

Initial assessment and stabilization of Poly-Trauma Patients

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ABSTRACT

Poly-trauma is severe injury to more than one organ system or physical regions, one of which will be life threatening, hence the name poly-trauma or multisystem trauma. Like heart disease or cancer, trauma is also a disease, as it has identifiable causes, established method of treatments and defined methods of prevention. Overall trauma is the sixth leading cause of death and third major cause of disability in the developed countries but, it is the second leading cause of death in the developing countries. Majority of deaths due to trauma occur between 15 - 44 years of age. The deaths due to trauma occur in trimodal distribution. The first peak occurs within seconds to minutes due to airway obstruction, ventilation failure or injury to the vital organs like brain, the second peak occurs within minutes to hours due to exsanguinous hemorrhage or due to rupture of major vessels like aorta and the third peak occurs over days to weeks due to sepsis or multi organ failure (MOF). Trauma can be best managed through the algorithm derived by American College of Surgeons committee on trauma (ACSCoT) called Advanced Trauma Life Support (ATLS) guide lines.

The principle of treatment is the identification of life threatening injury and its correction before moving on to the limb threatening injuries. The components of the trauma management are Primary survey, Resuscitation, Secondary survey and Definitive care. Management of trauma requires broad knowledge, sound judgment and technical skills through an organized and structured team approach. Critical care specialists play a vital role in stabilization and diagnostic features of trauma care. What happens in this period often determines the outcome of care.

KEY WORDS: Poly-trauma, Trimodal, Primary Survey, Secondary Survey, Definitive care.

Introduction

Poly-trauma or multisystem trauma, is defined as severe injury to more than one physical region or organ system, one of which will be life threatening [1].

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Poly-trauma involves injury to two cavities with the fracture of one long bone or injury of one cavity with the fracture of two long bones. Trauma can lead to immediate death due to exsanguinating hemorrhage, intracranial hemorrhage with injury to the brain or pathological pressure in the thoracic cavity (tension pneumothorax). Trauma is the leading cause of death below 44 years in both developed and developing countries.

The death in poly-trauma occurs in trimodal distribution. The first peak occurs within seconds to minutes after injury, the second peak within minutes to hours after injury

(hemorrhagic shock) and the third peak occurs in days to weeks due to sepsis or multi organ failure (MOF). It is in the second peak period, resuscitation and life saving surgery performed can save most of life and patients can lead a normal life span hence, the interval is called golden hour[2] .

Management of poly-trauma patients involves organized team approach (trauma team) through the algorithm derived by American college of surgeons committee on trauma (ACSCoT) called as Advanced Trauma Life Support (ATLS) [15]. The principle of treatment is life threatening injuries are identified and treated before moving on to the limb threatening injuries.

Trauma Care

Trauma is a serious problem, in America alone more than 1.2 million people die each year due to road traffic injuries. It is estimated that by the year 2020, 8.4 million people will die every year from injury. Injuries from road traffic accidents are the third most common cause of disability in the developed world but 2nd most common in the developing world. The management of seriously injured patients requires rapid assessment of injuries and initiation of life preserving strategy through a team approach (Trauma team). Priorities of care include- Preparation, Triage, Rapid primary survey (ABCDE), Resuscitation, Adjunct to primary survey, Consideration and need for patient transfer, Secondary survey (Head to toe evaluation and patient history), Adjunct to secondary survey, Continued patient resuscitation , Monitoring - evaluation and Definitive therapy.

Trauma Centers

Trauma centers are dedicated health care providing hospitals or institutions in the order of hierarchies (excellence) include Level I to Level V and Dedicated paediatric trauma centers.

Level I (highest trauma care) centers will have a team of doctors well versed with advanced trauma care. The team includes, Team leader, neurosurgeons, orthopedic surgeons, surgeons trained in trauma care, anaesthesiologist, ENT surgeons, physicians, cardiothoracic surgeons, interventional radiologist, plastic surgeons, nurses, technicians and other paramedics. The centre will be with well equipped blood bank (with all blood components) working 365 days (24x7). Research activities and training programmes are routinely carried out throughout the year centre receives the poly-trauma patients from other lower order centers i.e. Level II to V as well as pediatric trauma centre for the management of sick patients. Level II and III will provide necessary services to trauma victims if available facilities need further assistance then the patients are transferred to the Level I centre for further management. While, Level IV centers will resuscitate the poly-trauma patient with the available trained specialist and transfer to the higher centre for further management. Level V centre will resuscitate for life threats and subsequently transfer to the ideal excellent centre for the further management.

