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ORIGINAL ARTICLE • PELVIS - FRACTURES

Short-term follow-up of anterior and posterior both column fractures of acetabulum managed through both column plating

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Abstract

Objective To evaluate the results of short-term follow-up of patients of both column acetabular fractures managed through anterior and posterior column plating.

Introduction Both column acetabular fractures are challenging articular injuries. Majority of them are treated operatively. The concept of "secondary congruence" was introduced by Letournel. Despite this, biomechanical data on secondary congruence indicate that nonoperative treatment leads to an increase in peak pressures in the supraacetabular region with the potential risk of developing posttraumatic degenerative osteoarthritis. Operative management is therefore justified.

Methodology A cohort of 10 patients having both column (anterior and posterior) acetabular fractures managed using bicolumnar plating between January 2016 and December 2017 were enrolled in the study and were analyzed during follow-up period.

Results In total, 80% of the patients had excellent to good result. Average postoperative score was 85.7. Assessment was done using modified Harris Hip score.

Keywords Anterior and posterior column fracture · Modified Harris hip score · Letournel and Judet classification

Introduction

Fractures of acetabulum occur by the impact of femoral head with acetabular surface [1]. This force of femoral head can be applied from the greater trochanter or from femoral shaft. Subsequently, the type of acetabulum fracture that occurs depends on position of hip and direction of force [1].

Both column fractures, defined as acetabular fractures with no articular fragment in connection with the axial skeleton, account for approximately 20% of all acetabular fractures [2, 3]. The typical type of both column fractures is the C1.2 fracture with a multifragmentary anterior column fracture extending to the iliac crest and a large posterior fragment in more than half of the patients [4, 5]. The majority of both column fractures are treated operatively. Letournal stated acceptable results after conservative treatment of this fracture type [6]. Despite this, biomechanical data on secondary congruence indicate that nonoperative treatment leads to an increase in peak pressures in supraacetabular region (roof) with the potential risk of developing posttraumatic degenerative changes [7, 8]. The goal of operative treatment is to preserve a functional, mobile, painless hip joint that continues to function for the rest of the patient's life [9, 10]. The success of the operation after high-energy trauma is contingent on the articular cartilage of the hip remaining viable.

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Methodology

This study focuses on short-term outcome of complex acetabular fractures managed through anterior and posterior column plating using modified Harris Hip score [11, 12]. The observational prospective study was conducted at tertiary care hospital between January 2016 and December 2017. Ten patients with complex acetabular fractures including both column fractures treated using both column plating were enrolled in this study based on following inclusion and exclusion criteria.

Inclusion criteria

- Complex acetabular fractures involving both columns
- Close fractures
- Displaced fractures
- Medically fit patients

Exclusion criteria

- Open fractures
- Fractures in children and pregnant females
- Pathological fractures
- Fractures with bowel and bladder injuries

Radiographs were taken, and 3D CT scan was performed to identify the fracture whether it was both columns or of any other type (based on Letournel and Judet system) [6]. Only both column fractures were included in the study. Preoperative work-up including blood investigations, chest radiographs, abdomen ultrasonography, ECG and preanaesthetic checkup was done. Preoperatively antibiotics were given as per hospital protocol. All patients were operated with both column plates. Total surgical procedure was completed in two phases. There was a gap of 7 days between fixation of anterior and posterior column. Kocher–Langenbeck approach was used for fixing posterior column, and ilioinguinal approach was used for fixing anterior column [8, 13–15]. Total blood loss during entire surgical procedure was around 2000 ml (collection in suction chamber), and blood transfusions were given to the patient either intraoperatively or postoperatively accordingly. Postoperative care inclusive of antibiotic support and dressing was done. Postoperatively, the patients were encouraged to perform static quadriceps exercises, active quadriceps exercises and high sitting exercises. This was followed by non-weight-bearing using walker. Full weight-bearing was started at 12 weeks postoperatively in uncomplicated cases depending upon union status. Patients were followed up at 6 weeks, 3 months and 6 months followed by quarterly visits thereafter. Final result was assessed using modified Harris Hip score.

Observation and analysis

Ten cases of both column acetabular fractures fixed using both column plating were included in this study. Among these four patients were between 21 and 40 years of age, four patients were between 41 and 60 years of age and two patients were 61 years and above. Among 10 patients, eight had road traffic accidents (RTA) and two had fall from height (FFH). Nine patients were males, and one was a female. Six had acetabular fracture on right side and four had on left side. The surgical lag time observed is depicted in Table 1.

Postoperative reduction

The postoperative reduction of acetabular fracture was categorized into satisfactory (< 2 mm) or unsatisfactory (> 2 mm) according to Matta's criteria [12, 16]. This is shown in Table 2.

Follow-up period

The patients were followed up till December 2017, the longest follow-up being 2 years and shortest being 6 months. The average follow-up period was 15 months. The follow-up period is shown in Table 3.

