



Original Article: **Resilience in terror and disaster medicine through consolidation of institutional memory - National Hospital Sri Lanka Easter Sunday 2019 experience**

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Background

Suicide bombing generates a significantly larger number of casualties per attack than other uses of force by terrorist groups. Acts of terrorism are evolving and becoming more complex. Health emergency trauma care systems should advance and be resilient to withstand shocks of terror mass casualty event while catering routine community care. Easter Sunday emergency and trauma care response at the Accident Services National Hospital Sri Lanka (AC-NHSL) accrued invaluable lessons to be learned and shared with global emergency care fraternity.

Method

Sri Lanka lacks a mature trauma network and fully scaled emergency medical services (EMS) facing a terror attack following nine years of peace after ending three decades of civil war prompted our research team, Easter Sunday Attack Research Consortium (ESARC) to analyze the perspective of challenges encountered and strategies used in terror mass casualty incident (MCI) to improve on.

Findings

Qualitative research into the 2019 MCI highlighted the wealth of experience NHSL staff gained facing multiple MCIs in the past. Prompt activation of disaster management plan drilled just two weeks prior to the incident, better fleet of prehospital ambulance service (1990- SUWASERIYA), overwhelming staff response, commitment and volunteerism, leadership contribution by experienced consultants well versed with past mass casualty incidents, communication and coordination with media and foreign embassies were the positive aspects of the Easter response.

AC-NHSL was developed at the height of the Sri Lankan Civil War after multiple terror-related MCIs and maintained indelible institutional memory despite the years of ensuing peace. In The 2019 Easter MCI highlighted issues outside human and material resources as the greater challenges: communication, security, and coordination with other agencies.

Conclusion

Terror mass casualty events are complex, evolving, and infrequent. Lessons learned rapidly dissipate and forgotten if not carefully accrued and integrated into institutional memory.

Introduction

Terrorism inflicts society in many forms, including armed assaults, hijackings, hostage-taking, drone attacks and varying types of bombings including suicide bombings. Prominent weapon in the armamentarium of violent nonstate actors, suicide bombing generates a significantly larger number of casualties per attack than other uses of force by terrorist groups. The ability of the suicide bomber to deliver a relatively large explosive load accompanied by heavy shrapnel to the proximity of targeted victims has caused devastating effects¹.

Terrorist targets can also vary and can be aimed at civilians, state actors, or public infrastructure including health care institutes. According to the global terror index 2021 (GTI) report, 7,142 deaths from terrorism recorded. The number of countries experiencing a least one death from terrorism in 2021 was 44. South Asia remains the region with the worst average GTI score in 2021, with the region recording 1,829 deaths from terrorism in 2021. In 2020, 97.6 percent of deaths from terrorism occurred in conflict affected countries. Terrorist attacks in conflict countries are more than six times deadlier than attacks in peaceful countries².

Terrorist attacks pose a challenge to even mature trauma systems in the global north. The culprits manage to infiltrate the modern defense mechanisms and inflict the deadly blow in the most unexpected moment. The number of victims and their injuries vary depending on the context of the target incident. The survival of the injured will depends on seamless continuum of care from scene of injury to trauma center; triage to identify most critically injured, the efficient transport of survivable victims by emergency medical services (EMS) and the capabilities of the medical facilities and personnel therein to distribute and perform critical life and limb saving procedures without exhausting available resources^{3,4}.

In an aftermath of a terror event, trauma network function as such that the individual patient receives the best possible treatment but also that individual hospitals are not overwhelmed by patients. This means that available prehospital decision-making and treatment algorithms as well as network structures can be used not only for the management of single injured patients but

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also for the tailored and coordinated distribution of multiple patients in a mass-casualty situation⁵.

Sri Lanka lacks a mature trauma network and fully scaled emergency medical services (EMS) facing a terror attack following nine years of peace after ending three decades of civil war prompted our research team, Easter Sunday Attack Research Consortium (ESARC) to analyze the perspective of challenges encountered and strategies used in terror mass casualty incident to improve on^{6,8}.

