



Military Trauma System Review

US Central Command

Donald Trunkey, MD, FACS

Ronald Maier, MD, FACS

Lynette Scherer, MD, FACS

Lt Col David Dawson, MD, FACS

Col Warren Dorlac, MD, FACS

23 OCT – 4 NOV 2010

US Central Command - Trauma System Consultation

Table of Contents

I. INTRODUCTION	4
II. DISCLAIMER.....	5
III. SUMMARY OF ADVANTAGES AND ASSETS	5
IV. SUMMARY OF CHALLENGES AND RECOMMENDATIONS:	6
V. SYSTEM LEVEL ISSUES.....	9
A. Development and Maintenance of a Trauma System Model	9
B. Committee Leadership with Casualty Care Impact	10
C. Performance Improvement Patient Safety, Trauma Registry and Transparency	11
D. Communication	13
E. Education and Training	14
1. Pre-deployment training: Medical and Ancillary Services.....	14
2. Pre-deployment training: Combat Skills.....	16
3. In-theater team transition training	16
F. Clinical documentation/ informatics.....	16
G. Telemedicine	17
H. Evidence-Based Practice	18
I. Logistics	19
1. Medical Supplies	14
2. Blood products	16
VI. PRE-FACILITY CARE.....	22
A. Point of injury (POI) and Level I medical care	22
B. Army MEDEVAC.....	24
1. General	24
2. Flight medic qualifications and job stressors	25

3. Triage and communication.....	26
4. Medical Care Protocols.....	27
5. Documentation.....	27
6. Evacuation times	28
C. Air Force Pararescuemen (PJ)	29
D. Aeromedical evacuation (AE) and Critical Care Aeromedical Transport Teams (CCATT).....	29
1. CCATT Clinical Practice Guidelines	30
2. Air Transport Specialty Teams.....	31
VII. HOSPITAL CARE.....	31
A. Team composition.....	32
B. Variances in care	32
C. Theater Level III.....	33
1. Craig Joint Theater Hospital (CJTH), Bagram AF	33
2. Kandahar Role III	34
3. Aeromedical Evacuation Hub	34
D. LPMC Level IV	35
E. CONUS Level V	37
VIII. RESEARCH.....	37
IX. OBSERVATIONS REGARDING SPECIFIC INJURIES AND SURGICAL CARE	38
A. Perineal injuries.....	38
B. Spine injuries.....	38
C. Pain management	39
SUMMARY	40
GLOSSARY OF TERMS.....	41
CONTACT INFORMATION FOR VISITING REVIEWERS	45
TRIP ITINERARY AND SUMMARY OF ACTIVITIES.....	46

Executive Summary

I. INTRODUCTION

At the invitation and sponsorship of US Central Command (CENTCOM) and the Joint Staff Surgeon, a group of nationally recognized trauma experts visited US and NATO medical facilities in Germany and Afghanistan. The consultants consisted of three civilian trauma/critical care surgeons, one active duty US Air Force trauma/critical care surgeon, and one US Air Force Reserve vascular surgeon. The visit was coordinated by the Air Mobility Command Surgeon (AMC/SG), sponsored by Air Forces, Central Command Surgeon (AFCENT/SG) but supported fully by CENTCOM and the deployed medical leadership at TF MED East, 62 Medical Brigade, 101st Airborne, and US Forces-Afghanistan (USFORA). The purpose of the visit was to: (1) provide specific civilian surgeons who are involved in the military trauma system or in military medical education an orientation to the complexities and context of casualty care and specific injury patterns and (2) to provide expert evaluation of components of the existing military trauma system and recommendations for improvement.

The two-week mission was neither intended nor structured to provide a comprehensive evaluation of in-theater trauma care. The visit did provide an opportunity for trauma care experts to directly observe and participate in medical activities in a variety of settings, to interact with deployed military medical personnel and their leadership, and to evaluate the emplaced systems for patient care.

The review agenda consisted of three days at the Level IV military treatment facility (MTF) in Germany and nine days in Afghanistan visiting two Level III MTFs. The team engaged in interactive dialogue with a broad range of representative military trauma system participants. There was also an opportunity for participating in formal ICU rounds, operative cases as well as informal discussion with the stakeholders; time was devoted to questions and answers. The team participated in the first DoD Afghanistan Trauma Conference held at Kandahar Role III. During the visit, the team met for detailed reviews and discussion, for the purpose of producing the following report which represents the groups consensus opinion on the various issues and recommendations gleaned from this visit.

The evolution of military trauma care capabilities in Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) is an extraordinary success story of adaptation, evolution and focused feedback driving performance improvement. Significant advances have occurred in casualty management to include enhanced care at the point of injury, improved resuscitation strategies, use of damage control surgery, and enhancements in monitoring and treatment during patient movement through the continuum of care. The combined effect of these changes has resulted in the lowest case fatality rate in the history of warfare.

At the present time, the in-theater trauma care capabilities are robust, the morale of the deployed medical personnel is excellent, and the clinical outcomes are very good—despite the devastating nature of the combat injuries that are now being seen with improvised explosive devices (IEDs). Even so, there remain a number of practical challenges at every level of care and opportunities to enhance systems of care. Specifically, there would be benefit from improvements in pre-deployment medical training, consistent use of clinical practice guidelines based on medical evidence and theater experience, improved communication, medical informatics, improved data collection during the transport of critically ill or unstable patients, and performance improvement (PI) processes. Variations in clinical practice and local procedures are unavoidable, given the differences in resources and tactical

requirements of medical facilities at different locations. A more consistent approaches between services (and with other coalition medical partners), sharing of lessons learned, and critical evaluation of the impact of variations in care on outcomes are needed.

There are five levels, or echelons, of care in the military trauma care system, each with progressively greater resources and capabilities. Level I care provides aid at or near the point of injury. Level II care consists of surgical resuscitation provided by forward surgical teams that directly support combatant units in the field. Level III care provides a much larger and resource capable facility and serves as the highest level of care within the theater of operation. Generally speaking, military Level III centers offer advanced medical, surgical, subspecialist, and trauma care, similar to a civilian Level I trauma center. Level IV care is the first echelon at which more definitive surgical management is provided outside the combat zone. For the Afghanistan (and Iraq) Theater, this is the Landstuhl Regional Medical Center (LRMC) in Germany. Level V care is the final stage of evacuation to one of the major military centers in the continental United States (CONUS), where definitive care is also provided and more comprehensive rehabilitation services are provided. In this review, the term "Role III" is used interchangeably with "Level III," as this is the terminology used by the North Atlantic Treaty Organization (NATO).

The senior members of the review team have substantial experience. Dr Trunkey and Dr Maier have over 75 years of combined experience in trauma care and have held every major academic and leadership position in American surgery. This trauma system evaluation is provided in confidence to the DoD for the intent of performance improvement.

II. DISCLAIMER

This report is the result of direct observations, interviews, and review of selected documents. It includes the opinions and recommendations of experts in trauma systems, surgical care, military medicine, and medical education. There was not, however, an opportunity for a comprehensive evaluation of all aspects of military trauma care in Afghanistan and higher echelons. Thus there is the potential that the information that served as the basis of this report is incomplete or that contrary perspectives were not fully considered.

III. SUMMARY OF ADVANTAGES AND ASSETS

1. Commitment, esprit de corps, and skill of the physicians, nurses, medics and support staff who address the demanding medical needs of this challenging group of patients in the austere combat setting and at LRMC.
2. Collaborative effort of all military services to develop this complex and integrated military trauma system, which was spearheaded by the Joint Theater Trauma System (JTTS) and resulted in a systematic and integrated approach to reduce morbidity and mortality and to optimize the ability to provide essential care required for combat casualties.
3. The medical care administered on the battlefield and Level II facilities.
4. The US Air Force Critical Care Air Transport Team (CCATT) and Aeromedical Evacuation programs that transport these combat casualties from the theater to CONUS via LRMC.
5. The weekly video trauma conference (VTC). The VTC provides a multidisciplinary forum for inclusion of all military trauma care facilities (Level II through Level V), pre-hospital providers and evacuation personnel, to provide a unique method for system-wide feedback and process improvement.
6. The maturity and effectiveness of the trauma performance improvement program at LRMC.

7. The establishment of an Afghanistan theater-wide trauma care and coordination conference (the inaugural conference was held on October 2010).
8. The development of military-specific, evidenced-based clinical practice guidelines (CPG's) by the JTTS that address the unique medical needs of combat casualties.
9. The combined investigative efforts of the Institute for Surgical Research (ISR), the in-theater research teams and the LPMC research program.
10. The development, regular updates and distribution of Tactical Combat Casualty Care (TCCC) Guidelines for Level I care.

IV. MAJOR RECOMMENDATIONS:

1. JOINT THEATER SYSTEM AUTHORITY

Establish, sustain and incorporate the processes and function(s) of the Joint Trauma System (JTS). The JTS must be a joint service DoD asset and readily available for current and all future deployed medical operations. The JTS must be institutionalized across all Medical Corps services and sustained in non wartime and include periodic external peer led trauma system reviews. It should be under the authority of and directed by the Joint Staff Surgeon.

2. PRE-DEPLOYMENT, 'OCCUPATION SPECIFIC' THEATER TRAINING

Establish consistent standards for individualized pre-deployment training for medical and ancillary services to include current CENTCOM JTTS clinical practice guidelines (CPG's), medical informatics, trauma performance improvement principles, clinical documentation systems, communications, and logistics. All medical personnel including medical sub-specialties should be educated to a common basic level of principles and best practices prior to deployment. Pre-deployment training should focus on critical information related to anticipated deployment location, injuries/treatments, job specifications, performance expectation, standards of care and team building.

3. PERFORMANCE IMPROVEMENT

Communicate the principles of the Joint Trauma System Performance Improvement (PI) Plan throughout the combat casualty continuum. Establish a JTS PI Advisory Council chaired by the JTS Director which encompasses a continuously evolving process for conducting concurrent performance improvement in- theater, en-route evacuation, to establish system-wide improvements. This needs to be under the appropriate authorities with a closed loop mechanism for acting on the recommendations. This must include adopting standardized definitions for the evaluation of combat related mortality and morbidity. Communication of newly identified performance improvement events must reach back through the DoD to develop corrective action in a timely fashion. These recommendations may include but are not limited to medical practice, equipment development and tactics.

4. CLINICAL PRACTICE GUIDELINES

Clinical Practice Guidelines (CPGs) should continue to be developed on an ongoing basis. CPGs should be consistently applied across all services and all levels of care with tracking of compliance and evaluation of their effectiveness on outcomes. CPGs should be taught during

pre-deployment medical training and utilized for care of significant battlefield injuries and the management of serious clinical problems in the deployed setting.

5. INFORMATICS

The military needs an expeditionary deployable electronic medical record which is facile, readily taught, increases productivity, is secure, web based/instantly visible from all echelons including the Veterans Administration (VA), and built by established experts in information systems. The deployed Electronic Medical Record (EMR) must fit backwards into existing DoD database(s) to ensure continuity of the medical record and trauma registry.

6. PRE-HOSPITAL HELICOPTER TRANSPORT PERSONNEL TRAINING

Significantly increase the training, education and medical experience of all personnel involved in helicopter transport to meet the civilian standard of care. It is strongly recommended that the pre-hospital helicopter community incorporate the standards established by the Committee on Tactical Combat Casualty Care.

7. TRANSFER OF CRITICALLY ILL PATIENTS FROM LEVEL 2 TO LEVEL 3 FACILITIES

Composition and training requirements for this mission is highly variable across all three service branches. It appears that the current system allows for significant gaps in both training and competency for the care providers thereby creating an undesirable decrement of care during these transports. It is recommended that the three service branches develop a joint capabilities and requirement document to address these shortfalls and needs. The US Air Force Critical Care Air Transport Team provides a model that may be modified and adapted to meet this need.).

8. RESEARCH

Research has been crippled by redundant Institutional Review Boards (IRB) across all levels and services. This unwieldy administrative burden appears to focus primarily on legal rather than patient centric issues. The military medical corps is ethically obligated to advance care based upon battlefield care experience. Recommend that the DoD establish a single (Tri-service) IRB for casualty care research which is efficient, properly staffed and emphasizes the rights and welfare of the patient. Timely and medically appropriate review should be the focus of this board.

9. COMMUNICATION

The need for effective inter-service communication and communication between levels of care should be recognized and addressed. Lessons learned are not uniformly being passed from one rotation to the next or from one branch of service to the next. Recommend that the Combat Trauma Surgery Committee in conjunction with the JTS ensure appropriate transmission of medically pertinent lessons learned to all service branches.

10. LANDSTUHL REGIONAL MEDICAL CENTER

Recommend that the US Army, Air Force, and Navy commit to placing permanent Trauma/Critical Care fellowship trained surgeons at LPMC with staggered “time on station” to maintain continuity of experience at the sole Level IV facility supporting the CENTCOM war effort. It is important that LPMC be sustained as an American College of Surgeons (ACS) verified trauma center; this ensures that a trauma system is in place and that good quality of care at the onset of combat activity occurs. This will require continued staffing for the Trauma Program and a distinct manning for the understaffed Acute Lung Rescue Team which supports EUCOM, AFRICOM, and CENTCOM AORs. Additional capabilities would be derived from the continuous rotation of DoD surgical residents and critical care fellows. This provides the additional advantage to these young surgeons with exposure to combat casualty care and research initiatives prior to their own deployments to the combat theater.

V. SUPPORTING RECOMMENDATIONS:

See 138 individual recommendations within the body of the text

V. SYSTEM LEVEL ISSUES

A. Development and Maintenance of a Trauma System Model

At the initiation of combat operations in Iraq in 2003, an organized trauma system did not exist nor had it even been conceived. The Joint Theater Trauma System (JTTS) was developed through the efforts of military surgeons, nurses and commanders and was in large part modeled after aspects of the U.S. civilian trauma care system. This development eventually led to a systematic and integrated approach to better organize and coordinate battlefield care to minimize morbidity and mortality and to optimize the ability to provide essential care required for casualty injuries.

