



Current Opinion

Forging alliances: examining civil-military partnerships and their impact on war-time casualty care in Sri Lanka

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Keywords - civil military health partnerships, combat casualty care, trauma system development, national trauma care system, civil military health system integration.

ABSTRACT

Over the course of the 26-year civil war in Sri Lanka between the Liberation Tigers of Tamil Eelam (LTTE) and the government forces, LTTE's 'military' capacity and strategy evolved from guerrilla-type ambushes using landmines to semi-conventional warfare with light arms and eventually to heavy artillery and improvised explosive devices. This evolution required both military and civil surgeons to enhance their knowledge and skills in managing high-energy war wounds to handle the large number of casualties admitted to health institutions. The Sri Lanka Medical Corps (SLMC) had been meticulously organized into echelons of care with graded capacity and capability to medivac battle injured personnel from point of injury to definitive care facilities. All injured personnel eventually found their way to Colombo Army Hospital and Ragama Rehabilitation Hospital for comprehensive rehabilitation. The civil war in Sri Lanka presented a significant influx of war-related injuries, demanding the creation of a comprehensive system seamlessly integrating both military and civilian elements. With a decade of peace, accompanied by shifts in injury epidemiology, the evolving landscape has mandated the exploration of innovative strategies to sustain and enhance the surgical skill-base for both military and civilian casualty care.

Introduction**Context of the war**

Over the course of the 26-year civil war in Sri Lanka between government forces and the Liberation Tigers of Tamil Eelam (LTTE), four main phases occurred, interspersed with periods of reduced activity, particularly during internationally brokered ceasefires. During these lulls, the LTTE regrouped to counter government forces' territorial advances^[1,3]. (Table 1)

TABLE 1. The timeline of the Eelam war

Eelam war	Period
Eelam war 1	1983 - 1987
Eelam war 2	1990 - 1995
Eelam war 3	1995 - 2002
Eelam war 4	2006 - 2009

The LTTE gained infamy as one of the world's most ruthless and sophisticated terrorist organizations, employing terrorist, guerrilla, and conventional tactics through its semi-conventional fighting force.

Starting as a small armed cadre, the LTTE evolved into a battle-hardened force of around 30,000 cadres, comprising military, sea tiger, air, and black tiger wings. The latter was a special unit dedicated to suicide attacks against security forces and terrorist attacks on civilians in Sri Lanka^[4,5].

The conflict zone encompassed diverse vegetation, including semiarid flat lands with tropical thorn forests, dry evergreen jungles, and bush-type vegetation. The terrain was further complicated by seasonal North-Eastern monsoon rains from December to February, leading to waterlogged conditions that posed significant challenges for casualty evacuation^[4].

Nature of injuries

In contemporary warfare, musculoskeletal injuries predominated, caused by blast munition fragments and automatic assault rifle bullets. A published report from Eelam War 3 revealed that 65% of injuries resulted from exploding ordnance, while 35% were gunshot wounds. Explosive wounds were largely inflicted by mortars, landmines, grenades, and artillery shells. In the urban and suburban terrains where close-range fighting occurred, injuries were predominantly due to small arms fire by T 56 and AK 47 automatic assault rifles. Additionally, there were burns and blunt injuries in the minority, specifically in armored corps personnel. There were reported incidents of drowning during a Kalmadukulam Tank bund blast by the LTTE in January, 2009. Extremities were the predominant region to be injured in battle. Torso, head and neck contributed a minor percentage in personnel surviving to reach medical care^[6].

During active conflict, the LTTE engaged in conventional war with a defined front line, using a variety of arms, ammunition, and equipment that resulted in an estimated death of around 30,000 government soldiers^[7]. (Table 2).

TABLE 2. Types of weapons used by the LTTE (verified by Lt Col. (Dr) Bandula Nishshanka RSP USP psc Phd.

Category of weapons	Weapons used by LTTE
Light arms	Type 56 Chinese assault rifle AK 47 assault rifle Type 69 RPG M2 browning 12.7mm Mines used

DOI:

TABLE 2. (Continued)

machine gun	Jony 95 (a small wooden box mine)
	Jony 99 (with motion sensor)
	Rangan 99 (with anti-handling features)
	SN 96 (Claymore-type mine)
	Amman 2000 (anti-vehicle mine)
	MK1 and MK2 (anti-vehicle mines)
	Claymore mine
Heavy weapons	152 mm towed gun-howitzer
	130 mm towed field gun
	122 mm howitzer
	85 mm Gun T-56
	Improvised 106 mm Artillery
	Indigenously produced long-range artillery
	107 mm Indigenous Single BRL (1-barrel)
	140 mm Mortar
	120 mm Mortar
	82 mm Mortar
	81 mm Mortar
60 mm Mortar	

Mines and amputations

The no man’s land was seeded with improvised anti-personnel mines (IAPM) aimed at maiming soldiers rather than killing them. Unique to the LTTE were improvised devices connecting multiple blast components to cause severe injuries to multiple victims simultaneously. Anti-personnel mines (APM) led to numerous amputations, with approximately 6,000 post-war amputees in the Sri Lankan Army. Anti- personnel mines improvised by the terrorists

referred to as “Jony mines” were triggered by victims stepping on them, causing extensive damage and posing a high risk of infection and sepsis^[2,4].