Background

The health care Institutes in the capital Colombo, Colombo suburbs and borderline towns in the warzone were inflicted by multiple terror events during the 30-year-old civil conflict; these attacks were part of civilian life till the year 2009. Since then, the country has seen peace, and such incidents were not heard of till the easter Sunday of 2019 when multiple bombs were exploded in the Colombo city as well as outside.

Accident Services of the National hospital Sri Lanka (AS-NHSL) the apex trauma center (compatible with American College of Surgeons level 1) of the Island nation. AS-NHSL treats about 100,000 patients per annum of which almost one third are given in-house care. It is a purpose-built trauma institution with a separate building and entrance of its own. It has a well demarcated triage, resuscitation areas and space allocated for Priority 2 and Priority 3 patients. It has two dedicated acute trauma wards and two intensive care units with a capacity of 10 ventilator beds. The most remarkable feature of the institution is the three dedicated trauma theaters which function 24/7 handling trauma victims with inhouse consultant surgeon. AS-NHSL is fortified with adjoining robust neuro-trauma and orthopedic units.

The Orthopedic department of the accident service consists of four units with bed strength of four hundred and thirty which functions under direct supervision of four senior consultant Orthopedic surgeons⁹.

The Neuro-trauma center is equipped with an Emergency Treatment Unit, eight operation theaters, six ICU units inclusive of 66 beds, a High Dependency Unit and Wards with 228 beds to provide a better service for head injury patients. A Helipad is also built to facilitate transfer of critical patients by helicopters in case of an emergency⁹.

Easter Sunday blast was the first ever large-scale mass casualty event responded by Sri Lanka's first ever Island wide free ambulance service; SUWASERIYA established by Act of Parliament in 2016, with a fleet of 88 ambulances, a generous grant from the government of India and functions under Primary Health Care, Epidemics and COVID Disease Control State Ministry. 1990 Suwasariya provides island-wide, free pre-hospital emergency care to all Sri Lankans, with an average response time of 15:32 minutes. 297 SUWASERIYA ambulances are strategically located in police stations across the island and are connected to fast and efficient call centers that operate 24/7 to ensure medical emergencies. Victims receive the immediate attention it requires. Suwasariya currently, served by a 1390+ member passionate team. After initial training of EMTs in India, now the organization has shifted the training to a specifically designed Diploma in Paramedical Sciences for EMTs conducted by the Faculty of Medicine, University of Kelaniya^{10, 11}.

Institutional memory

The eight storied Accident and Orthopedic services building was constructed and equipped under the General Hospital, Colombo, rehabilitation project which was funded by the Finland government and de-

clared open in 1991. The unit since its inception has catered for many natural and manmade disasters including the Indian ocean tsunami in 2004 and multiple (more than fifty) terrorist bombings during the civil war (1980-2009) has made the AS-NHSL well adapted and resilient in dealing with large scale incidents. The worst-case scenario was the central bank bomb blast in 1996, by a 440-pound high explosive mounted lorry accompanied by an attack with semi-automatic rifles and rocket-propelled grenade launchers at the prime financial hub in Colombo. NHSL received 1300 victims in less than one hour with a recorded 76 deaths. But since the end of civil war in 2009 the incidents were far sparse in frequency and in volume. But NHSL accident Services 'institutional memory, which has been well established over the years, was instrumental in bouncing back to a resilient state catering to the Easter Sunday disaster victims^{7,9,12}.

Incident Description

On 21st of April 2019 between 8 25 am and 9 20 am, 6 bombs were exploded. Four in Colombo, out of which 3 were in five-star hotels and one in a St Anthony's Catholic Church. Another two blasts occurred in St Sebastian Church Negombo and in Zion church, Batticaloa, 20 km north of Colombo and in 300 km east of Colombo, respectively.