The focus of the JTTS is to improve battlefield trauma care through enabling the right patient, to the right place, at the right time, to receive the right care. The components of the JTTS system include injury prevention, pre-hospital integration, education, leadership and communication, quality improvement/performance improvement, research, and information systems.

The structure, function and role of the JTTS is largely modeled after the civilian trauma system principles outlined in the American College of Surgeons Committee on Trauma (ACS COT) *Resources for the Optimal Care of the Injured Patient, 2006*. This document identifies criteria for civilian trauma care resources and practices for optimization of standards of care, policies, procedures, and protocols for care of the trauma patient. The content of the manual provides guidance for medical care personnel from the pre-hospital, through hospital and subspecialist care. The ACS COT Verification Review Committee (VRC) was initially developed in the early 1970's and functions as the oversight process and verifying entity for the American trauma care system.

Following the example of the ACS COT, the JTTS identifies and integrates processes and procedures to record trauma patient related data at all levels of care to promote continual process improvement. This combat trauma system allows for coordination of care and provides essential data to predict needed resources, evaluate outcomes/education/training needs, to improve continuity of care across the combat care continuum and to facilitate real-time changes (based on data) in these conflicts. Oversight and direction for the theater trauma system above Level I is directed by the CENTCOM surgeon. The stateside parent organization, now known as the Joint Trauma System (JTS), embraces the system concepts for the entire continuum of care including point of injury to medical facility and onward to rehabilitation in continental United States facilities.

The goal of the military JTTS is to develop and implement a true trauma system. The organization and scope of the JTTS is modeled after the successes of the civilian trauma systems (which were initially developed as a result of the military lessons learned in Vietnam), but with pragmatic respect to the realities of combat and austere environments. The JTTS is now a well organized and highly functional trauma system, delivering state of the art care to combat casualties. As a result the medical care and systems of care being delivered during current operation(s) is extremely mature and in many ways exceeds the capabilities of the US trauma care system it was intended to model. After eight years of continuous maturation, the JTTS is at a crucial junction. It is the opinion of the panel that at this juncture it is imperative to codify this experience for all future Department of Defense (DoD) deployed medical operations and to maintain its existence through funding, planning and staffing. This will ensure that the benefit(s) of the current system will be available at the time of future conflicts.

RECOMMENDATION:

- *The development and implementation of the JTS should be a joint service DoD asset and documented for all future DoD deployed medical operations. This should include issues of funding, planning and staffing (currently JTS core funding is in POM submission 2013-17). This systematic approach should be integrated into doctrine and used in any future Department of Defense (DoD) deployed medical operations.*
- *The JTS should report directly to a joint organizational leader such as the Joint Surgeon.*
- *The JTS must be maintained and sustained in non wartime.*
- *Invite periodic external, subject matter expert and peer led trauma system reviews.*
- *Develop a formalized relationship with the American College of Surgeons Committee on Trauma for bilateral informational exchange and continued advancement of global trauma care.*
- *Establish use of a specific theater-level trauma care system (as exemplified by the Joint Theater Trauma System) as baseline building block doctrine, to be employed in all future contingencies.*

B. Committee Leadership with Casualty Care Impact

A number of other committees outside of the JTTS directors group have direct and immediate impact on casualty care. Ideally these additional committees compliment the function and form of the JTTS. The most productive and successful example of this is the Committee on Tactical Combat Casualty Care (CoTCCC). The CoTCCC was established in 2001 and consists of military and civilian trauma care providers with a specific emphasis on special operations groups and tactics. This group of civilian and military experts, including Special Forces personnel (Rangers, Green Berets, SEALs and PJ's), evaluates all aspects of prehospital care on the battlefield through tactical evacuation. The CoTCCC has organized their recommendations into categories of:

- Care under Fire
- Tactical Care
- CASEVAC Care

Tactics, equipment, supplies, and treatment algorithms are constantly reviewed and updated. Quarterly meetings are held led by the CoTCCC chairman (US Navy CAPT (ret) Frank Butler). This committee is a working group of the Defense Health Board's Trauma and Injury Sub-committee. Extensive progress and revisions have continuously streamed from this committee throughout the war and it should be congratulated for its leadership, joint collaboration and vast set of contributions.

A second effective and functional committee is the Combat Trauma Surgery Committee (CTSC). This group of primarily military appointees is led by the Defense Medical Readiness Training Institute (DMRTI) located at Ft. Sam Houston, Texas. The CTSC Charter was most recently approved by Mrs. Ellen Embrey as the Acting Assistant Secretary of Defense for Health Affairs. The purview of this committee is Level II and III care, integration with other facilities, and training. The CSTC excels in the area of establishing standards across all three services and should be tasked in setting standards for deployed equipment and devices. Two notable examples where this has not occurred include spine stabilization hardware and intracranial pressure monitors. The CSTC would also be ideally suited to consolidate and coordinate the War Surgery Course. Currently all the three medical corps are not using the same version to teach these core principles. The current (2004) NATO Emergency War Surgery text does not reflect some the current practice in care of the combat casualty although there have been recent efforts to update it. Revisions to these as well as training requirements should continually be vetted through this committee. Inconsistent progress has been made through this leadership organization in part due

to a lack of funding, lack of regular meetings, extensive additional duties of all members, and an absence of a viable charter.

RECOMMENDATION:

- *There is a need to structure both the Combat Tactical Surgery Committee (CTSC) and Committee on Tactical Combat Casualty Care (CoTCCC) similarly. The CTSC would be more effective with regularly scheduled meetings, invigorated funding, an updated charter, dedicated full time chairman and staff. Placement under the Defense Health Board has been beneficial for the successful CoTCCC.*
- *A core pre-deployment War Surgery course should be developed, approved and taught for all services. This should be supported with centralized funding.*
- *The NATO Emergency War Surgery text should be revised to reflect current care practices and distributed to deploying medical teams (currently undergoing revision).*
- *Guidelines for pre-deployment MEDICAL training should be set and completion enforced.*
- *Equipment and medical devices should be standardized across the services and levels of care.*
- *The CTSC jointly with the JTTS and the CoTCCC should continue to establish evidenced based guidelines as well as set standardized care guidelines and treatment.*

C. Performance Improvement Patient Safety, Trauma Registry and Transparency

A military trauma system performance improvement plan is optimally designed to encompass multiple factors such as injury description, mortality/morbidity, timeliness of care, and appropriateness of care, compliance with standards of care, transfer times, resource utilization, and clinical outcomes. A system wide plan should measure performance improvement maturity, sustainability, effectiveness and opportunities for improvement in combat casualty care and military trauma system issues. The performance improvement information system should be available for concurrent access to the databases for the purpose of routine surveillance and monitoring of clinical care and must be a shared responsibility and participation among all services of care and at all Levels of care. Creation and sustainment of such a program would also serve as a critical performance barometer to the respective Surgeon Generals of each service. An appropriately constructed performance improvement program would allow comparison both within a Service corps as well as between Corps.

The Trauma System Performance Improvement/Patient Safety (PIPS) program, which should provide oversight and feedback to the members of the system, is currently under-resourced. Sections of the PIPS plan should include aeromedical transport, resuscitation, critical care, acute care, rehabilitation, and system-wide issues. This program should be adequately prescriptive for the processes and activities to measure, monitor, evaluate and improve the process and outcomes of combat casualty care. The ability to provide a concurrent and timely “performance dashboard” across all services and to all levels of oversight is a cornerstone of the PIPS program.

High quality data available through the Joint Theater Trauma Registry (JTTR) allows for development of clinical protocols and practice guidelines. The transparent dissemination of the outcomes data allows for comparisons and improvement within each service as well as providing benchmarking data for each service. To date, utilization of JTTR data has driven clinical practice guidelines that have contributed to decreasing mortality and morbidity in injured patients to include those receiving Massive Transfusion, with burns and head injury, and those presenting with hypothermia. The development of the Joint Theater Trauma Registry (JTTR) with specialty-specific clinical modules, along with stand-alone registries

(e.g. vascular injury databases), has provided essential data for performance improvement, policy development, and knowledge creation. These registries have been useful only because of the existence of dedicated trained clinical personnel (trauma nurse coordinators, registrars, etc.) who concurrently extract, record, and review over 400 data elements for completeness and accuracy for each individual casualty entering the trauma care system.

Currently the implementation and integration of the JTTR varies among the Services (as an example, NNMC Bethesda is using the Collector trauma registry and not the JTTR) and by Level of care. This less than desirable state results in a loss of transparency and creates difficulty in performing concurrent PI. Ideally, a web based trauma registry platform with a comprehensive trauma outcomes management database used at all military treatment facilities providing care to combat casualties will allow for more robust data acquisition, concurrent monitoring and outcomes management.

It is important to maintain transparency and accountability with the clinical registry data. A robust and audited quality assurance activity is needed. To ensure data integrity and the validity of analyses, information about injuries and outcomes needs to remain accessible to investigators, performance improvement processes, and external reviewers and most importantly, to individual service leadership.

RECOMMENDATION:

- *Establish a Joint Trauma System Performance Improvement/Patient Safety Advisory Council under the JTS director.*
- *Continue to provide necessary support for the Joint Theater Trauma Registry to ensure comprehensive and verified data collection with a strong focus on performance improvement and data-driven quality metrics.*
- *Establish a continuously evolving structure for conducting system-wide PIPS which adopts uniform methods and processes for conducting PI at system level which. This should include adopting standardized definitions for the evaluation of trauma-related mortality, morbidity, and defining expectations of care, outcomes, and other relevant aspects of the review process.*
- *Update a comprehensive military trauma system performance improvement/patients safety plan. This plan should be divided into sections, each representing a level of care, written to stand separately as a guide for that level. The sections would include pre-facility, aeromedical transport (MEDEVAC, Pararescue, AE, CCATT) resuscitation, acute care, rehabilitation, and a system-wide trauma system. Outline the authority, purpose, structure, responsibilities, data collection/validation, evaluation and reporting processes and priorities for the implementation.*
- *The JTS should encourage the development of and contribute to monthly status reports with stratification of injuries, severity scores, and process and outcome markers from data submitted from all Levels of care. Routine reports and dashboards of their efforts should be distributed to all participating levels stakeholders.*
- *The JTTR should be integrated with all clinical registries in the system to enhance system assessment and performance improvement activities. This should be 'expeditionary' to allow for immediate use during standup of new facilities worldwide.*
- *Efforts should focus on developing a wide range of report writing tools which enable each Level of care to continuously and effortlessly retrieve data. This is critically important at the Level IIs.*
- *Train all key deploying personnel forward and sustaining personnel to the rear regarding performance improvement concepts as outlined in the Trauma Outcomes and Performance Improvement Course-Military version (TOPIC-M). This could come under the Defense Medical Readiness Training Institute and be included in other predeployment training programs*

- *Collaborate with benchmarking efforts developed by ACS Committee on Trauma.*

D. Communication

The value of effective communication was the most consistently repeated theme heard from deployed personnel at every level. Commanders, surgeons, nurses and medics agreed that when things go well, good communication was an essential element, but when things work poorly, ineffective communication is the major factor.

The current medical care system emphasizes the ability to treat, stabilize and transfer to the next level of care. The success of this system is uniquely dependent on continuous and effective transmission of patient data. Effective communication is especially important during transition, not only for physician staff, but also for patient administration, radiology personnel, nurses and technicians. During “hand offs,” there should be an organized method for sharing standard methods of documentation, mass casualty plans, clinical guidelines, standard operating procedures for use of the patient evacuation system, and all other facility functions.

An example of effective communication among personnel was the 28-29 OCT 10 Afghanistan theater wide trauma conference supported by the JTTS and held in Kandahar during which the Trauma directors (level II and level III) had an opportunity to meet each other for the first time and share patient care concerns. This conference also included nurses, evacuation personnel and leaders. Open discussions regarding current logistical challenges and patient related issues occurred.

RECOMMENDATION:

- *Provide JTTS sponsored multi-service Trauma Conference semi-annually within the AOR with consideration of inclusion of CENTCOM wide partners and LRMC directors..*
- *Transparency and improved opportunities for communication between trauma Czars/directors, key pre-hospital personnel and the FST (forward surgical team) commanders should be maintained through integration of personnel via participation in in-house meetings or theater wide trauma meetings.*
- *Participation in weekly video teleconferences should be expected for trauma care staff at Level II and Level III facilities, LRMC (level IV), and CONUS major receiving medical centers (Level V).*
- *To enhance communication Level III trauma directors should visit other Level III and selected Level II facilities*

E. Education and Training

At present, there is substantial variability in the amount and content of training provided to medical personnel rotating into theater. Most queried members noted that they received ZERO medical training pre-deployment. Deploying medical personnel from different services have different requirements. Further, most of the training content focuses on non-clinical topics. Providers must understand the current clinical practice guidelines for casualty care, TCCC concepts, how to use theater-deployed health record, practical aspects of clinical practice in the location to which deployment is planned. More comprehensive pre-deployment training may be appropriate for those without prior deployment experience or in command positions (where knowledge of medical logistics is paramount to success).

The emphasis on combat skills training for those who will not going into unsecured locations (“outside the wire”) is thought by many to be poorly aligned with actual training needs i.e. overemphasis on the combat skills training at the expense of and in many cases instead of clinical skills training .

1. Pre-deployment training: Medical and Ancillary Services

All personnel deploying to the combat theater should have a clear understanding of the injuries and treatments necessary to provide optimal combat casualty care. In personnel transitions from one team to the next, much information on job expectations and performance measures are lost. This issue has led to significant system inefficiencies, personal frustration, and the potential for significant errors in care. This was described as “a constant relearning of lessons learned with each team rotation”. This is particularly pertinent with respect to working knowledge of the Clinical Practice Guidelines (CPG’s) published and disseminated by the JTTS. The CPG’s are meant to be the common “playbook” by which military medical care is guided. The familiarity of providers with the content and scope of the CPG has varied widely.

