Committee on Tactical Combat Casualty Care
Meeting Minutes
8-9 February 2011

Tampa, FL

Attendance:

CoTCCC Members

COL (ret) Frank Anders	USA
Dr. James Bagian	University of Michigan
Dr. Brad Bennett	NMCP
Dr. Dave Callaway	Beth Israel Deaconess Medical Center
Dr. Howard Champion	USUHS
COL Jim Czarnik	JSOC
COL Virgil Deal	USSOCOM
Mr. William Donovan	75th Ranger Regiment
Col Warren Dorlac	USAF Trauma Consultant
CAPT James Dunne	USN Trauma Specialty Leader
COL Brian Eastridge	USA Trauma Consultant
COL Warner Farr	SOCCENT
Dr. John Holcomb	UT Health Sciences Center Houston
Dr. Jay Johannigman	University of Cincinnati
CAPT Kenneth Kelly	Tripler AMC
Dr. James Kirkpatrick	AMEDD Center and School
LTC Russ Kotwal	USASOC
Dr. Norman McSwain	Tulane University
MSG Harold Montgomery	75th Ranger Regiment
COL Kevin O'Connor	Physician for the Vice President
Dr. Edward Otten	University of Cincinnati
MSG Joseph Paisley	USASOC
Mr. Donald Parsons	DCMT
CMSgt Thomas Rich	58RQS
HSCM Glenn Royes	USCG
CMDCM Eric Sine	3rd Marine Division
Mr. Richard Strayer	JSOMTC

CoTCCC and Defense Health Board Staff

Dr. Frank Butler	CoTCCC
Ms. Danielle Davis	CoTCCC
Dr. Stephen Giebner	CoTCCC
COL Wayne Hachey	DHB
Ms. Olivera Jovanovic	DHB
Ms. Hillary Peabody	DHB

Guests

CAPT Roland Arellano	FMTB - East
LTC Constance Bell	USAMMDA
CAPT Linda Beltra	BUMED
Mr Keith Beaulieu	C-Stars Baltimore
MSG Dean Bissey	82nd Airborne Division
SGM F Bowling	USASOC
LCDR Christopher Burns	NAMRU-SA
Mr. William Cang	GEAA
HM1 Heather Casey	USMC Training & Education.
LTC Kao Bin Chou	75th Ranger Regiment
Col George Costanzo	JTTS
Dr. David Cresla	University of South Florida
MSgt David Dahl	ACC
MAJ John Detro	Center for Predeployment Medicine
LT Brian Drzewieki	FMBT-West
Mr. Richard Dunnigan	USSOCOM
Dr. Thomas Gross	FBI
Dr. Ben Hatano	OTSG Japanese Liaison Medical LNO
Ms. Kelly Hughes	USSOCOM
COL Andy Jose	OTSG British Liaison Medical Officer
Mr. Kevin Joyner	MARCORSYSCOM
CPT Carl Kusbit	82nd Airborne Division
LTC Pam Lucas	OTSG AF
Mr. Mark Lueder	PHTLS
LTC Rob Malsby	82nd Airborne Division
Mr. John Miles	FMTB East
CDR Larry Miller	MARCENT
K. Scott Mohr	160th SOAR
CDR William Padgett	HQMC Health Services
COL Andre Pennardt	USASOC
CDR Michael Penny	NSWDG
Ms. Leyan Riley	AFSOC
CAPT Scott Rineer	MARCENT
MAJ Brandi Ritter	DMMPO
MAJ Erin Savage	Canadian Forces
Maj Greg Siebert	AFMSA
MSG John Steinbaugh	USASOC
MSG Conty Steven	USASOC
Ms. Misty Talley	C-Stars Baltimore
LT Christopher Thompson	NUMI
SFC Fred Ziems	USASFC
Dr. Scott Zietlow	Mayo Clinic

Tuesday 8 February 2011
CoTCCC Public Session

Administrative Remarks **Dr. Frank Butler**

Dr. Butler called the meeting to order and asked CoTCCC members and guests to introduce themselves. He reviewed the agenda for the meeting and asked that individuals in the audience reveal any financial interests in the agenda items to be discussed. There were no financial interests disclosed. The next CoTCCC meeting is planned for 4-5 April in Houston, TX. Dr. Butler recognized Ms. Danielle Davis, Mr. Dom Greydanus, and Dr. Steve Giebner for their outstanding efforts in setting up the CoTCCC meetings.

Combat Medic Presentation **MSG John Steinbaugh**

MSG Steinbaugh presented a casualty scenario from Afghanistan. His unit conducted a daylight assault to capture a high value-target in a walled compound. The mission was supported by 2 tactical helicopters.

As they reached the walls of the compound, the enemy dropped several grenades over the wall, and a gunfight ensued. Approximately half of the assault force were wounded by the enemy's grenades in the first five minutes of the encounter. Nine operators were wounded, but the wounds were not life-threatening.

MSG Steinbaugh assessed the wounded; pre-deployment trauma care training for all unit operators paid off in rapid and effective treatment of wounds through self and buddy aid. MSG Steinbaugh relayed two factors he considered targets for improvement. First, he tended to accept the operators' self assessments of "I'm OK" without checking them with his own eyes and hands. Some of the less severe wounds were not discovered until later. Second, he did not intervene with a psychiatric casualty (a very young Afghan soldier with only moderate fragmentation wounds to his legs) when two other Afghanis took themselves out of the fight to console him. Three guns were taken off line instead of just one.

As the fight continued, the assaulters used ladders to scale the walls and took another casualty while on the roof. This casualty had three gunshot wounds: upper left chest, left calf and right thigh. His pre-extraction care included two Halo chest seals, two tourniquets above the wound on his right thigh, two Combat Gauze dressings packed in wounds, one morphine autoinjector, and 800 mcg of oral transmucosal fentanyl citrate (OTFC). He was placed on a litter and extracted from the roof. The ladders used were several feet short of the roof. Treatment and extraction were rushed because the helicopter providing evacuation had only five minutes on-site due to low fuel. Two team members on the roof were former medics. This helped a great deal with treatment and movement. Medic-to-medic handoff with the evacuation platform was excellent. MSG Steinbaugh noted three problems in the care and movement of this casualty: 1) his medic kit was carried on his chest and was in the way as he climbed onto the roof after

reaching the top of the ladder; 2) he did not have a tag line (a length of rescue line); and 3) in the rush to get the casualty to the helicopter, no antibiotics were given.

