

Trauma - How to Prepare? A review

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INTRODUCTION

"Trauma" is the Greek word for "a wound" (and for "damage or defeat").

Any injury, whether physically or emotionally inflicted. "Trauma" has both a medical and a psychiatric definition. Medically, "trauma" refers to a serious or critical bodily injury, wound, or shock. This definition is often associated with trauma medicine practiced in emergency rooms and represents a popular view of the term.

In psychiatry, "trauma" has assumed a different meaning and refers to an experience that is emotionally painful, distressful, or shocking, which often results in lasting mental and physical effects.¹

Trauma can be inflicted in an ever increasing variety and severity. The modern form of trauma include the Terrorist attacks e.g. Bomb blasts, suicidal blasts, firing incidents and bioterrorism, Natural calamities e.g. Earth quakes, Floods, Lightening and Land slides, Domestic Violence e.g. Blunt trauma, Penetrating injuries (Stab/ Firearm/ Shrapnel) or burns, and last but still most commonly the form of road traffic accidents and occupational hazards².

BURDEN OF THE PROBLEM

There is dearth of data on the trauma victims in the country and its impact is unknown. In a report published for the year 2006 National road safety secretariat³ estimated that about 0.418 million serious accidents out of total of two million accidents in Pakistan. The number of road traffic accidents multiplied 17.5 times during a thirty year period (1956-1996) while the number of vehicles multiplied by 15.8 times during same period in Pakistan.⁴

Commercial vehicles were involved in 69% of the accidents even though they constituted only 12% of the total vehicles. Similarly, an increase of 55% was noted in homicidal attacks during a ten year period (1985-1994) in one study⁵. Over 90% of the victims of violence were males^{6,7} mostly belonging to the age group of 20-40 years. Most of the victims of road traffic accidents were also young males. The report by National road safety secretariat estimated a cost in excess of 100 billion rupees for the year

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2006². Estimated loss of 31.94 healthy life years per 1000 population in Pakistan due to injuries in 1990 have also been reported⁸.

Many of these injury related disabilities and deaths are amenable to low cost measures such as better training, better organization and planning of the services and availability of right skills and equipment at the appropriate time and place.

The new setting of terrorism in its various forms has added tremendously in the incidence of trauma in the country. In the last 6 months (Jan1 to June 16, 2009) alone there have been more than 30 incidents of bomb blasts; suicide bombings and terror firing incidents killing more than 500 and injuring 1691 victim across the country, while 84 victims killed and around 50 were injured in political violence in the country⁹.

Internationally the rate of trauma related deaths are not small. Even the developed nations with research and technology available to there rescue have rates as high as 14 000 in Canada each year of injury, and approximately 250,000 need hospitalized, resulting in a combined estimated direct and indirect cost of injury of \$12.7 billion annually¹⁰ which is by far thrice the total annual budget (2009-10) for the province of Punjab alone.

TRAUMA SYSTEM AROUND THE WORLD

The American System: American college of surgeons have a well set criteria for verification of a trauma center as level I - highest level of service being provided round the clock.¹¹. Salient features of the criteria includes:

- Surgical commitment is essential for a properly functioning trauma center.
- A Level I trauma center must meet admission volume performance requirements (one of the following):
 - Admit at least 1200 trauma patients yearly,
 - 240 admissions with an Injury Severity Score (ISS) of more than 15,
 - An average of 35 patients with an ISS of more than 15 for the trauma panel surgeons (general surgeons who take trauma all).
- The trauma director must have responsibility and authority for determining each general surgeon's ability to participate on the trauma panel based on an annual review.

