

Orthopaedic Approach in Patients with Multiple Injuries

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ABSTRACT

Background: Polytrauma is the result of high energy trauma and presents itself as damage to multiple systems of the body. Fractures frequently exist. The presence of femoral and pelvic fractures is alarming and presents a great challenge to trauma surgeons. There are two different schools of thought regarding the timing of definitive surgical fixation in polytrauma patient i.e. early total care and the damage control orthopaedics. Each approach has its merits and demerits. The clinical status of the patient determines the appropriate orthopaedic approach, which should aim at the survival of the patient.

Objective: To assess the best possible orthopaedic approach in a patient with blunt multiple injuries.

Patients and Methods: This is a retrospective study that included 36 patients of multiple trauma with associated fractures of femur or pelvis during the period 1433-35 at Prince Mutaib Bin Abdul Aziz Hospital Sakaka, Aljouf, Saudi Arabia. The patients' age was 20-60 years. The spectrum of injuries varied. All patients had deranged one or more vital functions. Road traffic accident was the main cause of multiple injuries in our series. Early total care (ETC) or damage control orthopaedics policy was followed. We tried to find out the best possible orthopaedic approach by studying the incidence of acute respiratory distress syndrome (ARDS), multiple organs dysfunction syndrome (MODS), pneumonia, pulmonary embolism, death rate as well as the length of ICU and hospital stay. Postoperatively patients received antibiotics and low molecular weight heparin (clexane 40 mg S/C). The effect of early total care/damage control orthopaedics (DCO) on surgical fixation was also studied. Bilateral femoral fractures were excluded from the study. They represent separate entity with different prognosis.

Results: The mean patients' age was 38.61 ± 10.28 (range 20-60 years). We followed Pape classification to group the patients on the basis of their clinical status. There was derangement of one or more vital functions along with fracture of femur or pelvis. We targeted to achieve control of bleeding, haemodynamics and ventilation. Subsequently the clinical status of the patient guided us to follow the policy of ETC or DCO. In our series ETC was carried out on 33 patients after resuscitation. Seven of them deteriorated after surgical stabilization of femur/pelvis. Early total care was effective in 26 stable patients (72.3%). Damage control orthopaedics was followed in 3 unstable patients (8.4%). Seven borderline cases in our study developed ARDS after ETC (19.4%). The mean follow-up period was 10.08 ± 1.11 (range 9-12 months). Bony union was achieved in all cases.

Conclusion: The results of our series of multiple trauma patients indicate that the best orthopaedic approach can not be predetermined definitely at the time of presentation of patient to emergency room. Early total care is indicated in a stable patient within 24-48 hours after injury. Damage control orthopaedics is adopted in unstable patients preferably between 5th-10th days. Effectiveness of resuscitation plays important role.

Keywords: Multiple trauma, Femoral/pelvis fracture, Early total care, damage control orthopaedics

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INTRODUCTION

There is no consensus on the definite definition of polytrauma. However it may be defined as blunt trauma patients having damaged multiple body cavities or regions, dysfunction of uninjured organs and

compromised physiology.¹ Early total care involves definitive operative stabilization of all long bone and pelvic fractures during the early phase of treatment (24-48 hours).² DCO consists of four stages (i) focus on saving the life, (ii) control of haemorrhage, temporary external stabilization of major fractures and management of soft tissue injuries, (iii) monitoring in ICU and (iv) definitive fracture fixation.³ The literature shows that polytrauma is one of the main causes of death in patients under 40 years.⁴ Fractures frequently accompany polytrauma, most common being the pelvic and femur fractures. The significance of pre-hospital trauma management should be emphasized. Since 1980s the ideal approach has been to perform definitive fixation of all fractures under single anaesthesia (early total care) to make possible the prompt mobilization of patients. However with the passage of time and more and more exposure to polytrauma it became evident that in unstable patients lengthy surgery with associated blood loss resulted in a catastrophe further worsening the condition of a patient. Thus in 90's the idea of damage control orthopaedics emerged.⁵ This deviation from ETC to DCO was the result of better understanding of pathophysiological and immunological mechanisms regulating the host responses to injury.⁶

