

2021 COMBAT MEDICAL CARE CONFERENCE ABSTRACTS

"Now, more than ever"

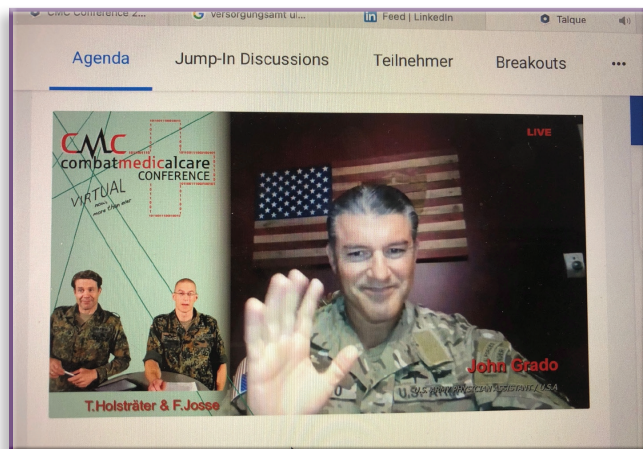
The Virtual Combat Medical Care Conference 2021 in a Pandemic Setting

Capt Sebastian Weber¹; LtCol Dr Florent Josse, MD^{2*}

For the fourth time, the Combat Medical Care Conference (CMC) took place under the motto "Now, more than ever" on July 13–14, 2021.

The research, development, and training of Combat Casualty Care have no standstill. Correspondingly, there was great motivation and commitment of the organizing team to hold the CMC 2021 despite of the COVID-19 (SARS-CoV-2) pandemic. Therefore, the conference had a new look, as a virtual event with live moderation and interactive components and live discussions.

The German Society for Military Medicine and Military Pharmacy e.V. (DGWMP) was responsible for organizing this event, as in the past. The cooperation between the Department for Anesthesiology, Critical Care, Emergency Medicine and Pain Therapy from the military hospital of the Bundeswehr in Ulm with Lieutenant Colonel (MD) Dr Florent Josse as responsible officer (scientific supervision), the Special Operations Training Center (AusbZSpezlOp) Pfullendorf, and the Tactical Rescue & Emergency Medicine Association (TREMA e.V.) was again successful, as in the past conferences.



John Grado and the organizers of the CMC at the virtual platform of *talque*.

The organizing team chose the specialized real-time community and management tool *talque* as event venue to master the balancing act between hygiene regulations on the one hand and providing an interactive platform for international and scientific exchange on the other.

Through their *talque* account, the participants had access to presentations, live discussions, and virtual workshops.

There was a virtual exhibition room for 25 companies to present their products related to the treatment of combat-related injuries in their profiles and workshops. Moreover, there was the possibility for direct interaction between the participants as well as between the lecturer and the audience by using the messenger client.

The symposium was bilingual (English and German) to meet the international character. All lecturers and instructors invested a lot of commitment and passion and created interesting and enriching lectures and workshops.

The opening contribution, "11 Years Since the Battle of Isa Khel, Afghanistan – What Have We Learned?" with the subsequent live discussion with three involved soldiers, was an exceptional introduction to the event.



CAPT (Ret) Frank Butler – A Quarter-century of Tactical Combat Casualty Care

On the occasion of the 25th anniversary of the Tactical Combat Casualty Care (TCCC) Guidelines, it was a huge honor to host the developer of the TCCC concept, CAPT (Ret) Frank K. Butler, MD for his presentation. SGM (Ret) Mike Hetzler's presentation about the latest updates of the TCCC guidelines completed this subject, and the subsequent live discussion with the two speakers was very special.

The livestream was split into three virtual rooms during the first evening of the event to meet the number of lectures and presentations. Case reports of military missions by the French Armed Forces in Africa and the US Armed Forces in Yemen were presented in the main program. Simultaneously, there were presentations in the virtual rooms: "CBRN," such as the management of chemical warfare agents, and "Force Health Protection," including a report of health protection during

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captivity in Syria and the psychological and physical impacts of missions abroad.

