Casualty Care and Management

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Abstract

Throughout history, trauma care of wounded soldiers has been the foundation of military medicine. Management of military trauma care is a science, based on fundamentals of trauma surgery, which understands and reflects as well the principles of military missions, austere and rapidly changing tactical environment, mass casualty, blunt and penetration injury, multiple trauma, triage, emergency surgical resuscitation, damage control surgery, distance an time and consequently medical evacuation.

Therefore military surgeons must take a leadership role in tactical combat casualty care, embedded in a modern combat trauma system. It provides a rapidly deployable, mobile modular and sustainable infrastructure that coordinates care, provides data to address and answer operational questions (JOINT THEATRE TRAUMA REGISTRY – JTTR[1]), predicts manpower needs and ensures situational awareness (7). Starting with Afghanistan and continuing to the present, NATO Forces especially the U.S. military has fielded a steady stream of new technologies and procedures for trauma care and trauma management for the betterment of our soldiers, whom we serve.

1. Medical Mission in NATO Operations

The mission of medical support in military operations is to support the mission, through conversation of manpower, preservation of life and minimisation of residual physical and mental disabilities. Appropriate medical support makes a major contribution to both force protection and morale by the prevention of disease, rapid evacuation and treatment of the sick, wounded and injured and the return to duty of as many individuals as possible. In order to accomplish the mission a spectrum of services is required. The principal components are Medical Force Protection, Emergency Medicine, Primary Health Care (PHC), Secondary Health Care (SHC) and Evacuation. The operational medical support capabilities must deploy with the forces they are tasked to support, being held at the same readiness state as the forces they support. (3)

2. Standards of Medical Care

The standards of care available can have a permanent effect upon outcome. The four main aspects affecting clinical quality are organisation, training, environment and equipment. Medical support to NATO forces must meet standards acceptable to all participating nations. Among the medical principles, responsiveness, which is providing timely and effective medical care, is a cornerstone. Therefore primary surgery must be provided as soon as possible, ideally within the first hour but not later than four hours from wounding. (3)

[1] Until July 2008 more than 19000 cases were documented

3. Continuity of Care

Patients passing through the medical system must be given care, which is continuous and relevant. Casualties must be managed continually until they reach definitive care.(3)

4. Medical Capabilities

All component medical facilities are categorised into **four** Roles, defined according to the minimum clinical capability available in a facility, not the capacity or manoeuvrability. “Capability” describes what the Military Treatment Facility (MTF) can do with capability increasing from Role 1 to Role 4. MC 326/2 defines the standard capability of the Role 2 MTF. Therefore this publication (fig. 1) introduces delineation between the traditional Role 2 capabilities providing advance trauma care and resuscitation designed for war fighting type manoeuvre (light manoeuvre – Role 2LM) and the evolved and more clinically capable variant providing light secondary health care (enhanced – Role 2E). Highly sophisticated medical facilities in the combat zone could encumber the commander and restrict his freedom of movement. However, if the nature of the operation allows it, sophisticated MTFs should be positioned near to the point of wounding. Under battle conditions the flow of casualties generally follows the pattern from Role 1 to Role 3 facilities. Details are described in STANAG 2228. (3)

5. Medical Treatment Facilities (MTFs)

MTFs should, where appropriate, be as mobile and robust as the units they need to support, within the time related constraints of medical care and the provision of medical evacuation assets. Furthermore, the MTFs should be described by their capability and capacity as detailed in AMedP-16. (3)

5.1 Role 1 MTF

The Role 1 MTF provides primary health care, specialised first aid, triage, resuscitation and stabilisation. Generally Role 1 medical support is ultimately a national responsibility and it must be readily and easily available to all force personnel.

5.2 Role 2 MTF

The deployment of Role 2 MTFs is mission-dependent, especially when:

a. There are large numbers of personnel or a risk of high numbers of casualties.

b. Geographic, topographic, climatic or operational factors may limit medical evacuation capability to Role 3 to comply with treatment timelines, especially when lines of communication are extended.

c. The size and /or distribution of the force does not warrant the deployment of a full Role 3 capability.

Therefore Role 2 MTFs are now classified into Role 2 Light Manoeuvre and Role 2 Enhanced.