The last casualty on the mission suffered a gunshot wound through his upper left arm with arterial bleeding and a fractured humerus. Treatment included a self-applied tourniquet, ChitoGauze, and 800 mcg of OTFC. The casualty took off all of his body armor after he was shot, and refused to put it back on, even though he had to run across the courtyard exposed to potential enemy fire in order to get to the CASEVAC helicopter. He felt could move faster without his body armor.

The rest of the mission personnel exfiltrated on the second tactical helicopter. MSG Steinbaugh noted that he did not think to convey to the flight medic that the operators on the second aircraft were all OK. This created stress for the flight medic, who was expecting casualties from the unit's earlier transmissions.

MSG Steinbaugh's observations, comments, and lessons learned were:

1) The unit should rehearse moving casualties off of a roof by litter and ladder as part of their pre-deployment training;

2) The medic should not allow himself to get separated from his Aid Bag and Critical Care Kit;

3) Always get another litter from the flight medic after loading a litter casualty onto the aircraft;

4) Medics should always carry extra pens and markers;

5) Don't forget to give antibiotics when indicated;

6) Giving plasma at the point of injury could save many lives.

When asked about items that he wished he had had to take on his mission, MSG Steinbaugh's answer was "freeze-dried plasma." Dr. Otten asked about their litter of choice and the answer was the Talon.

MSG Steinbaugh noted that all members of his unit get regular TCCC training that includes training with live tissue.

Combat Medic Presentation II **SFC Fred Ziems**

SFC Ziems presented a casualty scenario from Operation Enduring Freedom. A 4-vehicle Italian convoy was attacked by a car carrying an estimated 600 pounds of explosives on a busy urban street. Six of the Italian personnel in the convoy were killed and six were wounded. Twenty-nine civilians were killed and at least 69 were wounded.

Two 18-D Special Forces (SF) medics, one 68-W Army medic, and 6 SF operators responded along with several Afghan National Army (ANA) soldiers from nearby intersections. Ambulances from the International Security Assistance Forces extracted the dead and wounded Italian personnel. SF and ANA personnel set up security as best they could, while the SF and Army medics triaged and began treating the civilian wounded. The scene was very spread out with shrapnel injuries occurring as far as 100 meters away. A Casualty Collection Point was established to triage the casualties. Many vehicles of all types were appropriated to transport the casualties to a nearby Afghan hospital.

Facilities, equipment and supplies at the Afghan hospital were completely inadequate to handle mass casualties and the Afghan doctors were not well trained in

managing trauma. As the casualties were moved to the hospital, the medics moved with them to continue to help with treatment. One 18-D went to each of the hospital's two operating rooms while the 68-W continued treating the wounded and provided secondary triage as casualties were moved to the ORs. SFC Ziems used IV ketamine to help apply an external-fixation device on an Afghani boy with a broken leg. A U.S. Navy physician who was part of an ISAF training team also helped with continuing triage. Even with poor facilities, inadequate supplies, and undertrained Afghan surgeons, only 2 of the dozens of wounded who
made it to the ORs alive died in surgery. Eight more died later from infections.

SFC Ziems' observations, comments, and lessons learned were:

1) There should be a cricothyroidotomy set in every medical kit;

2) Medical personnel should continue to train with improvised materials for tourniquets. In a mass casualty Incident, supplies of manufactured tourniquets may run out.

3) Medics should maintain proficiency in suturing;

4) When needed, make full use of resources embedded in indigenous medical facilities.

TCCC Update **Dr. Frank Butler**

The Defense Medical Materiel Program Office (DMMPO) has recently identified problems with the fabrication of the newly fielded SOFT-T (Wide) tourniquet. The distributor (Tactical Medical Solutions) announced a voluntary exchange of these devices in their letter of 10 December 2010. The problem does not affect the previous versions of the SOFT-T.

A TCCC brief was conducted by CAPT Jeff Timby on 7 January 2011 for the combat leaders at the Second Marine Expeditionary Force (Forward) Of interest, with a mix of both line leaders and medical personnel in the audience, only approximately half of the group recognized the term "Tactical Combat Casualty Care" or "TCCC" and only approximately one-third of the group had actually had TCCC training.

A New York Times article dated 7 January 2011 describes the success of tourniquet use in Iraq and Afghanistan. The article notes that "Doctors said a change in attitude about tourniquets also prevented many deaths. Until a few years ago, they said, tourniquets were often regarded as a measure of last resort, not always applied swiftly to those with severe extremity wounds. Every soldier now carries at least one tourniquet – some carry several – in their first-aid kits or visibly on their flak jackets. Fellow soldiers apply them immediately. "The liberal use of tourniquets has clearly been a lifesaver," said Dr. Eric Elster, a Navy Commander and director of surgical services at the NATO hospital at Kandahar Air Field." The article also describes success with the battlefield use of surgical airways, needle decompression of tension pneumothorax, and hemostatic agents such as Combat Gauze.

Marine Corps MARADMIN message 016-11 dated 10 Jan 2011 states that "TCCC has been identified as one of the reasons that U.S. military operations have experienced the highest casualty survival rates in history." The message notes that TCCC Guidelines reflecting the most recent updates are posted on the Military Health System website under TCCC at: **http:/www.health.mil** and directs that the following action be taken: "4. EFFECTIVE

IMMEDIATELY, THE MOST RECENTLY APPROVED TCCC GUIDELINES WILL BECOME THE STANDARD TO WHICH TRAINING EFFORTS ARE TO BE FOCUSED AND EVALUATION WILL BE BASED. THESE CHANGES WILL AFFECT NUMEROUS TRAINING PROGRAMS AND COURSES. EFFORTS ARE UNDERWAY TO UPDATE TRAINING STANDARDS AND WILL BE ACCOMPLISHED THROUGH THE NORMAL STAFFING PROCESS. A KEY ELEMENT OF THE TCCC GUIDELINES IS THEIR APPLICABILITY TO MEDICAL PERSONNEL, COMBAT LIFESAVERS, AND INDIVIDUAL DEPLOYING COMBATANTS."

