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Military Medicine

Forward surgical care: Emerging issues and challenges

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ABSTRACT

War strategies have been evolving with time and battlefield casualty care services have been trying to keep pace with the changing demands. Technological advances in the field of trauma care have revolutionised the way in which erstwhile 'non-salvageable' lives and limbs are managed with more favourable outcome. The quality of Pre-Hospital Trauma Care Services will largely determine the survival statistics of battle casualties. The surgeon has to acknowledge the various resource constraints imposed upon him in the course of delivery of expert trauma care in the battlefield. The philosophy of Tactical Field Care and TACEVAC has, to a great extent, standardized point-of-care services and the manner in which combat casualties are managed. This has resulted in increasing favourable clinical outcome in a demanding, resource restricted and challenging environment. Training of Military Surgeons prior to induction into theatres of combat is an operational imperative and has to be based on validated guidelines promulgated by apex institutes specialised in Combat Casualty Care. CASEVAC hurdles, resource paucity, command and tactical decisions, govern casualty care and impose serious constraints that are not present in an urban setting. This article highlights the basic tenets of battlefield care, the challenges associated with it and the way forward.

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Introduction

Principles of forward surgical care in the last few years have diversified to include civilian and urban casualties due to a growing epidemic of mass killings and terrorist related activities. Today, civilian emergency response teams are not just using techniques adopted from the battlefield of yore to save civilian lives but have actually overtaken military responses in some respects.¹ The dynamics of war have also been changing with time, transcending from hand to hand mortal combat to proxy wars and unmanned assaults. Thus

there is a case for redefining and realigning what constitutes forward surgical care with the overriding emphasis being on saving lives and limbs. Resource constraints, the focus on "life and limb" saving strategies, the frailty of the human element, are all factors that an astute surgeon has to harness, to mitigate the devastation inflicted by war.

Reports from all across the world shows that there is a trend towards better survival on the battlefield today. This can be attributed to incorporation of cutting edge technology, better personal protective equipment, point-of-care medical care services, safer and effective CASEVAC, better paramedic training and a concept of staged medical care.

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The understanding of forward surgical care itself has evolved and undergone a tectonic paradigm shift. Now we know that the quality of Pre-Hospital Trauma Care will determine, to a great extent, the survival statistics of battle casualties. The skills of a surgeon come into play only after the casualty reaches him alive. The Pre-Hospital care will depend on the dynamics of the modern battlefield, the threat perception to the injured and the care giver; and the availability of the resources and skill of the care giver. Three levels of care have been envisaged.²

1. **Care under fire:** In such a scenario both the injured and care givers are exposed to hostile fire, environmental extremes with limitation of resources. In addition there is uncertainty of evacuation time and skill levels may range from self-care, to buddy care or the whole hog of medical personnel care.
2. **Tactical Field Care:** This is the initial care offered by the first responder once effective hostile fire has ceased. In such situation better pre-hospital care can be offered to the casualty in a more permissive and safer environment. It is imperative to remember that effective hostile fire can resume at any time. The resource constraint imposed upon the first responder continues to remain the same and the time taken to evacuate the casualty to the next higher echelon will vary based on combat dynamics.
3. **Tactical Evacuation Care (TACEVAC):** Refers to medical care offered to the casualty during the evacuation by land/air/water. After initiation it entails use of additional trained manpower and specialised equipment for better casualty management. The term "Tactical Evacuation" encompasses both Casualty Evacuation (CASEVAC), which utilises non-medical assets and Medical Evacuation (MEDEVAC), which includes specialised medicare equipment marked. This mode of casualty care ensures that specialised care and continuous patient monitoring is maintained till patient reaches the next higher echelon.