Table 1 Surgery lag time

Surgery lag time (days)	No. of patients	Percentage
0–7	6	60
8–14	3	30
> 14	1	10

The mean surgery lag time was 6.1 days

Table 2 Postoperative reduction

Post-op reduction	No. of cases	Percentage
Satisfactory (< 2 mm)	8	80
Unsatisfactory (> 2 mm)	2	20
Total	10	100

Table 3 Follow-up period

Months	No. of patients	Percentage
6–12	3	30
13–18	4	40
18–24	3	30
Total	10	100

Table 4 Complications

Complications	No. of patients	Percentage
Early		
Nerve injury (sciatic)	1	10
Acute postoperative infection	1	10
Late		
Osteoarthritis hip	1	10
AVN femoral head	1	10

Table 5 Functional outcome

Result	No. of patients	Percentage
Excellent (90–100)	4	40
Good (80–89)	4	40
Fair (70–79)	1	10
Poor (< 70)	1	10
Total	10	100

Table 6 Result based on age of the patients

Age (years)	Excellent	Good	Fair	Poor	Total
0–20	0	0	0	0	0
21–40	3 (30%)	1 (10%)	0	0	4 (40%)
41–60	1 (10%)	2 (20%)	0	1 (10%)	4 (40%)
61 and above	0	1 (10%)	1 (10%)	0	2 (20%)
Total	4 (40%)	4 (40%)	1 (10%)	1 (10%)	10 (100%)

Postoperative complications

Postoperative complications observed are shown in Table 4.

Overall functional outcome

Patients were assessed using modified Harris Hip score. The average postoperative score for the patients was 85.7. Overall functional outcome is shown in Table 5.

Distribution of results based on age

Result according to age is shown in Table 6.

Distribution of results based on sex

Result according to sex distribution is shown in Table 7.

Distribution of results based on mode of injury (MOI)

Result according to mode of injury is shown in Table 8.

Table 7 Result based on sex distribution

Sex	Excellent	Good	Fair	Poor	Total
Male	4 (44.4%)	3 (33.3%)	1 (11.1%)	1 (11.1%)	9 (100%)
Female	0	1 (100%)	0	0	1 (100%)

Table 8 Result according to MOI

MOI	Excellent	Good	Fair	Poor	Total
RTA	4 (40%)	2 (20%)	1 (10%)	1 (10%)	8 (80%)
FFH	0	2 (20%)	0	0	2 (20%)
Total	4 (40%)	4 (40%)	1 (10%)	1 (10%)	10 (100%)

Table 9 Result according to surgical lag time

Surgery lag time	Excellent	Good	Fair	Poor	Total
0–7 days	3 (30%)	2 (20%)	1 (10%)	0	6 (60%)
8–14 days	1 (10%)	2 (20%)	0	0	3 (30%)
>14 days	0	0	0	1 (10%)	1 (10%)
Total	4 (40%)	4 (40%)	1 (10%)	1 (10%)	10 (100%)

Distribution of results based on surgery lag time

Result according to surgical lag time is shown in Table 9.

Distribution of results based on Matta's criteria

Result according to Matta's criteria is shown in Table 10.

Figure 1 shows preoperative radiograph of a 45-year-old male having right-sided both column acetabular fractures included in the study. Figure 2 shows the preoperative 3D CT scan of the same patient. Figure 3 shows the immediate postoperative radiographs of the same patient in three different views (obturator, iliac and anteroposterior view). Figure 4 shows the final follow-up radiograph of the same patient after 18 months.

Discussion

In our study, majority of patients were in the age group of 21–60 years. Mean age of the patients was 47.1 years. The mode of injury was road traffic accident in 80% cases and fall from height in 20% cases. Fractures of acetabulum are caused by forces that drive the femoral head into the acetabulum. The sitting position during driving is important because the position of femoral head while sitting can affect the type of fracture pattern. As most of these fractures occur due to dashboard injury, implementation of seat belt legislation can prevent these fractures caused due to high-velocity trauma.

Table 10 Result based on Matta's criteria

Post-op reduction	Excellent	Good	Fair	Poor	Total
Satisfactory (< 2 mm)	4 (40%)	4 (40%)	0	0	8 (80%)
Unsatisfactory (> 2 mm)	0	0	1 (10%)	1 (10%)	2 (20%)
Total	4 (40%)	4 (40%)	1 (10%)	1 (10%)	10 (100%)

