

Classification of Injury Pattern has no Effect in Outcomes of Posteriorly Fixed Patients of Pelvic Ring Injuries

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Abstract

Background: Pelvic fractures are complex injuries with a significant impact on functional status and quality of life. It is thought that posterior fixation for pelvic ring has the utmost importance as the stability of the pelvic ring depends mainly on the integrity of the posterior weight-bearing sacroiliac complex.

Methods: This was a cross sectional descriptive study. All consecutive patients from 2016 to 2021 operated with posterior fixation for pelvic ring injuries were contacted out of which 50 patients were enrolled in the study.

Results: Our study had 64 percent male patients of younger age group with a mean age of 40.1 ± 16.25 years with mean follow-up was of 1154 ± 581 days with maximum follow-up of 2289 days and minimum follow-up of 390 days. Most number of patients treated by posterior fixation in our study was vertical shear injuries contributing to around 36 percent of the patients followed by LC-II which were 24 percent and APC-III which were 12 percent. Posterior fixation was done either by Spinopelvic fixation (36 percent), Percutaneous Iliosacral screw fixation (38 percent) and ORIF with plates/screws (26 percent). Isolated percutaneous fixation was done in 12 patients (63.2 percent), whereas it was supplemented with ramus screw in 2 patients (10.5 percent) and anterior symphyseal plate in 4 patients (21.1 percent). One patient also had external fixator application along with Percutaneous Iliosacral screw fixation for APC type-III injury. Mean Majeed Score was 85.96 amongst all the patients with no significant difference amongst different groups according to Young and Burgess Classification. Majeed scores were excellent in 36 patients (72 percent), good in 6 patients (12 percent), fair in 7 patients (14 percent) and poor in 1 patient (2 percent). On comparison between different methods of fixation, none of the method showed any statistical difference in outcome scores amongst themselves.

Conclusion: The pattern of injury and fracture classification had no association with all functional outcome scores if the standard protocol of care is followed in pelvic trauma.

Keywords: Pelvic ring injuries; Majeed score; Functional outcomes; Young and burgess classification; Posterior Fixation

Level of study

Level VI

Introduction

The pelvic ring is a highly stable structure. 60% of pelvic stability is contributed by posterior structures therefore; posterior pelvic ring

fixation provides adequate pelvic ring stability necessary for fracture healing and ambulation of patient. [1]

Posterior pelvic ring injury is usually a very high energy trauma. There are different methods of fixation including Iliosacral screws, plating, and spinopelvic fixation. Posterior pelvic fixation can be done percutaneously or openly. Iliosacral screw fixation is the most common percutaneous technique used. [2]

Depending on the energy of fracture, objectives and indications of surgical treatment are different. In high-energy fractures, anatomic reduction and stability restoration by rigid fixation is the aim, while restoration of stability with minimum possible rigid fixation is the objective in low-energy fracture. [3] Pelvic ring injuries can be seen lead to huge consequences for the patients' daily life. Apart from the substantial mortality rates, principally in high-energy trauma, these injuries coincide with long periods of impaired mobilization and intense rehabilitation.

To identify prognostic factors of functionality after pelvic injury, a cross sectional study was needed. The main purpose of this study was to gain insight into functional outcomes and quality of life after pelvic injury which has been operated by posterior fixation.

Materials and Methods

Study design and Sample size calculation

This was a cross sectional descriptive study conducted in the Department of Orthopaedics at Government Medical College and Hospital Sector 32, Chandigarh. After approval of protocol by Institutional Ethics Committee, all consecutive patients from 2016 to 2021 operated with posterior fixation for pelvic ring injuries were contacted out of which 50 patients could be enrolled in the study. Written and informed consent was taken.

Inclusion criteria

1. Patients with pelvic ring injuries managed by posterior fixation with or without anterior fixation
2. Age group 15-75 years

Exclusion criteria

1. Patients managed conservatively
2. Patients with associated spinal injury including ASIA grade A and B.
3. Patients not willing to give consent.

Data Collection

All the patients were contacted and called for follow-up. Histories regarding the mechanism of injury, date of injury were recorded. Previous available records were evaluated and morphological classification of the injury was done according to Young-burgess classification. Functional scores were evaluated with Majeed scores.

Results

The study was conducted among 50 patients aged 15 to 75 years having pelvic ring injuries managed by posterior fixation with or without anterior fixation to study their functional outcomes. The mean age among the study participants was 40.1 ± 16.25 years. Mean time of follow-up (from the date of surgery to the present date) was $1154.90+581.14$ days, ranging from 390 days to 2289 days. Most common category under Young Burgess Classification was VS (36%), followed by LC-II (24%), LC-I (18%), APC-III (12%), LC-III (4%), LC \pm VS (4%), and LC \pm APC (2%).

