



TIMING OF FRACTURE FIXATION IN POLYTRAUMA PATIENTS WITH MUSCULOSKELETAL INJURIES:EARLY TOTAL CARE AND DAMAGE CONTROL ORTHOPAEDICS

Dr. Shaneed
karinkappara

ABSTRACT

In case of polytrauma involving musculoskeletal injuries, it is often unclear whether ETC (early total care) or DCO (damage control orthopaedics) would bring about the best possible outcome. The present study was conducted to identify the timing of fracture fixation in poly-trauma patients: Early Total Care and Damage Control Orthopaedics. The study was conducted at MIOT Hospitals, Chennai, India from 1-Oct-2014 to 1-Dec-2015 for a period of 14 months. One hundred and forty nine cases of poly-trauma with musculoskeletal injuries were selected and classified as stable, borderline, unstable and in extremis and received either ETC or DCO. The patients were objectively evaluated pre-operatively, post operatively and at 2 weeks, 2 months, 4 months and 6 months after discharge. Of the 149 cases 69 cases received DCO while 80 received ETC.

KEYWORDS : Polytrauma, Damage Control Surgery, Damage Control Orthopaedics, Early Total Care.

INTRODUCTION

Polytrauma patients represent the ultimate challenge to trauma care and the optimization of their care is a major focus of clinical and basic science research. Polytrauma cases are approximately 16-18% of all traumatic pathology worldwide and still have a high mortality rate (15-50%)¹. It is the leading cause of death for population under 40 years and the third major cause of death for all ages behind cardiovascular diseases and cancer. 90% of polytrauma are encountered in developing or under developed countries and their incidence is still growing, thus making polytrauma a major health problem in many countries, including our own¹. Over the years many definitions have been proposed for polytrauma with varying evidence of validation and acceptance. After several iterations Keel and Trentz defined polytrauma as a syndrome of combined injuries with an injury severity score (ISS > 17) and consequent SIRS for at least one day, leading to dysfunction or failure of remote organs and vital systems, which had not been directly injured themselves².

Musculoskeletal injuries involve an extremity and/or pelvic girdle. Musculoskeletal injuries are seen in 70-80% of polytrauma patients¹. As opposed to those in isolated cases, musculoskeletal injuries in polytrauma patients can be complicated to treat. The optimal timing of surgical stabilization of fractures in the polytrauma patient is controversial³. There are advantages to early definitive surgery for most patients. Early temporary fixation using external fixators, followed by definitive fixation (i.e. the damage control approach), may increase the chance for survival in a subset of patients with severe multisystem injuries.

Polytrauma patients are triaged into four classes: stable, borderline, unstable and in extremis³. They are classified depending on manifestation of shock, coagulopathy, derangement of body temperature and soft tissue injuries. The stable patient can undergo fracture surgery as necessary. An unstable patient should be resuscitated and adequately stabilized before receiving definitive orthopaedic care. The decision whether to perform initial temporary or definitive fixation in the borderline patient is individualized, based on the clinical condition. In patients presenting in extremis, life saving measures are pivotal, followed by a damage control approach to their injuries.

The timing of definitive fixation of major extremity fractures in the polytrauma patient has been the subject of debate for the past four decades³. Before 1950s surgical stabilization of fracture were not performed routinely due to high complications like fat embolism syndrome and other associated pulmonary complications⁴. Definitive operative stabilization was deferred for 10 to 14 days until the pulmonary, cardiovascular, and neurologic systems and the coagulation profile had been stabilized⁵. There were reports by some authors that healing of fractures would be quicker if the operation was not performed acutely and this led to the

recommendation that the operation should be delayed until up to 14 days after the injury⁶.

In the 1960s, immediate stabilization of long-bone fracture in the patient with multiple traumatic injuries was associated with an unacceptably high mortality rate. The major concern of surgeons treating polytrauma patients was the development of fat embolism syndrome and associated pulmonary dysfunction⁷. In the late 1980s it was found that early stabilization of fractures (ETC) in selected patients with polytrauma can be beneficial due to early mobilization and decreased recumbency related complications.

DCO (Damage control orthopaedics) mainly deals with management of musculoskeletal injuries in polytrauma patients who are not fit for early total care. DCO comprised of three stages. The first involves early temporary stabilization of unstable fractures and the control of haemorrhage and, if indicated, decompression of intracranial lesions. The second stage consists of resuscitation of the patient in the intensive-care unit and optimization of the general condition. In the third stage delayed definitive management of the fracture is undertaken when the patient's condition allows.

A patient can be classified as stable (grade I, cleared for surgery), borderline (grade II, uncertain condition with episodes of cardiovascular instability and hypoxemia), unstable (grade III, cardiovascular instability [systolic blood pressure <90 mm Hg]), or in extremis (grade IV, acutely life-threatening injuries). Although several parameters are considered in classifying patients, clear numerical cutoffs have not been established; thus, judgment and experience are required.

