ISSN 1553-9768 Spring 2007 Volume 7, Edition 2

Journal of Special Operations Medicine

A Peer Reviewed Journal for SOF Medical Professionals

THIS EDITION'S FEATURE ARTICLES ARE:

- CME Care of the Military Working Dog by Medical Providers
- Case Report and Review of the Literature of Anterior Thigh Heterotopic Ossification in a U.S. Air Force Special Operations Parachutist
- Force Health Protection in U.S. Army Special Operations Forces
- Moderate to Severe Traumatic Brain Injury From the Battlefield to the Community

Dedicated to the Indomitable Spirit & Sacrifices of the SOF Medic

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COVER

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The Spring 2007 cover celebrates the JSOM's 25th edition. This cover consists of the Component Surgeons that have been the Executive Editors of the JSOM.

From the Editor

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

Disclosure Statement: The JSOM presents both medical and nonmedical professional information to expand the knowledge of SOF military medical issues and promote collaborative partnerships among services, components, corps, and specialties. It conveys medical service support information and provides a peer-reviewed, quality print medium to encourage dialogue concerning SOF medical initiatives. The views contained herein are those of the authors and do not necessarily reflect the Department of Defense. The United States Special Operations Command and the Journal of Special Operations Medicine do not hold themselves responsible for statements or products discussed in the articles. Unless so stated, material in the JSOM does not reflect the endorsement, official attitude, or position of the USSOCOM-SG or of the Editorial Board.

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Articles, photos, artwork, and letters are invited, as are comments and criticism, and should be addressed to Editor, JSOM, USSOCOM, SOC-SG, 7701 Tampa Point Blvd, MacDill AFB, FL 33621-5323. Telephone: DSN 299-5442, commercial: (813) 828-5442, fax: -2568; e-mail JSOM@socom.mil.

The JSOM is serial indexed (ISSN) with the Library of Congress and all scientific articles are peer-reviewed prior to publication. The Journal of Special Operations Medicine reserves the right to edit all material. No payments can be made for manuscripts submitted for publication.

Distribution: This publication is targeted to SOF medical personnel. There are several ways for you to obtain the Journal of Special Operations Medicine (JSOM). 1) USSOCOM-SG distributes the JSOM to all our SOF units and our active editorial consultants. 2) SOMA members receive the JSOM as part of membership. Please note, if you are a SOMA member and are not receiving the subscription, you can contact SOMA through www.somaonline.org or contact MSG Russell Justice at justicer@earthlink.net. SOMA provides a very valuable means of obtaining SOF related CME, as well as an annual gathering of SOF medical folks to share current issues. 3) For JSOM readers who do not fall into either of the above mentioned categories, the JSOM is available through paid subscription from the Superintendent of Documents, U.S. Government Printing Office (GPO), for only $30 a year. Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. GPO order desk -- telephone (202) 512-1800; fax (202) 512-2250; or visit http://bookstore.gpo.gov/subscriptions/alphabet.html. You may also use this link to send a email message to the GPO Order Desk—orders@gpo.gov. 4) The JSOM is online through the Joint Special Operations University's new SOF Medical Gateway; it is available to all DoD employees at https://jsou.socom.mil/medical/. On the left you will have several tabs; you must first "log-in" using your SS#, DOB, and name; then go to "publications." Scroll down until you get to the JSOM and click on the picture. From this site, you can link straight to the Government Printing Office to subscribe to the JSOM. We are working with the JSOU to have a SOCOM-SG medical site; we will keep you posted as that progresses. 5) The JSOM can also be emailed in PDF format; if you would like to be added to the PDF list please send your request to JSOM@socom.mil.

We need Continuing Medical Education (CME) articles!!!! Remember, our continuing education is for all SF medics, PJs, and SEAL corpsmen. In coordination with the Uniformed Services University of Health Sciences (USUHS), we also offer CME/CNE to physicians, PAs, and nurses.

JSOM CME consists of an educational article which serves to maintain, develop, or increase the knowledge, skills, and professional performance and relationships that a physician uses to provide services for patients, the public, or the profession. The content of CME is that body of knowledge and skills generally recognized and accepted by the profession as within the basic medical sciences, the discipline of clinical medicine, and the provision of healthcare to the public. A formally planned Category 1 educational activity is one that meets all accreditation standards, covers a specific subject area that is scientifically valid and is appropriate in depth and scope for the intended physician audience. More specifically, the activity must:

- Be based on a perceived or demonstrated educational need which is documented
- Be intended to meet the continuing education needs of an individual physician or specific group of physicians
- Have stated educational objectives for the activity
- Have content which is appropriate for the specified objectives
- Use teaching/learning methodologies and techniques which are suitable for the objectives and format of the activity
- Use evaluation mechanisms defined to assess the quality of the activity and its relevance to the stated needs and objectives

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

Maj Michelle DuGuay Landers

Meet Your JSOM Staff

EXECUTIVE EDITOR

Warner Dahlgren Farr, MD
warner.farr@socom.mil

Colonel "Rocky" Farr was the distinguished honor graduate of his Special Forces 18D class in 1968 and completed 40 years of active service this April. He served as a recon team member with the 5th SFG(A) in SOG-Studies and Observations Group. He attended the DLI (German) and joined Detachment A, Berlin Brigade, an early special mission unit. He became the SF instructor at the ROTC Detachment, Northeast LA University and completed his BS. As a SFC, he taught in the 18D course and was selected for MSG. COL Farr was accepted to the Uniformed Services University of the Health Sciences and while a medical student, he was the medical platoon leader for the 11th SFG(A). He received his MD in l983 and has completed residencies in aerospace medicine, and anatomic and clinical pathology. He commanded Company F (ABN), 3rd BN, Academy BDE, Academy of Health Sciences as Course Director of the Special Operations Medical Sergeant's Course; and advisor to the 12th SFG(A). He was Chief, Department of Pathology, Blanchfield Army Community Hospital, and Flight Surgeon, 50th Medical Company (Air Ambulance), 101st ABN Division (Air Assault). COL Farr was the Division Surgeon of the 10th Mountain Division (Light Infantry) until becoming Deputy Commander of the U.S. Army Aeromedical Center. He attended the Air War College before becoming the Deputy Chief of Staff, Surgeon, U.S. Army Special Operations Command; Command Surgeon, U.S. Army Special Forces Command; and Command Surgeon, U.S. Army Civil Affairs and Psychological Operations Command. He became the Command Surgeon of the U.S. Special Operations Command in Tampa, FL in July 2006. He has numerous operational tours to include Bosnia, Kosovo, Kuwait, Vietnam, Cambodia, and Afghanistan.

MANAGING EDITOR

Michelle DuGuay Landers, RN
duguaym@socom.mil

Maj Landers joined the Army Reserve in 1987 and served as a nurse in a Combat Support Hospital unit for three years before switching services in 1990 to become an Air Force C-130 Flight Nurse. She is currently an IMA reservist attached to the SOCOM/SG office where she has been in charge of management, production, publication, and distribution of the JSOM since it's inception in Dec 2000. Maj Landers has a Bachelors in Nursing and a Masters in Business Administration/Management. Her 20 year nursing career includes being a flight nurse in both the military and private sector, 15 years of clinical experience in emergency and critical care nursing as well as being an EMT and a legal nurse consultant. She also served as the military liaison to her Disaster Medical Assistance Team (DMAT). Prior to the SG office, Maj Landers' experience at USSOCOM includes an assignment in the Center for Force Structure, Resources, Requirements, and Strategic Assessments.

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From the Command Surgeon

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

NAME:	DATES:
COL William F. Hughes, USA	17 JUL 89 - 01 JAN 93
COL Edmund L. Davis, USA (Interim)	01 JAN 93 - 14 JUL 93
COL Richard W. Smerz, USA	14 JUL 93 - 30 SEP 96
COL Larry J. Godfrey, USA	01 OCT 96 - 25 MAY 98
COL Steven J. Yevich, USA	28 APR 98 - 30 MAY 01
Col David L. Hammer, USAF	30 May 01 - 01 MAR 04
CAPT Frank K. Butler, USN	01 APR 04 - 30 JUN 06
COL Warner D. ("Rocky") Farr, USA	01 JUL 06 -

We are celebrating our twenty-fifth issue of the Journal of Special Operations Medicine! My deep felt thanks and gratitude go out to the former U.S. Special Operations Command Surgeons, pictured on the front cover of this anniversary issue, who were forward thinking enough to start, and continue, this essential publication which is such a vital part of our Command Medic Certification Program helping to produce and sustain our medic joint interoperability standard. Our truly unique managing editor, Major Michelle Duguay-Landers, has stepped up the production pace. All should by now have seen the double (two-volume) last issue with the supplement containing updated information on the *Command Medic Certification Program* and updated *Tactical Medical Emergency Protocols* (TMEPs). Both appeared in the Training Supplement. I plan to have such a training supplement annually if we have significant updates. As always, I urge everyone to write more articles for the journal. For Continuing Medical Education (CME) reasons, Major Duguay-Landers needs longer articles as well as short ones. So get started! We are ready to help folks write articles.

The *Command Medic Certification Program* is maturing nicely. We have started giving the certification examination at the Pararescue School at Kirtland AFB, NM. The Requirements Board (RB) and the Curriculum Evaluation Board (CEB) will have a joint meeting in Tampa this April to continue the quad-component requirements updating and the question/examination development necessary to have a quality command certifying board examination. I am indebted to the many military and civilians members on these two boards, RB and CEB, who toil silently, for no personal reward and at a large expense of their time, to make this vital program succeed. At the April meeting


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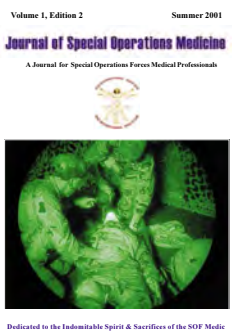
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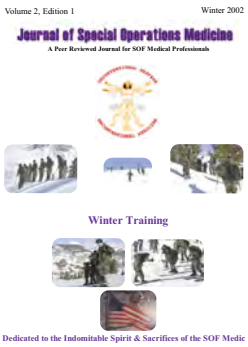
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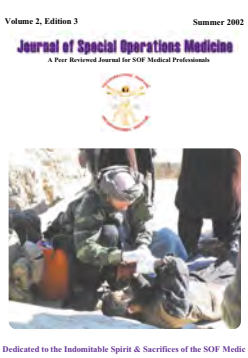
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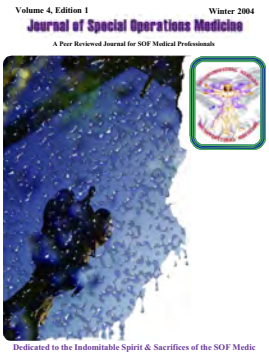
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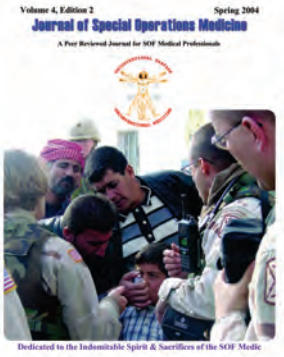
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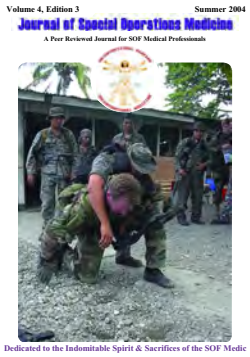
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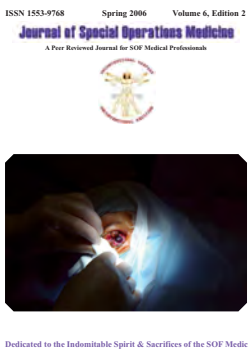
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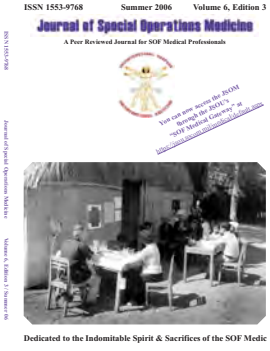
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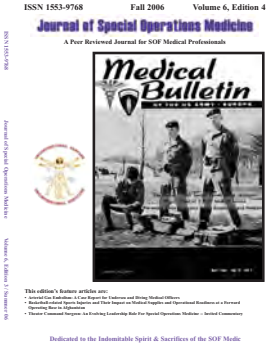
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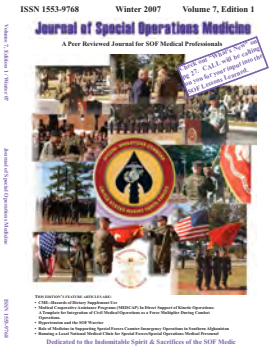
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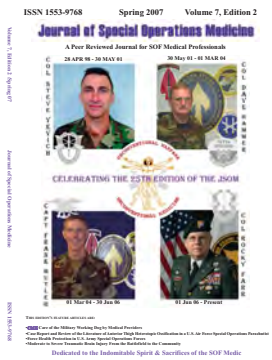
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we should have enough feedback from our certifying examination results to begin looking at trends, strengths, and weaknesses, of the training programs as their students take the examination. The next real mark on the wall is the Joint Special Operations Medical Training Center (JSOMTC) recertification scheduled for 2009, and I see no issue at this time standing in the way of another successful recertification. We, Colonel Keenan and his Soldiers, Sailors, and Airmen, actually passed flawlessly last time. Another training issue, Tactical Combat Casualty Care, is alive and well as it transitions from an Institute of Surgical Research (ISR) funded research traveling team to a component of the "TCCC Acquisition Program" as "new equipment training (NET)."

The revision of the Special Operations Forces Medical Handbook proceeds on schedule. I correspond regularly with the various authors working on it. I plan to have it out on schedule in 2008. The 75th Ranger Regiment has just published a Ranger Medic Handbook. Kudos to Major Kotwal and MSG Montgomery for a fine job.

We just had a Biomedical Initiatives Steering Committee (BISC) meeting last week in Fayetteville, North Carolina. This was only a week after the tragic and untimely death of Mr. Bob Clayton's wife, Janice, in a motor vehicle accident here in Tampa. We are thinking of Bob as he soldiers on. Please surface any research needs through your component surgeons and steer all sellers of snake oil to Bob.

The command here is strengthening its system to gather operational lessons learned and its use of them to guide important decisions. I urge all to submit any medical, or other, lessons learned. If you are unsure how – – contact Master Chief PO Mercer in my office. As we fight various echelons above-reality-issues, your lessons learned input becomes critical to make our case on your behalf.

Our medical equipment acquisition program is progressing well. We are trying to supplement what our components can get through their service supply channels without duplicating items, or issuing you things which you do not need or do not want. It is still early in a very complicated acquisition process but the command is supporting the effort well. I hope to grow the NET training as the program matures.

We will have two changes in our medical operations and plans cell this summer. Army Major Chris Coley and Navy Lieutenant Shawn Wood are both departing. They have both done yeoman's work in the Center for Special Operations. I thank them for their service and eagerly await their replacements.

Our veterinary officer, Colonel Bob Vogelsang, is making a command policy on military working dogs. I think all the subordinate command veterinary officers have talked to him but if you are in this business and without a veterinary officer you need to talk to him. He also inspects and ensures that all civilian medical training courses that our components use (when requested by component surgeons) met DoD guidelines on both human and animal research and/or use.

It is not too early to be planning your Special Operations Medical Association (SOMA) presentation or at least attendance. Although a private organization, the SOMA's December annual meeting is a unique CME event; the only SOF-medicine specific CME that I am aware of. I plan to be there and this year I plan not to be limping! I look forward to seeing you there.

ENLISTED CORNER

SENIOR ENLISTED MEDICAL ADVISOR (SEMA)
SOCM GLENN MERCER

The first quarter of this year was relatively busy, with temporary additional duty time around the country nearly every week. This issue follows our recent release of the Tactical Medical Emergency Protocol (TMEP) supplement so this is an advantageous time to stress the requirement from which they came. During the evolution of the Joint Interoperable Combat Medic (described in the supplement), the capability gap that was not covered directly by policy was the category of **Medical Emergencies.** Between the components there was substantial disparity about what scope of practice existed for events that were not clear-cut trauma but had the potential to stop or delay a mission due to manifesting symptoms from constitutional illness (asthma) or a focal injury that caused enough performance deterioration to affect reliability on target, in most instances due to pain. Secondary to this was the reality that we had the ability to pre-start a care plan for almost all of the defined medical conditions, but had no unifying orders to affect that. To that end, the discussion on TMEPs began almost three years ago, culminating in the Version 3 contained in the supplement.

Over the last two years the concept of the Joint Interoperable Combat Medic has come to fruition, both in day-to-day reality, and with the directives that provide top cover. The emerging policy issues are currently at the senior level of practice. Most of the SOF Components have historically employed some kind of physician extender at the operator level. MOS 18D is the most historical reference, but by no means the only precedent. When these discussions are distilled down to their requirements and their labels are removed we **do not have** an easy congruent line up; especially when we compare mature theaters to immature, environmentally challenging ones. In fact geography and disassociation from fixed level II and III resources make it even more difficult to have a generic conversation.

As this year elapses, this strategic issue will move up the priorities list. Critical talking points include the definition of a SOF physician extender, service-specific requirements weighted against joint interoperable needs and the inherent liability of pushing differential diagnosis to the lowest usable level. Further complicating this issue are the possible needs for veterinary and nursing skills in the equations (e.g., unconventional warfare [UW] or civil military operations [CMO]). Currently our advanced, independent skill sets are managed by multiple personnel that source from similar career fields, but completely different doctrinal uses. The real challenge for the collective is defining the necessary skill set for the geographic assignment; recognizing that can change even within a year. Presently we have achieved solid ground in our management and movement of trauma at Level I.

On the next page we have provided the MOS announcement (re-classification) of the NSW Combat Medic. As of 1 OCT 2006 Hospital Corpsman is no longer a rate that is present in the Special Warfare rating inventory. Combat Medics, currently employed will be identified by a secondary MOS, described in the enclosure. Topically it is a simple label change, but it has strategic manpower ramifications which present new challenges for the Force Manager.

DEPARTMENT OF THE NAVY
NAVY MANPOWER ANALYSIS CENTER
5722 INTEGRITY DRIVE
MILLINGTON, TN 38054-5011

1221
Ser 10/ 0028
2 Feb 07

From: Executive Secretary, Navy Enlisted Occupational Classification System Board
To: Commander, Naval Special Warfare Command

Subj: PROPOSAL TO ESTABLISH NAVY ENLISTED CLASSIFICATION (NEC) CODE SO-5392

Ref: (a) COMNAVSPECWARCOM ltr 1221 Ser N1/0576 of 17 Aug 06

1. Reference (a) has been approved by the NEOCS Board Members. The following NEC will appear in the April 2007 edition of NAVPERS 18068F, Volume II:

SO-5392 Naval Special Warfare Medic
Provides pre-hospital medical care in support of Naval Special Warfare training and operations. Performs basic and advanced first aid and life support, tactical combat casualty care, tactical medical emergencies and other paramedicine emergency care. Conducts pre-deployment and pre-mission medical planning and coordination. Advises on medical tactics, techniques and procedures for special operations. Instructs personnel in basic and advanced first aid, tactical combat casualty care, basic and advanced pre-hospital life support. Provides emergency care to diving casualties. Enters hyperbaric chambers to serve as inside tender to care for patients undergoing hyperbaric treatment.

Rating: SO, SB	Billet Paygrades: E3-E9	Personnel Paygrades: E3-E9
Course: Mandatory	CIN: K-431-0021, B-300-0042	CDP: 3596, 434W
Sequence Code: 4		NR Ind: R
Component NEC:	Related NEC:	Open to Women: No
Primary Advisor: CNO 851	Technical Advisor: SPECWAR	ECM: 4011D7

Notes:

1. NEC 5392 is a SNEC assigned to SEAL and SWCC personnel who are assigned to Naval Special Warfare SEAL and Special Boat Teams. Personnel must be a qualified SO or SB to be awarded this NEC.

2. Mandatory training B-300-0042, Special Operations Combat Medic course and K-431-0021, Special Operations Technician course.

3. SEAL personnel who previously held PNEC 8491 or 8492, or any SEAL or SWCC personnel who attended Special Operations Combat Medic course B-300-0042 may be awarded NEC 5392.

4. NEC may be assigned to inactive duty SEAL and SWCC Navy Reservists who have completed the mandatory training B-300-0042, Special Operations Combat Medic course and maintains the USSOCOM Advanced Tactical Practitioner certification.

COMPONENT SURGEON

USASOC

Joe Caravalho, MD
COL, USA
Command Surgeon

In support of their respective warfighter commander, one will find that each of the USASOC medical sections has a stated mission comprising four critical tasks. In no particular order, these are: 1) treat Soldiers who are injured or sick; 2) train, organize, and equip those assigned to do the treating; 3) prepare non-medical warfighters with basic lifesaving skills; and 4) force health protection. The latter task is probably the most compelling, in my opinion, because of its comprehensive nature and significant overall impact on the fighting force, regardless of its wartime mission.

To the casual observer, this may be the most unflattering part of the medical section's job — ensuring warfighters remain available and physically capable to take on the command's assigned mission takes a lot of "behind the scene" type of work. In large part, I'm convinced that most of the seasoned medical officers will attest that this aspect of their job is the most frustrating. It oftentimes involves getting warfighters to do what they don't see as pressing priorities.

In general, we're talking about public health issues on a very small scale — health maintenance, to be more precise. Regardless of our clinical background, we must all become specialists in this regard. Our job is to ensure that our respective commanders have the highest percentage of fully medically ready Soldiers among those assigned to our units.

Force health protection (FHP), as I see it, encompasses everything from garrison healthcare to field sanitation during deployment. Although seemingly easy enough, it's what's "in between" that gets tricky. Individual medical readiness is FHP's major effort. Add to this medical intelligence and incorporation of countermeasures against medical threats, and one begins to see the breadth of this responsibility. Also of note, FHP takes place before, during, and after every deployment, and lights should begin to click on. The commanders rely on our medical personnel to ensure our Soldiers are physically fit to fight. Finally add to the equation that we not only represent the unit in ensuring the fighting force is fully medically ready, but we are also the advocate for every individual Soldier to ensure each one of them has the appropriate screening, evaluations, treatment, and, most importantly, documentation, for medical and dental ailments.

For those of us less inclined in this field of medicine, we have help. The resident subject matter experts assigned at some level within our commands are our environmental science officers (ESO) and preventive medicine (PRVNTMED) officers and NCOs. These colleagues undergo extensive training, and oftentimes have years of experience before coming to USASOC. Unfortunately, without a thorough understanding of what this group of experts brings to the table, they stand a very great risk of being underutilized by the command.

Lieutenant Colonel Lisa Forsyth, the USASOC force health protection (FHP) officer, and the senior ESO in the command, hosted a USASOC-wide PRVNTMED

workshop at Fort Bragg this past winter. In addition to our FHP team, we had 23 subordinate unit ESOs and PRVNTMED officers and NCOs in attendance. In this issue of *The Journal of Special Operations Medicine*, LTC Forsyth reviews in detail the outcome of the working group. In addition to the networking made possible from such a venue, I was immensely pleased with the products generated by the group. Please read LTC Forsyth's article for a detailed encapsulation of the week's events.

In the future, I hope to be able to host similar working group meetings among the various medical specialists within USASOC. There are just too many good ideas out there for us not to have a mechanism to have them brought forward, exchanged and discussed in open forum — all in the spirit of enhancing USASOC, Army Special Operations Forces (ARSOF), and throughout the SOF community.

Sine Pari!

COMPONENT SURGEON

AFSOC

Timothy Jex, MD
Col, USAF
Command Surgeon

First I'd like to thank all those who attended our AFSOC medical conference in January. Based on the feedback I received, I'm confident we were able to provide an agenda that was relevant and useful, and I appreciate everyone's participation. Your contributions have made this the best conference we've ever had. OK … I know this was only the second one we've ever held, but it was still outstanding!

In the next couple of months, three of my division chiefs here at AFSOC headquarters will be handing off the baton. Col Matt Coatsworth, Chief of Medical Modernization (SGR), will retire this month and Lt Col Keith Groth will become the new division chief. Col (s) Tim Robinette, Chief of Aerospace Medicine (SGP), will be taking command of the 374th Medical Group at Yokota AB, Japan, and Col Bill Nelson will arrive as our new SGP. And finally, Lt Col Mike Curriston, Chief of Medical Operations (SGO) retired last month and Lt Col Mark Ervin has taken his place on the staff. I can't even begin to express adequate appreciation for the service these men have provided, but we are deeply grateful to them and wish them Godspeed in their new adventures.

As I and members of my staff continue to visit the various medical units in the Command, we are continually impressed by the incredibly bright and dedicated people we have in AFSOC. The best thing about my job, and one of the big reasons I've stayed in the Air Force all these years, is the privilege of serving with truly exceptional professionals like you. I hope you all appreciate the value and impact of your service and sacrifices. We are engaged in a world-wide war against an enemy and ideology that knows no moral limits and is determined not just to conquer, but to completely destroy our society. If you ever doubt the importance of your role, consider the fact that your line commanders won't go anywhere without you. You serve in units with a wide variety of missions, but whether you're providing best-in-the-world medical care or winning hearts and minds, you are enjoying unprecedented recognition as one of the most effective weapons available in the GWOT.

Thank you again for all you do and God keep you safe in your service.

COMPONENT SURGEON

NAVSPECWARCOM

Jay Sourbeer, MD
CAPT, USN
Command Surgeon

Hello from the NAVSOC SG's office,

Southern California's dynamic weather takes a toll on you, changing from great, to good, and back to great again. The full view of the beach should be available by the time this article comes out and as we prepare to host the next SG's conference in sunny San Diego, CA.

Naval Special Warfare medicine continues to evolve, meeting the needs of the wartime Special Operations environment. This year has been a real challenge with several changes, preferably labeled "upgrades," providing better medical care and training coverage to the community.

SEAL and Special Warfare Combatant Crewman (SWCC) medics are the highest trained enlisted medical personnel joining the NSW community. They complete an additional 130 days of training, as compared to their "slick" warrior teammates, prior to reporting to their operational commands. Their skills are sharp, and techniques, cutting-edge, and combined they are the backbone of initial trauma management for NSW operations and training worldwide. Training and equipment will continue to develop as we gain experience and keep pace with medical technological advancements as well as the community's mission.

With the dramatic near-term growth of the entire community, a significant portion of this growth will be medics and we'll need more training opportunities to match this increase. We currently have 60 quotas per year for NSW at JSOMTC (aka "the schoolhouse") and future demands will require even more. Consequently, the community will be called upon to provide a relative increased number of instructors to retain the highest standards already being achieved and ensure that the graduates' top notch battlefield skills remain undiminished.

The tremendous growth of this community requires more medical personnel to support it. We may see a time in the near future where there are more medical support personnel than there are operator-medics.

Navy Independent Duty Hospital Corpsmen (IDCs) were introduced into the NSW community as a result of very few 300-F1 medics having never before provided proper "Navy medicine" prior to showing up to "the Teams." Today, we know that the only way we can keep up with Navy medicine enterprise is to use the very members who make up this professional community.

This year we grew by more than 40 Corpsmen (HMs) community-wide. This is just the first of many steps to keep pace with our sister services. We've also increased the number of physical therapists and athletic trainers caring for our injured and wounded throughout their recovery and reintegration. This newly formed team of medical professionals is doing a tremendous job, and shows great promise in capabilities and quality of care.

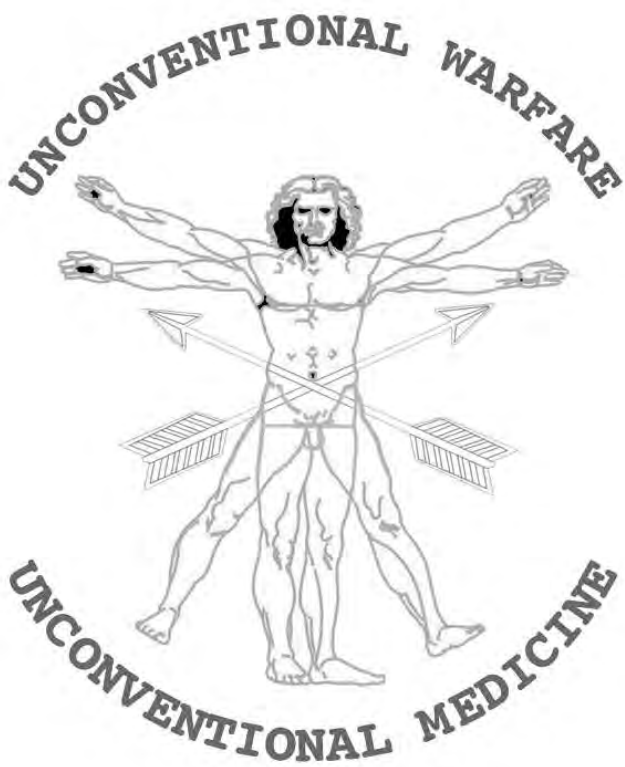
I recently received an email from a retired friend who told me about how he used his medical skills to help a neighbor in need. This friend had been enjoying a peace-

ful afternoon at home in his quiet suburban neighborhood when he heard a blood-curdling scream from his neighbor's house across the street. He immediately ran to the yard to find the man of the house lying in a pool of blood after falling off his roof. Recognizing the critical situation, he quickly assessed that his neighbor was terribly disoriented and soon became unresponsive. The call for EMS had already been made so he attempted to find the source of the bleeding. His airway remained patent, based on the moans and groans, but his circulation was covering the cement. With the help of other neighbors he managed to control the bleeding and prepare him for the paramedics that arrived soon after. He said, "The few minutes that it took for the emergency crew to arrive felt like hours." I'm sure we've all felt the same way in similar stressful situations.

He brought up the fact that although he had been retired a few years, he still remembered the basics that his team Corpsmen had taught him about emergency medical care and he was able to apply it during this recent situation. His neighbor suffered significant injuries including three rib fractures, a collapsed lung, lacerated spleen, fractured forearm, a severe head laceration, and a short loss of consciousness. The paramedics praised the care rendered prior to their arrival and the patient was swiftly evacuated and transported the patient. Bravo Zulu to these Good Samaritans.

Medical support will always be needed wherever we are, whether performing training or conducting missions. As teammates and medics we will never provide a casualty less than the full medical attention they require. By caring for injured teammates, medics instill in his teammates, trust in his skills and make his teammates feel safe, supported, important, and willing to step through that door knowing that his medic will do everything in his power to keep him alive. We are doing just that. We are saving lives on the battlefield in greater percentages than ever before in history. That is why "The only easy day was yesterday" and we'll never forget.

Until next time…



COMPONENT SURGEON

MARSOC

Stephen F. McCartney, MD
CAPT, USN
Command Surgeon

The 20th anniversary of United States Special Operations Command (USSOCOM) takes place in April 2007. As the medical representative of the Marine Corps Forces, Special Operations Command (MARSOC), the newest component within USSOCOM, it is an honor to participate in this celebration. The tradition of achievement within USSOCOM instills pride in the past and enthusiasm for the future for all MARSOC medical professionals. We proudly join USSOCOM in saluting all the brave and dedicated people who served before us and honor those heroes who gave the last full measure of devotion in service to our country.

Spring 2007 finds U.S. Marine Corps Forces Special Operations Command, MARSOC, fully committed and operationally engaged in the Global War on Terror.

At present, MARSOC is at 58% of its overall T/0 of 2515. MARSOC Medical Services is currently manned at 48% of the highly qualified and motivated personnel we require, with Navy medical officer status currently at 38%. Extremely qualified officer applicants from the operational forces continue to come in and I am always pleased to meet so many motivated and talented professionals who desire to serve with us. Such an exemplary population to draw from makes personnel selection difficult, but it is an enviable problem to have.

Marine Special Operations Advisory Group, or MSOAG (formerly FMTU) continues to grow and deploy to all Geographic Combatant Commands (GCC). Host nations respond enthusiastically to persistent engagement by MSOAG and request the return visits that build long-term relationships, develop host nation counter-terror capabilities, and build good will towards the United States in developing countries.

1st and 2nd Marine Special Operations Battalions (MSOB) have each deployed one trained and certified Marine Special Operations Company (MSOC). The MSOC is the Special Operations force forward deployed afloat expeditionary shipping. The MSOC is under operational control (OPCON) of the Theater Special Operations Command (TSOC) and is available for tasking at the direction of the TSOC.

At this writing, the Marine Special Operations School (MSOS) is engaging its first full iteration of the RSAS (recruit, screen, assessment, and selection) process. RSAS is the process by which all MARSOC Marines and Sailors gain entry to MARSOC and subsequent operational assignments.

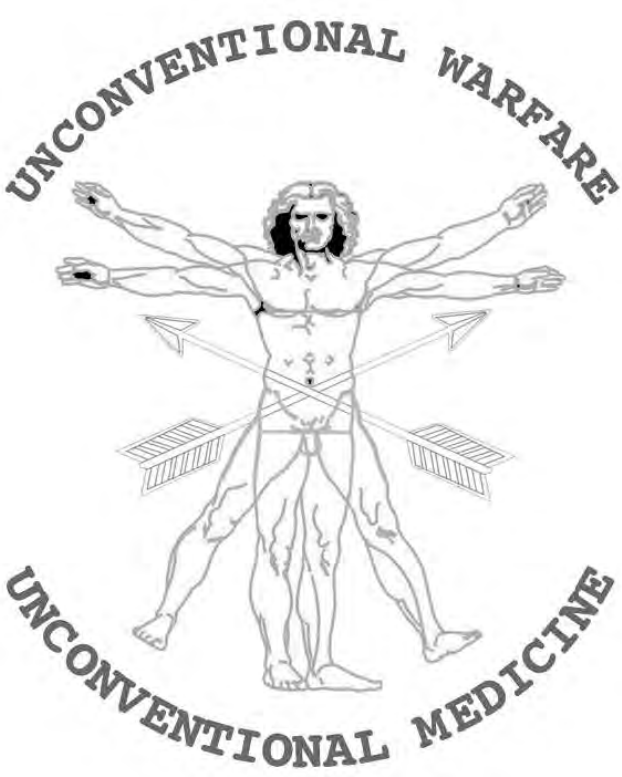
It has been a pleasure to represent MARSOC in many venues. I recently spoke to the graduating class at the Field Medical Service School, Camp Pendleton. Coincidentally, that day marked 41 years since HM3 Robert Ingraham, USN, received the Congressional Medal of Honor for service as a "Doc" with Lima Company, 3d Battalion, 1st Marines. Looking at the faces of the hundreds of graduate combat corpsmen assured me that HM3 Ingraham's legacy survives and that all is well

with the future of Navy medicine. Additionally, I was fortunate to attend the Joint Special Operations University (JSOU) Medical Orientation Course in April. The presence of the Component Surgeons, as well as Colonel Farr, was appreciated and lent weight to the importance of this symposium. The presentations by retired SOF faculty from USAF Special Operations School, GCC medical leadership , and especially "The Ambassador" were memorable. Congratulations to Lt Col John McAtee, USAF and his capable staff for the course.

Our direction at MARSOC continues to be one of recruiting and screening Navy medical personnel with the required leadership and operational experience for MARSOC service. We are training, organizing, equipping, and deploying new MSOCs and MSOAG teams and providing key medical support to both. Our build plan for the future involves the increased growth of the Special Amphibious Reconnaissance Corpsmen (SARC) pipeline as well as the production of more SARC Independent Duty Corpsmen (IDCs) at the U.S. Army Special Warfare Center in the future. We are thankful for the assistance and support we have received thus far and appreciate continued assistance in the future.

The efforts of the MARSOC Medical Services Section have been likened to trying to painting a car while driving seventy miles per hour. While the car shows no signs of slowing, the paint is drying!

Happy Birthday USSOCOM and God Bless America



COL Bob Vogelsang, VC
Deputy Surgeon of USSOCOM Clinical Services

Note: This issue of JSOM includes reprinted pages of the TMEP booklet. You probably noticed that the Training Supplement had a couple formatting problems which put the header for High Altitude Pulmonary Edema and HIV Post Exposure Prophylaxis in the wrong place (pp. 116-117 of last issue). This reprint fixes the formatting. We have also changed the word **Formulary** to read **Drug List**. You will need to change out the Formulary cover page and the list of authors to the two updated pages that are at the end of the TMEPS booklet. Additionally, it was noted that the **Disposition** portion for the **Meningitis** protocol was wrong in the Winter Training Supplement (p. 60). It should simply read "Urgent evacuation" and this is corrected in this issue.

INSTRUCTIONS FOR CREATING TMEP HANDBOOK

The layout of the TMEP booklet is set up so that you make two-sided copies from the journal pages, then cut to create sequential front-back pages which can be laminated and bound if you wish.

1. Open the journal to the begining of the TMEP booklet pages (four small protocol pages per one journal page). You will notice that the cover and pages 1, 3, and 5 are on the left-hand side and pages 2, 4, and 6 (and blank which corresponds to the back of the cover) are on the right.

2. First make one-sided copies of each journal page. You should end up with 26 separate copies, each with 4 TMEP booklet pages.

3. Then put all the copied journal pages in order and oriented in the same direction and place in copier. Make two-sided copies.

4. Your booklet pages should now be in order on each side (e.g., page 2 should be on the reverse of page 1, etc.). Ensure you place them in order from cover of the actual TMEPs to page A-45 of the Drug List.

5. Cut the stacked journal pages in half vertically and horizontally so that each booklet page is now a separate page. You now have four stacks of booklet pages. Sort one from each stack to put them in the correct chronological order.

6. Binder rings placed through holes in the side of the pages can be used to secure pages after lamination.

Meningitis

SPECIAL CONSIDERATIONS:

1. May be bacterial, viral, or fungal. The bacterial type may cause death in hours, even in previously healthy young adults, if not treated aggressively with appropriate antibiotics.
2. Consider malaria in differential diagnosis. Treat for both if malaria cannot be ruled out.

SIGNS AND SYMPTOMS:

1. Classic features include:
   A. Severe headache
   B. High fever
   C. Pain with any neck movement, particularly forward flexion
   D. Altered mental status
2. May also see:
   A. Photophobia
   B. Nausea and vomiting
   C. Malaise
   D. Seizures
3. Positive Brudzinski (pain on head and neck flexion) and Kernig's (neck pain with hip and knee flexion) signs

MANAGEMENT:

1. If this diagnosis is suspected, treatment should be initiated immediately.

2. IV access

3.  Decadron (dexamethasone) 10mg IV Q6h (IM route possible alternative but prefer IV route) or PO

4.  Ertapenem 1gm IV/IM QD **OR** 3rd generation Cephalosporin Rocephin (ceftriaxone) 2gm IV Q12 h (IM route possible alternative but prefer IV route)

5.  Tylenol (acetaminophen) 1000mg PO Q6h for relief of pain and fever if able to take PO meds. If no response, follow *Pain Management Protocol.*

6. Control of nausea and vomiting with an antiemetic (Zofran **OR** Phenergan) may be necessary.

7. If seizures occur, use *Seizure Protocol*.

8.  Moxifloxacin 400mg PO x1 **OR** Rocephin 250mg IM for prophylaxis for close contacts

DISPOSITION:

1. Urgent evacuation.

U.S. SPECIAL OPERATIONS COMMAND

TACTICAL MEDICAL EMERGENCY PROTOCOLS

For SPECIAL OPERATIONS ADVANCED TACTICAL PRACTITIONERS (ATPs)

December 04, 2006

USSOCOM OFFICE OF THE COMMAND SURGEON
DEPARTMENT OF EMERGENCY MEDICAL SERVICES AND PUBLIC HEALTH
7701 Tampa Point Boulevard
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PREFACE

Management of medical emergencies is best accomplished by appropriately trained physicians in an Emergency Department setting. Special Operations combat medics (SOCMs), however, may often find themselves in austere tactical environments where evacuation of a teammate to an MTF for a medical emergency would entail either significant delays to treatment or compromise of the unit's mission. Although SOCM-trained medics are not routinely authorized by the services to treat non-traumatic emergencies, in many SOF situations, training SOCMs to treat at least some medical emergencies may result in both improved outcome for the individual and an improved probability of mission success. The disorders chosen have one of the following properties in common: they are relatively common; they are acute in onset; the SOCM is able to provide at least initial therapy that may favorably alter the eventual outcome; and the condition is one that is either life-threatening or could adversely effect the mission readiness of the SOF operator.

TABLE OF CONTENTS

Acute Barotrauma from Diving or Swimming (Includes Eardrums, Sinuses, Lungs)

SPECIAL CONSIDERATIONS:
1. Barotrauma (damage from changes in pressure) can occur from descent in the water column ("squeeze") or from ascent from depth if compressed air was used ("reverse squeeze" or pulmonary over-inflation).
2. The most commonly affected site is the middle ear and tympanic membrane, but paranasal sinuses and even teeth can be affected.
3. Pulmonary barotrauma occurs when compressed air is breathed at depth followed by ascending with a closed airway (i.e. breath-holding) , and can cause pneumothorax or arterial gas embolism.

SIGNS AND SYMPTOMS:
1. Middle ear - acute pain in ears, usually on descending. May be accompanied by tinnitus and vertigo. Exam may show redness, bleeding, or rupture of tympanic membrane.
2. Paranasal Sinuses - acute pain in affected sinus area (mid-face, upper jaw, peri-orbital, or forehead). May cause bleeding from nose or facial bruising.
3. Dental - acute pain localized to tooth or jaw, usually upon ascent from diving.
4. "Facemask Squeeze", with conjunctival hemorrhage and peri-orbital bruising, may occur if mask is not equalized..
5. Pulmonary Over-inflation: cough, shortness of breath, sharp pain over one side of chest with deep inspiration, voice change, or crepitation in skin over upper chest or neck (subcutaneous emphysema). Possibly decreased breath sounds over one side of chest (pneumothorax).
6. WARNING Pulmonary barotraumas may lead to cerebral arterial gas embolus (CAGE). CAGE may cause symptoms similar to a stroke, with confusion, visual changes, speech difficulty, or unconsciousness. Monitor patient carefully for neurological signs and symptoms.

MANAGEMENT:
1. Middle ear - if tympanic membrane is not ruptured, no specific treatment other than rest and avoidance of further pressure changes. Decongestants optional. If TM is ruptured, protect ear from water or further trauma. Consider antibiotics, but do not use ear drops. Refer to higher level of care when feasible.
2. Paranasal Sinus barotraumas. No specific treatment other than avoidance of further trauma. Decongestants may be helpful.
3. Dental. No specific treatment other than pain control, observation, and evaluation of underlying dental defect (abscess, cavity, or loose filling).
4. Facemask squeeze - No specific treatment. Cold compress may reduce bruising, if it occurs.
5. Pulmonary barotraumas - if no respiratory distress, subcutaneous emphysema or small pneumothorax may be treated with oxygen breathing at normal pressure. Monitor pulse oximetry, if available. If respiratory distress occurs, treatment for tension pneumothorax, including needle thoracentesis or tube thoracostomy (chest tube), may be necessary.
6. WARNING If cerebral arterial gas embolus is suspected, administer 100% oxygen and IV normal saline and consider evacuation to recompression chamber ASAP. If possible, avoid altitude exposure greater than 1000 feet during evacuation.