On the second day, there were various interesting lectures about the medical disaster control during terrorist attacks such as the Christchurch mosque shootings on March 15, 2019, and the terrorist attacks in Paris on November 13, 2015. Further, there were several inspiring talks on new approaches to medical procedures in tactical settings, like the use of Pentrox for analgesia or different “out-of-the-box” uses for the rescue blanket. A detailed impressive report from the battle of Mosul integrated the need but also success of training and interoperability in a high-risk environment.



LtCol Dr Thorsten Holsträter and LtCol Dr Florent Josse, who were responsible for the virtual CMC conference, in front of the green wall.



Setting of one of the session rooms at the virtual CMC conference.

One highlight of the main program, especially for soldiers of the German Bundeswehr, was CPT Timothy Lomas’s presentation live from Gao, MLI, about the combat casualty care of German soldiers during the suicide attack on June 25, 2021, in Mali. In addition, the virtual rooms for the TECC and Combat First Responders Symposiums were opened for all participants with the corresponding authorization.

With the “Virtual CMC 2021,” it was possible to create a unique knowledge database for the subject “tactical medicine,” which was accessible on-demand for 3 additional months after the conference until October 2021. Recognizing this and because there finally was a platform again for education and exchange concerning tactical medicine from the military, police, EMS, fire department, and disaster control communities, the participants and organizers consider the CMC 2021, despite adverse conditions, to be a remarkable milestone.

The next CMC conference, titled “All In,” will take place for the fifth time on June 5–6, 2023. We hope we can return to a face-to-face event again because no virtual platform can replace real encounters, discussions, or hands-on workshops.

2021 Combat Medical Care (CMC) Conference Abstracts

Force Health Protection – A Short Story of Mice, Men and Microbes

Bender K, Ltr SanGrp KSM

Force Health Protection (FHP) and field hygiene are not the first aspects coming to mind when planning the medical support of Special Forces operations. But maintaining the soldier's health can prevent derogation of combat strength of a whole unit or team.

According to the Allied Joint Medical Force Health Protection Doctrine (AJMed-P 4; Field Hygiene and Sanitation), historically around 80% (!) of reported casualties among U.S. military personnel have been attributed to disease non-battlefield Injuries (DNBI). While Direct Action (DA) missions require fast-track preparation facing other issues and priorities, strategy for long-term missions (like Special Reconnaissance (SR) and Military Assistance (MA) missions) should include FHP and preventive medicine measures.

On the basis of the made experiences during a MA mission in the sub-Sahara region, recommendations and examples for the successful implementation of FHP and field hygiene aspects are given.

The leading special forces officers should be aware of possible environmental risks and the recommended mitigation measures to prevent a spreading of infectious diseases or other environmental health risks among their soldiers. FHP and preventive medicine measures should be part of the medical concept as soon as planning for long-term missions starts.

Tactical Medicine and Tactical Combat Casualty Care: Singapore's Perspective

David Chew

Even though Singapore is a relatively safe country with low incidences of violence, constant vigilance is key to security. Over the years, Tactical Medicine and TCCC have gone through significant development and adoption in Singapore. The evolution of medical care in austere environments has been key in our capability development and improving the operational efficiency of the uniform personnel from different agencies and services. Case studies will be discussed in this presentation to give the audience a better understanding on the impact of Tactical Medicine and TCCC in the management of casualties in terrorist attacks and the battlefield both current and future.

Critical Skills in Austere Environment

JC de Schoutheete, Queen Astrid Military Hospital and University Hospitals Leuven – Belgium

Massive bleeding remains the leading cause of preventable death in trauma patients. In order to remedy this, various Western armies have tested in recent years a concept of "Forward Surgery" using Special Operations Surgical Team

(SOST). In this context, a BEL SOST was deployed in IRQ in 2017. In three weeks' time, it took care of more than 250 wounded patients.