Mean Majeed score was maximum (96 ± 5.66) among LC-III class and minimum in LC \pm APC class (66). Mean Majeed score was maximum (86) among those who had undergone percutaneous ilio-sacral fixation and minimum among those who had spinopelvic fixation (85.13 ± 13.48). Among the participants who had undergone percutaneous ilio-sacral fixation, isolated fixation was done among 12 study participants, fixation with ramus screw was done in 2, fixation with efix was done in one and with anterior symphyseal plate among four study participants. No significant association was observed between Majeed score and type of procedure performed (p-value: 0.94).

Young Burgess classification	Mean \pm SD
LC-I	88.67 ± 13.57
LC-II	87.42 ± 10.96
LC-III	$96 + 5.66$
APC-III	84.67 ± 11.61
VS	84.11 ± 13.44
LC \pm APC	66 *
LC \pm VS	85.5 ± 7.78

Table 1: Mean Majeed Score according to Young Burgess Classification among the study participants (n = 50).

Procedure performed	Frequency	Percent
Spinopelvic fixation	18	36.0
Percutaneous ilio-sacral fixation	19	38.0
ORIF with plates/screws	13	26.0

Table 2: Distribution of study participants according to procedure performed ($n = 50$).

Procedure performed	Mean \pm SD	p-value
Spinopelvic fixation	85.17 \pm 12.8	0.94 [§]
Percutaneous ilio-sacral fixation	86.79 \pm 12.41	
ORIF with plates/screws	85.85 \pm 12.3	
[§] Kruskal Wallis test		

Table 3: Mean Majeed Score according to procedure performed among the study participants ($n = 50$).

Discussion

Pelvic fractures are complex injuries with a significant impact on functional status and quality of life. The increased incidence of pelvic ring injuries has been seen in recent times. Pelvic ring injuries are usually caused by high energy trauma such as motor vehicle accidents usually occurring in males. Traumatic disruption of the pelvic ring should be treated for the following important anatomic features: horizontally round configuration of the ring, femoro-sacral longitudinal weight bearing axis, the 'keystone' structure of the sacrum, and symphysis pubis that 'anchors' the oval ring. It is thought that posterior fixation for pelvic ring has the utmost importance as the stability of the pelvic ring depends mainly on the integrity of the posterior weight-bearing sacroiliac complex. Posterior internal fixation restores posterior alignment and decreases the incidence of malunion, nonunion, and leg length discrepancy, and gait disturbance.

Comparisons of pelvic ring fracture patterns are made based on a variety of classification systems. Most commonly used classification system is Young-Burgess classification. The scheme devised by Burgess et al described the mechanism of injury and provided information regarding the patient's associated injuries. Most number of patients treated by posterior fixation in our study was vertical shear injuries contributing to around 36 percent of the patients followed by LC-II which were 24 percent and APC-III which were 12 percent. Mean Majeed score was maximum (96 ± 5.66) among LC-III class and minimum in LC+APC class (66). Similarly, Mean Harris hip score was maximum (96.5 ± 4.95) among LC-III class and

minimum in LC+APC class (68) and mean IPS was maximum (96 ± 5.66) among LC-III class and minimum in LC+APC class (66). Mean Majeed Score was 85.96 amongst all the patients with no significant difference amongst different groups according to Young and Burgess Classification. This may signify that protocol based treatment and anatomical reduction may lead to good results irrespective of classification. One might expect more long term complications in fractures that involve the sacrum or Ilium with extension into the sacroiliac joint because of the difficulty in obtaining proper anatomic reduction and because of the joint cartilage damage. However, there was no difference in functional outcome when comparing the various posterior fracture patterns.

The goal of fixation remains restoration of stability within an anatomic or near anatomic position of the pelvic ring. There are numerous reports in the literature describing radiological and clinical results. To get a better global understanding of the outcome following various injuries and diseases, studies including patient-reported outcome have in recent years provided new and valuable insights.

In our study, mean Majeed Score was 85.96 ± 12.286 . Majeed scores were excellent in 36 patients (72 percent), good in 6 patients (12 percent), fair in 7 patients (14 percent) and poor in 1 patient (2 percent). Though in our study, in correlation analysis there was no association between fracture patterns and functional outcomes, we observed that Majeed's score was found excellent in 6 patients (75%), good in 1 patients (12.5%) and fair in 1 patient (12.5 percent) among the 8 patients in our study, who had less severe pattern of injuries (LC1), where as in 42 patients who had unstable pattern, we observed that 30 had excellent scores (71.4%), 5 patients showed good scores (11.9%), 6 patients showed fair results (14.2%) and 1 patient had poor result (2.3%). These findings indicate that better outcomes are understandably more in less severe fracture patterns.