DISPOSITION.
1. Cerebral arterial gas embolus or pneumothorax with respiratory distress, *Urgent* Evacuation
2. Mild to moderate middle ear, sinus, or pulmonary barotraumas without respiratory distress, Observation and *Routine* evacuation.
3. Tympanic Membrane rupture - *Routine* evacuation for consultation.

The protocols outlined in the following pages carry the following assumptions:

A. The SOCM medic is in an austere environment where a medical treatment facility or a unit sick call capability is not available. If a medical treatment facility or a medic authorized to treat patients independently is available, then the patient should be seen in those settings rather than by a SOCM medic.
B. The individual to be treated is a team member, a coalition partner, or a detainee.
C. Immediate evacuation may not be possible and, even if it is, may still entail significant delays to definitive treatment. The medical problem may worsen significantly if treatment is delayed.
D. The SOCM will contact a consulting physician as soon as feasible.
E. SOCM treatment will be done under the appropriate protocol.
F. Medication regimens are designed to minimize the number of medications the SOCMs are required to learn and carry. Medications have been used for multiple conditions when feasible without compromising care.
G. Appropriate documentation of diagnosis and treatment rendered in the patient's medical record will be accomplished when the unit returns to forward operating base.
H. Note these protocols are not designed to allow SOCM medics to conduct Medical/Civic Action (MEDCAP) missions independently.
I. Evacuation recommendations are based on the appropriate therapy per protocol being initiated on diagnosis.
J. The definitions of Urgent, Priority, and Routine evacuations are based on the times found in Joint Publication 4-02.2 of 2, 4, and 24 hours respectively.
K. The changes in the combat pill pack (Moxifloxacin and Mobic), as recommended by the Committee on Tactical Combat Casualty Care, have been changed in the TME Protocols.
L. The Fentanyl oral dosage of 800 mcg, as recommended by the CoTCCC has been incorporated into the pain protocol.
M. The change in the IV antibiotics has also been changed to reflect medication availability.
N. When possible, alternate antibiotics or anti-emetics have been listed.
O. For any infection, limit contact and use universal precautions.

Acute Behavioral Changes (Includes Psychosis, Depression and Suicidal Impulses)

SPECIAL CONSIDERATIONS:
1. In a tactical setting consider sleep deprivation as a cause.
2. Etiologies are numerous and will often dictate the management; thus, mental status changes could be caused by head trauma, metabolic and endocrine disease processes, environmental toxins, infections, combat stress disorder, hypoxia, hyperthermia, hypothermia pharmaceutical agent use (i.e. mefloquine) or withdrawal.
3. Consider diabetic hypoglycemia as a cause of altered mental status

SIGNS AND SYMPTOMS:

1. Acute behavioral changes include withdrawal, depression, aggression, confusion, or other behavioral patterns atypical for the individual.
2. Psychosis is an acute change in mental status characterized by altered sensory perceptions that are not congruent with reality:
   A. Auditory and/or visual hallucinations
   B. May include violent or paranoid behavior
   C. Disorganized speech patterns are common
   D. May include severe withdrawal from associates

MANAGEMENT:

1. Remove all weapons or potential weapons from patient and treating medic.
2. Place patient in safe environment under continuous surveillance
3. If hypoxia is suspected as a cause, check pulse oximetry.
4. For acute agitation, combativeness, or violent behavior, restrain patient with at least four individuals and give Valium (diazepam) 10mg IM.
5. Repeat Valium (diazepam) once if needed after 30 minutes.
6. Consider giving contents of 1 sugar packet sublingually to treat for possible hypoglycemia.
7. **IF MENINGITIS IS SUSPECTED OR IF THERE IS A DECREASE IN MENTAL STATUS, USE VALIUM WITH CAUTION DUE TO POSSIBLE RESPIRATORY DEPRESSION, HYPOTENSION, AND MASKING OF PROGRESSION OF DISEASE RELATED ALTERED MENTAL STATUS.**
8. If meningitis is suspected, use the *Meningitis* protocol.
9. If sedated or restrained, maintain constant vigilance for a change in the hemodynamic status or loss of airway reflexes.

DISPOSITION *Urgent* Evacuation

Acute Abdominal Pain

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

SIGNS AND SYMPTOMS:

1. Severe, persistent or worsening abdominal pain is the key sign.
2. Rigid abdomen
3. Rebound abdominal tenderness
4. Fever
5. Diarrhea is not typical but can be present with appendicitis.
6. Absence of bowel sounds
7. Focal percussive tenderness
8. Nausea and/or vomiting

MANAGEMENT:

1. Start IV with normal saline (NS) at 150cc/hr.
2. Ertapenem 1gm IV QD **OR** 3rd generation Cephalosporin Rocephin (ceftriaxone) 1gm IV QD
3. Keep patient NPO
4. Tylenol (acetaminophen) 1000mg PO q6h PRN pain (OK to take with sip of water)
5. Zofran (ondansetron) 4mg IV undiluted administered over 2 to 5 minutes or IM BID for nausea/vomiting, **OR** Phenergan 25mg IM/IV/PO.
6. For severe pain, use Fentanyl 800mcg oral transcutaneous lozenge (attempt to discuss treatment with receiving surgeon before use). This medication needs to be well documented when use

DISPOSITION:
1. *Urgent* evacuation to a surgical facility.

Acute Dental Pain

SPECIAL CONSIDERATIONS:
Most common causes are deep decay, fractures of tooth crown/root or acute periapical (root end) abscesses

SIGNS AND SYMPTOMS:

1. Intermittent or continuous pain, usually intense, heat or cold sensitivity
2. Visibly broken/cracked tooth
3. Severe pain on percussion
4. Intraoral swelling/abscess

MANAGEMENT:

1. Follow *Pain Management Protocol*
2. If signs and symptoms of infection are present, administer Keflex, 250mg QID for 7 days **OR** Rocephin 1gm IV/IM QD x 7 days

DISPOSITION
1. Evacuation usually not necessary
2. *Routine* evacuation if not responding to therapy

Acute Mountain Sickness (AMS)

SPECIAL CONSIDERATIONS:
1. Usually occurs at altitudes of 8,000 ft. and higher.
2. Consider pretreatment with Diamox, 250mg BID, when rapid ascent to altitudes above 8,000 feet may occur
3. Preceded by 6 to12 hour latent period after ascent.
4. Can avoid onset by limiting initial ascent to no higher than 8,000 ft., then 1,000 ft. per day thereafter.
5. A specific acute mountain sickness prophylaxis protocol may already exist at your location.

SIGNS AND SYMPTOMS:

1. Generally benign and self-limited, but symptoms may become debilitating.
2. Headache
3. Nausea/vomiting
4. Insomnia
5. No correlation with fitness level (likely genetic predisposition).

MANAGEMENT:

1. Halt ascent.
2. In a severe case of AMS or if patient is allergic to sulfa, give Decadron (dexamethasone) 10mg IM/IV initially, followed by 4mg IM, IV, or PO q6h for 3 days.
3. Diamox (acetazolamide) 250mg PO BID **UNLESS PATIENT IS ALLERGIC TO SULFA.**
4. Tylenol (acetaminophen) 1000mg PO q6h for relief of pain. If no response, follow *Pain Management Protocol.*
5. Zofran (ondansetron) 4mg IV undiluted administered over 2 to 5 minutes or IM BID for nausea and vomiting or 8mg PO, **OR** Phenergan 25mg IM/IV/PO.
6. Descend 1,500 ft. or more for severe or refractory cases if tactically feasible.
7. PO or IV hydration per *Dehydration Protocol* PRN

DISPOSITION:
1. Most cases are relatively mild, resolve in 2 to 3 days, and do not require evacuation.
2. Remain vigilant for signs of HACE (altered mental status and ataxia) or HAPE (dyspnea at rest). *See individual protocols for management of these diseases.*

Anaphylactic Reaction

SPECIAL CONSIDERATIONS:
1. Acute, widely distributed form of shock which occurs within minutes of exposure to an allergen.
2. Primary causes include insect envenomation, medications, and food allergies.
3. Death can result from airway compromise, inability to ventilate, or cardiovascular collapse.
4. The medic's responsibility is to know if members in the unit have such a condition. Moreover, the medic most also ensure that the member has some sort of anaphylaxis kit and is trained to use it.

SIGNS AND SYMPTOMS:
1. Wheezing (bronchospasm)
2. Dyspnea
3. Stridor (laryngeal edema)
4. Angioedema
5. Urticaria, Hives
6. Hypotension
7. Cardiac dysrrhythmias
8. Myocardial ischemia

MANAGEMENT:

1. Epinephrine is the mainstay of therapy.
   a. 0.5mg (0.5ml of 1:1000 IM**). DO NOT USE INTRAVENOUSLY.**
   b. Repeat one time in five minutes if symptoms persist
2. Benadryl (diphenhydramine) 50mg IM, IV, or PO
3. IV access with normal saline TKO (heplock)
4. Decadron (dexamethasone) 10mg IM or IV
5. Oxygen (if available)
6. Pulse oximetry monitoring
7. Zantac (Ranitidine) 150mg PO or 50mg IV/IM
8. If severe respiratory distress exists, aggressive airway management with bag-valve-mask and airway adjuncts (oral and nasopharyngeal airways). Intubate early if no response to epinephrine.
9. Administer a 1 to 2 liter normal saline bolus for hypotension; then titrate to establish systolic blood pressure > 90mmHg or normal radial pulse if BP cuff not available.

DISPOSITION:
1. If signs and symptoms resolve completely, monitor for 6 hours. Evacuation is not required if patient remains stable.
2. *Urgent* evacuation for severe cases not responsive to initial therapy or recurrence of symptoms during the 6 hour observation period.

Back Pain (Acute, Musculoskeletal, Severe)

SPECIAL CONSIDERATIONS:
1. Usually there is a previous history of back pain.
2. Generally musculoskeletal in etiology.
3. Often associated with heavy lifting or unaccustomed physical activity.

SIGNS AND SYMPTOMS:

1. Onset of acute back pain – often poorly localized.
2. Pain worsens with movement.
3. Pain radiating down one of the legs is usually caused by a herniated intervertebral disc.
4. Lack of neurological involvement :
   A. No weakness
   B. No numbness
   C. No bowel or bladder dysfunction
5. Pain is often severe and debilitating.

MANAGEMENT:

1. Tylenol (acetaminophen) 1000mg PO Q6h for relief of pain. If no response, follow *Pain Management Protocol.*
2. Apply cold compress to painful area for 20 to 25 minutes TID, followed by stretching.
3. Trigger point injections with local anesthestic (if trained). Lidocaine, 1 to 2cc per trigger point. May repeat daily for 2 days.
4. If the above therapy is unsuccessful after 24 hours, consider using Valium (diazepam) 10mg IM/ IV. Repeat once in 6 to 8h if needed.
5. Minimize activity initially, but encourage a gradual return to full mobility as soon as tolerated.
6. Avoid high impact exercises (vigorous calisthenics) or other vigorous exercise until fully recovered.
7. If back pain is accompanied by fever and/or urinary symptoms, treat as per *Flank Pain Protocol.*

DISPOSITION:
1. Evacuation is often not required if the back pain responds to therapy.
2. Routine evacuation for severe cases not responding to therapy.
3. Urgent evacuation for patients with neurological involvement (other then pain)
   A. Weakness
   B. Bowel or bladder dysfunction
   C. Anesthesia

Allergic Rhinitis/ Hay Fever/ Cold Like Symptoms

SPECIAL CONSIDERATIONS:
1. History of allergies to cedar, mold, pollen, etc.

SIGNS AND SYMPTOMS:

1. Clear nasal drainage
2. Pale, boggy or inflamed nasal mucosa
3. With or without complaints of nasal congestion
4. Watery or red eyes
5. Sneezing
6. No oral temperature

MANAGEMENT:

1. Pseudoephedrine (Sudafed), 30mg tabs, 2 tabs every 4 to 6 hours
2. **OR** Benadryl (diphenhydramine) 25 to 50mg PO if tactically feasible. **(Drowsiness is a side effect.)**
3. Increase oral fluid intake

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Acute Head and Neck Infection, Including Epiglottitis

SPECIAL CONSIDERATIONS:
1. Most common causes in young healthy patients include odontogenic (dental origin) cutaneous sources or post-injury (wound or fracture) infections.
2. These infections may progress rapidly from minor to airway/life threatening

SIGNS AND SYMPTOMS:

1. Pain, fever and malaise
2. Intra/extra oral swelling
3. Trismus
4. Pus
5. Dysphagia
6. Airway compromise

MANAGEMENT:

1. Manage airway and breathing first!
2. Place patient in position of comfort
3. Monitor pulse oximetry
4. O_2 prn
5. IV access
6. Moxafloxacin 400mg PO QD for 7 days **OR** Rocephin 1gm IV/IM QD for 7 days
7. Follow *Pain Management Protocol*
8. **FOR ANY AIRWAY INVOLVEMENT, CONSIDER DECADRON, 10mg IV**
9. If airway intervention is felt to be indicated, make a single attempt at intubation if feasible (the epiglottis is not swollen to the extent that visualization of cords is not possible.)
10. If intubation is attempted, do not attempt the procedure more than once. If intubation has failed, the next step is a cricothyroidotomy (using lidocaine if conscious).
11. Have cricothyroidotomy kit available before attempting intubation

DISPOSITION
1. If there is no airway compromise present and the infection is not widespread *Routine* Evacuation
2. If any airway compromise is present - *Urgent* Evacuation

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Bronchitis/Pneumonia

SPECIAL CONSIDERATIONS:
1. Consider also high altitude pulmonary edema (HAPE) at high altitudes.
2. Consider also pulmonary embolism (PE) and pneumothorax (fever and productive cough are atypical for these).
3. Patient may already be on doxycycline for malarial prophylaxis. Therefore, assume causative organism to be doxycycline resistant.

SIGNS AND SYMPTOMS:

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

MANAGEMENT:

1. Mild cases: Zithromax (azithromycin) 500mg PO first dose and then 250mg QD for 4 days **OR** Moxifloxacin 400mg PO QD for 5 days
2. **Severe Cases:** Add Ertapenem 1gm IV/IM **OR** 3rd Generation Cephalosporin IV Rocephin (ceftriaxone) 1gm QD IV
3. Albuterol by metered dose inhaler 2 to 4 puffs Q4 to 6h
4. Tylenol (acetaminophen) 1000mg PO Q6h PRN pain and/or fever or *Pain Management Protocol*
5. Pulse oximetry monitoring
6. Oxygen for hypoxic patients (if available)
7. Descend 1,500 to 3,000 ft. if at high altitude

DISPOSITION:
1. *Urgent* evacuation for severe dyspnea.
2. *Priority* evacuation otherwise.

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Asthma (Reactive Airway Disease)

SPECIAL CONSIDERATIONS:
2. Pulmonary disorder characterized by bronchiolar hyper-responsiveness and narrowing of the distal airways.
3. SOF patients may mask early signs and symptoms due to physical fitness, but may suddenly worsen.
4. Pulse oximetry hemoglobin oxygen saturation should be greater than 96% unless patient is at altitude.
5. Other disorders to consider: anaphylactic reaction, spontaneous pneumothorax, HAPE, and pulmonary embolism.
6. May see acute exacerbations of asthma with changes in geographic locations due to varying allergen levels in the environment.

SIGNS AND SYMPTOMS:

1. Wheezing
2. Dyspnea
3. Respiratory distress

MANAGEMENT:

1. Albuterol (metered dose inhaler – works better with use of spacer) 2 to 3 puffs q 5 min for 3 times
2. **IF THERE IS NO RESPONSE TO ALBUTEROL,** Epinephrine 0.5mg (0.5ml of 1:1000 solution) IM **(DO NOT INJECT INTRAVENOUSLY)**. May repeat one dose in 5 to 10 minutes.
3. IV access with saline lock
4. Decadron (dexamethasone) 10mg IV or IM
5. Oxygen (if available)
6. Pulse oximetry monitoring
7. Field intubation is not indicated for this disorder unless respiratory arrest occurs.
8. If there is superimposed fever, chest pain, and cough, treat per *Pneumonia* protocol.

DISPOSITION:
1. If the patient responds to management, observe for 4 hours and then return to duty if there is decreased wheezing upon auscultation, increased ease of respiration, and normal oxygen saturation.
2. If Returned To Duty, continue Albuterol (2 puffs every 6 hours and re-evaluate in 24 hours. Repeat Decadron 10mg IM QD for 4 days if symptoms recur.
3. If poor response to therapy, arrange *Urgent* evacuation.

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Cellulitis

SPECIAL CONSIDERATIONS:
1. Superficial bacterial skin infection
2. Often secondary to trauma or scratching other skin lesions
3. Generally begins about 24 hours following a break in the skin, but more serious types of cellulitis may be seen as early as 6 to 8 hours following animal or human bites.

SIGNS AND SYMPTOMS:

1. A painful, erythematous, slightly raised plaque with well-demarcated borders is seen.
2. Fever may or may not be present.
3. Typically, erythema spreads without treatment.
4. Rapidly spreading and very painful infections suggest the possibility of necrotizing fasciitis, a life-threatening infection of the deeper tissues, and should be treated per the bacterial *Sepsis* protocol.

MANAGEMENT:

1. Moxifloxacin 400mg PO QD x 10 days **OR** Zithromax pack
2. Clean and dress wound and surrounding area.
3. Use a marker to demarcate the border of the infection and re-evaluate in 24 hours.
4. If possible, limit activity until infection clears.
5. For cellulitis not responding to above therapy, use Ertapenem 1gm IV/IM QD **OR** 3rd generation Cephalosporin and continue with PO (Moxifloxacin 400mg PO QD **OR** Zithromax Pack).
6. Follow *Pain Management Protocol.*

DISPOSITION:
1. Re-evaluate daily and watch for progression of erythema while on antibiotics.
2. Typically evacuation is not needed, but *Priority* evacuation should be initiated if improvement is not seen within 24 to 48 hours or if infection continues to worsen on antibiotics.

Constipation/Fecal Impaction

SPECIAL CONSIDERATIONS:
1. Often seen with change of rations in the field.
2. Differential diagnosis includes acute appendicitis, volvulus, ruptured diverticulum, bowel obstruction, and pancreatitis.
3. Acute onset, severe pain, point tenderness, and fever point to etiologies other than constipation and fecal impaction.

SIGNS AND SYMPTOMS:

1. A recent history of infrequent passage of hard, dry stools or straining at defecation.
2. Abdominal pain, which is typically poorly localized with cramping.
3. If pain becomes severe and is associated with nausea/vomiting and complete lack of flatus or stools, consider a bowel obstruction.

MANAGEMENT:

1. Dulcolax (bisacodyl) 10mg PO TID as needed to initiate bowel movement
2. Tylenol (acetaminophen) 1000mg PO Q6h for relief of pain (***no narcotics – they cause constipation***)
3. For impacted stool or no relief with above measures, give normal saline enema with 500ml per rectum (use lubricated IV tubing).
4. If above measures fail, perform digital rectal examination to check for fecal impaction. If fecal impaction is present, perform digital disimpaction, if trained.
5. Increase PO fluid intake.
6. Increase fiber (fruits, bran, and vegetables) in diet if possible.
7. Consider parasitic infections.

DISPOSITION:
1. Evacuation is usually not required for this condition.
2. *Routine* evacuation if there is no response to therapy.
3. If severe pain, rigid board-like abdomen, fever, and/or rebound tenderness develop, and moderate to large amounts of blood are present in the stool, then treat per the *Surgical Abdomen* protocol.

Corneal Abrasions, Corneal Ulcers, Conjunctivitis

SPECIAL CONSIDERATIONS:
1. Contact lens corneal abrasions are at a high risk for development of a corneal ulcer. They should not be patched and require more intensive antibiotic therapy.
2. Consider LASIK Flap dislocation for anyone that sustains eye trauma after LASIK surgery.

SIGNS AND SYMPTOMS:
1. History of eye trauma or contact lens wear
2. Eye pain – typically becoming worse over several days
3. Eye redness
4. Tearing
5. Blurred vision
6. Light sensitivity
7. Fluorescein positive (bright yellow area of the cornea after applying fluorescein and examining the eye with a cobalt blue light source)
8. White or gray spot on cornea (usually need tangential penlight exam to see) for corneal ulcer
9. For sudden onset of eye pain after trauma in a patient after LASIK surgery, consider LASIK flap dislocation

MANAGEMENT:

1. Remove contact lens if worn.
2. Tetracaine 0.5%, 2 drops in the affected eye for pain relief. Do not dispense to patient.
3. Check for foreign body to include eyelid eversion.
4. Zymar (gatifloxacin) 0.3% drops – 1 drop in the affected eye QID while awake.
5. Tylenol (acetaminophen) 1000mg PO Q6h PRN pain or *Pain Management Protocol*
6. Reduce light exposure, stay indoors if possible - sunglasses if not.
7. For corneal abrasions: monitor daily for worsening signs and symptoms of a corneal ulcer (increasing pain and development of a white or grey spot at abrasion site). **DO NOT PATCH.**
8. Check with fluorescein drops daily—abrasions should get progressively smaller. Continue antibiotic drops until 24 hours after cornea becomes fluorescein negative (no bright yellow spot).
9. **IF CORNEAL ULCER PRESENT**: Increase Zymar to Q2h and priority evacuation.

DISPOSITION:
1. Evacuation may not be needed for corneal abrasion if improving with treatment.
2. Priority evacuation for Corneal Ulcer
3. Urgent evacuation for LASIK Flap dislocation.

Cutaneous Abscess

SPECIAL CONSIDERATIONS:
1. Do not attempt I&D in the tactical setting unless:
   A. The abscess is clearly red, hot, and tender to the touch.
   B. The abscess is on a location other than eyelid, neck, or face and is superficial.
   C. Local anesthesia with lidocaine 1% without epinephrine is available.

SIGNS AND SYMPTOMS:

1. Pain
2. Erythema
3. Warmth
4. Tenderness
5. Swelling
6. Fluctuant Mass
7. Induration

MANAGEMENT:

1. **For cellulitis without abscess, follow *Cellulitis Protocol.***
2. Incise and drain (I&D) if discomfort is severe:
   A. Establish sterile incision site with betadine.
   B. Local anesthesia using Lidocaine 1% without epinephrine.
   C. Incise with scalpel making an opening no larger than necessary to allow purulent material to drain freely.
   D. Incision should be parallel to skin tension lines if feasible.
   E. On initial treatment, leave wound open and pack tightly with iodoform gauze, if available. On subsequent dressings, wick the wound. **DO NOT SUTURE THE SITE**.
3. Bandage over site with wound checks daily
4. Moxafloxacin 400mg PO QD x 10 days **OR** Zithromax pack

DISPOSITION:
1. Evacuation is usually not required.
2. Return To Duty with appropriate wound management precautions.
3. Infection precautions and daily checks of wounds site.
4. If condition is worsening (spreading erythema, increasing pain, fever) then patient needs to be treated as per *Cellulitis Protocol* and evacuate as *Priority.*

Contact Dermatitis (Poison Ivy and Oak)

SPECIAL CONSIDERATIONS:
1. Insect bite(s) as a differential diagnosis - are also accompanied by itching, but have discrete red popular lesions(s).
2. Cellulitis as a differential diagnosis- is bright red, painful, not pruritic, and typically becomes steadily worse without antibiotics.
3. Fungal infection as a differential diagnosis – is not always pruritic; infections sites(s) slowly enlarge without therapy.
4. Effects are particularly dangerous if there is contact in or around the eyes.

SIGNS AND SYMPTOMS:

1. Acute onset
2. Skin erythema
3. Intense itching (pruritis)
4. May see edema, papules, vesicles, bullae, discharge, and/or crusting.

MANAGEMENT:

1. Change clothes when possible and bag original clothes until they can be machine washed.
2. Wash area with mild soap and water to remove resin from skin.
3. Apply cold wet compress to affected area to help decrease itching.
4. If available, apply 1% hydrocortisone cream to the affected area and cover with a dry dressing to help prevent spread to other parts of the body or clothing.
5. In severe cases, Decadron 10mg IM daily for 5 days, PRN.

DISPOSITION:
1. Evacuation is not needed for mild cases.
2. Priority evacuation for severe symptoms, intra-oral or eye involvement, or >50% body surface area (BSA) involvement care.
3. Monitor for secondary infection; treat as per *Cellulitis Protocol* if suspected on the basis of increasing pain, redness, or purulent crusting.

Chest Pain of Possible Cardiac Origin

SPECIAL CONSIDERATIONS:
1. This treatment protocol assumes no access to ACLS monitoring and defibrillation equipment.
2. The Special Operations Combat Medic (SOCM) typically does not carry most ACLS medications when deployed in tactical operational environments.
3. Myocardial infarctions (heart attacks) usually occur in patients over 40, but may occasionally be seen in younger individuals.
4. Beta blockers were also not felt to significantly improve likely outcome in the tactical setting.

SIGNS AND SYMPTOMS:

1. H/O hypertension, diabetes, smoking, elevated cholesterol, obesity, family history of MI at a young age are all risk factors.
2. Substernal chest pain which may radiate to left arm or jaw.
3. Pain often described as pressure or squeezing.
4. Dyspnea
5. Diaphoresis (sweating)

MANAGEMENT:

1. Aspirin (ASA) 325mg – chew to speed absorption
2. IV access
3. Morphine sulfate 4mg IV initially, then 2mg Q5 to 15min as needed for pain relief
4. Oxygen (if available)
5. Pulse oximetry monitoring

DISPOSITION:
1. *Urgent* evacuation
2. The evacuation package should include personnel certified in ACLS and an evacuation platform with ACLS equipment and medications.

Deep Venous Thrombosis (DVT)

SPECIAL CONSIDERATIONS:
2. DVT is a potentially life threatening condition, in which a clot is present in the large veins of a leg. This clot may dislodge and become localized in the pulmonary system (pulmonary embolism).
3. May occur in young adults secondary to trauma, long airplane rides, altitude exposures, and genetic predisposition.
4. Low dose anticoagulants acceptable here because of rapid evacuation to medical treatment facility.
5. May be confused with a ruptured Baker's cyst in a tactical setting.

SIGNS AND SYMPTOMS:

1. History of preceding air travel, trauma, birth control pill use (especially smokers), or family history of DVT
2. Defined as an occluding thrombus (blood clot) in the deep venous drainage system.
3. Usually seen in the lower extremities but may occur in any of the deep veins
4. Pain and swelling in the lower extremities (often the calf muscles).
5. May have palpable venous "cord"
6. Warmth over affected area
7. Increased pain in the affected calf muscles with dorsiflexion of the foot

MANAGEMENT:

1. Monitor patient with pulse oximetry (sudden decrease in oxygen saturation suggests a pulmonary embolism.)
2. ASA 325mg PO
3. For associated respiratory distress see *Pulmonary Embolus Protocol.*
4. Immobilize the affected extremity.

DISPOSITION:
1. *Priority* evacuation if no respiratory distress.
2. *Urgent* evacuation If respiratory distress and chest pain develop or are present

Cough

SPECIAL CONSIDERATIONS:
1. Usually viral etiology, but may also occur with high altitude pulmonary edema (HAPE) and pneumonia.

SIGNS AND SYMPTOMS:

1. Cough with or without scant sputum production.
2. Often accompanied by other signs and symptoms of upper respiratory tract infection (i.e. sore throat and rhinorrhea).

MANAGEMENT:

1. Treat symptomatically (using Cepacol lozenges or other appropriate medications) when the findings on history and physical do not suggest pneumonia.
2. Albuterol Metered Dose Inhaler 3 to 4 puffs Q4h may also help control coughing
3. Force PO hydration.
4. Avoid respiratory irritants (smoke, aerosols, etc).

DISPOSITION:
1. Evacuation is usually not required.
2. Treat as *Pneumonia* if accompanied by fever, chest pain, dyspnea, and/ or colored sputum (green, dark yellow or red-tinged).

Dehydration

SPECIAL CONSIDERATIONS:
1. Troops in the field are often chronically dehydrated.
2. Prolonged missions, acute diarrhea (gastroenteritis), viral/bacterial infections, and environmental factors (heat stress or working hard) all may exacerbate the dehydration.
3. May also occur in cold or high altitude environments due to low humidity and low availability of water.

SIGNS AND SYMPTOMS:

1. Lightheadedness (worse with sudden standing)
2. Mild headache (especially in the morning)
3. Dry mucosa (mouth, nose, and eyes)
4. Decreased urinary frequency and volume
5. Dark urine
6. Degradation in performance
7. Poor skin turgor

MANAGEMENT:

1. Increase oral fluids if tolerated.
   A. Use carbohydrate/electrolyte drink mixes for fluid replacement if available. However, use a dilute solution (1:4) to avoid an osmotic shift due to high sugar/salt load.
   B. If water is to be used as a replacement fluid, add rehydration packets if available.
2. If unable to tolerate PO fluids, use normal saline (NS) IV for rehydration. Use an initial bolus of 1 liter NS, followed by attempted PO hydration. If unable to tolerate PO hydration repeat 1 liter bolus of NS.
3. If NS is not available, use available IV fluids (Ringer's, Hespan, Hextend, etc.)
4. If nausea, vomiting, and/or diarrhea are present, treat per the *Gastroenteritis Protocol*.
5. Switch to PO fluids when tolerated.

DISPOSITION:
1. Monitor closely for recurrence of dehydration.
2. If signs and symptoms resolve with treatment, no evacuation is needed.
3. If dehydration persists, *Priority* evacuation.
4. Heat stroke requires *Priority* evacuation.

Gastroenteritis

SPECIAL CONSIDERATIONS:
1. Etiology of acute diarrhea is often viral, but bacterial or parasitic infections are common in the deployed environment.
2. Emerging fluoroquinolone resistance among enteropathogenic E. Coli and Campylobacter makes azithromycin the new primary agent for therapy.
3. Consider antibiotic-related diarrhea if on antibiotics at onset.
4. Consider parasitic infection is symptoms persist for 3 or more days.
5. Must rule out malaria if fever and GI symptoms exist in a malarious area.

SIGNS AND SYMPTOMS:

1. Acute onset of nausea, vomiting, and diarrhea
2. Fever may or may not be present

MANAGEMENT:

1. Imodium (loperamide) 4mg PO initially, then 2mg PO after every loose bowel movement with a maximum dose of 16mg per day
2. Do not use Imodium in the presence of fever or bloody stools.
3. Moxifloxacin 400mg PO QD x 3 days **OR** Zithromax pack.
4. If allergic, use Doxycycline 100mg PO BID for 7 days.
5. Zofran (ondansetron) 4mg IV undiluted administered over 2 to 5 minutes or IM BID for nausea and/or vomiting **OR** Phenergan 25mg IV/IM/PO
6. Orally hydrate with carbohydrate/ electrolyte fortified fluids if tolerated. Use normal drinking water as a secondary fluid replacement if CHO/ electrolyte fluids are unavailable. Add electrolyte rehydration packages to water if available.
7. IV rehydration using normal saline if intolerant of oral fluids; titrate fluid intake to regain normal urination frequency, urine color, and good skin turgor.
8. If diarrhea lasts for over 3 days treat the patient as having Giardia (also effective treatment for amebiasis), and give Flagyl (metronidazole) 500mg PO TID for 10 days.

DISPOSITION:
1. Evacuation is usually not required if the condition responds to therapy.
2. If dehydration occurs despite above therapy, evacuate as *Priority*.
3. If severe, persistent diarrhea occurs after 5 to 10 days of antibiotics, evacuate as *Priority*.
4. Grossly bloody stools or circulatory compromise requires *Urgent* evacuation.
5. Monitor hydration status by observing urinary frequency, urine color, and skin turgor.

Flank Pain

SPECIAL CONSIDERATIONS:
1. May be associated with testicular torsion. Assure normal external GU exam first.
2. May be associated with pyelonephritis.

SIGNS AND SYMPTOMS:

1. Flank pain
2. Flank pain radiating to testicles
3. Back pain
4. Nausea/vomiting
5. Hematuria
6. Urinary retention

MANAGEMENT:

1. IV hydration with normal saline. Give 1,000ml over 1 hour and then 250ml/hr.
2. Zofran (ondansetron) 4mg IV undiluted administered over 2 to 5 minutes or IM BID for nausea and vomiting **OR** Phenergan 25mg IM/IV/PO
3. Morphine 5 to 10mg IV or IM or per *Pain Management Protocol*
4. If febrile, give Rocephin 1gm IV Q24h.

DISPOSITION:
Priority evacuation

High Altitude Cerebral Edema (HACE)

SPECIAL CONSIDERATIONS:
1. Rare below 11,500 ft.
2. Headache is common at altitude. Ataxia and altered mental status at altitude are HACE until proven otherwise.
3. A specific HACE treatment protocol may already exist at your location.

SIGNS AND SYMPTOMS:

1. Unsteady, wide, and unbalanced (ataxic) gait
2. Altered mental status
3. Headache
4. Nausea and vomiting
5. Hallucinations
6. Disorientation
7. Typically preceded by AMS signs and symptoms
8. Cranial nerve palsy
9. Hemiparesis
10. Stupor
11. Unconsciousness

MANAGEMENT:

1. The only effective treatment is descent. Immediately descend at least 1000 ft. or until symptoms subside
2. Decadron (dexamethasone) 10mg IM/IV initially, then 4mg IV/IM Q6h
3. Diamox 250mg PO BID
4. Oxygen if available
5. Pulse oximetry monitoring
6. Individuals with HACE should not be left alone and especially not be allowed to descend alone.
7. If available, use a GAMOW bag in 1 hour treatment sessions with bag inflated to a pressure of 2 psi (approximately 100mmHg) above ambient pressure. Four or five sessions are typical for effective treatment.

DISPOSITION:
Urgent evacuation

Fungal Skin Infection

SPECIAL CONSIDERATIONS:
1. Insect bite(s), eczema, and contact dermatitis are in the differential diagnosis - are also accompanied by itching, but have discrete red popular lesions(s).
2. Cellulitis as a differential diagnosis- is bright red, painful, not pruritic, and typically becomes steadily worse without antibiotics.
3. Acute contact dermatitis as a differential diagnosis - is diagnosed by sudden onset of intense itching, skin erythema, and a history of environmental exposure.
4. Poison Ivy and Oak as a differential diagnosis - skin erythema present and is intensively pruritic.

SIGNS AND SYMPTOMS:

1. Skin erythema
2. Pruritis is variable
3. Slow spreading
4. Borders of the erythematous plaques are generally irregular and/or circumferential.
5. Often initially diagnosed as contact dermatitis but gets worse with use of steroids (those without antifungal agent added).
6. Most common sites of infection are feet ("athlete's foot" or tinea pedis), groin ("jock itch" or tinea cruris), scalp (tinea capitus), and torso or extremities ("ring worm" or tinea corporis).

MANAGEMENT:

1. Use Diflucan (fluconazole) 150mg PO once per week for four weeks (total of four doses in the absence of a cure, or 1 dose after clinically clear). If not resolved after 4 weeks, refer to Physician.

2. Clean rigorously with soap without injuring the skin.

DISPOSITION
Evacuation is usually not required for this condition.

High Altitude Pulmonary Edema (HAPE)

SPECIAL CONSIDERATIONS:
1. Caused by the hypoxia of altitude, HAPE is the most common cause of death from altitude illness.
2. Usually occurs above 8,000 ft.; respiratory distress at high altitude is HAPE until proven otherwise.
3. A specific HAPE treatment protocol may already exist at your location

SIGNS AND SYMPTOMS:

1. Shortness of breath
2. Dry cough
3. Dyspnea at rest
4. Symptoms of AMS
5. Late symptoms include:
   A. Gurgling on auscultation
   B. Blood tinged sputum (hemoptysis)
   C. Generalized weakness
   D. Severe respiratory distress
   E. Orthopnea

MANAGEMENT:

1. The only effective treatment is immediate descent. Descend at least 1000 ft. or until symptoms subside.

2. Pulse oximetry monitoring

3. Decadron (dexamethasone) 10mg IV/IM initially, then 4mg Q6h

4. Nifedipine 10mg PO; repeat Q8h if blood pressure is stable.

5. Oxygen 6 to 10 liters/min if available

6. If immediate descent is not tactically feasible, and if a GAMOW bag is available, use a GAMOW bag in 1 hour treatment sessions with bag inflated to a pressure of 2 psi (approximately 100mmHg) above ambient pressure. Four or five sessions are typical for effective treatment. GAMOW BAG TREATMENT IS NOT A SUBSTITUTE FOR DESCENT.

DISPOSITION:
1. Evacuation may not be required if good response to therapy.
2. Do not re-ascend in a tactical setting.
3. Avoid vigorous activity for 3 to 5 days.
4. *Priority* evacuation for patients that worsen despite therapy.

Epistaxis

SPECIAL CONSIDERATIONS:
1. Common at altitude and in desert environments due to mucosal drying.
2. May be anterior or posterior
3. Posterior epistaxis may be difficult to stop and may cause respiratory distress due to blood flowing into the airway. This type of epistaxis is uncommon in young healthy adults. It is more commonly seen in older, hypertensive patients.

SIGNS AND SYMPTOMS:

1. Nosebleed
2. Often previous H/O nosebleeds

MANAGEMENT:

1. Afrin (oxymetazoline) nasal spray 2 squirts in each nostril then pinch anterior area of nose firmly for full 10 minutes WITHOUT RELEASING PRESSURE
2. **IF BLEEDING CONTINUES:**
   A. Insert Afrin-soaked nasal sponge bilaterally along floor of nasal cavity. Continue pinching the nose just below the nasal bridge, for 10 minutes.
3. Once bleeding has stopped, remove the Afrin nasal sponge (after 30 minutes) and apply Bactroban to the affected nostril 2 to 3 times per day.

4. Clear airway of clots and other material (if required) by having patient sit up, lean forward, and blow his/her nose.

5. IV access via saline lock or NS TKO if indicted by severity of nose bleed.

6. **IF BLEEDING CONTINUES**
   A. Prepare 14 French Foley catheter (Tip is cut to minimize distal irritation)
   B. Advance catheter along floor of nose (straight in) until visible in mouth
   C. Fill balloon with 5cc of normal saline
   D. Retract catheter until well opposed to posterior nasopharynx.
   E. Add another 5cc of normal saline to balloon
   F. Clamp in place without using excessive anterior pressure
   G. Moxifloxacin 400mg PO QD until packing is removed.
   H. **LEAVE BALLOON AND PACKING IN PLACE FOR 72 HOURS.**

DISPOSITION:
1. Evacuation may not be required if epistaxis is mild, anterior, and resolves with treatment.
2. *Priority* evacuation for severe epistaxis not responding to therapy or if Foley catheter is used.

Headache

SPECIAL CONSIDERATIONS:
1. A common and usually benign disorder
2. The differential diagnosis for the acute headache is large and includes disorders that encompass the spectrum of minor to severe underlying disorders.
3. Exposure to smokeless propellants containing nitrates or other battlefield toxins from fumes may cause acute headaches.
4. Consider altitude sickness, intracranial bleeds or meningitis .

SIGNS AND SYMPTOMS:

1. If the headache is atypical for the patient, check for elevated blood pressure (if possible), fever, neck rigidity, visual symptoms, mental status changes, neurological weakness, and hydration.
2. If the patient has fever, nuchal rigidity, photophobia, petechial rash, or nausea and vomiting, proceed to the *Meningitis Protocol.*

MANAGEMENT:

1. Tylenol (acetaminophen) 1000mg PO Q6h for relief of pain. If no response, follow *Pain Management Protocol.*

2. If headache is accompanied by nausea & vomiting, use Zofran (ondansetron) 4mg IV undiluted administered over 2 to 5 minutes or IM BID **OR** Phenergan 25mg IM/IV/PO .

3. Oxygen (if available) and if other therapies ineffective

4. PO or IV hydration if dehydration is suspected as a cause

5. If at altitude, consider acute mountain sickness (AMS) and treat accordingly.

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

HIV Post Exposure Prophylaxis

SPECIAL CONSIDERATIONS:
1. Addition of the antiretroviral medications is expensive.
2. Initiation of the highly active antiretroviral therapy (HAART) must occur ASAP. Ideally, this is less than 8 hours after exposure, but still has some effect up to 72 hours after exposure.
3. Antiretrovirals have a significant side effect profile, including nausea, vomiting and diarrhea.
4. The amount of medications is dependant on the risk at the deployed location.
5. Obtain a sample of the source's blood for HIV testing, if applicable.

HIGH RISK EXPOSURES

1. Percutaneous injury (Needlestick or other contaminated penetrating injury).
2. Contact between body fluids and mucous membranes or non-intact skin.
3. Prolonged contact between body fluids and intact skin.
4. Unprotected sexual intercourse with a high risk individual.

MANAGEMENT:

1. Wash area with soap and water to clean area and minimize exposure.
2. Initiate antiretroviral triple therapy (recommend Combivir® [Lamivudine and Zidovudine] 1 tablet PO BID, Viracept® [Nelfinavir] 1250mg PO BID) as soon as possible.
3. Do not use alcoholic beverages after Combivir administration.
4. Treat nausea and vomiting with antiemetics (Zofran **OR** Phenergan).
5. Maintain hydration and nutrition status

DISPOSITION:
1. If a significant exposure exists and HAART is not available, *Urgent* evacuation
2. If HAART is available, *Routine* evacuation

Joint Infection

SPECIAL CONSIDERATIONS:
1. May result from penetrating trauma (especially animal or human bites), gonorrhea, or iatrogenic causes (i.e. attempted aspiration of joint effusion).
2. Consider also an acute joint effusion due to blunt trauma or overuse (usually less red and no fever).

SIGNS AND SYMPTOMS:

1. H/O adjacent penetrating trauma or infection
2. Single red, swollen joint
3. Fever
4. Pain

MANAGEMENT:

1. IV access
2. Ertapenem 1gm IV/IM QD **OR** 3rd generation Cephalosporin Rocephin (ceftriaxone) 2gm IV/IM BID
3. Tylenol (acetaminophen) 1000mg PO Q6h PRN pain. If no response, follow *Pain Management Protocol*.
4. **IMMOBILIZE THE JOINT**

DISPOSITION:
Priority evacuation

Hypothermia

SPECIAL CONSIDERATIONS:
1. Cardiac resuscitation should only be attempted during active rewarming.
2. Drug effects often delayed or diminished in moderate to sever hypothermia.

SIGNS AND SYMPTOMS:

1. Shivering
2. Pale, cool skin
3. Weak pulses
4. Frostbite
5. Altered mental status
6. Irregular heartbeat

MANAGEMENT:

1. Move to warm environment and remove any wet clothing.
2. Begin passive rewarming by placing in a blanket or device.
3. If responsive, administer warm fluids by mouth.
4. Consider active rewarming by administering IV fluids warmed to 40ºC (101.6ºF).
5. Do not attempt to rewarm pulseless hypothermic victims unless a defibrillator and all necessary resuscitation medications available.
6. Immerse frostbitten areas in water warmed to 40ºC (101.6ºF) only when there is no danger of refreezing.

