stage impetigo may simulate varicella and herpes simplex. Treatment with general measures includes removal of crusts, cleanliness with gentle washing 2-3 times daily. Clean with antibacterial soap, chlorhexidine or betadine. Systemic antibiotic therapy is still considered the standard treatment, especially when lesions are extensive. Dicloxacillin 250 mg qid for 7-10 days or erythromycin 250 mg qid for 10 days for those patients not able to tolerate penicillins.

*Photo Gallery*



Robert LaPoint-far right and fellow PJs at the dedication of the Air Force Cross to the family of Jason Cunningham.



Taking cover while giving buddy care during a medical training scenario



Coming to Shore



A difficult IV stick



Talk about trying to stuff 35 lb of beans in a 5 lb capacity bag...



Here's a good reason for Preventive Medicine



Any time-anywhere



7th Special Forces Group Medical Team, Fort Bragg, N.C., and Chilean Army Medic Team perform an Air Evacuation scenario, Oct. 18, 2002. The purpose of the exercise to successfully transport a patient from the scene of an accident to a Chilean hospital during Cabanas 2002 Chile, held in Fuerte Lautaro, Chile. Cabanas 2002 This exercise provides an opportunity for over 1,300 military and civilian personnel from Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and the United States to increase their state of readiness in combined multinational peacekeeping operations and a forum to encourage human rights.

*U.S. Air Force photo by Senior Airman JoAnn S. Makinano obtained from DOD Imagery (Released)*



INTUBATION--Chilean Army Staff Sgt. performs Intubation on a dummy during a Joint Medical Training Class with 7th Special Forces Group Medic Team, Oct. 10, 2002 at Fuerte Lautaro, Santiago, Chile. The purpose of the class is to do an exchange of medicalequipment information between Chilean and American medics in preparation for Cabanas 2002 Chile, held at Fuerte Lautaro, Chile. Cabanas 2002 Chile is a multinational combined readiness training exercise centered on peacekeeping operational tasks. peacekeeping operations and a forum to encourage human rights. (U.S. Air Force photo by Senior Airman JoAnn S. Makinano obtained from DOD Imagery) (Released)



Chilean Army Pvt. and a U.S. Army Sgt. 1st Class, 7th Special Forces Group Medic Team, Fort Bragg, N.C., perform first aid on a Sgt. from the 7th Special Forces Group Medic Team, during a Medical Evacuation training scenario, Oct. 15, 2002. (U.S. Air Force photo by Senior Airman JoAnn S. Makinano obtained from DOD Imagery ) (Released)



Soldiers provided free medical treatment for the people of the local village outside of Camp Salerno in Afghanistan, on Sept. 26, 2002 The free medical care is part of the many Humanitarian Assistance Programs which was set up to help rebuild the nation of Afghanistan and uplift the people during the campaign on the War on Terrorism. U.S. Army photo by Sgt. Albert Eaddy obtained from DOD Imagery (Released)



## Dedication



*Please Don't stand and Weep  
Those men I had to save  
Not because of Courage  
or because I'm Brave*

*Not because of Orders  
or because it was my Dream  
I did it for my Brothers  
I did it for the Team*

*So Please Don't weep for me  
for all I had to give  
I did it for a reason  
"So That Others May Live"*

*Written by Jason's brother-in-law Jared Marquis*

On 13 September 2002, the SECAF posthumously awarded the the Air Force Cross to Jason Cunningham. The ceremony was an extremely emotional event. Approximately 1400 persons were in attendance. Over 500 PJs were in the audience, all proudly wearing maroon berets. The PJs included active duty, air national guard, reserve, and retirees. Many of these men were hardened combat veterans but were either moved to tears or close to it.

### ***Hero awarded Air Force Cross***

Senior Airman Jason D. Cunningham, a pararescueman who lost his life in Afghanistan while saving 10 lives and making it possible for seven others who were killed to come home, was posthumously awarded the Air Force Cross at Kirtland AFB on Sept. 13.

The Air Force Cross is awarded for extraordinary heroism while engaged in action against an enemy of our nation. It is second only to the Medal of Honor.

"We gather to salute his bravery and to reward his heroism," said Secretary of the Air Force Dr. James Roche. "We gather to pay tribute to an airman who, on the field of battle, not only gave his life serving his nation, but also gave his life serving his fellow Americans."

Air Force Chief of Staff Gen. John Jumper presented the Air Force Cross to Cunningham's wife, Theresa. Cunningham's parents, Lawrence and Jackie Cunningham, also received medals from Jumper.

"In the frailty of our human existence we are ill equipped to express the extremes of our emotions," Jumper said. "For in the peak of our love or the depths of our sorrow, we have only feeble words that never truly capture the peaks and valleys of our feelings."

"I stand before you today in the humble attempt to assemble the words to honor a hero, knowing in advance that my attempt will fall short of the tribute that is his due."

Cunningham, a Carlsbad, N.M., native, joined the Air Force's elite combat rescue program and graduated pararescue technical training here in June 2001. He was deployed to Southwest Asia in February 2002.

On March 4, Cunningham was the primary Air Force combat search and rescue medic assigned to a quick reaction force in Afghanistan. The force was sent to rescue two American servicemen evading capture in austere terrain occupied by al-Qaida and Taliban forces.

Before landing, his MH-47E Chinook helicopter received rocket-propelled grenade and small-arms fire, disabling the aircraft and forcing it to crash-land. Crewmembers formed a hasty defense and immediately suffered three fatalities and five critical casualties.

The citation accompanying Cunningham's Air Force Cross reads, "Despite effective enemy fire, and at great risk to his own life, Airman Cunningham remained in the burning fuselage of the aircraft in order to treat the wounded. As he moved his patients to a more secure location, mortar rounds began to impact within 50 feet of his position.

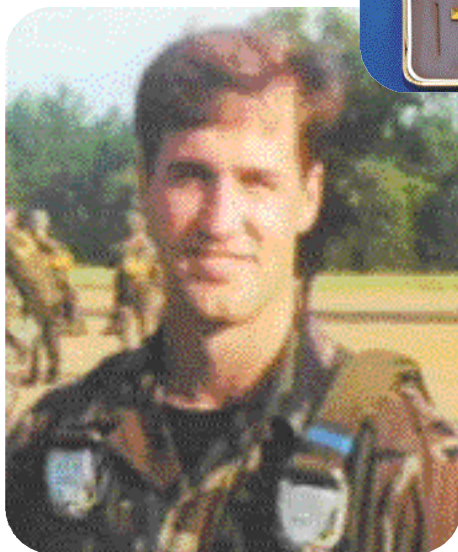
"Disregarding this extreme danger, he continued the movement and exposed himself to enemy fire on seven separate occasions. When the second casualty collection point was also compromised, in a display of uncommon valor and gallantry, Airman Cunningham braved an intense small arms and rocket-propelled grenade attack while repositioning the critically wounded to a third collection point."

The citation continues, "Even after he was mortally wounded and quickly deteriorating, he continued to direct patient movement and transferred care to another medic. In the end, his distinct efforts led to the successful delivery of 10 gravely wounded Americans to life-saving medical treatment."

In remarks that seemed to capture Cunningham's spirit, Chief Master Sergeant of the Air Force Gerald Murray, said, "The former Navy petty officer considered joining the SEALs, but became an Air Force PJ. His reasoning? While other special operators search and destroy, PJs search and save."

Cunningham was laid to rest in Arlington National Cemetery on March 11.

*(Courtesy of Air Force Materiel Command News Service)*



### Special Forces Aidman's Pledge

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



### Pararescue Creed

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



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

### Navy Poem

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



~ Harry D. Penny, Jr.

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