

TRAUMA SYSTEMS



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INTRODUCTION

The word trauma derives from the Greek word meaning "bodily injury." Trauma can be defined in terms of bodily injury severe enough to pose a threat to life or limb. Care of the injured patient has been fundamental to the practice of medicine since recorded history. The Greek word *iatros* (healer) was originally found in Homer's *Iliad* and referred to the "remover of arrows." The first trauma centers were used to care for wounded soldiers in Napoleon's armies. The lessons learned in successive military conflicts have advanced our knowledge of care of the injured patient. The Korean conflict and the Vietnam War established importance of minimizing time from injury to definitive care. The extension of this concept to the management of civilian trauma led to the evolution from the 1970's onward to today's trauma systems. Considerable reduction in the number of people dying during second peak can occur if there is rapid transport from the scene of the accident to a hospital fully staffed and equipped to care for victims suffering severe injuries. If the number of fatalities due to trauma is plotted as a function of time after injury, three peaks appear. The development of a 'systems' approach to trauma care has resulted in a significant reduction in the mortality of patients dying within hours of injury. A trauma system operates within a geographical region (i.e. city, country, state) and provides for rapid transport of victims of major trauma to specified

hospitals within that region. These specific hospitals are called trauma centers because they have concentrated resources and expertise to treat severely injured patients immediately and effectively. The integration of pre-hospital care, rapid transport and immediate surgical treatment within a trauma system has been demonstrated to reduce preventable deaths due to trauma from 20-30% to 2-9%. In general further development of trauma system, organized protocols for care of predictable injuries and expanding the availability of these systems to rural area will result in the reduction of mortality during 2nd period. In a system, the hospital which provides acute care for the severely injured patient (trauma center) is a key component of a system which encompasses all phases of care from pre-hospital through acute care and rehabilitation. The trauma center remains a key component but the system recognizes the necessity of other health care facilities. The structure of a trauma care system involves a number of components and providers, each of which must be adopted to a specific environment, whether urban or rural. The structure of a trauma system consists of operational and clinical components and administrative components.

Operational and clinical components

Injury prevention and control.

Human resources

- * Work force resources
- * Education

Pre-hospital care

- * Emergency medical services management agency
- * Ambulances and non-transporting guidelines

- * Communication system
- * Emergency/disaster preparedness plan

Definitive care facilities

- * Trauma care facilities
- * Inter-facility transfer
- * Medical rehabilitation

Information systems

Evaluation

Research

Administrative component

Leadership

System development

Legislation

Finances

An ideal trauma system would include all the components identified with optimal trauma care, such as prevention, access, acute hospital care, rehabilitation and research activities. Central to an ideal system is a large resource rich trauma center. The need for resources is primarily based on the concept of being able to provide immediate medical care for unlimited numbers of injured patients at any time. Optimal resources at such a trauma center would include in-house board-certified emergency medicine physicians, general surgeons, anesthesiologists, neurosurgeons and orthopedic surgeons. Other board-certified specialists would be available, within a short time frame to all patients who require their expertise. This center would require a certain volume of injured patients to be admitted each year, and these patients would include the most severely injured patients within the system. Additionally, certain injuries that are infrequently seen would be concentrated in this special center to ensure that these patients could be properly treated and studied, providing the opportunities to improve the care of these patients. These research activities are necessary to enhance our knowledge of the care of the injured. Basic science research in areas such as

shock, brain edema, organ failure, and rehabilitation would also be present in the ideal center. This trauma center would have an integrated concurrent performance improvement program to ensure optimal care and continuous improvement in care. This center would not only be responsible for assessing care delivered within its trauma program, but for helping to organize the assessment of care within the entire trauma system. One resource of a trauma center that cannot be limited is the surgical commitment. This commitment is often difficult to objectively measure it can be recognized in a number of ways. These include a surgeon who acts as full time director of the trauma program, surgeons who take an active role in all aspects of caring for the injured patient, surgical participation in the trauma performance improvement program, and surgeons who take an advocacy role for the injured patients. Surgical leadership promoting the trauma program to the community, hospital and other colleagues should also be easily recognized. Surgical commitment is a valuable resource which is integral to a successful trauma program.

Injury is the leading cause of death and disability in the first four decades of life and is the third most common cause of death overall. Dr. Donald Trunkey has pointed out that deaths following injury fall broadly into three groups giving a distinct trimodal pattern. Immediate death(50 percent)- those occurring immediately or within the first few minutes of injury and usually due to widespread damage to the brain or upper spinal cord, the heart or major vessels, or multiple injuries. This first peak is due to the injuries which are generally lethal so that little can be done in their management that is likely to affect outcome. Reduction of this peak can only be achieved by preventive measure such as wearing of appropriate seat belts in automobiles, head protection on bicycles and motorcycles, road safety legislation and education for pedestrians.

Early death (30%) - those occurring within the first few hours after injury (called by some 'golden hour/ hours' of trauma). These deaths are deemed preventable and are due to facial injuries with developing airway obstruction, lethal disruption of the breathing mechanism, massive blood loss into body cavities or from multiple long bone fractures leading to collapse of the circulation and dysfunction of central nervous system due to space-occupying collections of blood within the skull.