DISPOSITION:
4. Mild to moderate cases can be treated and not evacuated.
5. Sever cases should be evacuated to a facility capable of active rewarming and resuscitation.
6. *Priority* evacuation for severe hypothermia

Malaria

SPECIAL CONSIDERATIONS:
1. Malaria MUST be considered in all febrile patients currently in, or recently in, a malarious area.
2. It is not uncommon for malaria to present like pneumonia or gastroenteritis (with vomiting and diarrhea)
3. *P. falciparum* is often fatal if not diagnosed and treated promptly
4. It is appropriate to treat suspected malaria cases empirically if diagnostic tests (blood smears or rapid test) are not available
5. A single negative blood smear does not rule out malaria. Patients should have blood smears every 8 to 12 hrs for 48 hrs to exclude malaria. FDA approved rapid diagnostic tests will likely be available soon and will be a valuable field diagnostic tool
6. Persons on effective chemoprophylaxis may have very low parasitemias and atypical presentations
7. Consider bacterial meningitis in evaluating the patient – treat for both disorders if meningitis is suspected
8. Patients who cannot tolerate PO meds must be evacuated for antimalarial therapy via IV or NG tube with antiemetic suppository
9. **IF SPECIES IS UNKNOWN, TREAT FOR P. FALCIPARIUM**.

SIGNS AND SYMPTOMS:
1. Prodrome of malaise, fatigue, and myalgia may precede febrile paroxysm by several days
2. Paroxysm characterized by abrupt onset of fever, chills, rigors, profuse sweats, headache, backache, myalgia, abdominal pain, nausea, vomiting, and diarrhea (may be watery and profuse) in *P. falciparum*
3. Intermittent fever to >40ºC (105ºF). Fever may be near continuous in P. falciparum malaria; classic "periodicity" is usually absent. Profuse sweating between febrile paroxysms
4. Tachycardia, orthostatic hypotension, tender hepatomegaly, moderate splenomegaly, and delirium (Cerebral malaria)

MANAGEMENT: *P. FALCIPARUM* MALARIA

1. Malarone (atovaquone 250mg/proguanil 100mg) 4 tabs daily for 3 days with food **OR** give Mefloquine 750mg and then 500mg 12 hours later.
3. **OR** give Doxycycline 100mg PO BID x 7 days **PLUS** Quinine 650mg PO TID for 3 days (Africa), **OR** 5 days (S. America), **OR** 7 to 10 days (SE Asia)
4. Tylenol (acetaminophen) 1000mg PO Q4h PRN fever

MANAGEMENT: *P. VIVAX* MALARIA

1. Chloroquine 1gm PO x 1 then 500mg daily x 3 days starting 6 hours after 1st dose PLUS primaquine 30mg QD x 14 days (MUST rule out G6PD deficiency before giving primaquine)

DISPOSITION
1. Complicated malaria (cerebral, pulmonary, unstable vital signs) is a medical emergency, requiring *URGENT* treatment and evacuation
2. Routine evacuation for uncomplicated cases (normal vital signs, normal mental status, no nausea and vomiting, no cough/shortness of breath)
3. In *P. Vivax* cases, gently examine patient to ensure splenomegaly has resolved before allowing return to full duty.

Ingrown Toenail

SPECIAL CONSIDERATIONS:
1. Typically caused by trimming toenails in a curved fashion which impinges the lateral nail fold.
2. Other causes include nail deformity, tight fitting shoes, and rotational deformity of toes.
3. Can occur in any toe of the foot but usually occurs in the big toe.

SIGNS AND SYMPTOMS:

1. Presents with pain, edema, hyperkeratosis, and erythema of the lateral nail fold.
2. Pressure over the nail margins increases the pain.
3. Inflammatory or infectious responses are generally localized.
4. Partial or complete nail removal is typically indicated in chronic inflammation/ infection, with severe pain, of both lateral nail folds especially if the condition has lasted one month or greater

MANAGEMENT:

1. Partial toenail removal:
   A. Clean the site with soap, water, and betadine.
   B. Rx Perform a digital block using lidocaine 1% **WITHOUT EPINEPHRINE.**
   C. Apply a tourniquet at the base of the toe.
   D. Stabilize the toe in the nondominant hand and remove the lateral quarter of the nail toward the cuticle, using a sharp scissors with upward pressure.
   E. Separate the nail from the underlying matrix and grasp it with a hemostat or forceps, removing the free piece by twisting it toward the remaining nail.
   F. Curette the posterior and lateral nail grooves to remove any debris.
   G. Remove the tourniquet if one was used.
   H. Control bleeding with direct pressure and dry the underlying nail bed.
2. Rx Bactroban (mupirocin) 2% ointment to exposed nail bed.
3. Dress the area with a nonadherent dressing followed by a dry sterile dressing.
4. Instruct the patient to wash the area daily.
5. Recheck wound and change dressing daily.
6. Instruct patient to wear less constricting shoes and to trim their nails straight across. Optimal care is to limit walking and marching for 3 to 5 days.
7. Rx Tylenol (acetaminophen) 1000mg PO Q6h PRN pain. If no response, follow *Pain Management Protocol.*
8. Rx Systemic antibiotics are typically not needed in these procedures; however consider using Moxifloxacin 400mg PO QD for 10 days, **OR** Zithromax pack if an infection is suspected (increasing pain, redness, and swelling).

DISPOSITION:
1. Evacuation is usually not required if the condition responds to therapy.
2. The nail bed may have serous drainage for several weeks, but will usually heal within 2 to 4 weeks.

Hyperthermia

SPECIAL CONSIDERATIONS:
1. Heat stroke is a life-threatening effect of hyperthermia and characterized by altered mental status and/or the absence of sweating.
2. Mild and moderate hyperthermia can often be treated and the casualty returned to duty.
3. Dehydration accompanies hyperthermia due to sweating.
4. Suggest that colloids (Hextend, Hespan) be avoided in favor of crystalloids.

SIGNS AND SYMPTOMS:

1. Warm skin to touch
2. Increased thirst
3. Sweating (may be absent late)
4. Muscle cramps
5. Abdominal cramps
6. Mild-moderate weakness
7. Positive tilt test
8. Tachycardia
9. Tachypnea
10. Altered mental status

MANAGEMENT:

1. Place in cool area; dampen patient's clothes with water. Place ice packs on sides of neck, in armpits, and in groin area. **AVOID SHIVERING WHICH WILL RAISE THE PATIENT'S CORE BODY TEMPERATURE!!**
2. **Increase oral fluids if tolerated.**
   A. Use carbohydrate/electrolyte drink mixes for fluid replacement if available. However, use a dilute solution (1:4) to avoid an osmotic shift due to high sugar/salt load.
   B. If water is to be used as a replacement fluid, add rehydration packets if available.
3. If unable to tolerate PO fluids, use normal saline (NS) IV for rehydration. Use an initial bolus of 1 liter NS, followed by attempted PO hydration. If unable to tolerate PO hydration repeat 1 liter bolus of NS. 2 to 4 liters of NS may be required.
4. Rx Zofran (ondansetron) 4mg IV undiluted administered over 2 to 5 minutes or IM BID for nausea and vomiting or 8mg PO, **OR** Phenergan 25mg IV/IM/PO.
5. **For heat stroke,** apply external ice (if available) until core temperature reaches 39 degrees C (101 degrees F). Avoid excessive cooling to prevent shivering.

DISPOSITION:
1. Mild to moderate cases can be treated and not evacuated.
2. Casualties with heat stroke should be evacuated to a higher level of care.
3. *Priority* evacuation for severe hyperthermia

Meningitis

SPECIAL CONSIDERATIONS:
1. May be bacterial, viral, or fungal. The bacterial type may cause death in hours, even in previously healthy young adults, if not treated aggressively with appropriate antibiotics.
2. Consider malaria in differential diagnosis. Treat for both if malaria cannot be ruled out.

SIGNS AND SYMPTOMS:

1. Classic features include:
   A. Severe headache
   B. High fever
   C. Pain with any neck movement, particularly forward flexion
   D. Altered mental status
2. May also see:
   A. Photophobia
   B. Nausea and vomiting
   C. Malaise
   D. Seizures
3. Positive Brudzinski (pain on head and neck flexion) and Kernig's (neck pain with hip and knee flexion) signs

MANAGEMENT:

1. If this diagnosis is suspected, treatment should be initiated immediately.
2. IV access
3. Rx Decadron (dexamethasone) 10mg IV Q6h (IM route possible alternative but prefer IV route) or PO
4. Rx Ertapenem 1gm IV/IM QD **OR** 3rd generation Cephalosporin Rocephin (ceftriaxone) 2gm IV Q12 h (IM route possible alternative but prefer IV route)
5. Rx Tylenol (acetaminophen) 1000mg PO Q6h for relief of pain and fever if able to take PO meds. If no response, follow *Pain Management Protocol.*
6. Control of nausea and vomiting with an antiemetic (Zofran **OR** Phenergan) may be necessary.
7. If seizures occur, use *Seizure Protocol.*
8. Rx Moxifloxacin 400mg PO x1 **OR** Rocephin 250mg IM for prophylaxis for close contacts

DISPOSITION:
1. Urgent evacuation.

Loss of Consciousness (without Seizures)

SPECIAL CONSIDERATIONS:
1. The most common cause of loss of consciousness (LOC) in healthy adults is orthostatic hypotension (associated with sudden standing) or vasovagal syncope (associated with sudden adverse stimulus – injections are a common cause).
2. Consider hypoglycemia, anaphylactic reaction, medication, recreational drug use, head trauma, and intracranial bleeding in addition to #1.

SIGNS AND SYMPTOMS:

1. Unconsciousness

MANAGEMENT:

1. If no respirations or pulse, follow the BLS guidelines.
2. Management of orthostatic hypotension and vasovagal syncope is accomplished by placing the patient in a supine position and ensuring that the airway is open. Patients experiencing these two disorders should regain consciousness within a few seconds. If they don't, consider other etiologies and proceed to the steps below.
3. Place either 1 tube Glutose 15 (oral glucose gel) or contents of one packet of sugar sublingually.
4. IV access
5. Rx Narcan (naloxone) 0.8mg IV. May be repeated in 5 minute intervals to a maximum dose of 10mg. (Eyes may be miotic.)
6. If no response, treat for *Anaphylaxis* per protocol.
7. Pulse oximetry monitoring
8. Oxygen (if available)

DISPOSITION:
1. *Urgent* evacuation, unless loss of consciousness judged due to orthostatic hypotension or vasovagal hypotension.
2. The evacuation package should include personnel certified in Advanced Cardiac Life Support (ACLS), and a transport vehicle with equipment, supplies and medications necessary for ACLS care.

Otitis Externa

SPECIAL CONSIDERATIONS:
1. Infection of external ear canal
2. Often called "swimmer's ear" and commonly occurs after repeated head immersion.
3. Ophthalmic antibiotic drops are used to minimize number of medications carried and to prevent possible instillation of ear drops into the eye.

SIGNS AND SYMPTOMS:

1. Ear pain – increased by passive external ear movement
2. Pruritis
3. Possible exudate in external ear canal
4. Pain with movement of ear is highly suggestive
5. Decreased auditory acuity
6. Sensation of fullness and moisture in ear
7. Pain, swelling, and erythema of ear and periauricular area in severe cases

MANAGEMENT:

1. Zymar (gatifloxacin) – 4 drops in affected ear Q2h while awake. Ensure patient maintains head position for 5 minutes so meds do not drain out of site.
2. If available, Cortisporin Otic drops, 5 drops TID - QID until symptoms resolve for 48 hours
3. Form a wick from a sterile dry dressing, and place into ear canal.
4. Tylenol (acetaminophen) 1000mg PO Q6h for relief of pain. If ineffective, proceed to Pain Management Protocol.
5. **IF NO RESPONSE WITHIN 24 HOURS, OR IF SIGNS AND SYMPTOMS WORSEN,** use Moxifloxacin 400mg PO QD for 10 days **OR** Zithromax Pack

DISPOSITION:
1. For simple cases, no evacuation is necessary.
2. *Priority* evacuation for "malignant" otitis externa signs and symptoms:
   a. Severe headache
   b. Otorrhea (purulent drainage from ear)
   c. Cranial nerve palsy

Pain Management Protocol

SPECIAL CONSIDERATIONS:
1. Any use of narcotic medications will be sedating and degrade the mission performance of patients
2. Avoid IM or SQ injections of narcotic medications due to the potential for delayed absorption

SIGNS AND SYMPTOMS:
Pain

MANAGEMENT:

1. Start in sequential manner in order to maximize pain control with mission performance
   A. Tylenol 1000mg PO Q6h.
   B. Non Steroidal Anti-inflammatory drugs
      I. Mobic 15mg PO QD PRN pain
      II. **OR** Motrin 800mg PO Q8 hrs PRN
   C. Narcotic Medications
      I. Oral Transmucosal Fentanyl Citrate 800mcg PO over 15 minutes (may repeat dose once)
      II. Morphine sulfate 4mg IV initial dose and then 2mg IV every 5 minutes up to 10mg total dose

2. Add Zofran 4mg IV over 2 to 3 minutes **OR** Phenergan 25mg IM/IV/PO for Morphine induced nausea or vomiting

DISPOSITION:
Priority evacuation for any patients with narcotic use.

Renal Colic / Kidney Stone

SPECIAL CONSIDERATIONS:
1. May be associated with preceding lower urinary tract obstruction or infection.
2. May proceed to life-threatening systemic infection.

SIGNS AND SYMPTOMS:

1. May have preceding UTI S/S
2. Back pain
3. Flank pain
4. Nausea/vomiting
5. Costovertebral angle tenderness
6. Fever

MANAGEMENT:

1. Moxifloxacin 400mg PO QD for 7 days if able to take PO, **OR** Zithromax Pack
2. Ertapenem 1gm IV/IM **OR** 3rd generation Cephalosporin Rocephin (ceftriaxone) 1gm BID IV/IM if unable to take PO or not responding to oral treatment
3. Tylenol (acetaminophen) 1000mg PO Q6h PRN pain or *Pain Management Protocol*
4. Zofran (ondansetron) 4mg IV undiluted administered over 2 to 5 minutes or IM BID for nausea and/ or vomiting for nausea and vomiting **OR** Phenergan 25mg IM/IV/PO
5. Force PO hydration
6. IV hydration with normal saline (NS) at 250cc/hr if unable to tolerate PO fluids

DISPOSITION:
Priority evacuation

Sepsis/Septic Shock

SPECIAL CONSIDERATIONS:
1. Sepsis is a form of severe, life-threatening bacterial blood infection caused by an overwhelming bacterial infection.
2. Rapid onset - death may occur within 4 to 6 hours without antibiotic therapy.
3. **If crystalloid solutions are not available, the use of Hextend or Hespan in sepsis is acceptable in larger volumes than typically used in trauma cases.**

SIGNS AND SYMPTOMS:

1. Hypotension
2. Fever
3. Tachycardia
4. Altered mental status
5. Dyspnea
6. May see skin rash (purpura)

MANAGEMENT:

1. Start an IV (May need intraosseous infusion device - IV may be hard to start in a patient with shock.)
2. Ertapenem 1gm IV QD **OR** Rocephin (ceftriaxone) 2gm IV as soon as IV is started
3. If patient is hypotensive (by blood pressure measurement or absent radial pulse), give 2 liters of normal saline or Ringer's Lactate IV fluid bolus. If normal saline is not available, give 1 liter of Hextend or Hespan.
4. Epinephrine 0.5mg (0.5ml of 1:1,000 solution) IM **(DO NOT GIVE IV)** for persistent hypotension after 2 liter bolus of NS or RL, or after 1 liter bolus of Hextend or Hespan.
5. Repeat 2 liter normal saline bolus if required for continued hypotension, then titrate fluids to maintain systolic blood pressure >90mmHg or palpable radial pulse.
6. Watch for decreased mental status and be prepared to manage airway.

DISPOSITION:
Urgent evacuation

Pulmonary Embolus

SPECIAL CONSIDERATIONS:
1. Usually preceded by deep venous thrombosis (DVT) with lower leg pain and a history of trauma or long periods in sitting positions (e.g. aircraft flights).
2. Easy to confuse with heart attack so treat patient as having a myocardial infarction.
3. Patient with this condition may also have history of long bone or pelvic fracture.
4. Acute onset, lack of fever and no cough differentiates from high altitude pulmonary edema (HAPE) and pneumonia.
5. Lack of wheezing differentiates from asthma.

SIGNS AND SYMPTOMS:

1. Shortness of breath
2. Localized chest pain (on either side)
3. Tachycardia
4. Tachypnea (rapid breathing)
5. Diaphoresis (sweating)
6. Decreased oxygen saturation on pulse oximetry
7. Full breath sounds with no wheezing
8. Often lower extremity pain, swelling, and tenderness

MANAGEMENT:

1. Aspirin (ASA) 325mg – chew to speed absorption
2. IV access
3. Morphine sulfate 4mg IV initially, then 2mg Q5 to 15min as needed for pain relief
4. Oxygen (if available)
5. Pulse oximetry monitoring
6. Treat patient using the *Chest Pain Protocol.*
7. If at altitude greater than 8,000 ft., descend at least 1000 ft. to treat for possible HAPE. See *HAPE Protocol.*

DISPOSITION:
Urgent evacuation

Smoke Inhalation

SPECIAL CONSIDERATIONS:
1. More common after closed-space exposures to fire.
2. Consider possibility of carbon monoxide (CO) poisoning and need for hyperbaric oxygen in all significant cases of smoke inhalation.
3. Normal oxygen saturation by pulse oximetry DOES NOT rule out the possibility of CO poisoning.
4. Consider possibility of airway burns and need for early intubation in the presence of face or neck burns.
5. Consider possibility of other inhaled toxins.

SIGNS AND SYMPTOMS:

1. H/O smoke exposure
2. Burns
3. Coughing
4. Respiratory distress (may be delayed in onset)

MANAGEMENT:

1. Consider the use of early intubation or cricothyroidotomy if significant burns (singed nares, facial burns, etc.) suspected
2. Albuterol by metered dose inhaler 2 to 4 puffs Q4 to 6h
3. Decadron (dexamethasone) 10mg IV/IM QD for two days
4. Apply oxygen if available
5. Limit patient exertion if possible.

DISPOSITION:
1. *Urgent* evacuation for respiratory distress.
2. *Priority* evacuation if not in distress but significant inhalation suspected.

Otitis Media

SPECIAL CONSIDERATIONS:
2. Infection of the middle ear which may be viral or bacterial in etiology.
3. Increased pressure in the middle ear may cause intense pain and may result in rupture of the tympanic membrane (associated with sudden decrease in pain and drainage from ear canal.)
4. The Special Operations Combat Medic (SOCM) typically may not carry an otoscope when deployed in tactical operational environments. Significant ear pain not accompanied by pain with passive movement of the external ear constitutes a presumptive diagnosis of otitis media in the tactical setting.
5. May follow air travel or ascents in mountainous terrain due to changes in ambient pressure.
6. If a patient has a history of being near a blast, consider a perforated TM.
7. Otitis Media in the SOF population is likely to be associated with changes of atmospheric pressure or a URI.

SIGNS AND SYMPTOMS:

1. Ear pain
2. Decreased auditory acuity
3. Sensation of fullness in the ear
4. Often present in the setting of an upper respiratory infection
5. May progress to rupture of the tympanic membrane with or without treatment.
6. Erythema and bulging of the tympanic membrane are hallmarks signs of this disease, but these findings are often not useful for diagnosis in the tactical environment.

MANAGEMENT:

1. Moxifloxacin 400mg PO QD x 10 days **OR** Zithromax Pack
2. Tylenol (acetaminophen) 1000mg PO Q6h for relief of pain. If not effective go to *Pain Management Protocol*

DISPOSITION:
1. For uncomplicated cases, no evacuation is necessary.
2. *Routine* evacuation for complicated cases not responding to therapy or involving a ruptured TM.

Seizures

SPECIAL CONSIDERATIONS:
1. May be caused by injury, infection, high fever, alcohol withdrawal, drug use, toxins, and structural abnormalities of the central nervous system (CNS).
2. Normal respirations do not occur during generalized convulsions.
3. Seizures may cause multiple secondary problems including:
   A. Rhabdomyolysis
   B. Lactic acidosis due to prolonged hypoxemia during seizure
   C. Aspiration pneumonia and respiratory distress
4. Diazepam is the medication selected to treat seizures in the tactical setting because it comes pre-mixed, is stable for long periods at room temperature, and works rapidly.

SIGNS AND SYMPTOMS:

1. Generalized seizure
2. +/- H/O previous seizures
3. +/- H/O recent head trauma
4. +/- H/O evidence of CNS infection
5. +/- H/O preceding headaches

MANAGEMENT:

1. Avoid trauma to patient during the seizure.
2. Valium (diazepam) 5 to 10mg IV (inject no more than 5mg per minute) for ongoing seizures (consider intraosseous (IO) access if needed.) May repeat in 15 minutes for continuing seizures up to maximum dose of 30mg.
3. If no IV or IO access, give 10mg Valium (diazepam) IM initially, and then repeat Q15 min as needed up to a total of 30mg.
4. Do not attempt to force an object into the mouth to open airway.
5. Open the airway as soon as possible after seizure subsides.
6. Pulse oximetry monitoring
7. Apply oxygen if available and oxygen saturation is below 90%.
8. If seizures are accompanied by fever, consider meningitis and treat per *Meningitis Protocol*.
9. Place either 1 tube Glucose 15 (oral glucose gel) or contents of an MRE sugar packet sublingually to treat for possible hypoglycemia.
10. Be aware of postictal state that follows seizure.

DISPOSITION: *Urgent* evacuation

Spontaneous Pneumothorax

SPECIAL CONSIDERATIONS:
1. Usually results from anatomic abnormalities of lung, genetic predisposition, or smoking.
2. Consider also: anaphylaxis, pulmonary embolism, high altitude pulmonary edema (HAPE), asthma, and pneumonia.
3. More common in tall, thin individuals

SIGNS AND SYMPTOMS:

1. Often H/O smoking
2. Spontaneous unilateral chest pain
3. Dyspnea – typically mild
4. No wheezing
5. Decreased breath sounds on affected side
6. No leg pain or swelling

MANAGEMENT:

1. Pulse oximetry monitoring
2. Oxygen if available (use oxygen for all suspected spontaneous pneumothoraces - may help speed resolution.)
3. Consider needle decompression for suspected tension pneumothorax.
4. If needle decompression allows for patient improvement, followed by worsening of condition, consider repeat needle decompression.
5. Descend at least 1000 ft. if at altitude and HAPE is a possibility.
6. Monitor respiratory status closely while waiting for evacuation.
7. Consider the need for decompression for high altitude evacuation.

DISPOSITION:
1. *Urgent* evacuation for significant respiratory distress despite therapy.
2. *Priority* evacuation for patients whose respiratory status is stable.

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Testicular Pain

SPECIAL CONSIDERATIONS:
1. The primary concern in testicular pain is differentiating testicular torsion from other causes of testicular pain
2. Testicular torsion is an medical emergency requiring urgent correction to prevent loss of the affected testicle
3. Other common causes of testicular pain include epididymitis and orchitis, infections commonly caused by STDs, as well as hernias and testicular masses

SIGNS AND SYMPTOMS:

Testicular Torsion:

1. Sudden onset testicular pain
2. Usually associated with activity
3. Associated testicular swelling
4. Abnormal position or lie of the affected testicle
5. Symptoms may be increased by testicular elevation
6. Usually associated with pain induced nausea and vomiting

Epididymitis

1. Gradual onset of worsening pain
2. May have fever and/or dysuria
3. Can be also be traumatic

MANAGEMENT:

1. If pain is sudden onset and the testicle is lying abnormally in the scrotum, an attempt to manual detorse the testicle is warranted.
   a. A single attempt to rotate the testicle outward (like opening the pages of a book) should be made
   b. If pain increases, 1 attempt to rotate the opposite direction should be made
   c. Successful detorsion will result in relief of pain
   d. If unsuccessful, treat per pain protocol and evacuate
2. Gradual onset pain with a normal lying testicle
   3. Treat per *Urinary Tract Infection Protocol*.
   4. Treat pain per *Pain Management Protocol*.

DISPOSITION:
1. For testicular torsion that cannot be detorsed, *Urgent* evacuation
2. For testicular torsion that has been successfully detorsed, *Priority* evacuation
3. For other causes of testicular pain, treat cause and consider evacuation if symptoms persist more than 7 days

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Urinary Tract Infection

SPECIAL CONSIDERATIONS:
1. More common in females.
2. More common in tactical settings with dehydration and/ or kidney stones.
3. Symptoms may be confused with a sexually transmitted disease (STD). Azithromycin has been added to the treatment regimen to treat for possible STD

SIGNS AND SYMPTOMS:

1. Dysuria
2. Urinary urgency and frequency
3. Cloudy, malodorous, or dark urine may be present
4. Suprapubic discomfort

MANAGEMENT:

1. Moxifloxacin 400mg QD x 3 days **AND** Zithromax (azithromycin) 1000mg one time dose
2. Tylenol (acetaminophen) 1000mg Q6h PRN pain. If no response, follow *Pain Management Protocol.*
3. If fever, back pain, flank pain, and/or costovertebral angle tenderness develop, suspect kidney infection and go to *Flank Pain Protocol.*
4. Force PO hydration.

DISPOSITION:
7. Usually responds to therapy – evacuation not required if it does.
8. *Routine* evacuation for worsening signs and symptoms.
9. *Priority* evacuation for severe pyelonephritis (See Flank Pain Protocol)

Subungual Hematoma

SPECIAL CONSIDERATIONS:
A collection of blood under a nail: typically occurs after trauma to fingernail or toenail.

SIGNS AND SYMPTOMS:

1. Pain from the affected nail
2. Purplish-black discoloration under the nail

MANAGEMENT:

1. Decompress the nail with a large gauge needle by rotating needle through the nail directly over the discolored area until the underlying blood has been released and the pressure is relieved. Make sure that it is introduced into the affected nail with a gentle but sustained rotating motion.
2. Gentle pressure on the affected nail may help to evacuate more blood.
3. Tylenol (acetaminophen) 1000mg PO Q6h for relief PRN pain. If no response, follow *Pain Management Protocol.*
4. If a fracture is suspected, consider taping the injured finger or toe to an adjacent toe or finger, or consider splinting the injured digit with either an improvised or a commercial splint.

DISPOSITION:
Evacuation should not be required for this injury if the subungal hematoma is successfully treated.

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Joint Special Operations
Tactical Medical Emergency Protocol Drug List:

December 4, 2006

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2006 Joint Drug List Authors

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Current Events

MEDICAL TEAM AIDS SOF ROLE IN MALI

Capt Darrick Lee
U.S. European Command Public Affairs

It's another hot day in Gao, a small village north of Bamako, in the West African country of Mali. A team has assembled at a local village, preparing to perform tasks that would make the average person cringe. A team member is struggling to get a grip on a cow's tongue. Another is fighting to repel insects. A woman tries to stop an infestation of worms from spreading, while another has only a few minutes to stick her hand in a mouth full of teeth … and take one out.

This is not an episode of the popular television show Fear Factor. It's the scene at a recent Medical Civil Action Program Exercise, MEDCAP as it's known, and is a humanitarian operation designed to provide medical, dental, and veterinarian outreach to local civilian populations. During November, the team, consisting of a physician, a nurse, a dentist, and a veterinarian, deployed with Special Operations Command, Europe (SOCEUR) Special Operations Forces to Mali as part of Joint Combined Exchange Training in the area.

The exchange training pairs U.S. forces with Malian military officials to provide infantry training as part of the ongoing military-to-military relationship the United States enjoys with Mali. While Special Forces focus on interacting with the Malian military, the medical teams serve the local community by providing free basic medical and dental care for villagers and vet care for their livestock. By interacting with foreign military forces and exposing local civilian populations to positive contacts with U.S. military personnel, the United States hopes to strengthen counterterrorism capabilities. Winning the "hearts and minds" of the locals with these MEDCAPs is part of that strategy.

Capt Sharon Moss is a nurse and element leader of flight medicine, serving with the 435th Medical Group at Ramstein Air Base, Germany, and jumped at the opportunity to deploy to Africa to help SOCEUR with their work.

Maj (Dr.) Darin Brown, a physician with the 435th Medical Group, checks the condition of a Malian child during a Medical Civil Action Program conducted near Gao, Mali. Brown and other military medical and dental professionals deployed with Special Operations Forces as part of the latest in a series of Joint Combined Exchange Training events. The training, aimed at fostering communication and cultural exchanges between the two militaries, is part of the United States effort to maintain positive relationships while bringing stability to the region. Dental and medical readiness are considered a key element of the training.
Photo by Capt Darrick Lee.

"Our focus is preventative medicine," said Moss. She administered anti-parasitic medicine to Gao villagers during the exercise. "I was just hoping I could do some good [for the villagers.]"

Air Force Maj (Dr.) Darin Brown, M.D., also worked vigorously. He provided physical exams and health assessments focusing on children.

"If we can assist them while they're young, they'll be more able to deal with health issues in the future," said Brown. "We have the ability to treat malaria and other real-world medical issues that some of these Malians face," said Brown. "They can gain months of benefit from our assistance."

Communicating with the villagers was a small obstacle, but the team used local interpreters to help them diagnose

some of the less obvious illnesses. The team dentist, Air Force Capt Sarah Clark, did not have that problem. The need for dental care in the area was evident; all she needed was the patient to open wide and say "aaaahhh."

Clark saw 63 dental patients, most of whom were children, within a matter of hours.

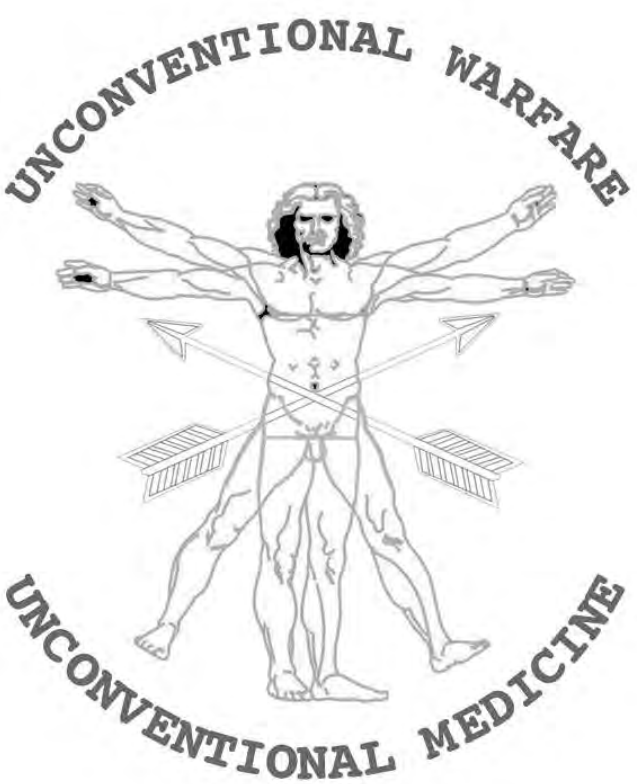
"We performed brief clinical exams, removed teeth that caused pain, and educated them about dental hygiene," said Clark.

With the occasional moans from the dentist's chair, one would think that the other children would be scared away. Yet the lines remained full … even if some of the smaller children needed a bit of coaxing from their elders. Brown has a rational explanation for why the children overcome their fear to see the medical team. "The phrase: 'First, do no harm' is part of the Hippocratic Oath, and it's important to us," says Brown. "The villagers know that we're trying to build relationships; we're trying to help."

They help the animals of the villages, as the team pulled together to assist U.S. Army Capt (Dr.) Jeremy Bearss, the team's veterinarian, assesses the health of local livestock and provide treatment as necessary. Bearss, who serves with the Northern Europe Veterinary Detachment at Royal Air Force Lakenheath, England, provided anti-parasitics and vitamins to the village's animal populations. The team tagged some of the animals so their health can be monitored in the future.

"One of the most valuable things the villagers have is their animals," said Bearss. "If their animals are healthy, then their children (and their nutritional status) will be as well."

Special Operations Command, Europe forces will continue to rely on the assistance of medical teams to perform Medical Capabilities Exercises as Special Forces focus their efforts on developing nations like Mali.



Care of the Military Working Dog by Medical Providers

Robert Vogelsang, DVM, MS

Accreditation/Designation Statements

CME: This activity has been planned and implemented in accordance with the essential areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through joint sponsorship of USUHS and the Journal of Special Operations Medicine. USUHS is accredited by the ACCME to provide continuing medical education for physicians.

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Financial Disclosure

The author, Robert Vogelsang, has indicated that, within the past year, he has had no significant financial relationship with a commercial entity whose product/services are related to the topic/subject matter.

Objectives

1) Differentiate normal from abnormal vital signs and laboratory values in the dog.
2) Recognize treatment for emergent conditions common to the military working dog.
3) Describe drugs, their dosages and routes, commonly used in the military working dog.

***Note:** The intent of this article is only to make healthcare providers aware that military working dogs (MWD) are part of the asymmetric battlefield. There will be occasions when healthcare providers (HCP) may be the only resource available to intervene when supporting MWDs become sick or injured. The article addresses only basic veterinary knowledge of the canine patient and is not to be considered definitive for HCPs to routinely care for MWDs. Veterinary care should be left to veterinarians and animal technicians whenever possible. However, HCPs may be called upon to provide immediate care in emergent situations. U.S. Army Special Forces Medical Sergeants (18D) receive a small amount of veterinary training through their course at the Joint Special Operations Medical Training Center, as well as some unit-level training with their Group Veterinarians. Any expansion of veterinary care by 18Ds outside the realm of emergent intervention should only be considered after consultation with the Group Veterinarian. There are few images of procedural demonstrations and canine anatomy and therefore it is recommended that HCPs become familiar with such by engaging with local Army Veterinary Corps officers (VCO). A few "hands-on" sessions will afford HCPs with an understanding of and comfort performing MWD physical exams and procedures.

Abstract

Military Working Dogs (MWD) are important force multipliers. The U.S. Department of Defense MWD program has expanded significantly in both total numbers of dogs and scope of their missions. MWDs are utilized to enhance law enforcement and force protection capabilities usually associated with detection of explosives or illicit/illegal drugs. Currently, in support of the Global War on Terrorism, MWDs are particularly involved with explosives detection and perform duties such as vehicle and building checks, route and minefield clearing, cache sweeps, crowd control, and cordon searches. Though there currently are no MWDs organic to SOF, the concept of using MWDs within SOF is being considered.

Depending on the size and maturity of a particular theater, conventional veterinary support may or may not be readily available to any MWDs which could potentially be used in support of SOF. In situations where veterinary support is difficult to obtain, or is non-existent, the only care available for MWDs will have to come from the handler or medical providers within the supported unit. MWDs are valuable and scarce assets which cannot be replaced easily or in a timely fashion. As such, it is important for medical providers to have at least a minimal knowledge set of emergent conditions common and/or unique to the MWD so that their intervention has the best chance of success to preserve life, limb, or eyesight of the canine patient.

Though many conditions in the dog are treated in a similar fashion in the human patient, differences in anatomy, vital sign and laboratory parameters and, medications and dosages, may give the medical provider cause for hesitation to attend to canine patients. This article attempts to provide medical providers some basic knowledge of MWD patients, their conditions, and treatments.

Dog use since 9/11 and in GWOT

Military Working Dogs (MWD) have been part of the Global War on Terrorism (GWOT) since its inception. MWDs are utilized for various law enforcement and force protection purposes, most commonly in the form of patrolling and detection of explosives or illegal drugs. As the GWOT has evolved, so has the use of MWDs, and dogs are now being used in concert with ground forces to assist in conducting cordon searches, route clearance, and ammunition/weapons cache sweeps, for example. At present, there are hundreds of MWDs deployed in support of OIF and OEF at over 30 locations.

Veterinary assets in theater

Veterinary support within a theater of operations is usually provided by Army Table of Organization and Equipment (TOE) units, specifically the Medical Detachment, Veterinary Service (MDVS). This unit is comprised of six squads or teams that are usually dispersed throughout the operational area. Each squad has one veterinarian and one animal care specialist. It also has four or five food inspectors, but these personnel do not significantly contribute to MWD care. Of these squads, only one is usually equipped with significant equipment (i.e. anesthesia machine, surgical table, etc.) to provide up to Level II+ care to MWDs. More definitive or extensive care requires evacuation of a sick or injured MWD back to Germany, Okinawa, or San Antonio, TX, depending upon the geographic area from which the MWD will be evacuated. Depending on the freedom of movement and permissiveness within a particular area, the ability of veterinary assets to travel to the dog or vice versa, may be severely limited and even routine care may be extremely difficult to obtain.[1] Needless to say, depending on the circumstances, acquiring timely emergent care from veterinary assets may be nearly impossible.

Within SOF, one Veterinary Corps officer (VCO) is assigned to each Army Special Forces Group (Airborne) (SFGA). In cases where these units are supported by MWDs and their VCO has been deployed to the same location, care for the dogs is more easily provided. It should be noted that these officers have minimal equipment and are limited in their ability to furnish anything more than resuscitative care in emergent situations. Even so, the VCOs are not always deployed, and when they are, they have other responsibilities (e.g. conduct of civic assistance missions, working with host nation veterinary or agricultural officials, etc.). As a result, there is no assurance that MWDs will always be attended to by a veterinarian. Army Civil Affairs (CA) battalions/brigades also have assigned VCOs. However, MWD care is not usually part of the CA VCO duty description. If CA units are near your location, inquire as to whether a VCO has deployed and whether they would be willing to assist with MWD care as mission priorities and availability allow.

Need for level I/II care

Like their human counterparts, MWDs are at risk of illness and injury throughout a deployment. Handlers are provided training in first aid procedures (e.g. cleaning and bandaging wounds, splinting fractures, etc.) and are generally very good at performing preventive and maintenance measures such as administration of parasite control products, bathing/grooming, and feeding of their dogs.

Most minor or non-emergent conditions can be managed or mitigated with solid medical knowledge of the human patient applied to a MWD, in concert with advice from a veterinarian or animal technician, until such time that veterinary personnel can attend to the MWD, or the dog can be taken to the veterinary unit. More serious conditions however, may present considerable peril to a MWD which is unable to receive swift veterinary care. For this reason, local health care providers (HCPs) such as physicians, physician assistants, nurses, and medics/corpsmen may need to intervene to preserve life, limb, and eyesight of certain sick or injured MWDs. There are also clearly humane reasons for HCPs to provide the best care they can to MWDs in pain and distress. Humaneness notwithstanding, MWDs are a "weapons systems" of relative rarity and considerable expense, and replacement of any "field loss" is a lengthy and costly process. One cannot simply walk over to the supply clerk and retrieve another MWD "off the shelf."

MWD Medical Readiness for deployment

Like service members, MWDs have deployment medical readiness requirements.[2] MWDs will be medically processed for deployment by home station veterinary facilities. Dogs should arrive in theater with enough medications (e.g. heartworm preventive, ectoparasite control products, and any prescribed drugs) to last the duration of the deployment. Handlers are given a deployment veterinary treatment record which includes copies of the master problem list, the vaccination record, pertinent history and laboratory data (minimum two years), monthly weight charts, and most recent health certificates.

Veterinary recordkeeping will not be a priority in the event that a HCP should have to treat an emergency condition in a MWD. However, some record of events, findings, and treatment would be optimal. The dog's record may be kept with the supporting veterinary unit or with the handler. Ideally, if the dog is living in your area, the

medical section will maintain the MWD's medical file. Entry into a Standard Form 600 is generally sufficient and the SOAP format should be utilized whenever possible.

Planning for MWD health service support

Care for any MWDs which may be utilized by your unit should be included in deliberate health service support (HSS) planning. Once it is known that MWDs will be supporting your unit, whether prior to deployment or after arrival in theater, medical planners should engage their command veterinary staff officer. Army SOF should utilize the USASOC Command Veterinarian; all other SOF units should utilize the USSOCOM Command Veterinarian.

If the destination is within an established area of operations (AO), it is likely that veterinary TOE units are already there and it is essential the medical planners know where those units exist and how to contact them. Communication should be made with supporting veterinary units soon after arrival of the MWDs to inform them that dogs will be, or are already in theater. These units are not fed any information regarding movement of dogs into the AO and will not be prepared to care for them if they are not aware that they exist. If OPSEC is a concern, there is no need to specify what the dogs' mission is or where they will be located. However, the veterinary unit should at least know a particular number of MWDs are "out there" and calls for their care may be made as required.

It is important you understand what veterinary capabilities exist at which locations as the assets closest may not necessarily be adequate for a particular condition. As mentioned earlier, by its TOE, only one squad of the MDVS has any significant surgical capability and that squad may not be the one overseeing routine care for the dogs in that area.

The Army Field Manual covering medical evacuation includes one paragraph about MWDs, stating only that this responsibility lies with the using unit and that dedicated ambulance assets are authorized for MWDs when mission priorities and availability exist.[3] However, this falls short of real medical evacuation doctrine for MWD casualties and such planning needs to be made ad hoc between the supported unit, the veterinary unit and potential transportation assets. True MEDEVAC of MWDs will rarely take place as that term implies that en route care is being administered. In most MWD cases, CASEVAC will be conducted to move a dog to a veterinary facility. As such, non-medical conveyances are the most probable means of transport. Medical planners should ensure that local units with possible CASEVAC platforms are contacted to determine whether they have the ability to support transport of MWD casualties.

Even if a good evacuation plan has been created, it can be rendered ineffective with poor communication. Anecdotal reports indicate communication is sometimes very difficult between units with MWDs, and also between units providing CASEVAC and the receiving veterinary unit. This is typically due to insufficient radio or telephone capacity or capability. It is important to attempt to contact the supporting veterinary unit prior to transporting a sick or injured dog in order to determine which veterinary location would be best to evacuate the patient based on its condition. VCOs have food inspection and responsibilities to other MWDs which may require them to be away from their treatment facility, so if there is no prior contact and the dog arrives at the veterinary facility when the VCO is not available, this will be putting the dog at additional risk. A handler should always travel with a MWD during evacuation. In the event that the dog's handler has been injured or killed, another handler should accompany the MWD if available.

The last task to accomplish in the MWD HSS plan is to contact supporting level II+/III medical treatment facilities (MTF) to discuss use of their facilities and personnel for emergent MWD care. Such an agreement and prior coordination is useful when veterinary personnel and facilities are not available and HCPs determine that use of the MTF would allow for the survival of a dog with a life-threatening condition. The author's experience is that MTF personnel are generally very willing to assist with MWD care when the mission allows. However, anecdotal reports indicate that some MTF commanders will not allow MWDs in their facilities under any circumstance.