AIM OF THE STUDY

The aim of the study is to identify the timing of fracture fixation in polytrauma patients with musculoskeletal injuries: ETC and DCO

MATERIALS AND METHODS

Study area:

Study was conducted at MIOT International Hospitals at Manapakkam in Chennai, Tamil Nadu, India. It involved the Department of Orthopedic Surgery, Department of Trauma and Emergency, Trauma Intensive Care Unit and Post-operative Unit. MIOT International is a tertiary center for orthopaedic surgery and trauma and functions as a referral center for polytrauma cases in the city. It is a 450 bedded multispecialty hospital with specialized operating theaters, ICUs and rehabilitation facilities and staffed by highly qualified personnel.

Study population:

The study was conducted on polytrauma patients with musculoskeletal injuries who were admitted to MIOT International

hospitals from the period 1-10-2014 to 1-6-2015. Children, pregnant women, patients who were treated at other centers, patients with concomitant psychiatric or terminal illness and those with GCS 3 were excluded from the study.

Study period:

The duration of the study was 14 months from 1-10-2014 to 1-12-2015. Patients were enrolled for the study from 1-10-2014 to 1-6-2015. Regular follow ups were post operatively before discharge and at 2 weeks, 2 months, 4 months and 6 months after discharge.

Sample size:

Initially 230 patients who fit the inclusion criteria were included for the study. Of these 81 were lost to follow up and thus excluded. The study was conducted on 149 patients.

Study design:

This was a prospective study. Patients were chosen according to the Keel and Trentz definition of polytrauma.

RESULTS AND OBSERVATIONS

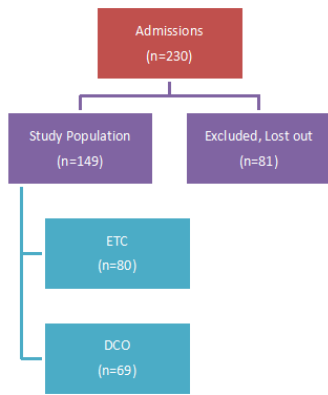


Figure 1 SCHEME OF THE STUDY

A total of 230 polytrauma patients with musculoskeletal injuries were seen in the emergency department in the period from 1-12-2014 to 1-8-2015. Eighty one patients were rejected because of the exclusion criteria or lost to follow up from the trial subsequently. One hundred and forty nine patients (n=149) with polytrauma and musculoskeletal injuries who fit the selection criteria were chosen from them to be the test subjects and they were then followed over a period of 4 to 12 months.

CLASSIFICATION OF PATIENTS

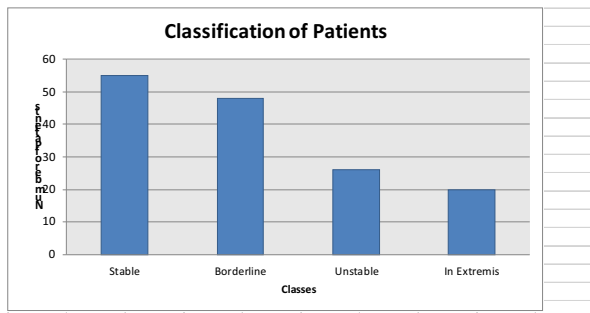


Figure 2 CLASSIFICATION OF PATIENTS

The patients were triaged into the stable, borderline, unstable and in extremis depending upon the condition at admission. Factors like shock, coagulation, hypothermia and soft tissue injuries were taken into consideration. Data shows that 36.91% (n=55) of the patients were in stable condition, 32.20% (n=48) of the patients were in borderline condition, 17.45% (n=26) of the patients were classified as unstable and 13.42% (n=20) of the patients were classified to be in extremis condition.

ISS SCORE DISTRIBUTION OF PATIENTS

Table 1 ISS SCORES OF PATIENTS

Class	ISS Range	Mean ISS	Percent
Stable	18-27	21.49 ±2.27	36.91
Borderline	24-37	31.17±3.31	32.20
Unstable	39-46	41.46±2.37	17.45
In extremis	43-58	50.60±4.33	13.42
Total	18-58	32±10.60	100

In stable patients the ISS scores ranged from 18-27 with a mean of 21.49 and standard deviation of 2.27. In borderline patients the ISS scores ranged from 24-37 with a mean of 31.17 and standard deviation of 3.31. In unstable patient the ISS scores ranged from 39-46 with a mean of 41.46 and standard deviation of 2.37. In patients in extremis the ISS scores ranged from 43-58 with a mean of 50.60 and standard deviation of 4.33.

TREATMENT PROTOCOL

Of all the 149 patients, 53.69% (n=80) were treated with the ETC protocol. DCO was applied in 46.31% (n=69) of the patients. Among the 80 patients treated with ETC 68.75% (n=55) were stable and 31.25% (n=25) were borderline. Among the 69 patients treated with DCO 33.33% (n=23) were borderline, 37.68% (n=26) were unstable and 28.99% (n=20) were in extremis.