Late death (20%) - those occurring days or weeks after injury generally due to sepsis and multiple organ failure. Organ failure may involve the heart, kidney, liver, lung, brain and haemopoietic systems. The development of trauma systems has changed the epidemiology of death in this peak in regions where trauma care is most developed. The availability of early rapid transport and early, aggressive in-hospital care has improved early resuscitations and changed the character of the third traditional peak following injury into three smaller peaks. Occurring within the first week following injury, inability to control intracranial hypertension following severe head injury now accounts for a significant portion of late mortality.

Sepsis and accompanying multiple organ failure have diminished as a result of better, more aggressive resuscitation and early care. They now account for approximately 5% of overall mortality and only 30% of late mortality in an organized system of care. Fatal pulmonary embolus accounts for a significant portion of the late mortality peak as well. Continued understanding of the epidemiology of death and immunosuppression in this third peak will refocus our attention on care and research strategies to deal with this changing pattern during acute care.

The scope of the problem should not be limited to mortality. Morbidity accounts for the majority of

efforts provided by both the acute care team and the rehabilitation team. In essence, society's efforts will have to parallel the peaks in mortality and morbidity following injury to make an impact on the problem. Prevention aimed at aetiologies of injuries and better protection against injury will reduce the first peak. Ongoing development of trauma systems will deal with the second peaks and the better understanding of late death along with focused research towards those problems identified will impact the third peak.

INJURED PATIENT MANAGEMENT WITHIN A TRAUMA SYSTEM

Once injury is identified, the trauma system must ensure easy access, central Emergency Medical service dispatching and the appropriate medical responses to and at the scene of injury. The system must also assign responsibilities and authority for care and triage decisions made prior to trauma center access. Triage guidelines must be accepted by all providers and used to determine which patients require immediate trauma center care. This co-ordination requires direct communication systems between pre-hospital providers, physicians who provide medical direction, and trauma facility professionals.

The trauma center, which serves as the definitive specialized care facility, is a key component of the trauma system. The trauma center is different from other hospitals since it guarantees immediate availability of specialized surgeons, anesthesiologists, other physicians, specialists, nurses, and resuscitation life-support equipment 24 hours a day. Within a region or a state, trauma centers need to be integrated into the system plan to allow for the best and most timely match of the facility's resources with the patient's needs. The system co-ordinates care among all levels of trauma centers and facilities so that efficient and prompt inter-facility communication and transfer can take

place according to patient's need. Access to rehabilitation services, first in the acute care hospital and subsequently in more specialized facilities, is of paramount importance for the patient's optimal recovery. Equally important is the return of transferred patients to their own communities and physicians when medically appropriate.

MAJOR COMPONENTS OF TRAUMA SYSTEMS

Major components of trauma systems are pre-hospital care, acute hospital care and long-term care and rehabilitation.

PREHOSPITAL CARE

The aim should be for rapid and smooth transfer of patients from the scene of the accident to a hospital that is well equipped and adequately staffed, with trained personnel to deal quickly and efficiently with all of the injuries encountered. A 'scoop and run' policy is best where transfer time to hospital is short. A 'stay and play' policy may be required in the face of entrapment but pre-hospital personnel must be properly trained and equipped. Emergency Medical Services is usually organized on a local government level and works within a medical system that will supervise and evaluate its activities and performance.

The 'golden hour' after a traumatic event is the period in which proper evaluation and treatment will provide the best outcome for the trauma patient. The major goals of an Emergency Medical Services system are to provide rapid access by well-equipped vehicles, appropriate field management by trained personnel and rapid transport to an appropriate hospital while providing good care en route.

Establishment and maintenance of Emergency Medical services within a community will be required before patient contact is made. It should establish an adequate and a consistent source of funding to

ensure that the entire system is maintained. It also includes the initial training and continuing education of relevant personnel, purchasing and equipping of vehicles, as well as stocking of supplies before each emergency call, adequate and appropriate staffing of units, and development, updating and approval of treatment protocols.

Upon arrival at the scene the Emergency Medical technicians should evaluate the situation that caused the accident, determine the number of patients involved and ascertain whether additional equipment or personnel are needed. The patient is then assessed and treatment started with the use of established guidelines and treatment protocols. Care is continued while en route to the hospital and hospital personnel are notified prior to arrival. Information provided to the hospital should be sufficient and to the point, like mechanism of injury, identified injuries, vital signs, treatment rendered etc.

Review of every call after it has been completed to assure that proper medical care was provided is essential and it also helps to develop a continuing education program. The emergency medical technicians are responsible for field assessment, treatment and transport of the trauma victim. There are three different levels of emergency medical technicians based on the amount and type of training. Basic emergency medical technicians are able to perform basic life-support skills including cardio-pulmonary resuscitation, splinting and handling, extrication and simple airway management. Intermediate emergency medical technicians are proficient in all basic requirements and in addition they can insert intravenous line for fluid therapy and endotracheal tube placement. Paramedic are trained in all the skills taught to intermediate Emergency medical technicians and have additional training in the use of specific drugs that may be useful in the field, such as adrenaline, insulin, glucose, naloxone, morphine, diazepam, sodium bicarbonate, calcium

and frusemide. In order to evaluate and manage patients adequately in the field, treatment protocols should be established for almost all medical conditions likely to be encountered. Obtaining accurate diagnoses in the pre-hospital setting is difficult and is better accomplished at the hospital, where definitive care can be provided.