A retrospective study of the SOST casualty logbook was carried out, with as primary objective, to evaluate the surgical management performed and to compare it with the results of other military surgical teams. The secondary objectives were threefold: investigate the inadequacy between the actual doctrine and patients' survival; define which invasive procedures should be implemented to reduce preventable mortality in pre-hospital environment; implement the actual doctrine.

This study showed that the fifteen most frequent Damage Control Resuscitation and Surgery procedures during these three weeks accounted for 87% of all the invasive procedures performed at the casualty collection point where the BEL SOST was based.

Therefore, implementing these procedures in military medical doctrine so that they can be performed as quickly as possible after a trauma by the lowest echelon possible would reduce preventable trauma-related mortality. It also seems essential to teach these critical procedures to surgical teams, both military and civilian, before being deployed to combat zones.

Terrorist Attacks in Paris: Managing Mass Casualties in a Remote Trauma Center

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Objective: On 13 November 2015, Paris was the target of multiple terrorist attacks responsible for a massive influx of casualties in emergency departments (EDs). Because of the activation of a local crisis plan and the arrival of extra staff, our capacities increased markedly. Our aim was to analyze whether our center, in this challenging context, efficiently managed this massive influx of patients. **Patients and methods:** We carried out a monocentric retrospective study. All patients received in the first 24 h were included (isolated psychological trauma with no physical injury excluded). Our main endpoint was to assess patient diversion through early secondary transfers (≤ 24 h) because of an overrun of our capacities. **Results:** A total of 53 victims were sent to our center in a 4 h timeframe; 12 patients were excluded (no physical injury). We analyzed 41 victims. Their median injury severity score was 4 (1;9). Three (7%) patients were transferred after ED management to a nearby hospital within the first 24 h for minor orthopedic surgery. There was a significant increase in medical/surgical staff (eight ED physicians instead of two; six intensivists vs. two; three orthopedic surgeons vs. one). Among the victims, 71% had firearms wounds and 30% had open fractures. Twenty surgeries were performed in the first 24 h. There were no in-hospital deaths. **Conclusion:** Faced with an unusual

event and thanks to the increase in staff, our operating capacities increased. Our center took charge of almost all victims. Patient diversion concerned only three patients transferred to a nearby hospital for minor orthopedic surgery.

Care Under Heat: Focused Discussion on Heat Stress and Performance of Combat Medics

