

# THE ARMY COMBAT CASUALTY CARE SYSTEM

By COL(DR) Poon Beng Hoong

## ABSTRACT

The Army Combat Casualty Care system has evolved over the years in accordance to the prevailing medical evidence and best practices. The doctrine, equipping, platforms and training of the various echelons were strengthened over time to provide the best possible care to our soldiers in the battlefield as well as in the expanding spectrum of operations such as peacetime contingency operations. This article describes the development of the echelons of medical care over time and also paints the key directions for the coming years.

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## INTRODUCTION

The history of caring for casualties of trauma is extensively documented, with practices in each time period being driven by the available knowledge of the time. Illustrating this from earliest available material are the Edwin Smith (1600 B.C.) and the Ebers (1550 B.C.) papyri, two of Egypt's most important medical documents, which both describe wound treatment. Recommendations include the application of goat dung in fermenting yeast or a frog warmed in oil as topical therapies for burns and raw meat for crocodile bites.<sup>1</sup> While all were done with good intent, every preceding era's practices were often found to be suboptimal, and some outright harmful, by the next generation. New knowledge from war and trauma management in the civilian setting continues to positively influence the care of trauma casualties to offer them the best chance

of survival and lower morbidity. Reviewing data from the United States (US), lethality from war wounds has been on a downward trend (*see Table 1*). This can be attributed to the changing nature of operations, soldier protection and improving casualty care.

Herein lies the philosophy of the Army Medical Services: we always examine our practices critically through studying the contemporary evidence and update them in accordance to our operational context. In addition to the sharing of experiences with foreign militaries and the civilian sector, knowledge acquired through our operational deployments over the years has also contributed to the regular renewal of capabilities. This article reviews and highlights the progress of Army's combat casualty care system.

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War	No. wounded or killed in action	No. killed in action	Lethality of war wounds (%)
Revolutionary War, 1775–1783	10,623	4,435	42
Civil War (Union Force), 1861–1865	422,295	140,414	33
World War I, 1917–1918	257,404	53,402	21
World War II, 1941–1945	963,403	291,557	30
Korean War, 1950–1953	137,025	33,741	25
Vietnam War, 1961–1973	200,727	47,424	24
Persian Gulf War, 1990–1991	614	147	24
War in Iraq and Afghanistan, 2001–2004	10,369	1,004	10

Table 1: Lethality of War Wounds among US soldiers.<sup>2</sup>

## SYSTEMIC APPROACH TO COMBAT CASUALTY CARE

Primarily, development and optimisation will be driven by a systemic approach centered on the soldier and balanced with operational practicality. In this system, the appropriate level of care will be delivered to the injured soldier in a timely fashion, both on-site and also by evacuation up to a higher echelon of more capable medical support till the required definitive care is administered. Components in a highly functional system should include: (1) competency in the delivery of care at all echelons, (2) timely evacuation up the medical echelons, and (3) awareness of the resource utilisation across the echelons for responsive resource allocation. These components would interact differently in various natures of operations.

## HIGH PROFESSIONAL STANDARDS ACROSS THE ECHELONS

The medical competencies and capabilities at the various echelons have advanced over the years. For the soldier at the frontline, from only being capable of delivering basic first aid with First-Aid Dressing (FAD), he will now be

able to deliver Combat Buddy Aid using wound dressing impregnated with haemostatic agents as well as an arterial tourniquet. Today, competent buddy aid is especially crucial in the dispersed nature of peacetime contingency operations. While tourniquet use has existed for centuries (3rd Generation combat medics are equipped with one each), it would surprise many that it was one of the most controversial medical paraphernalia in combat casualty care up till 2008 when a series of data from casualty treatment in Operation Iraqi Freedom validated its value and importance in haemorrhage control.<sup>3</sup>

## THE SAF COMBAT MEDIC

The SAF combat medic is the first medical responder and he has undergone a transformation through training and equipping to manage the injuries seen across the spectrum of modern warfare.

He can secure the airway of a casualty, arrest haemorrhaging effectively with haemostatic agents and tourniquets, and prevent life-threatening tension pneumothorax with a chest seal. He is accredited for his professionalism through the Workforce Skill



*The SAF Combat Medic in Action.*

Qualification Higher Certificate in Healthcare Support (Pre-hospital Emergency Medical Services), an accreditation awarded since 2015. Pre-hospital emergency care is maturing as a field of study in its own right and large-scale studies are emerging, showing that appropriate intervention delivered at the point of injury impacts survival more than the speed of reaching a hospital.

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### **THE BATTALION CASUALTY STATION**

The Battalion Casualty Station (BCS) is the soldier's first contact with the Medical Officer

(MO). Here, casualties receive Advanced Trauma Life Support (ATLS), the internationally recognised standard of care for the early management of trauma casualties. Since its introduction to Singapore in 1992, ATLS has grown in strength and close to 10,000 doctors have been trained. The SAF Medical Training Institute (SMTI) as the key training and accreditation centre in Singapore, thus contributes to building the capacity of civilian hospitals in trauma management. The 3rd Generation BCS has moved away from the familiar modular tentage set-up, renewed its doctrines, training and incorporated the latest medical equipment.