The indications for surgical stabilization of pelvic ring injuries are based on an assessment of the extent of disruption of the pelvic ring and the associated deformity of the bony pelvis. The decision to perform operative reduction and stabilization of displaced pelvic ring injuries is often not straightforward. This process involves consideration of the instability and the deformity present and the demands of the patient and his or her ability to withstand the physiologic challenge of operative intervention. Stable fractures, including Tile Types A, B1 and B2 (that is, APC injuries with less

than 2.5 cm of diastasis and LC injuries with sacral impaction), are generally managed nonoperatively. When stable pelvic injury patterns have substantial deformity, surgical reduction and stabilization may be indicated. Anteroposterior compression injuries with pubic symphysis diastasis more than 2.5 cm are usually associated with rotational instability. Operative stabilization of these injuries by symphyseal plating or external fixation usually speeds rehabilitation and ensures healing in acceptable alignment.

The LC II or Tile C1 injury is typically internally rotated and may have some superior displacement of the involved hemipelvis. Reduction and stabilization of this fracture pattern is indicated when substantial displacement is present; this can be achieved either by open reduction and internal fixation or by external fixation. When the LC II injury occurs with involvement of the sacroiliac joint posteriorly, open reduction is preferred to ensure anatomic restoration of the sacroiliac joint. Posterior pelvic ring injuries that have a vertical instability pattern usually are fixed with spinopelvic fixation. Careful evaluation of the anterior and posterior soft tissues is mandatory in considering methods of posterior ring fixation for globally unstable injuries. Vertical shear injuries are characterized by complete loss of the bony connection between the spine and pelvis. In our study, posterior fixation was done either by Spinopelvic fixation (36 percent), Percutaneous Iliosacral screw fixation (38 percent) and ORIF with plates/screws (26 percent). Isolated percutaneous fixation was done in 12 patients (63.2 percent), whereas it was supplemented with ramus screw in 2 patients (10.5 percent) and anterior symphyseal plate in 4 patients (21.1 percent). One patient also had external fixator application along with Percutaneous Iliosacral screw fixation for APC type-III injury. Recently, external fixator has only been used for resuscitation and provisional fixation, and less commonly for definitive treatment. In patients who are not stabilized quickly for posterior surgical intervention, long term maintenance of nonanatomic position with an external fixator has been associated with difficulty in accomplishing later posterior reduction. [29]

In patients with comminuted or bilateral pubic rami fractures combined with pubic symphysis diastasis, it may be difficult to achieve anatomic reduction of the anterior portion of the pelvic ring. In our study, out of the 18 patients with vertical shear injuries, 16 were treated with spinopelvic fixation, 1 with percutaneous iliosacral screw and 1 with ORIF with plates/screws. The outcome measures were lower in the group with percutaneous iliosacral screw with

Majeed score of 66 in the patient treated with percutaneous iliosacral screw as compared to mean of 85.13 ± 13.475 in spinopelvic fixation group and 86 in ORIF group. Similar results were seen in all other outcome measures as well. But as there was a single patient treated with percutaneous iliosacral screw statistical analysis could not be performed. We had 9 patients of LC1 injuries out of which 8 were treated by percutaneous iliosacral screw and 1 with ORIF. Mean Majeed score in percutaneous iliosacral screw was 87.25 ± 13.781 . One patient treated with ORIF had Majeed score of 100. Both had excellent and comparable scores. Similar results were seen in all other outcome measures as well. 12 Patients had LC2 injuries out of which 2 were treated by percutaneous iliosacral fixation and 10 with ORIF with plates/screws. Mean Majeed scores in both groups were excellent. All the patients having LC3 injuries were operated with percutaneous iliosacral screw. Mean Majeed score in this group was also excellent (96 ± 5.66). Out of the 6 patients of APC3 injuries in our study, 3 were treated with isolated iliosacral screw fixation with mean Majeed score of 88 ± 12.124 , 2 were treated with iliosacral screw fixation along with anterior symphyseal plate with mean Majeed score of 75 ± 8.485 and 1 was treated with exfix with iliosacral screw with Majeed score of 94. Various mechanisms of posterior fixation and a variety of surgical strategies have developed; therefore, the most appropriate next step would be to evaluate which methodology is associated with the best functional outcomes. On comparison between different methods of fixation, none of the method showed any statistical difference in outcome scores amongst themselves. We may understand that disrupted pelvic ring alignment must be reconstructed surgically, but different methods of posterior fixation as and where indicated did not have much effect on the outcomes. We believe disrupted pelvic ring alignment must be reconstructed surgically according to the accepted protocol with appropriate surgical method.

Conclusion

The pattern of injury and fracture classification had no association with all functional outcome scores. Our study also indicates that better outcomes are understandably more in less severe fracture patterns. On comparison between different methods of fixation, none of the method showed any statistical difference in outcome scores amongst themselves.

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