Once recognition of an injury has taken place and after providing initial stabilization, the emergency medical services personnel must then decide what level of care the injured patient will require for optimal outcome. Trauma patients can be divided into three different groups, based on the extent of their injuries: those are rapidly fatal, those that are potentially fatal and those that are not fatal. The first group consists of patients who are sustained mortal injuries and expire within the first 10-15 minutes after the incident. They represent approximately 5% of all patients sustaining trauma. Pre-hospital care is unlikely to benefit these patients. The third group consists of patients whose injuries are minor and will not cause a threat to life if treatment is delayed. These injuries are usually confined to the soft tissues or isolated extremity fractures and represent about 80% of all trauma patients. The remaining second group, approximately 7-15% of all trauma patients consist of patients who have sustained potentially fatal injuries, and it is this group of patients who will benefit most from established pre-hospital and trauma systems. Studies have shown that when these patients are taken to designated trauma centers, the numbers of potentially salvageable deaths and cases of unacceptable care are significantly reduced, Field triage techniques are used to help to identify these patients.

Triage is the sorting and classification of casualties and determination of the priority of need and proper place of treatment. The purpose is to be selective because there is a finite amount of resources available for the care of patients within a given medi-

cal system.

Field triage systems use physiological, anatomical and mechanism of injury data to make decisions that determine how a patient will be subsequently treated. These data are used in the field to determine whether the patient has a possibility of having sustained a serious or potentially life-threatening injury and, if so, what hospital resources are going to be required in order to diagnose and treat those injuries adequately. The field triage system in use by a trauma system should be reviewed periodically for cases of under-triage and over-triage. Under-triage occurs when a patient is not felt to have a serious injury but actually does and results in potentially preventable morbidity and mortality. Over-triage occurs when a patient is felt to have sustained a serious injury but actually has not and can result in over utilization of finite material, financial and human resources.

The information gathered in the field is combined and quantified using triage scoring systems, which help the field-personnel to quantify the severity of injury and aid in making a decision as to whether the trauma victim requires the resources of a trauma center. The first trauma triage tools reported in the literature used physiological parameters in their assessment of trauma victims.

Physiological criteria include measurements of basic body function parameters such as heart rate, blood pressure, respiratory rate and effort, level of consciousness and temperature. Currently, the Revised Trauma Score is the most widely used field system.

Anatomic criteria are used in determining the potential for serious or life-threatening injury. This includes but is not limited to : penetrating injury to the head, neck, torso or proximal extremity, two or more proximal long bone fractures, pelvic fracture.

flail chest, amputation proximal to the wrist or ankle, limb paralysis, greater than 10% total body surface area burn or inhalation injury.

Mechanism of injury criteria help to predict the likelihood of injury by estimating the amount and direction of force applied to the body. Mechanisms of injury felt to have a high potential for major trauma include falls of more than 5 meters motor vehicle accidents with a fatality at the scene, passenger ejection, prolonged extrication (>20 min.) or major intrusion of the passenger compartment, pedestrian struck by a motor vehicle, motorcycle accidents at a speed of more than 20m.p.h. or any penetrating injuries to the head, neck, torso or proximal extremities.

Other criteria used in triage decisions include the patient's age, associated medical conditions, environmental conditions, paramedic judgment and length of time to transport to the nearest trauma center.

Perhaps the best triage system is one that employs a combination of criteria from mechanism of injury, anatomical region and type of injury, pre-existing illness and paramedic judgment combined with physiological data, help to determine whether a patient requires transport to a designated trauma center.

METHODS OF TRANSPORT

The principle is to move the trauma patient to the receiving hospital as quickly and as safely as possible. Since outcome is directly related to time to definitive care, the quickest mode of transport that assures patient safety should be chosen. However, choosing the best mode of transport can be dependent on the distance geography, weather and patient status, as well as the availability and skills of the transport personnel and the equipment that are likely to be needed during transport.

Several options are available at major trauma centers, including ground transport, helicopter and fixed wing air transport.

The main benefit of air transport, in terms of patient survival, is its use for long distance transport. However, air transport is subject to unique complications found specifically when a patient is taken up to high altitudes. These include expansion of gases within body cavities such as the thorax or abdomen, as well as potential spaces such as tissues with gas gangrene or penetrating eye injuries. This phenomenon can also occur with equipment such as air splints used for limb stabilization and endotracheal cuff balloons. When used in an air transport setting, these devices must be periodically checked to prevent tissue ischaemia from compression. The available working space within most air transport vehicles is significantly less than that found in ground transport vehicles.

TRAUMA CENTRE WITHIN A TRAUMA SYSTEM

Hospital categorization as a designated trauma center is divided into four levels. While all four levels are maximally committed to the care of the trauma victims, the distinction between them is the availability of resources and personnel capable of caring for the acutely injured patient.