An example of robust, medically-focused pre-deployment training is the British HOSPEX, an experience offered to US Navy personnel deploying to the U.K. run Bastion Role III. In the HOSPEX training, individual and team training in a simulated Role III medical facility was provided, including many aspects of clinical care as well as training for operating in the tactical environment.

The Emergency War Surgery Course is a 3 day intensive training course for Air Force surgeons intended to prepare providers for care in a combat casualty setting. The Navy and Army have a similar course. Most Air Force specialty groups (e.g.: orthopedic surgery, ENT, pediatrics, etc) have pre-deployment training that focuses on specifics of casualty care. Currently, there is no equivalent subspecialty training for deploying neurosurgeons, a group noted to have a wide range of clinical and deployment experience. Participation is also not required before deployment for some services and participation by Guard and Reserve surgeons has been reported to be overly complex due to scheduling and funding constraints.

Another example of a NATO sponsored pre-deployment training program but similar to the EWS course is the Norwegian Definitive Trauma Surgery Course (DTSC). At its teaching in a military facility outside of Oslo, Norway, they perform a one week trauma course, which could be modified to accommodate US soldiers. It is approximately a 50% didactic course and 50% practical skills. The morning hours for five days is didactic, and could include many of the things listed above. The afternoon course takes place in an operating room theater where there are six stations. A pig is anesthetized in a different area (veterinary lab) and then taken to the shooting range, where a sharpshooter inflicts a 7.62 mm wound on the right thigh, fracturing the femur and causing massive hemorrhage often due to the superficial femoral artery. A 9 mm round is then inflicted in the right upper quadrant of the pig's abdomen. A team of paramedics (2) go to the pig and pack the right femur wound until hemorrhage stops. Two IVs are started, the pig is put on a gurney and brought to the operating room theater, where a team of 1 anesthesiologist, 2 surgeons, and a scrub nurse prepare the pig for immediate surgery and the various wounds are treated. Over a 3—3.5 hour period they become familiar with how to explore the abdomen and chest. Simulated wounds to various organs by the instructors allow the surgeon to learn the appropriate damage control, such as how to pack a liver and remove the spleen. Temporary shunts are inserted into wounded arteries or inferior vena cava. Lung wounds are treated, and finally, cardiac wounds are inflicted and each surgeon learns how to repair a cardiac wound. At all times, the pig is treated humanely and there is a veterinarian present at all times to administer analgesia if required. At the end of the exercise, the pig is euthanized. Each surgeon will be exposed to two pigs at a minimum. The program is under the auspices of Johann Pilgram-Larson.

Ancillary services do not have an organized approach to ensuring all personnel are prepared to do their job when they arrive. Much information on job activities is lost with personnel transitions. The lack of enduring knowledge of the proper registration process into the computerized medical record by patient administration personnel has led to major patient safety concerns due to the creation of multiple patient records for the same individual casualty. This has been tracked by the JTTS and was reported to occur in 100% of electronic medical records during one transition period.

RECOMMENDATION:

- *Establish consistent standards for individualized pre-deployment training for medical and ancillary services to include:*
 - *Current Joint Theater Trauma System clinical practice guidelines(CPG's)*
 - *Medical informatics*
 - *Trauma performance improvement principles*
 - *Clinical documentation systems, communications, and logistics.*
- *All medical personnel including medical sub-specialties should be educated prior to deployment regarding:*
 - *Critical information regarding anticipated deployment location and injuries/treatments*
 - *Job specifications*
 - *Performance expectation*
 - *Standards of care including JTTS clinical practice guidelines and team building.*
- *Critical information should be made available to the incoming personnel, such that the group does not start at baseline every time there is a turnover in personnel which is associated with inefficiency, frustration and potential patient safety issues.*
- *Technical and administrative personnel (e.g.: patient administration) need pre-deployment training relevant to the specific tasks they will be expected to perform while deployed (e.g., administrative personnel need to know how to register patients).*

2. Pre-deployment training: Combat Skills

Emphasis on combat skills training appears to have significantly negated the ability to instruct medical personnel in pertinent casualty care issues. For example, the first Kandahar US Navy Role III personnel deployed after receiving 6 weeks of combat skills training (despite members having no plan to depart the largest base in Afghanistan), while receiving no pre-deployment theater-specific medical training. The three services have all had varying amounts of combat skills training to deploy to the same location.

RECOMMENDATION:

- *Tailor the scope and content of combat skills training for medical personnel to what is appropriate for their deployed setting and role.*
- *Those personnel that are deployed far forward should continue to receive thorough and pertinent combat skills training.*

3. In-theater team transition training

Medical personnel benefit from orientation and additional training to assist them as they assume their professional roles after arrival to Level II and Level III medical facilities. Some facilities have well developed manuals with institution-specific information. An excellent example of this was the manual at the Forward Surgical Team at FOB Ghazni. Others maintain “continuity books,” that can be accessed for notes from prior groups’ experiences in theater. Much of the information transfer between inbound and outbound personnel in theater, however, remains dependent on a direct “hand off” briefing and a period of time together known as “left seat-right seat”. These are inadequate to ensure all topics are completely covered, and once the outgoing person has redeployed there is a loss of knowledge. At present, the nature and extent of training for transitioning staff is inconsistent and unstructured. This process would be enhanced by utilizing a common check list of hand-off knowledge items pertinent to each provider’s scope of practice.

RECOMMENDATION:

- *All facilities should have standardized in-theater team transition training beyond current approach.*
- *Training should be documented utilizing a consistent methodology (continuity book, electronic document, hand-off checklist) which is reviewed and updated semi-annually. Responsibility for this should rest with the senior medical officer and commander.*
- *Access to transition training materials should be provided to all personnel as part of their pre-deployment preparation*
- *When possible personnel turnovers should be staggered to avoid complete staff turnover at any given site all at one time.*

F. Clinical documentation/ informatics

Military physicians interviewed expressed extreme negative impression of DoD clinical informatics systems, but this dissatisfaction is not specific to the deployed setting. (AHLTA has been listed as a major physician retention problem for the DoD). Providers with experience using other electronic medical record (EMR) systems in civilian or Department of Veterans Affairs health care facilities highlight

a number of problems with DoD clinical informatics systems, including slow access and navigation, lack of intuitive user interfaces, difficulties with data access, and lack of cross-platform connectivity. These shortcomings are magnified in the deployed setting.

Use of the outdated TC2 (Theater Medical Information Program Composite Health Care System Caché) and the Theater Medical Data Store (TMDS) are not taught to medical personnel prior to their arrival in theater. As a result, there is underutilization of the capabilities of the systems that are available. These systems do not leverage current technology to improve care and efficiency. This further magnifies the frustration.

Creation of multiple records for individual patients remains problematic within the current systems. One patient's data may reside in several systems, sometimes with multiple pseudonyms or patient record numbers. There are no standardized procedures in use to create temporary names and identifiers (despite attempts by CENTCOM to correct this), nor are there effective means to merge records once the presence of multiple records is recognized. As a result, much of the clinical information recorded in the early phases of care may be effectively lost. As previously discussed, the continuum of care across multiple facilities and levels is absolutely dependent on effective and efficient transmission of medical information. The current level of informatics at the theater level is woefully inadequate to achieve this.

RECOMMENDATION:

- *Implement a patient identification and medical record system that allows a single record platform initiated at the point of injury to follow the patient through the echelons of care (and Veterans Administration). This should be an up-datable data management system which is system wide with intuitive user interface for ease of documentation across the system.*
- *Establish reliable means for archiving, transmitting, and reviewing clinical images, including radiographs, CT scans, and clinical photographs. Images should be available to the next echelon of care prior to the patient's arrival at that facility. Images should be accessible for clinical care conferences, performance improvement review processes, and other applications.*

G. Telemedicine

A JTTS video teleconference (VTC) is conducted weekly, reviewing patients' treatment and status as they progress through the other care locations in the trauma system. This VTC involves Level II and Level III facilities in Afghanistan and Iraq, Landstuhl Regional Medical Center (LRMC) in Germany (Level IV), and military medical facilities in the continental United States (CONUS), including Walter Reed, National Naval, Brooke Army, Wilford Hall, and other medical centers (Level V). This conference is unique and central to the coordination of care and it provides an essential forum for process improvement. Its influence in casualty care has been remarkable. Unfortunately, there is no means for viewing radiographs or other clinical images in the VTC.

Though the weekly VTC provides a mechanism for regular inter-facility communication it is imperative that there is trauma and subspecialty participation at each level. At the moment there is variable participation at some level V's, particularly the leaders of the trauma surgery services.

Transmission of clinical data in theater is problematic, but image transfer is especially so. Some patients are transferred from Role III facilities with images (x-rays, CT scans, etc.) recorded to a CD-ROM, to be

hand carried by accompanying personnel. These disks may be misplaced, damaged or incompatible with receiving facility software.

Medweb is an internet-based system in use at the Craig Joint Theater Hospital for image storage, retrieval, and transfer. The system has been upgraded numerous times. Only a limited portion of the system's potential functionality is in use, however, due to limitation on the software license and unresolved interoperability issues. Impact of theater advances is limited by bandwidth availability; an example of this is the 64 slice CT scanners which cannot have their reconstructed images transferred from theater.

RECOMMENDATION:

- *Participation at the weekly VTC should be mandatory at all levels.*
- *Expand Medweb capability to enhance the effectiveness of the trauma weekly VTC and to be viewable at all levels of care.*

H. Evidence-Based Practice

Clinical practice guidelines (CPGs) have been developed and implemented in CENTCOM by the Joint Theater Trauma System (JTTS) since 2004. These CPGs incorporate practical experience from the theater, guidance from military and civilian subject matter experts, and review from the JTTS Directors and the CENTCOM Surgeon. Compliance with CPGs is tracked, and improvements in outcomes have been observed. For example, mortality and complications were reduced after dissemination of CPGs on burn management, prevention of hypothermia, and damage control resuscitation.

All services and clinical specialties should contribute to the development and utilization of *theater-wide* CPGs, ensure personnel are familiar with them, and follow their guidance when appropriate. Many providers are entering theater without knowledge of the CPGs and there is no current ability to consistently track compliance with CPGs. CPGs limit variability in care and maintain a standard basis of care.

An example of the effectiveness of clinical practice guidelines and systematic care is a recent paper presented by US Air Force Maj Joseph DuBose at the Annual Meeting of the American Association for the Surgery of Trauma. The title of the paper was "Isolated severe traumatic brain injury sustained during combat operations: Demographics, mortality outcomes, and lessons to be learned from contrast to civilian counterparts." The authors looked at isolated severe brain injuries. They queried the Joint Theater Trauma Registry (JTTR) over a five year period beginning in 2003. Results from this review were then contrasted to similar patients between the ages of 15 and 55 over the same period from the American College of Surgeons' National Trauma Data Bank (NTDB). The JTTR review identified 600 patients meeting study criteria with a mean age of 25.7. GCS < 8 for 27.8% of the study population and 98% were male. Blast injuries accounted for 61.9% and gunshot wounds for 19.5%. ICP monitoring was utilized in 15.2%, and 27.0% underwent some form of operative cranial decompression, lobectomy, or debridement. When compared to matched civilian NTDB counterparts, JTTR patients were significantly more likely to undergo ICP monitoring (13.8% vs. 1.7%, p= 0.001) and operative surgical intervention (21.5% vs. 7.2%, p=0.001). Mortality was also significantly better among military casualties overall (7.7% vs. 21%, p>0.0001, odds ratio 0.32 (0.16)), and particularly following penetrating

mechanisms of injury (5.6% vs. 47.9%, $p=0.0001$, odds ratio 0.07) compared to a propensity score matched NTDB counterparts.

In this review the military was able to achieve significantly better results than the civilian model (where practice guidelines and randomized trials have not been used extensively despite the fact that the Brain Trauma Foundation Guidelines have been out for several years). It appears that practice guidelines lead to superior outcomes although more work needs to be done to demonstrate CPG compliance (as addressed under PI section). This is also an example of how the JTTR may be utilized as an effective tool to provide benchmarking data.

CENTCOM Trauma CPGs are accessible online at the US Army Institute of Surgical Research home page: <http://www.usaisr.amedd.army.mil/cpgs.html>. They are updated yearly and maintained by the JTS.

RECOMMENDATION:

- *Clinical practice guidelines should continue to be developed and used for care of significant battlefield injuries, management of serious clinical problems in the deployed setting, and other causes of mortality, major morbidity, or disability. Use of CPGs should be taught during pre-deployment medical training and compliance should be tracked. Use of CPGs should extend to all levels of care as applicable.*
- *Although use of CPGs should be encouraged, individual providers are expected to exercise professional judgment in the care of specific patients. To facilitate this, future CPGs and revisions of current CPGs should specify the level of evidence used in establishing the guidelines and the strength of the recommendations provided should be graded.*
- *Deviations from established standards (CPGs) should not be considered prima facie evidence of inappropriate care, but outcomes should be tracked in an expanded way that helps to determine if the deviation from the recommended care resulted in an adverse outcome. To do this properly would likely require additional resources.*
- *All deviations from CPGs should have a documented statement by the physician/surgeon in the medical record as to why a deviation was necessary.*

I. Logistics

a. Medical supplies

Units currently maintain a 4-week supply of most expendable items. Urgent requests for resupply of specific items can sometimes be met by movement of materiel from other units in theater. While most needed supplies are available at every level of care, the medical logistics process and supply chain is poorly understood by most medical personnel. The medical providers' perception that the logisticians lack responsiveness has led to creative alternatives that have the benefit of meeting immediate needs, but without addressing the underlying supply problems. A common example of this was in-theater units reaching back to non-governmental agencies for donations of clothes, blankets, and even surgical materials to better care for their patients. Another and probably the most common example is regular reachback to LRMC for medications and supplies. Most LRMC providers will send the items requested

into theater with the next AE missions but this is actually counterproductive to the system as it does not allow the CENTCOM logistics chain to understand that there is a shortage or an issue in supply. Also, these re-supplies come out of the LRMC budget and are not replenished/reimbursed by CENTCOM. A more robust and responsive re-supply system should be established in the matured theater setting.