Rather than the most obvious injury, life threatening problems like airway obstruction, ventilation problem, compression of heart (cardiac- tamponade) kill the patient. So, the correction of this life threat is most important and should be within 10 minutes of pre-hospital care, this period is called "platinum 10 minutes" of the golden hour. The Golden hour truly speaking, "golden period" of a particular poly trauma patient, is the period following the injury to the achievement of hemostasis. Aim is to prevent occult hypo perfusion and metabolic failure. The metabolic failure with on - going blood loss can lead to lethal triads of death due to trauma i.e. Hypothermia, coagulopathy and acidosis. If the patient is properly managed further secondary injury to

the vital organs can be prevented. The Golden period includes the time from the injury to the time of achieving hemostasis in the operation theatre, but not just the transfer from the scene of occurrence to the emergency department or operation room.

Actual management of the trauma patient occurs in two phases: Pre hospital phase and the hospital phase.

Pre Hospital Phase

Pre hospital phase covers the services provided at the scene of occurrence, by the bystanders, fire fighter service providers and the team from trauma center or Emergency Medical Service providers (EMS) with emphasis mainly placed upon – Airway maintenance, Immobilization of patient and immediate transfer to the nearest appropriate facility.

Hospital Phase

In the hospital setting advanced planning before trauma victim arrival is essential. Place should be organized, resuscitation equipment, airway equipment appropriate monitoring facilities should be kept ready and warm crystalloids should be primed and kept ready for infusion .

Triage

Triage is sorting of patient based on the needs for treatment with resources available for that treatment. The patients are categorized with immediately life threatening problems, potentially life threatening problems, minor injuries and already dead. Assessment judged by the ability to walk, maintain the airway, respiratory rate, tissue perfusion by capillary refill.

Patients labeled with different tags–Red, Yellow, Green and White [4]. Red tag represent patients with immediate threat to life requiring immediate attention e.g. – Tension pneumothorax.

Yellow tag- patients with potentially life threatening problems, requiring urgent attention e.g. – Fracture of femur.

Green tag- patients with minor injuries and they can walk out with the first aid treatment e.g. – Sprained ankle.

White tag- those with absent reflex activity and respiration, presumed to be dead and time is not unnecessarily wasted in assessing these patients at the time of emergency.

Complexity of the multi trauma patient demands the trauma victims to be managed by team approach. The urgency often demands the treatment based on initial survey of vital organ system followed by resuscitation. Sometimes injuries are missed in unconscious patient, so there is need for frequent reassessment.

Priority in the management includes high priority areas and low priority areas.

High priority areas: include Airway, Breathing, Shock (Hemorrhage control) and Cervical spine stabilization.

Low priority areas: include neurological, abdominal, cardiac, musculoskeletal and soft tissue injuries.

Primary Survey

Include assessment of life threatening injuries through the- ABCDE approach.

Airway

Establishing and maintaining an airway is always the top priority. If patient can talk airway is usually clear but unconscious patient will require airway and ventilation assistance. The Signs of airway obstruction include- snoring, gurgling and paradoxical chest movements. When the airway cannot be protected i.e. Glasgow coma scale below 8, patient unable to maintain Oxygen saturation more than 95%, unconscious patient with

major trauma (increased risk for aspiration) or with inadequate ventilation (Respiratory rate below 10 or above 30) patient requires intubation[8,9]. Cervical spine injury is unlikely in alert patients without neck pain or tenderness. However, cervical spine fracture must be assumed in presence of neck pain, any neurological signs and symptoms associated with trauma as well as in intoxicated patient. The incidence of cervical spine fracture is approximately 2 %, but in the presence of head injury it may go up to 10%. Hyperextension of the neck should be avoided in suspected cervical injury in such patient jaw thrust maneuver is preferred over chin lift. Manual in line stabilization (MILS) techniques should be used to stabilize the cervical spine during laryngoscopy[9,16-20]. While the Patients with maxillofacial injury, penetrating neck injury (expanding haematoma) and chest injury require cricothyrotomy or tracheostomy.