A Washington Post article dated 21 January 2011 describes the use of TCCC techniques in the recent mass shooting incident in Tucson. The article notes in part that: "Doctors and law enforcement officials told reporters here that the incident would have been much worse without a small brown kit devised by David Kleinman, a SWAT team medic who had become concerned about rising violence. Kleinman cobbled together the Individual First Aid Kits out of simple items used by combat medics in Iraq and Afghanistan: an emergency bandage pioneered by the Israeli army; a strip of gauze that contains a substance which coagulates blood on contact; a tactical tourniquet; shears that are sturdy and sharp enough to slice off victims' clothing; and sealing material that works especially well on chest wounds. The items in the kit were each inexpensive; the Israeli bandage, for example, cost only $6, but deputies reached for one "over and over at the scene," Kleinman said. It is unusual for police officers to carry such medical equipment, but Capt. Byron Gwaltney, who coordinated the sheriff's office's response to the shooting, said it proved crucial in this case because the deputies were the first to arrive. "It would have been a lot worse" without those tools, Gwaltney said. The deputies were trained to use the kit in a program the Pima force called "First Five Minutes," six months ago. The deputies who initially responded said they were not the ones who arrested the suspect, Jared Lee Loughner. Instead, their focus was conducting triage through the parking lot: figuring out who was dead, who was injured and who was simply a helpful person who had jumped in to help. They used the tourniquets and gauze to stop the bleeding. They used a chest seal, also in the kit, to close bullet wounds. They used the shears in the kit to cut off the victims' clothes."

An e-mail from Dr. Peter Rhee dated 1 February 2011 reported that Combat Gauze was used on many of the shooting victims.

The benefit of having first responders trained in basic TCCC hemorrhage control measures was further discussed in an e-mail from FBI physician Dr. Tom Gross on 1 February 2011:

> "Interesting that this should come up at this time. Dr Fabbri and I have been lobbying for some time now that the "first aid" class taught to new FBI agents should not be taught by a contractor, but by us, using FBI agents who are also paramedics or ER nurses. Independent of the events in Tucson, our first class is scheduled for 18 April. We intend to give the new agents a kit very similar to this one, and to give them 6 hrs of basic TCCC "Care Under Fire."

Dr. Steve Giebner, Developmental Editor for the CoTCCC, has finished revising the TCCC Curriculum to reflect the change in fluid resuscitation in TCCC approved by the Defense Health Board on 1 November 2010. The updated curriculum has been sent to the Military Health System and PHTLS websites. He has also mailed CDs with the updated TCCC curriculum directly to all of the combat medical basic training centers in the DoD.

The TCCC Equipment After Action Report format has been reviewed by the Defense Medical Material Program Office (DMMPO), the Army Department of Combat Medic Training (DCMT), and the Joint Special Operations Medical Training Center (JSOMTC). Recommended changes have been incorporated into the format and DMMPO has agreed to collect and collate the completed AARs after approval of the proposed form.

A manuscript has been prepared by LTC (P) Russ Kotwal from USASOC that describes the results of the 75th Ranger Regiment's "Ranger First Responder" program. Through their focus of training all Regiment personnel, not just combat medics, in TCCC techniques, they have drastically reduced preventable deaths suffered during Ranger combat operations. When published, this study will document the lowest preventable death rate ever reported in modern warfare. (Note: this paper has been accepted for publication in Archives of Surgery.

The Trauma and Injury Subcommittee will be briefing the Defense Health Board on 8 March. Proposed action items in the brief will be an endorsement by the DHB of the Battlefield Trauma Care RDT&E Priorities approved by the CoTCCC at the November meeting and a memo noting the dramatic reduction in preventable deaths reported in the Kotwal study. Although all services in the U.S. military have now adopted TCCC training for combat medical personnel, the proposed memo would call for an increased emphasis in training medical department personnel (physicians, nurses, and PAs) as well as combat leaders in TCCC.

Publications

The CoTCCC maintains a Journal Watch to ensure that current publications relating to TCCC are reviewed. Recent publications of interest include:

<u>Clot-Inducing Minerals Versus Plasma Protein Dressing for Topical Treatment of External Bleeding in the Presence of Coagulopathy</u>

Kheirabadi et al – J Trauma 2010

- Swine model – 50% blood volume replacement with Hextend and animals cooled to 33 degrees C
- Tested: Combat Gauze, WoundStat, FAST fibrin dressing, and gauze
- ISR 6 mm femoral arteriotomy bleeding model
- Survival: FAST 10/13; CG 6/15; WS 2/15; gauze 1/12

Conclusions

- WoundStat was ineffective in a coagulopathic bleeding model
- Combat Gauze was partially effective in this model
- The fibrinogen-based FAST dressing was the most effective agent in this study, but is not yet FDA-approved

<u>Prehospital Intravenous Fluid Administration is Associated With Higher Mortality in Trauma Patients: A National Trauma Data Bank Analysis</u>

Haut et al – Ann Surg 2011

- 776,734 patients from the National Trauma Data Bank were included
- Mortality was higher in patients who had IVs started: 4.8% vs 4.5 %
- This increase was present for all subgroups

- The hypotensive subgroup had an OR of 1.44 for mortality
- A significant problem with this paper is that it did not address the type and amount of prehospital fluids given
- Also, some patients had IVs started but just for KVO
- Military evacuations are longer than most civilian EMS systems
- Factors possibly contributing to poorer outcomes with initiation of IV fluids: Longer time at the scene vs hydrostatic interference with forming clots vs dilutional coagulopathy?

TCCC from the Level III **LCDR Chris Burns**

LCDR Burns did two tours as a Navy SEAL officer before attending medical school and completing a general surgery residency. He just completed a deployment as a trauma surgeon at the Role III hospital in Kandahar. His observations regarding TCCC as observed by a trauma surgeon in theater included:

- Kandahar received many critically injured casualties. He attributes the 95% survival rate in large part to excellent prehospital care;

- He saw many patients with tourniquets on, but with distal pulses still present. These were effectively venous tourniquets.

- He saw no Hextend being used on casualties prior to arrival at the ED. Crystalloids were the prehospital fluid of choice;

- Combat Gauze was not used prehospital on many occasions where it might have been indicated;

- He did not observe a significant incidence of tension pneumothorax and questions its current prevalence as a cause of preventable death in combat casualties;

- Many catheters used in needle decompression of tension pneumothorax did not reach the pleural space. Ineffective/improper attempts at needle decompression were more frequent than effective/proper ones.