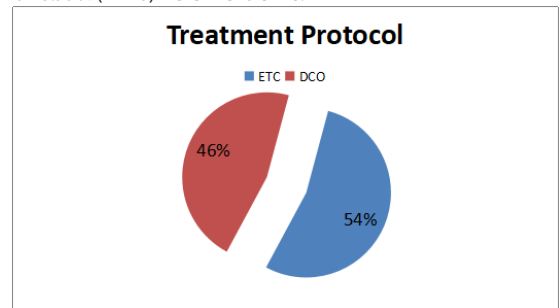


Figure 3 TREATMENT PROTOCOL

Timing of Definitive Fixation-ETC

Table 2 TIMING OF FRACTURE FIXATION IN ETC GROUP

Class	Number of Patients	Time Range	Mean Time
Stable	55	1 day	1 day
Borderline	25	1-3 days	1.76 days
Total	80	1-3 days	1.24 days

The patients who underwent ETC came from two classes: 100% (n=55) of stable patients and 52.08% (n=25) of all borderline patients. Among the stable patients the definitive fixation of fracture was done within one day after the injury. Among the borderline patients who underwent ETC, the definitive fixation of fracture was done in 1 to 3 days after the injury, with a mean elapsed time of 1.76 days. When considered as a whole the definitive fracture fixation was performed within a mean time of 1.24 days.

Timing of Definitive Fixation-DCO

Table 3 TIMING OF FRACTURE FIXATION IN DCO GROUP

Class	Number of Patients	Time Range	Mean Time
Borderline	23	6-11 days	8.91 days
Unstable	26	10-19 days	14.54 days
In Extremis	20	17-36 days	24.75 days
Total	69	6-36 days	15.91 days

The patients who underwent DCO came from three classes: 47.92% (n=23) of borderline patients, 100% (n=26) of all unstable patients and 100% (n=20) of all patients in extremis. Among the borderline patients who underwent DCO, the definitive fixation of fracture was done in 6 to 11 days with a mean time of 8.91 days. Among the unstable patients, the definitive fixation of fracture was done in 10 to 19 days after the injury, with a mean elapsed time of 14.54 days. Among the patients in extremis, the definitive fixation of fracture was done in 17 to 36 days after the injury, with a mean

elapsed time of 24.75 days. When considered as a whole the definitive fracture fixation was performed in 6 to 36 days with a mean time of 15.91 days.

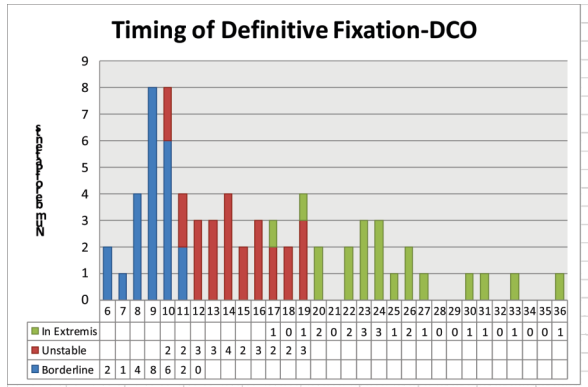


Fig 4 TIMING OF DEFINITIVE FIXATION IN DCO GROUP DISCUSSION.

The optimal timing of surgical stabilization of fractures in the polytrauma patient is controversial. In this study, all stable patients underwent ETC with a mean interval of 1 day from injury to surgical stabilization. There are advantages to early definitive surgery for most patients. Patients in DCO category take mean interval of 14.9 days from injury to fracture stabilization. Being forced to stay in a hospital in a recumbent and immobile condition can result in dysfunction of multiple organ systems, leading to a variety of disorders. Benefits of early fracture stabilization include early mobilization of the patient and beneficial effects on the clinical course of the multiply injured patient, decreasing above mentioned complications.

ETC provides the best outcome for stable polytrauma patients with musculoskeletal injuries and in the borderline or unstable patients who respond well to resuscitation. DCO provides best outcome for those patients with life threatening injuries and those in shock. Response to resuscitation is the parameter to be considered for the management of borderline patients.

CONCLUSION

Early definitive fracture fixation is recommended for the stable polytrauma patient and in the borderline or unstable patient who responds well to resuscitation. However, in the patient who presents with severe hemorrhagic shock or any other life-threatening condition, prolonged surgical procedures should be avoided, and staged fracture fixation should be done

LIMITATIONS

The age group that was chosen to select the patients for the study was from 18 to 70. Hence no conclusion can be derived about the nature of injuries and their frequencies in paediatric and geriatric population. Since the Hospital was located in a major city, the polytrauma patients received also mirrored the situation in an urban scenario. The challenges in a rural environment will be expectedly different. Although several parameters are considered in classifying patients, clear numerical cutoffs have not been established; thus, judgment and experience are required. So chance of interobserver variability cannot be excluded.

CONFLICT OF INTEREST

There is no conflict of interest.

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