Breathing

Breathing is assessed by the position of tracheal deviation, respiratory rate and movements of chest. Asymmetrical chest wall movement with hyper resonant percussion note along with the absent breath sounds reveal tension pneumothorax.

Tension pneumothorax is treated by inserting 14 or 16 gauge needle into the 2nd intercostal space in the midclavicular line. Inter costal drain in the 4th or 5th intercostal space in the midaxillary line will be performed for massive haemothorax and pneumothorax. Ventilation supported with 100% oxygen to maintain SpO₂ more than 95%.

Circulation

Hemorrhage is the most important cause of preventable death after injury. Hypotension after injury is always hypovolemic unless proved otherwise.

Adequacy of circulation is assessed by the vital organ perfusion. Easiest way to assess the perfusion is the capillary refill which should be less than 2 seconds.

Presence of radial pulse reveals systolic pressure of >80 mmHg, while palpable femoral pulse exhibits systolic blood pressure >70 mmHg and palpable Carotids exhibits systolic pressure >60 mmHg. Significant external hemorrhage is controlled by compressive dressing, otherwise the bleeding vessels are ligated and tourniquet should be used as a last resort. Open chest wound of the size of 1 1/2 times diameter of trachea results in sucking wound, such wound should be packed with three dimensional occlusive compressive dressing. The circulatory volume should be supported with two large bore intravenous cannulae of size 16 or 14 G, with rapid administration (infusion) of warm IV fluids viz; Ringer lactate or Normal Saline. Paediatric patients administered IV fluid at the rate of 20 ml / kg (Body weight) BW. Basic shock therapy applied with Medical Anti shock Trouser (MAST) or Pneumatic Anti Shock Garments (PASG) to restore the normal body temperature between 36 – 38 ° C.

Disability and Neurological Evaluation

A rapid neurological evaluation is done at the end of primary survey by evaluating the level of consciousness by AVPU

- A – Alert
- V – Response to verbal commands
- P – Response to Pain
- U – Unresponsive

Pupils are windows of CNS. They are assessed for the size, equality and responsiveness to light.

Glasgow coma scale (GCS) is a quick simple method for determining the level of consciousness and it predicts the patient outcome.

The integrity of higher functions are assessed to rule out CNS involvement.

Exposure

Patient fully undressed, to facilitate a thorough examination and evaluation (detect unseen injury and external bleeding). Care should be taken to avoid hypothermia.

Adjuncts to Primary Survey

Include ECG, ABG, pulse oximetry, End tidal CO₂, X-Ray chest, X-Ray cervical spine. Catheterization of the bladder and decompression of the stomach carried out.

X-Ray cervical spine can be delayed, when the neck has been stabilized and well controlled with cervical collar. Once, cervical spine is stabilized other life threatening threats will require attention while X-Ray cervical spine can be carried out during secondary survey along with X-Ray pelvis and other radiological examinations.

If the available resources are inadequate as seen in level 3–4 trauma centers, considering the need for transfer is an important step at this stage.

Secondary Survey

Once the life threatening problems are assessed and controlled, one should go for detailed history and physical examination by secondary survey. The rule of thumb is secondary survey should be performed only when life threatening problems are managed and ruled out, with resuscitation efforts under way with the normalization of vitals.

Detailed history with regard to nature of injury –blunt or penetrating, cold or hot, fire arm injuries, suicidal or homicidal injury gathered through the history. Detailed examination from head to toe should be carried out systematically in the order head, face and Neck, Chest abdomen with Pelvis, extremities and Back. They are carried out in the same order for each and every patient including reassessment of all vital signs by

AMPLE– Allergy, Medications, Past history of illness, Last meal and Event.

Body should not be unnecessarily moved to avoid inadvertent injuries. If necessary, body should be moved like log of wood by 4 –5 people with the manual in line stabilization of neck (MILS), taking care of head and airway.