Trauma causes systemic inflammatory response syndrome (SIRS) followed by recovery period mediated by a counter-regulatory anti-inflammatory response (CARS). Severe inflammation may cause acute organ failure and early death after injury. Initial trauma or the first hit may increase the risk of deterioration of patient after surgery.⁷ In such situation surgery manifests itself as a 'second hit' which may lead to ARDS, MODS or even death. Early total care may cause fat emboli and hypoxic events which may further damage the injured lungs in polytrauma patient who has sustained pulmonary contusions or rib fractures.⁸ In damage control orthopaedics definitive osteosynthesis should be carried out within 15 days. Further delay increases the contamination rates in external fixator pin sites. With shift from ETC, data supports the evidence of upto a 5-fold increase in the death rate in patients who do not have early surgical stabilization of a femoral fracture.^{9,10} So most trauma surgeons surgically fix femoral fractures within first 24 hours after injury provided that patient is haemodynamically stable.¹¹ Weninger¹² concluded that early unreamed intramedullary nailing of femur fractures is safe in polytrauma patient with severe

thoracic injury and is justified to achieve early definitive care. Brundage¹³ reported that chest and head traumas are not contraindications to early fixation with reamed intramedullary nailing. The literature shows that pelvic ring disruptions range from 3-8.2% of all trauma patients.^{14,15} These fractures are the result of high-energy trauma and are associated with other injuries which strongly influence the outcome and survival rates.¹⁶ DCO is most suitable option for pelvic fractures. The mortality rate of polytrauma patients with pelvic fracture and unstable haemodynamics is as high as 50% in one series.¹⁷ Early mortality is due to uncontrolled haemorrhage whereas late mortality is the result of associated injuries and sepsis induced MODS. If even after external fixation of pelvis the patient remains haemodynamically unstable, then the possibility of arterial bleeding must be kept in mind. These patients benefit most from angiographic embolization. Temporary pelvic packing via laparotomy aids in control of pelvic bleeding and gives a chance for more selective management of haemorrhage. ETC is rarely undertaken for the management of pelvic ring fractures.

PATIENTS AND METHODS

This retrospective study included 36 adult blunt polytrauma patients with ISS >16 points and age 20-60 years who were admitted through the Emergency Department of Prince Motaib Bin Abdul Aziz Hospital Sakaka within first few hours after the injury during period 1433-35. Road traffic accident was the only cause of polytrauma. They were assessed by our trauma team which included general surgeon, orthopaedic surgeon, Neurosurgeon, Urologist and anaesthetist. The assessment was made on the basis of advanced trauma life support (ATLS) criteria. Primary survey of airway, breathing, circulation, neurological status and body temperature was carried out. The initial survey included the trauma series X-rays i.e. cervical spine, chest and pelvis to see fractures and haemothorax or pneumothorax etc. X-rays of the extremities were then done. In more severe cases CT scan (cervical spine, chest, abdomen and pelvis) was done straightaway and patients were rushed to operation theatre. Other ER evaluations included systolic blood pressure, heart rate, haematocrit, CBC, coagulation status and acid-base balance. We followed Pape classification which divides patients into four groups based on their clinical status: stable, borderline, unstable and in extremis. Twenty six patients fell into

stable, 7 borderline and 3 unstable categories. The criteria for assessing borderline patient included polytrauma, ISS 20 and additional thoracic injury, polytrauma with abdominal/pelvic injury (Moore 3) and shock (initial BP 90 mmHg) and X-ray findings of bilateral lung contusion. The pattern of injuries varied in our study. Twenty five polytrauma patients had diaphyseal fractures of femur, 11 pelvic fractures, 3 head injuries, 14 chest injuries, 19 abdominal injuries, all in combination.

Thirty three patients had shown satisfactory response to initial management, the haemodynamics was stable and there was no evidence of hypothermia, coagulopathy, occult hypoperfusion, abnormal acid-base status or any life threatening injury. They were labelled as stable and ETC was done within 24 hours of injury. Seven patients were labelled as borderline patients in our series. They were in stable condition after resuscitation pre-operatively but deteriorated unexpectedly and developed ARDS post-operatively. One of them developed pulmonary embolism. They were shifted to ICU and medical team was involved. Three of our patients had major internal soft tissue injuries, BP <90 mmHg, body temperature <33°C, platelets count <90,000 and raised lactate levels. They were labelled as “unstable” patients. We considered DCO approach in order to avoid a second hit that might have been responsible for subsequent ARDS, MODS or even death. They had pelvic fractures which were fixed immediately with rapid external fixation.