Fig. 1 Preoperative radiograph

Sixty percentage of the patients were operated within 7 days of injury as they were declared fit from anaesthetic point of view. Forty percentage of the patients having excellent/good functional results had a surgical lag time of less than 7 days. So it can be said that better functional results are obtained with less surgical lag time. In 80% of the patients, we achieved satisfactory postoperative reduction (according to Matta's criteria). According to Matta, less than 2-mm displacement between fracture fragments comes under the category of satisfactory postoperative reduction [17, 18]. Matta had also described the roof arc angle measurement as one of the important parameters to judge whether operative reduction is required or not. He concluded that in fractures with a roof arc > 45°, enough weight-bearing articular surface remains intact to consider nonsurgical treatment when the femoral head is congruent with the superior acetabulum [19]. Subsequent investigation using computed tomography (CT) reaffirmed this concept: Fractures that entered the joint 10 mm or more below the vertex on CT scan correlated with a CT roof arc of 45° [16, 20–23]. It was found that unsatisfactory postoperative reduction led to poorer results. This had also been reflected by our study very clearly. In follow-up period, five patients had slight pain, four patients used cane for long walk distance, four patients were able to walk for 1 km and six patients were able to walk unlimited. Three patients were using railing for climbing staircase, and all the patients were able to sit comfortably, able to wear shoes and socks easily. Five patients had five points on range of motion scale. The mean modified Harris Hip score was 85.7. Out of all 10 patients, 80% had excellent to good results. Remaining 20% patients had fair to poor results.

Conclusion

Bicolumnar acetabular fractures are more common in third to fifth decade of life. Male preponderance is due to their involvement in heavy manual. Open reduction and internal fixation of both columns in displaced acetabular fractures is an effective method of treatment despite the complexities and difficulties in approach and reduction. The conservative management advocated before 1920 in the form of lateral skeletal traction, pelvic binders and derotation boots had very high rates of complications like avascular necrosis of

Fig. 2 Preoperative 3D CT scan

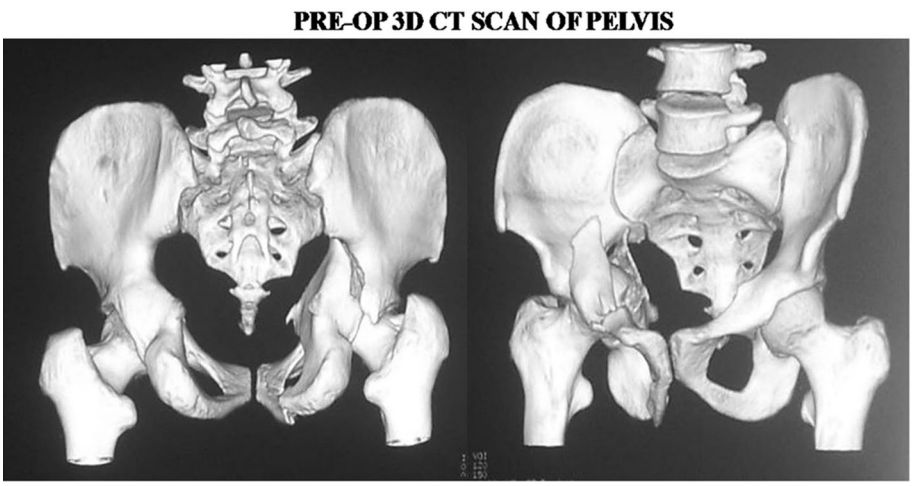

Fig. 3 Immediate postoperative radiographs

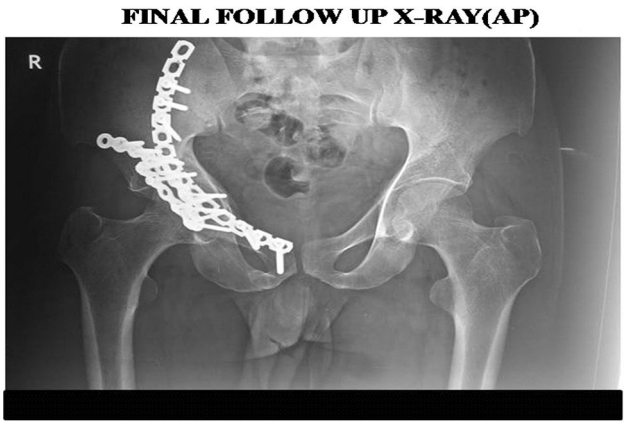

Fig. 4 Final follow-up radiograph

femoral head, posttraumatic osteoarthritis and significant mortality [24, 25]. The complications encountered due to prolonged immobilization like bed sores, joint stiffness and deep vein thrombosis also caused significant morbidity in the follow-up period. The combination of an irregular articular surface with a multidirectional femoroacetabular impingement justifies poor outcome of the conservative management [19]. Even if we take into account the concept of "secondary congruence," the outcome of such fractures after conservative management is poor as compared to surgical management. Taking into account the poorer results and complications faced due to conservative management, the open reduction and internal fixation of both column acetabular fractures is highly recommended. Hence, the present study favoring open reduction and internal fixation of both column acetabular fractures is justified. In the Indian population, with occupational and social demands like squatting and sitting cross-legged, it is important to have a functional and stable hip joint with good range of motion that can be achieved with open reduction and internal fixation of both column acetabular fractures. Finally, even if the prognosis of restoration of joint is not always good, restoring normal anatomy will enable the patient to have a better quality of life in the near future and to have successful reconstructive procedures in distant future.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical standards The study has been approved by Ethical Committee of Baroda Medical College and SSG Hospital Vadodara Gujarat, India.

Informed consent Informed consent was obtained from all the patients while conducting the study.

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