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POSSIBILITIES AND QUESTIONS OF NATO EMERGENCY CARE SYSTEM. BLUNT THORACIC INJURIES AFTER HIGH ENERGY TRAUMA – THERAPEUTICAL STRATEGIES AND EXPERIENCES.

The medical challenges are often more complicated than just a simple clinical case problem in operational area. Their solution requires not only clinical skills, but also effective communication, cool head and confidence. The author discusses here blunt thoracic injuries with focus on multinational medical task force. Professional surgical challenges in operation area sometimes play a joke with the physicians, but with well built multinational teamwork they can be managed.

Edwin Smith Surgical Papyrus, written in 3000 BCE. Galen reported attempts to treat gladiators with chest injuries with open packing. In 1635, Labeza de Vaca first described operative removal of an arrowhead from the chest wall of an American Indian. 1814, Larrey (Napoleon's military surgeon) reported various injuries to the subclavian vessels. Rehn performed the first successful human cardiorrhaphy in Germany in 1896. Penetrating trauma to the thoracic vessels was not extensively reported until the 20th century because of the absence of survivors. In 1934, Alfred Blalock was the first American surgeon to successfully repair an aortic injury.

Guidelines for treating thoracic trauma were not established until the World War II. Our experiences is developed in Afghanistan since 2003 to 2006 (Kabul, ROLE 3 German Hospital ,ROLE -2 Greek Hospital ).

The author is evaluates therapeutical strategies and outcome of sever trauma patients with thoracic basket and report early and late effects for thoracic wall visceral coating of severe chest wall injury and polytrauma.

In the seventh and eighth decades of the last century, huge developments in science and technology were also reflected in the operation theatre and intensive care units. Trauma and thoracic surgeons at that time took up the challenge of trauma surgery more aggressively for complete repair of complex injuries at the first chance. The patients could survive the initial onslaught but soon they succumbed to a new kind of clinical situation. Conditions like shock lung syndrome or ARDS (Adult Respiratory Distress Syndrome), SIRS (Systemic Inflammatory Response Syndrome), MODS (Multi Organ Dysfunction Syndrome), MOF (Multiple Organ Failure) were recognized and ultimately, the majority of these patients died early in the postoperative period.

Damage control management is a general term including all activities concerning medical treatment, communication and evacuation starting from primary damage control surgery and ending with definitive medical care.

Damage control resuscitation comprises all resuscitative, anaesthesiologic and intensive care activities concerning damage control management, will provide ongoing critical care monitoring and treatment. Damage control surgery is one component of the overall management of the severely traumatized patient. It includes those techniques that are used to save life or limb in the potentially unstable patient. It is used in conjunction with other anaesthetic and intensive care techniques for the overall management of the trauma patient. This type of care will be provided at any level of surgical facility.

Figure 1.: Gunshot injury of arm

Figure 2.: After skin transplantation
The theory of damage control was developed in an effort to improve outcome in patients with vascular and multi-organ injuries, who had 40%–60% morbidity rates. The principles of the first 'damage control' procedure then are control of haemorrhage, prevention of contamination and protection from further injury.

Damage control of chest injuries has a different philosophy than that of abdominal injuries. Damage control in the abdomen primarily consists of multiple staged operations with abbreviated closures. Damage control in the chest consists of different technical manoeuvres to use quicker and technically less demanding operations to accomplish the same goal.

Only a small percentage of trauma patients require damage control measures and early identification of these cases produces optimal results. The principles of the first 'damage control' procedure then are control of haemorrhage, prevention of contamination and protection from further injury. The conventional sequence of the management of trauma surgery was to bring the patient to the operating room after initial resuscitation and then to operate for complete repair of the injuries. Even patients with multiple complex injuries were operated more aggressively over a prolonged period of time for definitive primary repair.