LEVEL-I TRAUMA CENTRE: The level I trauma centre should be a regional resource centre and will generally serve large cities or population-dense areas. This institution will usually serve as the lead hospital for a system. In larger population-dense areas, more than one Level-I may be needed. Specialized personnel and services are available 24 hours a day. Surgeons with special skills to treat injured patients facilitate an immediate diagnosis, surgery and critical supportive care. Operating rooms, anesthesia, blood bank, computed tomography scan and so forth are available 24 hours

a day. Emergency physicians, Neurosurgeons, Orthopedic surgeons, and other surgical and medical specialists will be available within minutes. This institution is expected to manage large numbers of injured patients with a certain severity level of injury. These centers are expected to admit at least 1200 trauma patients yearly and of those 20 percent will have an Injury severity score of 15 or greater, or there will be 35 patients per surgeon with an injury severity score of 15 or greater. The trauma director using the trauma performance improvement program is responsible for determining each general surgeon's ability to participate on the trauma panel. This will be based on annual review of each surgeon's performance in the trauma program. Qualified general surgeons are expected to participate in major therapeutic decisions and be present in the emergency department for major resuscitations and at operative procedures in all seriously injured patients.

The 24 hour in-house availability of the attending surgeons is the most direct method for providing this involvement. A post-graduate resident may be approved to begin resuscitation while awaiting the arrival of the attending surgeon but cannot be considered as a replacement for the attending surgeon in the emergency department. This may allow the attending surgeon to take call from outside the hospital. In this case, local criteria and performance improvement must be established to define condition requiring the attending surgeon's immediate hospital presence. The attending surgeon's participation in the major therapeutic decisions, presence in the emergency department for major resuscitation, and presence at operative procedures are mandatory. Compliance with these criteria and their appropriateness must be monitored by the hospital's trauma performance improvement program. The level-I center is also expected to conduct trauma research and be a leader in education, prevention and outreach activities.

LEVEL II TRAUMA CENTER

The level II trauma center provides comprehensive trauma care in two distinct environments which have been recognized in the ongoing verification program. The first is in a population-dense area where a Level II supplements the clinical activity and expertise of a Level I institution. In this scenario, the Level I and II work together to optimize resources extended to care for all injured patients in this area. This implies a cooperative environment between institutions which allows patients to flow between hospitals, depending upon resources and clinical expertise. The trauma director using the trauma performance improvement program is responsible for determining each general surgeon's ability to participate on the trauma panel. This participation will be based on annual review of the surgeon's performance in the trauma program. Qualified general surgeons will be expected to participate in major therapeutic decisions and be present in the Emergency Department for major resuscitations and at operative procedures in all seriously injured patients. Additionally, the attending general surgeon would be responsible for the timely evaluation of every trauma admission.

Local conditions may allow the surgeons to be rapidly available on short notice. Under these circumstances, local criteria must be established that allow the surgeon to take call from outside the hospital, but with the clear requirement on the part of the hospital and the surgical staff that the general surgeon will participate in the early care of the patient. Compliance with this requirement and applicable criteria must be mentioned by the hospital's performance improvement program.

The second, Level II environment occurs in less population-dense areas. The level II hospital now serves as the lead trauma facility for a geographical area, as a Level I institution is not likely to be geographically close. Many rural areas will use this

model. Volume performance standards will depend on geographic area served, population density, resources available, and the maturity of the system. This lead trauma hospital is expected to have an outreach program which incorporate smaller institutions in their service area. Transfer arrangements with distant Level I or II institutions are dictated by local resources.

LEVEL III TRAUMA CENTER

A trauma system will usually determine the need for Level III trauma centers. Definition of the Level III's role will be aided by communication with Level I and II trauma centers. A Level III will have continuous general surgical coverage. Level III must have the capability to manage the initial care of the majority of injured patients and have transfer agreements with other trauma hospitals for patients that exceed its resources. A resuscitation team will be organized for the severely injured patient. The general surgeon must be promptly available for all major resuscitations. The Level III trauma center must be involved with prevention and must have an active outreach program for its refereeing communities. Level III will conduct education programs for nurses, physicians, and allied health care workers involved with trauma.

LEVEL IV TRAUMA CENTER

The Level IV hospital is usually located in a rural area and will supplement care within a larger network of hospitals. Level IV facilities will provide initial evaluation and assessment of injured patients. Most patients will require transfer to larger facilities that have more resources that are dedicated to providing optimal care for the injure patient. A Level IV facility will have 24 hour emergency coverage by a physician. The hospital has operative capabilities when the surgeon is available. Specialty coverage may or may not be available. It will have transfer plans to handle most patients. The surgeon will respond promptly for the resuscitations of the

injured patient. A resuscitation team will be organized for the severely injured patient. Level IV facilities should be involved in prevention, outreach and education.