Evolution of LTTE military strategy

Over decades, the LTTE’s military capacity and strategy evolved from guerrilla-type ambushes using landmines to semi-conventional warfare with light arms and eventually to heavy artillery and improvised explosive devices. This evolution required both military and civil surgeons to enhance their knowledge and skills in managing high-energy war wounds to handle the large number of casualties admitted to health institutions. Workshops in military surgery conducted by the College of Surgeons of Sri Lanka together with the surgeons of the International Committee of the Red Cross and the College of Military Medicine helped in updating the knowledge of the surgeons treating the battle wounded^[4,5,8]

Evolution of military medical system in Sri Lanka

The inception of the medical corps traces back to 29th July 1881, with the establishment of the stretcher bearer (Medical) company as an integral part of the Ceylon Light Infantry (Volunteers). Major (Surgeon) J. Tothill, a retired regular medical officer, assumed command during its formation.

Following Ceylon’s independence in 1948, the Ceylon Army was established, and in 1950, the 1st Battalion of the Ceylon Army Medical Corps emerged as a regular force within the army. Over the ensuing years, the medical corps has undergone significant evolution, currently comprising four regular units and one

TABLE 3. Landmarks events of evolution of SriLanka Army Medical Corps (SLAMC)

Event	Year
The first stretcher bearer (Medical) company was raised as a part of the Ceylon Light Infantry (Volunteers). This was commanded by Major (Surgeon) J. Tothill, a retired regular Medical Officer.	29th July 1881
Formation of Ceylon Medical Corps (Volunteer)	1911
1st Battalion of Ceylon Army Medical Corps was created as a regular force in Ceylon Army.	1950
The former British Military Hospital of the Royal Army Medical Corps in Colombo was opened as a medical reception station with 10 beds. Very soon this was upgraded to a 30 bed service hospital.	-
Medical Reception Station (MRS) was opened in Diyathalawa Garrison, later upgraded to a Base Hospital.	-
A medical reception station in Palaly, Jaffna was made an Army Base Hospital as did the MRS at Panagoda Cantonment.	1983
Military Hospital Colombo was expanded with a new wing. Soon followed the building of rehabilitation institute ‘Ranaviru Sevana’ at Ragama.	1988
Regimental Centre SLAMC was established at Army Headquarters premises	15th January 1990
Military Hospital, Anuradhapura was established to treat soldiers in Vanni Sector	1997
3rd Battalion of Sri Lanka Army Medical Corps was formed	1999
Army Nurses Training School was established at Anuradhapura.	2001
4th Battalion of Sri Lanka Army Medical Corps was formed	November 2007
5th Battalion of Sri Lanka Army Medical Corps was formed	December 2010
He largest ever military hospital in Sri Lanka, Army Hospital Colombo, with 1,024 beds commissioned. It has 21 wards, 12 dental surgery units and nine operation theaters	May 2014

volunteer unit. The operational landscape includes two army hospitals, seven army base hospitals, and four field hospitals strategically positioned and operational nationwide.^[9,10] (Table 3)

The Sri Lanka Army Medical Corps was a relatively small Division and by 2006 there were only 118 officers and 3200 men of which only a small proportion were deployed in the field. In response to the demanding casualty care requirements during high-intensity conflict in North and East Sri Lanka, a group of infantrymen from each regiment were trained as nursing assistants in the combat life support training course. This extended to all special force personnel, commandos and young medical officers. Further, since 1995, the Sri Lanka Medical Corps (SLMC) had been meticulously organized into echelons of care with graded capacity and capability to medivac battle injured personnel from point of injury to definitive care facilities. Over the years of high Intensity war, operation of echelons matured into a formidable integrated system of casualty care with a combination of both military and civilian health care assets. Currently, the medical corps boasts a workforce of more than 4000 personnel including 363 skilled medical officers, 908 staff nurses, 1133 medical assistance ^[10,11].