Almost all patients from the Colombo blasts were directly admitted to AS-NHSL. Some of the severely injured patients from the Negombo blasts were transferred secondarily to Colombo NHSL for further specialized care^{13,14}.

A total of 259 patients died in the blasts and over 500 were injured. The national hospital received 251 admissions out of which 50 were dead on arrival. First patient received by the trauma unit was at 9.05 am approximately 20 minutes after the first explosion. Out of the victims, 208 were found to be Sri Lankans and rest of the 43 were foreigners. Majority of the patients were in the 3rd to 5th decades of life depicting the normal distribution of the general population. Out of the live admissions, 17% (34) were categorized as severe injuries (Priority 1) and 23% (46) were found to be moderate injuries (Priority 2) while 60% (121) were categorized as walk-in casualties (Priority 3). The victims had a remarkable number of head injuries. This is presumably due to most of the victims being in the seated position inside the church while the terrorist being in standing position⁷.

Surgical interventions and outcomes

135 operative procedures were performed in the first 24 hours consisting of 8 laparotomies, 21 craniotomies, 4 vascular procedures, 30 orthopedic procedures, 56 wound debridement and 16 burn patients.

Easter response had more lifesaving neurosurgeries performed in comparison to similar events in the past. The NHSL Department of Neurosurgery communicated with peripheral hospitals to direct management of neurotrauma.

Out of the 201 live admissions there were 5 deaths during subsequent institutional care.

There were 35 consultants and 50 medical officers involved in the MCI response at NHSL. Accident and emergency, general surgery, neurotrauma, orthopedic, vascular, reconstructive, anesthesia critical care and radiology services were the main disciplines contributed in patient management during the Ester response^{7,8}.

Lessons learned

Mass casualty incidents (MCIs) are diverse, unpredictable, and increasing in frequency, but preparation is possible and necessary. Mass casualty preparedness is a complex, iterative process that requires an integrated, multidisciplinary, and tiered approach. Through effective

preparedness planning, trauma systems should be well-placed to deliver an optimal response when faced with MCI⁵.

Qualitative research into the 2019 MCI highlighted the wealth of experience NHSL staff gained facing multiple MCIs in the past. After nine years of peace, the immediate response was intuitive. The initial flood of patients arrived within 15 to 30 min of the bombings, before activation of the MCI plan, which resulted in initial chaos. The first wave consisted of 50 critically injured patients loaded on a bus by security forces with no medical triage or treatment initiated. Experienced consultants and senior staff took on the challenge of triaging, while another team established surge capacity by vacating ICUs and wards. Three anesthetists, who faced similar prior events, expedited preparing the operating theaters with staff and equipment to receive the first surgical cases. Prompt activation of disaster management plan drilled just two weeks prior to the incident, better fleet of prehospital ambulance service (1990- SUWASERIYA), overwhelming staff response, commitment and volunteerism, leadership contribution by experienced consultants well versed with past mass casualty incidents, communication and coordination with media and foreign embassies were the positive aspects of the Easter response.

AC-NHSL was developed at the height of the Sri Lankan Civil War and therefore maintained adequate staff and resources despite the years of ensuing peace. In The 2019 Easter MCI highlighted issues outside human and material resources as the greater challenges: communication, security, and coordination with other agencies^{4,9}.

Conclusion

Twenty first century geopolitical environment made terrorist attacks become more frequent and lethal with the rise of religious ideological movements, necessitating resilient health care system to counteract complex emergency surgical care needs. Number and complexity of the wounded consistently challenged emergency and trauma care system continuum and terrorist tactics are evolving. National Hospital Sri Lanka is well resourced, and decades long war experiences left indelible mark of institutional memory. Being a robust, well-resourced accident and emergency care center in a developing nation, institutional memory of the Accident Services - National Hospital Sri Lanka is invaluable knowledge to share with global emergency and trauma care fraternity.

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