TRAUMA RESUSCITATION AREA

The emergency department should have a large space designated as the trauma resuscitation area. If the number of trauma patients is significant or there is little or no pre-hospital notification of patient arrival, this space must be dedicated to the trauma patient. The space should be large enough to allow assembly of the full trauma team plus necessary equipments such as a ventilator and/or portable x-ray machine. The area should be well-lighted and have independent room temperature control devices or heating elements. Materials and equipment necessary for the various jobs of team members should be openly displayed, well labeled and kept in close proximity to the team members who will need them. Examples of this practice include airway and intubation equipment kept at the head of the stretcher, intravenous devices and blood drawing equipment placed near the two sides of the stretcher and chest tube trays located at the sides adjacent to the thorax.

Access to this large space should be relatively limited, and the space should not be confining to team personnel. The design should prevent nonessential personnel from disrupting the resuscitation. In addition, there should be a physical or visual barrier to the entrance beyond which universal precautions are employed, eye protection and fluid impervious gowns and gloves. Ideally for busy trauma centers, the space should be able to handle simultaneously two or three patients. If the facility is limited, protocols must be in effect to adopt the space for a two-patient resuscitation or for performing a "slit" team resuscitation in two different spaces. Last, the space must be designed to allow ease of cleaning and re-setup for additional trauma patients.

Proper handling of patients, clothes, valuables, and bio-contaminated materials must be ensured.

TRAUMA TEAM

The trauma team may vary in size and composition, however, one physician must be in charge and provide overall direction. That responsible surgeon should assume command of the trauma team and move the team efficiently through the various phases of the resuscitation. In some trauma centers, the team may consist of as many as seven to ten members, all responding from within the hospital. In other trauma centers, the organization of the team will likely be based on a rapid communication system that notifies surgeon and team members to respond and supplement as emergency physician and nurse. In some trauma centers, these may be the only in-house personnel. Regardless of size, the keys are organization and protocols that guarantee the rapid assembly and efficient working of the trauma team.

The exact composition of the trauma team will vary according to the "local rules" designed by the trauma service director and the hospital trauma committee. Each team member should have defined roles. Each individual trauma team member must accomplish numerous tasks if the overall goal of patient assessment and stabilization is to occur. These activities include assessment of ABCs (Airways, breathing and circulation) with simultaneous life support, diagnosis of injuries, acquisition of laboratory specimens, initial radiographic survey, and communication and mobilization of any and all necessary hospital resources. Coordination of the multiplicity of tasks can best be accomplished if each team member has assigned responsibilities.

INTER-HOSPITAL TRANSFER

Hospital categorization as a designated trauma center is divided into four levels. While all four levels are maximally committed to the care of the trauma victim, the distinction between them is the

availability of resources and personnel capable of caring for the acutely injured patients. Specific types of injuries, when suspected or diagnosed, may be best treated at designated trauma centers.

These include injuries that will require prompt attention by surgical subspecialty services. Identification of a trauma victim who may benefit from transfer to a designated trauma center is based on specific criteria. A number of factors must be examined when making this decision, including patient status and recognition of possible injuries and co-morbid factors as well as the personnel and equipment resources necessary for optimal patient care.

The physiological criteria that identify a patient as a major trauma victim in the field can also be applied when deciding whether the patient may benefit from inter-hospital transfer. Upon arrival at the emergency department, the central nervous system, cardiovascular and respiratory systems need to be objectively assessed. This can be done using the field triage scoring tools. Derangements in the patient's physiological status should be identified and, to the best of the physicians and initial receiving hospital's ability, stabilized prior to transport. Ongoing deterioration of the patient's status despite resuscitative attempts may benefit from urgent transfer but needs to be managed on a case-by-case basis. Individual physician assessment plays a key role in the transfer of the injured patient. The initial care physician should know what resources are available at that particular hospital. This physician should also be able to recognize serious potential injuries based on mechanism of injury or significant co-morbid factors. If the initial care physician feels that the patient requires transfer for optimal care of the injuries based on any part of this general assessment, the physician should institute transfer to the nearest trauma center.

COMMUNICATION

Efficient communication is the key to an integrated trauma system. Key points of communication for the resuscitation involves the following: Pre-hospital/hospital link for direct medical command and early hospital notification, trauma team alert and activation, pre-hospital provider and trauma teams information transfer, trauma team and intra-facility personnel communication, inter-facility communication.

The radio or phone communication between pre-hospital and hospital(emergency) personnel must (a) be dedicated to medical emergencies, (b) ensure availability of direct medical directive, and (c) provide the earliest possible notification to the hospital's emergency department or trauma center that a seriously injured patient is about to arrive.

The trauma alert should be activated based on predetermined field and hospital trauma triage guidelines. A multiple beeper system should announce the alert with either a voice or digital printout message. The trauma alert should activate and assemble the team. In most instances, the team will be responding from both inside and outside the hospital. The key then is early communication to ensure the arrival of all team members with the patient.

The transfer of the patient from pre-hospital provider to trauma team requires accurate and concise communication of vital data upon arrival. These data should include age, mechanism of injury, vital signs, observed and suspected injuries, and any therapies treatments or medications rendered. In addition environmental factors, times, and other relative circumstances should be relayed. The trauma team leader will integrate this information into the assessment and treatment plan and disseminate it to all members of the trauma team in a timely fashion. The pre-hospital provider must leave a

completed ambulance run-sheet with the team, and, if possible, this should include patient identification and the identification of all emergency medical services and public safety agencies involved in the pre-hospital phase.