If the theater is immature or the location austere, it is unlikely that veterinary units will be available to support dogs. If a VCO is assigned that will travel with the unit, then they can work with the medical planners to determine a MWD care plan. A big problem, much like for human patients in such situations, is evacuation. Getting any casualty, dog or human, out of sub-Saharan Africa, for instance, can be challenging. STRATEVAC to the regional main support area is usually the best choice, but because the Theater Patient Movement Requirements Center is unlikely to send an aircraft for a MWD, use of any MILAIR assets available to evacuate a sick or injured dog tends to be more realistic.

Depending on location, there may be host nation military or civilian veterinary personnel and facilities. Occasionally, these assets may be utilized, though many will not meet U.S. veterinary care standards. However, if the case is such that the dog is likely to die long before any evacuation to U.S. facilities may occur, use of local veterinary resources might be the only reasonable course of action available.

Safety around MWDs

The first thing a HCP must do to provide care to a MWD is not become a casualty while caring for the animal. Many people have had a pet dog and/or are comfortable being around them. Some MWDs are very tolerant of physical examination while others are very difficult to examine, and will thrash and growl and try to hurt you if given the chance. MWDs are trained to bite and hold until commanded to release. It is a serious concern and though rare, dog bites have led to the loss/removal or functional degradation of various extremities – whether through the trauma itself or due to subsequent infection. The HCP does not want any of the cases in these journal articles which can be found in Pub Med; (e.g. "Successful Replantation of an Amputated Nose after Dog Bite Injury,"[4] "Microsurgical Replantation of the Lip: A Multi-Institutional Experience,"[5] and especially, "The Therapy of Genital Trauma by Dog Bite" to be mimiced.[6]

First, never examine a dog without a handler present. The handler should keep the dog close on a very short leash. Do not get tricked into getting close to a dog that has slack in its leash. Keep out of striking distance. Make an effort to be slow and gentle. You can try "baby talk" and words of praise ("Oh, you're such a good boy! Who's a good boy? YOU'RE a good boy, Oh yes you are!"). If the HCP is comfortable in doing so, and the dog is relatively calm, pet the dog or scratch behind its ears; they actually do seem to like that. Try to be at ease. Though they probably cannot really smell fear, they do seem to sense something from timorous individuals, which adds to a tense situation. Since the dogs are trained to work with people, most are socialized well and are not dangerous … if common-sense precautions are taken. However, there are a few "buzz saws" out there, and in aggressive dogs, it is recommended that the examiner not attempt to "show him who's boss." Avoid direct eye contact; just look at what is needed to be looked at and do not react submissively or aggressively in return. A dominant, aggressive dog will react to perceived threats to that dominance and create an even worse situation.

Only get close to the dog after the handler has demonstrated that they have positive and tight control of their dog (Figure 1). Next, make sure the dog has a muzzle secured to its head and face. This is standard operating procedure for handlers. However, the HCP needs to be aware that while they are near the dog's head for any reason (examining eyes, head/face, auscultation, etc.), they can be injured if the dog lunges at them with the muzzle. Muzzles can be made of plastic or wire as well as leather and the HCP will regret it if they are struck in the eye or face.

Figure 1. Handler in positive control of MWD for exam.

Physical Examination of the Dog

There are parallels between caring for dogs and some pediatric human patients in that neither can effectively communicate their perceived health status with the caregiver. There may be obvious signs of distress or discomfort or other changes that are seen in each patient, but neither can provide a simple answer to "Where does it hurt?" Not only will dogs not tell the HCP what seems to be ailing them, but, many times continue to work as best they can until a problem has progressed to a point at which the illness or injury has become a serious condition. Handlers will invariably pick up even small changes in their dog's behavior and request that their MWD be seen for seemingly inconsequential reasons. This may also share some commonalities with pediatrics, but generally, if the handler is concerned, the dog should be given a cursory examination.

It is not expected that HCPs will be providing routine sick call to MWDs, but if MWDs are only looked at when they are in extremis, HCPs won't be able to determine lesser changes that are meaningful in identifying an actual problem prior to the dog having a bona fide emergency. The philosophy is similar to passing the jumpmaster personnel inspection portion of the jumpmaster course. The key to determining something is wrong with a jumper's rig is not inspecting a lot of jumpers with different gigs; rather it is inspecting huge numbers with no gigs. That way, since it is well known what normal looks like, it is much easier to pick out when something is wrong. It may not always be known exactly what is wrong, but knowing it's not right, the HCP can then pursue their finding.

Anatomic directions on a dog

The fact that the dog is a quadruped creates potential problems between veterinary and medical personnel

when it comes to communicating where exactly on a body one is talking about. Terms applied to humans may either mean something different to a veterinarian, or mean nothing at all, when it comes to dog anatomy. In quadrupeds, toward the head is "cranial," (superior for humans) and the tail is "caudal" (inferior). Toward the spine is "dorsal" (posterior) and towards the sternum, "ventral" (anterior). See Figure 2.
http://en.wikipedia.org/wiki/Image:Anatomical-directions.svg?

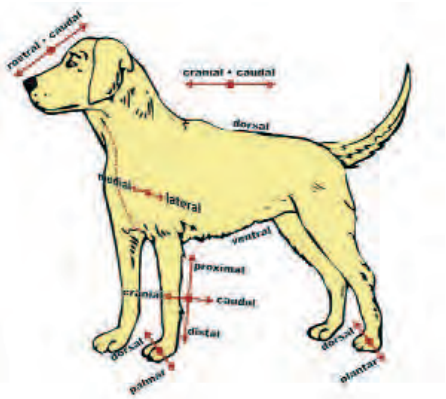

Figure 2. Anatomic directional terms for the dog

Vital Signs

Normal canine values are in Table 1. Methods of determining vital signs in the dog are not unlike acquiring them from pediatric patients. The HCP needs little more than a stethoscope (adult size) and digital thermometer, though a penlight may be wanted on occasion. Though infrared auricular thermometers are commercially available, it is recommended that HCPs utilize digital thermometers which can be placed rectally. Unlike the relatively straight, horizontal ear canal in humans, the canine canal has vertical and horizontal portions at approximately 100 to 120 degrees to each other. Because of this anatomy, and unfamiliarity of HCPs with it, simple placement of infrared thermometers into the vertical canal will probably not engage the beam with the tympanum, thereby giving inaccurate results. Additionally, most dogs will resist when something is placed in their ears, by either tucking or thrashing their heads, creating a moving target. Continued attempts, especially in more aggressive or fractious MWDs, will usually make things worse.

Thoracic auscultation is generally accomplished with little protestation from the MWD. However, there are some differences between auscultation of the canine and human thoraces. Anatomically, the dog thorax is flat from side to side, not front to back as it is in a human. The point of maximal intensity (PMI) to best hear the heart is the left axillary region and just caudal to it. Because MWDs are meant to be trim and fit, the HCP can many times feel the PMI with their fingers simply by placing them on the left side of the thorax caudal to the forelimb. The heartbeat should be heard easily; however, the diaphragm of the stethoscope must be held firmly against the chest wall as the movement of the diaphragm over the dog's coat will produce loud scratching sounds that may drown out the heartbeat. Another sometimes frustrating factor is that many dogs pant during the exam and the associated lung sounds make it harder to hear the heart sounds. A trick to help temporarily stop the dog from panting is to wedge an alcohol prep pad in the muzzle near the nose. This will usually stop panting for a short while, but if it is not removed relatively quickly, the dog may start to resist and struggle to get away from the odor.

Once a strong loud heartbeat is heard, the HCP will notice that it is faster than what they are used to hearing in human patients. Due to the anxiety cause by the exam, the rate may be almost twice as fast as that in a resting, physically conditioned, healthy, young male. Within the context of this article's intent, the HCP will not really have to discern arrhythmias or murmurs and will be auscultating the heart mostly to determine the heart rate. It is more difficult to hear heart sounds clearly from the right side of the thorax, and, for our purposes, there is no specific need to auscultate the heart from this side. Occasionally, sternal placement of the stethoscope can allow the examiner to hear heart sounds with less interference from panting.

Lungs are easily auscultated, but panting may make it more difficult to gain useful information. The HCP should be able to appreciate crackles and wheezes just as in human patients, but be sure to listen to all lung fields on both sides of the thorax. Conditions which cause changes to the sounds normally heard in thoracic auscultation in humans (e.g. pneumothorax, hemothorax, pneumonia, etc.) will cause the same changes in canine patients. The HCP will also realize that they cannot make the dog take a deep breath ... hold it … and exhale, so just do your best. Again, the interposition of hair between the skin of the thorax and stethoscope might cause interference which may hide abnormal sounds to those not accustomed to it – another reason to practice listening to normal MWD lung and heart sounds.

Sphygmomanometers are not particularly useful in the dog, especially an awake one. Blood pressure is assessed by looking at mucous membrane color, capillary refill time (CRT), and pulse quality. The best place to palpate for a pulse is high in the groin where the femoral artery can usually be felt. Due to most dogs' trim physiques, this is not difficult to do. Cup the right hand and set it along the cranial aspect of the dog's right thigh

(or left hand for left thigh). Then place the fingers under the fold of the flank and, as high along the medial aspect of the limb as possible, gently compress the thigh. If a pulse isn't felt right away, reposition the fingers until it is felt. Pulses should be strong and steady with one pulsation per heartbeat. The main reason to be able to find a pulse is to determine shock, in which case it will be thready like it is in the human patient.

Table 1. Normal Vital Signs and Basic Lab Values of the Dog and Human

Parameter ▲	Dog (MWD)	Human (adult male)
Temperature (ºF)	99.5 to 102.5 (rectal)	96.3 to 99.9 (oral)
Heart Rate (beats/minute)	60 to 120	40 to 60*
Respiratory rate (breaths/minute)	20 to 40 and pant**	12 to 20
Capillary refill time (seconds)	<2	<2
PCV/HCT (%)	35 to 54	40 to 52
Total protein (g/100 ml)	5.7 to 7.3	6.3 to 8.2
WBCs ($x10^3/\mu l$)	6.4 to 16.0	4.1 to 10.9
Urine specific gravity	1.015 to 1.040	1.002 to 1.030
Blood urea nitrogen	6 to 24	7 to 21
Blood glucose (mg/dl)	60 to 125	60 to 100

* For conditioned athlete; otherwise normal adult male range, 60 to 100.
** Though not normal for a calm dog at rest, many normal dogs will pant during an exam if anxious or excited.

Laboratory values

For the intent of this article, only a few canine laboratory values are given (Table 1). Packed cell volume/hematocrit, white blood count, total protein, urine specific gravity, and blood urea nitrogen provide useful information. Some information is fairly easy to obtain, but others require equipment which may not be available at every location, or in an austere environment. Utilize whatever laboratory items are available for the MWD just as for human patients. Though erythrocyte and white cell counts may not be accurate if dog blood is run through a machine calibrated for human blood, electrolyte and blood gas results are thought to be generally reflective of the actual values in the canine patient.[7] Though the HCP may not need, or have time, to interpret canine laboratory results, such values should be obtained when possible and provided to the supporting veterinary unit for advice or when transferring the patient into veterinary channels.

Emergent conditions and management

Most emergent conditions in the dog can be managed similarly as they would be in the human patient. Canine emergencies are approached using the ABC (airway, breathing, and circulation) mnemonic. Unique conditions to the canine patient, without a commonly seen analogue in the human, will be covered separately.

Airway: Establishment of a patent airway in the obtunded/unconscious MWD is made with an endotracheal tube (ETT). Dogs tend to have larger tracheal lumen diameters than humans per body weight. An adult male human and MWD would require about the same size ETT; the MWD being able to accommodate a slightly larger tube (8.0 to 9.0mm ETT, human; 9.0 to 11.0mm ETT, canine). Intubation of the canine patient should generally be easier than in a human as the dog's jaws can be widely opened to allow direct visualization of the vocal folds. A stylet is generally not required and dogs should be intubated in sternal recumbency (pronate).

The HCP can use dry gauze to grasp the dog's tongue to pull it forward and down while an assistant/handler grasps the maxilla behind the upper canine teeth. This allows the jaws to be opened wide with good visualization of the glottis. The tube can then be inserted between the vocal cords. To preclude intubation of only one lung, the end of the tube should not extend past the thoracic inlet. Determination of the how far to insert the tube can be made by approximating the course of the tube and trachea next to the dog prior to the tube's insertion. The HCP should make a mental note of how much of the tube should remain extending out of the muzzle when determining proper placement of the ETT. Because it is likely that the ETT will extend relatively far from the muzzle when placed properly, it must be secured to prevent its accidental removal. This is obtained by using a three-foot long piece of roll gauze or a large rubber band placed around the tube at the point where the tube passes the commissure of the mouth, and then secured behind the head near the occiput, or on the dorsal surface of the muzzle. Cuff inflation should be done slowly as the Ambu bag is squeezed. When air no longer escapes from around the tube, cuff inflation is sufficient. The patient should be bagged eight to twelve times per minute ensuring good chest excursions.

Catheter placement in the canine patient is usually made in the cephalic vein on the dorsal/dorsomedial aspect of the forelimbs. Occasionally, it is placed in the

lateral saphenous vein, (runs craniodistal to caudoproximal on the lateral surface of the hind limb above the hock, or "ankle"), or the jugular vein. One item of equipment that really makes catheter placement easier, but is generally lacking in medical sets, is a pair of hair clippers such as those used in a barber shop. If the hair is not clipped, especially in dogs with long hair, it can be very difficult to place a catheter at all, much less aseptically. Hair can be cut with scissors, but results are mixed. Safety razors with chlorhexidine/povidone iodine scrub (not solution) as a "lather" can be tried in short-coated dogs, or after long hair is trimmed with scissors, but it takes time and can cut the skin. Catheter size is important and, if possible, 18G x 2″ should be used. However, if the vein is small, something as small as 22G may be necessary, but larger is preferred for fluid resuscitation.

A tourniquet or assistant's hand is used to occlude the vein proximal to the insertion site. Initially the HCP should attempt to place the catheter at the most distal location where they can clearly see the vein. If they are unsuccessful, they will want to be able to try again closer to the elbow/stifle (knee). Do not try to insert the catheter directly through skin and into vein in one thrust. First, place the catheter through the skin alongside the vein and, once through, direct it into the vein. Catheters must be firmly secured with tape to help preclude dislodgement.

Single-lumen central venous/jugular catheters are not difficult to place in an otherwise fit and well-conditioned MWD. If available, and the situation permits, placement of a jugular catheter is recommended, especially if the dog will be transported to a veterinary unit later. Peripheral catheters can be easily dislodged due to movement of the patient. With the dog in lateral recumbency, shave the neck from thoracic inlet to angle of the mandible just lateral to the trachea. Extend the head, wet the shaved area, and occlude the jugular where it enters the thorax. The vessel should be easily seen so standard catheter placement can be accomplished. Be sure to secure the catheter by suturing to the skin.

Shock

Shock in the canine patient will present as it does in the human patient. A shocky dog will have tachycardia and a weak/thready pulse, may have changes in mentation, and can exhibit pallor and increased CRT. Potential confounding factors for the HCP in assessing mucous membrane color and CRT are that the oral mucosa in some dogs may be highly pigmented. Try to find a portion of the gingiva or mucosal surface of the lip that is pink when checking CRT and color. In dogs with completely black (due to pigmentation) oral mucosa, which is rare, assess color by looking at the conjunctiva of the eyes. Cool, clammy skin is not as well appreciated in the dog due to its hair coat, though the feet may subjectively feel cooler than normal.

Shock in the dog can be caused by the same things that cause shock in humans and symptomatic treatment is also generally the same, primarily treatment of the underlying cause. Type of fluid(s) used will depend on severity of shock. Compensated shock can be addressed with crystalloids only, but if decompensation is occurring or has occurred, use of colloids and/or hypertonic saline can be used. Fluid rates can be found in the section on gastric dilatation-volvulus.

Gastric Dilatation-Volvulus (GDV)

GDV is a life-threatening condition seen with some frequency in the common MWD breeds (German/Dutch Shepherds, Belgian Malinois). One study found that almost 10% of MWD deaths are due to GDV.[8] As the term implies, the stomach can fill with gas and fluid (dilatation) and in many cases will subsequently twist upon itself (volvulus). The condition is commonly called "bloat," due to the abdominal distention which GDV causes. GDV leads to gastric wall ischemia/necrosis and circulatory shock due to occlusion/impingement of the distended stomach on the caudal vena cava and portal vein (see Figures 3 and 4). Aggravating factors can include myocardial ischemia/arrhythmias, disseminated intravascular coagulopathy, renal failure, and splenic torsion, so it is very important that GDV is quickly diagnosed and treated

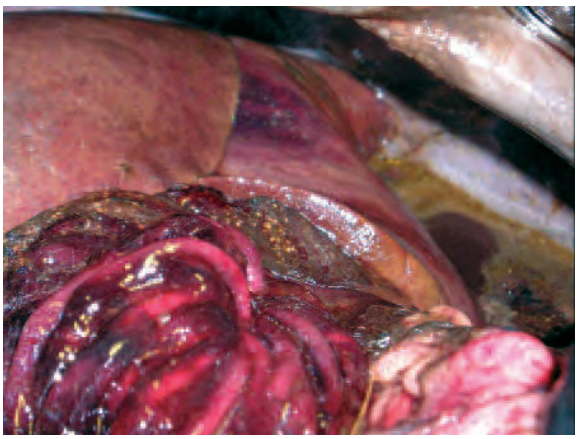

Figure 3. Intra-operative view of MWD with gastric wall necrosis and perforation secondary to GDV. Note dark purple rugal folds of exposed gastric lumen, flocculent particles of food, and brown fluid accumulation in the abdomen. This patient died during surgery. Liver is at upper left, with intestines at lower right.

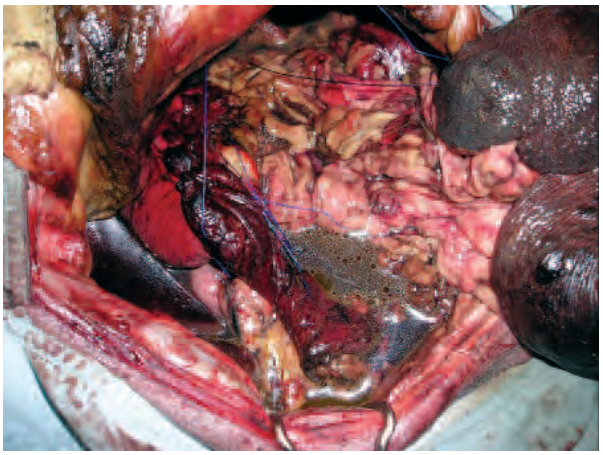

Figure 4. Post-mortem image of open abdomen in same patient as in Figure 3. Partial gastrectomy was being performed to remove necrotic stomach wall. Cranial to left, caudal to right.

to help preclude these other complications.

Clinical signs are fairly characteristic. The abdomen is usually distended and the dog will appear uncomfortable and seem to have some difficulty breathing due to the restriction of diaphragmatic movement. The handler may have noted that the dog has retched with no vomitus expelled. Early in the course of GDV, dogs may not seem to be particularly compromised, but the condition can proceed very quickly, leading to death within minutes to an hour, depending on severity. In more advanced cases, the dog will be shocky. In garrison environments where dogs may be monitored infrequently during the night, reports of a dog appearing normal one hour and dead the next (due to GDV) are not unheard of.

Diagnosis is fairly straightforward based on history, clinical signs, and physical exam. Imaging studies are generally not required, but if unsure and there is the ability, take a right lateral abdominal x-ray; GDV has a very recognizable radiographic presentation (Figure 5).

A recent study indicated the two most important prehospital predictors of unsuccessful outcome in GDV were hypotension and clinical signs for more than six hours prior to examination.[9] As such, the immediate treatment goal is to quickly provide hemodynamic support and decompress the stomach. Place an 18G x 2″ cephalic catheter for fluid administration and IV access for other drugs. Ideally, a jugular catheter is subsequently placed for ensuing transport to a veterinary facility. Do not place a catheter in the lateral saphenous vein (or any vein in the hind limbs) of a GDV patient. Because the dilated stomach impedes venous return from the caudal vena cava, fluids administered through the saphenous cannot easily be delivered to the heart.

If 5 to 7.5% hypertonic saline in 6% dextran 70 is available, administer a 5ml/kg bolus then follow-up with crystalloid at 20ml/kg/hr.[10] If hypertonic saline is not available, an initial bolus of 6% hetastarch can be given at 20ml/kg followed by crystalloid administration. If no other fluids are readily at hand, start with a crystalloid at 90ml/kg (generally, running fluids "wide open") and reassess heart rate and pulse quality every 10 to 15 minutes.[11] If using straight crystalloids, in most cases it will be reasonable to give at least two liters (in a 60 to 80 pound dog) at this rate prior to considering the need to adjust it downwards.

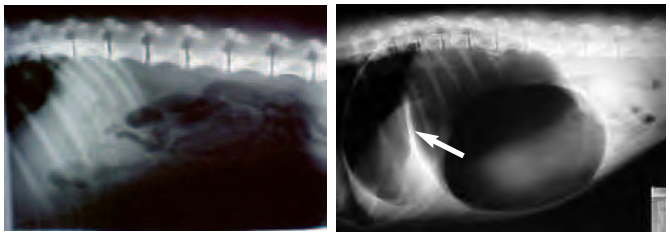

Figure 5. Abdominal radiographs of dogs taken in right lateral recumbency.
Picture on the left is of a normal stomach. Picture on right is GDV. The stomach is severely distended and filled with gas. Soft-tissue "shelf" (arrow) indicates volvulus and not simple gastric dilatation.

If an assistant is available, proceed with antibiotic administration after fluids are started. A first generation cephalosporin (e.g. Cefazolin) or Ampicillin can be given at 22mg/kg IV.[11] Ceftriaxone, a broad-spectrum third-generation cephalosporin can be used instead, if available (see Table 2 for dosing information). If things are too chaotic however, give antibiotics after the dog is decompressed and stabilized. Corticosteroids have been widely used in GDV patients, though its effectiveness is not proven. They might help, but probably only if given prior to decompression of the stomach (after which it is thought endotoxins are released); methylprednisolone sodium succinate can be given IV at 30mg/kg.[11]

Immediate decompression of the stomach is most easily accomplished by trocharization. Percutaneous placement of a large bore IV catheter (12 to 16G, 2″ or longer) is not only useful for quick removal of some gas, but also may ease subsequent passage of an orogastric tube. Though gas may be vented through a trochar, it is not effective for removing fluid. For more effective function, additional fenestrations (one or two) can be made into the sides of the catheter with a scalpel blade while it is still on the stylet; this allows gas to be relieved if the end becomes clogged with fluid/ingesta.

With a distended abdomen, it is not difficult to hit the intended target. However, the area just caudal to the ribs must first be "pinged" to insure the trochar is placed in the gas cap of the stomach and not into fluid or some other organ such as the spleen. To ping, place a stethoscope over the uppermost (toward the ceiling) portion of the abdomen (assuming the dog is in lateral recumbency) and then percuss the area immediately adjacent to the stethoscope diaphragm. If placement is over the gas cap, a resonant "ping" will be heard; if not, a dull thud will be heard. If unable to successfully ping the stomach, place the dog on its opposite side and try again.

When satisfied the gas cap has been identified, shave a small area and simply place the catheter perpendicular to the body wall in one swift motion. Local anesthesia is generally not required, though lidocaine infiltration beforehand would surely be appreciated by the patient. Do this only if the MWD's physiologic status permits. If the trochar is properly placed, foul-smelling gas should immediately be detected when the stylet is removed, perhaps along with a sputtering of fluid. Do not let go of the trochar during decompression and follow the body wall downward as decompression occurs. This would prevent the stomach from falling away from the body wall and off the catheter as gas escapes.

Handlers whose dogs have not received a prophylactic gastropexy should be deployed with an orogastric tube (Figure 6) which is the best way to more effectively decompress the stomach after trocharization. Orogastric tubes used in dogs generally are intended for use in the equine patient, so they are sometimes referred to as "foal tubes" as the size which works in the neonate horse is appropriate for the MWD. Such tubes are 1/4 to 3/8" (approximately 20 to 32 French) internal diameter.

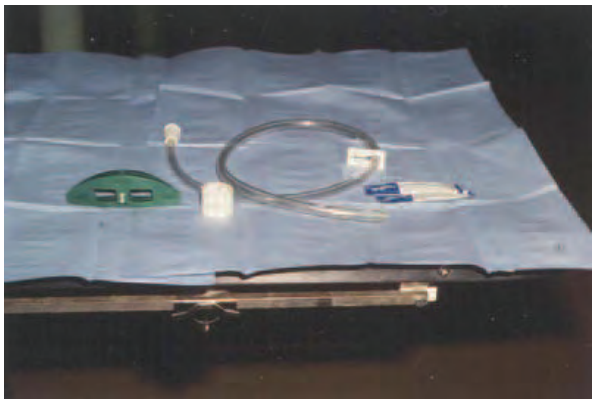

Figure 6. Orogastric tube

Nasogastric tubes used in human patients are not likely to be useful in a dog with GDV as they are too small in diameter. Though NG tubes could possibly be passed through a twisted gastroesophageal junction, the fluid and ingesta usually found in the stomach would not likely be evacuated. The large-bore orogastric tube better allows for removal of such material.

Placement is not difficult though there are a few points to remember. Prior to inserting into the mouth, hold the tube with the tip midway between the last rib and xiphoid process and stretch the tube to the tip of the nose, placing a piece of tape at that point. This landmark will help prevent forcing the tube too far and potentially puncturing the stomach wall. Because the tubes usually are packaged in a coil, the tip of the tube will have curve to it. After liberally lubricating the last four to six inches of the tube, insert the end into the mouth with the curve pointing toward the top of the head as this will help prevent placement into the trachea. The tube should slide easily, at least until it reaches the gastroesophageal junction. If there is any question as to whether the tube is in the esophagus or not, palpate the neck, if two tubes (trachea and orogastric tube) are felt, it is OK. More likely, if the tube is in the trachea, the dog will cough violently. For those inclined, another means to check placement is to suck on the free end of the tube and if able to withdraw air, the tube is probably in the trachea. If the tube is in the esophagus, the suction will pull the mucosa into the end of the tube and obstruct the ability to withdraw air. (A field-expedient Toomey syringe!)

The tube may be difficult to pass into the stomach due to torsion/volvulus of the organ. Do <u>not</u> force the tube in such cases. First, attempt to rotate the tube clockwise and counterclockwise as it is attempted to gently advance it. If this does not work, the dog can be suspended by its front limbs, nose pointed upward, so the dog is in a vertical orientation, and then gently jostled. The weight of the stomach may allow some unwinding of the stomach. This may facilitate enough relief to pass the tube into the gastric lumen. If this maneuver is required, ensure the dog is placed back in lateral/sternal recumbency after the tube is in the stomach. The dog's head should hang off the edge of the table so that if contents are vomited, the HCP can mitigate against aspiration.

Successful gastric intubation generally results in food/fluid filling the tube, depending on the viscosity of the contents. Many times it is required that the HCP suck on the free end of the tube, as in siphoning, to get fluid contents out of the stomach. Most veterinarians who have treated more than a few GDVs have received at least one mouthful of partially-digested kibble in the process. When contents are thick, water can be poured down the tube into the stomach, the tube gently agitated (remem-

bering your tape mark limit) and siphoning continued. The stomach need not be completely evacuated of fluid and food, it just needs to be decompressed enough to allow for cardiovascular stabilization. This stage is reached when heart rate decreases, pulse gets stronger, and the breathing pattern becomes easier. Mucous membrane color and CRT time should also get better or normalize when decompression is sufficient.

Dogs which are not severely depressed will need to be sedated in order to pass an orogastric tube. Diazepam/midazolam can be given alone (0.1 to 0.125mg/kg slow IV) or in conjunction with ketamine.[11] In veterinary medicine, diazepam (5mg/ml) is often mixed with ketamine in equal volumes and given IV to effect. However, veterinary formulations of ketamine are 100mg/ml. If using a benzodiazepine-ketamine cocktail, use a twice the volume of ketamine if using the 50mg/ml form.

If trocharization and orogastric tube placement do not work, the last resort for decompression is a temporary gastrostomy. Such a procedure is not difficult, though it may be daunting depending on the experience and skill level of the HCP. Heavy sedation, and local infiltration of lidocaine at the proposed incision site, or light general anesthesia (ketamine-benzodiazepine to effect as described previously) is required. With the dog in left lateral recumbency, the HCP will ping the right side of the abdomen to insure the gas cap is immediately under the body wall. After shaving and prepping the skin, the HCP will make a 4 to 6cm incision parallel to the costal arch ensuring they are caudal to the last rib (precluding potential pneumothorax). Separate the underlying muscles parallel to the long axis of the muscle fibers using a gridiron technique until through the peritoneum. It is best to use blunt dissection to avoid unintentional puncture of the gastric wall (or possibly spleen), as it should be firmly pressed against the peritoneum. Once through, the HCP will tack the gastric wall to the skin edges using 3.0 suture in a simple continuous pattern. They will then incise into the gastric lumen, being careful not to stand in the way of gastric contents being expelled.

When transporting GDV patients to veterinary facilities via aircraft, it must be remembered that gas-filled viscus will fill with more gas at altitude due to lower atmospheric pressures. Pilots should be alerted to this risk when coordinating evacuation with the unit and should fly as low as the tactical/security situation allows. In such cases, the (sedated) patient should have an orogastric tube placed during transport to avoid further accumulation of gas which can lead to shock, gastric wall necrosis, and death in an otherwise favorable case. If a temporary gastrostomy was performed, then no orogastric tube is needed for transport.

The ECG will oftentimes show ventricular arrhythmias, usually premature contractions and tachycardia. However, most of these arrhythmias seem to occur after definitive surgical treatment.[12] Administration of lidocaine at 1mg/kg slow IV bolus should only be given if the patient is clinically affected by the condition, when ventricular tachycardia is sustained, or if R-on-T phenomenon is recognized.[11]

Heat Injury [11]

Heat stress is not uncommon in the MWD. Dogs do not sweat like humans and particularly when the dogs are working in environments which are very hot/humid, they are at greater risk to become a heat casualty. Even if the dog is not engaged in physical activity, it can sustain heat injury such as being confined in a vehicle without sufficient ventilation/air-conditioning. Dogs new to such environments must have a period of acclimatization, perhaps one to two weeks prior to working full days. As in humans, dogs can have gradations of heat injury which, in its severest form, is deadly. A dog with exertional hyperthermia will pant heavily, but is not dyspneic and can stop panting if an alcohol swab is placed by, or when someone blows into, the dog's nose. The dog will generally be responsive and ambulate normally. Rectal temperatures in these dogs may be up to 106ºF. The dog may also be tachycardic. However, the pulse is strong and steady. In such cases the dog should be given rest in a cool/shaded area, offered water, and reassessed every five minutes. If signs abate, then nothing more need be done.

A diagnosis of heat exhaustion is made when the panting is uncontrolled and rectal temperature is 106 to 108ºF. Dyspnea in the form of noise from the upper airway may be present. Most dogs in this category will be tachycardic with only fair or poor pulse quality. The dog may seem weak. Heat stroke in a MWD will generally show a rectal temperature of over 108ºF, which may be in excess of what the thermometer may be able to register. However, make the diagnosis based on clinical signs, and not temperature alone, as heat exhaustion/stroke can occur at lower body temperatures in some unacclimated dogs. Signs of heat stroke are those of exhaustion with the addition of weakness or collapse, obtunded mental status, muddy (dark) mucous membranes, vomiting, and shock.

The immediate treatment for these conditions is external cooling. Try to decrease stress on the dog with minimal restraint during examination and treatment. The goal is to bring the rectal temperature down to less than 103.5ºF and support hemodynamic stability. External cooling should be accomplished with circulation of air (fans, air-conditioned area), application of isopropyl alcohol to the foot pads/outer (concave) surface of the ears; and place-

ment of ice/cold packs in the axilla and groin. If such means are not immediately available, the dog can be soaked in flowing, cool (not cold) water, though this method is not as effective as those previously mentioned. Cooling should be continued until the temperature is ≤103ºF. Continuation of cooling below 103ºF may lead to hypothermia, so the temperature must be closely monitored. Pulse rate/quality and body temperature should be rechecked every five minutes until the dog maintains a temperature below 103ºF for 20 minutes. Ensure the collar and muzzle do not impede the dogs ability to pant. For the safety of the medical team and handler, the muzzle should generally be left on, though it should be loosened.

Fluid therapy should be added to the treatment regimen whenever heat exhaustion/stroke is diagnosed. Once cooling is started, place an IV catheter (18G, 2" in the cephalic or saphenous vein) and begin rapid administration of a crystalloid at room temperature. Rate of administration should be 20 to 30ml/kg (10 to 15ml/lb) over 10 to 15 minutes. The pulse must be monitored for rate/quality. If the pulse quality is not improved after this bolus, a second may be given.

Due to possibilities of gastrointestinal damage and cerebral edema in heat stroke cases, it is not unreasonable to administer 1gm of cefazolin and 30mg/kg methylprednisolone sodium succinate IV.

Hemangiosarcoma rupture

Splenic hemangiosarcoma (HSA) is a relatively common neoplasia in German Shepherds.[13] This condition also occurs in other MWD breeds. Splenic HSA most often occurs in older dogs (eight to thirteen years of age).[13] Elderly dogs make up a smaller percentage of the MWD population, but they can still deploy if they are clinically healthy and can perform their job to standard. Dogs with splenic HSA can appear totally normal one minute, and hours later be near death due to rupture and hemorrhage of the tumor. The handler may indicate whether the dog has had episodes of weakness followed by normalcy which could be attributed to acute bleeding from the tumor followed by recovery. However, many times there is no previous abnormal history and the dog presents with varying severity of clinical signs ranging from weakness to shock to sudden death in rarer cases. Along with weakness or shock, tachycardia, panting, and abdominal distention are often seen in a dog with ruptured splenic HSA. If the abdomen is distended, ping it to rule out GDV. Hemoabdomen will not produce a resonant ping as gas does in a distended stomach.

Diagnosis is made through history, clinical signs, and physical exam, as well as imaging (see imaging section). If imaging modalities are not available, abdominocentesis with large-bore (16 to 18G, 2") IV catheter can be utilized. In lateral recumbency, infiltrate an area on the abdominal midline at the umbilicus (which is not particularly distinct in dogs) and is about midway between the xiphoid and groin (an inch or two cranial to the prepuce in male dogs), from skin to abdominal wall with a local anesthetic. Use a scalpel blade to make a shallow stab incision, being sure to guard the blade to the estimated distance to the abdominal cavity. Create extra fenestrations in the catheter as described for GDV trocharization and insert it through the body wall in one swift thrust. As with the scalpel blade, guard down on the catheter and stylet so it will just go through the body wall; being careful to prevent a puncture/laceration of the spleen or other viscera with the stylet. Once through, slide the catheter into the abdominal cavity.

Next, place an extension set on the catheter and attach a 35 to 60cc syringe. If able to withdraw blood or bloody fluid easily, the diagnosis of tumor rupture is almost certain, or the catheter has been inserted into either the spleen or major vessel. If no fluid can be withdrawn, the fenestrations may be occluded by omentum, or the amount of fluid in the abdomen is small. In such cases, place a drip set into a bag of crystalloid fluids, attach to the extension set, then run 500 to 1000ml into the abdomen. A minute or so after the fluid is in, attempt to aspirate it out with the syringe, or leave the bag attached and place it on the floor. Be sure to keep a good grasp of the catheter during this procedure to prevent it from slipping out of the abdomen. If blood-tinged fluid is recovered, it is likely rupture of a splenic tumor. Applying a "belly band" around the abdomen theoretically may prevent more blood from a ruptured tumor from accumulating. However, this could also increase resistance to excursion of the diaphragm leading to decreased ventilation. Other than supportive therapy, there is little the HCP can do, short of performing a splenectomy, which is the definitive treatment for this condition. Though dogs surviving splenectomy do very well after surgery, eventual decline and death due to metastatic disease tends to occur within months.[13] Though dogs with a diagnosis of splenic HSA have no future as a working dog, the determination of whether to euthanize the patient or perform splenectomy should lie with, and be performed by the supporting veterinarian.

Envenomation

Through prior medical planning, the HCP will likely already know of potential venomous reptiles and/or arthropods which may be encountered. Antivenin on hand for human patients can be utilized in canine patients, but it may cause anaphylactic reactions and is

many times not required for successful treatment. Antivenin should be used with caution, but should be used when the species of snake is positively known, the specific antivenin for that species is available, and the dog's condition dictates.

A handler may or may not witness their dog being bitten or stung. If they did, they will likely bring this to the HCPs attention quickly. If not witnessed, the dog may present with clinical signs such as swelling, pain, bleeding, tissue necrosis and heat at the envenomation site, shock, vomiting and/or diarrhea, or neurologic abnormalities. In known or suspected bites/stings, be ready to place a catheter to provide cardiovascular support. Fluids can be given as described elsewhere, depending on the dog's physiologic status and fluid availability. If indicated, diphenhydramine (Benedryl®) can be given at a dose of 50mg IV. Broad-spectrum antibiotic such as cefazolin or amoxicillin-clavulanic acid should be given and routine wound care administered.

If antivenin is given, it is imperative the dog be observed for an anaphylactic reaction. Diphenhydramine administration prior to antivenin is suggested. If erythema of the ear edges is noted or the dog starts to rub its face, the MWD is probably reacting to the antivenin and administration should be stopped.[11]

Arthropod bites/stings are many times going to be unnoticed by the handler, unlike a snake bite. Acute swelling of an area without history of trauma could be due to an arthropod bite/sting and should be treated symptomatically. For both snake bites and complicated arthropod bites/stings, transfer the patient to a veterinary facility as soon as practicable.

Ingestion of training aids and finds

To maintain detection proficiency, MWDs must be continuously trained on odor. This training is accomplished using training aids. These aids can be smaller amounts of the actual substance, and though extremely uncommon, MWDs may ingest these aids. Similarly, MWDs could also ingest substances they find on missions. In this article, we are only concerned about explosives, and not drugs, as support of SOF units by drug detection dogs will be very unlikely. However, if such occurs, treat the dog as you would a human patient who has ingested the particular drug.

There is little experience or scientific knowledge regarding explosives ingestion in dogs. Cyclonite, also known as RDX and used as the base in C-4, Semtex and other "plastic" explosives, was identified as causing the illness of at least two police dogs.[14,15]

General treatment for incidences of explosives ingestion is to cause emesis and provide supportive therapy while contacting the supporting veterinary unit for instructions. Cyclonite causes similar signs as strychnine poisoning and may require the use of anticonvulsants such as the benzodiazepines.[15] The handler should know when such ingestion occurs and present the MWD to the HCP quickly after it has happened.

Analgesia, Anesthesia, and Chemical Restraint

All drugs of these categories commonly used by military medical personnel are also used in dogs to greater or lesser degrees. For moderate to severe pain from traumatic injury or other painful incident/condition, morphine and fentanyl can be used. The HCP should rarely face a situation where general anesthesia is required; however, ketamine/benzodiazepine cocktails or propofol can be used in the dog when needed. Such instances may be for emergency temporary gastrostomy (do not use propofol for this procedure due to its hypotensive properties) or when attempted sedation does not allow for procedures needed to save life, limb, or eyesight (never use ketamine in eye cases). Chemical restraint may be needed to perform catheter placement, required examinations in fractious patients, or orogastric tube placement.

Table 2 shows these drugs with dosage and routes. However, as in the human patient, clinical judgment must be made as to which drugs and amounts should be given under the circumstances encountered. If a particular drug would not be given in a certain human patient senario, do not give it to a canine patient in an analogous situation. Drugs should be given "to effect" ensuring any patient and their vital signs are monitored during administration.

Monitoring methods

MWDs should be monitored during any period of heavy sedation/anesthesia and during treatment for emergent conditions. Vital signs can be assessed by standard, low-tech methods such as chest auscultation, manual assessment of the pulse of the femoral artery, mucous membrane color and CRT, skin tenting, rectal temperature, observation of mental state, character of respirations, response to painful stimuli, etc. If available, use of a pulse oximeter, especially one that can show an ECG, is recommended. Problems with using an oximeter/electrocardiograph made for human patients is that it is sometimes difficult to get reliable SPO_2 readings when the standard finger clip is used on anything other than the tongue of a dog, or when ECG pads are placed on shaved skin. However, adhesive ECG leads for human patients can be placed on the dog's footpads to obtain a tracing.[16]

Diagnostic imaging

Some emergent conditions lend themselves to diagnosis with imaging methods that may be available in some units. Though GD/GDV can usually be determined without imaging, radiography will confirm the diagnosis in most cases when the HCP is unsure. If x-ray equipment is available, lay the dog on its right side and make an exposure on the biggest screen available. Center the beam just in front of the last rib. The HCP can use whatever technique with which they are comfortable. Almost any image made on the film will probably give the answer, so a perfect image is not needed. Get the picture and then get back to treating the patient.

Diagnosis of a splenic hemangiosarcoma rupture can be confirmed with application of an ultrasound probe. Though a large spleen with a nodule may actually be seen, it is recommended that if rupture of a splenic hemangiosarcoma is high on the rule out list, simply perform a focused assessment with sonography for trauma (FAST) scan and evaluate for free fluid in the abdomen. If suspicion is high and the scan is positive, the fluid is likely blood and indicates a tumor nodule has probably ruptured.

Radiography and sonography can be applied to the MWD for penetrating or blast trauma as they would be for the human patient.

Images courtesy of http://thehousehound.net/_wsn/page4.html

Dog-Handler bond

It is reasonable to assume that a handler will develop a very strong bond with his dog. Though many officers and enlisted personnel bear responsibility for those that serve under them, the handler's role in the care and preservation of his/her dog is more personal, intimate and demanding. The handler has to do everything for the dog. He has to feed and water the dog, he takes it out to urinate and defecate, he cleans the dog's kennel, and he grooms and bathes the dog. He gives the dog its medications, he takes it to sick call, he provides recreation and exercise for the dog, and in deployed environments, sometimes keeps the dog in his quarters during rest. The dog's ability to perform its role is based almost solely on the training provided by that particular handler. The handler's requirement to do all these things for the dog places the handler in a role similar to that of a parent. Most handlers seem to enjoy being handlers and genuinely love their dogs. Dogs are the non-judgmental confidants of their handlers and they even tell their dogs things they would never tell another person. Dogs usually don't have mood swings and are generally upbeat regardless of what transpires throughout the day.

Though little scientific data exists, it is believable that illness, injury, or death of a MWD would bring considerable stress and sadness to the handler. As such, it would be prudent for medical providers to ensure handlers who have lost their dog, or whose dog is seriously ill or injured, be provided some type of mental health care or grief counseling.

Image courtesy of http://www.uswardogs.org/index.html

Remote veterinary reachback and telemedicine

Anecdotal reports indicate that when local veterinary care or advice is unobtainable when needed, generally when theater communication methods fail, handlers have called their home station veterinary staff for guidance. If this is true, it is hopefully rare. However, the HCP may

wish to have the MWD handlers obtain good contact numbers of home station, or other veterinary offices as appropriate just in case.