- Training for needle decompression and chest tube placement must be well-done and effective. Neither procedure is easy to do correctly without that training;

- He never saw prehospital infusion of blood products;

- TACEVAC times were variable. Some were short and some were quite long;

- Of the cricothyroidotomies he saw, more than half were failed attempts. Some were too high, some were too low, and some created false passages. Good training and maintaining proficiency are essential. Failures occurred at all provider levels;

- Prehospital antibiotic use appeared infrequent, although reliable data from this phase of care was uncommon;

- He saw many casualties with pelvic fractures. None had the pelvis stabilized in any way. He generally saw no indication that the prehospital providers were aware of the pelvic fractures;

- Some casualties were hypothermic upon arrival at the ED; none had hypothermia prevention equipment in place;

- While in theater, he and others formed a Rotary Wing Enroute Critical Care Team. Members included a surgeon, a pulmonologist, a pediatrician (these were all critical care physicians), two ICU Nurses, and two Emergency Medicine Nurses sharing

a call schedule. This team did mostly role II to role III transports of trauma patients.

Lessons learned from LCDR Burns' deployment were:

1) The current excellent casualty survival rate is largely a testament to the prehospital hemorrhage control measures advocated by TCCC;

2) TCCC should be taught broadly to medical personnel;

3) It is important to teach TCCC in the various school houses for combat medical personnel;

4) Providers trained in critical care are a valuable addition to the helicopter evacuation care capability.

New Technology: Military Emergency Tourniquet **Dr. Mel Otten**

Dr. Otten is the chair of the New Technology Subcommittee. He presented an initial assessment of the Military Emergency Tourniquet (MET™).

When new prehospital trauma care technology appears, there is often little available data pertaining to its safety or efficacy. This is presently the case with the MET™.

TCCC at present recommends three tourniquets (C.A.T.™, SOF-T™, and EMT™), but there are at least 25 tourniquets on the commercial market. Most of them have not been tested using the U.S. Army Institute of Surgical Research model described in ISR Technical Report 2005-05.

The MET™ is a windlass type tourniquet. It is somewhat heavier than the CAT tourniquet. It has been tested in tourniquet studies performed at the Navy Experimental Diving Unit and has been purchased by approximately 50 groups within the military. In the assessment of Dr. Otten's subcommittee, this is how things lie presently with the MET tourniquet:

Medical Issues:

- Has efficacy been clearly demonstrated? Possibly.
- Has equivalency with ISR-tested tourniquets been shown? No.
- Has primacy over ISR-tested tourniquets been established? No.

Training Issues:

- Does the MET™ require the same training as tourniquets already in the system? No.
- Does the MET™ require training that is similar to that for tourniquets already in the system? Yes.

In Dr. Otten's practical demonstration, an Emergency Medicine physician experienced in CAT tourniquet use experienced some initial difficulty in applying the MET™ to an extremity and tightening it.

Dr. Otten recommended that the MET tourniquet not be used by non-medical personnel and that it be used only as a back-up by medical personnel who have been trained on it. It should not be mixed with other tourniquets in medical kits due to possible confusion about the correct technique of application. Ideally, there should be only one tourniquet used throughout deployed U.S. forces, so that when a first responder has to

put a casualty's tourniquet on him, he won't pull an unfamiliar tourniquet out of the casualty's IFAK.

CDR Mike Penny from the Naval Special Warfare Development Group noted that his unit fields the MET tourniquet and has had good results with it. Dr. Callaway noted that having a wide variety of tourniquets on the battlefield may result in unnecessary delays in achieving hemorrhage control as a result of a first responder trying to apply an unfamiliar tourniquet. LT Thompson noted that he has used the MET tourniquet with good results. MSG Montgomery added that there are still some Ranger Rachet tourniquets being carried in theater.

Multiple Amputation and Urogenital Casualties in OEF **Dr. John Holcomb**

There has recently been a marked increase in the number of casualties with high bilateral amputations of the lower extremities resulting from dismounted IED attacks in Afghanistan arriving at Landstuhl Regional Medical Center. These casualties also often have injuries to the external genitalia, penetrating pelvic and abdominal injuries, and upper extremity amputations.

As noted in the Stansbury paper in Journal of Trauma in 2008, the rate of amputations in combat casualties from OEF/OIF who survive is approximately 6%. This rate is consistent with those seen in previous conflicts. In the last half of 2010, monthly major amputation rates rose to as high as 38% in Marine casualties in December 2010. Over the last ten months, amputation rates for evacuated Marines have increased 200% over baseline. Most of the amputations from these dismounted IED blasts are high, proximal injuries which are extremely disabling. There has been a concomitant rise in urogenital injuries – the incidence of urogenital injuries in casualties arriving at Landstuhl has almost doubled in recent months.

How the increased incidence of these injuries relates to ongoing operations and possible steps to reduce the occurrence of these injuries in the future are line commander issues. Both the Army Surgeon General and the CoTCCC are reviewing the care provided to these casualties to ensure that all possible steps to optimize their care are being taken.

In the ensuing discussion, COL Jose noted that protective undergarments ("blast boxers") are now being worn by British troops in Afghanistan; data on injury mitigation from these garments will hopefully be available in the near future. LTC Malsby noted that the incidence of this type of injury has increased recently in the 82nd Airborne Division as well.

Combat Medic Presentation III **MSG Dean Bissey**

MSG Bissey presented a casualty scenario from Afghanistan in which he was a crew member aboard one of two DUSTOFF MEDEVAC helicopters that responded to a 9-line request from a U.S. unit (approximately two platoons) whose convoy had been ambushed. When DUSTOFF 26 (DO26) and DUSTOFF 27 (DO27) arrived at the scene of the fight, the convoy was still heavily engaged with small arms, machine gun,

and RPG fire. United States A-10 aircraft were conducting “danger close” gun runs against the enemy.

After offloading personnel and supplies, D26 continued to orbit to provide additional security while DO27 remained on the LZ in order to receive casualties and act as a Class- 8 re-supply platform. The planned Casualty Collection Point (CCP) was an old roofless mud hut near the LZ. This CCP was not used because available vehicles sustained significant damage during enemy contact. The distance to the CCP and the requirement of moving 12 patients made use of this CCP untenable. Instead, medics and crew chiefs moved to the vehicles to triage and treat. Since the firefight was ongoing, the casualties in the vehicles had received no care from medics, only that self-aid and buddy care which could be given inside the vehicles.