The multiple transfers of shipped materials and the use of supply depots results in some specific problems for medical care facilities. Drugs and other materials with limited shelf life may reach forward locations at or after their expiration date (identified at Bagram and level II facilities). Breakage of fragile materials and drug containers is reported to be common at the level II and level III facilities that were surveyed.

The use of a *prime vendor* for direct supply of critically needed inventory is not standard, though it may be more efficient, effective, and cost-saving, with reduced product damage and less loss of inventory due to expiration.

Some items always appear to be in short supply. As an example, the Hypothermia Prevention and Management Kits (HPMK) are significantly more effective than a wool blanket and outlined in the Hypothermia CPG; however, only the minority of patients arrive to treatment facilities with them in use. Despite data that indicates that wool blankets are ineffective at hypothermia prevention, they continue to be used in 80% of trauma patients (in the most recent evaluation) due to unavailability of the HPMK as well as unawareness of the CPG and absolute benefits of the kit. Most patients will require both the wool blanket AND the HPMK when they are available but there seems to be a discrepancy in the ability to order equal amounts or keep the proper numbers in supply.

RECOMMENDATIONS

- *Use prime vendors for supply of selected medical items, to allow timely shipping to forward or in-theater location for subsequent distribution using the military supply system.*
- *Medical logistics should be taught to all unit leaders and information of the process and its limitations should be addressed in the continuity binder at each location.*
- *High volume items that are critical to patient outcomes should be more aggressively managed by the logistic system*

b. Blood products

The organization of the in-theater blood bank is very different from its civilian counterpart in that economics are not the driving factor. It is expertly run and maximizes the benefit of blood products for the casualty. Despite countless logistic challenges, blood products are delivered rapidly throughout the theater. The banked blood supply for US led facilities is obtained from 100% screened blood donors in the United States, transported to blood support detachments located at Bagram Airfield and Kandahar Airfield, and then distributed to Level II and Level III medical units across Afghanistan. The British Role III at Bastion also maintains a large supply of US blood products.

Contrary to civilian blood bank practice, the military recognized the benefit of younger aged units of stored blood and promotes a program of “last in-first out” for patients at higher risk of mortality (ie- those patients that have undergone a massive transfusion). The current average age of blood

transfused to the massive transfusion patient is 23 days old (down from 42 days when the program was initiated). The JTTS has also implemented a 1:1:1 transfusion ratio of PRBC: Plasma: Platelets (to mimic more closely the whole blood composition) that has been shown by the DoD to decrease mortality in the massively transfused patient. This population in theater now has a 90% or better survival as compared to the best survival documented by a US major trauma center of 74%. This dramatic survival difference corroborated now by numerous civilian trauma center studies has led to changes in worldwide transfusion practice.

Although nearly all blood requirements are met using banked blood, the use of locally (US military donors) obtained whole blood is an additional (sometimes essential) mechanism to meet emergency requirements. Whole blood drives are reserved for the occasions when the banked blood product supply is depleted or when no platelets are available. Although not specifically FDA approved, stringent safety standards are employed to ensure recipient safety. Published data supports the use of whole blood transfusion and this treatment is associated with improved survival in a combat setting. Importantly, a whole blood drive can yield the first unit of blood within 35 minutes. To date, over one thousand units of whole blood have been transfused in combat support facilities with a complication rate of less than one-percent.

Loss (waste) of frozen blood products (fresh frozen plasma) due to damage to the packaging during transportation remains a problem. The material used for the bags that hold the frozen plasma becomes brittle at subfreezing temperatures, leading to cracks in the bags that make the plasma unusable. Through a performance improvement program targeting this problem, several procedural changes were instituted (changes in packaging, changes in handling) with a reduced number of fractured bags. However, the problem has not been eliminated. Some Level IIs reported as high as a 25% loss of FFP after thawing; often when urgently needed for a massive transfusion patient.

Frozen Red Blood Cells have been used on a limited basis at Bagram hospital and previously more extensively at the Dutch hospital in Tarin Kwot, Afghanistan. Limitation in further use at Bagram appears to be limited at the moment by a lack of sufficient personnel to process the product.

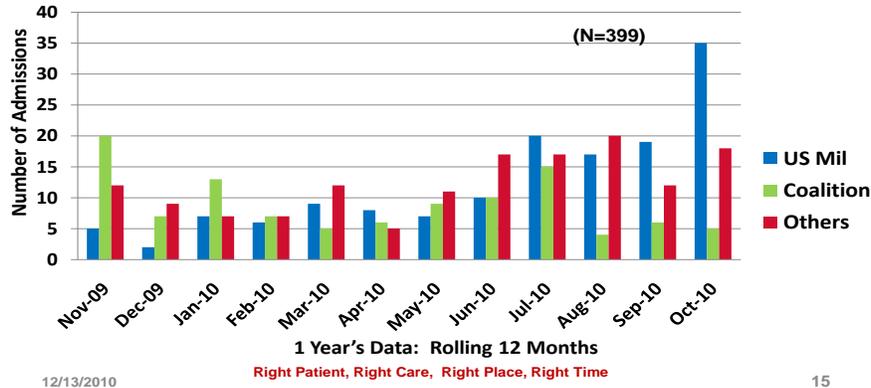
RECOMMENDATION:

- *Support the CENTCOM goal for blood products used in patients who receive massive transfusions (10 or more units of packed red blood cells) will be no more than 14 days old. The freshest available blood products should be used for any patient anticipated to need massive transfusion.*
- *If logistically feasible, consider extending shorter usage time frame (21 days) to all patients receiving blood transfusion.*
- *Continue to allow use of fresh whole blood for emergency resuscitations. Clarification or modification of FDA requirements that might relate to the use of fresh whole blood use in theater should be sought, if required.*
- *A temperature stable bag should be developed for storage and transportation of frozen blood products.*
- *Resources should be sufficient to support additional use of frozen blood at Bagram.*



OEF Total Massive Transfusions

**Massive Transfusions
Defined as ≥ 10 units PRBCs in 24 hours**

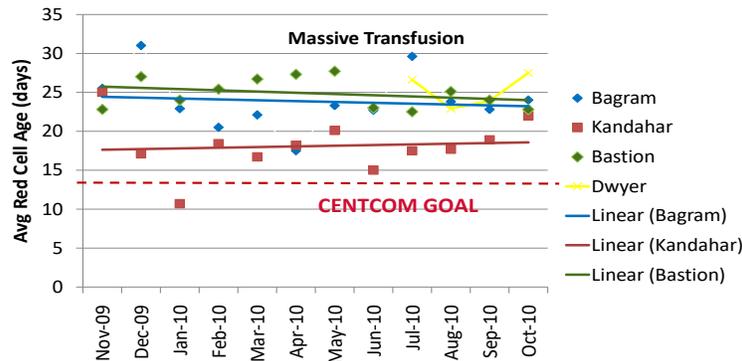


12/13/2010

15



Trend Line of Red Cell Age in Massive Transfusion



12/13/2010

Right Patient, Right Care, Right Place, Right Time

23

VI. PRE-FACILITY CARE

A. Point of injury (POI) and Level I medical care

Point of injury (POI) care and Level I medical care was not evaluated in detail but all indications point to good adherence to TCCC guidelines in hemorrhage control, release of tension pneumothorax, and damage control resuscitation. In October 2010 the USMC officially announced plans to field a TCCC approved tourniquet. An En-Route Care review by the USAISR, however, recently showed significant variability in fielded fluids used in resuscitation. These ranged from Hextend, Normal Saline, Lactated Ringers, D5W and D10W.

The importance of first-responder training was emphasized by the Division Surgeon for the 101st Airborne Division. 100% of the division's deploying warfighters had Combat Lifesaver training augmented with additional training to include medical responses being incorporated into field training exercises (Eagle First Responder). The Ranger Regiment has a similar emphasis on medical training for the warfighter as well as a medical component of every operational training mission. Their experience (submitted for publication) reports NO preventable deaths since adoption of these principles.

It is not clear that all combat units share this lifesaving training focus. One Marine colonel stated that he felt as though the Army units were better trained than his units at placing tourniquets rapidly.

Ground medics receive advanced airway management training, but ground medic leaders recognize this is a difficult skill to acquire and maintain currency and have requested additional training resources. TCCC is in the process of augmenting the component of the airway training module.

Most combat casualties are not receiving care at Level I facilities unless an event occurs on a fixed compound/base. More frequently, battle casualties are being transported directly from POI to a more capable Level II facility. The ability to move more casualties from POI to Level II locations is a result of the forward positioning of MEDEVAC assets and more level II locations.

RECOMMENDATION:

- *Continue to improve and augment airway training for the medics. Although instructed in cricothyroidotomy using live animal models, medics would benefit from additional training, to include better simulation models, videos and use of cadavers. Participation in elective surgical airway procedures would also be helpful.*
- *TCCC guidelines for airway management and fluid resuscitation need to be re-emphasized regularly.*
- *Provide more extensive first responder training to all warfighters, including self and buddy care. The most important aspect to be trained at this level is when and how to rapidly place a tourniquet.*

B. Army MEDEVAC

1. General Patient Movement

In-theater evacuation of casualties (MEDEVAC) in Afghanistan is faced with many tactical and geographic challenges which include

- (1) frequent high altitude helicopter transports in an unpressurized cabin,
- (2) long transport distances, which translate to long transport times,
- (3) the patients' injury or illness severity,
- (4) the limited space of the primary MEDEVAC aircraft, the H-60 Blackhawk, which limits the number of patients that can be carried and what may be medically accomplished for patients *en route*.

In-flight patient care during rotary wing medical evacuation (MEDEVAC) remains relatively unchanged since the Vietnam War. Currently, U.S. Army *en route care* from the point of injury is provided by a single flight medic (68W) who is trained at an EMT-Basic level with minimal advanced capability. This is in contrast to the U.S. civilian medical transport system which is conducted by highly trained flight paramedics and flight nurses onboard medically equipped rotary wing (helicopter) platforms with advancing levels of capabilities.

Rotary-wing transport is commonly used for transport of critically ill patients from Level II to Level III facilities, even when a runway suitable for a fixed-wing C-130 aircraft is available. This choice appears driven primarily by the observation that the process of requesting rotary wing transport is faster and more flexible. The disadvantage of this practice, however, is that it may put patients at increased risk. Fixed-wing aircraft can accommodate additional equipment and personnel (including Critical Care Air Transport Teams, CCATTs). Fixed wing transport may also be preferable when multiple routine or priority patients need to be transferred. No defined mechanism currently exists to determine if the additional capacity or capabilities of a fixed-wing aircraft is more appropriate than a helicopter for a specific mission.

In specific locations, use of C-130s has become a preferred method for movement of critical patients. For example, from Camp Bastion, C-130s operated by AFSOC (Air Force Special Operations Command) (FEVER missions) can be rapidly launched, bypassing some of the "bureaucracy" that is encountered using conventional patient movement requests. This suggests that factors other than what is best for patients may be defining how aeromedical evacuation platforms are selected.

Questions that were brought up included ability of a CCATT to fly without the addition of the AE team and the type of training required by all before performing the missions. Use of CCATT or a similar trained team for critical care transport, when feasible, would seem to be the preferred means for intra-theater critical care patient movements.

RECOMMENDATION:

- *Define clinical or tactical conditions for which fixed-wing aircraft should be used in preference to a helicopter for in-theater movement of critically ill patients.*
- *Streamline the process for requesting fixed wing transport with CCATT support for transfer of patients to Level III facilities. The process for handling patient movement requests (PMR) to obtain*

fixed-wing transport should be as agile and responsive as the 9-line procedure to request rotary wing MEDEVAC.

- *Forward Surgical Team (FST) personnel should be trained in proper use of the processes to request rotary wing and tactical fixed wing patient transfer. This would be appropriate to incorporate in centralized in-theater training program at Bagram AF or Kandahar AF.*
- *Ensure that critically ill patients are being moved by critical care trained teams that are also trained in the platform being utilized.*

2. Flight medic qualifications and job stressors

Many deploying flight medics (estimated 40-50% of units) lack prior deployment or similar practical experience, which prompts the need for continued training in theater. The need for transportation of critically ill or injured patients is common, but flight medics lack sufficient medical training to support this role. It was reported that 27% of POI patient transports require advanced (paramedic level) skills, skills beyond the level of training and experience of most Army flight medics (airway management, traumatic brain injury management or advanced extraction skills). Of special note, airway compromise is an injury for which a pre-hospital intervention may be lifesaving. “Burnout” was identified as a problem for flight medics. Contributing factors that were cited included operational tempo, short recovery time between deployments and lack of appropriate training. It is reasonable to assume that it is stressful to function in a capacity that exceeds one’s level of training. “Raising the bar” for medical training for flight medics should improve retention and decrease “burnout.”

The relatively short periods between deployments have limited opportunities for additional medical training. This has led to a flight medic culture of adapting to the environment rather than being prepared (trained to a higher level).

Another problem is the lack of an appropriate CME program for the military provider. The only recognized accreditation standard in the US is the National Registry Program. The requirements of the program stipulate a significant ongoing level of CME that includes topics such as geriatrics and cardiac care that are not as relevant to the combat medic. The CoTCCC has discussed the concept of a separate accreditation process for the military medic at either the EMT-B or EMT-P level.