QUALIFICATION AND CHARACTERISTICS OF TRAUMA CARE PERSONNEL

The trauma service is established by the medical staff and is responsible for coordinating care of injured patients, the training of personnel, and trauma quality improvement. Privileges for physicians participating in the trauma service will be determined by the medical staff credentialing process. All patients with multiple system or major injuries must be evaluated by the trauma service. The surgeon responsible for the overall care of the patient must be identified.

THE TRAUMA SERVICE DIRECTOR

The trauma service director shall be a board certified surgeon with demonstrated special competence in trauma care. Through the quality improvement process, the director will have responsibility for all trauma patients and administrative authority for the hospital trauma program. The director is responsible for recommending appointment to and removal from the trauma service, along with the medical staff credentials committee and in consultation with appropriate service chiefs.

THE TRAUMA COORDINATOR

The trauma coordinator is fundamental to the institution's trauma program development, implementation, and evaluation. Working in conjunction with the trauma medical director, the trauma coordinator is responsible for the organization of services and systems necessary for a multidisciplinary approach throughout the continuum of trauma care. The trauma coordinator is supervised by the trauma service director and is most commonly an employee of the department of surgery or department of

nursing.

SURGEONS

Board certification is a basic qualification for trauma care for any surgeon. Qualified surgeons must be regularly involved in the care of injured patients. In a hospital committed to trauma care, surgeons with special expertise in trauma should be identified. In level-I and II trauma centers, surgeons should participate annually in the care of approximately 50 or more patients with immediately life-threatening and urgent injuries. Participation in the organization of trauma protocols, trauma teams trauma call rosters, and trauma rounds are clear indicators of commitment to excellence in trauma patient care. Successful completion of the ATLS course is an optimal standard for all general surgeons on the trauma team. If a general surgeon on the trauma team has extensive experience and recognized competence in trauma care, the trauma service director may waive the obligation for the general surgeon to complete the ATLS course. Surgical specialists involved in trauma care are encouraged to participate in trauma related continue medical education (CME) activities on a regular basis.

EMERGENCY PHYSICIANS

Many physicians participate in the care of the severely injured patients in the emergency department. In most Level I and many Level II hospitals, the initial evaluation and resuscitation are led by experienced in-hospital surgical staff. In other institutions, the initial evaluation and resuscitation are performed by an emergency physician. This individual must be a member of the trauma team and should participate in all of the audits and critiques necessary for excellence in trauma care. Emergency physicians should be involved with surgeons in the development of trauma care systems as part of the overall development of emergency medical systems in a community or region. In addition, they should be active in organization contributing to the benefit of

injured patient.

ANESTHESIOLOGISTS

The crucial role of the anesthesiologist in the management of the multiple injured patients is obvious. In addition to responsibilities in the operating room, personnel from the anesthesia department may, under the aegis of the trauma team, plan an important role in preoperative airway control, and resuscitation and act as post operative consultant in cardio-respiratory support and pain control. Anesthesiologists who participate on a trauma team should be appropriately certified, have the necessary educational background in care of the trauma patient and engage in trauma quality improvement and in investigative, teaching, and community activities analogous to those of the surgeons.

MEDICAL CONSULTANTS

Medical specialists including cardiologists, pulmonary medicine specialists, nephrologists and their respective support team (for example, respiratory therapy and dialysis team) should be available for consultation in the care of the multiple injured patients. However, the surgeon should not relinquish the overall responsibility for patient care. In addition to appropriate board certification such medical consultants should have an awareness of the unique problems of trauma patients.

ORTHOPEDIC SURGEON

A qualified orthopedic surgeon is essential for the management of trauma patient. He is needed for the assessment of spine, pelvis, extremities, for application of external fixator and management of fractures. Orthopedic surgeon can be a team leader. Neurosurgeon, Thoracic surgeon, Plastic surgeon, Radiologist etc. not necessarily involved in every trauma call but need to be available to the trauma team immediately.

NURSES

Nursing personnel occupy a crucial position in the care of the injured, and in many centers, the position of trauma coordinator is filled by a registered nurse. The nursing personnel has specific requirements in the emergency department, operating room, recovery room, intensive care unit, and in short and long-term rehabilitation. However, specific commitment to care of the injured can be demonstrated in several ways.

Nurses who participate in the pre-hospital phases are highly trained for their function. They work within well-developed, advanced life-support pre-hospital systems involving both fixed-wing and rotor-blade aircraft.

In the hospital committed to trauma care, the emergency department nursing staff will provide a high level of dedication to and skill in the care of the injured patients. Integration of nurses into the trauma team or service should have a high priority, as does the involvement of nurses in trauma training and research.

ALLIED HEALTH PROFESSIONALS

Allied health professionals such as emergency medical technicians and paramedics, may participate in trauma care in both the pre-hospital and hospital phases. Nurse anesthetists have critical role in perioperational air way control and resuscitation of the multiple injured patients. The radiographer should immediately start with the trauma series of x-rays, in the order cervical spine, chest and pelvis, unless directed otherwise by the team leader. The radiographer should also liaison to the C.T. scan. Laboratory technicians take the blood samples and bring blood from blood bank.