	Op Environment Examples	Tactical Mobility	Clinical Capability	Position in Deployed System
Role 2LM	Potential high intensity combat, support to manoeuvre. Mainly land or amphibious ops	Highly mobile, quick to establish and redeploy	Advanced trauma care and specialist medical officer led resuscitation routinely including DCS	Will usually need to evacuate post-surgical cases to Role 3 (or Role 2E)
Role 2E	Potential low intensity combat: a. Manoeuvre, light forward hospital. b. Non-warfighting, manoeuvre limited. c. Enduring PSO. Land or maritime ops	Medium to low mobility, may be set up in fixed accommodation	Primary surgery, ICU and nursed ward beds	May be last MTF before strategic AE for post-surgical cases

Fig. 1Comparison between Role 2 LM and Role 2E (3)

5.3 Role 3 MTFs

Role 3 MTFs are designed to provide theatre secondary health care within the restrictions of the Theatre Holding Policy.

5.4 Role 4 MTFs

A Role 4 MTF provides the full spectrum of definitive medical care that cannot be deployed to theatre or is too time consuming to be conducted there.

6. Medical definitions according to EMERGENCY WAR SURGERY (Third United States revision) (2)

6.1 Triage

Triage is the dynamic process of sorting casualties to identify the priority of treatment and evacuation of the wounded, given the limitations of the current situation, the mission and available resources (time, equipment, supplies, personnel, and evacuation capabilities). The ultimate goals of combat medicine are the return of the greatest possible number of soldiers to combat and the preservation of life, limb, and eyesight in those who must be evacuated.

6.2 Damage Control Surgery

Prolonged operative times and persistent bleeding lead to the lethal triad of coagulopathy, acidosis, and hypothermia, resulting in a mortality of 90 %. Damage control is defined as the rapid initial control of hemorrhage and contamination, temporary closure, resuscitation to normal physiology in the Intensive Care Unit (ICU) and subsequent re-exploration and definitive repair. This approach reduces mortality to 50 % in some civilian settings.

6.3 Thoracic injuries

The goal of abbreviated thoracotomy is to stop the bleeding and restore a survivable physiology; contamination is usually not a problem.

6.4 Critical Care Considerations

Physiologic support in the post-op Tactical Abbreviated Surgery Control (TASC) patient is paramount to survival.

- Core rewarming: warmed resuscitative fluids, blankets, ventilator air, and environment, or commercially available products such as Bair Hugger, Chill Buster.
- Reversal of acidosis: appropriate/aggressive resuscitation with crystalloid, colloid, and blood products.
- Reversal of coagulopathy: at many locations, only ultra fresh whole blood is available to correct coagulopathy .

6.5 Critical Care

Damage control is the initial control of hemorrhage and contamination followed by intraperitoneal packing and rapid closure, then resuscitation to normal physiology in the intensive care unit and subsequent definitive re-exploration. This places large logistic requirements on the ICU. This may include rewarming, large volume resuscitation, blood products, vasoactive drugs, and mechanical ventilation. Fever or leukocytosis should prompt a thorough search for infection. Antibiotic discipline must be enforced, savings these medications for short-course prophylaxis, documented infections, or empiric treatment of rapid deterioration due to sepsis. Hypo-perfusion implies inadequate delivery of oxygen to the body's cells. Oxygen delivery is a function of cardiac performance, arterial haemoglobin content, and arterial oxygen saturation. All attempts to correct shock involve optimizing these three variables. (2)

6.6 NATO Trauma Registry

As member of the RTO-TR-HFM-131(8) "A Proposed NATO Trauma Registry" allow me to quote our summery and our recommendations.

The power of a trauma registry to improve trauma care is being continually demonstrated in both civilian and military healthcare environments. The US JTTR has enabled evidence based decision making and resulted in improved care of the wounded, improved quality of treatment outcomes, reduced mortality and morbidity, optimized medical resource allocation and informed developments in personal protective equipment. The JTTR has also been used to refine tactics, techniques and procedures to enhance operational performance through the reduction of injury.

The RTG has consulted widely and identified the benefits to NATO. Specifically, the RTG has identified the data collection and deployed trauma registration requirements, common data set requirements, technical characteristics of a registry structure and the potential legal issues. Finally, the RTG has identified three possible options for implementation (national compatible registries, a lead- nation registry or a centralized NATO registry) and the policy, economic and organizational requirements associated with a NATO Trauma Registry.

The RTG recommends that:

- COMEDS approve the concept of a NATO Trauma Registry and take appropriate actions for its establishment.
- NATO establish a Trauma Registry open to all troop contributing nations.
- Option 1, the national compatible trauma registries, be selected.
- Implementation would best be accomplished through each nation adopting and adapting as necessary the format of the JTTR.
- The appropriate COMEDS and NSA bodies be tasked to develop the necessary policy, doctrine and standardization documents.