Thoracic trauma is a very important choice of mortality in the trauma patient, the complex injuries thoracics deserve stabilization techniques which guarantee the survive as far the surgical correction, beginning the concept of «damage control». In thorax to make use emergency room thoracotomy, tractotomy and vascular control pulmonary hilium and chest wall stabilisation.

Chest wall trauma the most common chest injury occurs in about 40 % of all patients admitted with torso injuries. The vital role played by blunt chest trauma in the outcome after multiple injuries in highlighted by the fact that polytraumatized patients with severe thoracic trauma have a higher mortality rate than patients with the same injury severity without thoracic trauma. Blunt chest trauma is frequently present in patients with multiple traumas. In polytraumatized patients thoracic injuries have significant influence on the treatment strategy, not only in the emergency room but also in the intensive care unit.

Therefore it is crucial for the treating physician to promptly make the correct diagnosis and to quantify the severity of the injury.

Within the broad category of thoracic trauma, there are many different types of injuries. Mortality rate (18 %) markedly decreased in patients with stable hemodynamic despite a relatively high ISS (Injury Severity Score). Patients with persistent hemodynamic instability had a mortality rate of 18 %. As such, it is a source of morbidity and mortality and an additional expense for the institutions that care for these patients.

Mortality is well decreased by primary definitive treatment (debridement, stabilisation). The most common associated visceral injury is myocardial contusion, which can lead to significant arrhythmias and hemodynamic instability. More rib are fractured, there is progression of pathophysiologic findings, including ventilation / perfusion abnormalities, increase of respiratoric work, hypoxemia and decrease in the functional residual capacity. There are especially common when multiple rib fractures result is flail chest.

The bellows action of the chest wall muscle reduces, leading to further abnormalities in ventilation. If the flail segment is large enough, this segment may collapse during inspiration. There is an associated atelectasias and shunting of blood in the larger contusions, either of the chest wall or the lung. Compliance decreases and airway resistance increases, the associated decrease in pulmonary diffusion and increase in respiratory work in additive to that contributed by the chest wall defect. Blood trapped within the pleural space impairs its own absorption and acts as an ideal culture medium for bacterial proliferation. Posttraumatic empyema remains a significant clinical problem occurring in 2-10 % of victims with thoracic trauma. Many of the factors responsible for the development of posttraumatic empyema are preventable and iatrogenic in nature. Thus treatment of patients in extremis must
be focused on aggressive resuscitation and surgical intervention without extensive diagnostic procedures to effectively control lethal haemorrhage. Chest x-ray has limited value and use in the diagnosis of the chest wall injury. In our experience up to 50% of rib fractures are not evident on plain x-ray. Thus, a reliable CT-independent classification of the severity of thoracic trauma is essential. Thoracic wall visceral coating is disorganised during dislocated fractures of bony chest wall resulting in the communication of intra- and extrathoracic field. Fractures of the clavicle are common and rarely cause major pathophysiologic changes. Although painful, they usually do not embarrass ventilation and only rarely are associated with major vessel laceration.

Cardiopulmonary performance is reduced with the detachment of interstitial fibrosus sheet.

Adequate treatment could be accomplished by careful preoperative diagnosis, surgical operation and high level intensive care. The scapula is uncommonly fractured. It is protected by a thick coat of muscle and lies in protected position. Therefore, fractures of the scapula are associated with a significant amount of kinetic energy imparted to that portion of the body and should make the clinician suspicious if significant injuries. The combination of multiple injuries and thoracic wall disorganisation often represents a devastating injury pattern. Decollement is observed in 75% as part of multiple injuries. Thoracic decollement occurred in 3.5% in our retrospective studies. The bleeding source and the paradox movement of the chest could be misleading and the occurrence of bacterial infection could make the disease serious. Primary definitive treatment was initiated during the observation of intrathoracic space occupying mass, primary decompression and decollement verified by CT.