Emerging issues and challenges

1. **Harsh environment:** The military surgeon in forward areas always has to work with limited resources and a suboptimal work environment. He remains prone to hostile enemy attack, work speedily in an austere environment and has to rapidly evacuate combat casualties due to operational reasons. Limited light in battlefield conditions, inclement weather and uncertain evacuation times pose other daunting challenges on the battle field.³
2. **Professional competency:** The military surgeon on returning to the safe areas has to face the competition of highly sub-specialised civilian counterparts with the latest equipment and gizmos. The military surgeon also faces the "peace time" hiatus. Long periods of inactivity on the operative front produce lethargy of action and lack of skill accrual. When actual numbers of cases handled are listed, the military surgeon often lags behind his civilian counterpart.
3. **Resistance to change:**
 - (a) **Changing maxim of ABC – airway, breathing and circulation:** This maxim has been etched into the psyche of surgeons for over a century. The battlefield surgeon however now has to recognise that his losses

are always due to the circulatory loss – the bleed out from an exsanguinating limb. Over time, the C is taking precedence, mandating a revision of the maxim as C-ABC. The idea is to tackle lethal haemorrhage using pressure dressings, tourniquets and haemostatic agents first and then address the ABC component of battlefield trauma care in the conventional manner.

- (b) **Tourniquets:** "We believe that the strap-and-buckle tourniquet in common use is ineffective in most instances under field conditions...it rarely controls bleeding no matter how tightly applied." – was outlined by a medical veteran from the World War-II era. In spite of compelling data from civilian use and statistics that at least 2500 lives could have been saved in Vietnam alone by applying a tourniquet on exsanguinating limbs, the trauma care teachers in the 1990s were still teaching the Armed Forces NOT to apply tourniquets. However, newer evidence suggests that there is need to change this thinking especially with the advent of the Combat Application Tourniquet (CAT) and the Abdominal Junctional Tourniquet (AJT) which have shown proven utility.⁴
- (c) **Airways:** Aggressive airway management using Nasopharyngeal airways, needle thoracostomy, surgically created airways for trauma to the maxillofacial region, are the newer advances which need to be instituted in military medicine.
- (d) **Fluid resuscitation:** There is a paradigm shift in the battlefield resuscitation techniques. Damage controlled resuscitation with intra-osseous infusion in desperate situations, permissive hypotension and use of blood for blood with advanced carriage of platelets and freeze dried secured plasma reconstitution on the battlefield is the need of the hour.⁵ The role of shock pack consisting of ONE pRBC: ONE platelet: One FFP which is now considered the ideal Resuscitation fluid needs consideration.⁶
- (e) **Pain relief:** Traditional analgesics and sedatives are giving way to fentanyl lozenges and IV ketamine analgesia. The importance of eliminating pain altogether is now slowly gaining precedence and we need to institute these protocols on an urgent basis.
- (f) **Combat Gauze:** (Quickclot) Combat Gauze is a 3" × 144" roll of sterile gauze, impregnated with kaolin. It initiates clotting of blood in vivo, within seconds of exposure and restrict life threatening haemorrhage. It has proven to be far more beneficial than traditional shell dressing and is different from the Quickclot granules which were sold earlier and are now withdrawn.
4. **Modernise equipment:** It is evident from the foregoing that the combat personal kit of the front line soldier requires a complete overhaul. Feasibility of augmenting with the following needs to be examined:
 - a. Combat Application Tourniquet
 - b. Combat Application Gauze (Quickclot – kaolin)
 - c. Nasopharyngeal airway
 - d. Fentanyl lozenges/Adequate painkiller

The need of medical responder to carry the following is advocated:

- a. Cricoid – thyroidotomy Kit

- b. Needle thoracostomy set
- c. Junctional Tourniquet
- d. IV Ketamine

5. **Training of a Military Surgeon:** The moot question arises as to whether acquiring a MS (General Surgery) degree is enough for training a military surgeon. Indeed, basic surgical skills, with limited exposure to trauma and emergency responses, are acquired in any general surgical training programme. The military setting brings in a plethora of new challenges and therefore requires specialised training for acquiring the skill sets required for handling trauma in a combat location.

What is lacking at present is training, reaccreditation and ongoing exposure to combat skills and readiness. A basic certification, similar to the Advanced Trauma Life Support (ATLS) given by American College of Surgeons (ACS), and mentoring of fresh inductees may be used as a credible parameter for ensuring uniformity of training.