In our series, we fixed femur shaft fractures with interlocking I/M nails (reamed) and one femoral neck fracture with screws. 5 pubic symphyseal disruptions were fixed with 3.5 mm reconstruction plates. Posterior ring fixation was done in 2 cases with 3.5 mm DCP and in one case with percutaneous cannulated ilio sacral screw. Chest intubation was the mainstay of treatment for chest injuries in our study. Three of our patients had head injury (GCS >8). Majeed functional scoring system was applied to assess functional outcome of pelvic fractures in polytrauma.

RESULTS

This study included 36 patients with polytrauma. Initial resuscitation was done in all cases. We followed Pape classification. Early total care was carried out on 33 stable patients but was effective in 26 stable patients. Damage control orthopaedics was followed in 3 unstable cases. Seven borderline cases developed acute respiratory distress syndrome (ARDS) after ETC.

We did not observe any local complication. Follow-up period was 9-12 months. There was no mortality in our series. All patients had bony union of their fractures. There was no sexual or urinary dysfunction and no neurological deficit (Table 1). Majeed functional scoring system was applied to assess functional outcome of pelvic fixation in polytrauma cases with special emphasis on sitting, work, pain, sexual intercourse, gait, walking aids and walking distance. The total score measures 0-100. Total score grading was as follows i.e. excellent = 95, good = 85-94, fair = 70-84 and poor = less than 70 points (Table 2). Early total care was successful in femoral fractures (Table 3).

Table 1: Complications

Complication	Early total care	Damage control orthopaedics
ARDS	7	-
MODS	-	-
Pnumonia	-	-
Pulmonary embolism	1	-
Death rate	-	-
Length of ICU stay	1-2 days	10-14 days
Length of hospital stay	10-12 days	20-25 days

Table 2: Functional outcome of 11 pelvic fixations

Outcome	Early total care(n = 8)	Damage control orthopaedics (n = 3)
Excellent	4 (50%)	-
Good	2 (25%)	2 (66.6%)
Fair	2 (25%)	1 (33.4%)
Poor	-	-

Table 3: Final outcome of femoral fixation in polytrauma patients (n=25) after early total care

Outcome	No.	%
Excellent	13	65.0
Good	9	45.0
Fair	2	10.0
Poor	1	5.0

DISCUSSION

The multiple injuries in a polytrauma patient need serious consideration. Polytrauma is one of the major causes of death in young people under the age of 40.⁴ The commonest cause is RTA. Tissue destruction,

massive bleeding and insufficient oxygenation after trauma are the main challenges to trauma team. Fractures are important constituents of polytrauma. In the past, these patients were labelled as too sick to undergo surgical stabilization of fractures and manipulation was thought to precipitate fat embolism syndrome¹⁸ but in 80's and early 90's early stabilization of long bones fracture was considered important. Early total care involves definitive operative fixation of all long bone fractures within 24-48 hours after injury.² This also reduced the incidence of pulmonary complications, length of ICU and hospital stay.¹⁹ The concept of ETC started changing during the 90s as it was observed to have higher rate of pulmonary complications in unstable patients.²⁰ Patient is considered stable if there is no life-threatening injury, hypothermia, coagulopathy, any occult hypoperfusion or abnormal acid base status, he shows satisfactory response to initial management and is haemodynamically stable. If the patient has major soft tissue injuries, blood pressure less than 90mmHg, platelet count <90,000, increased lactate levels and body temperature <33°C, then DCO should be considered.²¹ The choice of treatment also depends on patient's age and comorbidities. The mortality rate increases in elderly patients.²² Obesity increases the risk of mortality.²³ Borderline patients are difficult to manage because the choice between ETC and DCO remains uncertain. Preoperatively these patients are apparently stable but deteriorate unexpectedly and may develop organ dysfunction after the surgery.²⁴ Injury severity score (ISS) is an important factor in multiple injuries as it is related to mortality, morbidity and hospitalization time after trauma.

CONCLUSION

There is no universally accepted precise definition of polytrauma. Thorough preoperative assessment of patient's haemodynamics and ventilation is a key factor in determining the type of treatment policy. Identification of borderline cases is very important, their treatment is controversial. The orthopaedic surgeon should not make intervention which is likely to give the patient a "sustained" hit. In a well resuscitated patient early stabilization is warranted. ETC is the gold standard in stable patients. Currently DCO is the preferred approach in "unstable" and "in extremis" patients. Major goal is survival of the patient. Adequate resuscitation before surgery is essential.

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