- General surgeon or appropriate substitute (postgraduate-year 4 or 5 resident) must be in house 24 hours a day for major resuscitations (must be present and participate in major resuscitations, therapeutic decisions, and operations).
- It is expected that the surgeon will be in the emergency department on patient arrival, with adequate notification from the field. The maximum acceptable response time is 15 minutes for Level I and II trauma centers and 30 minutes for Level III trauma centers, tracked from patient arrival. The program must demonstrate that the surgeon's presence is in compliance at least 80% of the time. Demonstration of the attending surgeon's prompt arrival for patients with appropriate activation criteria must be monitored by the hospital's trauma PIPS program.
- The trauma surgeon on call must be dedicated to the trauma center while on duty
- The hospital has the commitment of the institutional governing body and the medical staff to become a trauma center
- The multidisciplinary trauma program continuously evaluates its processes and outcomes to ensure optimal and timely care.
- The trauma medical director is either a board-certified surgeon or an ACS Fellow.
- The trauma medical director participates in trauma call.
- The trauma director has the authority to correct deficiencies in trauma care or exclude from trauma call the trauma team members who do not meet specified criteria
- Seriously injured patients are admitted or evaluated by an identifiable surgical service staffed by credentialed providers.
- There is sufficient infrastructure and support to the trauma service to ensure adequate provision of care.
- There is a multidisciplinary peer review committee chaired by the trauma medical director or designee, with representatives from appropriate subspecialty services.
- There must be a Trauma Program Operational Process Performance Improvement Committee.
- An attendance threshold of 80% must be met for trauma surgeon presence in the emergency department.
- There is a multidisciplinary peer review committee with participation from general surgery, orthopaedic surgery, neurosurgery, emergency medicine, and anesthesia
- The emergency department has a designated emergency physician director supported by an appropriate number of additional physicians to ensure immediate care for injured patients.
- Emergency department physicians must be present in the emergency department at all times.
- A neurosurgical liaison is designated
- Neurotrauma care is promptly and continuously available for severe traumatic brain injury and spinal cord injury and for less severe head and spine injuries when necessary
- The hospital provides an on-call neurosurgical backup schedule with formally arranged contingency plans in case the capability of the neurosurgeon, hospital, or system to care for neurotrauma patients is overwhelmed.
- An attending neurosurgeon is promptly available to the hospital's trauma service when neurosurgical consultation is requested
- Qualified neurosurgeons are regularly involved in the care of head - and spinal cord- injured patients and are credentialed by the hospital with general neurosurgical privileges
- Level I and II centers provide sufficient resources, including instruments, equipment, and personnel, for modern musculoskeletal trauma care, with readily available operating rooms for musculoskeletal trauma procedures
- Operating rooms are promptly available to allow for emergency operations on musculoskeletal injuries, such as open fracture debridement and stabilization and compartment decompression.
- There is an orthopaedic surgeon who is identified as the liaison to the trauma program.
- Plastic surgery, hand surgery, and spinal injury care capabilities are present at Level I trauma centers.
- Anesthesiology services are promptly available for emergency operations
- Anesthesiology services are promptly available for airway problems
- There is an anesthesiologist liaison designated to the trauma program.
- Anesthesia services in Level I trauma centers are available in-house 24 hours a day
- When anesthesiology chief residents or CRNAs are used to fulfill availability requirements, the staff anesthesiologist on call is (1) advised, (2) promptly available or all times, and (3) present for all operations.
- All anesthesiologists taking call have successfully completed an anesthesiology residency.
- The anesthesia liaison has been identified
- The operating room is adequately staffed and immediately available. In a Level 1 trauma center, this criterion is met by having a complete operating team in the hospital at all times, with