Seven of nine initial casualties needed basic first aid such as pressure dressings and splints for various gunshot and shrapnel wounds. Two had life-threatening hemorrhage. Casualty #1 had two gunshot wounds with severe bleeding. There was a GSW to the lower right thigh with femoral bleeding which was controlled with two tourniquets. He also had profuse bleeding from the groin area which was initially treated with direct pressure. Then, through slight change of hand position, digital pressure was applied directly to the injured blood vessel. The wound was subsequently blunt dissected digitally so that a Kerlix gauze packing could be placed directly on the damaged vessel. On top of this packing was placed a pressure dressing held in place through Kerlix and large ace wraps. A splint was achieved by wrapping both legs to stabilize the right femur fracture.

Casualty #2 was still pinned under a radio mount inside a smoking vehicle. An RPG round had breached the vehicle’s armor through the door jamb, entered his right thigh, exited, removed his genitalia, and then went through his left thigh. Since there were no active flames inside the vehicle, hemostasis by direct pressure and packing with Kerlix gauze was obtained inside the vehicle. The RPG had not caused major vessel injury. The bleeding was diffuse and coming from the large area of injured soft tissue. Due to the location of the wound, the quickest and most efficient pressure dressing that could be made for this casualty after packing his groin wound with Kerlix was a Kerlix/ ace wrap “diaper” that was tightly placed around the casualty’s pelvis, groin and upper legs. The DUSTOFF Crew Chief held additional pressure on the wound from the point of injury inside the vehicle, during the extrication from the vehicle, and throughout the flight to Bagram ED. (Note that Combat Gauze was not available to the units at the time of this scenario. The treating medic did have QuikClot, but elected not to use it because of concern for thrombotic/embolic complications.)

Most of the casualties in this scenario were in vehicles in which the Halon fire suppression system had been activated. Casualty #2 spent the most time inside a damaged vehicle due to extrication difficulty.

During the MEDEVAC flight, direct pressure was continued to the Casualty #1’s groin injury and smaller shrapnel wounds were dressed. He received 5 mg of intramuscular morphine sulfate and high-flow oxygen. He remained awake and oriented, but complained of shortness of breath and tightness and pain in his chest. No thoracic injuries were identified. He insisted on propping himself up on his elbows because of the dyspnea. Casualty #2 began the flight obtunded. He had an IO started and was given 500cc of Hextend. His mental status improved after fluid resuscitation. He also

complained of shortness of breath and chest pain. He was further treated with 5 mg morphine sulfate IO, 1 gm Ancef, and oxygen.

These two casualties were both believed to be suffering from inhalation injury due to Halon exposure in their damaged ground vehicles. This exposure continued in the helicopter due to off-gassing from their clothing. None of the flight crews had been aware of the Halon systems being installed in the vehicles or the implications of Halon exposure for casualties. The windows in DO26 were closed to prevent wind in the cabin from impeding medical care. DO 26 and 27 transported 9 casualties in the first extraction. DO 26 returned later to pick up 3 additional casualties. MSG Bissey noted that both of these two seriously injured casualties survived.

MSG Bissey's observations, comments, and lessons learned were:

1) Halon fire suppression systems have been installed in up-armored Humvees in both OEF and OIF. Several of the casualties in this incident may have suffered hypoxia and pulmonary insult due to Halon exposure

2) All DUSTOFF Crew Chiefs in the 82nd Airborne are cross-trained in trauma care so that they are part of the medical team when needed. This has helped tremendously;

3) Intraosseous access is faster than IV access for hypotensive resuscitation. MSG Bissey had good results with the Pyng FAST-1;

4) Aggressive hemorrhage control should take precedence over IV or IO access;

5) Early, aggressive use of tourniquets is warranted to control extremity hemorrhage;

6) An aggressive pre-deployment training schedule (TCCC, Brigade Combat Team Trauma Training, Tactical Combat Medical Care, LTT, ACLS, PALS) is invaluable;

7) Medics need a velcro uniform patch to distinguish them from medically trained Crew Chiefs;

8) EZ-IO intraosseous infusion devices work well;

9) When a medic leaves the helicopter to care for wounded on the ground during Troops In Contact (TIC) evacuations, he should replace his flight helmet with an Army Combat Helmet with communications gear.

10) Eye protection works – wear it!

Plasma for Prehospital Fluid Resuscitation **Dr. Scott Zietlow**

Dr. Zietlow is an associate professor of surgery in the Division of Trauma, Critical Care and General Surgery at the Mayo Clinic and Medical Director of Mayo One. He presented data from a feasibility study on the use of prehospital plasma currently being conducted by Mayo Clinic Medical Transport.

Mayo Clinic Medical Transport is a large program that covers an extensive geographic area and provides over 60,000 transports annually by helicopter, fixed wing aircraft, and ground vehicles. For their feasibility study, administration of blood products in prehospital settings is an extension of Emergency Department practice.

In their study, blood products are given to treat hemorrhagic shock if an adult patient has two or more of the following after traumatic injury or other evidence of bleeding:

- Hypotension (single reading of systolic blood pressure $\leq$ 90mmHg
- Tachycardia (single reading of heart rate $\geq$ 120)
- Penetrating mechanism of injury
- Point of care lactate $\geq$ 5.0 mg/dL
- Point of care International Normalized Ratio (INR) $\geq$ 1.5

Under the initial protocol, the order of transfusion was 2 units of thawed plasma, followed by up to 4 units of packed red blood cells (PRBC's). The rate of transfusion was determined by the patient's clinical condition and hemodynamic parameters. For those patients known to be on anti-coagulants and who had a stable hemoglobin, 2 units of thawed plasma were administered followed by close monitoring of hemoglobin levels with an I-stat handheld blood analyzer to determine if PRBC transfusion was necessary.

In the two years of the study, 29 patients have been transported and treated on the protocol. 16 of those were trauma patients and 13 were medical. 21 of the 29 patients were on Coumadin. Seven were treated for elevated INR on Coumadin; 7 for hemorrhagic shock; and 2 for both. Seven of the trauma patients died, mostly from head injury. All 29 patients received additional plasma or PRBCs following transport. There were no transfusion reactions in these patients. Prehospital plasma was noted to result in earlier normalization of INR.

This study is continuing. The current prehospital transfusion protocol is three units of thawed plasma followed by three units of PRBCs. This protocol has been conducted without wasting any blood products.