Veterinary use of drugs intended for humans

Almost all drugs used in the human patient can be used for similar indications in dogs, though dosages may be very different. An example is the common antibiotic cephalexin. A typical human dose is 500mg twice daily which, assuming the patient was 180 lb (82 kg), equals about 6mg/kg. A typical cephalexin dose in the dog is 20mg/kg two to three times daily. If you guessed that a 90 lb dog would need half that an adult male would, you would be underdosing the dog. Table 2 shows some drugs commonly used in the dog and the human. Doses and routes are based on use described in this article for the canine patient, with comparison for similar use in the human patient.

Table 2. Drugs commonly used in the canine patient

Drug	Dog (MWD)[11,17]	Human (adult male)[18]
Epinephrine	0.02mg/kg IV	0.1mg IV, 0.3 to 0.5mg IM/SC
Diphenhydramine	2mg/kg IM	10 to 50mg IM/IV
Cefazolin	20 to 30mg/kg IV Q8h	250 to 2000mg IM/IV Q8h
Ceftriaxone	25mg/kg IV Q8-12h	1 to 2g IV Q12 to 24h
Cephalexin	20 to 30mg/kg PO Q8 to 12h	250 to 1000mg PO Q6h
Amoxicillin-clavulanic acid*	13.75mg/kg PO Q12h	875mg PO Q12h
Methylprednisolone sodium succinate	30mg/kg IV	up to 30mg/kg IV
Morphine	0.5 to 2.0mg/kg IM/SC Q3 to 4h	5 to 20mg IM/SC Q3 to 4h
Diazapam (IV) / Midazolam (IM or IV)	0.2 to 0.3mg/kg	2 to 10mg / 5mg
Ketamine	5 to 10mg/kg IV/IM	1 to 2mg/kg IV, 3 to 8mg/kg IM
Fentanyl	4 to 10µg/kg IV	50 to 100µg IM
Propofol	3 to 6mg/kg slow IV to effect, then 0.1 to 0.6mg/kg/min	2 to 2.5mg/kg slow IV to effect, then 0.125 to 0.3mg/kg/min IV

*Veterinary formulation of this compound is in a 2:1 ratio of amoxicillin to clavulanic acid regardless of strength; dosage is based on combined quantities of both drugs. Human use formulations have variable ratios of amoxicillin to clavulanic acid and are dosed on the amoxicillin component only.

SOF medical staff training in garrison - Linking with local Army vets at home station

SOF medical personnel in units with organic MWDs, or working with attached MWDs, are urged to contact their unit VCO for training opportunities. Units without VCOs should contact the nearest Army veterinary facility to coordinate MWD care training. SFGA VCOs will come to Battalion/Group Surgeons and PAs for help. Be willing to assist your VCOs with caring for the MWDs.

Retirement and adoption of MWDs

Until November 2000 when Public Law 106-446 (also known as the "Robby Law" for the MWD which spurred its passing) was signed by President Clinton, MWDs could not be adopted after it had been determined that they were no longer able to perform their mission. Since then, however, many MWDs have been able to live out the remainder of their natural lives as pets, usually adopted by dog handlers.

Due to the possibility of adoption, it is reasonable that veterinary and medical personnel attempt to save wounded/injured MWDs which would not be able to perform their mission subsequent to recovery (e.g. amputation, loss of eyesight, etc.).

Veterinary emergency medical library

There are many available texts on the subject of veterinary emergency medicine. The below list is in no particular order, nor are any texts endorsed by the Department of Defense and U.S. Special Operations Command.

- Kirk and Bistner's (2006). *Handbook of Veterinary Procedures and Emergency Treatment*. Ford and Mazzaferro, 8th ed.
- MacIntire et al. (2004). *Manual of Small Animal Emergency and Critical Care Medicine*.
- Battaglia. *Small Animal Emergency and Critical Care*; new edition expected May 2007.
- Hackett and Mazzaferro (2006). *Veterinary Emergency Critical Care Procedures*.
- Mathews. (2006). *Veterinary Emergency and Critical Care Manual*, 2nd ed.
- Wingfield. (2000). *Veterinary Emergency Medicine Secrets*, 2nd ed.

Summary

Military working dogs are valuable partners in the Global War on Terrorism. Veterinary care for these dogs may at times be difficult to obtain, or untimely in its procurement. SOF healthcare providers should have basic knowledge of emergency care principles and treatment in the canine patient so that they may intervene to preserve life, limb, and eyesight.

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Case Report and Review of the Literature of Anterior Thigh Heterotopic Ossification in a U.S. Air Force Special Operations Parachutist

Brian Delmonaco, MD

Abstract

The development of heterotopic ossification (HO), also known as myositis ossificans, after blunt trauma to the quadriceps muscles is a well-described disease in athletes. It is a disease with an interesting and predictable course; it is the unusual case that leads to chronic morbidity or requires surgery.

This report describes a case of HO in a U.S. Air Force Special Operations parachutist following a routine parachute landing fall (PLF) after performing a high-altitude-low-opening (HALO) jump. The literature was reviewed; however, no other reports of HO in the parachutist occupation were identified. The work-up to rule out other diseases, particularly sarcoma of the thigh is reviewed, as well as the recommended management and expected course of the disease.

An interesting exacerbating factor and contributor to this parachutist's injury was the placement of his sunglasses in his anterior distal thigh pocket of his flight suit. While performing his PLF, the parachutist's sunglasses bluntly traumatized the area that subsequently developed HO.

The military parachutist population as well as civilian skydivers are particularly at risk for HO. The third point of contact of every PLF after the feet and lateral calf is the lateral aspect of the thigh. Strong effort to avoid exacerbating the force vectored into the thighs of parachutists by leaving pockets empty should be emphasized prior to any jump.

Delaying surgical intervention until six months is also advised due to the risk of recurrence and exacerbation of the disease if surgery is performed at an earlier time. The majority of those with HO of the anterior thigh simply require supportive care and watchful waiting.

Case Report

A 29 year-old healthy male U.S. Air Force Special Operations pararescueman presented to the flight surgeon's office three weeks after he sustained trauma to his left distal thigh during a PLF following a HALO jump. He complained of left knee swelling and pain, as well as a hard mass in the soft tissue near the superior lateral patella. He reported that he broke his sunglasses, which were in his left thigh pocket of his flight suit when his knee crushed the sunglasses into the ground during his PLF. He remembered that the impact of his sunglasses into his thigh was exactly over the area that developed the mass.

He denied any penetrating trauma or laceration of the skin over the area of impact. He complained of 2/10 knee pain intensity with swelling that intermittently became more severe. At the time of initial exam, he reported that his swelling was not at its worst. He denied any limitation to range of motion. He denied fevers, redness to the knee, chills, weight loss, or other constitutional symptoms. There was no parasthesias, weakness, or other injury.

His past medical history was unremarkable except for a remote history of pneumomediastinum sustained during military dive operations. He had an appendectomy as a child, took no medications, and had no drug allergies.

The patient remained active in the weeks after his injury up until several days prior to arrival for initial evaluation. He continued to train with his team and to participate in athletics to include rock-climbing, but denied further injuries. He requested medical authorization to attend hyperbaric chamber refresher training the day after his initial presentation.

On exam he was afebrile with normal vital signs. He was well-appearing, ambulatory without a limp, in no acute distress. His physical exam was unremarkable except for his left knee exam. The overlying skin was intact; he had full range of motion (ROM) with mild pain at maximum flexion. A moderate, ballottable knee effusion was present without redness. Mild increased

warmth was present. No tenderness to palpation of any of the bony structures, joint spaces, or soft tissue structures was elicited. A hard mass was palpable at the superior lateral aspect of the patella. The mass was nontender, subcutaneous, and mobile, not well delineated but measured at 2x4cm. The remainder of the knee exam was unremarkable. His distal neurovascular exam was intact, and no lesions to the distal leg, feet, or interphalangeal areas were present.

Lab studies were unremarkable:
WBC 4.9, Hgb 14.9, Plt 271, 50.5% neut., 31.3% lymph, 0% mono.
Na 137, K 4.5, Cl 102, CO2 30, Glucose 71, BUN 15.0, Creat 0.9, CA 9.5
ESR 2, Alk Phos 61
Synovial fluid aspirate was without organisms or crystals, gram stain was negative, with only occasional WBCs, and culture was negative.

Plain films showed the left knee with small joint effusion, 2 to 3mm soft tissue calcification, superior to the patella without a connecting stalk. The mass was slightly less dense than adjacent bone.

CT, at five weeks post-date of injury, showed soft tissue edema, a small joint effusion, and no evidence of calcification in or around the knee.

After initial evaluation, HO was suspected given the mechanism of injury, exam, and plain radiograph findings. His risk factors for HO versus other disease included; (1) a history of trauma to the affected site, (2) patient age of younger than 30 years, (3) location of the lesion (anterior thigh), (4) the presence of an intact cortex, and (5) a negative alkaline phosphatase level.[1] Joint sepsis or other infection was unlikely. Osteosarcoma was unlikely although this diagnosis required close attention with further evaluation and radiography at several months post-date of injury.

He was prescribed Celebrex® as needed for pain and instructed to resume activities as tolerated. Specifically regarding his planned dive in the hyperbaric chamber, he was instructed not to dive until resolution of his joint pain. Although the hyperbaric environment is not expected to adversely affect patients with HO, it may be difficult to ascertain if knee pain after a dive is secondary to decompression sickness (DCS) or simply pain from HO.

The patient used Celebrex® three to four times a week for the first week, and then declined further analgesia. He successfully completed his hyperbaric chamber dive one week after diagnosis. At two months post-date of injury, the patient reported 0/10 pain. Serial re-examinations showed his effusion to improve but persist, with no redness or warmth. The mass was no longer palpated. A repeat CT scan showed no soft tissue calcification, minimal edema, and no mass.

Discussion

HO is well described in athletes. A three-year study of 117 West Point cadets with quadriceps contusions acquired during athletics showed a 9% rate of HO development. Risk factors thought to contribute to HO were: (1) knee motion less than 120 degrees, (2) injury occurring during football, (3) previous quadriceps injury, (4) delay in treatment greater than three days, and (5) ipsilateral knee effusion.[2] Other studies of cadets have found a 20% rate of HO development after quadriceps contusions. Another risk factor well-identified in HO patients is a concomitant spinal cord injury.

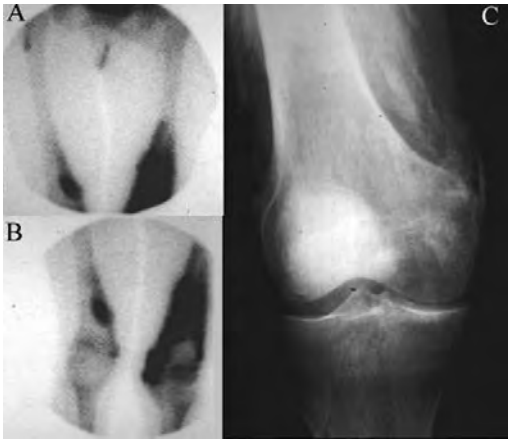

Figure 1. HO in left knee as seen on bone scintigraphy and plain radiography.

HOs prevalence in parachutists is unknown. The case of HO after a normal PLF in this U.S. Air Force Special Operations pararescueman was exacerbated by the impact of his sunglasses into his distal thigh. This patient's risk factors included a delay in treatment greater than three days and an ipsilateral knee effusion. The radiograph in Figure 1 shows soft tissue calcification similar to the subject patient's radiograph.

The course of the patient in this case was typical. He developed no complications or chronic morbidity. He required no surgery. Follow-up evaluations showed nearly complete resolution of symptoms and pseudo-normalized radiographs at eight weeks post injury.

Unfortunately initial evaluation of this patient occurred three weeks after the date of injury. The early treatment of simple quadriceps contusions is thought to be beneficial in order to prevent complications such as HO and to provide for an early return of patients to nor-

mal activities. Early efforts to reduce thigh hematoma formation with the RICE regimen (rest, ice, compression, and elevation) are advised. Non-contact activities should be prescribed. Other treatments for quadriceps contusions and strains include several days of immobilization in 100 to 120 degrees of flexion, followed by closely observed range of motion exercises and heat therapy. Athletes may return to normal activities in two to three weeks after quadriceps contusions if their evaluation and management begin in the early stages.[2,3]

Other important diagnoses to consider in a patient with suspected HO include: (1) osteosarcoma, (2) chronic osteomyelitis, (3) deep venous thrombosis, (4) diabetic muscle infarct, (5) hydroxyapatite deposition disease, (6) pyomyositis, and 7) tumoral calcinosis. In this patient, a lab study that was not performed but which may be helpful to exclude infection is a serum C-reactive protein (CRP) level. An initial ultrasound was also not performed but these can help identify early HO. The ultrasound will show a disorganized pattern typical of early HO. Both CRP level and ultrasound can be followed serially to advance or exclude the diagnosis.

The radiologic modality of choice to diagnose HO and exclude osteosarcoma is not clearly identified in the literature. Options include plain radiograph, ultrasound, bone scan, CT scan, CT-enhanced arteriogram, and MRI. In a patient with a history and physical consistent with HO, a combination of serial radiographs with a CT, MRI, or bone scan at one to two months post injury is advised.[4]

Surgical excision of HO is not advised until 6 months after injury.[1] Earlier surgical intervention may be a disaster in some cases since HO may return in a more aggressive manner and increase the patient's disability.

Summary

Heterotopic ossification was diagnosed in the distal left lateral thigh of a U.S. Air Force Special Operations Pararescuemen after a PLF which was complicated by blunt trauma to the thigh from sunglasses in his flight suit pocket. HO can occur at a nine to twenty percent rate following quadriceps muscle injuries in athletes. The prevalence of HO in parachutists is unknown at this time, but the disease can be expected given the nature of PLFs.

Risk factors for HO in a suspected case should be elicited. Other important diagnoses such as osteosarcoma must be excluded.

A two to four-month recovery period is predicted in a patient with HO and may be improved with the use of NSAIDs. Occasionally surgical excision is required but is not advised until six months after HO development. Repeat radiography at time of HO maturation is important to exclude other diagnoses and to document disease progression or resolution.

Pre-jump emphasis to parachutists is advised to avoid, if possible, carrying objects in thigh pockets. Soon after a quadriceps injury sustained during parachute operations, a patient should seek medical care to minimize recovery time and the risk of HO complications. After HO develops, restriction of flying and parachute activities may be necessary. Specifically dives in the hyperbaric chamber should be restricted to avoid confusion with DCS.

Author's Notes: Permission to include patient's medical report has been secured by the author from the patient.

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Force Health Protection in U.S. Army Special Operations Forces

Lisa Forsyth, MS

Abstract

The ultimate goal of USASOC Force Health Protection programs is health sustainment of Army Special Operations Forces. Preventive medicine officers, environmental science officers, and preventive medicine Soldiers remain the cornerstone in providing health sustainment to ARSOF Soldiers. The lack of doctrine and understanding of preventive medicine core competencies may result in a degradation of unit medical readiness and individual health sustainment.

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The U.S. Army Special Operations Command (USASOC) deploys on average over 8,000 Soldiers and civilians for worldwide special operations, across the full range of military operations, in support of regional combatant commanders, American ambassadors, and other agencies as directed. In essence, one quarter of the force is deployed on any given day. Deployment frequency and extreme operational environments require a proactive force health protection (FHP) program to maintain healthy, fit Special Operations Forces (SOF). Force health protection assets are located throughout the command, but very little understanding within USASOC exists of core competencies, capabilities, and employment of those assets. The purpose of this article is to outline USASOC FHP assets and to propose a list of FHP core competencies in support of SOF missions.

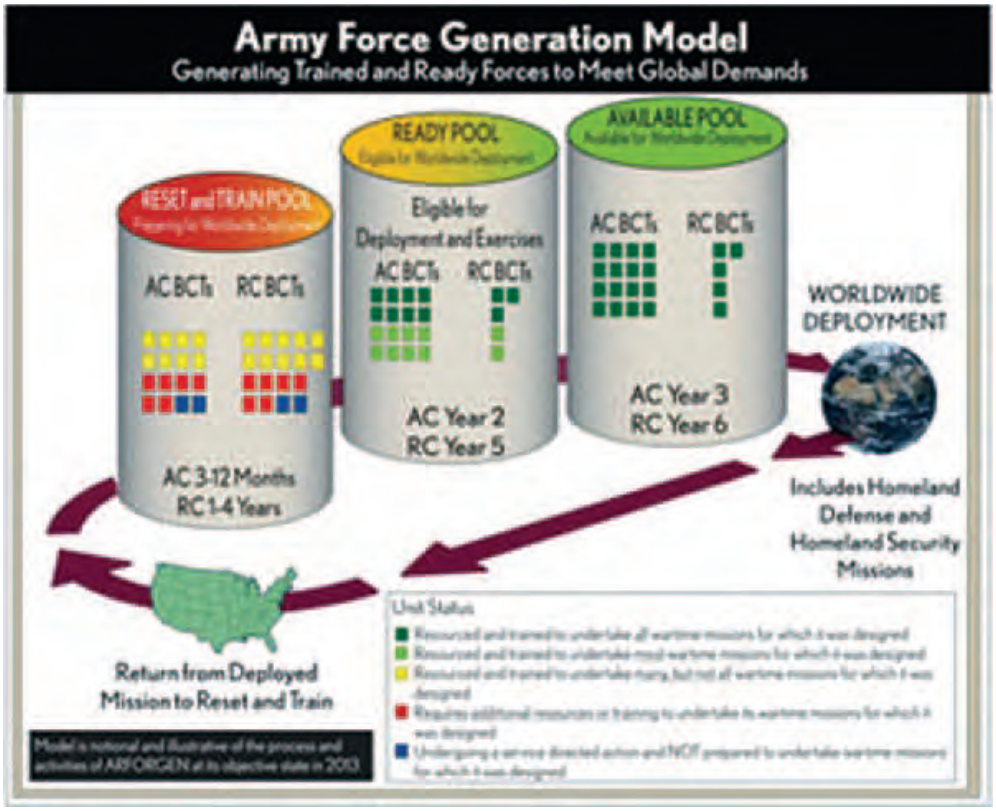

Figure 1 Army Force Generation Model

In accordance with the Army Force Generation Model (ARFORGEN), active forces would be home for two years and then available for deployment in the third year. The Army Reserve would have its Soldiers home for four years and then available in the fifth year. The Army National Guard would have its Soldiers home for five years and then available in the sixth. The ARFORGEN model creates operational readiness cycles wherein individual units increase their readiness over time, culminating in full mission readiness and availability to deploy.

Figure 2 Global SOF Posture (GSP) Model

Despite the model, the current time between deployments in the active force is approximately one year.[1]

In comparison, Army Special Operations Forces Generation (ASOFGEN) is a capability-based readiness assessment. Mission requirements are synchronized with the Global Special Operations Forces Posture (GSP), with teams available when they have the personnel, equipment, and training required for their specific mission. According to this model, teams will deploy for one six-month deployment every two years into a given theater. As end strength increases, USASOC will progress towards the ASOFGEN model. This model is based on reaching an objective state in 2010 with each Special Forces Group having four battalions from one Group deployed in support of the Central Command area of operations.[2]

In reality, teams now deploy for seven months followed by six months at home station. Unlike the conventional Army force, with a one year recovery cycle, Army Special Operations Forces (ARSOF) has a six-month, compressed recovery/refit cycle. During this period ARSOF completes post-deployment activities, block leave, and sends equipment to the depot and Soldiers to school. Often pre-deployment activities for upcoming missions occur shortly after completing the previous post-deployment requirements. Within USASOC, the use of smaller military units enhances the importance of the individual. Therefore, a reduction in individual medical readiness translates into a significant decrease in operational efficiency of the unit. Maintaining health sustainment of an individual over multiple deployment cycles increases in importance, and this poses a challenge.

The 2003 Force Health Protection Capstone Document provides the vision for FHP and introduces the concept of life-cycle health maintenance programs for human weapons systems.[3] Recent Department of Defense, De-

Table 1 Initial Assessment of USASOC FHP Programs, October 2006.

	USASOC FHP Assessment			
	Readiness Rating			Solution
Army Domain	Green	Amber	Red	
Doctrine		X		Update USASOC FHP Regulation; review and provide input to Army, Joint, and USSOCOM FHP regulations
Organization		X		Review current organizations and provide recommended changes; strengthen ties with SOF, ARMY, Joint, and Interagency organizations
Training			X	Develop PRVNT MED core competencies and mandatory sustainment training
Leader Development			X	Dev. & submit for approval ASI awarded to AMEDD officers with SOF experience; enlisted are eligible for "S" ASI
Materiel		X		Provide SME input to development of SKO, validate PRVNT MED equip on SOF peculiar list and move to Big Army if applicable
Personnel		X		Re-assess PRVNTMED personnel positions (AOC/MOS and rank structure) to ensure USASOC has the right number and mix of PRVNTMED personnel
Facilities	X			No SOF specific facilities need at this time
Validation			X	Update OIP checklist to reflect changes in USASOC FHP Regs/policies

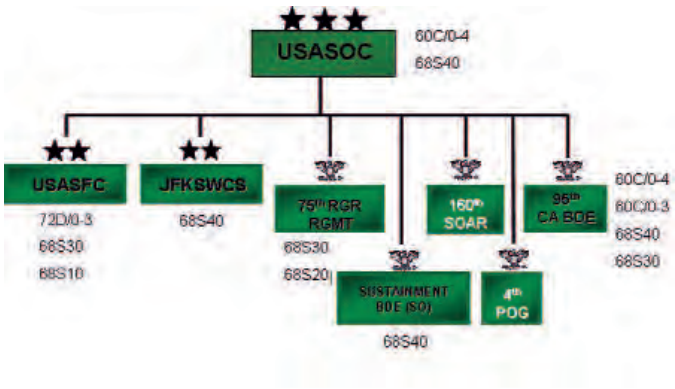

Figure 3 U.S. Army Special Operations Organizational Structure

partment of the Army, and USASOC FHP policies and regulations place a greater emphasis on medical readiness, health surveillance, and other FHP programs. Components of a FHP program include a medical surveillance system involving the ongoing collection and analysis of uniform information on deployments (pre- and post-deployment health assessments), recognizing and assessing potentially hazardous occupational and environmental health exposures and conditions, employing specific preventive medicine countermeasures, monitoring of real-time health outcomes, and timely reporting of disease and non-battle injury (DNBI) data.[4] Preventive medicine personnel within ARSOF oversee and execute FHP policies and programs and monitor medical readiness.

The USASOC Surgeon's Office strategic meeting in October 2006 provided an opportunity to conduct an initial assessment of the USASOC FHP programs across the doctrine, organization, training, leader development, materiel, personnel, and facility (DOTLMPF) process. This assessment identified several shortfalls as depicted in the table below.

In February 2007 the USASOC Surgeon's Office sponsored a preventive medicine workshop attended by 23 USASOC preventive medicine professionals representing various major subordinate commands and units. The purpose of the workshop was to further assess USASOC FHP programs across the DOTLMPF process with specific emphasis on personnel and leader development.

Table 2 USASOC Preventive Medicine Core Competencies

	SOF MISSIONS								
PRVNTMED CORE COMPETENCIES	IO	FID	SR	DA	UW	CT	CA	PSYOP	CP
Medical Readiness	**CONTINUOUS: GARRISON MISSION**								
Environmental Health Surveillance		X	X	X	X	X			
Field Food/Water Vulnerability Assessments		X			X				
Vector Control		X	X		X		X	X	
Medical Civilian Support		X			X				
Medical Intelligence/Information	X	X	X	X	X	X	X	X	X
Humanitarian Assistance/Disaster Relief		X	X		X		X	X	
Inter-Agency Support/Coordination	X	X	X		X		X	X	X
Field Sanitation		X	X	X	X	X	X	X	
Training	X	X	X	X	X	X	X	X	X
Support to Detainee Operations		X			X		X		
Public Health	X	X			X		X	X	
Risk Assessment/Risk Communication	X	X	X	X	X	X	X	X	X
Occupational Environmental Health Surveillance	X	X	X	X	X	X	X	X	X

LEGEND:

IO	**Information Operations**
FID	**Foreign Internal Defense**
SR	**Special Reconnaissance**
DA	**Direct Action**
UW	**Unconventional Warefare**
CT	**Counter-Terrorism**
CA	**Civil Affairs**
PSYOP	**Psychological Operations**
CP	**Counter Proliferation**

The diagram to the left depicts the USASOC organizational structure. Preventive medicine assets (60C, Preventive Medicine Officers; 72D, Environmental Science Officers; and 68S, Preventive Medicine Soldiers) exists in every major subordinate command and major subordinate unit (MSC/MSU), except for the 4th Psychological Operations Group (4th POG) and 160th Special Operations Aviation Regiment (160th SOAR).

Throughout the workshop participants asked several questions. First, does USASOC have the optimal mix of preventive medicine assets? Based on mission analysis and review of organizational manning documents, the USASOC Surgeon's Office submitted recommendations to increase Environmental Science Officers (72D) authorizations in the USASOC Surgeon's Office, U.S. Army Special Forces Command, and 95th Civil Affairs Brigade. The preventive medicine officer and preventive medicine Soldier authorizations were deemed adequate. Second, are the current authorizations filled? In October 2006 the 25 preventive medicine enlisted authorizations were 76% filled. In March 2007, the percent fill increased to 84% despite an increase in authorizations due to transformation. The positive change in percentage is attributed to a concerted effort to increase awareness of USASOC preventive medicine programs and personnel requirements in the Army Medical Department (AMEDD), Human Resources Command (HRC), and USASOC enlisted management. Current recruiting efforts are on-track and are effective.

The workshop participants also looked at increasing the awareness of preventive medicine assets and capabilities with the units. Keeping the unit commanders and staff informed is the responsibility of unit preventive medicine assets. A lack of understanding in FHP programs and preventive medicine assets resulted in a migration away from FHP core competencies. The risk is a degradation of unit medical readiness and individual health sustainment. A welcome letter for new commanders, primary staff members, and subordinate medical staff outlining unit preventive medicine assets and capabilities is an effective communication tool. Also, it is important to incorporate the importance of FHP programs and preventive medicine assets in other venues, such as the pre-command course, the USASOC Orientation Course, and the Special Operations Medical Indoctrination Course.

Current doctrine does not delineate preventive medicine core competencies and application of preventive medicine skills to support Special Operations' missions. The workshop participants developed a core competency table for consideration into doctrine to increase awareness, and to assist in the mission planning process.

Further work is required to develop doctrine outlining FHP requirements and mission sets. Doctrine must also include requirements for sustainment training and identify existing training venues. Doctrine and training will focus USASOC preventive medicine assets on core competencies to support SOF missions.

The next USASOC preventive medicine workshop is schedule during the Annual Force Health Protection Conference, 5 August 2007, in Louisville, Kentucky.[5] This workshop will build on the products developed during the February workshop and will specifically focus on desired capabilities and preventive medicine equipment sets. This forum will also provide an opportunity to discuss pertinent preventive medicine issues at each MSC/MSU. The target audience is USASOC preventive medicine officers, environmental science officers, and preventive medicine NCOs.

In summary, preventive medicine officers, environmental science officers, and preventive medicine Soldiers remain the cornerstone in providing health sustainment to ARSOF Soldiers. Doctrinal changes are required to reflect identified core competencies and training requirements. Improving commanders' awareness of existing preventive medicine assets will enhance the units' medical readiness and will improve mission planning. The ultimate goal of USASOC FHP programs is health sustainment of ARSOF throughout the deployment cycle and the service members' life cycle.

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Moderate to Severe Traumatic Brain Injury From the Battlefield to the Community

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Abstract

Traumatic brain injury (TBI) has been recognized as one of the signature injuries of recent warfare. Tactical combat casualty care (TCCC) plays an integral part in triaging and treating combat wounded troops including Special Operations Forces with TBI and other life threatening injuries. Patients with the most severe brain injuries require rapid evacuation from the battlefield to emergency medical centers capable of providing computerized tomography (CT) imaging, intracranial pressure (ICP) monitoring and ongoing neurological care. Medical treatment to manage brain injury is often provided in tandem with lifesaving surgery and immediate medical services for other injuries. Once stabilized, servicemen with TBI enter a continuum of care which extends across the globe. Joint military and VA trauma and rehabilitation teams work to ensure the best possible outcomes for patients with brain injury. Military and VA medical centers have established new systems of care to help treat increasing numbers of troops with TBI and community-based care and reentry programs help patients with moderate and severe TBI adjust to physical and cognitive changes allowing them to live meaningful and productive lives.

Objectives

TBI can significantly impact an individual's overall health and future independence. Special Operations medics are treating increasing numbers of troops with traumatic brain injury. The goal of this article is to provide a broad overview of TBI occurrence, treatment, and care within military and VA systems. Within this context, the authors describe several strategies for the assessment and management of moderate and severe TBI, with an emphasis on closed brain injuries and its occurrence on the battlefield. This includes resources to support a recovery trajectory as well as the continuum of care which supports critically wounded TBI patients who require comprehensive and intensive rehabilitation efforts. This information should not be viewed as a clinical practice guideline addressing all aspects of care, but rather as a general overview for medics and corpsmen who wish to increase their understanding of TBI. After reading this article, readers should be able to:

1. Describe important steps in assessing and managing acute TBI on the battlefield.
2. Describe the military and VA resources available to assist soldiers with TBI and their families.
3. Understand the potential outcome of acute TBI and its relationship to early diagnosis and treatment.

Future articles may further explore brain physiology and the techniques mentioned within and/or the identification and treatment of mild TBI which is an increasingly pervasive problem in military settings.

Background

Traumatic brain injury (TBI) has been recognized as one of the signature injuries sustained by service members wounded in Afghanistan and Iraq.[1,2] Understanding TBI assessment, treatment, and risk factors is essential for medics and corpsmen that operate in remote areas. Any delay in emergency treatment can reduce the chance for optimal recovery and survival following traumatic brain injury.

Once medically evacuated, services for patients with TBI include acute medical treatment, rehabilitation, and ongoing TBI care in community settings. These services are provided in part by clinicians at the Defense and Veterans Brain Injury Center (DVBIC) who work in partnership with military and VA polytrauma centers throughout the country. The DVBIC is a tri-service DoD/VA congressionally mandated organization that comprises three military treatment facilities (Walter Reed

Army Medical Center, Wilford Hall Medical Center, and National Medical Center San Diego), four VA polytrauma centers (Minneapolis VA, Palo Alto VA, Richmond VA and Tampa VA), as well as two community reentry civilian facilities (Lakeview Virginia Neurocare and Laurel Highlands Rehabilitation Center). The DVBIC at Walter Reed Army Medical Center screens all medically evacuated service members from Iraq and Afghanistan who have been injured in explosions or other events known to cause head injury. The relatively large number of TBI patients seen at WRAMC may be the result of several factors, including careful screening, medical advances, and the rapid triage and transport evacuation system.[2]

Traumatic Brain Injury

Traumatic brain injury is defined as a blow, jolt, or other injury to the head that disrupts the functioning of the brain. A TBI occurs when an external force applied to the brain is significant enough to alter neurological functioning or consciousness. Previous studies on the residual effects of TBI resulting from combat, identified as early as World War II, focused on *penetrating* brain injuries which were a significant cause of morbidity at that time.[3] Over the last 15 years, between 14 and 20% of surviving casualties of armed conflicts have sustained a TBI.[4,5] While changing medical practices and varying research methodologies make it difficult to compare actual TBI rates with past wars, it is believed that a greater number of brain injuries, which occur in theatre today, can be categorized as closed TBI.[2]

The causes of brain injury in combat include exposure to blasts, falls, gunshot wounds and motor vehicle accidents. These mechanisms impact the brain with varying levels of force. The resulting injuries can be either localized (confined to one area) or diffuse (impacting many areas of the brain). Individual physical characteristics combine with these varied mechanisms to yield unique sequelae which affect multiple systems. To help distinguish these effects, an initial classification is made between penetrating and closed brain injuries. Any injury which involves the penetration of a foreign object, munitions fragment, bone chip, etc., through the dura mater, which covers the brain, is called a penetrating brain injury. Conversely, a brain injury that does not penetrate the dura is considered closed. The pathophysiology of closed TBI differs in many ways from penetrating TBI; however, the damage to the brain can be equally severe. The following classification system is used to determine the severity of injury related to blunt force trauma / closed TBI.

TBI Severity Indicators

The severity of injury can be determined by comparing three indices: The overall Glasgow Coma Score (GCS); the length of loss of consciousness (LOC); and the amount of post traumatic amnesia (PTA). Though sometimes difficult to assess in an austere environment, this information can help to classify the severity of injury ranging from mild to moderate to severe. Mild TBI (mTBI) is characterized by a LOC of less than an hour, a period of posttraumatic amnesia that resolves within 24 hours, or a GCS score of 13 to 15.[6] Moderate TBI is indicated by LOC that lasts between one and twenty-four hours, PTA for more than 24 hours (but less than seven days), or a GCS score between nine and twelve. A severe TBI is classified by LOC longer than 24 hours, PTA greater than seven days, or a GCS score between three and eight.[7] When severity indicators are inconsistent, the most severe characterization is used. It is uncommon for all indices to be reported or available. Any one of them alone can qualify to assign severity of injury.

Severity of Traumatic Brain Injury Rating Scale:

Severity	GCS	LOC	PTA
Mild	13 to 15	<1 hr	<24 hr
Moderate	9 to 12	1 to 24 hrs.	24 hrs. to <7days
Severe	3 to 8	>24 hrs.	7 days or more
GCS = Glasgow Coma Scale			
LOC = Loss of consciousness			
PTA = Posttraumatic amnesia			

Symptoms may vary between each level of severity. Mild cases of TBI are indicated by a brief change in mental status or consciousness which may be followed by temporary symptoms associated with concussion such as headache, dizziness, and memory problems. The symptoms of mild TBI generally resolve in a short period of time but require patients to limit their activity to prevent

further injury or harm to others. This is particularly true of military populations whose occupational activities are more rigorous and place them at greater risk of re-injury than civilian populations.

Moderate brain injuries are associated with longer periods of LOC or PTA which follow the traumatic event. Patients with moderate TBI may experience a variety of symptoms including mood and memory disturbances, and physical and emotional problems which may persist for months. Moderate TBI may require increased levels of medical intervention to allow patients to return to their maximal level of functioning. There is a greater incidence of disability among those with moderate brain injury than those with milder injuries.

A severe TBI most often results in long-term problems with independent functioning and can result in moderate to severe disability in some patients. Patients with severe brain injury have more significant impairments and thus the cognitive, physical, and emotional symptoms are more pronounced, may compound one another, and may complicate the delivery of needed treatment. Since severe TBI frequently occurs with other traumatic injuries, comprehensive nursing care and ongoing rehabilitation are usually required. Optimal recovery from severe TBI relies on early intervention, rapid evacuation, and ongoing specialized treatment in acute settings.

The complexity of severe TBI requires a multi-disciplinary approach to care. Neurology, psychiatry, neuropsychology, physical and rehabilitative medicine, and neurosurgery comprise the core disciplines needed for initial treatment of severe TBI. However, many ancillary services and therapies are required early on as well. Comprehensive care and rehabilitation can include physical therapy, occupational therapy, audiology, optometry, cognitive rehabilitation, behavioral therapy, and case management. The level of recovery from TBI is highly variable; however, prognostic indicators have been identified which help to guide clinical practice and recovery. While the long-term effects of acute brain injury may be significant, there is often potential for considerable improvement which allows patients with brain injury to lead meaningful and productive lives.

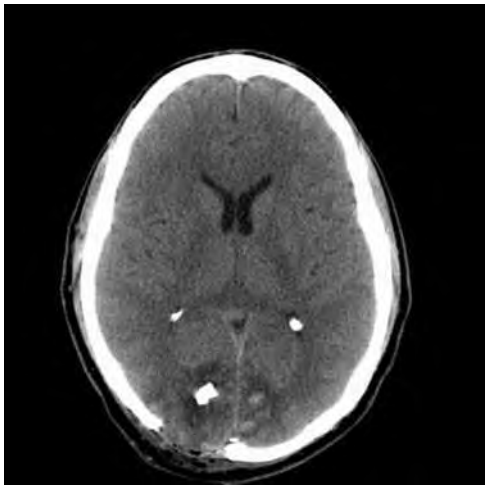
TBI Sustained in the Theatre of Operations

Improvements in protective body armor have reduced the threat of penetrating wounds; however, explosive attacks continue to place troops at high risk for traumatic brain injury. The blast itself can cause injury through multiple mechanisms. These mechanisms may include direct exposure to the over-pressure wave of the explosion which can impact the body at a velocity greater than 300m per second, equal to the speed of sound in air, causing primary blast injury. This impact may rapidly compress air-filled organs and/or displace the entire body. Secondary blast injury may then be caused by the energized (projected or falling) debris or explosive fragments which impact with the head. Tertiary blast injury may also occur as the displaced body impacts the ground, a wall, or any other object. Finally quaternary injuries may occur through the inhalation of gases or other toxic substances.[8,9] Individually, these mechanisms can compromise the brain resulting in significant physical, cognitive, and neuropsychiatric impairment. Together, they can cause severe TBI along with any number of other injuries such as burns, abdominal wounds, or limb amputation.

Special Operations Forces also share the risk of TBI associated with more traditional means of warfare as well. Motor vehicle accidents can result in blunt force trauma to the head in which the brain impacts the rigid interior of the skull. Gunshot wounds can be lethal although advances in helmet design are reducing the risk of penetrating injuries and increasing survivability when they do occur.

Unlike closed TBI, penetrating brain injuries occur when a projectile or fragment lacerates and destroys brain tissue. Bullets and other high-velocity objects create centrifugal forces and "shock waves" within the brain that can create a cavity many times greater than the diameter of the missile itself. Though this cavity is reduced in size once after the projectile transverses the brain, the tissue that was compressed during cavitation remains injured.[10]

Helmets outfitted with shock absorbing pads provide ballistic protection for the head by allowing room for cavitation caused by blast forces and projected fragments. More importantly, increased comfort makes it more likely



Head CT scan of penetrating brain injury. Lower white mass indicates intracranial bone fragment. Also visible is opening / skull fracture.

that the helmet will be worn and remain firmly on the head. The CT scan shown below illustrates a penetrating head wound caused by a bullet in which the missile velocity was reduced. Traumatic brain injury caused by blast and gunfire in which the head is unprotected is likely to be much more severe.

Forward Medical Assessment and Treatment of Acute TBI

Tactical combat casualty care (TCCC) plays an integral part in triaging and treating combat wounded with life threatening injuries. Special Operation Forces may be at increased risk for sustaining critical injuries due to the high risk nature of their missions worldwide. The *Guidelines for the Field Management of Combat-Related Head Trauma*[11] were formulated to provide a best-evidence document to address the specific needs of assessing and managing head injury in an austere environment. The guidelines address three main areas: assessment, treatment, and triage/transport decisions. The template to create these guidelines was the Guidelines for Pre-Hospital Management of Traumatic Brain Injury. Similar content areas are discussed in both documents; however, operational concerns are incorporated into the field guidelines which have more relevance for the military community.

Assessment of a head trauma casualty in theatre should include oxygenation and blood pressure evaluation. Neurological assessment should include obtaining a GCS score as well as the assessment of pupils. A single episode of hypotension can worsen the outcome of a severe TBI by causing secondary ischemic insults to the brain.[12] Support of arterial blood pressure is a central tenet of TBI management as hypotension is a powerful predictor of outcome and the only one of the five prognostic indiciators that is responsive to therapy.[12] Therefore, avoidance of hypoxemia and hypotension are two primary goals of care in the immediate post-injury period. Pulse oximetry should be used as soon as it is possible within the evacuation chain. Oxygen saturations below 90% should be addressed as soon as resources and the tactical situation allow; and hypotension, defined as systolic blood pressure below 90mmHg, should be avoided. Adequate cerebral perfusion is important in stabilizing a head trauma casualty. Cerebral perfusion is partly based on an adequate systemic blood pressure.

Comprehensive neurological assessment in the field may be difficult to perform. However, GCS score and pupillary assessment should be done by direct clinical examination by a far forward first medical responder as soon as tactically possible. GCS score and pupils should be reassessed prior to the service member moving to the next level of care.

Treatment in the field may consist of airway stabilization, fluid resuscitation, pain management, and brain specific therapies. Airway management is critical in the TBI patient because of the risk of loss of consciousness impacting the ability to protect one's airway. In addition, because the brain does not store oxygen and glucose, the two fuels needed to function properly, the need to maintain adequate cerebral perfusion requires constant oxygenation. Airway, ventilation, and oxygenation are thus crucial. Intravenous fluids may be used to ensure an adequate systemic blood pressure. However, there is inadequate clinical outcome data to support one resuscitation fluid choice over another in the TBI patient. Hypertonic saline and colloids offer logistical advantages over isotonic crystalloids in an austere environment.

Pain management in the TBI patient is difficult because of the desire to preserve a reliable neurological exam. The use of sedatives and analgesics in the TBI patient may cloud or hamper efforts to obtain the best GCS score. The Guidelines[11] suggest refraining from administering analgesics for short periods of time in the field, where monitoring is unavailable, to TBI patients who are unable to provide a pain assessment. Brain targeted therapies, such as Mannitol or hypertonic saline are appropriate in the presence of brain herniation. Herniation is the abnormal protrusion through a natural opening. Brain herniation occurs when the intracranial pressure escalates to a point that the brain tissue, due to increased intrracranial pressure (ICP), will protrude through the foramen magnum, thus compressing the brainstem. Some indicators of brain herniation may include an unresponsive (no eye opening or verbal response) casualty with unilaterally or bilaterally dilated unresponsive pupils or asymmetric pupils as well as a motor response of abnormal extension (decerebrate or decorticate posturing – they indicate completely different levels of brain injury) or no motor response to painful stimulation.

Triage and transport decisions are based on the tactical environment in which the injury has occurred. Patients with a GCS score between nine and thirteen should be evacuated from the field; however, this can be delayed when an emergent evacuation for a patient with a lower GCS score between three and eight is required. Severe TBI patients, as defined by a GCS score between three and eight, are the most critical. Decisions should be made with caution about those who are considered expectant. GCS scores obtained during an acute evaluation, may overestimate the severity of intracranial injury. Additionally, GCS data may underestimate the capacity for recovery of war fighters, a population who, at baseline, is likely younger and more- fit than the average civilian patient. Depending on available resources and tactical considerations, every

effort should be made to evacuate troops with severe TBI immediately.