7. Outlook

Starting with Afghanistan and continuing to the present, NATO Forces especially the U.S. military has fielded a steady stream of new technologies and procedures for trauma care and trauma management. In the field are two new bandaging technologies for stopping bleeding, the chitosan bandage, Hemcod and QuikClot. The chitosan bandage is made from shrimp shells and sticks to the wounded area, sealing it much like a tire patch. QuickClot is made up of desiccant granules that absorb water from blood, thereby concentrating the blood's clotting factors and encouraging rapid clotting to stop the bleeding. Both products have been proven highly effective. The U.S. military also fielded a new tourniquet system called the Combat Application Tourniquet. About 200,000 of these tourniquets have been fielded. In hypotensive resuscitation Military Research has shown that administering IV fluids increases blood pressure, which dislodges clots that have already formed and also increases the rate of bleeding. Obviously, these are complications medical professionals want to avoid in actively bleeding patients. The U.S. Combat Casualty Care Research Program also showed that Hextend is the best resuscitation fluid for hypotensive resuscitation, and the use of Hextend has been incorporated into tactical combat casualty care. To allow medics to bring blood products far forward on the battlefield, researchers developed the Golden Hour blood transport container that can keep four bags of red Cells at 10 degrees C for 72 hours with no electricity or wet ice. This container is being used in theatre on evacuation missions where red blood cells may be of help to the wounded patients. rFVIIa stops bleeding in trauma patients when their own clotting mechanisms are not working properly. rFVIIa is now being used in major trauma centres throughout the world and has been used on more than 400 wounded patients in Iraq. Program officials hope that this drug will slow down bleeding enough so that soldiers who receive it will be able to survive long enough to be evacuated to surgery. So far, the U.S. program's studies are showing that nothing is as good for treating blood loss as replacing it with whole blood. The problem is that medics cannot carry it because it must be refrigerated. As a result combat casualty-care researchers try to develop a fleet of freeze-dried blood products that can be used in lieu of whole blood. Army researchers are also participating in clinical trials of a haemoglobin-based oxygen carrier, which will act as a temperature-stable substitute for red cells. Through the Combat Casualty Care Research Program's efforts, the death rate on the battlefield is greatly reduced. Technologies still under development show promise to reduce that rate even more, while also reducing the terrible morbidity associated with the wounds of war. (1, 4)

As an outcome of the ATACCC conference in August 2008 MajGen Weightman (Commander US Army Medical Research & Materiel Command) presented the following main recent advances in combat casualty care with focus on transitioning for war of CCC products and concepts:

•**TCCC**
–Tourniquets and guidelines
–Hemostatic Dressings
–Hextend
–Hypotensive resuscitation
–Needle thoracostomy
–Triage guidelines
–Antibiotic guidelines
–Pain relief guidelines

Combat Application Tourniquet (CAT)

•**Trauma Systems**
–Joint Theater Trauma Registry
–Joint Theater Trauma System
–ICU teams
–Research team
•**CCATT**
•**CCC Products**
–CAT Tourniquet
–Hemostatic bandages
•**Routine Rapid Evacuation**
•**Burn prevention**
–Soldiers should routinely wear gloves
–Burn flow sheet reduced deaths of burn patients
•**Damage Control Surgery**
•**Wound Vacs**

Hypothermia Prevention and Management Kit (HPMK)

References

[1] Advanced Technology Application for Combat Casualty Care - (ATACCC-) Conference, St. Pete Beach, Florida, 16. – 18. Aug. 2006

[2] Emergency war Surgery. 3rd U.S. revision p. ;cm –3. Military Medicine. WO 800 E53 2004 I. Borden Institute (U.S.) RD151.E56 2004, 617,9´9-dc22

[3] STANAG 2228 MED (Ed 2) – ALLIED JOINT MEDICAL SUPPORT DOCTRINE –AJP –4.10(A)

[4] Vandre, R. "Military Medical Technology" (MMT), Volume 10, Issue 5, 2006: 8 – 10

[5] Final report of TG HFM 131: A Proposed NATO Trauma Registry, RTO-TR-HFM-131, March 2008

[6] The Journal of TRAUMA Injury, Infection, and Critical Care, Vol 64, 2, February 2008

[7] LtC Nessen et al "War Surgery in Afghanistan and Iraq. A series of cases 2003-2007" Ed 2008 ISBN 978-0-98 1822-80-8

[8] "A Proposed NATO Trauma Registry" Final Report of Task Group HFM 131/RTG March 2008