In the ensuing discussion, Dr. Holcomb asked: "What is your impression of this strategy as the treating surgeon?" Dr. Zeitlow's answer was that prehospital plasma is clearly better in that it allows an earlier start on definitive resuscitation and reduces the patients' acidosis on admission. Dr. Holcomb noted that correction of acidosis may be a more important metric than normalization of INR.

Naval Special Warfare TCCC Overview **LT Chris Thompson**

LT Thompson is a former SEAL corpsman; he is now a Physician Assistant stationed at the Naval Undersea Medicine Institute. He began his brief with a review of the Naval Special Warfare (NSW) force structure. The NSW force consists of 7300 billets; there are 3396 operator billets (2655 SEALs and 741 Special Warfare Combatant Craft crewmen). Medical manning consists of 39 officers and 505 enlisted members and is growing. NSW Squadrons now deploy with a physician or a PA.

In the past, the NSW community converted its corpsman billets to SEAL operator billets. This resulted in a loss of ability to provide independent medical care in remote locations. To regain this ability, NSW is now looking at sending its medics through the full Special Forces Medical Sergeants Course at the John F. Kennedy Special Warfare Center and School. They would then be granted the same scope of care as a Navy

Independent Duty Corpsman. These medics would then operate with medical privileges granted by Commander, Naval Special Warfare Command, and not the Bureau of Medicine and Surgery.

All NSW personnel get TCCC training both as part of SEAL Qualification Training and then during each pre-deployment workup. The pre-deployment TCCC training is provided by SOCOM-approved contractors.

With regard to combat trauma-related medical research and development, NSW medical is interested in freeze-dried plasma, sick call telemedicine, prehospital resuscitation with plasma, compression devices for junctional hemorrhage, and advanced hemostatic agents.

PHTLS TCCC Courses **Mr. Mark Lueder**

Mr. Lueder is a Chicago Paramedic and a member of the PHTLS Executive Committee. He gave an update on TCCC courses taught under the auspices of PHTLS. This program has been underway for about a year as a result of increasing demand for TCCC training by law enforcement agencies and allied nations. A growing number of teaching sites is being set up inside and outside the United States. The TCCC curriculum was recently translated into Spanish in order to teach it to the Mexican military.

Mr. Lueder noted that PHTLS TCCC instructors are volunteers and receive only travel expenses for their participation as TCCC instructors. He also reviewed the requirements to become a teaching site in the PHTLS TCCC program are:

- The instructor must first be a PHTLS instructor and working at a current PHTLS training site.
- TCCC instructor candidates must first be TCCC providers.
- Instructor candidates must be monitored teaching their first TCCC provider course by PHTLS instructor staff.

Mr. Lueder also noted that Chicago-area EMS Systems are now using tourniquets and Combat Gauze.

Dr. McSwain mentioned that he had just returned from Ecuador, where there was a great deal of interest in arranging TCCC training for their military; the PHTLS office is helping to coordinate that.

TCCC Equipment Issues **Major Brandi Ritter**

MAJ Ritter is the Department Head of the Joint Medical Test and Evaluation Department at the Defense Medical Materiel Program Office (DMMPO). She presented a synopsis of selected medical materiel issues.

A DMMPO evaluation identified a misalignment of the one-way valves on Bolin Chest Seals. DMMPO informed the company of these findings and the company used this input to improve the equipment design.

The now-outdated hemostatic agent QuikClot has been found on multiple recent occasions in individual Marine Corps Individual First Aid Kits (IFAKs). It is unclear if the

IFAKs have not been updated due to logistic delays or if Marines augmented their kits with QuikClot as an individual initiative. Logistical execution of upgrades to IFAK assemblages may take two years for full implementation.

Multiple incidents of material failure of the new Special Operations Forces Tactical Tourniquets-Wide (SOFTT-W) have been reported. The contracted manufacturer changed to a different (weaker) construction material without notifying the distributor, Tactical Medical Solutions. DMMPO worked with the company on sending out proper notifications and correcting the material. There has been a voluntary exchange notification letter from the company on the device, and an MMQC instructing military logisticians on procedures for implementation.

An imitation version of the SOFT-T has now been identified in theater. It resembles a Generation 1 SOFT-T, is made in Pakistan, and is carried by some of the ANA and the ANP units. U.S. forces should ensure that their SOFT-Ts are procured through normal military supply channels to avoid getting the imitation tourniquet.

The new Pyng Fast-X sternal intraosseous device was recalled from the market to address a design issue which caused malfunction when the device was not applied at precisely the proper angle. Pyng is conducting studies to ensure that the design changes for the Fast-X will correct the malfunction.

There have now been three incidents of a blue tibial EZ-IO needle being utilized in the humerus. This needle is not long enough to use on the humerus. The DMMPO recommends a reinforcement of IO training to emphasize the use of the blue needle in the tibia and the yellow needle in the humerus.

The next iteration of DMMPO's *Feedback to the Field* report will address humeral intraosseous devices. It will be posted on the DMMPO website in the near future.

The TCCC Equipment Overview Charts for service medical kits and IFAKs still shows areas of red. Eye Shields are still not in any of the service IFAKs, but the Marine Corps may add them soon. Fielding of the Combat Pill Pack is complicated by medication shelf-life considerations. The TCCC card is also still not uniformly fielded. The latest TCCC Equipment Overview is attached as Appendix 1.

In the discussion that followed, COL Czarnik stressed the need to field OTFC with the conventional forces in the U.S. military. DR. Holcomb agreed and stated that this should an item addressed on unit commanders' USR (Unit Status Report.)

Special Operations Medical R+D **MSG John Steinbaugh**

MSG Steinbaugh oversees a U. S. Special Operations Command medical research and development program that is directed at specific needs in combat casualty care equipment identified by medics returning from combat operations.

Items currently under development or evaluation in his program include:

- Freeze-dried plasma – he noted that much of the funding for this program now comes from the Army Medical Research and Materiel Command. There is concern about the anticipated long delays in fielding this product.
- The abdominal aortic tourniquet – This device has an inflatable bladder and a pelvic binder. It can be applied in less than a minute, but is not yet FDA-approved.
- The Combat Ready Clamp (CRoC) – FDA approval for this device was obtained in

August of 2010. It is now being deployed by SF and Ranger units for combat evaluation. It weighs less than a pound, can be applied in less than a minute, and has worked well in cadaver and LTT labs. Dr. Otten inquired about potential pelvic fractures in polytrauma casualties and what effect the CRoC might have on these injuries.