SCRIBE

The scribe is responsible for the full record of the trauma call. A separate individual, either doctor or

nurse should be allocated to this roll. They should be situated near the team leader so that all information passing through the leader is then passed to the scribe. Records must include: Time of arrival, mechanism of injury, personnel present on call, physical findings, vital signs, urine output, Glasgow Coma Scale, results of x-ray and other investigations, fluid administered, drug administered, previous medical history summary of injuries, disposal of patient.

The golden hour starts at time of injury. So most trauma teams will have about 30 minutes to accomplish this and should work towards achieving goal.

REHABILITATION

Trauma results in an acute decrement in the ability of the individual to function. Resulting pathology often leaving individuals with permanent impairments that affect their ability to care for themselves, to fulfill expected social roles, and to return to a pattern of daily activity associated with a meaningful and gratifying existence. Certain injuries e.g. spinal cord or traumatic brain injury affects numerous physiologic, psychological, social and vocational functions to the degree that the individual loses functional independence. The rehabilitation team is responsible for providing services that optimize function, maximize the return to independence, and enable the person to re-establish a meaningful existence. Interventions can involve direct treatment of the patient; education of family members, and recommending equipment and environmental modification to accommodate residual limitations. The rehabilitation team should be involved in the early stages of hospital care; such involvement has been shown to optimize outcome for the trauma patient. Attention to the prevention of disabling complications during the acute phase of treatment can minimize required intervention during the rehabilitation phase of treatment.

Rehabilitation of patients after trauma occurs in several stages, each with a corresponding venue.

Inpatient rehabilitation is required when patients for either physical or cognitive reasons are unable to manage their own basic self-care or mobility needs because of physical limitations. The goal of inpatient rehabilitation is to reestablish capability for basic routines of daily living so that the patient can function safely in the community, with a minimal amount of physical assistance or supervision.

Ideally, patients are restored to the point where they are both physically and cognitively independent, although this is not always possible. Rehabilitation interventions are directed towards minimizing the amount of physical or cognitive assistance that a patient will require on return to the community.

Initial phases of outpatient rehabilitation are directed towards enhancing the ability of the patient to return to active participation in the community outside of the home and to improving the patient's ability to manage more complex instrumental activities of daily living e.g. cooking, laundry, managing finances, home maintenance. These tasks involve more complex organizational and executive skills that are frequently affected in brain injury. Patients may also require assistance with behavioral problems that affect their interpersonal relationships. Residual deficits that limit mobility in the community can also be addressed along with continuing cognitive limitations. This phase of rehabilitation is sometimes referred to as "community re-entry."

The final phase of rehabilitation involves helping the affected individual to return to some form of competitive employment. Referred to as vocational rehabilitation, this involves the training of skills that enable an individual to return to the work place. It can also involve the provision of some assistance services e.g. job placement and job coaching as well as trial placements in voluntary positions in the community.

STEPS IN ORGANIZING A TRAUMA SYSTEM

Public support is necessary to enact enabling legislation that establishes the system. This process is begun by establishing the need for improved trauma care. Resource assessment must be formulated to identify the current capabilities for the system and the levels, distribution, and current operations of all components-including the pre-hospital and hospital providers and facilities-including acute care specialty and rehabilitative facilities. This detailed assessment enables planners to locate deficiencies and create solutions for the system. Legal authority for system development should be established once the need for a trauma system has been demonstrated. Criteria for optimal care must be established by the lead authority in conjunction with health and medical professionals. The adoption of criteria for optimal care and systemize standards are imperative to the success of any trauma system. The most widely recognized guidelines serve as the template for the trauma center designation process. Trauma systems are complex and dynamic organizational structures, with continually evolving standards of care. It is necessary to have a mechanism for on going evaluation. This evaluation process should have two components: self monitoring and external evaluation. Self monitoring requires a defined performance improvement program based on a trauma registry and a system medical audit process. These quality assessment and improvement activities should complement the performance improvement programs performed by the pre-hospital agencies and hospitals/facilities. External evaluation of the system is necessary for the initial development, evolution and improvement of trauma systems.

ADMINISTRATION

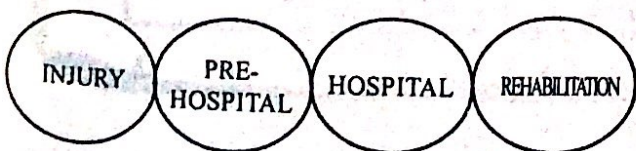
The system requires administrative leadership, authority, planning and development, legislation, and finances. Together these components form an outer sphere of stability that is vital for the continuation of activities directly related to patient care. The diversity of the population like rural, urban or special segments of population like geriatric, pediatric, and so on must be addressed by the system.

Prevention reduces the actual incidence of injury and is cost efficient for the system and for society. Injury prevention is achieved through public education, legislation, and environment modification. Public education leads to a change in behavior and thus minimizes injury exposure. The development of a system is a major challenge for any community. The trauma system will succeed only if all parties are involved in the initial planning, development and implementation.