An additional obstacle to professional development for flight medics is the limitation on the number of mid-level and senior non-commissioned officers (NCOs) that are retained in the MEDEVAC units. Thus, as flight medics gain experience, they are often forced into other career roles. It would be helpful if the field was extended to more senior medics or if they could transition into medical roles in other units, such as a non-commissioned officer in charge of a forward surgical team, a move that could also improve coordination and communication between medical units and MEDEVAC.

Within the last year, nurses with critical care experience have been used to augment MEDEVAC crews to provide more sophisticated care to severely injured patients, such as those who have been managed with initial damage control procedures; however, this is a short term solution and will be necessary until MEDEVAC crews are sufficiently trained to certified flight paramedic level. Their presence on the aircraft is limited to critical care transports but their influence in respect to training has a much broader impact.

Transport of patients from Level I facilities who have been initially treated which may include intubation is still considered a POI transport. Thus, the critical care nurses are not allowed to augment these flights, once again decreasing the level of care being provided while in the air.

The absence of a requirement (other than a CPG) to use critical care-trained personnel during inter-facility transport appears to be a major inconsistency in the in-theatre trauma care system and is a point of vulnerability (when unstable patients lack the care of those with expertise in the management of airway problems, use of mechanical ventilation, or resuscitation). The current policy creates a situation for a potential decrement in the intensity of patient care during rotary wing movement(s) within the theater.

An additional asset brought to the battlefield by the British operating out of Bastion is the Medical Evacuation and Resuscitation Team (MERT). These teams include an emergency medicine and/or anesthesiologist on board a Chinook Helicopter who can provide aggressive treatment and resuscitation while the casualty is being flown back to the Bastion Role III. Examples of inflight resuscitation include PRBC and FFP transfusion, intubation and initiation of mechanical ventilation, and pharmacologic therapy (pressors, pain medication, and sedation).

RECOMMENDATION:

- *Increase the flight medic training standard to paramedic level (EMT-P) for improved pre-hospital care. It is appropriate to match civilian air ambulance standards. Increase to a flight paramedic-certified (FP-C) level if they are expected to care for critical care transports.*
- *Establish a career path for flight medics that would permit career progression while increasing or improving their trauma care skills.*
- *Training requirements and performance standards for flight medics should be defined by medical personnel, not aviation officers.*
- *Two medically-trained personnel should be present on MEDEVAC helicopters, as it is common to have multiple patients requiring care or casualties with severe injuries.*
- *Improve airway training for MEDEVAC flight medics. Although instructed in cricothyrotomy using live animal models, medics could benefit from additional training, to include a better simulation models and use of cadavers. Additionally, being involved in elective surgical airway procedures could be helpful.*
- *Flight nurses supporting MEDEVAC critical care missions should be assigned to the MEDEVAC unit when possible. When not actively engaged in flying missions or medic training, they should be performing clinical nursing duties in the medical facility to maintain critical care skills.*
- *Transport from a Level I should not be considered a POI pickup and a critically care trained member should be present to augment care.*
- *Evaluate the outcomes of MERT transported patients to a cohort of similar injury severity scores and revised trauma scores transported by the traditional US evacuation system.*

3. Triage, communication and command/control

Patient movement categories in Afghanistan (NATO designated A, B, C), do not sufficiently discriminate injured patients who require urgent surgical treatment from those who are severely injured but may not need to be moved with the same urgency. There was previously a category in the 9-line MEDEVAC request that identified patients needing prompt surgical care as “Urgent Surgical”. Some facilities

reported a lack of communication between MEDEVAC units and the receiving facility and this leads to delays in care.

Currently the MEDEVAC units are under the command and control of line aviation. A number of MEDEVAC pilots felt that this has led to a decrease emphasis on the medical mission in terms of education, training, and medical performance improvement.

RECOMMENDATION:

- *Return to the four classes of patient movement categories. Identify patients needing “Urgent Surgical” care in MEDEVAC requests and pre-hospital communication.*
- *Criteria for “Urgent Surgical” category should include casualties with tourniquet(s) in place, GCS \leq 12, endotracheal intubation, a pulseless extremity, penetrating torso injury, penetrating proximal extremity injury, any amputation proximal to ankle or wrist, hypotension (absence of palpable radial pulse), or penetrating head injury with altered mental status (GCS \leq 14).*
- *There could be improved communication and better coordination of casualty care and movements if the Tactical Operations Center (TOC) for MEDEVAC was located within the Level II/III medical facility receiving the casualties. Co-location should be considered, when practical. At a minimum, the ability to monitor MEDEVAC communications should be acquired for all receiving facilities.*
- *For rotary wing transport system, there should be more directed medical leadership and input than currently is employed by the line model.*

4. Medical Care Protocols

Protocols for care of medical and surgical problems are not standardized throughout the theater, though MEDEVAC in Regional Command-East (RC-East) and Regional Command-North (RC-North) have established protocols based on unit experience. This standardization is a local or regional phenomenon, but it should be recommended as a DoD policy to institute a theater approved protocol. Without standardization, medical personnel do not have standards to which they train nor can uniform measures of performance be applied. Each MEDEVAC and Pararescue unit was noted to have different guidelines. A primary example of this inconsistency is the various recommendation(s) for the administration of IV fluids to a combat casualty during pre-hospital evacuation phase. The recommendation for fluid administration is often contrary to the guidelines of hypotensive resuscitation as established by evidence based practice and in the published guidelines of the CoTCCC.

RECOMMENDATION:

- *Establish DoD-wide clinical protocols for patient care in MEDEVAC/Pararescue. Protocols should specify training requirements for various types of procedures or interventions. (For example, a flight medic with basic training may be qualified for use of simple airway adjuncts, while mid-level training/paramedic may be needed for advanced training for surgical airway management.)*
- *The CoTCCC should be the lead agency for establishing all pre-hospital protocols including those for TACEVAC which will improve standardization across the theater and efficiency.*

5. Documentation

Written documentation of care in the field and during MEDEVAC is inconsistent. Many of the proposed solutions have not been found to be practical or user-friendly enough to be successfully adopted. It seems impractical to require flight medics to document injury and care during MEDEVAC transports, given the operational constraints. A patient care record is required for all MEDEVAC transports, but is

not always completed. A short post-flight report at the time of patient handoff that includes key items seems to be a more practical alternative, with the option to defer additional documentation of the patient movement until later, if the operational situation does not permit concurrent documentation. This is a system currently being evaluated by the JTTS. The JTTS has been uploading patient care records to the patient's electronic medical record.

The bedside patient transfer between RN and MEDEVAC personnel should be brief and documented in duplicate (one copy for the chart and one for the medic). This handoff tool would include information about a combat casualty care, treatment, condition and recent changes. Handoff tools have been used effectively at NASA and in the airline industry and when used repetitively, optimize precision and anticipate errors. The formal note should be created by the medic after the mission is complete.

RECOMMENDATION:

- *JTTS/MEDEVAC should establish requirements for reporting and documentation required at time of patient delivery. Requirements for additional documentation for the medical record are also needed. Use of electronic data collection and transfer should be considered as a supplement to simple paper records, but not as a primary strategy.*
- *Standardize MEDEVAC documentation. Basic clinical information and injury assessment should be captured, with space provided for narrative summary of the care and decision making.*
- *Separate process of bedside clinical report from final clinical documentation.*

6. Evacuation times

Though trauma experts recognize that the concept of the “Golden Hour” is not an absolute—some severely injured patients require lifesaving care within minutes, others are able to wait for hours without expectation of significant harm. There has been a mandate from Secretary of Defense Gates to deliver combat casualties to treating medical facilities within 60 minutes. Prior to this directive in January 2009, patient transport times (from initiation of the 9-line MEDEVAC request to arrival to surgical care) in theater averaged 82 minutes. By forward positioning MEDEVAC/Pararescue assets, increasing the number of level II facilities, and employing a focused performance improvement process, the average evacuation time has been reduced to 27 minutes (September 2010). This is a remarkable performance improvement process for which the entire system and the Secretary deserve great credit.

MEDEVAC missions require support from additional combat helicopters due to their lack of heavy weapons. However, the ‘red cross’ medical designation appears to offer little protection in the war on terrorism as the aircraft are routinely targeted by insurgents. Transport times could be decreased in some cases and additional protection offered to the aircrew if the ‘red cross’ was removed and larger weapons were added to the platform.

Some critical transports are being performed by two separate teams in an effort to preserve resources within a region. These split missions are performed infrequently but still occur.

RECOMMENDATION:

- *The JTS/JTTS should continue to evaluate transfer times and outcomes to identify areas for potential modification of the evacuation process (e.g.: patient's with GCS>8 may have similar outcome despite transfer time). This is data that has never before been collected concurrently in wartime but has significant implications on outcomes and tactical planning.*

- *JTTS needs to continue this effort looking at other variables other than time such as flight medic skill level, number of personnel available to care for patients during transport and others.*
- *Reevaluate the need for the 'red cross' designation on MEDEVAC helicopters.*
- *Attempt to completely avoid the "split" MEDEVAC mission. Additional handoffs, especially at a running helicopter, present additional risks to the patient. JTTS data should be used to evaluate the outcomes from such moves in comparison to equivalent non split missions.*

C. Air Force Pararescuemen (PJ)

Air Force Pararescuemen ("PJs") are special operations personnel, trained to paramedic level (EMT-P). Unlike most personnel involved in patient movement, PJs have additional specialized responsibilities for combat search and rescue (CSAR). They can provide an advanced level of care at the point of injury (POI) and they are trained and equipped to extract casualties while under fire in an unsecured location. They have the resources to support advanced training, including specialized rescue skills and medical training.

Although trained to EMT-P qualifications, less than 25% maintain clinical currency. Skills specific to supporting critical care transport (ventilator management, end tidal CO2 monitoring, etc) are not part of the standard PJ qualifications. At times PJs are being used for critical care transport between Level II and Level III facilities, though this does not seem ideal. In addition, the HH-60G that is the PJs' primary aircraft does not easily allow for critical care resources to be added.

The PJ unit based at Bagram AF expressed concern that they were underutilized for POI casualty recovery and CSAR functions. They indicated that they did not wish to take on a critical care air ambulance function, but would prefer to forward deploy to the regions where the warfighters need them.

PJ flight surgeons are not typically specialty trained in trauma or critical care and therefore unprepared to provide critical care back up or trauma leadership for the PJs.

The time allocated to training with the PJs by the Flight Surgeon is often limited due to a need to perform primary care duties on base.

RECOMMENDATION:

- *Remove PJs from critical care transfer movements unless a critical care RN or physician is assigned to the mission.*
- *Consider PJ primary role as casualty support for POI activities while maintaining response for Search and Rescue activities.*
- *Require PJs to gain additional annual clinical experience that includes elective intubations, rotations on a trauma service and a civilian paramedic experience.*
- *The physicians assigned to the PJ unit should be sub-specialty trained in Emergency Medicine, Anesthesia, Critical Care or Surgery in order to provide needed expertise.*
- *The physicians assigned to the unit should have protected time at the unit for PJ training activities.*

D. Aeromedical evacuation (AE) and Critical Care Aeromedical Transport Teams (CCATT)

The CCATT concept is now well established and validated. The primary issues identified relate to availability of CCATT and medical command and control.

There is concern that CCATTs (a limited resource) are inefficiently employed. This observation appears to be valid despite the recent addition of a CCATT theater director. Current CCATT command and control is assigned to the aeromedical evacuation control team (AECT). This situation creates significant liabilities in that the AECT may not have an appropriate level of medical knowledge or operation familiarity with the complex mission requirements of a CCATT team. The CCATT theater director should be deployed into a position with command and control authority with respect to the medical aspects of critical care patient transports. The current command and control of theater CCATT assets is problematic due to the lack of appropriate medical expertise and oversight. Appropriate CCATT medical direction and oversight would allow for a much more efficient triage and effective employment of the limited CCATT teams.

The performance improvement process for CCATT is limited without defined authority or integration into the Joint Trauma System. Performance improvement evaluations have been limited. The CCATT registry is severely limited in scope and visibility. The limited information currently available in the CCATT registry is not integrated with the JTTR.

The current patient movement item (PMI) equipment set for the CCATT team is old and outdated. There is significant opportunity to leverage technology to assist with documentation, communication, or mitigating patient safety risks. This equipment optimization initiative has been, and should continue to be, a primary focus of development and implementation.

The CCATT pre-deployment program is a mandatory requirement for all members and includes a clinical validation process. Successful completion of the program is required prior to each deployment. Current success rate is 88%. This appears to be the only such medical program identified in the DoD but should be a model for all deploying medical personnel.

RECOMMENDATION:

- *Establish a position integrated into the line of command and control for a CCATT experienced critical care physician (“CCATT Czar”) to coordinate CCATT use (providing direction on assignments of CCATT teams, AE resources, and aircraft). The “CCATT Czar” should be the approval authority for all in-service select (ISS) and urgent CCATT missions.*
- *Enhance the performance improvement process by addition of skilled personnel at the point of contact along the continuum and more rigorous processes.*
- *Integrate the CCATT performance improvement process with a research process which identified opportunities for improvement and quantifies effectiveness of these critical patient movements.*
- *Upgrade equipment package to leverage current technology and improve communication, documentation, and minimize patient risks.*
- *Fund CCATT data registry module to permit full integration with JTTR. Provide resources for initial development, implementation and long-term sustainment of the module.*

1. CCATT Clinical Practice Guidelines

CCATT clinical practice guidelines are not well known by the transporting teams and do not encompass the breadth of difficult problems encountered in the austere environment. CCATT clinical practice guidelines are limited and difficult to access.