The American forces train their combat surgeons on casualty evaluation and management in war, prior to induction into combat theatres, through courses like the Tactical Combat Casualty Course and the Operational Emphasis Version of the Advanced Trauma Life Support Course conducted by the ACS. There is felt need to replicate these in our setting. Even with all this pre-deployment training, the lacuna of operative inactivity and low case volume remains and this is the military surgeons' biggest bugbear. Simulators and frequent mock-drills can fill this breach and needs to be explored in the near future. Such training will lead to two echelons of military surgeons – those who are proficient enough to assist and those who can lead. The posting of such surgeons will need to be calibrated to have a healthy mix of both, leaving avenues for constant mentoring to create a flow of combat ready surgeons.

Presently what is also lacking is a mission specific training and equipping policy, which will enable the forward surgeon to be embedded with active front line troops, e.g. Para commandos, Special Forces, divers and airborne troops.

In simple terms, the military surgeon should make him confident of

- (a) Understanding of the patient's condition – what is wrong with the patient.
- (b) Have the knowledge and skill for emergency interventions – what should be done right now and how is it to be done.
- (c) Awareness of one's capabilities and limitations – what is it that cannot be/should not be done here and now.

6. **CASEVAC.** The standard response to trauma has traditionally stressed the need to 'push' expert medical care to the site of casualty occurrence within seconds or minutes of wounding thus providing a favourable milieu for better patient outcomes. In the Wound Data and Munitions Effectiveness Team study that was released after the Vietnam War, it is stated that, 42% of injured die immediately, 26% die within 5 min, 16% between 5 and 30 min, and 8–10% within 2 h. It also goes on to state that only 10% of all deaths occurred after initiation of battlefield medical care.⁷ These figures underscore the need to stress on terms like "Golden Hour" and "Platinum 15 minutes". Only embedded medical personnel with active troops can

provide this kind of forward care. Every combatant should be acquainted with basic life-saving skills like early application of haemostatic dressings, tourniquets, management of life threatening chest trauma and safe and effective casualty evacuation protocols.

Administrative perspective of CASEVAC is a matter of situational management and the following need to be understood during evacuation:

- (a) Awareness of the capabilities of higher centres in the chain of evacuation – where to send the patient so that the most appropriate interventions can be done.
- (b) Selection of correct method of casualty evacuation – how to send the patient to the right place within the right time frame using the right means of transport accompanied by the right team.

7. **Establishment of Casualty Critical Care Evacuation teams:** Designated and deployable teams of medical professionals capable of reaching out and "lifting" casualties can overcome the professional and administrative constraints of field situations to a large extent. As a regional expert resource, these teams should be able to provide the peripheral surgical facility with appropriate support, relieving their constrained resources of additional commitments of CASEVAC.

8. **Mobile surgical support facilities:** Quick transport of mobile operating facilities is now a reality with heavy lift aircraft. These may be inducted into the forces. Deployable teams of senior surgeons with adequate resources will then become possible and we may be able to provide facilities which are almost comparable to established fixed infrastructure. Integration of these facilities obviously demand capital expenditure and allocation of suitable land, sea, and air transport modalities.

9. **Formal designation of trauma centres:** Worldwide, experience has proven that the chances of survival of a trauma victim are significantly better when a formal trauma care system exists. Protocols are better followed when each centre is designated according to the level of care it can provide. Regional policies of inter-facility transport and referral are better followed when there is a proper designation of centres as per international norms.⁸ For this purpose, expertise and facilities available real-time at these centres should be clearly known by stakeholders as well as medical personnel in the region.

Conclusion

The management of combat casualties has always remained a challenge. Hostile environment, limitation of resources, inadequate and inadequately trained manpower and uncertainty of evacuation are some of the factors which are responsible for this. The way forward to save limb and life is to incorporate all the latest knowledge and technology optimally in combat care. Training which is standard, validated and protocol based, utilising the best available resources should be given to all care givers. The role at each echelon of care must be predetermined. It has to be understood that to reduce mortality and morbidity correct steps need to be taken at all levels, be it pre-hospital care, care

during evacuation or care after reaching different staging medical setups.

Conflicts of interest

The author has none to declare.

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