Maj. Jacopo Frassini, MD – NATO Centre of Excellence for Military Medicine

Introduction: Most modern allied military land operations have been taking place in hot climates. Harsh environmental conditions degrade both human performance and health. In the fight, heat stress, exertion and dehydration can rapidly compromise mental and physical skills. Combat medics are frequently subject to an additional burden in providing effective lifesaving interventions while constrained in their tactical engagement. **Aims:** (1) Investigate the factors that can facilitate the recovery to near-baseline physiological status between combat activations of highly trained elite warfighters in hot outdoor conditions. (2) Discuss the implications on the preparation of combat medics in order to sustain their mental/physical performance in the heat. **Methods:** A group of 33 SOF operators were monitored during a 30-minute submaximal self-paced aerobic exercise (running) and the subsequent 60 minutes of recovery when a fixed amount of water was administered. Each participant took a test at low and one at high heat stress exposures, calculated using the Wet Bulb Globe Temperature (WBGT) Index. Variations of heart rate were detected with the use of a dynamic 12-lead ECG recorder, along with periodic measures of blood pressure, body weight and running distance. Experimental conditions of the trial did not consider the additional heat stress generated by the tactical protective gear and by the exact combat tempo. **Results:** The peak heart rate reached at maximum effort was significantly higher in the test conducted at higher heat stress level (174.6 ± 10.2 bpm vs. 166 ± 9.9 bpm; $p < 0.001$). The most relevant difference was noticed among those participants that did not reduce the running distance in hot conditions, rapidly reaching their maximal heart rate. During the first 3 minutes into the recovery phase, heart rate dropped 52 bpm on average independently of the heat stress level and proceeded with a slope of -1.1 bpm/min. In the first 15–20 minutes of rest the curves of heart rate at high and low heat stress (WBGT respectively of $22.1 \pm 1.2^\circ\text{C}$ and $28.6 \pm 1.9^\circ\text{C}$) maintained a parallel separation of about 8.5 bpm. The weight loss was used to assess the hydration status. At mean WBGT values of 28.6°C , the average total weight loss was 1520 ± 200 gr. No significant difference between the tests at high and low WBGT values was noticed at the end of the effort, while increased losses were registered during the recovery at higher heat stress levels. In the recovery phase and independently from the WBGT values, the heart rate returned to baseline values after 45–60 minutes and the body weight stabilized between 30–45 minutes, with faster results in the subjects with 3 to 5 hours of aerobic training per week. The trend in systolic and diastolic blood pressure values reflected the loss in body weight. **Discussion:** Recent studies have shown that at increasing levels of WBGT there is a reduction in physical/mental performance and an increased incidence of exertional heat illness. The dynamic situations where the combat medics operate often involve repeated physical efforts with intensity and duration that vary according to the circumstances with limited possibility for rehydration and rest. Thus, heat stress has the potential to affect

the ability of performing effective medical interventions by tactically engaged first responders. Best practices among soldiers and athletes use work-rest cycles and hydration strategies to succeed in hot environments. According to data collected in this trial and in studies available in literature, it is reasonable to speculate that an aerobically fit soldier may require not less than 45–60 minutes of rest and rehydration before returning at near-baseline physiological parameters when exposed to a 30-minute continuous submaximal physical activity at WBGT of $28\text{--}31^\circ\text{C}$. In the same range of WBGT, rehydration requires not less than 1500 gr of fluids to replenish the sweat loss, mainly occurring during the first 30 minutes in the recovery phase. The importance of maintaining a 3–5 hour/week aerobic fitness for faster post-exertional recovery should be strengthened in individuals who favour mainly isometric and resistance training, which does not seem to provide benefits in this regard. Soldiers, especially if critical to the medical safety of the unit, should be aware of the additional cardiovascular burden in the heat and be able to self-regulate their effort in order to avoid exercising at maximal heart rate and risk premature exhaustion. **Conclusion:** Awareness of the problem and structured training profiles are essential to prepare combat medics to sustain reliable performance levels and avoid incapacitation when providing casualty care in environmental conditions at high risk of heat stress. Further studies are needed to address the detriment more specifically for specialized medical skills in realistic tactical conditions. (Main Ref.: Frassini J, Nocca P. Physical Activity, Hydration and Thermal Stress. *GMedMil* 2015;165(3):275-294).

Junctional Tourniquet use in the Modern Combat Environment

Major Rich Hilsden, Trauma Surgeon,
Canadian Armed Forces

Modern conflicts have changed the injury patterns seen in combat casualties. Many patients are the victims of blast injuries and improvised explosive devices. These weapons cause multiple amputations and pelvic disruption resulting in a devastating injury pattern. Junctional injuries are injuries that occur between the extremities and the torso. Junctional hemorrhage is a challenge to control with external compression and is not amenable to conventional tourniquet application. A junctional tourniquet is an external compression device which compresses the aorta or ileac artery restricting blood flow and preventing hemorrhage. These devices have recently been incorporated into combat casualty care.