The initial tier of care is strategically positioned in close proximity to the front line, providing essential casualty care immediately following injury. This primary care encompasses vital interventions such as control of bleeding, pain relief, and fracture immobilization. Notably, a range of tourniquet techniques were employed, ranging from improvised military tourniquets comprising belts and buckles to simple twined cloth adaptations. It's worth noting that, during the civil war in Sri Lanka, commercial tourniquets were unavailable and not advocated due to extended average evacuation times^[4,11].

The second tier of medical care comprised Advanced Dressing Stations (ADS), Main Dressing Stations (MDS), and field hospitals. ADS facilities strategically positioned around 400 to 5000 meters behind the front line served as pivotal points equidistant from three

forward regimental aid points. These stations were staffed by a medical officer, two nurses, and three nurse assistants, all proficient in emergency combat resuscitation, including advanced procedures such as intubation, chest-drain insertion, bleeding control, securing intravenous access and intravenous fluid infusion^[4].

A singular MDS, situated behind three ADSs, possessed the capability to stabilize casualties and facilitate their airlift to definitive care facilities. MDS units were manned by a senior medical officer, four nurses, six nurse assistants, and other support personnel. All support staff including the ambulance drivers were trained as nursing assistants. The procedures performed at the MDS included transfusing of un- cross matched group O blood when necessary, essential life-saving surgical interventions, including tracheostomies, emergency amputations, fasciotomy, and wound exploration to achieve hemostasis. All army doctors were trained in anesthesia to cater for field surgery. A blood store and portable ventilator were available for life-saving surgery undertaken at MDS. At each medivac station (ADS, MDS) casualties were triaged according to the priority of medical care needed. There was a good communication system in each dressing station, which helped to not only convey relevant information to higher headquarters but also to obtain relevant expert opinions from Colombo in difficult situations^[4].

The third tier of care encompassed military base hospitals and general hospitals equipped to provide definitive surgical care through specialized services such as vascular, orthopedic, oral-maxillo-facial, neurosurgical, and intensive care units. In 2008-2009, the military Base Hospital in Anuradhapura, located 180 kilometers away from the conflict zone, was repurposed as a center for definitive extremity vascular care. General surgeons trained in vascular surgery were deployed to minimize revascularization delays. The facility was well-equipped with two operating theaters, a three-bed intensive care unit, and an 80-bed ward^[4].

TABLE 4. Field casualty care organization in Sri Lanka medical corps. (verified by Col. (Dr) RKP Pushpakumara MD.)

Military organization (Commands, Formations & units)	Military medical evacuation (MEDEVAC) chain	Capacity and capability	Distance from the frontline / mode of transport to next the level / average time after injury to reach medical post during last phase of Eelam war
Company / platoons (units)	Company Aid Post (CAP)	In the casualty parties, Infantry soldiers are trained in combat life saving and bringing injured personnel from Frontline to CAP. At the CAP, Nursing assistant or Infantryman trained in basic first aid course / apply field dressing & bleeding control	Less than 400m / stretcher bearers / depending upon tactical and ground situation
Battalion / Regiment (formation)	Regimental Aid Post (RAP)	Regimental nurse or nursing assistants capable of applying proper dressing, giving intravenous fluid and analgesics, and carrying out splinting of fractured limbs.	200 to 400 m from Frontline / stretcher bearers / depending upon tactical and ground situation
Brigade headquarter (formation)	Advanced Dressing Station (ADS)	Medical officer or Registered Medical Officer (RMO) The responsibilities of the medical team at this point consisted of maintaining airway, breathing and circulation, continuation of antibiotics and IV fluids, giving tetanus toxoid, blood transfusion if required, stabilization of fractured bones, performing life-saving minor surgical procedures and stabilization of patients for transfer to MDS.	Advanced Dressing Stations are located about 400m – 4 km away from the frontlines / Ambulances, tractors, armored personnel carriers (APC) / usually within hour but can vary according to tactical and ground situation

TABLE 4. (Continued)

Division headquarter (formation)	Main Dressing Station (MDS)	manned by senior medical officers together with five nurses, PHI, storeman, lab technician, ambulance and driver and a clerk. A blood store and portable ventilator are available for life-saving surgery undertaken at MDS and from there patients are evacuated to Field Hospitals or Army Base Hospitals.	4 to 10 km from the frontline /Helicopters/ usually within 2 hours but can vary according to tactical and ground situation
Security Force Field command	Military Base Hospital (MBH)	Definitive care at the theater of war-manned by consultants, medical officers and other allied health, supportive and administration staff. Anuradhapura MBH was equipped with two operating theaters, a three-bed intensive care room, and an 80-bed ward	Victory (Anuradhapura Army Base Hospital) situated 180 km away from the conflict zone (Vanni theater of war- with 45 min helicopter flying time)/ Fixed wing air evacuation and by road ambulances to Colombo - 4 to 6 hours from Frontline to MBH
Sri Lanka Army	Army Hospital Colombo (AHC) / National Hospital Sri Lanka (NHSL- Ministry of Health)	Advanced surgical subspecialty care and rehabilitation	Situated 199 km from Anuradhapura (equivalent to 5 to 6 hours of traveling time by road)