RECOMMENDATION:

- *Designate a leader to provide oversight and facilitate development of more extensive CPGs to capture on the successes seen with the JTTS CPGs.*
- *Add CPGs to a DoD public website (such as with the JTTS CPGs) and update annually.*

2. Air Transport Specialty Teams

Several specialty teams exist within the DoD for transport of complex patients. The two that have been instrumental in casualty care are the US Army Burn Flight Team stationed out of the Institute of Surgical Research in San Antonio and the Acute Lung Rescue Team (ALRT) stationed out of Landstuhl Regional Medical Center. Both teams are innovative and have a rapid deployment capability. The ALRT recently added ECMO (Extra Corporeal Membrane Oxygenation) capability. These specialty teams currently utilize manning from ISR and LRMC. The ALRT operational tempo has been elevated and taxed the resources at LRMC. ALRT is not an officially recognized DoD capability, and a proposed “Concept of Employment” is under review at HQ AMC/SG at this time.

RECOMMENDATION:

- *Formalize ALRT as a recognized operational requirement and designate specific manning and other resources for the Acute Lung Rescue Team which does not deplete resources at LRMC.*

VII. HOSPITAL CARE

The overall quality of medical and surgical services rendered in Level II and Level III (CJTH, Kandahar, Bastion) hospitals in Afghanistan is excellent, though in some cases limited resources are constraining. The effectiveness of the damage control surgical care rendered at Level II facilities at Forward Operating Bases is demonstrated by the fact that survival for patients treated initially at Level II facilities is equal to that of those treated at the large Level III facilities. (Eastridge BJ et al, Forward Surgical Teams provide comparable outcomes to combat support hospitals during support and stabilization operations on the battlefield. J Trauma. 2009 Apr; 66 (4 Suppl):S48-50.)

Intra-facility operating procedures appear to be recreated by the clinical chief each rotation. A standardized format and content for operating procedures manual would be of benefit, as this could be used to provide a more consistent organizational approach. This is one example of where unification of operating concepts across all three medical corps offers the potential of great benefit. Intra-operability and quality of medical care will greatly benefit from common operational principles across the various echelons and services of care.

RECOMMENDATION:

- *A standardized format and content for operating procedures manual would be of benefit, as this could be used to provide a more consistent organizational approach across all Services and platforms of care.*
- *Access to operating procedures should be available prior to deployment and mandatory during pre-deployment training.*

A. Team composition

It is critically important that team composition at each location be considered prior to deployment. The best results have been reported when the medical team was balanced for prior deployment experience and expertise. At the Level II facilities, joint service was viewed as beneficial, helping to mature the systems of care.

It is vital that the individuals being assigned be specifically considered for their qualifications and experience rather than as a “generic” AFSC/MOS. To do otherwise should be considered a leadership failure. It is imprudent and unreasonable to consider a general surgeon with a strictly elective or minor surgery practice to be equivalent to a busy trauma/critical care trained surgeon. Further, surgeons who have only recently completed residency training are not interchangeable with surgeons who have prior deployment experience. The analogy to considering all surgeons to be equivalent is to consider all pilots to be interchangeable.

Team leaders should be based on expertise and not primarily on rank. Some of the services place more emphasis on the rank to the detriment of the mission.

Intensive Care Unit care is generally not provided by ICU trained specialists. Most deployed ICU doctors have minimal critical care background. This situation requires that there be a critical care trained specialist to provide oversight and direction.

RECOMMENDATION:

- *The complement of assigned medical staff should be modified to balance the variability that exists in deploying medical personnel. Medical training, clinical currency, leadership and deployment experience are all important considerations.*
- *Develop a system(s) based approach to the employment of military medical assets within a theater of operations. This system may be based upon the successful example of Trauma System development pioneered by the American College of Surgeons Committee on Trauma.*
- *ICUs need close oversight by Surgical Critical Care trained specialists.*

B. Variances in care

In civilian medicine, differences in clinical practice are recognized between academic and private settings, government *versus* fee-for-service, urban *versus* rural hospitals, etc. Variances in care have traditionally been accepted, in large part due to the recognition of the individual physician’s professional status and the need to accommodate to unique institutional and patient circumstances.

An organized and standardized approach, however, has clear benefits for trauma care and it is especially pertinent in the deployed setting where many care providers deploy with little (or no) prior experience managing the types of injuries encountered in the wartime setting. Care protocols and guidelines need to be codified and should be considered the standard of practice.

Within Afghanistan, there appears to be variation in the degree of organization and oversight in the trauma care system. From the perspective of the reviewers, it appeared that the Task Force-Med support appeared more consolidated and coordinated in the North and East than in the South. In the Regional Command-South, there was less consolidation of medical command functions. This

observation proved particularly telling in the NATO-managed facilities where multi-national layers of command and control added unwanted inefficiency.

Multi-national variance in the level of care seemed to be difficult to formally assess. Examples of differences in surgical management by U.S. and other NATO components were seen, but there did not seem to be a systematic way to characterize these differences and evaluate their impact. Further compounding this difficulty was a lack of a coordinated forum to assemble the appropriate level of medical leadership from coalition forces to a common platform to discuss such issues of inter-operability.

One example of disparity of practice standards is the use of proximal vessel ligation to assist with hemorrhage control, including ligation of internal iliac and profunda femoris arteries. It was unclear if this strategy was associated with a survival benefit (from hemorrhage control) or if it was a source of increased late morbidity (necrosis of skin flaps associated with proximal traumatic amputations, loss of length of residual limbs) or increased mortality (due to tissue necrosis and sepsis). At least one patient at a Level III facility was encountered who had surgical (graft) revascularization of a profunda femoris artery that (by report) had been ligated per protocol at the previous facility provided. In effect, one surgeon was operating primarily to undo the work of another.

RECOMMENDATION:

- *Variances in care should be a focus for study. The Performance Improvement (PI) programs of the Joint Theater Trauma System should identify when and where care practices differ from theater standards and the impact of these variances should be evaluated.*
- *Iatrogenic injuries or complications with a potential iatrogenic contributing cause should be specifically identified and characterized.*
- *A theater level conference involving all coalition partners in medical care should be regularly assembled. The focus of this conference should be alignment of clinical practice guidelines and best practice management. One potential opportunity for this conference is the annual ATACCC conference which is widely attended by NATO and other coalition members.*

C. Theater Level III

1. Craig Joint Theater Hospital (CJTH), Bagram AF

The leadership and care being provided throughout the facility was exemplary. The additional training that the “Trauma Czar” undergoes was clearly noticeable in terms of a breadth of knowledge of the entire system (understanding CCATT, TCCC, MEDEVAC, CPGs, etc).

Although the facility is adequate, the building is poorly constructed, poorly configured, and is in disrepair.

ICU and Intensive Care Ward bed space was limited, but adequate with rapid turnover. The facility’s capacity could be challenged, however, with a patient “surge,” a local mass casualty incident, or if there was a prolonged period with limited evacuation capacity (poor weather or flight line repairs).

Afghan nationals (e.g., ANP, ANA) who had few options for transfer have longer lengths of stay at CJTH. The staffing and care model at the Level III facility, however, are not particularly well suited to long-term needs of severely injured patients. For example, the lack of an assigned plastic surgeon might limit options for management of complex wounds with local or free flaps.

While the staff morale at CJTH was high, it was observed that there were relatively simple actions that could be taken to improve the “livability” of their situation. For example, only limited in-facility food service was available, even though operational tempo often constrained the ability of staff to leave the facility for meals at the base dining facility. Also, out of service laundry equipment had left only two washing machines for the use by the entire hospital’s staff.

While an evaluation of the working conditions of the deployed personnel was not a focus of this review, it seemed that there were some relatively simple accommodations that could have a positive impact.

RECOMMENDATION:

- *The complement of assigned medical staff may need to be modified when the medical mission expands beyond care of the wounded warrior and care for disease and non-battle injury (DNBI) in military personnel. For support of a counter insurgency (COIN) mission, expertise in pediatrics, plastic and reconstructive surgery, and pain management are needed. Add Plastic Surgeon, Hand Surgeon, and Pulmonary/Critical Care specialists to the Bagram manning document.*
- *Continue equipment support and supply support of newly deployed capabilities such as dialysis at Bagram.*
- *Ensure an adequate supply of essential neurosurgical supplies such as the Codman monitors.*
- *Develop a theater hospital neurosurgical equipment list for the facility; ensure that deployed neurosurgeons know what supplies and equipment are available; these could all be added to Neurosurgical deployment specific CPG and pre-deployment training.*
- *Consider 100-year modular designed facility of US construction to ensure US standards and improved materials. These are also available with ballistic protection and insulation that would be a considerable improvement of the locally constructed facilities.*
- *Develop ICU expansion project to allow for a longer holding capability. If a new facility is to be constructed at Bagram, consider the expansion of the ICU to adequate space for at least 24 patients.*
- *Create a nutrition medicine support plan that takes into consideration the facility’s mission.*
- *Continue to place importance on selection of ideal hospital leadership.*
- *Incorporate Bagram DCCS and Trauma Czar into Base MASCAL planning. Should include a base wide exercise at least q 6 months.*
- *Increase and augment the local liaison teams that assist in reintegration of Afghan military, police and civilian patients.*

2. Kandahar Role III

The NATO led Role III facility at Kandahar is a new facility, with modern operating rooms, ICU and a spacious emergency room. The time visiting Kandahar was substantially less than the time spent at CJTH, and the visiting team did not participate in patient care activities at Kandahar other than ICU/ward rounds. The intense multinational presence was notable for having Canadian, Dutch, Danish and others involved in care.

Based on observations at CJTH (of patients at CJTH, transferred from Kandahar), there were a number of variations in care, including techniques for escharotomy and fasciotomy, fluid resuscitation in burn patients, and others. This variance may be potentially addressed by clearly defining the roles of medical leadership within such a jointly staffed hospital. The senior medical leadership in a facility of this nature must possess significant trauma experience as well as system expertise. The lead medical authority should possess the ability to direct clinical practice guidelines (OPCON) within the hospital facility. The

hospital staff expressed disappointment with the lack of medical content in their pre-deployment training, with up to 6 weeks of combat skills training and no training days addressing medical topics.

RECOMMENDATION:

- *Limit multinational involvement at deployed medical facilities to just two countries. This would limit much of the variances in care/training noted. Alternatively, it is imperative to define medical leadership at these joint facilities. This designation must be accompanied by the appropriate authority to minimize variance in care and standards.*
- *Have the Level III/Role III ICU and the Trauma chiefs rotate through an advanced Trauma Systems training program (A “Trauma Czar’s Course”) to learn CCATT or develop a Trauma Czar program (as currently utilized by the USAF) to enhance the leaders’ knowledge base and skills prior to deployment and learn CCATT or other service unique ICU platforms. Combined training pre-deployment by all of the Level III trauma chiefs would be an ideal way to broaden the system and ensure similar training/compliance.*
- *Send all deploying Trauma Czar/Chiefs to JTS for training.*
- *Have all Level III/Role III ICU and the Trauma chiefs undergo orientation with trauma critical surgeons at Level IV Landstuhl Regional Medical Center while transitioning to theater.*
- *CENTCOM should require deploying medical personnel to undergo pre-deployment medical training as suggested by the Joint Theater Trauma System.*

3. Aeromedical Evacuation Hub

Currently Bagram functions as the primary site for evacuations out of theater. Due to increased injuries from southern regions of the country, there has been strong consideration for the development of an additional Aeromedical Hub. It is clear that a number of facility factors and major experience at this unique aspect of casualty care are necessary to facilitate these difficult long range transports safely. This should not be underestimated. From a practical standpoint, this unique aspect of care should remain at a single site to focus the experience and ensure quality of care through the continuum. The addition of additional sites will dilute the experience across the theater and require additional training and a larger medical footprint (such as increased ICU capability).

D. LRMC Level IV

Landstuhl Regional Medical Center (LRMC) is a permanent US Military installation located in Germany and is a Joint Commission accredited facility. The medical center represents the largest American hospital outside of the United States and is the first and only hospital outside of the United States to be verified by the American College of Surgeons Committee on Trauma (ACS COT) as a trauma center. It is a tertiary referral center for EUCOM, CENTCOM and AFRICOM supporting more than 530,000 beneficiaries. LRMC has also treated service member and contractor casualties from 44 Coalition countries. Inbound Aeromedical Evacuation flights arrive daily to nearby Ramstein AB. Outbound flights depart from Ramstein AB to Andrews AFB, then to other Continental United States (CONUS) medical facilities. LRMC represents a vital piece of the DoD infrastructure, serving as a healthcare power projection platform, training and sustainment base in the application of the National Security Strategy.

LRMC is staffed by a mix of active duty and reserve Army, Air Force, Navy, Civilian and Host Nation personnel. Active duty Army and Air Force rotate on three year cycles and can be deployed from LRMC with no backfill. Navy staffing is considered a deployed tour for one year. Civilians make up 40% of

staffing mix. The Army and Navy manning documents do not commit to manning with Trauma/Critical Care surgeons, but fills the manning request with General Surgeons who may be subspecialty trained and without any currency in trauma/emergency surgery or critical care. At the moment, two of the Army surgeons at LPMC are subspecialty trained in Trauma/Critical Care. The Air Force commits to continuous manning with at least 2 Trauma/Critical Care surgeons and will add a third during this upcoming year.

All OIF/OEF patients are tracked using the Theater Medical Data Storage (TMDS), a secure, Internet based repository of administrative and clinical information generated from the combat theater thru LPMC to the destination CONUS facility. The TMDS system is not used while patients are at LPMC or at stateside facilities. Two systems, the Essentris system for inpatients and AHLTA for outpatient care, are used at LPMC but they do not interface. In addition, Essentris information is not concurrently available to CONUS facilities. The Bidirectional Health Information Exchange platform is a stop gap measure to allow access for stateside users; however, it is not readily accessed, has the same difficulties with functionality as TMDS, and providers in CONUS are unaware of its existence as a stand-alone system.

LPMC has a standing capacity of 148 beds, with the ability to surge another 56 beds in times of need. The ICU has 18 beds with capacity to surge another 12 beds. There is no intermediate or step down unit with capacity to monitor the less acute combat casualties who depart the ICU or need centralized telemetry monitoring.