Contamination of retained hemothorax is derived from several sources, including tube thoracostomy, pneumonia or from the mechanical injury itself. The combination of tube thoracostomy and retained blood within the pleural space is implicated in most cases of posttraumatic empyema. The diagnosis of posttraumatic empyema involves the use of clinical parameters and imaging studies. Chest computed tomography, the most useful imaging modality, has a high degree of sensitivity and specificity but must also be correlated with clinical findings of leucocytosis, high CRP, fever and often respiratory dysfunction. Effective treatment of posttraumatic empyema centres on effective decortications and complete re-expansion of the involved lung. This can be achieved physically either at the time of thoracostomy or thoracoscopy (VATS) or chemically through the use of fibrinolytic agents. Thoracotomy with decortications is the most successful form of therapy and the rate of morbidity associated with this procedure is improving. Thoracoscopy with decortications is technically more difficult to perform and more successful when performed early. The CT-independent classification of thoracic trauma that is reliable and be performed quickly in the emergency room.

Figure 3.: Bleeding and dislocation in the chest

This will allow for adequate treatment of thoracic trauma and the prevention of secondary complications. In our experience, operative stabilisation has minimized the duration of mechanical ventilation and consequent complication. The rationale is to minimize ventilator time when a chest wall injury is the primary reason for its use. The condition of visceral coating define the treatment strategy during severe thoracic injury treatment similar to extremity injuries.

Parenchymal lung function can be assessed by CT, oxygen tension to fractional inspired oxygen ratio, shunt fraction and compliance but most of these require invasive monitoring and are performed in the intensive care unit.
The source of bleeding must be defined in visceral coating injuries during the treatment of therapy resistant hemothorax.

The major principles of damage control for thoracic injuries:

a. emergency centre thoracotomy is a damage control prototype.
b. postero-lateral thoracotomy is the empiric incision of choice
c. wedge, non-anatomically stapled lung resections, pulmonary tractotomy, and en masse lobectomy/pneumonectomy, chest wall stabilisation with Judet principle are pulmonary damage control procedures.

d. the chest may require en masse closure of muscles or patch closure of the wound.
e. packing thus has a limited role in thoracic damage control.
f. intravascular shunts, and ligation are common thoracic vascular damage control techniques.

g. new technology, an increased role for cardiopulmonary bypass and cardiac assistance may develop. (pECLA – pumpless extracorporeal lung assist, intraaortic balloon pump)
h. severe brain injury and ARDS (ICP stabilisation, good neurological function!)

High-energy blunt trauma that results in severe injury often involves multiple systems. Multispecialty team effort that is usually led by trauma surgeon and includes thoracic, vascular, abdominal surgeon, orthopaedics and increasingly interventional radiologist. The focus on haemorrhage control and the angiographer is unique access to vascular structures gives interventional radiology an important and increasingly recognised role in the treatment of patient with hemodynamic instability.
If myocardial contusion is suspected, the possibilities of subsequent complications, consisting mostly of cardiogenic shock. Hypotension is first resuscitated with fluid replacement. If volume replacement is not satisfactory to reverse the hypotensive state, then inotropic agents and even IABP (Intra Aortic Balloon Pump) have been utilized with success. Surgery may have to be delayed in patients with cardiogenic shock until stabilization is accomplished. Acute massive haemoptysis is a rare complication of pulmonary injury and contusion, and it is particularly difficult to manage. Recently, recombinant activated coagulation factor (rVIIa, NovoSeven) has been proposed as an adjuvant therapy for exsanguinating trauma patients with coagulopathy. This urgency is embodied in the concept of DC, which consist of staged surgical intervention with a focus on controlling haemorrhage and contamination, rapid resuscitation and second surgery for definitive repair.

The development of stent-graft technology has enlarged the scope of interventional therapy, involvement by the interventional radiographer, to include the rapid and definitive repair of conduit vessel injury. Effort should be made to terminate the septical focus because of lung stereotype reaction ability. With well built diagnostic sequence, treatment strategy, effective intensive therapy was achieved.

Keywords: operational area, blunt thoracic injuries, medical task force

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