



POLYTRAUMA DUE TO ROAD TRAFFIC ACCIDENT WITH DIAPHRAGMATIC RUPTURE, COMPLICATED BY TRAUMATIC BRAIN INJURY.

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ABSTRACT Polytrauma with traumatic brain injury due to road traffic accident involving multiple rib fracture, long bone fracture, pneumothorax, surgical emphysema and rupture of the left hemidiaphragm poses a serious initial pathophysiologic challenge in the form of onset of "Lethal triad" i.e., metabolic acidosis, hypothermia and coagulopathy. Such patients need a proper triage, admission into a well equipped and committed trauma care centre with multispecialty departments, a well equipped ICU and round the clock interventional radiology, laboratory facility. Adoption of "Damage control surgery" can prevent "Second hit" injuries and improve survival.

KEYWORDS : Polytrauma, traumatic brain injury, diaphragmatic rupture, multiple bone fracture, surgical emphysema.

INTRODUCTION:

Polytraumatised patients are those, who have sustained multiple traumatic injuries involving two or more organs. With the adoption of effective triage and standardized protocols for polytrauma management since more than a decade, there has been a reduction in the overall morbidity and mortality. These trauma protocols include prehospital and trauma scoring methods like Advanced Trauma Life Support (ATLS), Glasgow Coma Score (GCS), Injury Severity Score and Revised Trauma Score^{1,2}. The concept of Damage Control Surgery (DCS), is helpful, especially in polytrauma patients with immediate life threatening injuries. The most common cause for blunt injury due to polytrauma is motor-vehicular accident, followed by fall and direct violence, though penetrating injuries, due to stab wounds, gun shot, blast injuries and industrial accidents are less frequent but carries a higher mortality³.

CASE REPORT:

A 40 years male admitted to the neurosurgery department with polytrauma sustained while on a bicycle, met with RTA due to collision with a bike, being thrown to about 20 feet & dashed with a roadside large stone. He was unconscious since the accident, vomited twice in-between, but without seizure. On examination PR- 104/min, BP- 102/68 mmHg, R/R – 38/min, Temp. - 99.2^o F. His GCS was 3/15. Chest examination revealed diminished breath sound on right side. Examination of the abdomen was soft, mildly distended, nontender, no palpable organomegaly or free fluid & diminished bowel sounds. He is not a known case of DM/HTN/CAD/BA/any addiction. NCCT Head showed thin acute SDH at left fronto-temporo-parietal convexity. Multiple hemorrhagic contusion within B/L frontal & right fronto-temporo-parietal lobe, linear fracture of left lateral orbital wall, greater wing of sphenoid & left fronto-temporo-parietal bone. Urgent NCCT thorax done revealed right tension pneumothorax with complete collapse of right lung and left sided moderate hemopneumothorax with B/L subcutaneous & deep fascial emphysema in thorax. Contiguous fracture of 2nd-7th ribs on left side, comminuted fracture of scapula & multiple foci of left lung contusion. Discontinuity & thinning of left hemi diaphragm in its peripheral part suggestive of diaphragmatic rupture with massive pneumoperitoneum. He was immediately intubated & put on ventilator with ICT placement on right side.

Blood investigations including CBC, RBS, blood urea, serum creatinine, serum electrolytes, ABG & ECG all found within normal limits. Chest X-ray showed consolidation of left middle & lower zones, surgical emphysema, 2nd to 7th ribs fracture with ICT in place on right hemithorax. X-ray of extremities revealed fracture of lower end of tibia, fibula & fracture medial malleolus on left leg. The attendants were counseled by team of doctors including general surgeon, neurosurgeon, orthopedic surgeon & intensivist about the nature of the polytrauma, need for emergency surgery, guarded prognosis & need for post-op ventilator support. Under high risk consent, exploratory laparotomy was done by upper midline incision extending

below umbilicus. Intra operative findings were pneumoperitoneum, minimal hemoperitoneum, whole of stomach, part of transverse colon, large portion of greater omentum & the upper half of spleen found pushed into left hemithorax through a lacerated rent in it, parajejunal mesenteric laceration. Reduction of contents from left chest cavity by gentle pulling, the diaphragmatic tear found was oblique & posterolateral in location and about 15 cm. size. Thorough lavage of the peritoneal cavity done with normal saline, ICT placed to the left pleural cavity & the diaphragm was sutured by interrupted 1 prolene. Jejunal mesenteric laceration, repaired with 3-0 vicryl. Tube drain was placed in left flank to pelvis. Mass closure of abdomen done with 1 loop ethilon. Orthopedic surgeon applied posterior POP slab to left leg. Patient shifted to neurosurgery ICU under ventilator support. CXR post op after 6hours revealed a good lung expansion with left ICT functioning well. Fractures of lower end tibia & fibula were stabilized by external fixation. Patient was continued on pressure ventilation support due to persistent low GCS because of diffuse axonal injury (DAI). Abdominal sutures removed on 14th day & ICT removed on 20th day on Rt. side & 25th day on left side. Patient GCS improved gradually after 4 wks & he recovered fully by end of 7th week of admission & discharged home 2 days thereafter.