Limitations in coagulation monitoring/testing were noted. LPMC currently is often short of hemodialysis staff; CRRT is not available but could be staffed by ICU staff directly with additional training.

LPMC has a robust Trauma PIPS Program which concurrently identifies performance improvement (PI) events/complications related to in-theater, enroute, and interfacility care. Communication of events is a challenge due to varied provider demographics, multi-service/national providers, and distance across three continents, and due to the complexity of effective PI. LPMC is the epicenter for bidirectional communication and utilizes technology, trauma PI/registry taxonomy in all interfaces to leverage enhancements despite distances and diversity. The ACS COT praised the LPMC PI program and noted that it is second to none in the civilian sector.

RECOMMENDATION:

- *US Army and US Navy should commit to placing Trauma/Critical care fellowship trained surgeons at LPMC to complement the US Air Force contingent (2) for a total of 4-5 as recommended by the ACS COT Verification Committee.*
- *Trauma/Critical Care surgeon turnover should be staggered to maintain corporate knowledge at the sole level IV facility supporting the CENTCOM AOR. Due to system weaknesses caused by the constant medical personnel turnover at downrange facilities, LPMC is the first site providing personnel stability in the trauma care system and must maintain continuity in practices at its site as well as in advising the downrange facilities.*
- *LPMC trauma medical director (chief) should be a vetted position between the AF, Army and Navy trauma consultants to ensure this critically important wartime position is staffed by the highest quality personnel.*
- *Care of the wounded warriors at Landstuhl Regional Medical Center is the current priority for this MTF. LPMC should create a separate Division of Trauma and Critical Care to centralize the clinical chain of command for the medical personnel primarily involved with these duties.*

- *A burn/wound care specialist is needed to enhance clinical care to the severe wounds suffered to combat casualties and to liaison with the ISR Burn Flight Team for the most severely burned casualties.*
- *Increase Air Force Critical Care nurse manning to allow for multiple duties such as direct ICU patient care as well as Critical Care Air Transport and Acute Lung Rescue Team support of EUCOM, AFRICOM and CENTCOM AORs.*
- *Acquire CRRT equipment and train ICU nurse members in CRRT use to eliminate identified manning gaps in renal replacement therapy availability.*
- *Continuous rotation of DoD surgical residents and critical care fellows would support the attending physicians and provide an excellent, first-hand exposure to these patients to military medical trainees prior to their deployments to the combat zone following training.*
- *Interface between TMDS and Essentris would enable providers to maximize time spent with wounded warriors instead of at computer terminals.*
- *Provide TEG (thromboelastogram) and factor X assay (which are currently not available). As post resuscitation coagulopathy and hypercoagulability are significant factors in the management and outcome of combat casualty care, these studies are essential since they provide optimal care. These studies provide more clinically relevant information on coagulation than routine coagulation profiles or the activated clotting time.*
- *Provide an intermediate/step down unit with capacity to monitor the less acute combat casualties who step down from the ICU or need centralized telemetry monitoring.*
- *Continue to support trauma research initiatives at Landstuhl that may lead to improvements in trauma care system-wide.*

E. CONUS Level V

Not evaluated by members of the team. The only interaction was through the weekly VTC where all three of the participating stateside Medical Centers failed to have adequate and informed staff present. Brook Army Medical Center is an ACS verified Level I Trauma Center serving both civilian and combat casualties. Walter Reed Army Medical Center has undergone an ACS Level II Trauma consultative visit with multiple recommendations for improvement. National Naval Medical Center has not undergone the ACS consultative process.

RECOMMENDATION:

- *Encourage consistent leadership and participation from the Level V facilities in performance improvement and weekly video teleconference.*
- *Ideally Navy and Army leadership at these essential DoD resources would embrace the principles of trauma care as outlined by the ACS or state trauma programs.*

VIII. RESEARCH

Joint Combat Casualty Research Team (JCCRT) conducts and facilitates the conduct of military-relevant research in CENTCOM. The JCCRT assists in developing and implementing research, determines medical and operational feasibility, ensures proposals have potential to provide insights into combat-relevant issues or to improve health care, and it provides consultation on data analysis and the dissemination of research findings.

The responsibility for human subject's protection for in-theater research was recently moved to the Institutional Review Board (IRB) at the US Army Medical Research and Materiel Command (MRMC). This change has reportedly been a source of frustration for the JCCRT, as the process for review has been substantially slowed. MRMC has insufficient manpower to address the combat casualty care research program, and only recently have they added IRB members with relevant clinical experience related to the research topics that are the focus in the CENTCOM AOR. Attempts at performing retrospective data reviews from across the system are onerous and extremely time consuming and the IRBs are often seen as obstructionists. This has significantly decreased the ability to perform ongoing reviews which in all likelihood would change care for future casualties. Most members interviewed felt that vast improvements of the system have been stifled due to a lack of ability to use the data. MRMC's interpretation of equipment that needs to undergo FDA investigation device exemption (IDE) is not clear and consistent with previous IRB approvals.

RECOMMENDATION:

- *A joint organization which is appropriately staffed should be implemented to oversee and facilitate casualty care research.*
- *The DoD should develop a single IRB that suffices for all services and all facilities.*
- *Data sharing agreements between DoD facilities need to be easier and less time consuming. This needs to be supported and directed at the OSD level.*
- *Human subject's protection and appropriate research oversight require that the Institutional Review Board (IRB) include individuals with relevant clinical and operational knowledge. This may be better provided by the IRB at US Army Institute of Surgical Research/Brooke Army Medical Center until a single IRB is fully developed and staffed. The impetus needs to be on protecting patients not on preventing research.*
- *Research questions should include a strong focus on performance improvement of the military trauma system.*

IX. OBSERVATIONS REGARDING SPECIFIC INJURIES AND SURGICAL CARE

A. Perineal injuries

Perineal injuries from improvised explosive devices are complex and devastating.

RECOMMENDATION:

- *Research to develop protective garments for the warfighter is needed.*

B. Spine injuries

Inconsistent use of restraint harnesses contributes to head and spinal cord injuries. Warfighters wearing full body armor report difficulty using current vehicle restraint systems. Systems to link body armor to restraint devices may be of benefit. Development of the current version of Mine Resistant Ambush

Protected (MRAP) vehicle seats is encouraging in that the new seat fixation and seat padding has significantly reduced the recoil potential. Although these MRAPs appeared to reduce the incidence of spine injuries their rollout was considered to have been delayed. Surgical spine instrumentation is not consistent throughout the system. In theater instrumentation is Synthes® and in Level IV and V, is Medtronic®. This inconsistency does not allow Level IV to revise or augment stabilization and delays definitive and complete care until patients arrive at Level V.

RECOMMENDATION:

- *Provide consistent surgical spine instrumentation throughout the system in order to allow Level IV to revise or augment stabilization without delays in definitive care.*

C. Pain management

Advances in pain management strategies in combat casualty care have allowed for comprehensive patient comfort. Providers have incorporated regional anesthesia including single-injection peripheral nerve blocks and continuous peripheral nerve and epidural infusion catheters. The Military Advanced Regional Anesthesia and Analgesia Initiatives have allowed for comprehensive advances such as the ambIT PCA, epidural analgesia Enroute, the versatile ambIT pump. Implementation of the Regional Anesthesia Tracking System which will transition to TMDS allows for more comprehensive tracking of the effectiveness of these advances. Advanced regional anesthetic techniques have allowed for safe surgical anesthesia and analgesia in the management of the modern combat casualty. Limitations exist in moving patient in the AE system with peripheral nerve and epidural catheters. These patients must be escorted with CCATT personnel, thus limiting optimal pain management with traversing the AE system.

RECOMMENDATION:

- *Provide adequate training and staffing ratios for AE staff to manage peripheral and epidural catheters.*

SUMMARY

The objective of the military trauma system is prevention of traumatic injury and provision of optimal trauma care with resultant reduction in morbidity and mortality. This document identifies criteria for military trauma care resources and practices for optimization of standards of care, policies, procedures, and protocols for care of our wounded warriors. The content of this manuscript provides guidance for military medical care personnel from the pre-hospital, through hospital and subspecialty care. This requires a joint approach which allows for coordination of care and provides essential data to predict needed resources, evaluate outcomes, provide education/training needs, to improve continuity of care across the combat care continuum and to facilitate real-time changes. The Joint Theater Trauma System was modeled after aspects of the U.S. civilian trauma care system. This development eventually led to a systematic and integrated approach to better organize and coordinate battlefield care to minimize morbidity and mortality and to optimize the ability to provide essential care required for casualty injuries.

Historically, the United States military has sought excellence in medical care since the Civil War. During the Civil War, the Sanitary Commission was founded to control hospital gangrene and at least three studies using antimicrobials showed that use of such agents could reduce infection and gangrene to approximately 3%. Letterman was charged to develop an ambulance service for the Union Army and this was very successful. Clara Barton organized a nursing service for the Union Army, and Sally Tompkins did the same for the Confederate Army. She was the only woman to receive a commission from the Confederacy. During WWI, Robertson was the first to use whole blood in theater. Antibiotics were introduced during WWII. During the Korean conflict, helicopters were used for the transport of the wounded for the first time, and echelons of care were emphasized. During the Vietnam conflict, fluid resuscitation was improved, essentially eliminating acute renal failure as a complication of shock. Over-resuscitation was also identified as a problem, leading to Da-Nang Lung, or (Adult Respiratory Distress Syndrome (ARDS). During Operation Iraqi Freedom and Operation Enduring Freedom, the military has once again established itself as a leader in combat casualty care and system development. The research in theater has led to dramatic changes in resuscitation, operative care, protective armor, and rapid evacuation through the military health care system. This has led to outcomes that have never been previously achieved in an armed conflict.

Maintenance of this excellence in care is dependent on a system-wide plan that must measure performance improvement, sustainability, effectiveness, and opportunities for advances in combat casualty care and functionality of the military trauma system. This report documents more than 130 recommendations that provide a framework for enhancements in an integrated military trauma system of care for combat to be developed and supported jointly. Complacency is not an option. The military trauma system must have an infrastructure which allows constant reassessment and performance improvement techniques to promote unsurpassed care for our wounded warriors.

GLOSSARY OF TERMS

ACS	American College of Surgeons
AE	Aeromedical Evacuation
AECT	Aeromedical Evacuation Control Team
AFCENT	Air Forces, Central Command
AFRICOM	Africa Command
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
AHLTA	DoD Outpatient Electronic Medical Record
ALRT	Acute Lung Rescue Team (LRMC)
AMC	Air Mobility Command
ANA	Afghan National Army
ANP	Afghan National Police
AOR	Area of Responsibility
ARDS	Acute Respiratory Distress Syndrome
ATACCC	Advanced Technology Applications in Combat Casualty Care (annual meeting)
BAF	Bagram Air Field
CASEVAC	Casualty Evacuation (typically rotary wing, non medical)
CCATT	Critical Care Air Transport Team
CD-ROM	Compact Disk Read-Only Medium
CENTCOM	Central Command
CJTH	Craig Joint Theater Hospital
CME	Continuing Medical Education
CONUS	Continental United States
COIN	Counter-Insurgency
CO2	Carbon Dioxide
COT	Committee on Trauma
CoTCCC	Committee on Tactical Combat Casualty Care
CPG	Clinical Practice Guideline
CRRT	Continuous Renal Replacement Therapy
CSAR	Combat Search and Rescue
CT	Computerized Tomography
CTSC	Combat Trauma Surgery Committee
D5W	Dextrose 5% in Water
D10W	Dextrose 10% in Water
DHB	Defense Health Board
DMRTI	Defense Medical Readiness Training Institute
DNBI	Disease Non Battle Injury
DoD	Department of Defense
DCCS	Deputy Chief of Clinical Services
DTSC	Definitive Trauma Surgery Course
ECMO	Extra Corporal Membrane Oxygenation
EMR	Electronic Medical Record
EMT-B	Emergency Medical Technician-Basic
EMT-I	Emergency Medical Technician-Intermediate
EMT-P	Emergency Medical Technician-Paramedic
ENT	Ear, Nose and Throat (surgical subspecialty)
EWS	Emergency War Surgery Course
EUCOM	Europe Command
FDA	Federal Drug Administration
FEVER	AFSOC C-130 Medical Evacuation Mission