Outcomes: The combat vascular surgery working group out of Western University set out to align the experience of combat injuries with the new capability of junctional tourniquets. We suggest an algorithmic approach for the use of junctional tourniquets in combat casualty care. **Patient Population:** This research applies to all military personnel potentially exposed to combat threats which may result in junctional injuries. **Conclusions:** The vascular surgery working group successfully developed clinical decision tools for the use of junctional tourniquets through the phases of combat casualty care, up to the receiving surgical facility. Firstly, junctional tourniquets should not be considered during the care under fire phase. Once the environment has shifted to tactical field care, and beyond, junctional tourniquets should be available, and their use considered. The most frequently considered case is the application of a junctional tourniquet for a wound above the level which a conventional tourniquet could be applied, and after pressure

and packing have failed to control the hemorrhage. Junctional tourniquets may also be effective for the situation where injuries occur below the level of conventional tourniquet application, but conventional tourniquets have failed to control the hemorrhage. In addition, the circumstance where hypotension persists despite adequate control of external hemorrhage bilateral application of junctional tourniquets may temporarily support blood pressure for the purpose of transport. Finally, a casualty with a junctional tourniquet in place is a signal to providers at the receiving surgical support facility that the patient is severely injured. Care of such patients should proceed immediately to the operating room where the junctional tourniquet should remain in place until adequate measures have been taken to achieve proximal vascular control. As junctional tourniquets become more commonplace future research opportunities should focus on the safety and efficacy of junctional during tactical evacuation care.

Multipurpose Applicability of the Rescue Blanket (Multimodale Verwendung der Rettungsdecke)

Isser M, Wallner B, Salchner H, Wiedermann FJ,
Schachner T, Lederer W.

Rescue blankets were developed as polyethylene terephthalate foils with a thin aluminum coating by the National Aeronautics and Space Administration (NASA) in 1964. Originally, these blankets were used by Marshall Space Flight Center to protect exterior surfaces of spacecraft from radiated heat [1]. Nowadays, the low-weight and low-bulk foils with their characteristic silver and gold surfaces are essential parts of first aid kits and backpacks. Blankets can protect from and treat hypothermia by reducing heat loss from convection, evaporation, and thermal radiation. However, it is important to avoid direct skin contact with the foil as this would increase thermal conductance. In 2015, when Tactical Alpine Medicine was introduced by Tyrolean Mountain Rescue, we started to scientifically evaluate the multiple functions of rescue blankets. In 2016, we adopted the “napkin technique” from CMC Ulm as the preferred mode of application.

Our study with optometric measurements showed that rescue blankets are transparent to visible light and effectively block ultraviolet light. We are aware that our conclusions on transparency are restricted to the commercially available version of the rescue blanket and do not apply to the military version with altered coating. In our study transmission of ultraviolet B rays was less than 1% for the single layer. We concluded that rescue blankets potentially protect from solar radiation when used for facial protection and as makeshift sun goggles [2].

Furthermore, we demonstrated that a single-layer rescue blanket could sufficiently reflect infrared radiation to render detection of a body shape impossible. It did not matter whether the gold or silver side faced up as the transmission of near-infrared radiation in the infrared–visible radiation boundary region was very low [3,4].

In addition, we detected that blankets show impressive tensile strength, indicating that they have the potential to serve as temporary pelvic binders or even as makeshift tourniquets when urgent bleeding control is needed. However, it is important to use newly manufactured rescue blankets as flexibility diminishes with the ongoing loss of plasticizers in older samples [5].

Finally, we demonstrated that rescue blankets, when applied wet, are suitable as chest seals with good occlusive and adherence properties. Fixation on two sides of the dressing is sufficient to provide an outlet for entrapped air and sufficient sealing of the chest wound. When tested in an animal model, rescue blankets were superior to plastic foils from a gauze package and proved to function as a potent makeshift chest seal. This is particularly important in emergencies where no commercial chest seal is available [6].

In conclusion, our investigations of these fascinating multifunctional tools showed a considerable potential for numerous alternative applications. Rescue blankets are strong enough to function as a triangular arm-sling, figure-of-eight bandage and alternative tools for transportation in remote areas. Rescue blankets are potential makeshift pelvic binders and tourniquets in bleeding emergencies and can function as makeshift chest seals for sucking chest wounds. Rescue blankets can even substitute for sunglasses to protect against snow blindness on glaciers. Transparency and optical properties in the military version of the rescue blanket will differ from the commercially available version due to the altered coating. Specific optometric investigations of the military version of the rescue blanket are needed.