- The Wound Stasis Dressing: dehydrated, compressed, cellulose sponge pellets impregnated with Chitosan that can be injected directly into a wound. MSG Steinbaugh has been involved with preliminary testing of this product on a subclavian injury model and was impressed with its efficacy.
- Gas insufflation for tamponade of intra-abdominal hemorrhage. Questions from the group regarding this device included concerns about arterial gas embolism, creating a tension pneumothorax in patients with diaphragmatic injuries, and adverse effects from abdominal insufflation in hypotensive patients.
- Lightweight litters: the Talon litters work well, but there is a need for a lighter litter that can be carried on SOF missions.
- A lightweight portable compression chamber: The Gamow bag is used for the treatment of altitude-related illnesses but is too heavy at 30 pounds. There is a portable chamber being developed and reportedly nearing FDA approval that weighs only 7 pounds.
- A lightweight medic-to-medic battlefield communications system: this system facilitates communications between the ground medic and the flight medic when loading casualties onto an evacuation platform.
- Wireless combat casualty medical monitors: new devices can do oxygen saturation, capnography, EKG, blood pressure, temperature, and blood glucose.
- New hypothermia prevention kits to replace the HPMK.
- Battery-powered systems designed to warm IV fluids in cold environments. The Enflow battery was noted to be too large.
- A disposable IV fluid pressure infuser.
- Medical manuals and decision-assist protocols in an electronic format.
- A winter/alpine pneumatic litter.
- Realistic trauma manikins for casualty management training.

Additional topics of interest are the DARPA helmet-mounted blast sensors and ChitoGauze. MSG Steinbaugh said that many SOF medics preferentially carry Celox Gauze and ChitoGauze rather than Combat Gauze and that, in his experience, ChitoGauze works faster than Combat Gauze.

SOF Blood Protocol **SGM F Bowling**

SGM Bowling presented an overview of the teaching materials used in the Special Operations Combat Medic Skills Sustainment Course to teach fresh whole blood transfusion in the field. Special Operations Forces medics are trained in this procedure since SOF's position is that fresh whole blood transfusions can be conducted with reasonable safety on the battlefield when FDA-approved blood products are not available. He reviewed briefly an updated transfusion protocol being developed in Special Operations and solicited input from committee members and guests.

Wednesday 9 February
CoTCCC Internal Administrative Session

Administrative Remarks **Dr. Frank Butler**

The Chairman reviewed the agenda for this morning's meeting. He called for disclosure of financial conflicts of interest - none were declared.

The Committee's next meeting will be held on the 5th and 6th of April 2011 at the La Torretta Hotel which is north of Houston, Texas. The Core Board of the Defense Health Board will next meet on the 7th and 8th of March 2011 at the Dulles Hilton Hotel. The Advanced Technology Applications for Combat Casualty Care conference is scheduled for August 15, 2011. The August meeting of the COTCCC will therefore be scheduled for the first or second week in August, and there are several options for a meeting site. The committee staff is planning for a ten-year anniversary meeting, perhaps in Washington, DC or Arlington, Virginia in November 2011. A tenth anniversary dinner at an appropriate venue may be planned as part of the meeting.

The Chairman will plan for a discussion of TACEVAC care issues as the main focus for the April meeting of the CoTCCC. LTC Mabry will present his findings regarding TACEVAC skill levels versus patient outcomes in theater. The Chairman will also invite the USAF, the 160th SOAR, a representative from the British MERT, the 82nd Airborne division, and other units that perform TACEVAC to attend and present.

COL Hachey notified Committee members that their reappointment letters are currently being worked by the Defense Health Board staff. Without these reappointments, the CoTCCC will not be able to meet in April. Because congress has not yet passed the budget, fiscal year 2011 funding is still held up. The DHB is also working on a travel memo which should create additional flexibility in travel for CoTCCC members.

The Chairman pointed out that other organizations in addition to the Department of Combat Medic Training, the 75th Ranger Regiment, and the Special Operations Combat Medic Skills Sustainment Course may be included in the TCCC Equipment After Action Report project. The project will collect feedback only from medics who have actually taken care of combat casualties on the battlefield.

The Trauma Consultant to the Army Surgeon General is an ex-officio voting member. The new Trauma Consultant is COL Brian Eastridge, who is already a voting member. Members present agreed to allow COL Flaherty (the previous Consultant) to continue his membership on the committee while COL Eastridge is the Consultant.

Combat Medic Presentations Review **Group**

The Committee reviewed lessons learned from the combat medic presentations at this meeting. Issues discussed included:

- Vertical rescue during tactical operations: a 25-ft length of nylon line should be considered for inclusion in the medical equipment carried on selected missions.

- Halon fire suppression in tactical vehicles and its potential for inhalation injury in casualties: Dr. Butler will obtain the inhalation injury CPG from Col Costanzo and review with Dr. Otten.
- Casualties should be re-assessed frequently.

These items will be considered for inclusion in the next edition of the PHTLS (Military) manual and future revisions of the TCCC curriculum.

The Chairman will also investigate the possibility of adding a summary of the Combat Medic "Lessons Learned" to the TCCC website materials.

Potential Changes to the TCCC Guidelines **Group**

The following list of potential changes to the TCCC Guidelines were reviewed. None of these items were proposed by members as changes to the guidelines at present.

- Supraglottic airways for unconscious TBI patients
- Additional criteria for surgical airways in unconscious patients without direct airway trauma
- IV ketamine for battlefield analgesia
- Tranexamic acid (TXA) for non-compressible hemorrhage
- Axillary site for needle decompression of suspected tension pneumothorax
- Antibiotics in TCCC
  - Only for specific wounds?
  - Only for delayed evacuations?
  - Different antibiotic?
- IV fluid resuscitation – no crystalloids

There was also a discussion on taking MAST trousers out of TACEVAC section of the TCCC Guidelines. Dr. Holcomb recommended that MAST trousers be left in that section as a therapeutic option for pelvic hemorrhage.

DHB Action Items **Group**

The following topics will be included in the Chairman's brief at the next meeting of the Defense Health Board:

Recommended DHB Memos

1) Battlefield Trauma Care RDT&E Priorities – list from November 2010
2) TCCC training and equipment emphasis for:
   - Combat leaders
   - Medical department personnel
   - All deploying combatants

Information

Devastating Dismounted IED Injuries in OEF

Dr. Butler will prepare an executive summary on TCCC for inclusion in the read-ahead package for DHB members. It will include an overview of TCCC use by U.S.

forces, NATO, and other coalition partner nations as well as the positive impact that TCCC has had on casualty survival. Short bios of the membership of the CoTCCC will also be included in the package.