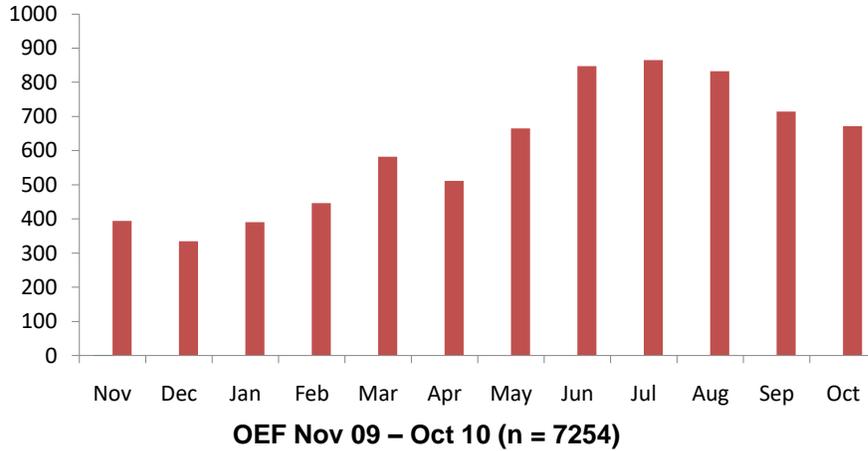
FFP	Fresh Frozen Plasma
FOB	Forward Operating Base
FP=C	Flight Paramedic- Certified
FST	Forward Surgical Team
GCS	Glasgow Coma Score
HOSPEX	Hospital Exercise (British)
ICU	Intensive Care Unit
IDE	Investigational Device Exemption (with FDA)
IED	Improvised Explosive Device
IRB	Investigational Review Board
ISR	Institute of Surgical Research
ISS	In-Service Select
JCCRT	Joint Casualty Care Research Team
JTS	Joint Trauma System
JTTR	Joint Theater Trauma Registry
JTTS	Joint Theater Trauma System
LRMC	Landstuhl Regional Medical Center (Level IV and ACS Verified Level II Trauma Center)
MASCAL	Mass Casualty
MEDEVAC	Medical Evacuation (on helicopters for this review)
MERT	Medical Evacuation and Resuscitation Team (British)
MOS	Army Medical Specialty Code
MRAP	Mine Resistant Ambush Protected
MRMC	Medical Research and Materiel Command
MTF	Medical Treatment Facility
NASA	National Aeronautical and Space Administration
NATO	North Atlantic Treaty Organization
NCO	Non -Commissioned Officers
NTDB	National Trauma Data Bank
OEF	Operation Enduring Freedom (Afghanistan)
OIF	Operation Iraqi Freedom
OSD	Office of the Secretary of Defense
PAD	Patient Administration
PCA	Patient Controlled Anesthesia
PI	Performance Improvement
PIPS	Performance Improvement Patient Safety (program)
POI	Point of Injury
PJ	USAF Pararescuemen
PMR	Patient Movement Request
PMI	Patient Movement Items (equipment)
PRBC	Packed Red Blood Cells
RC	Regional Command (Afghanistan)
RN	Registered Nurse
SEALS	Navy Special Operations Unit
SG	Command Surgeon
TACEVAC	Tactical Evacuation (medical personnel on board)
TC2	Theater Inpatient Electronic Medical Record
TCCC	Tactical Combat Casualty Care
TEG	Thromboelastogram
TF MED	Medical Task Force
TOC	Tactical Operations Center
TOPIC-M	Trauma Outcomes and Performance Improvement Course- Military
TMDS	Theater Medical Data Store
USFORA	United States Forces- Afghanistan

VA Veterans Administration
VRC Verification Review Committee (ACS Committee on Trauma subcommittee)
VTC Video Teleconference
WWI World War I
WWII World War II



OEF Monthly Admissions

Monthly Level III Admissions – 1 Year



12/13/2010

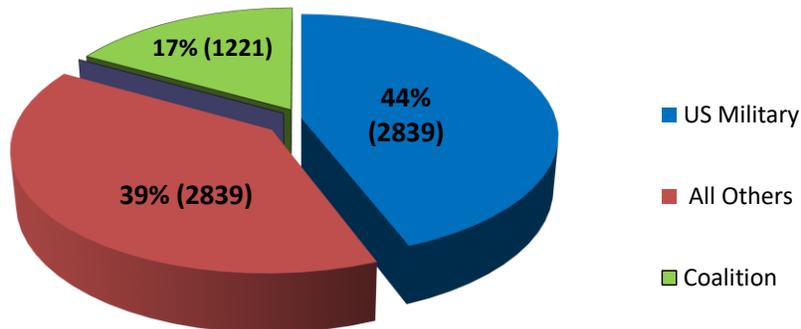
Right Patient, Right Care, Right Place, Right Time

3



OEF US Military, Coalition, All Others

Total Admissions (n=7254)



Rolling 12 months: Nov 09 – Oct 10

12/13/2010

Right Patient, Right Care, Right Place, Right Time

5

CONTACT INFORMATION FOR VISITING REVIEWERS

David L. Dawson, M.D.

Professor of Clinical Surgery
Division of Vascular and Endovascular
Surgery
University of California, Davis
Lieutenant Colonel, USAF Reserve,
Individual Mobilization Augementee, 60th
Medical Group, Travis AFB, CA



UC Davis Vascular Center
4860 Y Street, Suite 3400
Sacramento, CA 95618
(916) 549-1876
david.dawson@ucdmc.ucdavis.edu

Warren C. Dorlac, M.D.

Associate Professor of Surgery
University of Cincinnati
Director, CSTARS Cincinnati
Trauma Consultant to the USAF Surgeon
General
Colonel, USAF, MC, FS



University of Cincinnati
Division of Trauma/Critical Care
PO Box 670558
231 Albert Sabin Way
Cincinnati OH 45267-0558
(513) 558-5661
warren.dorlac@uc.edu

Ronald V. Maier, M.D.

Professor and Vice Chairman
Department of Surgery,
University of Washington
Surgeon-In-Chief,
Harborview Medical Center
Director,
Northwest Regional Trauma Center



Harborview Medical Center
Department of Surgery
Box 359796
325 Ninth Avenue
Seattle, WA 98104-2499
(206) 744-3299
ronmaier@u.washington.edu

Lynette A. Scherer, M.D.

Associate Professor
Department of Surgery
University of California, Davis
Chief
Trauma and Emergency Surgery Service
Co-Director
Surgical Intensive Care Unit



UC Davis Medical Center
2315 Stockton Blvd.
Sacramento, CA 95817
(916) 734-4771
lynette.scherer@ucdmc.ucdavis.edu

Donald Trunkey, M.D.

Emeritus Professor of Surgery
Oregon Health & Science University
Section of Trauma/Critical Care



Oregon Health & Science University
3181 S.W. Sam Jackson Park Road
Portland, Oregon 97239-3098
(503) 494-9145
trunkeyd@ohsu.edu

TRIP ITINERARY AND SUMMARY OF ACTIVITIES

22 Oct 10

Arrive Germany (Dawson, Scherer, Dorlac, Trunkey)

Events:

Scherer and Dorlac tour LRMC intensive care unit (ICU)

Dinner with Trauma Program and ICU staff, including Lt Col Raymond Fang, USAF, MC (Trauma Medical Director, USAFE CCATT Director), LTC Sandra Wanek, USA, MC (Surgical ICU Director), LTC John Oh, USA, MC (Associate Trauma Director), Kathleen Martin, RN, MSN (Trauma Program Nurse Director), Col Steven Silvey, USA, MC (Medical ICU Director)

Others: Matthew J. Wall, MD, visiting LRMC trauma surgeon, Baylor College of Medicine, Ben Taube General Hospital; Roger Shinnerl, visiting LRMC vascular surgeon, private practice

Key points: Scherer introduced to LRMC mission and function of ICU, introductions to LRMC ICU permanent party and visiting civilian staff

23 Oct 10

Maier arrives

Events:

ICU rounds at LRMC

Scherer and Dawson observe trauma cases in LRMC operating room

Scherer and Dawson observe casualty arrival from Ramstein AB and offloading at LRMC via Emergency Room entrance

Scherer and Dawson accompany CCATT from LRMC to Ramstein AB flight line, observe patient transfer to C-17 aircraft

Scherer gets aircraft tour; visits flight crew in cockpit

Mobility gear issue (Dawson, Dorlac, Maier, Scherer, Trunkey), including individual ballistic armor (IBA), helmet, individual first aid kit (IPAK).

Dinner with Fang family and Kathleen Martin (Dawson, Dorlac, Maier, Scherer, Trunkey)

Key points: Scherer was provided additional insights into aeromedical evacuation (AE) mission, role of LRMC.

Discussion:

Exposure to operational aspects of AE and gear issue catalyzes enthusiasm and excitement of visiting civilian trauma surgeons.

24 Oct 10

Events:

Predeployment briefings on Force Protection, Cultural Awareness-Afghanistan, personal safety on airfield, in aircraft, at destination.

Depart Ramstein AB approx 1600 local, KC-135 aircraft

En route: Scherer rides in cockpit jumpseat; Observe CCATT configuration in KC-135; Cockpit visit (all);

Boom position familiarization briefing (Maier, Scherer, and Trunkey)

Landing at Bagram AF with Scherer in cockpit and Maier in boom position

25 Oct 10

Events:

Arrive Bagram Airfield (BAF)

Morning ICU rounds at Craig Joint Theater Hospital (CJTH), meet medical and surgical staff

Meet with deputy commander, Col Mark Allen

OR cases, including arterial reconstruction involving Drs. Scherer and Dawson

Meet with hospital commander, Col Christian Benjamin

26 Oct 10

Events:

Clinical activities at CJTH, including ICU and ward rounds

Dinner with presentations by hospital commander

Observe casualty arrival and treatment in emergency room

Surgical cases at Craig Joint Theater Hospital, including involvement of all visiting surgeons; cases included burn management, arterial reconstructions, management of traumatic amputations

27 Oct 10

Events:

Travel from Bagram AF to Kandahar Air Field (KAF), civilian contract aircraft.

Base orientation.

Force protection briefing.

Counter IED/IED awareness training, including field training.

Discussion:

IED training provided useful insights into wounding patterns being observed in casualties.

28 Oct 10

Events:

Attend Kandahar CENTCOM-sponsored Joint Theater Trauma Systems (JTTS) Afghanistan Trauma Conference, hosted by Col Brian Eastridge, USA, MC. Conference included presentations by Drs. Trunkey (history) and Dawson (vascular injury management). Participants include medical staff of NATO Role III hospital at Kandahar.

29 Oct 10

Events:

Continuation of Kandahar CENTCOM Trauma Conference, including presentations by Drs. Scherer (negative pressure therapy) and Maier (transfusion medicine).

ICU and ward rounds at NATO Role III hospital at Kandahar AF.

Tour of medical facility, a recently constructed building with modern operating suites, imaging, emergency room, critical care, and patient wards.

Depart Kandahar AF approx 1800 local, C-130 aircraft, return to BAF

Key points:

Trauma Conference provides venue for discussion of system-wide issues (communication, pre-deployment training), pre-hospital care (including MEDEVAC and in-theater medical evacuation, documentation), in-hospital care (damage control surgery, resuscitation), aeromedical evacuation (CCATT), training, outcomes analysis/performance improvement (data collection, data quality assurance, data analysis).

Conference found to be extremely useful, as provided a needed venue for interaction between medical personnel from different facilities, levels of care, and the three services. (There are other venues for combined military lessons learned to be exchanged, mainly Advanced Technology Applications for Combat Casualty Care (ATACCC) and the National Trauma Institute meeting in San Antonio.)

Discussed differences in approaches to injury management that are being observed in care by different nation's medical systems.

Identified potentially significant variances in care in several areas, including strategies for vascular control, burn care, fluid resuscitation, and transfusion. Some patients are getting extensive early debridement of traumatic amputations that may adversely affect options for later wound closure and reconstruction.

Potential for benefit from more liberal use of ketamine to augment narcotics for analgesia, including during prehospital care.

Administrative problems with review and management of in-theater research initiatives discussed.

Transition of Institutional Review Board (IRB) responsibility from US Army Institute of Surgical Research (ISR)/Brooke Army Medical Center (BAMC) to US Army Medical Research and Materiel Command (MRMC) has adversely affected ability to conduct research projects, apparently due to the lack of clinical subject matter experts on the MRMC IRB.

30 Oct 10

Events:

Visit Bagram AF DUSTOFF, Maj Mark McFadden, unit commander – discussed en route care issues, viewed patient care equipment and supplies.

Visit Pararescue ERQS-- tour of aircraft, viewed extraction and rescue equipment, patient care equipment and supplies, and weapons.

Visit blood bank, 62nd BDE – discussed time for component delivery, use of frozen/deglycerated red cells, local processing of components and locally obtained fresh whole blood. Identified 9-12 day delay between collection of blood in US and its arrival in theater.

Email and phone communication with Col Margaret Walsh, USFOR-A Surgeon, for extension of country clearance.

Key issues:

Need to optimize use of “young” blood, less than 21 days, due to increased risk of complications with transfusion of older blood units.

31 Oct 10

Events:

ICU and ward rounds at CJTH

Meet with Combined Joint Task Force Surgeon, COL Brian Smalley (Division Surgeon, 101st Airborne Division) – review issues with Level I medical assets in RC-East

Teleconferences with Level II medical treatment facility surgeons/commanders at Forward Operating

Bases (FOB):

- Camp Qalat (CDR Theodore Edson)
- FOB Salerno (MAJ John Schovanes, 344 CSH)
- FOB Bostick (555 FSE)
- FOB Gahzni (Maj Brian Tyner, 655 FST)

Meet with CJTH logistics officer (Lt Col Kurt Prichard, MDSS commander) – discussion of theater medical logistics/supply systems.

Key Points:

Army Combat Lifesaver Training and emphasis on hemorrhage control has led to low rates of potentially avoidable death in combat wounded. Training for advanced procedures for medics (e.g. cricothyroidotomy) remains problematic, given challenges of tactical situation and limited clinical experience of provider. Use of critical care nurses for helicopter transport of intubated or unstable patients has been introduced and has benefit. Field personnel are well supplied.

Level II facilities have challenges due to relatively austere conditions. Some supply issues are problematic. There is a strong sentiment that assigned general surgeons should be experienced with trauma and critical care. The lack of a specific designator for trauma/critical care specialists fails to

recognize the increasing divergence in practice and experience that distinguishes a trauma specialist from a general surgeon who may have extremely limited experience with injury management.

1 Nov 10

Events:

ICU and ward rounds at CJTH

Meeting with Col Jay Johannigman, Deputy Commander for Clinical Services

Meeting with COL Brian Eastridge, USA, MC, Director, Joint Theater Trauma System

Meeting with leadership of Task Force 62nd MED

COL John P. Collins, USA, MSC, Commander

COL Mark W. Thompson, USA, MC, Deputy Commander for Clinical Services

COL Donald West, USA (incoming commander, effective Mar 11)

Work on draft report

2 Nov 10

Events:

Travel from Bagram AF, Afghanistan to Spangdahlem AB, Germany, C-17 Aircraft`

Ground transport to Ramstein AB

3 Nov 10

Report writing

Return issued personal equipment

4 Nov 10

Return to US