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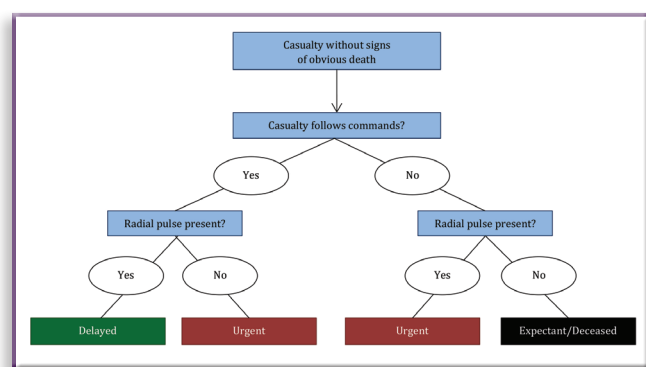
RAMP Mass Casualty Triage

Brad Keating, MPH, NRP

In recent years the number of high-profile events which required a tactical response has increased. From the events of the Pulse nightclub to more recent occurrences in Las Vegas. Not only are these types of “Black Swan” events more frequent, the casualty rates are increasing in number as well. Cited time and time again in the after-action reviews of the incidents is a failure to triage appropriately. In the Fort Hood shooting it was found that there was approximately a 70% inaccurate triage rate which led to poorer patient outcomes in

the end. Currently utilized methodologies of SMRT, START and SALT Triage when studied are shown to both be ineffective and neither sensitive nor specific at correctly categorizing critical patients. These algorithms suffer from significant flaws that this presentation will address including what are considered fatal flaws in their design.

A newly developed triage algorithm that is scientifically based and shown to be more easily remembered and applied is presented in this discussion. The Rapid Assessment of Mentation and Pulse (RAMP) Triage technique is a simple two step algorithm that categorizes patients into one of three categories; delayed, immediate, or expected/deceased. This evidence-based approach to triage is more easily deployed in the tactical environment and can cross over into all manners of mass casualty events in both the civilian and military world. Attendees to this presentation will be able bring the information provided back to their respective agencies and be able to implement the technique into their local protocols.



Use of the PFC Mnemonic "HITMAN."

Aebhric O'Kelly

The concepts of Prolonged Field Care (PFC) were created by Dr Sean Keenan and SFC Paul Loos in 2014 to meet the requirements found in current medical operations in the Middle East and Africa. Studies showed that deployed medics could not medevac due to the distance from the field hospital or due to the increased operational tempo. Therefore, additional skills are needed to address this deficit. PFC has several medical mnemonics currently in use. During the CMC Conference, Aebhric O'Kelly discussed the use of the PFC mnemonic "HITMAN." HITMAN stands for the following skills areas:

Head-to-Toe Exam is an enhanced secondary survey where assessments and treatments found during the primary survey will be have been found and fixed. This exam will check for any missed damages and will reassess all adjuncts and vital signs.

Infections are dealing with burns and open wounds. Since the deployed medic spends more time with the casualty, there is a risk of having the casualty under their care long enough to have an infection set in. Therefore, the medic will debride, clean and irrigate all burns and wounds. He will either close the wound or use a wet-to-dry dressing for delayed primary closure.

Tubes and Tidy are checking that the medical adjuncts placed in the casualty are still patent, clean and secure. The medic will remove all clothing and wash the casualty and wrap them in a hypothermia wrap.

Medicines management. During this phase, the medic will reassess the need for pharmacological interventions. He will calculate the therapeutic dosing of all drugs administered. Documentation is essential to keep track of the medications given.

Administration is when the medic can resupply their medical bag. They can grab a bite to eat and hydrate themselves. This is where they will document and create longitudinal observation charts.