*The 3<sup>rd</sup> Generation Army Battalion Casualty Station (BCS).*

### **THE ARMY SURGICAL UNITS – MOBILE SURGICAL TEAM AND COMBAT SUPPORT HOSPITAL**

The field hospital of modern militaries has evolved over the ages, from the 200-bed Mobile Army Surgical Hospitals (MASH) that supported troops during the Korean War, to the more mobile 20-person Forward Surgical Team, and the more modular but fixed-based Combat Support Hospital (CSH).<sup>4</sup> Surgical techniques progressed similarly and today, damage control resuscitation and surgery, whereby the emphasis is on controlling haemorrhage and reversing the physiology

insult rather than completing the correction of anatomy, is the doctrine that drives training and equipping.<sup>5</sup>



*Full Combat Support Hospital Setup.*

The 3<sup>rd</sup> Generation surgical capability similarly deploys Mobile Surgical Teams (MST) to support the brigades and deliver damage control resuscitation and surgery. This pushes surgery closer to the frontline where soldiers may have a high need for such medical procedures. Equipping the MST with diagnostic capabilities, sterile surgical fields, blood products, and state-of-the-art equipment was complemented by systematic training of the National Service (NS) surgical teams in the practice of damage control resuscitation and surgery. The CSH continues to be the anchor of surgical care and outfield inpatient management, with operating theatres, intensive care units, general wards, lab facilities and a blood bank. Oral and maxillofacial surgery also play a key role in the CSH and the dental community has systematically trained and equipped NS dentists to perform key life-saving procedures. Having incorporated the lessons learned from more recent operations, significant upgrades include the integration of medical fixtures with containers and their mechanised deployment, Information

Technology (IT) facilitation of internal work processes and patient flow, and the incorporation of advanced medical equipment.



*Mobile Surgical Team.*

## **EFFECTIVE AND EFFICIENT EVACUATION SYSTEM**

While vehicular platforms dominate our understanding of evacuation, the triage of patients for on-site treatment and observation vis-à-vis evacuation to a higher echelon must not be blindsided. The assessment of severity of injury is a crucial skill that we train and equip our medical personnel with, and the prioritisation of evacuation cannot be over-emphasised considering the limitation of evacuation resources.

The cornerstone of evacuation procedure lies at the platoon and company level. While today the organisation of stretcher-bearing parties is the norm, it will inevitably need to be transformed to a less manpower-intensive model. Trials have been done on casualty evacuation platforms with increased automation to understand how to incorporate them into our future operations.

In 2015, new cross-country combat ambulances replaced the Land Rover ambulances that served the SAF for many years. The new combat ambulance with its rugged Ford-550 Chassis and all-wheel-drive

makes it highly mobile cross-terrain and the on-board Advanced Life Support equipment sustains the casualties as they move across the echelons. For urban operations, the Belrex Protected Combat Support Vehicle launched in 2016 provides the required protection and similar cross-terrain mobility and advanced life support equipment as the combat ambulances.

In addition to land-based evacuation, closer integration of casualty aero-evacuation with the land medical units has always been desired. Over the years, the processes and equipment interfaces of both parties have been strengthened through a series of combined exercises and equipment development. Similarly, combined exercises with the restructured hospitals are conducted to iron out the kinks to ensure that casualty care is as seamless as possible regardless of the scenario.

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### **SITUATIONAL AWARENESS AND RESPONSIVE RESOURCE ALLOCATION**

It is challenging to redeploy resources from their pre-planned allocations and thus situational awareness is crucial for deciding medical resupply or redeployment

## **Medical Variant**



**Multi-configuration Battalion Casualty Station for flexibility in operations**

MINDEF

*Medical variant of the Belrex Protected Combat Support Vehicle.*

of medical units to augment areas of need. Unit status reporting today is done largely at pre-determined timings and the reported information is aggregated. This limits system-wide awareness and hampers the direction of medical resources to more needy areas. A first step was taken in the SAF's 3<sup>rd</sup> Generation transformation with Radio Frequency Identification (RFID) based Identification Tags that allowed casualty data to be retrieved and recorded in the field, and subsequently transmitted up the evacuation chain and consolidated. Lessons learned from this foray and the rapidly advancing information technology (IT) field will inevitably deliver a more responsive system for the combat setting in the next iteration that addresses the needs of peacetime contingency operations and conventional operations. The challenge of dwindling resources lends focus to system level optimisation and timely responses across the spectrum of operations.

## FUTURE AREAS OF DEVELOPMENT

Moving forward, there is a need to study and generate new knowledge on the nature of casualties in various contexts to direct research investments and capability development. The review of international experience and operational analysis studies would cover the spectrum of scenarios encountered by SAF in the future.

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The evaluation and selection of areas to invest resources would take into account this new knowledge gained so that the system continues to be improved upon. Promising areas being explored include unmanned evacuation platforms that will reduce the manpower needed for casualty evacuation, portable point-of-care diagnostic tools to aid medical personnel at the frontline, novel blood products that better sustain casualties and better portable IT systems to achieve timely situational awareness.

## CONCLUSION

Over the years, adopting the systems approach to combat casualty care has allowed the Army Medical Services to incorporate advances in medical science, IT, engineering and operational experience into our combat casualty care in a synergistic manner to lower the mortality and morbidity of combat casualties. This approach will continue to serve the Army well in optimising resources and achieving mission success in the expanding spectrum of operations.

## ENDNOTES

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