In the severe TBI population, there are certain prognostic indicators for recovery that have been studied and reported out in the literature. They include GCS score, age, pupillary diameter and light reflex, hypotension, and CT scan findings.[11] If the GCS score is reliably obtained, i.e., in the absence of hypotension, paralytics, or positive toxicology screen, approximately 20% of those with a GCS score of three or four will survive and eight to ten percent will have a functional outcome. In terms of age, children have better outcomes than adults. There is a significant increase in bad unfavorable outcomes above 60 years of age. In performing a pupillary assessment, hypotension and hypoxia should be corrected before using the pupils as a prognostic indicator. The duration of pupillary dilation and fixation should be documented for outcome. A fixed pupil is defined by the absence of constrictor response to bright light. Hypotension, which has been mentioned previously as an important index to correct, is a powerful predictor of outcome and the only one of the five factors that is responsive to therapeutic, non-surgical interventions. The findings on head CT scan are important to assess for prognostic values. The presence or absence of intracranial lesions, the status of the basal cisterns, and presence of a midline shift greater than 1mm are all important indicators of the severity of injury and the likelihood of recovery.

Far forward medical assessment and treatment of moderate and severe traumatic brain injury is crucial to the survivability and recovery of the combat wounded war fighter. The evidence-based guidelines discussed above offer sound recommendations to medics and corpsmen as they care for the most severely injured. Rapid interventions to promote oxygenation and stabilize blood pressure are essential. These injuries also require astute assessments with sound clinical judgment from the earliest stages. Unfortunately, variable medical assets and uncertain tactical environments sometimes complicate the delivery of such care for the severe TBI patient. In situations where an acute TBI may have been missed, it is important to conduct a neurological assessment and provide treatment as soon as possible. Delays in the initial treatment of brain injury reduce the chances for optimal recovery.

Moderate and Severe TBI Care at Military Treatment Facilities

The moderate TBI patient may require a broad continuum of care. While there are evidence based guidelines for the care of the severe TBI patient[7] there are no national standards or guidelines developed for the care of the moderate TBI patient. Individual injury characteristics influence the level of care and amount of resources necessary to optimize ultimate functional status. As with the severe TBI patient, optimizing blood pressure and oxygenation is crucial in the acute stages of injury. It is also important to conduct frequent neurological assessment to detect any subtle changes in level of consciousness or coma. The moderate TBI patient may or may not be in a coma.

One of the hallmark features of patients who incur a moderate TBI is agitation.[13] Therefore, sedation is sometimes necessary to control extreme agitation that may be harmful to the patient. In addition, environmental and behavioral strategies may be employed to help decrease agitation in a moderate TBI patient. Sedation use in traumatically brain injured patients can impose difficult clinical implications if the neurological exam is altered. Therefore, behavioral strategies such as the establishment of sleep/wake cycles, reorientation to self, place, and time, as well as implementing a structured schedule, may all be of benefit when trying to manage agitation.[14] In addition, environmental strategies such as the regulation of auditory, sensory, and tactile inputs, in a patient who may not be able to process all inputs, may be of benefit. Removing noxious stimuli for this patient population is also helpful. Limiting external stimulation such as the television, radio, and other sensory irritants may also help decrease the outward signs of agitation commonly found in the acute care setting. The therapeutic regiment for the management of agitation should be tailored to the individual needs of the patient with consideration of the external environment.

The severe TBI patient may require complex interventions to help facilitate recovery. Control of increased ICP should be the main focus of care. There are medical and surgical treatment strategies that are specifically aimed at the preservation of oxygen and glucose delivery to the brain. In addition, because the skull is a rigid, fixed vault there is little additional room for expansion and compliance when the brain swells after injury. Therefore, monitoring and treating ICP after severe brain injury is paramount. Surgical treatments to combat increased ICP may involve a craniotomy or craniectomy. Both procedures may decrease ICP by addressing the expanding lesion, whether it is a hematoma, contusion, or edema. During craniectomy, the bone flap is removed and is not replaced at the end of neurosurgical intervention. This is performed to allow possible brain herniation through a bony defect that is created during surgery as opposed to brain herniation onto the brainstem, which is incompatible with life.

There are many medical treatment modalities available to help alleviate increased intracranial pressure in a severe TBI patient. These include, but are not limited to, the use of cerebrospinal fluid (CSF) drainage via ven-

triculostomy, hyperosmolar agents such as hypertonic saline or Mannitol, sedation and paralytic agents, barbiturates, and others.[7] Intracranial pressure monitoring is crucial in this population because it allows for a dynamic evaluation of ICP as well as a gauge to evaluate the effectiveness of various treatment modalities. A ventriculostomy is considered the gold standard for ICP monitoring because it allows for both monitoring and drainage of CSF.[7]

Many other types of care are necessary to adequately assess and treat those who have critical brain injuries. Attention to nutrition, skin, and other body systems is important. Severe TBI patients are also at risk for numerous complications including seizures, pulmonary embolus, deep vein thrombosis, infection, sepsis, and electrolyte imbalances, just to name a few. In addition, moderate and severe TBI patients usually have altered mental status including coma and are unable to communicate their needs to their care providers, which makes addressing their medical concerns much more difficult.

Care Systems for Service Members and Veterans

While TBI may result in significant physical impairment, often the more problematic consequences of brain injury involve the individual's cognition, emotional functioning, and behavior. These can impact all aspects of life including the development or maintenance of interpersonal relationships with others. Following stabilization and medical evacuation from theater, there are a wide variety of clinical and rehabilitative resources available to service members. The particular resources used will depend upon the severity of the injury, the clinical presentation of the patient, and the extent of recovery during the initial intervention and stabilization.

In order to optimize recovery, inpatient rehabilitation commonly begins at a VA polytrauma center in Palo Alto, CA; Minneapolis, MN; Richmond, VA; or Tampa, FL. Each site is accredited by the Commission on the Accreditation of Rehabilitation Facilities and is staffed by a multidisciplinary team of clinicians who are trained to treat patients with moderate to severe brain injuries.[15] Since their designation as Polytrauma Rehabilitation Centers by the VA in 2005, these sites have also been resourced to treat brain-injured patients with other combat injuries.[16] This has been an important expansion of services as many of our warfighters sustain multiple traumatic injuries in theater and require simultaneous care for a variety of clinical and rehabilitative needs such as brain injury, amputation, and wound care. In this way, for example, both brain injury rehabilitation and physical therapy with training using a prosthetic device can happen at the same time, contingent upon the tolerance and ability of the individual patient. Co-treatment plans are common within the context of TBI rehabilitation.

Inpatient TBI rehabilitation at these four polytrauma centers comprises comprehensive interdisciplinary evaluation and treatment of brain injury sequelae as well as treatment of secondary complications and concomitant injuries. Rehabilitation services are provided by an interdisciplinary team of clinical specialists which may include the following professionals: physiatrist; neuropsychologist; physical, occupational, and recreation therapists; speech therapist; low vision specialist; nurse; social worker; and vocational rehabilitation counselor. Inpatient rehabilitation may also offer services such as coma stimulation or neurobehavioral management (described on previous page) for patients who require it. The structure of an inpatient rehabilitation stay is dictated by the particular patient's clinical needs and their responsiveness to the rehabilitation itself.

The scope and course of an individual patient's TBI rehabilitation treatment plan will be tailored to their specific deficits, using their particular capacities at the time of admission. It is generally expected that, for a patient to engage with a rehabilitation program fully, they will be able to tolerate three to four hours of intensive therapy per day at the time of their admission. These therapies, as previously noted, might include physical therapy, occupational therapy, kinesiotherapthy, and/or speech and language therapy. For a patient whose brain injury limits physical and cognitive functioning, this kind of regimen can be extremely tiring. For those who are able to tolerate more, treatment plans will be adjusted to reflect their individual capacities and to challenge them as appropriate to meet their level of therapeutic benefit. In addition, neurobehavioral management is available for those moderate to severe TBI patients whose deficits may have resulted in behavioral dysfunction. Behavioral problems following brain injury may be the result of the organic brain injury itself or an inability of the compromised brain to adequately assimilate external stimuli or negotiate novel situations.

The VA polytrauma centers also offer services and therapies to patients who enter at a much lower level of functioning. This would include service members who are minimally responsive, do not follow simple commands, or do so intermittently. Sometimes it is difficult for family members to understand the severity of these injuries as it is not uncommon for severe TBI patients to have their eyes open and to appear to track figures across the room, despite their inability to follow verbal commands. These patients are genuinely unable to engage with their environment. Coma stimulation programs may include physical therapy to exercise a patient's physical

body or sensory stimulation to introduce external stimulation to engage fundamental receptor responses in the brain.

The length of stay in an acute program will vary depending upon the initial deficits of the individual, their overall medical needs, their progress during rehabilitation, and their responsiveness to different treatments. An overall average length of stay for a moderate or severe TBI patient may span between three and six months, with an average of four months following emergence from coma.[17] For patients whose recovery does not progress significantly during the course of their acute rehabilitation, there are post-acute programs where they may continue their rehabilitation. These kinds of programs include assisted living facilities and skilled nursing facilities. An assisted living facility would be appropriate for an individual who needs ongoing assistance with activities of daily living such as meal preparation and some of the tasks of daily living, but does not require advanced on-site medical care. A skilled nursing facility would be appropriate for an individual who does need on-site medical care in addition to assistance with most of the activities of daily living. In some cases, home nursing care is provided for patients enabling them to return to their family and community where they may receive medical support as needed in their home.

The ultimate goal of any rehabilitation program is to return the individual to the community to pursue as full and rich a life as possible. For individuals who are able to leave an acute inpatient TBI rehabilitation stay and progress towards rejoining a community more independently, a community re-entry program may be indicated. This broad term includes various kinds of programs and may include residential transitional living facilities, home care services, or vocational rehabilitation programs. The kind of community that a brain-injured patient may return to, again, will be dictated by their course of recovery and their clinical presentation. For some, the community they return to may be their military installation as they return to full active duty status. Others may reenter the civilian community as a veteran.

Conclusion

Traumatic brain injury is the signature injury of current conflicts. Tactical combat casualty care plays an integral part in triaging and treating combat wounded troops with life threatening injuries. Far forward medical assessment and treatment of moderate and severe traumatic brain injury is crucial to the survivability and recovery of combat wounded warfighters. The information and strategies that have been described are intended as an overview to assist medics and corpsmen as they care for the most severe TBI patients. For a more complete step by step guide to TBI care please refer to the "Guideline for Field Management of Combat Related Head Trauma." Quick reference guides to the assessment and management of severe TBI are also available from the Brain Trauma Foundation. An optimal outcome can be achieved when these principals are applied with rapid medical evacuation, care coordination, and comprehensive rehabilitation. While the long-term effects of acute brain injury may be significant, there is often potential for considerable improvement which allows patients with brain injury to lead meaningful and productive lives.

Acknowledgements

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Continuing Medical Education Test

Care of the Military Working Dog by Medical Providers

Robert Vogelsang, DVM, MS

JSOM

Scenario A.

It is December and you are in northern Afghanistan. You are being supported by three military working dogs (MWDs) who have been at your location for three months. A handler rushes into your tent with a report that his dog has acutely become weak, lethargic, and depressed and pulls you to his hooch where his dog is lying quietly on the floor. The dog, Marco, will look at you and wag his tail when you talk to him, but indeed appears very depressed. His respiratory rate is 60 breaths/minute. The handler says Marco was totally fine an hour ago, but during an exuberant play session in the snow, Marco stopped chasing his ball and seemed reluctant to run. The handler brought him into the hooch and Marco just wanted to lie down. He would get up and move only if the handler really coaxed him hard, but Marco moved only slowly with seemingly much discomfort. Marco vomited once during this time. The handler sheepishly admits he last fed Marco only two hours ago.

Marco's signalment and known history: 8.5 year-old, intact male Belgian Malinois from Ft. Irwin, California. Significant medical history includes eating his handler's glove inserts in 2003 which required their endoscopic retrieval. He has not received a prophylactic gastropexy. He was previously deployed to Iraq from June 2005 to January 2006

You perform an exam on Marco. Results are below:

Heart rate: 144 beats/minute with no obvious arrhythmia
Lung auscultation: panting, but seemingly clear with no rales, wheezes, rhonchi
Femoral pulse: 144 beats/minute, but weak and thready
Hydration: normal, no skin tenting
Mucous membranes: pale pink; CRT: 2.5 sec
Rectal temperature: 99.1 F
Abdomen appears moderately distended; not painful to touch; no obvious mass palpated

1. Marco's vital signs are:
    a. abnormal; tachycardia, tachypnea, normothermic, slow CRT
    b. abnormal; bradycardia, tachypnea, pyrexic, slow CRT
    c. abnormal; normal heart rate, tachypnea, hypothermic, slow CRT
    d. abnormal; tachycardia, tachypnea, hypothermic, normal CRT
    e. normal

2. Given the history and physical exam findings your rule outs would not include:
    a. overeating
    b. ruptured splenic hemangiosarcoma
    c. diaphragmatic hernia
    d. splenic torsion
    e. gastric dilatation with or without volvulus

3. Positive "pinging" of the abdomen differentiates which condition from the others.
    a. overeating
    b. ruptured splenic hemangiosarcoma
    c. diaphragmatic hernia
    d. splenic torsion
    e. gastric dilatation with or without volvulus

Scenario A continued.

You "pinged" Marco's abdomen, but it was negative. He appears to be going into shock. While conducting sonograms on pregnant women during a recent MEDCAP, your Sonosite was apparently stolen by one of the locals when you weren't looking. You have no x-ray capability at your location.

4. You determine Marco needs fluid support. Which of the following protocols would initially be appropriate for this patient?
    a. 22G cephalic catheter; LRS, 20 ml/kg/hr CRI
    b. 20G saphenous catheter; normal saline, 10 ml/kg/hr CRI
    c. 14G cephalic catheter; 6% hetastarch, 50 ml/kg bolus
    d. 18G saphenous catheter; hypertonic saline, 20 ml/kg bolus
    e. 18G cephalic catheter; Plasma-Lyte 148®, 70 ml/kg/hr CRI

5. Which procedure would you perform next to best help diagnose Marco's condition?
    a. digital rectal examination
    b. ventral midline abdominocentesis near umbilicus
    c. pull a cephalic venous blood sample
    d. place a peroral gastroesophageal tube
    e. insert a large gage catheter or trochar into the abdomen behind the last rib

6. You correctly diagnosed gastric dilatation-volvulus (GDV) in a supporting MWD. You know the dog will need to be evacuated to the appropriate Army Veterinary Corps unit for treatment. You have previously coordinated CASEVAC for such an emergency and have arranged both evacuation aircraft and reception of the dog by the awaiting veterinary unit; a slick is almost at your location and expected flight time to the veterinary unit is 20 minutes, though the flight has to go over a mountain range about 8000 feet above sea level. The dog has only had clinical signs for about 15 minutes and is still ambulatory and reasonably stable. Knowing that he would likely become more shocky without fluids, you adeptly place a cephalic catheter and start LRS at approximately 30 to 40ml/kg/hr. You feel you have done everything needed to ensure the dog survives and perform no other procedures, nor give drugs or other medicaments. Everything seems to be going great and you are quite proud of yourself. However, the dog became very painful in flight and died shortly after arriving at the veterinary unit and it was totally your fault. Why?
    a. fluid rate was too high leading to hypervolemia and subsequent congestive cardiac failure
    b. fluid rate was too high leading to hypervolemia and subsequent pulmonary edema
    c. fluid rate was too low leading to hypovolemia and subsequent fatal cellular hypoxia (shock)
    d. did not decompress gas from stomach leading to dilatation of the twisted stomach at altitude, impeding venous return from the caudal vena cava to heart, and likely gastric necrosis and rupture
    e. cephalic catheter placement in a dog with GDV is contraindicated as the dilated stomach compresses the vena cava, preventing fluids from reaching the heart

7. One of your MWDs (77 pounds) sustains a single high-velocity through-and-through gunshot wound to the left hind limb. The wound is located about midway between the hip and the stifle (knee) and caudal to the femur. There is significant soft tissue damage, but no fracture of the femur and no obvious nerve injury. You have placed a cephalic catheter and have been informed that CASEVAC will be available to the supporting veterinary unit in approximately two hours. The flight time from your location to the treating unit is about 45 minutes. The dog appears hemodynamically stable, but is in obvious pain and you are also concerned about infection of the wound. Which of the following is best for your situation?

a. morphine 10mg SC and cefazolin 1gm slow IV
b. morphine 50mg IM and cefazolin 1gm slow IV
c. morphine 100mg slow IV and cefazolin 500mg slow IV
d. fentanyl 0.4mg SC and cefazolin 500mg slow IV
e. fentanyl 4mg IV and cefazolin 1gm slow IV

8. Which of the following fluid therapy protocols is the best for a dog with GDV?

a. cephalic 20G catheter; Hetastarch 6% at 20 ml/kg, then LRS at 90mls/kg afterward until the patient reaches a veterinary facility.
b. cephalic 18G catheter; 5-7.5% hypertonic saline in 6% dextran 70 at 20mls/kg, then normal saline at 5mls/kg, adjusting for changes in patient status.
c. saphenous 18G catheter; LRS at 90mls/kg, adjusting for changes in patient status.
d. saphenous 22G catheter; Hetastarch 6% at 20 ml/kg, then LRS at 20mls/kg afterward, adjusting for changes inpatient status.
e. jugular 16G catheter; 5-7.5% hypertonic saline in 6% dextran 70 at 5mls/kg, then LRS at 20mls/kg afterward, adjusting for changes in patient status.

9. A MWD is presented to you by a panicked handler who told you the dog became wobbly and collapsed just a few minutes ago. You are in the Al-Anbar Province if Iraq; it is August at 1500 hrs. The handler says he was training with the dog when it collapsed. The dog is panting uncontrollably and appears very dyspneic with loud upper airway sounds. The dog is obtunded and mucous membranes are dark. Heart rate is 152 with poor pulse quality. Rectal temperature is 108.3ºF. What is the diagnosis and which of the following is the best protocol for a dog with this condition?

a. exertional hyperthermia: place in shade; cephalic 20G catheter, LRS at 30mls/kg, 1g cefazolin IV
b. heat stroke: place in shade; cephalic 22G catheter, LRS at 10mls/kg, 250mg cefazolin IV
c. heat stroke: place cold packs in groin and axillae; saphenous 18G catheter, normal saline at 30mls/kg, 1g cefazolin IV
d. heat exhaustion: place cold packs in groin and axillae; saphenous 22G catheter, normal saline at 30mls/kg, 250mg cefazolin IV
e. heat exhaustion: hose down with water; jugular 16G catheter, hypertonic saline at 30mls/kg, 1g cefazolin IV

10. An untoward reaction in a dog receiving antivenin can be recognized by which of the following:

a. swelling of the face and rubbing its ears
b. erythema of the ears and swelling of the face
c. swelling of the ears and redness of the face
d. rubbing its face and redness of the ears
e. erythema of the feet and rubbing its ears

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Abstracts from Current Literature

Simulation Training for a Mass Casualty Incident: Two-Year Experience at the Army Trauma Training Center

King, David R. MD, MC; Patel, Mayur B. MD; Feinstein, Ara J. MD, MPH; Earle, Steven A. MD; Topp, Raymond F. MD, MC; Proctor, Kenneth G. PhD

Journal of Trauma-Injury Infection & Critical Care. 61(4):943-948, October 2006.

Abstract

Background: Civilian and military mass casualty incidents (MCI) are an unfortunate reality in the 21st century, but there are few situational training exercises (STX) to prepare for them. To fill this gap, we developed a MCI STX for U.S. Army Forward Surgical Teams (FST) in conjunction with the U.S. Army Trauma Training Center. **Methods:** After a standardized briefing, each FST has 60 minutes to unpack, setup, and organize a standard equipment cache into an emergency room, operating room, and intensive care unit. In an adjacent room, five anesthetized swine are prepared with standardized, combat-relevant injuries. The number and acuity of the total casualties are unknown to the FST and arrive in waves and without warning. A realistic combat environment is simulated by creating resource limitations, power outages, security breaches, and other stressors. The STX concludes when all casualties have died or are successfully treated. FSTs complete a teamwork self-assessment card, while staff and FST surgeons evaluate organization, resource allocation, communication, treatment, and overall performance. Feedback from each FST can be incorporated into an updated design for the next STX. **Results:** From 2003-2005, 16 FSTs have completed the STX. All FSTs have had collapses in situational triage, primary/ secondary surveys, and/or ATLS principles (basic ABCs), resulting in approximately 20% preventable deaths. **Conclusions:** We concluded (1) a MCI can overwhelm even combat experienced FSTs; (2) adherence to basic principles of emergency trauma care by all FST members is essential to effectively and efficiently respond to this MCI; (3) by prospectively identifying deficiencies, future military or civilian performance during an actual MCI may be improved; and (4) this MCI STX could provide a template for similar programs to develop, train, and evaluate civilian surgical disaster response teams.

Usefulness of Temazepam and Zaleplon to Induce Afternoon Sleep

Simons, Ries1; Koerhuis, Claudy L.1; Valk, Pierre J.L.1; Van den Oord, Marieke H.A.H2

Military Medicine, Volume 171, Number 10, October 2006, pp. 998-1001(4)

Abstract

Insufficient daytime sleep may result in reduction of effectiveness and safety during overnight military missions. The usefulness of temazepam and zaleplon to optimize afternoon sleep and their effects on performance and alertness during a subsequent night shift were studied. **Method:** In a randomized double-blind within-subjects design, 11 subjects took 20 mg of temazepam, 10mg of zaleplon, or placebo before a 5:30 - 10:00 p.m. sleep period. Sleep length and quality were measured. Subjects were kept awake throughout the night while alertness, cognitive performance, and muscle power were repeatedly measured. **Results:** Temazepam provided significantly longer and qualitatively better sleep than zaleplon or placebo. During the night, sleepiness increased and muscle power was impaired in all conditions. Better sleep was correlated with less sleepiness during the night. **Conclusion:** Temazepam is useful to optimize a 4.5-hour afternoon sleep be-

Cost-Effectiveness of HIV Treatment in Resource-Poor Settings — The Case of Côte d'Ivoire

Sue J. Goldie, M.D., M.P.H., Yazdan Yazdanpanah, M.D., Ph.D., Elena Losina, Ph.D., Milton C. Weinstein, Ph.D., Xavier Anglaret, M.D., Ph.D., Rochelle P. Walensky, M.D., M.P.H., Heather E. Hsu, A.B., April Kimmel, M.S., Charles Holmes, M.D., M.P.H., Jonathan E. Kaplan, M.D., and Kenneth A. Freedberg, M.D.

New England Journal of Medicine Volume 355:1141-1153 September 14, 2006 Number 11

Abstract

Background: As antiretroviral therapy is increasingly used in settings with limited resources, key questions about the timing of treatment and use of diagnostic tests to guide clinical decisions must be addressed. **Methods:** We assessed the cost-effectiveness of treatment strategies for a cohort of adults in Côte d'Ivoire who were infected with the human immunodeficiency virus (HIV) (mean age, 33 years; CD4 cell count, 331 per cubic millimeter; HIV RNA level, 5.3 log copies per milliliter). Using a computer-based simulation model that incorporates the CD4 cell count and HIV RNA level as pre-

dictors of disease progression, we compared the long-term clinical and economic outcomes associated with no treatment, trimethoprim–sulfamethoxazole prophylaxis alone, antiretroviral therapy alone, and prophylaxis with antiretroviral therapy. **Results:** Undiscounted gains in life expectancy ranged from 10.7 months with antiretroviral therapy and prophylaxis initiated on the basis of clinical criteria to 45.9 months with antiretroviral therapy and prophylaxis initiated on the basis of CD4 testing and clinical criteria, as compared with trimethoprim–sulfamethoxazole prophylaxis alone. The incremental cost per year of life gained was $240 (in 2002 U.S. dollars) for prophylaxis alone, $620 for antiretroviral therapy and prophylaxis without CD4 testing, and $1,180 for antiretroviral therapy and prophylaxis with CD4 testing, each compared with the next least expensive strategy. None of the strategies that used antiretroviral therapy alone were as cost-effective as those that also used trimethoprim–sulfamethoxazole prophylaxis. Life expectancy was increased by 30% with use of a second line of antiretroviral therapy after failure of the first-line regimen. **Conclusions:** A strategy of trimethoprim–sulfamethoxazole prophylaxis and antiretroviral therapy, with the use of clinical criteria alone or in combination with CD4 testing to guide the timing of treatment, is an economically attractive health investment in settings with Number 13th limited resources.

Acetazolamide: A Treatment for Chronic Mountain Sickness

M Rivera, P Bouchet, et al.

American Journal Of Respiratory And Critical Care Medicine. 2005;172:1427-1433) J Richalet, M Rivera, P Bouchet, et al.

Abstract

Chronic mountain sickness (CMS), also known as Monge disease, is characterized by excessive polycythemia with hemoglobin greater than 21 g.dL-l. According to this study, CMS is found in 5% to 18% of high-altitude dwellers who live higher than 3200 m. Clinical signs and symptoms include fatigue, headache, dyspnea, and digestive problems and can eventually result in heart failure and neurologic disorders such as stroke. Although three drugs (medroxyprogesterone, enalapril, and almitrine) have been used to treat the disorder, the only truly effective treatments are blood letting or moving to lower altitudes. The pathophysiology of the disorder is thought to be a decreased ventilatory response to hypoxia resulting in hypoventilation, which leads to excessive hypoxemia and resultant exaggerated erythropoiesis. This study examined the use of acetazolamide in CMS patients with the hypothesis that acetazolamide would decrease erythropoietin (EPa) by stimulation of ventilation, as well as by indirect effect of the medication on EPAa production in the renal tubule.

Peripheral Venous Cutdown

Stephen Chappell MD, Gary M. Vilke MD, Theodore C. Chan MD, Richard A. Harrigan MD and Jacob W. Ufberg MD

Journal of Emergency Medicine Volume 31, Issue 4 , November 2006, Pages 411-416. Received 14 March 2006; accepted 9 May 2006. Available online 12 October 2006.

Abstract

Timely establishment of vascular access is a critical component of the care of the acutely ill or injured patient. Peripheral venous cutdown, once a mainstay in the care of the severely traumatized patient, has progressively lost favor since the introduction of the Seldinger technique of central venous line placement. In fact, recent editions of the Advanced Trauma Life Support (ATLS) text refer to saphenous venous cutdown as an optional skill to be taught at the discretion of the instructor. In certain patients, percutaneous vascular access may be impossible to achieve or result in unacceptable time delays. In these situations, the ability to rapidly and proficiently perform peripheral venous cutdown techniques may prove invaluable and potentially lifesaving. This article reviews the anatomy of the most common sites used for peripheral venous cutdown, peripheral venous cutdown techniques, and the complications associated with peripheral venous cutdown.

Deaths of Detainees in the Custody of US Forces in Iraq and Afghanistan From 2002 to 2005

Scott A. Allen, MD; Josiah D. Rich, MD, MPH; Robert C. Bux, MD; Bassina Farbenblum; Matthew Berns; Leonard Rubenstein

Medscape General Medicine. 2006;8(4):46. ©2006 Medscape

Posted 12/05/2006 Retrieved 8 Jan 07.

Abstract

In light of the large number of detainees who continue to be taken and held in U.S. custody in settings with limited judicial or public oversight, deaths of detainees warrant scrutiny. We have undertaken the task of reviewing all known detainee deaths between 2002 and early 2005 based on reports available in the public domain. Using documents obtained from the Department of Defense through a Freedom of Information Act request, combined with a review of anecdotal published press accounts, 112 cases of death of detainees in United States custody (105 in Iraq, 7 in Afghanistan) during the period from 2002 to early 2005 were identified. Homicide accounted for the largest number of deaths (43) followed by enemy mortar attacks against

the detention facility (36). Deaths attributed to natural causes numbered 20. Nine were listed as unknown cause of death, and 4 were reported as accidental or natural. A clustering of 8 deaths ascribed to natural causes in Iraq in August 2003 raises questions about the adequacy and availability of medical care, as well as other conditions of confinement that may have had an impact on the mortality rate.

National Variability in Out-of-Hospital Treatment After Traumatic Injury

Eileen M. Bulger, MD, Avery B. Nathens, MD, PhD, Frederick P. Rivara, MD, MPH, Ellen MacKenzie, PhD, Daniel R. Sabath, MS, Gregory J. Jurkovich, MD

Annals of Emergency Medicine, 2007 Mar;49(3):293-301.

From the Harborview Injury Prevention and Research Center (Bulger, Nathens, Rivera, Sabath, Jurkovich), and the Departments of Surgery (Bulger, Nathens, Sabath, Jurkovich), and Pediatrics (Rivara), University of Washington, Seattle, WA; and Johns Hopkins School of Public Health, Baltimore, MD (MacKenzie).

Abstract

Study objective: The optimal out-of-hospital treatment for trauma patients remains a subject of national debate. Researchers designing future studies to address these issues must understand the variability in treatment that exists across the United States. We define the variability in the out-of-hospital treatment provided to trauma patients in the United States. **Methods:** This was a retrospective analysis of prospectively collected data for a cohort study of trauma outcomes. The study was conducted at 15 urban or suburban regions across the United States, 18 Level I trauma centers and 51 nontrauma centers. We used a weighted population sample based on data from all hospital trauma deaths and a sample of patients discharged between January 2001 and December 2002. Entry criteria included at least 1 body region with an Abbreviated Injury Score greater than 3 and age between 18 and 84 years. Exclusion criteria were patient age greater than 65 years and isolated hip fractures and patients with burns. **Results:** Complete out-of-hospital data were available for 3,357 patients, representing a weighted population sample of 9,929 patients. Out-of-hospital treatment varied substantially among the regions, including out-of-hospital intubation (5% to 48%), use of neuromuscular blocking agents or sedatives to facilitate intubation (0% to 100%), surgical airway access (0.1% to 3.5%), peripheral and central intravenous access (22% to 95%), and needle thoracentesis (0% to 5%). **Conclusion:** There is considerable national variability in out-of-hospital procedures performed for trauma patients.

The Diagnostic Accuracy of 64-Slice Computed Tomography Coronary Angiography Compared With Stress Nuclear Imaging in Emergency Department Low-Risk Chest Pain Patients

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Annals of Emergency Medicine Volume 49, Issue 2, Pages 137-143.e1 (February 2007)

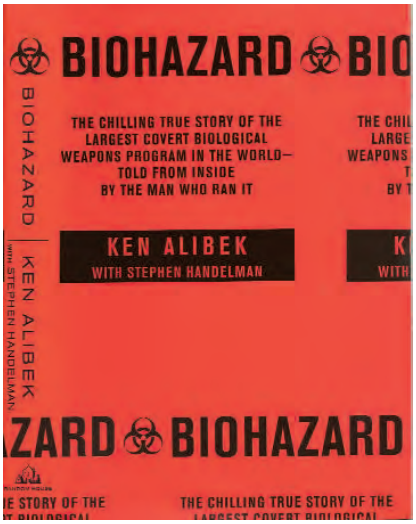
Abstract

Study objective: We compared the accuracy of multidetector computed tomography (CT) coronary angiography with stress nuclear imaging for the detection of an acute coronary syndrome or 30-day major adverse cardiac events in low-risk chest pain patients. **Methods:** This was a prospective study of the diagnostic accuracy of myocardial perfusion imaging and multidetector CT in low-risk chest pain patients. The target condition was an acute coronary syndrome (confirmed >70% coronary stenosis on coronary artery catheterization) or major adverse cardiac events within 30 days. Patients were low risk by Reilly/Goldman criteria and had negative serial ECGs and cardiac markers. All had both rest/stress sestamibi nuclear imaging and multidetector CT. Patients with abnormal stress nuclear imaging results (reversible perfusion defects) or multidetector CT results (stenosis >50% or calcium score >400) were considered for cardiac catheterization, and those with discordant results had a greater than 30-day reevaluation (including ECG) by a cardiologist. All were followed up for evidence of major adverse cardiac events within 30 days by review of hospital records and structured telephone interview. Primary outcomes were the accuracy of multidetector CT and myocardial perfusion imaging for the detection of an acute coronary syndrome and 30-day major adverse cardiac events. **Results:** Of the 92 patients, 7 (8%) were excluded because of uninterpretable multidetector CT scans. Of the remaining 85 study patients (49±11 years, 53% men), 7 (8%) were found to have the target condition, with all having significant coronary stenosis (88%±9%) and none having myocardial infarction or major adverse cardiac events during 30 days. Stress nuclear imaging results were negative in 72 (85%) patients, and multidetector CT results were negative in 73 (86%) patients. The sensitivity of stress nuclear imaging was 71% (95% confidence interval [CI] 36% to 92%), and multidetector CT was 86% (95% CI 49% to 97%), and the specificity was 90% (95% CI 81% to 95%) and 92% (95% CI 84% to 96%), respectively. The negative predictive value of stress nuclear imaging and multidetector CT was 97% (95% CI 90% to 99%) and 99% (95% CI 93% to 100%), respectively, and the positive predictive value was 38% (95% CI 18% to 64%) and 50% (95% CI 25% to 75%), respectively. **Conclusion:** The accuracy of multidetector CT is at least as good as that of stress nuclear imaging for the detection and exclusion of an acute coronary syndrome in low-risk chest pain patients.

Book Review

Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World – Told from the Inside by the Man Who Ran It

Ken Alibek. Random House: New York, 1999. 306 pages.
Reviewed by MAJ Kathleen Dunn Farr, 18 Sep 2006.



This book's ponderous title, Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World – Told from the Inside by the Man Who Ran It, tells the reader what to expect from this fast-paced, sounds-like-fiction-but-isn't, expose. The author is Ken Alibek, former deputy head of Biopreparat, a secret Soviet bioweapons laboratory, and Colonel in the Soviet Army. The plot lines — Soviet expansion of their biowarfare program, Alibek's rise within the Soviet scientific community, and his gradual development of conscience — are woven together in a way that keeps the reader engaged.

Alibek recounts how the former Soviet Union developed a massive scientific and industrial complex whose goal was to grow, refine, stockpile, and weaponize biological organisms such as smallpox, anthrax, tularemia, and plague. They also experimented with highly lethal viruses, such as Marburg and Ebola, which cause a gruesome death by massive hemorrhage. Often disguised as pharmaceutical companies making vaccines against the very organisms they were turning into weapons, the communities of scientists, technicians, administrators — and the KGB who watched over them — were scattered across the vast Soviet landscape. At its pinnacle, sixty thousand people worked at more than one hundred laboratories and industrial plants engaged in various aspects of the biowarfare program. The highest levels of Soviet ministries were involved, including the Academy of Sciences.

Alibek vividly describes animal studies, laboratory accidents, and coverups. He sets to rest questions the medical community has long had about an anthrax epidemic in Sverdlovsk, ostensibly from contaminated meat but in reality due to a mishap with a filter that allowed anthrax spores to flow from the laboratory to the community surrounding the facility. This outbreak haunted the Soviet scientific community for many years. As a young physician, I remember this was a topic of much concern at national epidemiologic conferences; most of my colleagues expressed frank disbelief with official explanations.

Breakthroughs in genetic engineering allowed the Soviets to develop superpathogens with increased lethality, increased resistance to known antibiotics, or characteristics of multiple pathogens. Alibek describes how the Soviets worked feverishly to combine the lethality of Ebola with the infectiousness of smallpox.

Alibek speaks with authority, knowledge, and experience. He graduated from the Tomsk Medical Institute with a major in infectious diseases and epidemiology. He has a PhD in microbiology, which he received for his work on the development of biological weapons using tularemia and plague. He also has a doctorate of science in biotechnology, which he received for developing an industrial process for manufacturing anthrax. Alibek held positions of increasing responsibility at Biopreparat, in-

cluding Deputy Chief from 1988 to 1992. Since defecting to the United States in 1992, Alibek has worked in the biodefense industry in the United States.

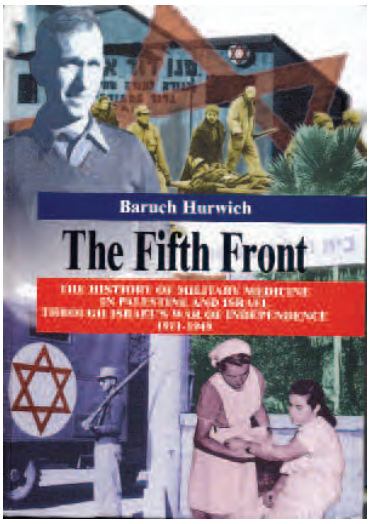
This book includes the first published comprehensive overview of the organizational structure of the Soviet Biological Warfare System. While not as gripping as Alibek's descriptions of the awesome destructive power of biological weapons, the sheer magnitude of the biowarfare system, its enormous budget, and the involvement of almost every Soviet Ministry impress upon the reader that the threat was real. Less convincing is Alibek's gradual questioning of the ethics of a program designed to lead millions to their deaths. He recounts his early days as a medical student bent on helping mankind, who detoured into biowarfare because he was convinced the Americans were working just as hard on annihilating the Soviet Union. Granted, at the time, there were few employment options for bright, ambitious Soviet scientists other than with the government. His pride in his accomplishments, and the power and privilege that came with them, ring true. In contrast, his reasons for defecting seem hollow. But whether his change of heart was for ethical or financial reasons, what matters is that he has chosen to share his knowledge of this threat with the world.

Although the Soviet Union signed the 1972 Biological and Toxin Weapons Convention, they continued to expand their biowarfare program throughout Alibek's tenure. At the time of his defection, they were consolidating some areas while expanding others. Alibek also contends that the threat did not disappear with the collapse of the Soviet Union. Concomitant economic collapse left Soviet microbiologists and biowarfare scientists ripe for recruitment by rogue states and terrorist organizations.

I highly recommend that all members of the defense community read this chilling and disturbing book. It is even more important in the aftermath of September 11, when various factions of the global insurgency are partnering with rogue nations and failing states in creative financial partnerships. Exchange of biowarfare trade secrets and industrial components is certainly one way to fund terrorist operations. Many experts believe that a bioterrorist attack on American soil is likely to occur. This book gives us a glimpse of what we can expect and how we can prepare for the worst.

The Fifth Front. The History of Military Medicine in Palestine and Israel Through Israel's War of Independence 1911-1949

Hurwich, Baruch. Ministry of Defense Publishing House: Tel Aviv, Israel, 2003, 704 pages.
Reviewed by COL Warner Farr



Fact: Few accounts of the medical aspects of guerrilla warfare exist. Corollary: Very few accounts of the medical aspects of urban guerrilla warfare exist. I recently mentored a Command and General Staff College student attempting to look at medical aspects of the Irish independence movement, an urban insurrection, and there was a dearth of information. As a prior member of Detachment "A," Berlin Brigade, the only Special Forces unit with urban guerrilla warfare as its primary wartime mission, I am always on the lookout for more historical medical examples of urban unconventional warfare.

An interesting, partially urban, resistance movement is that of the Jews in Palestine first under the Turks and then under the British Mandate. The Jews secretly developed their underground cells and auxiliaries to the point of being a shadow government, in place, waiting for the end of the mandate. They sometimes fought the British, sometimes the Arabs, sometimes both, occasionally each other, but they always prepared for the battle for independence that they knew would come someday. Nearly fifty years was spent conducting all types of underground operations; from basic soldier training for new immigrants to first aid classes for women. The amount of organization and commitment by the population was staggering. The underground movement encouraged its members to become involved in specific critical/sensitive occupations that furthered the needs of the resistance, such as the police for example.

There were three main underground groups, the largest being the Hagana, with the smaller Irgun Zvai Leumi (Irgun) and the smallest Lohamei Herut Yisrael (Lehi or Stern Gang), who sometimes fought against each other. At one point, during World War II, when the Stern Gang would not follow the other two groups in ceasing to fight the British, the Hagana kidnapped and imprisoned Stern Gang members to stop them from attacking the British (who were, of course, trying to win over the Axis powers).

All three of these resistance groups had a medical service and each had its chief surgeon. The Jewish Palestinian equivalent to the Red Cross, the Magen David Adom (Red Shield of David or MDA) was essentially overlapping with the medical arm of the Hagana. There were occasional disputes between regional MDAs but largely the resistance movement trained and used the MDA as a portion of its medical treatment and evacuation arm. This resulted in a state of medical readiness that was then translatable into an instant medical service for a conventional army when the 1948 war started. There were occasional disputes on first aid classes and who would attend them (early on, many thought first aid was women's work), and commanders who did not understand the need for field sanitation, and all the usual problems of an army in the making. Another well-tapped resource was the Jewish physicians and other medical personnel from Palestine and elsewhere who had served in the British, Polish, and other allied armies during World War II.

The two smaller resistance movements had even worse problems, as they were at odds regularly with the Hagana which held most of the medical cards. Both splinter groups were more urban focused than the Hagana. They both acted as classic auxiliaries, with casualties being cared for in private homes, doctors traveling to cached patients, etc. They taught first aid classes, as did the Hagana. The book has an excellent

section on "Secret treatment and recuperation sites for the wounded," by the Irgun, known for its famous leader, Menachem Begin. The Stern Gang, like the French Maquis, had concerns for their wounded soldiers in British hospitals and was known to snatch them from hospitals to avoid their being detained by the British.

The final chapters of this book discuss the transformation of a guerrilla force – actually three guerrilla forces – into a war-fighting, conventional force operating in the 1948 war. It shows the final steps of guerrilla warfare; conventional operations that we all studied in our military training courses. Some of the early regulations to be promulgated by the newly conventional medical force concerned obeying the Geneva Conventions (as they hoped the invading Arab armies would) and not medically boarding soldiers until "fully treated and fit for discharge from hospital before a final decision on discharge from active service can be reached." The Medical Service of the Israeli Defense Force (IDF) exhibited the growing pains of all armies when it directed. "As officer-members of a battalion's staff, the Medical Officer and the Chief Medic will participate in all staff meetings." It seems no one has completely fixed that! Additionally, early regulations also directed that a requesting unit could not "include what sort of medical unit to send" but rather needed to indicate "the site and number of wounded or injured and a description of their injuries."

As part of the standard confession of all book reviewers, I state that I received this book for free from the Surgeon General of the IDF when I visited Israel recently. The author's mentor, Colonel Robert J.T. Joy, MC, USA (Ret.) was and is also my history mentor. All that not withstanding, I highly recommend this book as a start to your guerrilla warfare medical library.

Previously Published

The Command of Biotechnology and Merciful Conquest in Military Opposition

Ji-Wei Guo

Previously published in Military Medicine. Vol. 171. November 2006

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

Introduction

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

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

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

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

The struggle of biotechnological dominance is a competence in modern science and technology, especially in biotechnology and military medicine. The meanings of the command theory of biotechnology consist of: taking a whole or partial lead in the military application of biotechnology; making biotechnology a real

power of defense and attack; maintaining a long-lasting advantage in competition of military biotechnology on a large scale. The concept put forward does not aim at modern wars, but at future military reforms. It is to build a foundation of intellective innovation, system construction, and advance defense with a notion of the command of biotechnology, the research and development of modern biotechnologies, and the effect of military establishment.