Selected Biomedical RDT&E Initiatives **Dr. Howard Champion**

Dr. Champion briefed the Committee on a number of current research areas in prehospital combat trauma.

The various trauma DoD trauma registries continue to be excellent sources of information on combat injury. For example:

- The Joint Theater Trauma Registry contains information on combat trauma care delivered to casualties admitted to Role III facilities.
- The Navy and Marine Corps Trauma Registry contains information on Role II trauma care, Returned-To-Duty rates, and Disease and Non-Battle Injury.
- The Armed Forces Medical Examiner Tracking System contains Killed-In-Action and Died-Of-Wounds data.

Information from all three of these registries goes into the Surface Wound Mapping™ database. This program can map patterns of injuries and can be used to help guide the development of better Personal Protective Equipment.

Combat injuries are not well described by civilian trauma descriptors such as the Abbreviated Injury Score, the Injury Severity Score, or International Classification of Diseases. A new Military Combat Injury Scale (MCIS) has been developed to address this deficiency and is currently under evaluation.

The Advanced Requirements for Crew Safety program is being used to design a new vehicle to replace the Humvee. It analyzes injury threats and models the vehicle's response to the threat and the effects on the crew.

Other areas of development include predicting the collective impact of individual disabilities on mission capability, a methodology to assess the efficacy of live tissue trauma training, and more advanced medical training simulators.

In the ensuing discussion, both COL Eastridge and CAPT Dunne agreed with Dr. Champion's statements about the need for an improved injury severity scale for describing combat-related injuries.

Additional Business

With regard to the last update on fluid resuscitation in TACEVAC, Mr. Strayer asked the question; "Is the dose of Hextend unlimited in TACEVAC as the guideline is now written?" His question pertains to section 5b in the TACEVAC Care guidelines:

b. If in shock and blood products are not available:
   - Hextend 500-mL IV bolus
   - Repeat after 30 minutes if still in shock.
   - Continue resuscitation with Hextend or crystalloid solution as needed to maintain target BP or clinical improvement.

The response was that the medic must weigh clinical, tactical, and other situational factors to make this decision, and further Hextend beyond the first two 500cc boluses may be used if indicated. The CoTCCC will consider changing "crystalloid" in the guideline above to "lactated Ringer's solution" to exclude normal saline. COL Deal noted that efforts are being made currently to establish an IND for the French freeze-dried plasma product.

Master Chief Sine noted that Pyng is working on the FAST-X problems that were reported yesterday. The issues with insertion of this device have occurred when there is patient movement during insertion.

2 May 2011

Frank K. Butler, M.D.
CAPT, MC, USN (Ret)
Chairman

Date

Appendix 1
TCCC Equipment Overview
February 2011

DEFENSE MEDICAL MATERIEL PROGRAM OFFICE

Service IFAKs Feb 2011

TCCC Item	USA IFAK	USMC IFAK	USAF IFAK
Tourniquet			
CAT			
SOFT-T			
Nasopharyngeal Airway		CAP	
Combat Gauze			
Elastic Pressure Bandage			
Chest Seal Dressing	Field Dressing used with tape	H&H Bolin/wound seal	
Rigid Eye Shield			
TCCC Card	Issued On Deploy	H & H CC	DD Form 1380
Combat Pill Pack			
Acetaminophen 650 mgER			
Moxifloxacin 400mg			
Meloxicam 15mg			

Legend
- In Assemblage
- Not in Assemblage
- Policy to have available when deploying

Slide 6

Appendix 1 (cont)
TCCC Equipment Overview
February 2011

DEFENSE MEDICAL MATERIEL PROGRAM OFFICE

Special Ops IFAKs Feb 2011

TCCC Item	SOF IFAK	AFSOC IFAK
Tourniquet		
CAT		
SOFT-T		
Nasopharyngeal Airway		
Combat Gauze		
Elastic Pressure Bandage		
Chest Seal Dressing		
Rigid Eye Shield		
TCCC Card		DD 1380
Combat Pill Pack		
Acetaminophen 650mg ER		
Moxifloxacin 400mg		
Meloxicam 15mg		

Legend
- In Assemblage
- Not in Assemblage
- Policy to have available when deploying

Slide 7

Appendix 1 (cont)
TCCC Equipment Overview
February 2011

DEFENSE MEDICAL MATERIEL PROGRAM OFFICE

Combat Medical Sets Feb 2011

TCCC Item	USA 68W	USMC (CAP)	AFSOC PJ	SOF ATP
Tourniquet				
CAT				
SOFT-T				
Combat Gauze				
Elastic Bandage				
Nasopharyngeal Airway				
Surgical Airway	H&H set	H&H	Individual	H&H
14ga, 3.25" Needle				
Chest Seal	H&H	Bolin	Asherman	HyFin
Hextend		BAS AMAL636		
IV Catheter Needle 18ga				
Saline Lock				
Occlusive Dressing				
Intraosseous Device	FAST1	FAST1	FAST1	FAST1
Hypothermia Prevention				
Rigid Eye Shield				
Pulse Oximeter		BAS AMAL635		
TCCC Card	Issued on deploy	H&H CC	DD 1380	

Legend

- In Assemblage
- Not in Assemblage
- Policy to have available when deploying

Slide 8

Appendix 1 (cont)
TCCC Equipment Overview
February 2011

DEFENSE MEDICAL MATERIEL PROGRAM OFFICE

Medications Feb 2011

TCCC Item	USA 68W	USMC (CAP)	AFSOC PJ	SOF ATP
Combat Pill Pack				
Acetaminophen 650mg ER (2)	MES BAS		325mg	
Moxifloxacin 400mg				
Meloxicam 15mg	MES Tactical Combat		*Also Ibuprofen 800mg	
Narcotic Analgesics				
OTFC 800mcg			Issued on deploy	
Morphine 5mg IV/IO	Morphine 10mg IM		Issued on deploy	
Naloxone				
Promethazine 25 MG IV	MES SickCall			
IV/IM ABX				
Ertapenem 1g	MES Tactical Combat			
Cefoxitin 2g			915F,K	
Fluid for Mixing Medication				

Legend
- In Assemblage
- Not in Assemblage
- Policy to have available when deploying

Slide 9