- individuals who are dedicated only to the operating room.
- There is a mechanism for providing additional staff for a second operating room when the first operating room is occupied
- The operating room has the essential equipment
- Trauma centers have the necessary equipment for a craniotomy
- The PACU has qualified nurses available 24 hours per day as needed during the patient's post-anesthesia recovery phase.
- (I, II, III) The PACU has the necessary equipment to monitor and resuscitate patients.
- Radiologists are promptly available, in person or by teleradiology, when requested, for the interpretation of radiographs, performance of complex imaging studies, or interventional procedures.
- Conventional radiography and CT are available in all trauma centers 24 hours per day.
- There is an in-house radiographer at Level I and II trauma centers.
- In a Level I trauma center, there is an in-house CT technologist.
- Conventional catheter angiography and sonography are available 24 hours per day.
- There is a surgically directed ICU physician team.
- Physician coverage of critically ill trauma patients must be promptly available 24 hours per day.
- Physicians must be capable of a rapid response to deal with urgent problems as they arise in critically ill trauma patients.
- The trauma service retains responsibility for patients and coordinates all therapeutic decisions appropriate for its level
- The trauma surgeon is kept informed of and concurs with major therapeutic and management decisions made by the ICU team
- The patients in Level I facilities have in-house physician coverage for ICU at all times.
- A qualified nurse is available 24 hours per day to provide care during the ICU phase
- The ICU has the necessary equipment to monitor and resuscitate patients.
- Intracranial pressure monitoring equipment is available
- Level I facilities must have a full spectrum of surgical specialists available. (orthopaedic surgery, neurosurgery, cardiac surgery, thoracic surgery, hand surgery, microvascular surgery, plastic surgery, obstetric and gynecologic surgery, ophthalmology, otolaryngology, and urology).
- A respiratory therapist is available to care for trauma patients 24 hours per day.
- Laboratory services are available 24 hours per day for the standard analyses of blood, urine, and other body fluids, including microsampling when appropriate.
- The blood bank must be capable of blood typing and cross matching.
- The blood bank must have an adequate supply of red blood cells, fresh frozen plasma, platelets, cryoprecipitate, and appropriate coagulation factors to meet the needs of injured patients.
- The capability for coagulation studies, blood gases, and microbiology must be available 24 hours a day.
- The hospital must provide physical therapy services.
- Trauma registry data are collected and analyzed
- The trauma center demonstrates a clearly defined PIPS program for the trauma population.
- The PIPS program is supported by a reliable method of data collection that consistently gathers valid and objective information necessary to identify opportunities for improvement.
- The process of analysis occurs at regular intervals to meet the needs of the program.
- The results of analysis define corrective strategies.
- The results of analysis and corrective strategies are documented.
- The trauma program is empowered to address issues that involve multiple disciplines.
- The trauma program has adequate administrative support and defined lines of authority that ensure comprehensive evaluation of all aspects of trauma care.
- The trauma program has a medical director with the authority and administrative support to lead the program.
- The trauma medical director has sufficient authority to set the qualifications for the trauma service members.
- The trauma medical director has sufficient authority to recommend changes for the trauma panel based upon performance reviews.
- Identified problem trends undergo multidisciplinary peer review by the Trauma Peer Review Committee.
- The trauma center is able to separately identify the trauma patient population for review.
- There is a process to address trauma program operational issues.
- There is documentation reflecting the review of operational issues and, when appropriate, the analysis and proposed corrective actions.
- The process identifies problems

- The process demonstrates problem resolution (loop closure).
- There is a trauma multidisciplinary peer review committee with participation by the trauma medical director or designee and representatives from general surgery, orthopaedic surgery, neurosurgery, emergency medicine, and anesthesia.
- Deaths are systematically categorized as preventable, non-preventable, or potentially preventable.
- When a consistent problem or inappropriate variation is identified, corrective actions are taken and documented.
- The Level I trauma center provides a continuous rotation in trauma surgery for senior residents that is part of an Accreditation Council for Graduate Medical Education- accredited program in any of the following disciplines: general surgery, orthopaedic surgery, or neurosurgery; or supports an acute care surgery fellowship consistent with the educational requirements of the American Association for the Surgery of Trauma.
- The trauma medical director has responsibility and authority to ensure compliance with verification requirements.
- The trauma surgeon (anesthesiologist in UK setup) remains in charge of patients in the ICU

All these features need to be functionally present in letter and spirit and every single deficiency goes against verification of the trauma center as a level I center¹¹.