Formation of the Command of Biotechnology

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

Change in Cognitive Ability at Higher Level

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

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

Multidimensional Expansion

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

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

Upgrade of the Means and Power of Conquest

Rather than annihilation of corporeal destruction, the military theory of command pursues a conquest

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

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

Following the Principles of Time-Effectiveness and Benefit

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

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

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

Trends of Integrated Development

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

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

AGGRESSIVENESS OF BIOTECHNOLOGY

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

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

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

Nonlethality

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

Reversibility

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

Exceeding Traditional Biological Warfare Weapons

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

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

REVOLUTION OF FIGHTING POWER

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

Maintaining Health

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

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

Bioinformation Processing, Monitoring, and Command

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

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

Innovation of the Attacking Mode

Traditional weapons cause body damage, and the effect should be judged on the battlefield. However, the damage of biotechnology can be predicated before war or even in laboratories. Therefore, the damaging capability, targets, and degree of damage can be determined according to the situation, greatly increasing the controllability of war, and realizing fighting effects-based operations. Although the application of military biotechnology is complex, biotechnology-based weapons will be easy to carry and use, and be simple and miniaturized. In combination of modern physicochemical technologies, such as directed energy induced mutagenesis, electromagnetic orientation, nanometer biological bullets, biotechnology can even radically change the trajectory-based attacking pattern, and provide more choices in terms of fighting distance, angle, and topography.

Versatile Military Applications of Biotechnology

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

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

Conclusion

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

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

Military biotechnology is not to realize fighting power. In the long run, the theory of command of biotechnology is an extension and addendum to the theory of command. It will combine with various technologies and biotechnology, such as information technology and materials science to become a commanding point in the struggle for the initiative in future military reforms. From the constitution of the command theory of biotechnology, we see changes not only in military technology, but also in the sense of war

concept and war civilization. With the advancement of science and technology, in recent unbalanced wars, how to reduce the casualty of the civilian and fighting members of both sides was a key factor restricting the military operations.[15] But this endeavor cannot protect civilization. The command of military biotechnology is hopeful to achieve a maximal reduction of damage to people and the environment, which represents a certain degree of war civilization.

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Case Management Study
Walter Reed Army Medical Center
A 43-Year-Old Colonel with Chills, Diaphoresis, and Headache

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The objectives were to illustrate the ease with which one might attribute concomitant or subsequent illness to an exposure such as the anthrax vaccine and to demonstrate an approach that keeps the significance of such exposures in appropriate perspective. A 43-year-old, active duty Army officer presents with a variety of nonspecific common symptoms and raises concerns about the relationship of his symptoms to receipt of the anthrax vaccine. He is admitted for an evaluation that includes a series of diagnostic tests and consultations. The course of his illness and the corresponding evaluation are reviewed using a series of questions and accompanying discussions to highlight key points regarding diagnostic considerations, the anthrax vaccine, and the ultimate identification of the correct diagnosis.

A 43-year-old, active duty Army colonel presented to the emergency room at Walter Reed Army Medical Center with chief complaints of chills, nighttime diaphoresis, and a frontal headache. These symptoms started two days before presentation. The patient reported as many as six similar episodes, beginning in March 1999, while he was stationed in Germany. The medical history was otherwise noncontributory. All episodes were reported to be sudden in onset, and each was self-limited, gradually resolving within 72 hours with rest and/or over-the-counter cold remedies. Medical evaluation was sought in two cases and was unrevealing, with the symptoms attributed to a viral syndrome. In the two years before the initial episode, the patient's travel history included time in Germany, Israel. Crete, Austria, The Netherlands, Belgium, and South Korea. Upon admission to the medicine ward to facilitate diagnostic evaluation, the patient was afebrile; his physical examination was entirely unremarkable. Complete blood count, electrolyte levels, kidney function, blood urea nitrogen levels, creatinine levels, urinalysis results, and chest radiograph findings were within normal limits. The infectious diseases service was consulted, and screening for malaria was recommended on the basis of time spent in the field near the demilitarized zone (DMZ) in Korea.

1. Which of the following is not true about malaria?

a. Malaria is transmitted by mosquitoes of the species Anopheles.
b. Plasmodium malariae typically induces fevers at 48 hour intervals.
c. Red blood cells infected by Plasmodiun ovale appear enlarged.
d. Plasmodium falciparum is the most pathogenic species of malaria.
e. Plasmodium vivax is endemic to Korea.

Malaria is caused by protozoans of the Plasmodium genus. There are four species that are of significance among humans. i.e.. *P.falciparum. P. vivax, P. ovale.* and *P. malarlae*, of which *P. falciparum* is the most pathogenic. Female Anopheles mosquetoes transmit all species of ma1aria. Typical clinical manifestations include fever, chills, sweating, malaise, and a frontal headache. These symptoms are caused by pyrogens released when infected erythrocytes rupture and release their merozoites. This classically occurs at 48-hour intervals for *P. vivax* and *P. ovale*, at 72-hour intervals for P. malariae, and with an irregular pattern for P. falciparum.

Although a variety of immunologic tests are available, Giemsa-stained thick and thin smears represent the standard for malaria diagnosis. An experienced professional should review the smears because false-negative results are quite common in practice. It is also possible to have false-positive results in endemic areas because the parasites found may not be the cause of a concomitant fever. If parasites are identified, then several common traits allow speciation, including the parasite count, number of rings present per red blood cell. shape and/or presence of gametocytes presence of Schuffner's dots, and size of the red blood cell. Because *P. vivax* and *P. ovale* preferentially infect reticu1ocytes, infected red blood cells are usually enlarged. Another trait specific to *P. vivax* and *P. ovale* is that these species can form exoerythrocytic hypnozoites that can remain latent in the liver for months or even years; in fact, a recent study found that one-third of

travelers developed malaria > two months after their return, despite the fact that most complied with prophylactic regimens.[1] Unlike other Plasmodium species, *P. falciparum* is able to infect all stages of red blood cell development, characteristically resulting in a higher parasite count. Definitive diagnosis of *P. falciparum* can be made through identification of distinctive banana-shaped gametocytes. Although *P. falciparum* does not exhibit relapse, infection by this parasite can exhibit recrudescence. This typica1ly occurs when treatment fails to completely eliminate the blood stages of the parasite, leading to a subclinical infection that can reappear up to two years after the initial infection.

Malaria attributable to *P. vivax* is endemic to the Korean peninsula, with thousands of cases reported among U.S. troops during the Korean War.[2] Eradication efforts by the World Health Organization, in conjunction with the Republic of Korea government, successfully eliminated malaria from South Korea for more than two decades. However, a case of malaria was diagnosed in the Republic of Korea near the DMZ in the early 1990s, and thousands of cases have subsequently occurred within the Republic of Korea. This presents a significant problem for U.S. and Korean forces distributed along the DMZ, in which a number of cases have occurred.[3] A study of 101 patients in Korea with symptomatic *P. vivax* malaria identified the most common clinical features as tertian fever (68.3%), headache (83.2%), and myalgias (42.6%). The median latent period was 278 days for the 77 patients for whom it could be estimated.[4]

The blood smear for malaria was negative. The patient's wife expressed concern that his symptoms were attributable to a series of three anthrax vaccinations, which were reportedly temporally associated with some of the initial symptomatic episodes approximately one year earlier. The patient had not received more recent anthrax vaccinations because of vaccine production problems that led to decreased availability.

2. Which of the following actions are recommended?

a. Nasal swab for anthrax test, with initiation of empiric antibiotic therapy.
b. Careful skin examination for a necrotic eschar.
c. Permanent waiving of all additional anthrax vaccinations.
d. Education of the patient and his wife about the anthrax vaccine.

Anthrax is an infectious disease caused by the spore-forming bacteria Bacillus anthracis. Infection can involve the skin, the gastrointestinal tract, or the lungs. Cutaneous anthrax is characterized by a necrotic eshar, and inhalational anthrax most commonly causes hemorrhagic mediastinitis. Anthrax vaccination does not cause anthrax; therefore, diagnostic tests looking for evidence of anthrax are not warranted.

As a result of heightened concern over the potential use of *B. anthracisas* a biological weapon, the Department of Defense (DoD) began to administer the anthrax vaccine (anthrax vaccine adsorbed [AVAI]) to service members in 1998. The AVA used by the DoD was developed by the Michigan Department of Public Health and is manufactured by the Bioport Corporation. The vaccine has been licensed by the Food and Drug Administration since 1970 and is made from filtrates of B. anthracis. As of October 1, 2002, >2 million doses had been administered to >500,000 individuals. Vaccine safety and efficacy have been reviewed.[5] As many as 30% of men and 60% of women note local tenderness, erythema, edema, and/or pruritus, which may persist for two to three days. Less than 1% experience systemic symptoms such as myalgias, headache, nausea, fever, chills, or malaise, which also may last as long as two to three days after immunization.

The administration schedule for the Anthrax Vaccine Immunization Program includes six shots, given at times of 0 weeks, 2 weeks. 4 weeks, 6 months, 12 months, and 18 months, followed by an annual booster. The DoD exempts individuals from vaccination for reasons of acute illness, recent surgery, pregnancy, immunosuppressive therapy, human immunodeficiency virus (HIV) infection or another chronic immunodeficiency, severe reaction to previous vaccination, or "other conditions." The latter category enables temporary vaccination deferral by a physician when a medical condition is being evaluated or treated. Possible vaccine-associated reactions fall into this category until a more definitive determination is made. For an AVA reaction to result in a permanent waiver, it must be deemed a severe reaction, such that additional doses would pose an undue risk to the vaccine recipient.[6] Although there is considerable ambiguity concerning what constitutes a severe reaction or poses an undue risk, the frequency of mild side effects has been published by the Centers for Disease Control and Prevention National Immunization Program (Table1).[7]

Although it is plausible that the vaccine was responsible for the systemic symptoms that were reported to occur in close temporal association with vaccine administration, there is no evidence that the vaccine causes such symptoms months or years later. The available data

regarding vaccine side effects should be provided to concerned patients, and their questions should be answered as clearly and fully as possible. The Anthrax Vaccine Immunization Program World Wide Web site may facilitate this (http://www.anthrax.osd.mil/default.asp).

The immunology service was consulted to evaluate the potential relationship between the anthrax vaccination and the patient's symptoms. The consultants concurred with the impressions of the primary care team that the nature of the patient's current symptoms, and the long period of time since his last vaccination, rendered a relationship between his symptoms and vaccination extremely unlikely.

3. As the primary care manager for this patient, what should you do if your patient wants to report his reaction to the vaccine?

a. Tell the patient that a report cannot be filed because his fever was not documented.
b. Tell the patient that a report cannot be filed because his side effects are not severe.
c. Discourage the patient from filing a Vaccine Adverse Event Reporting System (VAERS) report because his episode is not related to his anthrax vaccination.
d. File a VAERS report on behalf of the patient.
e. Instruct: the patient that only allergists can use the VAERS-1 form.

The VAERS, cosponsored by the Food and Drug Administration and the Centers for Disease Control and Prevention, has been used since 1990 to facilitate collection of data on vaccine side-effects. The VAERS-l form is used by the DoD, in conjunction with service-specific channels, to report AVA side effects.[6] To fully understand the frequency and scope of potential side-effects of the vaccine, it is important to try to report all cases of potential concern. This includes cases in which the findings are mild or in which the vaccine seems less likely than another cause to be responsible for the presentation. Although patients can file VAERS reports on their own, to improve accuracy it is preferred that health care professionals take an active role in the reporting of cases to the system.[8] The Assistant Secretary of Health and all branches of the service have issued statements encouraging physicians to me reports with VAERS to create a complete database.[6] Any health care professional can file a VAERS report. Through April 2002, 1,857 VAERS-l reports had been filed, of which 966 cases were judged to be certainly or probably caused by the anthrax vaccine. Eleven of those individuals were hospitalized, all because of allergic inflammatory reactions at the injection site.

Table I Frequency of Common Anthrax Vaccine Side Effects

Side Effect Description	Approximate Frequency(%)
Lump at injection site	50
Muscle or joint aches	20
Headaches	20
Fatigue	Men, 7; women, 17 5
Chills or fever	5
Nausea	5

The patient remained afebrile during three days of evaluation in the hospital. Consultations from infectious diseases, immunology, and neurology services did not identify a cause for his symptoms. Lumbar puncture and computed tomographic scans of the head and sinuses were unremarkable. However, liver chemistry tests demonstrated a slightly elevated unconjugated bilirubin level of 2.2mg/dL (normal range, 0.0 to 0.9mg/dL) at the time of admission and alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels that increased from their normal initial levels to 125 U/L (normal range, 9 to 52 U/L) and 124 U/L (normal range, 14 to 50 U/L), respectively, at the time of discharge.

4. What tests would you order at this point?

a. Hepatitis A, B, and C serologica1 tests
b. Serum ceruloplasmin levels
c. ά1-Antibypsin levels
d. Urgent ultrasound for bile duct obstruction
e. Liver biopsy

Liver chemistry tests are nonspecific but, in the absence of other definitive abnormalities, they can provide direction in the search for a cause of nonspecific systemic symptoms. In this case, the changes were acute and were at least temporally, and quite possibly causally, related to the patient's recent symptoms, and the pattern of transaminase level elevations indicated potential hepatocellular damage. This should lead to consideration of viral infections, as well as the effects of medications, dietary supplements, or other toxins. Screening for genetic anomalies such as Wilson's disease (screened for by checking serum ceruloplasmin levels) or ά1-antitrypsin deficiency is warranted in cases of chronic elevations. In addition, one of the more common causes, known as nonalcoholic fatty liver disease (previously called nonalcoholic steatohepatitis), is related to fluctuations in weight In a case like this, where the history and physical examination results are unremarkable and there are relatively mild, acute elevations of the ALT and AST levels, it is reasonable to perform additional serological evaluation for acute infectious diseases, especially in the setting of symptoms that might be explained as a result.

However, the pattern of liver chemistry test elevations was not consistent with an obstructive pattern, which would elevate the alkaline phosphatase and bilirubin levels to a greater degree than the aminotransferase levels. Liver biopsy can provide significant additional information and can influence management,[9] in the presence of chronic aminotransferase elevations and the absence of diagnostic serological findings; however, it is not warranted in the setting of acute mild elevations.

At an outpatient follow-up visit one week after discharge, the patient had returned to his usual state of good health and the ALT and AST levels were returning to normal. However, because of the nonspecific nature of his initial symptoms and the short-term transaminase elevations, as well as the fervent desire of the patient and his wife for an explanation for the symptoms, acute serological tests for Epstein-Barr virus (EBV) and cytomegalovirus (CMV) were obtained. They were notable for elevated levels of IgM antibody to CMV, consistent with acute infection.

5. Which of the following is not a characteristic clinical manifestation of CMV infection?

a. Asymptomatic
b. Acute mononucleosis illness
c. Elevation of liver transaminase levels
d. Retinitis
e. Burkitt's lymphoma

CMV is a member of the herpesvirus family. It is spread by person-to-person contact, with transmission occurring via both saliva and sexual contact. CMV infection is extremely prevalent in developed countries, congenital infection rates are estimated at 1% and prepubescent infection rates at 10 to 20%; rates of previous exposure among adults range from 40% to l00%, with higher rates in developing nations.[10] CMV diagnosis can be made through culture of the organism from blood, urine, and other body fluids and also through polymerase chain reaction.

For the vast majority of people with competent immune systems, CMV infection is asymptomatic. The most common symptomatic presentation among immunocompetent patients is an acute mononucleosis-like illness. In fact, although EBV is thought to be the most common cause of acute mononucleosis like illness, CMV was nearly as common in some studies.[11] Other potential causes include human herpes virus type 6, Toxoplasma, and HIV. Liver transaminase levels are typically mildly elevated in CMV mononucleosis syndrome, with AST usually peaking below 200 U/L.[12] Among immunocompromised patients, CMV infection can be a serious illness. CMV retinitis occurs for 30% of patients with acquired immunodeficiency syndrome in the United States and can progress rapidly unless treated. CMV infection is also associated with rejection of transplanted organs. EBV, but not CMV, is associated with the development of Burkitt's lymphoma.

Discussion

Malaria afflicts travelers (including Soldiers) to many parts of the world, including the Republic of Korea. It can present weeks to months after the return from being overseas and is often missed by U.S. physicians. A careful travel history is vital, and, if malaria is considered, then physicians should have a low threshold for ordering thick and thin smears. However, relatively few laboratory technicians in the United States have significant expertise in the interpretation of these smears, and careful review by experts is important.

The anthrax vaccine is relatively well tolerated by most individuals, but some do experience serious side effects. In addition, misinformation on the Internet and in lay publications is rampant, leading some individuals to fear the vaccine and others to attribute a host of symptoms or illnesses to their receipt of the vaccine. The symptoms are unrelated to the vaccine in most cases, and a careful history, physical examination, and directed laboratory testing are warranted to try to identify the cause of the presenting symptoms. In many cases, another cause may be identified or no clear cause found; nevertheless, it is helpful to report the temporal association through the VAERS system, with all pertinent clinical data, to establish a meaningful clinical database.

CMV is a member of the herpesvirus family and is highly prevalent in the general population. Although most cases are asymptomatic, it can become a serious disease among immunosuppressed patients. Among immunocompetent adults, CMV can produce a mononucleosis-like syndrome, with a variety of nonspecific complaints that can be mistaken for influenza or other viral processes, or numerous other common clinical syndromes. This infection has additional military relevance, in that it can be easily disseminated among young adults in close quarters, such as new recruits in basic training barracks, where contact with respiratory secretions and other bodily fluids may occur. In the case presented, CMV is thought to be the cause of the patient's most recent episode of symptoms. Some of his previous similar episodes might have been attributable to administration of the anthrax vaccine, whereas others were most likely attributable to unidentified viral causes, highlighting the nonspecific presentation that is common with CMV.

Answers: 1. b; 2. e; 3. d; 4. a; 5. e

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Medical History

Medical Support In A Counter-Guerrilla War: Epidemiologic Lessons Learned In The Soviet-Afghan War

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Throughout history, armies and disease have been constant companions. Death from disease often exceeded battlefield deaths. Typhus, plague, cholera, typhoid, and dysentery have decided more campaigns than the great generals of history. In the Crimean War of 1853 to 1856, the English and French combined forces against Russia. The French sent 309,000 men into the theater. Of these, some 200,000 were hospitalized—50,000 for wounds and 150,000 from disease.[1] English and Russian experience was similar. The following chart shows the ratio of combat losses to disease losses.

Table 1 Crimean war casualties among the European forces in Crimea[2]

	Wounded	Killed in action, died of wounds	Sick	Died of disease
French	39,869	20,356	196,430	49,815
English	18,283	4,947	144,390	17,225
Russian	92,381	37,958	322,097	37,454

Modern medicine and inoculations have significantly decreased wartime deaths due to disease, but disease continues to sap the strength of modern armies. Some armies do a better job of practicing preventative medicine than others. As the Soviet Army learned in Afghanistan, a strong preventive medicine program and field sanitation program are essential for maintaining a force in a foreign climate. **Authors Note:** *The Soviet invasion of Afghanistan on 25 December 1979 thrust Soviet ground forces into the middle of a civil war to fight a guerrilla enemy on some of the roughest terrain on earth. Their vain attempt to prop up an unpopular Marxist regime ended with their withdrawal which they completed on the 15th of February 1989. Discontent with the Soviet leadership's handling of the Afghanistan War was one of the causes of the disintegration of the Soviet Union. In Afghanistan, the fighting continues, but no longer between Afghan communists and Afghan Muslims. Now, the various Afghan resistance groups are fighting one another for control of this dry, mountainous South Asian land.*

For the first six years of the war, the Soviet press barely mentioned the war. When they did, it was in terms of happy Soviet soldiers building hospitals and orphanages. The Soviet combat role was not mentioned, nor was the fact that the Soviets filled more hospitals and orphanages then they constructed. When General Secretary Gorbachev's *glasnost* policy was implemented in the Soviet Union, the true casualty picture slowly began to emerge. Of the 620,000 Soviets who served in Afghanistan, 14,453 were killed or died from wounds, accidents, or disease. This is a modest 2.33% of the total who served. The rate of hospitalization during Afghanistan service, however, was remarkable. The 469,685 personnel hospitalized were an astounding 75.76% of those who served. Of these, 53,753 (or 11.44%) were wounded or injured. Fully 415,932 (or 88.56%) were hospitalized for serious diseases. In other words, of those who served in Afghanistan, 67.09% required hospitalization for a serious illness. These illnesses included 115,308 cases of infectious hepatitis and 31,080 cases of typhoid fever.[3] **Author's Note:** *In the original, the figures are given as 415,932 hospitalized for disease, including 115,308 cases of infectious hepatitis, 31,080 cases of typhoid fever and 140,665 cases of other existing disease. This leaves 128,889 cases or 39.99% of the total unaccounted for. I added the 128,889 to the 140,665 figure.* The remaining 233,554 cases were split between plague, malaria, cholera, diphtheria, meningitis, heart disease, shigellosis (infectious dysentery), amoebic dysentery, rheumatism, heat stroke, pneumonia, typhus, and paratyphus. [4]

Author's Note: *What is missing from the Table 3 is typhoid fever. According to official statistics, typhoid fever accounted for 7.47% of infectious cases, yet it is not in this chart. It is probably included in the upper respiratory category.*

Despite the best efforts of Soviet preventive medicine teams, hospitals, vector control teams, and water purification units, they were never able to get con-

Table 2 Category of Diseases Treated in Soviet Army Hospitals by percentage[5]		
Category of Disease	**Afghanistan 1980-1988**	**World War II 1941-1945**
Infectious disease	56.50%	35.27%
Vitamin deficiency and eating disorders	0.09%	4.98%
Growths and tumors	0.26%	0.41%
Nervous and psychological	2.21%	4.58%
Eye disease	0.93%	2.34%
Ear, nose & throat	0.97%	1.61%
Lung disease	4.10%	7.93%
pneumonia (in above)	1.30%	3.72%
Circulatory system	1.80%	6.46%
Digestive system	3.90%	13.88%
Uro-genital system	1.30%	3.11%
Blood and blood-producing organs	0.02%	0.12%
Bones, joints & muscles	2.10%	1.39%
Skin and subdermal tissue	9.90%	7.67%
Poisoning	0.13%	0.63%
Noncombat injuries	15.10%	8.62%
Other disease	0.60%	1.00%
Total	100%	100%

The above chart shows a dramatic increase in hospitalization for infectious disease and noncombat injuries—a result of deployment to a foreign climate where there are new strains of disease and the increased number of motorized vehicles in the Soviet Army in Afghanistan. The chart shows modest increases hospitalization for bones, joints, and muscles as well as skin and subdermal tissue. Most other categories show a decrease, probably due to the fact that the Soviet combatants in Afghanistan were young conscripts, while the World War II Soviet Army included many conscripted middle-aged men.

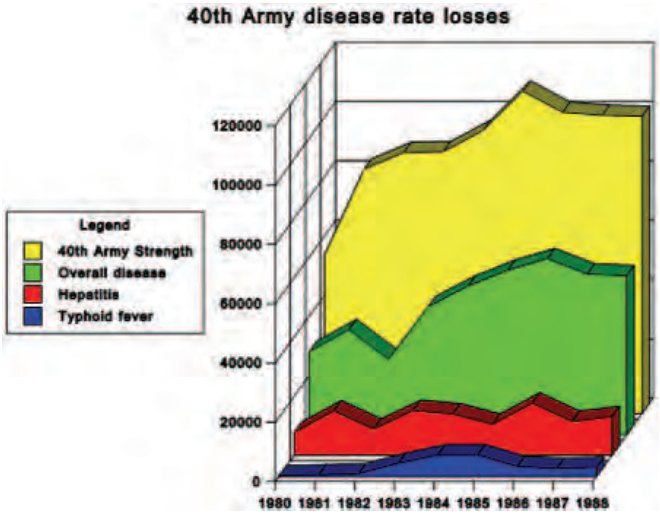
The following chart shows the breakdown of infectious diseases by type:

Table 3 Percentages of infectious disease treated by type in Soviet Army Hospitals[6]									
Disease	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**
Typhus-paratyphus	1.8	2.3	5.9	13.5	18.5	16.9	7.8	7.5	10.6
Shigellosis	11.4	6.1	13.1	14.1	20.8	21.1	15.3	13.7	12.9
Viral hepatitis	46.1	50.1	40.9	47.4	34.8	28.2	42.5	36	50.5
Amoebic dysentery	----	----	----	0.1	1.3	3.1	6.5	10.2	6.1
Tonsillitis	4.9	4.1	5.2	2.6	2.6	4	6.1	3.7	3.2
Upper respiratory	30.6	30.2	29	18	14.3	16.2	14.5	14	10.9
Malaria	0.8	0.9	2.7	3.2	4.2	6.6	4.7	4.2	2.7
Other	4.4	6.3	3.2	1.1	3.5	3.9	2.6	10.7	3.1

trol of the spread of infectious disease. The main reasons for the high rate of disease among Soviet servicemen were lack of sufficient supplies of clean drinking water; lack of enforcement of basic field sanitation practices (a historic Soviet problem, partly due to the lack of a professional NCO corps); failure of cooks to wash their hands after defecation; infestations of lice and rodents; poor diet; and failure to provide soldiers with clean uniforms and underwear on a regular basis.

The 40th Army was the primary Soviet force in Afghanistan. In addition, Soviet KGB and MVD forces served in Afghanistan along with some Soviet advisors to the Afghan Army and a Soviet civilian work force which supported the Soviet Army. **Author's Note:** *KGB was the Committee for Government Security. Their duties included intelligence, counter-intelligence, prison camp administration, and border guards. They also fielded a potent field force. The KGB role in Afghanistan was supporting the Afghan equivalent (the KHAD) and manning border guard posts within*

Afghanistan. The MVD was the Ministry of Internal Security. They were a large armed force which ran prison camps, provided crowd control and anti-riot forces, and performed a rear-area security function in wartime. The Soviets advised the Afghan Combat Police (the Sarandoy).



The above graph shows that the Soviet 40th Army had a very serious problem with disease prevention and that at any time over one-quarter of the troop strength might be unavailable due to disease. In October through December of 1981, the entire 5th Motorized Rifle Division was rendered combat ineffective when over 3000 of its men (over one-quarter of its strength) were simultaneously stricken with hepatitis. The sick included the division commander, most of his staff, and two of the four regimental commanders.[7] **Author's Note:** *The chart only shows personnel in hospital with hepatitis, so the personnel confined to quarters with the disease are not shown. The 5th Motorized Rifle Division, roughly one-fifth of the total strength of the 40th Army, exceeded the annual rate for hepatitis in two months. Thus the official statistics, although staggering, are on the low side.* Every year, one-third of the entire 40th Army was stricken with some form of serious infectious disease.[8]

Hepatitis

The major causes of hepatitis are viruses, alcohol abuse, and drug abuse. Vaccines can protect personnel from hepatitis B and troops going to Afghanistan received this vaccination. There are no vaccines against hepatitis A and hepatitis nonA-nonB. Hepatitis A was the most prevalent form of hepatitis among Soviet soldiers in Afghanistan (95%; the remaining 5% was hepatitis nonA-nonB).[9] Infectious hepatitis is a highly infectious disease and is spread by the fecal oral route—normally the result of failure to wash one's hands or drink clean water. The incubation period in Afghanistan was normally 37 days and recovery took six to eight weeks with relapses.

The combat tour was 18 months for conscripts and two years for officers. First-year soldiers were 2.5 times more likely to contract hepatitis A than second-year soldiers. The greatest number of hepatitis cases was contracted in the fall and winter.[10] Epidemiologic analysis showed that from 31 to 74% of cases of infectious hepatitis were contracted in base camp, 13 to 45% were contracted in the field, 8 to 15% were contracted in outposts, and 5 to 14% were contracted while on convoy duty.[11] This analysis is surprising, because one would expect that the best sanitation prophylaxis would be in the base camps. Instead, most of the hepatitis was contracted where it could have been best prevented.

Upper Respiratory Disease

Pneumonia and bronchitis were serious problems for the 40th Army, especially during the first four years of the war. Table 4 depicts the percentage various types of upper respiratory disease during 1982-1984.[12]

Servicemen contracted acute pneumonia all throughout the year, but the majority of the cases (and more serious and contagious cases) occurred in the fall and winter (65% versus 35% in the spring and summer). Approximately 10% of the cases initially diagnosed as acute respiratory infection were actually typhoid fever.

Table 4 Percentage of respiratory diseases treated by type

Disease	Enlisted Personnel			Officers		
	1982	1983	1984	1982	1983	1984
Acute pneumonia	52	57	65.1	39	52	47.8
Acute bronchitis	30	24	25.8	41	22	34
Chronic bronchitis	5.4	3.5	3	8.1	12	11.2
Chronic pneumonia	2	0.5	0.1	--	1	0.7
Acute respiratory infection	10.6	15	6	11.9	13	6.3
Totals	100	100	100	100	100	100

Table 5 shows that Soviet soldiers in Afghanistan were as likely to contract mycoplasmae pneumonia as the rest of the Soviet Army, but were more likely to contract lobar pneumonia. The army-wide figures do not total 100%, but no explanation is given. Why there is any difference between the private and NCO rate is a mystery since they are the same age and live under the same conditions.

Most Soviet soldiers had six months of training before being sent to Afghanistan. Further, many soldiers were sent to Afghanistan as part of a levy after serving a year in a Soviet military district or group of forces in Europe or Mongolia. Therefore, a comparison of time-in-service for soldiers who contracted pneumonia in Afghanistan and in the rest of the force seems skewed. Further, the Afghanistan service figures for the first six months of service and 6 to 12 months service add up to 100%, while the Army wide norms require the addition of the second year service figure to reach the 100% mark. Again, these figures are skewed.

Table 8 shows some double counting as the types of pneumonia total over 100%. Some of this must be due to the instances where a mild case worsens and the patient is double-counted.

Statistics show that 6% of Soviet soldiers in Afghanistan who developed pneumonia also had an illness of the digestive tract and that 30% were 10 to 15% below ideal body weight. The possibility of a servicemen in Afghanistan contacting a severe or grave case of pneumonia was twice as high as the Soviet soldier serving elsewhere. Incidents of bronchial pneumonia in Afghanistan were also double the army-wide average.[17]

Physicians had difficulty making the correct diagnosis, since the laboratory results and patients symptoms varied so widely from the usual results and symptoms. This created a delay in starting the correct treatment and in returning the soldier to duty. Table 9 shows a wide variance with common symptoms.[18]

Table 5 Comparing types of pneumonia (%)[13]

Symptoms	Afghanistan Service	Army-wide Norm
Mycoplasmae pneumonia (soldiers/NCOs)	89/75	86.6/75
Lobar pneumonia (soldiers/NCOs)	11/25	6.0/5.6

Table 6 Comparing time of service when pneumonia was contracted (%)[14]

Time when infected	Afghanistan Service	Army-wide Norm
1st year of service	82	80.1
2nd year of service	18	19.9
1st month of service	17.1	29.1
1st 3 months of service	43.9	44.1
1st 6 months of service	70.7	59.3
6-12 months of service	29.3	20.9

Table 7 Hospitalization time required for pneumonia (%)[15]

Time	Afghanistan service	Army-wide Norm
Hospitalization 1-2 days	42	40.9
Hospitalization 3-4 days	24	36.6
Hospitalization 5-7 days	22	15.3
Hospitalization 8-10 days	4	4.3
Hospitalization over 10 days	8	2.9

Table 8 Severity and complications of pneumonia (%)[16]

	Afghanistan service	Army-wide Norm
Mild cases	22	48
Moderate cases	50	39.3
Severe cases	28	12.2
Grave cases	30	16.7
Complications, pleural infusion, mild case worsens	14	4.2
Delirium	65.8	15

Lessons learned

In Afghanistan, many of the combat units were spread out in small outposts where hot meals and clean water were not available. Initially, the Soviet soldiers in isolated outposts ate nothing but dry rations. **Author's Note:** *Dry rations are similar to the old U.S. Army C ration. There were three types of dry rations. The first contained a can of meat, some crackers or toast, some jam, and a tea bag. The second contained two cans of meat mixed with oatmeal. The third contained a can of meat and a can of vegetables or fruit.* The lack of regularly-prepared, balanced meals weakened the soldier's resistance to disease. The accumulation of ration cans and other trash provided breeding grounds for rats and disease. As the war progressed, an effort was made to serve everyone a hot meal and tea for breakfast and dinner. Isolated units still had a dry ration for lunch. To get hot meals to some of the troops, the Soviets developed air-droppable containers.

Yet, hot meals were a mixed blessing since one of the primary sources of infection were the cooks. Cooks had

Table 9 Comparing pneumonia symptoms (%)		
Symptoms	**Afghanistan service**	**Army-wide Norm**
General weakness	92	100
Head ache	54	97
Insomnia	22	87
Thirst, dryness of mouth	26	98
Chills	44	84
Loss of appetite	30	99
Aching muscles and joints	16	48
Dizziness	38	92
Fatigue	8	97
Paleness	26	97
Inflammation of the upper respiratory tract	52	97
Cough	96	94
Paroxysms (over 25 per minute)	32	12
Shortness of breath	42	67
Wheezing: dry/damp	38/70	46\5
Tachycardia (over 100 per minute)	22	66
Low blood pressure	24	72
Weakened tone	8	85
Hyperresonance	8	19
Stomach ache	8	57
Coating of the tongue/swelling	34/2	100/100
Flatulence/diarrhea	4/6	68/55
Hepatomegaly	20	95
Splenomegaly	4	67

lice, intestinal pathogens, and little officer supervision. The personal hygiene of the cooks was no better, and sometimes worse, then the rest of the Soviet soldiers. The Soviets recognized this and began inspecting the cooks and conducting monthly medical examinations. Their laboratory results are listed in Table 10:[19]

These laboratory results are staggering. It only takes a few sick cooks to keep the hospital sick-bays filled and the Soviets were never able to keep all the cooks clean and sanitary.

Table 10 Laboratory findings of pathogenic intestinal bacteria among cooks (%)									
Organism	**1980**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**
Shigellosis	0.2	0.3	3.7	3.1	3.1	3.3	5.3	5.2	4.5
Typhus-paratyphus	---	0.1	1.4	3.7	2.8	2.7	3.1	3	1.2
E. coli & other salmonella	---	---	0.2	0.2	0.3	0.7	1.2	4.1	2.1

Physical conditioning and acclimatization is very important in disease prevention. Eventually, most soldiers trained for six months in mountain warfare schools before they arrived in Afghanistan. Physical conditioning was stressed, as was field craft, first aid, and field sanitation. However, physical training in the Soviet Union did not fully prepare the soldiers for the realities of the rugged field conditions of Afghanistan. The average field combat load in Afghanistan was 32 kilograms (70.5 lbs). Despite the rigorous physical conditioning program, soldiers were unable to routinely carry this much weight at high altitudes. The Soviets eventually developed special, lightweight field gear, but never produced it in enough quantity to get it to all the troops who needed it. Troops were rapidly debilitated by the harsh field conditions and consequently more prone to disease.

Rats, lice, and mosquitoes were a constant problem. Garbage was not quickly policed up and properly disposed of. Garbage dumps were often collocated with camps and base camps. Stagnant pools of water were not drained or treated for mosquito larvae. Troops were dusted with DDT, but since clothing and bedding were seldom washed or exchanged, lice were a constant feature of life in the 40th Army. Typhus and malaria were two consequences of inadequate vector control.

The water in Afghanistan has a high bacteriological content. Despite warnings and training, Soviet troops often drank untreated water. This was often due to the failure of the Soviet logistics system to provide clean water to troops at remote locations. Sometimes, Soviet soldiers drank untreated water because they did not like the taste of treated water and had grown up drinking water from all sources without apparent ill effects. The untreated water often carried typhus and amoebic dysentery. The Soviets began issuing boiled water treated with pantocides to their soldiers. Water purification points were set up at mess halls and cisterns were installed to store purified water. Large garrisons built pumping stations with chlorination units.[20] Despite these efforts, the Soviets were unable to

guarantee adequate supplies of clean water to all the force or insure that the troops drank it.

Basic field sanitation remained a Soviet problem throughout the war. Although field latrines were dug and flush latrines were installed in base camps, Soviet soldiers often did not bother to use them and relieved themselves close to the living and dining areas. The troops often did not wash their hands after relieving themselves. Troops could shower (or visit the steam bath) weekly at base camps, but seldom bathed in the field. Hepatitis, shigellosis and other diseases resulted.

The Soviets underestimated the amount of medical support necessary to support the 40th Army. They were well-equipped to handle the wounded, but they were unprepared to deal with the large number of sick soldiers. In order to relieve overcrowded hospitals, the Soviets evacuated large numbers of their sick and wounded to military hospitals in the Soviet Union and in Warsaw Pact countries. They also established a infectious disease hospital at Bagram, Afghanistan with a rehabilitation center annex for recovering infectious-disease patients. The Bagram Rehabilitation Center consisted of a command element, eight companies, a medical station, and a supply element. Each company had six combat arms officers and six warrant officers to administer the program and control the patients. The rehabilitation program included medical treatment, a two hour rest after dinner, five meals a day, therapeutic physical training, vitamin therapy, psychotherapy, and occupational therapy. Patients were discharged after full recovery.[21] Despite these efforts, the Soviet medical establishment was hard-pressed to deal with their patient-load resulting from disease.

After the war, the Soviets and then the Russians studied the U.S. Army deployment to the Persian Gulf for Desert Storm. Among the disease prevention measures taken by the Americans which impressed the Russians were the supply of 80 liters of water per person per day, the wide use of bottled water, the ration heating units on U.S. tanks and personnel carriers, the MRE ration, the issue desert chocolate bar which can withstand 150° Fahrenheit without melting, and the issue field clothing and load-bearing equipment.[22]

In 1994, Russian military doctors recommended the following measures be taken when deploying troops to another region:[23]

- conduct a rate of personnel illness forecast, taking into account the particular environmental factors which will impact on servicemen, and then coordinate logistic, engineer, and medical support to deal with the problem;
- immunize personnel well in advance of the deployment and train them on field sanitation practices for the new region;
- perform an advance reconnaissance of water sources and conduct a laboratory analysis of water quality;
- seize and protect water sources;
- establish a system to deliver clean water to field sites and maintain water stores on site;
- routinely repurify any piped water from local city systems;
- provide units and soldiers with water purification tablets or filters;
- establish reserves of bottled water;
- plan for the early delivery of water purification systems such as filtration systems, boilers, etc.;
- stock clean water reserves for raiding parties, combat operations, security outposts, and guards;
- train the soldiers how to maintain the purity of drinking water and operate water purification equipment;
- plan and conduct environmental protection measures, ensure that the troops use field latrines and dispose of garbage properly, ensure that troops wash regularly, and ensure that latrines and garbage dumps are disinfected regularly;
- ensure that troops receive regular hot meals and do not subsist on canned food for extended periods;
- supply battalions and companies with enough mermite-type containers to keep food hot until it is delivered;
- start issuing multivitamins to the troops immediately when the redeployment order is received;
- supply enough equipment to supply each mess with at least 20 liters of water (including 16 liters of hot water) per person per day;
- provide adequate sites for personnel to wash their mess kits;
- monitor prepared food portions to ensure that soldiers are receiving their full ration;

Author's Note: *Theft and resale of soldiers' food has a long history in the Russian and Soviet Army.*

- routinely issue clean underwear and bedding;
- build a steam bath for every battalion, separate company, or platoon;
- enforce scheduled bathing schedules for the troops;
- regularly inspect for lice and disinfect when necessary;
- disinfect the site within three hours whenever a soldier with an infectious disease is discovered;
- immediately isolate soldiers with infectious disease and hospitalize them within 24 hours;
- maintain sufficient contingency stocks of immunuglobulins, vaccines, anatoxins, and antibiotics to protect all personnel whether prior to deployment, upon deployment, during combat, and during convalescence.

Conclusions

The Soviet Army in the field was never a particularly clean army. They dug latrines, but seldom used them. They defecated in their mess and bivouac areas. They dumped un-

wrapped bread directly on the ground and left it there until they served it. They seldom washed their hands and did a poor job on washing their mess kits. They threw cans, trash and uneaten bits of food around the bivouac area. Showers and clean clothes in the field were occasional at best. Barracks life was not always much of an improvement.

In a European peace-time environment, the above was not much of a problem. Most of the soldiers had natural immunities to many of the local diseases and the command never had to pay a price for sick soldiers. Soldiers were cheap and plentiful. This was not the case in Afghanistan, however, where every soldier was necessary and in short supply. The 40th Army began to pay the price for years of Soviet neglect and poor field craft and hygiene. The Soviets were unable to logistically support the size army they felt they needed to successfully prosecute the war in Afghanistan. Their inability to effectively control infectious disease drastically cut into their present-for-duty strength. Combat units were often understrength by a third of their authorized strength. Two-company battalions and two-battalion regiments were common due to disease and other problems.

Part of the reason that the Soviets could not control infectious disease was their lack of a professional NCO corps. The Soviet NCO was a conscript who had attended a special six-month course. He had no moral or actual power over his fellow soldiers. The business of discipline, inspection, and enforcing standards fell on the platoon leader—a junior lieutenant. He personally had to ensure that all his troops were lice-free, washed their hands, drank clean water, disposed of their trash properly, prepared food correctly, and dug and used latrines. He was also responsible for maintenance, training, and combat. Without proper NCOs, the lieutenant was unable to accomplish all his duties correctly and lack of adequate field sanitation was one of the results.

The Soviets received brutal lessons in Afghanistan on the importance of diet, physical conditioning, pure water, field sanitation, vector control, and adequate medical support. Yet, the heir to the Soviet Army, the Russian Army, has not learned these lessons or taken them to heart. In 1988, Soviet soldiers were rushed into Armenia to provide earthquake relief. Their poor food, lack of field sanitation, and lack of clean clothing resulted in mass illnesses which required rescuing many of the rescuers. In 1989, the Soviet Kostroma airborne regiment, the Akhalkalaki motorized rifle regiment and the Kutaisi air assault brigade moved into Tbilisi, Georgia to put down rioting. The troops had one or no changes of underwear for an extended tour. **Author's Note:** *The Soviet (and Russian) Army issues three sets of underwear per soldier. Theoretically, the soldier wears one set, one set is held in regimental stores and one set is at the division laundry point. Underwear is supposed to be changed once a week, but due to shortages, losses, and breakdowns in the supply system, the soldier often wears his single set of underwear for months at a time. The situation with uniforms is not much better. The soldier has one field/work uniform and pair of boots. He wears these continually for six months. When he washes his uniform, he wears it damp the next day.* In 1992, the Russian 14th Army fought in Tirasapol, Moldova. Only the brevity of the combat prevented a serious outbreak of disease from the lack of clean water for drinking and cooking. In 1992, the Russian 201st Motorized Rifle Division deployed to the border between Afghanistan and Tadjikistan to help guard the border of this newly-independent republic against the *mujahideen*. In the rush to get forces forward to the border, the command again neglected to establish sanitary mess halls and field mess facilities and to provide adequate, pure water for drinking and washing. As a result, viral hepatitis, intestinal infections, and malaria mowed down the 201st Motorized Rifle Division and filled hospital wards with entire squads and gun crews.[24] Initial reports from the fighting in Chechnya indicate that disease is again a limiting factor in the number of troops that the Russians can deploy.