Adjuncts to secondary survey

Specialized tests are performed during the secondary survey to identify specific injuries. They include: X-ray of chest, pelvis, cervical spine and extremities, USG (FAST) – focused abdominal sonography for trauma and PAN CT or multi detector CT of the whole body. Even though PAN CT is good for proper diagnosis and to plan for definitive care it should be planned only when the patient is hemodynamically stable [5].

Reevaluation

Trauma patient must be reevaluated constantly to ensure that new findings are not overlooked and assess deterioration in previously noted findings.

Resuscitation

Hemorrhagic shock is the main cause of shock in poly trauma patients. Inappropriate treatment leads to cell hypoxia and death. Intravenous infusion of fluids is the main therapy for patient stabilization and reduction of shock effects.

The main goals of therapy are restoration of macro and micro circulation.

Stabilization include:

- (a) Optimization of mean arterial pressure (MAP), heart rate and urine output, at least 0.5 ml/kg B.W./hr.

- (b) Venous preload, cardiac output (CO) mixed venous oxygen saturation (SvO₂), oxygen delivery (DO₂) and maintaining regional hemodynamics (Splanchnic circulation)
- (c) Normalization of laboratory markers of hypo perfusion (lactates, pH, base deficit).

Aggressive volume resuscitation is binding to achieve required tissue oxygenation. However, empirical fluid infusions and blood are closely connected with overload of intravascular and extra vascular compartment.

Hypothermia, coagulopathy and abdominal compartment syndrome are the complications of large volume resuscitation [21]. Transfusion related acute lung injury (TRALI) and transfusion related circulatory overload (TRCO) remain leading cause of transfusion related mortality. Normalization of blood pressure not advised when there is an ongoing blood loss with internal cavity injuries. Normalization of BP results in disruption of organized clot and continued hemorrhage. Subsequent transfusion of blood results in hypothermia leading to coagulopathy, hypoperfusion and acidosis. Lethal triad's hypothermia, acidosis and coagulopathy are easy to prevent than cure.

Damage control resuscitation (DCR) is a systematic approach to major trauma related catastrophic bleeding, airway, breathing and circulation paradigm with a series of clinical techniques from point of wounding to definitive treatment in order to minimize the blood loss, maximize tissue oxygenation and optimize outcome. The damage control surgery (DCS) is a well established concept and consists of an initial time limited operation to save life (usually less than one hour), followed by a period of "haemostatic resuscitation" in the intensive care unit, then further definitive surgery. Nowadays, early total care (ETO) is

delayed to avoid 2nd hit and complications. While resuscitating the severely injured poly-trauma patient the concept of haemostatic resuscitation is carefully balanced with that of hypotensive resuscitation. In hypotensive resuscitation the aim is to achieve a systolic blood pressure (BP) of 80mmHg in poly-trauma patient without head injury and systolic BP of 90 mmHg in case of head injury or spinal cord injury to maintain cerebral perfusion and tissue oxygenation. Interleukin -6 is increased in the trauma post -OP period and remain elevated for a period of 5 days; patient will not be fit for definitive surgery for 4-5 days. Poly-trauma patient will be suffering from severe pain which will result from release of stress hormone and inflammatory markers into the circulation. The management of pain through the multiple drugs and multimodal technique is important. Stress response to trauma results in neuro - endocrine, metabolic, immunologic and inflammatory response. Chemical mediators like bradykinin, tumor necrosis factor, substance P, histamine, cytokine and serotonin are released into circulation with global inflammatory response.

"Prevention is better than cure"

Proper health education and the knowledge with regard to objects that can distract the motor vehicle riders like the use of mobile phone while driving, mobile texting, driving after consuming alcohol or drugs should be widely disseminated. Importance of wearing Seat belt to prevent thoraco- abdominal trauma (4 wheeler drivers) and helmet for motorcycle rider to prevent head injury should be stressed.

Summary and Conclusion

The management of poly-trauma patient starts in the field with pre hospital care continued in emergency department, Operation room and ICU (Intensive trauma care center). Trauma is like a sport and the Patient wins, when all

the members of trauma care in the field, in the trauma center and in operation room work together with a common goal of saving the individual patient.

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