Nursing requirements for the casualty are extensive. Since the operational medic will have their patient for an extended period.

As PFC is incorporated into current military operations, it became apparent that additional topics needed to be addressed within the PFC framework. The nursing care of the patient is not significantly discussed during the PFC curriculum. Therefore, there is need for a deeper look into the nursing care requirements when treating a critical casualty for extended periods.

The CMC workshop discussed the need for nursing skills in PFC and discussed the concept of SHEEP VOMIT as a medical mnemonic to cover the additional requirements for nursing care. SHEEP VOMIT stands for:

Skin protection	Vital signs
Hypothermia	Oral hygiene
Elevate the head	Massage
Exercise	Ins and outs
Padding	Turn, cough and deep breath.

Using this mnemonic, the medic will be reminded to assess and treat nursing requirements during operational situations where they are not able to medevac their casualty and will be required to assess and treat their casualty for extended periods of time.

Emergency Department Management of "Combat-Related Injuries"

Contrast Enhanced Ultrasound In Penetrating Abdominal Trauma: Description of Typical Findings in Gunshot and Stab Wounds

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Purpose: Computed tomography (CT) is the gold standard technique in penetrating injuries imaging. In military missions and in case of mass casualties availability of CT scanning and capacity of airborne transporting to reach a scanner in time may be limited. Nevertheless FAST (Focused Assessment with Sonography in Trauma) remains the primary imaging examination in abdominal trauma. In the last decade the additional application of Contrast-enhanced ultrasound (CEUS) in blunt abdominal trauma has shown promising data. CEUS could close the diagnostic gap between FAST and CT scanning and thus back-up shortage of diagnostic availabilities in the first approach or in the follow-up examinations.

If CEUS is used in penetrating abdominal injuries caused by gunshot or stabbing typical findings have to be considered. **Material and methods:** We report a case of gunshot wound of the liver during military mission in Afghanistan and a case of stab wound by knife of the left kidney. FAST was done in liver gunshot as first diagnostic imaging. CEUS was performed additionally in the emergency room (ER) by CX 50 Philips ultrasound system and ultrasound contrast agent (UCA, SonoVue, Bracco, Italy). CT scanning was performed after stabilization in ER. CEUS was repeated during and after each following operation. The stab wound to the kidney was a finding by CEUS in a stable patient (Logiq E9 ultrasound system, General Electric; UCA, SonoVue, Bracco, Italy). Active bleeding was excluded simultaneously.

Results: The extension of the gunshot to the liver could not be estimated on first CEUS examination due to aerodermectasia and gas echo extended along the bullet track. Subsequent CEUS after first operations revealed that the wound track echo was unenhanced in majority. Follow-up CEUS effectively detected the wound tract, hematoma, and the liver area injured by the gunshot and could accurately reveal necrotic tissue in the injured area.

CEUS of the stabbed left kidney revealed a triangular area without perfusion in the lower pole without extravasation of UCA as sign of a probable active bleeding. A diagnostic laparoscopy revealed abdominal hemorrhage. The subsequent laparotomy located an injury of the renal capsule causing a retroperitoneal hematoma. CT scanning was done 4 days after the Operation to rule out an urinoma. **Conclusions:** Application of CEUS may provide important imaging for gunshot and stab wounds. But in gunshot injuries the diagnostic validity in the initial examination is reduced by gas echos along the bullet track. In contrast the stab wound is a sharp deep cut and therefore the ultrasound examination is not hindered by entrapped air. Thus CEUS is an interesting diagnostic tool in blunt and penetrating trauma of the abdomen and may be an appropriate tool in between FAST and CT or instead of CT in the initial ER phase and in follow-ups. CEUS may spare time in ER and facilitate decision-making in case of mass casualties and may spare transport capacity in military missions.