The European System: The UK and the European system for the trauma care follows in many ways the well developed criteria of the American college of Surgeons, but at the same time new additions based on availability of new technologies have broadened the horizon for trauma care in these areas. The UK care system has prioritized the following vital components for establishment of trauma centers across Europe and UK in particular;

- Catchment area
- No. of trauma patients per year
- Major trauma per year (Injury severity score >16)
- Neurosurgery/24 hour – on call/on duty
- Dedicated Burn unit
- Operating theatre for trauma
- Headed by a General Surgeon/ anaesthesiologist
- No. of doctors (approx 1:1.5 beds)
- No. of nurses (1:2 bed)
- Surgical ICU
- Team leader (anesthesiologist/ Gen surgeon)

- Admission incharge (Anesthesiologist/General surgeon/ emergency physicians
- Laison / centralized ambulance service¹²

Introduction of the new COMPUTER TECHNOLOGY like the geographic information system (GIS) is being effectively put into force to develop a **location-allocation trauma system** in wales¹³.

The Canadian System: The regionalized trauma care services have been developed of late and in the last 15 years or so the concept is well conceived and Quebec (the biggest province of the country) has 59 trauma centers affiliated to 4 university run level 1 trauma centers.

In addition to the on road emergency system; the **“BRIGHT ORANGE”** System of airborne emergency services in “ONTARIO” constitutes 12 helicopters and 4 fixed winged aircrafts for evacuation and transfer of victims.¹⁰

HOW TO GET THE DATA?- DATA REGISTRY SYSTEM

Quality assurance for process and outcome is determined by applying audit filters by committees on trauma. These audit filters are described differently by institutions taking care of the quality assurance for the trauma patients like one described by **Maryland Trauma Registry Data Dictionary**. The details of the data entry filters and audit filters can be found from respective systems. These include pre-hospital; admission, operative, and morbidity and mortality in detail.¹⁴

Data entry system includes data collection for all the patients presenting with trauma; Following steps are the key components of the data registry system in force in most part of the developed countries and trauma care systems across the world.

- Defining trauma; victim and modes of presentation
- Inclusion /exclusion criterias and code allocations
- Designing the data set
- Designing the data base
- Hard ware and software development
- Personnel education and training
- Implementation
- Evaluation of the process
- Continuing audit on the system and data evaluation.

WHY SUCH A SYSTEM MAY FAIL IN PAKISTAN?

- All these systems are well in force in the developed countries of the world but in third world

countries including Pakistan such system may always fail because of a number of reasons but the most common are

- Little or no pre-hospital care
- Non-availability of (or inefficient) evacuation and transportation system
- Limited inter-hospital communication in case of transfers
- Lack of standardized and uniform hospital data formats
- Limited availability of electronic data storage and retrieval facilities
- Inadequate funding
- Unfavorable government health policies
- Inadequate census and population data¹⁵

LIGHT AT THE OTHER END OF THE TUNNEL

In the present state of affairs the trauma management is the need of the hour and government is showing signs of willingness to address this problem effectively. The ever increasing number of trauma victims is also gearing up the medical services of our country. The beginning of trauma management is based on an effective trauma registry.

In any setting, the essential operation of an effective trauma registry requires adequate funding, reasonable and dependable software, a well-defined patient population, adequately trained personnel, a process for data collection, reporting, and validation, and a process for ensuring privacy. Generally, trauma registries are maintained by trauma registrars and/or the equivalent of trauma registry coordinators.

We propose the following to improve our health delivery mechanisms for the trauma patients:

- Introduction of the trauma registry system.
- Introduction of trauma center criteria following American College of surgeons guidelines to start with.
- Introduction of the emergency medical response to all major areas of the Pakistan.
- Allocation of large budget for quality assurance in trauma care.
- Introduction of location allocation system. Introduction of trauma committees.
- Identification of locations across the province with transfer of time less than one hour for its catchment areas.
- Proposed centers with the respective catchment areas.
- Pilot studies can be started in trauma centers.
- Assignment of a committee to identify; recruit and establish trauma teams including dedicated surgeons; anesthetist and nursing staff.

- Assignment of committee to recruit trauma center directors for adult as well as pediatric centers.
- Pilot studies for identifying building / infrastructure for proposed trauma centers
- Formation of committee of eminent surgeons; anesthesiologist and trauma physicians to chalk out data entry codes and audit filters.
- Constitution of teams to determine the minimum criteria for these trauma centers and setting some minimum goals.

Conflict Of Interest: There is no conflict of interest.

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