In recent years, the U.S. Army has had an excellent record of disease prevention, field sanitation, and disease control. However, as the United States conducts foreign policy by membership in multi-national alliances, the chances increase that the U.S. Army will have allies whose record in field sanitation and disease prevention is similar to that of the Soviets. The U.S. Army medical professionals could find themselves providing medical support to these allied forces. If so, the U.S. Army medical community needs to prepare to fight epidemics not isolated cases.

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Dear Johnny
The SOF VA Disability Answer Man

CPT Johnny Wayne Paul, SP, APA-C

Dear Johnny,

I have been in Special Forces fifteen years and I was with the Rangers for the first five years of my Army career. I now have my twenty years of service and plan to retire in the next few months. I am applying for VA disability for the following conditions: Chronic back and neck pain (injured during a parachute jump), chronic knee pain (injured during PT), chronic sinusitis after deployment to Afghanistan in 2003, and hearing loss with tinnitus. Now that I am retiring, I want to know more about Combat Related Special Compensation. What is it and how much will I get? Signed, SGM Show Me the Money

Dear Show Me the Money,

Simply put, Combat Related Special Compensation (CRSC) is specifically for retired veterans with combat-related injuries. CRSC allows you to collect your retirement and a VA disability tax free for any disability that results from:

- Conditions Simulating War
- Instrumentality of War
- Hazardous Service
- Armed Conflict

Added Benefits of CRSC:

- CRSC is NOT subject to either taxation or division with a former spouse.
- CRSC is retroactive.

History

While some form of disability compensation has been offered to injured Soldiers since colonial times, military retirement benefits were not introduced in the United States until 1861 during the Civil War. In 1890, the first legislation prohibiting concurrent receipt was introduced by Senator Cockrell of Missouri, who argued that military retirement benefits "[are] intended to be [compensation] in full for all military services." In 1941, Congress enacted legislation which, while maintaining the ban on concurrent receipt, allowed veterans to elect which benefit they would receive. The ban on concurrent receipt was consistently maintained by Congress until 1999.

Without CRSC			**With CRSC**		
Military Retired Pay		$4,600	Military Retired Pay		$4,600
VA Offset		-$4,600	VA Offset		-$4,600
VA Pay		+$4,600	VA Pay		+$4,600
			CRSC		+$4,600
***Total Pay**	=	**$4,600**	***Total Pay**	=	**$9,200**
***Note Total pay is tax free.**					
***Is not representative of all claims.**					

Enacted by Congress on December 2, 2002, the Combat-Related Special Compensation (CRSC) program restores military retired pay to eligible retired veterans with combat-related injuries. The CRSC program is a special part of a larger legislative initiative to restore military retirement compensation so that a veteran can receive a full military retirement in addition to his entitled disability pay.

Let us use SGM Show Me the Money as an example:

Chronic back and neck pain (injured during a parachute jump)	20%
Chronic knee pain (injured during PT)	10%
Chronic sinusitis after deployment to Afghanistan in 2003	10%
Hearing loss	10%
Tinnitus	10%
Total:	60%*

*Note VA percentages may not add up to 60%

Approximate Amount: $1045/Month

As documented, the SGM would get approximately $420 in CRSC per month. However, if he could show that his chronic knee pain was due to physical fitness training in a combat simulation or his hearing loss and tinnitus were due to firing his weapon on a certain date, he would qualify for the entire $1045 CRSC per month.

ELIGIBILITY

Retired veterans with combat-related injuries must meet all of the following criteria to apply for CRSC:

1. Active, Reserve, or medically retired with **20 years** of creditable service

2. Receiving military retired pay

3. Have 10% or greater VA-rated injury

4. Military retired pay is reduced by VA disability payments (VA Waiver) **AND…** must be able to provide documentary evidence that the injury was a result of one of the following:

- **Training that simulates war (e.g., exercises, field training)**
    - Simulating War - hurt ***knee*** while reacting to enemy fire during FTX
- **Hazardous duty (e.g., flight, diving, parachute duty)**
    - Hazardous Services - hurt ***knee*** on a night jump during SF school
- **An instrumentality of war (e.g., combat vehicles, weapons, Agent Orange)**
    - Instrumentality of War - hit ***knee*** on rotating tank turret during FTX
- **Armed conflict (e.g., gun shot wounds [Purple Heart], punji stick injuries)**
    - Armed Conflict - shot in ***knee*** by enemy during Gulf War

When supplying documentary evidence regarding a CRSC claim, make sure that the documentation contains specific details about each injury and the combat-related event(s) that identifies and documents the origin of the injury. It is relatively common for SOF operators to have no documentation. In the event that there is no documentation available, a letter from the primary care provider (Battalion Surgeon/PA) may suffice; however, the more documentation that is available, the better. For example, if an operator was injured during a parachute jump, a copy of a sick call slip and his jump log would probably help to substantiate his claim. DOD guidelines will not allow personal or "buddy" statements. The provider/medic should encourage operators to obtain documentation such as a sick slip or SF600.

Situation		
Simulating War	**Combat-Related**	**Service-Related**
Must be contributed to "training for combat"	Tactical Road Marches	Routine Road Marches
	Physical Fitness Training in Combat Situation	Physical Fitness Training
	Combat Obstacle Courses	Confidence Obstacle Courses
	Ranger Training (Rappelling)	Ranger Training (Battalion Run)
Hazardous Service	**Combat-Related**	**Service-Related**
Linked to specific incident	Flight Duty	Military job related injuries not caused by a specific incident (i.e, Assigned infantry, artillery, engineers)...
	Demolition Duty	
	Parachute Duty	
	Diving Duty	
Instrumentality of War	**Combat-Related**	**Service-Related**
Instrument must be used in military training	Routine auto accident in unique military vehicle	Military sedan in civilian vehicle accident
	Tanks, armored vehicles, etc.	Repairing military vehicle in maintenance setting
	Ammunition and explosive devices	Improper use of pyrotechnics
	Lifting artillery round	Off-post weapon incidents
	Rappelling from military aircraft	
Armed Conflict	**Combat-Related**	**Service-Related**
Occurred in combat	Gunshot wound	Service-related injuries in combat zone
	Shell fragment wounds	Sporting events/ recreational activities in a hostile area

Conclusion

During patient visits, the provider should consider future disability claims that may be affected by what the provider documents. The difference between "twisted right ankle during PT," versus "twisted right ankle during combative training can be significant." The provider may want to consider using the statement "This injury/illness meets the combat related criteria for CRSC."

CRSC Links

DEPARTMENT OF THE ARMY
Combat-Related Special Compensation (CRSC)
200 Stovall Street
Alexandria, VA 22332-0470
Website: http://www.crsc.army.mil

AIR FORCE
United States Air Force
Disability Division (CRSC)
550 C Street West Ste 6
Randolph AFB TX 78150-4708
Phone: 1-800-616-3775
Website: http://ask.afpc.randolph.af.mil/crsc

COAST GUARD
Commander (adm-1-CRSC)
U.S. Coast Guard
Personnel Command
4200 Wilson Boulevard
Arlington, VA 22203-1804
Website: http://www.uscg.mil/HQ/psc

NAVY and MARINE CORPS
Secretary of the Navy Council of Review Boards
Attn: Combat-Related Special Compensation Branch
720 Kennon Street SE, Suite 309
Washington Navy Yard, DC 20374
Phone: 1-877-366-2772
Website: www.hq.navy.mil/corb/CRSCB/combatrelated.htm

NOAA CORPS
Director, Commissioned Personnel Center
SSMC/Room 12100
1315 East West Highway
Silver Spring, MD 20910
UNITED STATES PUBLIC HEALTH SERVICE
Division of Commissioned Personnel
Office of the Director, Room 4A-15
5600 Fishers Lane
Rockville, MD 20857-0001

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If you have a VA disability question for Johnny, e-mail him at j.paul@us.army.mil. He currently works at HQ, USSOCOM for COL Warner "Rocky" Farr as a physician assistant.

Picture This....

Mike Rossman, MD; Daniel J. Schissel, MD

You are building relationships with a tribe that primarily inhabits the border region between Iraq and Syria when you are asked to examine a skin lesion on a young adult male in the village. The lesion (Photo 1) on his forearm is four days old as described by the translators. On physical exam you note the patient to be afebrile, has the cutaneous lesion shown in Photo 1, and has shotty epitrochlear nodes and axillary lymphadenopathy. You treat this as a standard carbuncle with some oral antibiotics and instruct him to follow-up if the lesion persists or acutely changes. The translator runs you down a few days later and brings the patient back to the team area. Now the lesion has progressed to a painless blackened presentation as illustrated in Photo 2. He is now febrile and on physical exam you find an additional lesion on his right neck as illustrated in Photo 3.

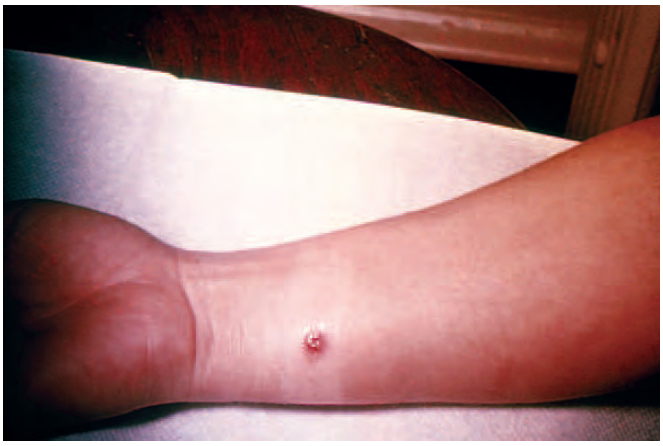

Photo 1

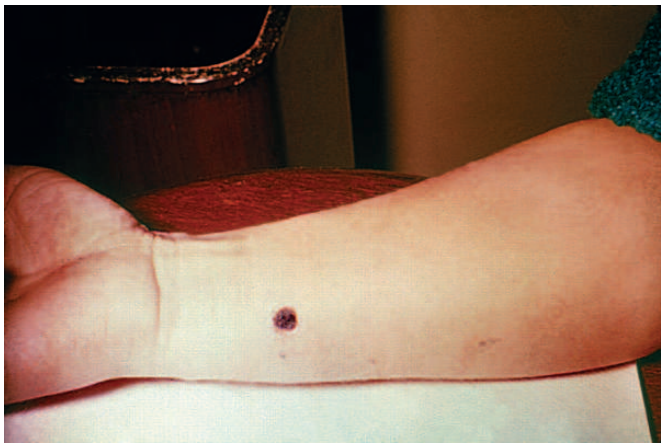

Photo 2

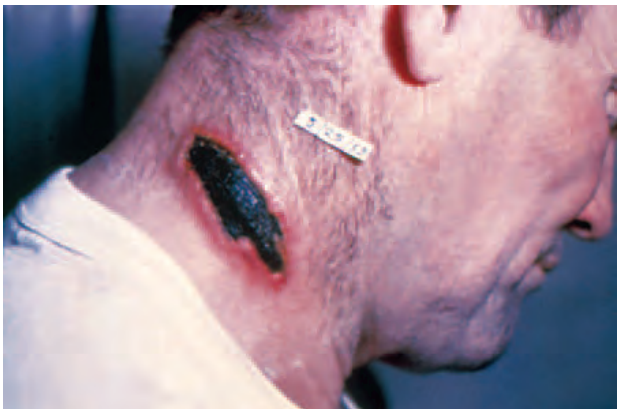

Photo 3

Using the primary lesion definitions outlined in your SOF medical handbook, how would you describe the morphology of these lesions?

What is the differential diagnosis of these lesions?

Answers

Morphology lesion Photo 1— **Erythematous Papule:** A solid lesion, usually dome-shaped, <1 cm in diameter and elevated above the skin.[1]

Morphology lesions Photos 2 and 3 — **Ulcer**: Loss of epidermis and at least part of dermis that results in scarring, **with black eschar**.[1]

Differential diagnosis

Photo 1: Has a very broad differential that includes actinic keratosis, angiofibroma, basal cell carcinoma, dermatofibroma, an early bacterial or fungal infection, hemangioma, amelanotic melanoma, molluscum contagiosum, neurofibroma, nevus, pyogenic granuloma, or squamous cell carcinoma.[2]

Photos 2 and 3: Cutaneous anthrax, brown recluse spider bite, ecthyma, ulceroglandular tularemia, accidental vaccinia, necrotic herpes simplex infection, orf, glanders.[3]

CUTANEOUS ANTHRAX

Epidemiology

Bacillus anthracis has a nearly worldwide distribution, existing in the soil as an extremely resistant spore. More than 95% of naturally occurring anthrax is the cutaneous form. Under natural non-bioterroristic conditions, humans usually acquire anthrax infections from contact with infected animals or contaminated animal products, such as hides, wool, and hair.

Between 20,000 and 100,000 cases of anthrax have been estimated to occur worldwide annually. However, in the United States early in the 20th century, the annual incidence was 127 and declined to less than one. This low annual incidence rate has been consistent for the lasted 20 years, until the recent terrorist act utilizing anthrax in 2001.[4]

Epizootic anthrax will continue to occur in highly endemic areas, such as Iran, Iraq, Turkey, Pakistan, and sub-Saharan Africa, where the use of animal anthrax vaccine is not comprehensive. In 2001, there were 22 confirmed or suspected cases of anthrax related to the terrorist act of mailing anthrax spores in the Eastern United States. Eleven of these cases were inhalational and the other 11 cutaneous. Four of the people died of inhalational anthrax.[5]

Etiology/Pathogenesis

Cutaneous anthrax is a bacterial infection caused by the endospores of *Bacillus anthracis*. Anthrax can infect the individual's lungs through inhalation, the gastrointestinal tract through ingestion, and/or the skin through cutaneous abrasions. *B. anthracis* is a non-motile, gram-positive, aerobic rod, 1.2 to 10 micrometers in width (Photo 4). Spores can remain dormant in soil for decades, in virtually any weather condition.[3]

Anthrax spores germinate when they enter an environment rich in amino acids, nucleosides, and glucose, such as the blood and/or tissue in either animals or humans. The replicating bacteria produce at least three pathogenic proteins: protective antigen (PA), lethal factor (LF), and edema factor (EF). These proteins combine to form two toxins known as lethal toxin and edema toxin.[6]

Clinical

Over 90% of cutaneous anthrax lesions occur in exposed areas such as the face, neck, arms, and hands. The reported incubation period for cutaneous anthrax is from one to twelve days. Skin infections begin as a small papule that may be pruritic, progresses to a vesicle in one to two days, which then erodes, leaving a necrotic ulcer with a characteristic black central eschar. Secondary vesicles around the primary lesion may develop. The lesion is usually painless; however, other symptoms may include swelling of adjacent lymph nodes, fever, malaise, and headache. The diagnosis of cutaneous anthrax is suggested by the presence of the eschar, the presence of edema out of proportion to the size of the lesion, and the lack of pain during the initial phases of infection.[6]

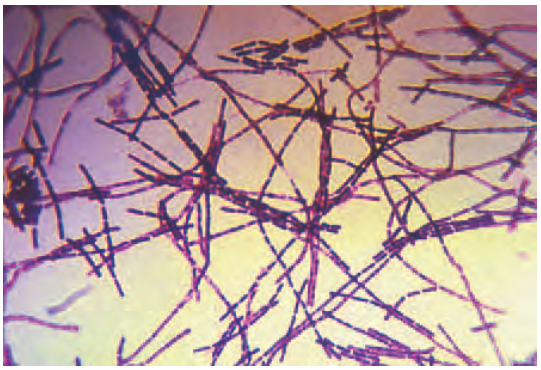

Photo 4

The diagnosis of cutaneous anthrax should be suspected by the characteristic painless, shallow ulcer with black crust (Photos 2 and 3). Gram stain of vesicular fluid will reveal typical gram-positive bacteria (Photo 4). Diagnosis can be confirmed by tissue culture and polymerase chain reaction (PCR) studies that are available through Landstuhl Regional Medical Center (LRMC) for the indicated areas of operation.[6] It should be noted that one is not considered at risk for contracting pulmonary anthrax when evaluating a patient with cutaneous anthrax since the disease is acquired through contact with anthrax spores, not active bacteria.[7]

Specimens should be collected from any patient being evaluated for cutaneous *Bacillus anthracis* infection. The CDC recommends that the following procedure be used for cutaneous anthrax testing. Initially, regardless of the stage of the lesion, collect two separate swabs: one swab for Gram stain and culture and one swab for PCR. If lesions are in the vesicular stage, aseptically collect vesicular fluid on sterile dry swabs from previously unopened vesicles. In addition, it should be noted that anthrax bacilli are most likely to be observed on Gram stain in the vesicular stage. When lesions are in the eschar stage, collect eschar material by carefully lifting the eschar's outer edge. Insert a sterile dry swab, then slowly rotate for two to three seconds, beneath the edge of the eschar without removing it. If the lesion is in the ulcer stage and no vesicle or eschar is present, swab the base of the ulcer using a sterile saline, pre-moistened swab. Specimens intended for culture, or both culture and PCR, should be shipped using cold packs and stored at 2 to 8°C. Specimens intended only for PCR testing may be shipped on dry ice and stored at -70°C.[8]

A skin biopsy should be obtained on every patient with a lesion being evaluated for cutaneous anthrax. If the patient is on antimicrobial therapy at the time of presentation, obtain one full thickness 4mm punch biopsy sample from a papular or vesicular lesion and include adjacent normal skin. Place the specimen in the standard 10% buffered formalin for histopathology. If the patient has not received antibiotics or if antibiotic therapy has been initiated in the proceeding 24 hours, obtain a second full thickness punch biopsy specimen for culture, Gram stain, PCR and frozen tissue for immunohistochemical studies. Do not attempt to split one 4mm sample for all of the studies. Biopsies should be taken from both vesicular and eschared lesions if present. Fresh samples (not formalin fixed) should be stored and shipped frozen to LRMC in this area of operation (or your closest major medical center in other settings) at -70°C and formalin fixed samples should be shipped at room temperature. More specific guidelines on collection of these specimens are provided in Shieh et al., *American Journal of Pathology*, Nov 2003, Vol 163, No. 5, Page 1908, Column 2.[8]

Acute serum specimens should ALWAYS be collected within the first seven days of symptom onset or as soon as possible after known exposure. Even if the diagnosis of anthrax is confirmed by isolation of *B. anthracis* from clinical specimens, collect a convalescent serum sample, 14 to 35 days after symptom onset. Both acute and convalescent serum specimens should be obtained with a minimum of 8ml blood, yielding ~ 4ml of sera.

If the patient has evidence of systemic symptoms, specimens for blood culture should be obtained. Collect two sets of cultures and a 10ml blood sample in EDTA (purple top tubes) for PCR testing.[8]

Therapy

For cutaneous anthrax, ciprofloxacin or doxycycline is the recommended first line therapy. Intravenous therapy is recommended for cutaneous anthrax with signs of systemic involvement, for extensive edema, or for lesions on the head or neck (Tables 1 and 2). Cutaneous anthrax is typically treated for seven to ten days. However, in the setting of a bioterrorism attack or deployment, the risk for simultaneous aerosol exposure may be high. As a result, persons with cutaneous anthrax associated with bioterrorism or deployment to OIF/OEF should be treated for 60 days.[9]

Treatment of cutaneous anthrax with antibiotics does not stop nor delay the normal progression of the lesion through the eschar phase. Antibiotics are given in hopes of eliminating the chance of this localized cutaneous infection transitioning to a systemic infection and causing significant mortality and increased morbidity. The case-fatality rate of cutaneous anthrax is five to twenty percent without antibiotic treatment, and less than one percent with antibiotic treatment.[4]

Table 1[9]

Category	Initial therapy (oral)†	Duration
Adults*	Ciprofloxacin 500 mg BID **or** Doxycycline 100 mg BID	60 days§
Children*	Ciprofloxacin 10–15 mg/kg every 12 hrs (not to exceed 1 g/day)† **or** Doxycycline:¶ >8 yrs and >45 kg: 100 mg every 12 hrs >8 yrs and ≤45 kg: 2.2 mg/kg every 12 hrs ≤8 yrs: 2.2 mg/kg every 12 hrs	60 days§
Pregnant women**	Ciprofloxacin 500 mg BID **or** Doxycycline 100 mg BID	60 days§
Immunocompromised persons*	Same for nonimmunocompromised persons and children	60 days§

* Cutaneous anthrax with signs of systemic involvement, extensive edema, or lesions on the head or neck require intravenous therapy, and a multidrug approach is recommended. Table 1.
† Ciprofloxacin or doxycycline should be considered first-line therapy. Amoxicillin 500 mg po TID for adults or 80 mg/kg/day divided every 8 hours for children is an option for completion of therapy after clinical improvement. Oral amoxicillin dose is based on the need to achieve appropriate minimum inhibitory concentration levels.
§ Previous guidelines have suggested treating cutaneous anthrax for 7–10 days, but 60 days is recommended in the setting of this attack, given the likelihood of exposure to aerosolized *B. anthracis* (*6*).
¶ The American Academy of Pediatrics recommends treatment of young children with tetracyclines for serious infections (e.g., Rocky Mountain spotted fever).
** Although tetracyclines or ciprofloxacin are not recommended during pregnancy, their use may be indicated for life-threatening illness. Adverse effects on developing teeth and bones are dose related; therefore, doxycycline

Table 2[9]

Category	Initial therapy (intravenous)††	Duration
Adults	Ciprofloxacin 400 mg every 12 hrs* **or** Doxycycline 100 mg every 12 hrs¶¶ **and** One or two additional antimicrobials§	IV treatment initially**. Switch to oral antimicrobial therapy when clinically appropriate: Ciprofloxacin 500 mg po BID **or** Doxycycline 100 mg po BID Continue for 60 days (IV and po combined)§§
Children	Ciprofloxacin 10–15 mg/kg every 12hrs¶¶,*** **or** Doxycycline:¶¶,¶¶ >8 yrs and >45 kg: 100 mg every 12 hrs >8 yrs and <45 kg: 2.2 mg/kg every 12 hrs ≤8 yrs: 2.2 mg/kg every 12 hrs **and** One or two additional antimicrobials§	IV treatment initially**. Switch to oral antimicrobial therapy when clinically appropriate: Ciprofloxacin 10–15 mg/kg po every 12 hrs*** **or** Doxycycline:¶¶ >8 yrs and >45 kg: 100 mg po BID >8 yrs and ≤45 kg: 2.2 mg/kg po BID ≤8 yrs: 2.2 mg/kg po BID Continue for 60 days (IV and po combined)§§
Pregnant women¶¶	Same for nonpregnant adults (the high death rate from the infection outweighs the risk posed by the antimicrobial agent)	IV treatment initially. Switch to oral antimicrobial therapy when clinically appropriate.† Oral therapy regimens same for nonpregnant adults
Immunocompromised persons	Same for nonimmunocompromised persons and children	Same for nonimmunocompromised persons and children

* For gastrointestinal and oropharyngeal anthrax, use regimens recommended for inhalational anthrax.
† Ciprofloxacin or doxycycline should be considered an essential part of first-line therapy for inhalational anthrax.
§ Steroids may be considered as an adjunct therapy for patients with severe edema and for meningitis based on experience with bacterial meningitis of other etiologies.
¶ Other agents with *in vitro* activity include rifampin, vancomycin, penicillin, ampicillin, chloramphenicol, imipenem, clindamycin, and clarithromycin. Because of concerns of constitutive and inducible beta-lactamases in *Bacillus anthracis*, penicillin and ampicillin should not be used alone. Consultation with an infectious disease specialist is advised.
** Initial therapy may be altered based on clinical course of the patient; one or two antimicrobial agents (e.g., ciprofloxacin or doxycycline) may be adequate as the patient improves.
†† If meningitis is suspected, doxycycline may be less optimal because of poor central nervous system penetration.
§§ Because of the potential persistence of spores after an aerosol exposure, antimicrobial therapy should be continued for 60 days.
¶¶ If intravenous ciprofloxacin is not available, oral ciprofloxacin may be acceptable because it is rapidly and well absorbed from the gastrointestinal tract with no substantial loss by first-pass metabolism. Maximum serum concentrations are attained 1–2 hours after oral dosing but may not be achieved if vomiting or ileus are present.
*** In children, ciprofloxacin dosage should not exceed 1 g/day.
††† The American Academy of Pediatrics recommends treatment of young children with tetracyclines for serious infections (e.g., Rocky Mountain spotted fever).
§§§ Although tetracyclines are not recommended during pregnancy, their use may be indicated for life-threatening illness. Adverse effects on developing teeth and bones are dose related; therefore, doxycycline might be used for a short time (7–14 days) before 6 months of gestation.

If you are DEPLOYED and have concerns about a puzzling skin condition, you can email your clinical photos and a concise morphologic description of the lesion to our Operational Teledermatology site at derm.consult@us.army.mil or directly to Daniel.Schissel@us.army.mil. The lesion you describe just may make its way to the next edition of **Picture This…**

Thanks for all you do.

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LTC Daniel Schissel originated "Picture This" for the MED Quiz. He is a 1993 graduate of the Uniformed Service University of the Health Sciences and completed his internship with the family practice department at Fort Bragg in 1994. He then served as the 2/10th Special Forces Group (Airborne) Surgeon and followed on as the 10th SFG(A) Group Surgeon. He completed his residency training in dermatology at the Brooke Army Medical Center in 1999. LTC Schissel is presently station in Heidelberg, Germany as a staff physician and the European Regional Medical Command Dermatology Consultant. He has authored the dermatology section of the new SOF manual, serves on the USSOCOM Medical Curriculum and Examinations Board, and is the U.S. Army Aviation Dermatology Consultant.

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Human Performance Forum (HP)

SOCM Glenn Mercer
Moderator
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This edition's forum expands on the several mail responses from Winter 2007 that asked about the fundamental problems created by the Services fitness testing procedures. Beyond the initial problems with quality, accuracy, and cultural influence, many readers wanted to know where the testing gradient should actually begin. Within the realm of human performance (HP) we can reference and cite multiple modalities to test both patients and athletes. While many of these tests are useful in a focal, isolated scenario, they are often only fragments of the total picture when the concept of function and subsequently performance is applied.

Considering the shifting thought processes within both SOF and the DOD it is appropriate to advance the dialogue on testing for function. In this capacity we can address the operator as both a recovering patient and a functioning human weapons system. From this standpoint we are able to apply some engineering principles to the discussion. Before evaluating peak performance we can, and should consider both the efficiency and function of the system without demand. In medical parlance this would be the definition of baseline, normal or unremarkable.

The SG office has kept abreast of sports performance screening methods that have been gathering inertia as evidence-based. To provide a broad based response to the, "Where should we start" question, I have enclosed an article that provides both practical reference and detailed methods for considering athletes function from the perspective of normal. The concept of measuring an athlete for impairment or dysfunction in pre-performance setting continues to emerge as an exceptional method to prevent or mitigate the rate of injury incidence within the force. I look forward to your feedback.

R/Glenn Mercer

Functional Testing of Military Athletes

Michael Strock, MS, ATC, CSCS; Lee Burton, PhD, A.T.,C., C.S.C.S

Abstract

The authors of this narrative have performed over 1000 functional movement assessments on professional and collegiate athletes, firefighters, and military personnel who perform essential tasks and operate in physically demanding environments. Feedback was provided from several large city fire departments who are currently utilizing a functional movement screen tool as part of an injury prevention and performance training program. They have reported a significant reduction of Workers Compensation cases and care costs. Over the past three years as part of an ongoing performance training program with Echelon III and IV Special Operations units, movement screening analysis has been conducted on over 200 operators. Strong trends were identified from data points and direct observation of the aforementioned military, athletic, and industrial settings that suggest low screening scores and asymmetries identified on the assessment can be used as a predictor for injury. The following forum discussion provides an overview of how information from functional movement analysis can be utilized to drive and implement injury prevention and performance training standards. Furthermore, it poses the hypothesis that it is possible to establish a numerical predictor of injury probability that has significant efficacy.

Historically, performance-based strength and conditioning programs have placed an emphasis on improving an individual's overall performance statistics such as bench press, squat, vertical leap, linear speed, and dimensional agility. These types of quantitative statistics are important pieces of data to gather prior to beginning a strength and conditioning program. However, this information doesn't provide detailed, fundamental data on how to effectively reduce injury and promote resilience. Performance tests exist to gather baseline quantitative information, and then attempt to make recommendations and establish training goals.

Traditional military physical training methods commonly focus on conventional components of physical fitness such as flexibility, strength, muscular endurance, and cardiovascular stamina. *Performance* is typically measured by service readiness tests composed of running, muscular endurance assessments (e.g. calisthenic pressing or pulling). These tests are constrained to measuring general fitness with minimal fiscal investment and are conducive for managing large masses. In this regard, they are the path of least resistance. This may be acceptable for service-support personnel, but grossly misses the mark in evaluating performance requirements for specialized combat units. Such units require a higher level of physical strength and conditioning to retain resilience in their repetitive-use environments.

The majority of our Special Operation personnel score very well on these tests. However, a high mark only provides rudimentary information. A tremendous amount of these SOF tactical athletes are able to perform high-level activities even though they are inefficient in the way they move and perform operational tasks. These compensations are compounded when you add laden weight such as armor and fighting kit which ultimately increase demand and change the center of gravity (Compare Figures 1 & 2). It is not uncommon to see a mid-to late-career operator with a significant decrease in mobility and stability which leads to degradations of proprioception and postural control. These deficiencies are not commonly identified and often go unrecognized. Hence, no corrective or progressive measures are generally prescribed, as part of a physical training program, to ensure optimal effectiveness of movement and strength. To some degree this is known as an unqualified state of predisposition. Failure to consider movement deficits may limit performance and subsequently predispose the operator to injury.

Prescribed strength and conditioning programs often work to improve agility, speed and strength, yet commonly are done without consideration for postural and/or proprioceptive control of basic movement mechanics. An example of this would be a person who is deemed strong by how much weight they can move during a bench press or squat. However, the same individual could have difficulty performing a simple push-up or body weight deep squat, indicating mobility and stability inefficiencies. The focus has too often been on improving an individual's quantitative statistics without first determining their fundamental level of movement and postural stability.

The main goal in performing prepatory movement screening should be first and foremost to decrease injuries and create durability in the highly active individual. Secondary to this is the recognition of when an operator is entering a state of pre-disposition. If the initial screening focuses on identifying fundamental movement and stability im-

Figure 1 Operational equipment in excess of 35 pounds above normal center of gravity.

pairments, then a more effective individualized program can be created, thus decreasing the likelihood of inappropriate application of strength training variables.

Currently, research is inconsistent on whether pre-participation screenings or performance testing have the ability to determine who is predisposed to injuries. Most pre-performance examinations are performed primarily to help detect life-threatening conditions, abnormalities, vice musculoskeletal conditions, which may lead to injury. Examples of common evaluations are clinical medical history, height, weight, blood pressure, pulse, vision, and certain gross musculoskeletal tests. A problem with this traditional form of assessment by the military medical infrastructure is the tremendous gap between the medical evaluation for health and functional testing. These annual testing batteries do not indicate who is prepared to perform complex athletics or high intensity / high volume tasks in a tactical environment. tasks.

Figure 2 Conditioning patterns with normal center of gravity.

In order to bridge the gap between the pre-performance physical and fitness testing, the individual's movement mechanics must be assessed. The active individual should demonstrate sound mechanics in order to be successful during both fitness and functional testing. If basic movement patterns cannot be performed effectively, then higher-level functional activities will be executed with excessively high risk. In this regard a racing analogy is appropriate. This has been clearly evident with the military operators that were identified as having deficiency in squat mechanics and lower extremity mobility. They were unable to properly execute good quality dead-lift mechanics. Once proper mobility was attained thorough progressions and corrective exercises the operators were able to perform the lift correctly and without pain or discomfort.

The Functional Movement Screen (FMS)™ is an evaluation tool that attempts to assess an individual's fundamental movement patterns. This assessment tool fills the void between the pre-training/pre-placement health screenings and performance tests by evaluating the individual in a more dynamic and functional approach. A screening tool such as this offers a systematic approach to injury prevention and performance predictability. It leads to individualized and functional recommendations for human performance. Specifically, when reviewing the data points obtained from one NFL team over the course of one season, the risk of being placed on injured reserve increased from 15% to 51% when the individual's score was below 14 (This research is currently under review for publication in the North

American Journal of Sports Physical Therapy.)

The test is composed of seven fundamental movement patterns that require a balance of mobility and stability (Examples in Figure 3 through 5). The individual movements have certain criteria that must be accomplished in order to obtain a high score. The scoring is broken down into four basic criteria; a "3" is given if the individual can perform the movement without any compensations according to the established criteria, a "2" is given if the individual can perform the movement but must utilize poor mechanics and compensatory patterns to accomplish the movement, a "1" is given if the individual cannot perform the movement pattern even with compensations, and finally a "0" is given if the individual has pain during any part of the movement or test. There are five tests which require bilateral testing. This will result in two scores for those tests. The lowest test score is recorded for the overall score. However, for assessment and data collection purposes both scores are needed. Three tests have a clearing test associated with them that are scored as pass or fail. If a person fails this part of the test, then a "0" is given as the overall score. This simplistic scoring system allows for quick, easy testing while giving the tester a blueprint of the individual's movement patterns.

Figure 3
Hurdle Step Test frozen at apex (score 3)
no deficiencies

Figure 4
Deep Squat Movement with no
deficiencies (score 3)
Anterior view

Figure 5
Deep Squat Movement with no
deficiencies (score 3)
Lateral view

These fundamental movement patterns are designed to provide observable performance of basic locomotor, manipulative, and stabilizing movements. The tests place the individual in extreme positions where weaknesses and imbalances become noticeable – if appropriate stability and mobility is not utilized.

It has been observed that many individuals who perform at very high levels during activities are unable to perform these simple movements. These individuals are considered to be utilizing compensatory movement patterns during their activities, sacrificing efficient movements for inefficient ones, in order to perform at high levels. A specific observed example of this would be a SOF operator who is at the half-way mark of a 20-year career and has lost requisite balance, mobility, or stability to perform specific training and operational tasks efficiently. This could be due to an injury exposure or imbalanced training methods. The operator will perform these skills utilizing compensatory movement patterns in order to

Figure 6 FUNCTIONAL MOVEMENT SCREEN SCORING SHEET

Test	Score	Dysfunction
1. Deep Squat	3 2 1 0	
2. Hurdle Step	3 2 1 0	
Left Leg Up	3 2 1 0	
Right Leg Up	3 2 1 0	
3. In-Line Lunge	3 2 1 0	
Left leg Forward	3 2 1 0	
Right leg forward	3 2 1 0	
4. Shoulder Mobility Impingement test R____ L____	3 2 1 0	
Left top	3 2 1 0	
Right top	3 2 1 0	
5. Active straight leg raise	3 2 1 0	
Left	3 2 1 0	
Right	3 2 1 0	
6. Trunk Stability Push Up Prone push up test _____	3 2 1 0	
7. Rotary Stability Kneeling lumbar flexion test ____	3 2 1 0	
Left up	3 2 1 0	
Right up	3 2 1 0	

Total Score Tests 1-7 ___/21_____

overcome the stability or mobility impairments they have acquired. The compensatory movement pattern will then be developed throughout the training. If this happens, the individual creates a poor movement pattern that will be utilized subconsciously whenever the task is performed. This has the potential to lead to mobility and stability imbalances, which can create micro-trauma, establish predisposition, and progress to chronic injury.

Therefore, an important factor in preventing injuries and improving performance is to quickly identify deficits in mobility and stability because of their influences on creating altered movement patterns throughout the body. The complexity of the body's neuromuscular system makes it difficult to evaluate weaknesses using conventional, static methods. It is critical that functional tests incorporating the entire kinetic chain need are utilized to isolate deficiencies in the system.

The FMS™ (Figure 6) is designed to identify individuals who have developed compensatory movement patterns in the kinetic chain. This is accomplished by observing right and left side imbalances and mobility and stability weaknesses. The seven movements in the FMS™ attempt to challenge the body's ability to facilitate movement through the proximal-to-distal sequence. This course of movement in the kinetic chain allows the body to produce movement patterns more efficiently.

However, due to weaknesses in the kinetic linking system, a poor movement pattern may have resulted. These occur due to previous injury and/or as individuals gravitate toward specific skills and movements through habit,

lifestyles, and/or training. The individuals rely on compensatory movement patterns during their activities, sacrificing efficient movements for inefficient ones in order to perform at high levels. If these compensations continue, then poor movement patterns will be reinforced leading to poor biomechanics. Once an inefficient movement pattern has been isolated by the FMS™, functional prevention strategies can be instituted to avoid problems such as imbalance, micro-traumatic breakdown, and injury. Currently, the Functional Movement Screening system has been successfully implemented within fire services, the National Football League, National Hockey League, numerous NCAA Division I athletic programs, and Special Operation commands. These programs all utilize this form of screening to identify who is predisposed to injury as well as direct their strength and conditioning programs. In order to really have prosperous effect on injury prevention and mitigation, we must first identify who is at risk. The functional movement screening has been successful within these organizations because it has been able to identify individual areas of weakness which otherwise could have been overlooked using conventional assessment methods. Since 2003, over 500 movement screens have been done on a select Special Operation command as a pre-screening tool prior to entering into a supervised / centrally managed performance training program. Several consistent trends have been identified on a plurality of operators who were screened. Ultimately, this affects the performance training prescription and progressions for individual operators. As discussed earlier scoring on the seven test screen is based off a 21 point scale. (Figure 6)

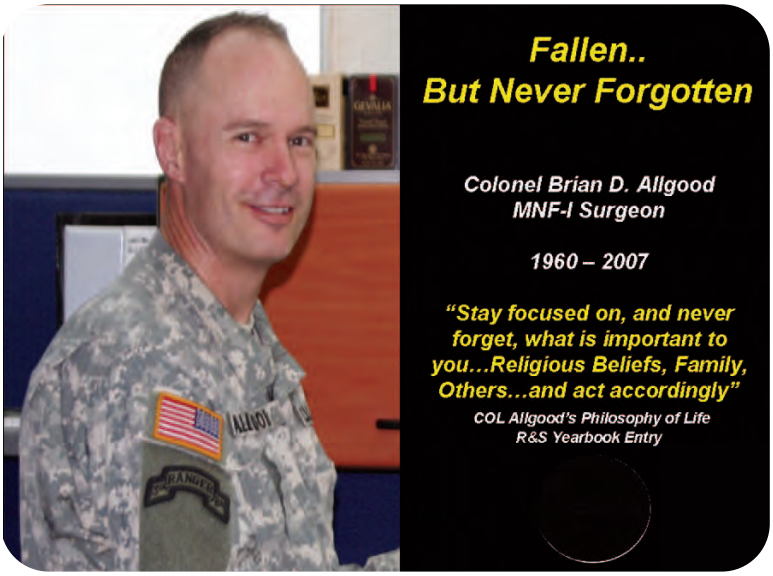
It was observed that operators who scored below a 14 typically had a relevant history of musculoskeletal trauma. These operators needed to engage in a corrective phase of training prior to entering into a higher, more physically demanding stage of training. The length of this corrective phase will vary from operator to operator based on the complexity and underlying cause of the movement deficiency. Often during the screening painful movement patterns were identified that typically would not present themselves during a traditional static evaluation done on the treatment table. If pain is noted on a specific movement pattern or clearing test further evaluation is done to identify the root cause and corrective and rehabilitation strategies were initiated.

The SOF operator lives in a dynamic and physically challenging environment. Our evaluation methods must go further than measuring general fitness and static assessments. Physical readiness scores may be identical between two separate operators while movement analysis could be decisively different. Individual programming and training goals should be different and personalized based on performance measures and a movement analysis of each operator. The end state will likely be the same, but it could take two different training prescriptions to get there. Without more specific and dynamic methods of evaluation, we lack the road map to get us to the destination.

Lee Burton, PhD, A.T.,C., C.S.C.S., Lee is currently the Program Director for Athletic Training at Averett University. He holds a Doctorate Degree in Health Promotion and Wellness from Va. Tech. He is a Certified Athletic Trainer, and Certified Strength and Conditioning Specialist. He has consulted with numerous professional sports, private performance entities as well government agencies on injury prevention and performance enhancement.

Michael Strock, MS, ATC, CSCS, is currently the human performance and rehabilitation manager at Naval Special Warfare Group 4. He is a 1991 graduate of Salisbury University and received his Master's of Science degree at the University of Kentucky in 1993. He is a Certified Athletic Trainer and Strength and Conditioning Specialist.

Dedication



COL Brian D. Allgood,
Command Surgeon,
Multinational Force -Iraq

COL Brian D. Allgood, 46, was assigned to the 30th Medical Brigade, European Regional Medical Command, Heidelberg, Germany, as the Command Surgeon, Multinational Force –Iraq. COL Allgood died in Baghdad on Jan. 20 when the UH-60 Black Hawk helicopter he was in crashed. He had been serving in Iraq for about six months before the crash. COL Allgood was born in Regensberg, Germany, 19 October 1960. He graduated from the United States Military Academy in 1982 with a Bachelor of Science Degree. After receiving a Doctor of Medicine degree from the University of Oklahoma in 1986, he interned in General Surgery at Brooke Army Medical Center from 1986 to 1987. He completed his residency in Orthopedic Surgery at Brooke Army Medical Center from 1990 to 1994 and subsequently became board certified. Military education includes completion of the AMEDD Officers Basic and Advanced Courses, the Command and General Staff College, and the U.S. Army War College.

Previous assignments include Battalion Surgeon of the Third Battalion, 75th Ranger Regiment (1987 to 1990) where he participated in operation JUST CAUSE; Division Orthopedic Surgeon, 82d Airborne Division (1994 to 1996); Chief, Orthopedic Surgery Clinic, Womack Army Medical Center (1996 to 1997); Commander, 274th Forward Surgical Team (ABN), Fort Bragg, NC (1997 to 1999); and Commander, 232d Medical Battalion/ Course Director for the Combat Medic course (1999 to 2001); Commander, Keller Army Community Hospital and USMA Surgeon, West Point, NY (2002 to 2004); Commander, 18th MEDCOM and 1218. General Hospital (2004 to 2006)

His awards and decorations include the Legion of Merit (1 OLC), Meritorious Service Medal (3 OLC), the Army Achievement Medal, the Humanitarian Service Medal (Hurricane Fran), the Joint Service Achievement Medal (Joint Special Operations Command), the Armed Forces Expeditionary Medal with Arrowhead (Just Cause), the Combat Medical Badge (Just Cause), the Expert Field Medical Badge, the Army Flight Surgeon Badge, the Master Combat Parachutists' Badge, and the Ranger Tab. He is also a recipient of the Order of Military Medical Merit.

COL Allgood is survived by his wife and son.

Journal of Special Operations Medicine

Special Forces Aidman's Pledge

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

Pararescue Creed

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

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

A Navy Poem

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

I'm the one called "Doc".

~ Harry D. Penny, Jr. USN Copyright 1975

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