Intramuscular (IM) Tranexamic Acid (TXA) in Tactical And Combat Settings: Data to Support IM TXA at the Point of Injury

Erik N. Vu, MSM, CCP, MD, FRCPC

Introduction: Uncontrolled hemorrhage remains a leading cause of preventable death in tactical and combat settings. Recent attention on the use of TXA as an adjunct in the management of hemorrhagic shock has resulted in investigations into alternate routes of delivery. Balancing tactical priorities, maintaining situational awareness and the time and skill required to obtain vascular access while under duress, the question was raised as to the potential role for IM administration of TXA in the out-of-hospital setting, as soon as possible from the point of injury. A working group for the Committee for Tactical Emergency Casualty Care was established to review the available evidence on this subject. **Methods:** Embase® and Medline®/PubMed® databases were searched by professional medical librarians from the College of Physicians and Surgeons of British Columbia, Canada. These databases were sequentially searched to assess for evidence on the use of TXA in the following contexts, and/or using the following key words:

prehospital, trauma, hemorrhagic shock, optimal timing, optimal dose, safe volume, incidence of venous thromboembolism (VTE), IM bioavailability. **Results:** In total, 186 studies were reviewed. The strength of the available data was variable, and ranged from laboratory research, case reports, retrospective observational reviews, with few prospective studies. Current volume and concentrations of available formulations of TXA make it amenable to IM injection. Current best-practice guidelines for large volume injection (i.e. 5cc) support IM administration in 4 locations in the adult human body. There is now new data demonstrating complete bioavailability of IM TXA in both healthy subjects and those in hemorrhagic shock, with serum concentrations achieving antifibrinolysis in a clinically meaningful time. **Conclusion:** The available data on the out-of-hospital use of TXA supports its use in hemorrhagic shock, with maximal efficacy seen when TXA given as soon as possible from the point of injury. Studies on IM TXA are limited, but the available data supports complete bioavailability of IM TXA with peak concentrations sufficient to achieve antifibrinolysis and in operationally meaningful time frames. Balancing the available data and risk:benefit ratio, IM TXA should be considered a viable treatment option for tactical and combat applications.

Psychological Effects of Terrorist Attacks on Emergency Responders and Possibilities for Faster Detection

Ulrich Wesemann, Oliver Hochfeld, Carolyn Rose, Gerd Willmund, Chris Röhrich

Introduction: The prevalence rate for PTSD in emergency service personnel (ESP) after terrorist attacks ranges between 1.3% and 16.5%, for anxiety disorders between 0.7% and 14%, and for major depression between 1.3% and 25.8%. This wide range is attributed to different intensities of the terrorist attacks. The aim is to develop and validate a questionnaire to reduce stigma and to optimize the detection rate of soldiers and ESP with deployment-related mental disorders by involving their partners. **Methods:** The partners assessed the changes in the soldiers with mental disorders following deployment. The answers were categorized through thematic analysis and then used to develop a questionnaire. The questionnaire asks to rate the changes in the partners (soldiers) on a five-point Likert scale. In a pre-test, N = 47 partners of soldiers who had been stationed abroad in the past 12 months completed the questionnaire. Half of the soldiers were diagnosed with a mission-related mental disorder (n = 24) and the other half (n = 23) were not. The presence/absence of mental disorders was verified through a psychiatric interview. **Findings:** Out of 33, the top 24 ranking items with a discriminatory power >.5 were included in the final version of the questionnaire. Cronbach's alpha was .98. Preliminary cut-off values were calculated by ROC analyses with a sensitivity and specificity of over 90% (AUC = .93). **Conclusions:** The main evaluation of the final test version is running now with a state and a trait component. Cronbach's alpha, a cut-off value as well as sensitivity and specificity are calculated. This approach actively addresses the greatest and most pressing problem currently facing military psychology in the Bundeswehr. Nevertheless, it is only one tool in a complex system of measures.

KEYWORDS: mental health; military psychology; military personnel; emergency responders; stigma; partners; health services accessibility