For complex injuries requiring advanced neurosurgical, spinal, visceral, orthopedic, and reconstructive services, patients were transferred to the Colombo Army Hospital (CAH) and the National Hospital of Sri Lanka (NHSL), both situated 199 km from Anuradhapura (equivalent to 5-6 hours of travel time by road). All injured personnel eventually found their way to Colombo Army Hospital and Ragama Rehabilitation Hospital for comprehensive rehabilitation^[4]. (Table 4)

Contribution of civilian health system in combat casualty care

The protracted nature and heightened intensity of the war, coupled with inherent limitations in human and physical infrastructure, underscored the inadequacy of relying solely on the Sri Lanka Medical Corps for managing the entire spectrum of combat casualty care—from the initial point of injury to rehabilitation at tertiary care centers. Recognizing this challenge, a pioneering solution emerged: the development of a distinctive hybrid approach that seamlessly integrated military and civilian health systems, orchestrated at the highest administrative level to achieve a shared objective ^[4,8,11,13].

The pivotal stages of resuscitation, stabilization, and evacuation from the battlefield were skillfully executed by field surgeons well-versed in the intricacies of managing war casualties. Meanwhile, the bulk of definitive care was shouldered by civilian surgeons and healthcare personnel stationed across multiple tertiary care centers. To fortify the healthcare infrastructure at the fringes of the conflict zone, selected Health Ministry General Hospitals were transformed into specialized facilities dedicated to the intricate management of battle trauma. These centers were meticulously equipped with the requisite materials and human resources. While General Hospital Anuradhapura primarily attended to the medical requirements of both armed forces personnel and civilians wounded in the Northern sector and adjacent regions, the Base Hospital at Polonnaruwa played a crucial role in providing care to those injured in the Eastern Province and Polonnaruwa District. In 1987, the introduction of a dedicated military ward at the Polonnaruwa Hospital, managed by civilian staff, significantly bolstered these efforts, underscoring the effective collaboration between the military and civilian sectors in addressing casualties

during the conflict. This collaborative approach extended to other civilian hospitals, further emphasizing the synergistic relationship between military and civilian healthcare in these challenging circumstances ^[4,8,13].

In a commendable show of solidarity, Ministry of Health consultants, doctors, and nurses volunteered their expertise, converging at Army Base Hospitals to alleviate the strain on the military medical system caused by the overwhelming influx of casualties. This dynamic collaboration between military and civilian healthcare entities formed an integrated and effective hybrid system of care. Notably, this model drew inspiration from Israel’s successful implementation of a similar approach, wherein the swift dissemination of knowledge acquired during wartime was seamlessly applied to enhance civilian trauma care ^[4,11].

Lessons learned for future national trauma systems

The civil war in Sri Lanka presented a significant influx of war-related injuries, demanding the creation of a comprehensive system seamlessly integrating both military and civilian elements. Operating in austere conditions necessitated the use of improvised techniques to preserve life and limb in frontline areas, followed by a transition to more sophisticated settings for damage control and definitive surgery. With a decade of peace, accompanied by shifts in injury epidemiology, the evolving landscape has mandated the exploration of innovative strategies to sustain and enhance the surgical skill-base for both military and civilian contexts ^[4,14,15].

Combined civil military medical alliances in natural and manmade disasters have already been evident in the peacetime. Further these alliances can be expanded to civilian trauma care, combating epidemics, medical education and research on the way towards a combined national trauma care system.

Legends for figures and tables

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Acknowledgement : Lt Col (Dr) Bandula Nishshanka RSP USP psc Phd –Institute for Combinatorial Advanced Research & Education (KDU CARE), General Sir John Kotelawala Defence University, Sri Lanka, for verifying military related facts and figures.

All authors equally contributed in conceptualizing, writing, editing and approval of the final version of the manuscript
No conflict of interest declared by the authors

This work does not involve human subjects or live animals
No funding received for this work

Funding : The author(s) received no financial support for the research, authorship, and/or publication of this article.

Competing interests: The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Patient consent for publication: Not applicable.

Ethics approval This study: Not applicable.

Data availability statement: Images are not available for patient confidentiality.

Supplemental material: Not applicable.

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Artificial intelligence: Generative artificial intelligence or artificial intelligence assisted technologies were not used in preparation of this article

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