DISCUSSION:

The first hour following trauma is considered as the "golden hour" of trauma and is responsible for a majority of death during this period⁴. This period involves prehospital resuscitative measures taken during initial period at the site of trauma and during transfer to the emergency department and in selected cases, care in the emergency department⁵. Major trauma related deaths occur in three time zones³ as :

- Sudden death in major trauma at the accident site are attributable to catastrophes or lethal injuries like aortic rupture or injury to the brain stem, which in almost all cases are unsalvageable.
- Early mortality occurring within the golden hour are due to blockage of airways, tension pneumothorax, severe traumatic brain injury with intracranial hematomas, cerebral edema or herniation, massive intracavitary (thoracic or peritoneal) or tissue plane or external bleeding (fracture long bone, lacerated major vessels, retroperitoneal bleed).
- Delayed deaths occurring within days to weeks of severe trauma are the result of sepsis, multiorgan dysfunction (MOD) and unresponsive refractile raised intracranial pressure with cerebral edema.

For the better outcome of the severely injured trauma patients, a team effort by health care personnel who are well trained and committed is very essential. The team leader is preferably a trauma surgeon or an emergency medicine trained physician⁷ with his immediate support as physicians, a well equipped radiology and laboratory facility, well trained and committed nursing and technical staffs. The severe trauma care personnel are supposed to be periodically updated with the ATLS algorithm as followed by American College of Surgeons⁸.

The severely injured polytrauma patients needs early restoration of the “Lethal triad” that includes metabolic acidosis, hypothermia and coagulopathy, preferably in the ICU and prolonged surgical interventions are possibly avoided till then in order to prevent lethal “Second hit” injury⁹. The concept of “Damage control surgery” is based on four phases of assessment and management as :

- (1) life saving surgery like acute decompression of tension pneumothorax, cardiac tamponade, traumatic pneumo- or hemothorax or a large epidural hematoma.
- (2) salvage operation for the control of hemorrhage as in massive hemoperitoneum, hemothorax, retroperitoneal hematoma due to pelvic ring disruption and contamination.
- (3) ICU management for the stabilization of physiological and immunologic functions and
- (4) “Reconstructive phase” allowing definitive surgery¹⁰. A secondary survey is done during day 2-4 and include a thorough head to toe examination, neurologic status, concomitant diseases and associated factors as mechanism of injury.

A multislice CT scan is the gold standard investigation in such hemodynamic stable patients¹¹. Adoption of a precise multilevel survey system is very essential for optimized care of severely injured polytrauma patients. Primary survey involves the initial evaluation in relation to the ABCDE i.e., open airways, stabilization of breathing, establishing circulation, disability assessment, evaluation for life threatening injuries and their active management. During secondary survey, the patient is subjected to adjunctive measures like FAST (focused assessment with sonology for trauma), chest, spine, pelvic and suspected long bone X-rays. Multispecialty evaluations, laboratory tests, CT scans, and necessary interventions (medical, surgical and radiological) are to be followed as necessary without delay.

A tertiary survey conducted within 24 hours of hospitalization obviates injuries missed during prior surveys and management¹². Certain categories of patients with severe polytrauma need special care like extremes of age, pregnancy, patients with associated comorbidities like diabetes, renal, cardiac or pulmonary disorders, patients on anticoagulants or immunosuppressive drugs etc. So also is the importance of early detection and active management of secondary illnesses or complications arising during the hospital course, like local or systemic infections, aspiration pneumonia, stress ulceration, worsening of comorbid conditions or thromboembolism. In order to improve and optimize survival, an intensive and strategical approach further include “Damage control surgery” with an aim of delaying the definitive management of injuries till the immediate physiologic stabilization is achieved as far as practicable¹³. Delayed primary surgery are carried out within first 24 hours and aimed at saving injured limbs and joints, decompressing different compartments like abdomen, chest, extremities, spinal cord or cranial cavity and tried to be achieved within short time in order to avoid an iatrogenic “Second hit” that compounds the poorer prognosis. During days 2-4 after trauma, the patho physiological phase of hyper inflammation, that runs a higher risk for “Second hit” injury and likewise, the immunosuppression during 2nd-3rd week, necessitates the avoidance of surgical intervention during these periods for better outcome. The next physiological phase is between days 5-10 after trauma called “time window of opportunity” and is best for carrying out scheduled definitive surgical procedures like soft tissue repair or secondary wound closure, correction of unstable vertebral fracture and open reduction and internal fixation of long bone and pelvic ring fractures¹⁴.

TABLE -1: PATIENT'S PHYSIOLOGICAL CONDITION DETERMINES THE PRIORITIES OF SURGICAL INTERVENTIONS IN POLYTRAUMA PATIENTS.

| Physiological condition | Surgical intervention | Timing of surgery |
|---------------------------------|--|-------------------|
| Vital functions – compromised | Life saving surgery | Day-1 |
| Vital functions – stable | Delayed primary surgery | |
| Vital functions – very unstable | Damage control surgery | |
| Hyper inflammation phase | No surgery – 2 nd look only | Day 2-4 |
| Window of opportunity | Scheduled definitive surgery | Day 5-10 |
| Immunosuppression phase | No surgery | Day 11-3wks |
| Recovery phase | 2 nd ary reconstructive surgery | After 3 wks |

CONCLUSION:

The significance of polytrauma care in the hope of an optimized survival outcome as has been discussed, actually depends on factors like properly instituted triage and emergency care at accident site, time interval from injury to care by the trauma unit or emergency department, importantly patient transport to the nearest appropriate hospital (not necessarily the closest) by the adoption of “Rule of 3 R's” by Donald Trunkey i.e., “get the Right patient to the Right hospital in the Right time”¹⁵. A patient who recovers from the severe polytrauma may often require, multispecialty long-term recovery measures including physical, speech and occupational therapies, as well as prolonged neurology and psychiatric care.

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