It is crucial that physicians and particularly surgeons are involved in the system planning process. These physicians should help establish standards for all clinical components and participate in planning, verification, performance improvement and system evaluation.

MULTIPLE AND MASS CASUALTIES

Major civil disasters, war, use of weapons of mass destruction by terrorists, bio-terrorism produces large numbers of casualties and leave many dead. Patient numbers may for a time exceed the capacity of medical team to render normal care. Under these circumstances, it is necessary to sort casualties on the basis of need so that available resources and personnel can render the 'most for the most.' This is 'triage.' Triage assessments and categorization should be delegated to a senior, experienced and trained doctor. Failure to perform correct triage will disrupt optimal management for those most at need and divert scarce resources often to those who can wait. Triage is a dynamic process and needs to be repeated at each level of care from point of injury until arrival in hospital. In general, field triage is for evacuation to hospital. Once in hospital, triage is for access to resuscitation and to operating theatres. Triage means to shift or to sort and refers to the allocation of injured patient into certain categories for action by emergency team. Triage sieve-a quick survey is made to separate the dead and the walking from the injured. Triage sort-remaining casualties are now assessed and allocated to three or four groups according to local protocols.



Category I - Critical and cannot wait e.g. airway obstruction and catastrophic hemorrhage.

Category II - Urgent, seriously injured but can wait a short time, 30 minutes in most systems.

Category III - Less serious injuries. Not endangered by delay.

Category IV - Expectant, severe multi- system injury, survival not likely.

Implementation of disaster plans helps to manage mass casualties effectively and efficiently.

WHERE DO WE STAND ?

It is doubtful that anyone in Nepal either at home or outside the home is immune to the effects of the terrorist attack. Health professionals cannot prevent the primary attack but it will be the responsibility to manage the victims of attacks. The management of any type of trauma victims is done at trauma systems which starts from injury site through pre-hospital service, in-hospital service and to rehabilitation of the injured patient. So far we have not developed trauma systems in our country which is already overdue. In the military setup, few components of trauma systems are functioning. Pre-hospital service and transportation of casualties, hospital services are available but completely lacking rehabilitation component of trauma systems and accident and emergency department. There is no categorization of trauma centers. Army has large trauma patient admitting area but lacking resuscitation beds although near to trauma admitting area has 2 bedded resuscitation rooms which is not in active use at present. Disaster plans are present and becoming very useful during mass casualties situations. The modern management of injured patients should be in trauma systems therefore it is essential to develop National Level and Regional Level trauma system in Nepal.

CONCLUSION

Trauma remains one of the leading causes of death and disability throughout the world. Trauma is a national health problem best dealt with a coordinated system ensuring prompt access to optimal care and rehabilitation. Modern management of trauma victims should be at trauma systems. Trauma

systems have equalize access of patients in both urban and rural environments to similar level of care, reduce death and disability , create a formalized continuum from accident scene to rehabilitation and provide a mechanism for continuous quality improvement of the system.

REFERENCES

1. Baily and Love's Short Practice of Surgery, 23rd edition. Edited by RCG Russell, Norman S. Williams and Christopher J. K. Bulstrode.
2. Essential Surgical Practice. Basic Surgical Training, 4th edition. Edited by Sir Alfred Cuschieri, Robert J.C. Steele and Abdool Rahim Moossa.
3. The Trauma Manual, 2nd edition, Andrew B. Peitzman, Michael Rhodes, C. William Schwab, Donald M. Yealy, Timothy C. Fabian.
4. Surgery for Victims of War. D. Dufour, S. Kromann, M. Owen-Smith, J. Salmela, G.F. Stening, B. Zetterstrom
5. Pre-hospital Trauma Care. Eldar Soreide, 2001 Marcel Dekker, INC.
6. Current Therapy of Trauma. Donald D. Trunkey, M.D., F.A.C.S., 1999 Mosby, INC.
7. PHTLS-Basic and Advance Pre-hospital Trauma Life Support. 1994 Mosby-year book, INC.
8. Penetrating Trauma. Rao R. Ivatury, M.D., M.S (surg.), F.A.C.S., F.R.C.S(C), Williams and Wilkins, 1996.
9. Complications of Trauma. Kenneth L. Mattox, M.D., Churchill Livingstone INC. 1994.
10. Trauma Anesthesia and Critical Care. Chief Christopher M. Grande, M.D., 1993 Mosby-year book, INC.
11. Management of Trauma-Pitfalls and Practice. Robert F. Wilson, M.D., 1996 Williams and Wilkins.
12. Resources for Optimal Care of the Injured Patients. 1999 Committee on Trauma, American College of Surgeons.
13. Advances in the Military Management of Mass Casualties. Antopol M.R. In: J G West(ed) Trauma Care Systems, New York, Praeger, 1983.
14. Trauma Center design, Cleveland H. C., Mitchell F. In: Moore E, Mattox K L, Feliciano D V(ed) Trauma, Norwalk, C T, Applet and Lange, 1990.
15. ABC of Major Trauma. 3rd edition. Edited by Peter Driscoll, David Skinner and Richard Earlam.



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