Section: Orthopedics

Original Research Article

COMPARATIVE STUDY OF FUNCTIONAL OUTCOMES OF ANTERIOR COLUMN ACETABULAR FRACTURES MANAGED CONSERVATIVELY VERSUS SURGICALLY IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Anterior column acetabular fractures are complex injuries commonly caused by high-energy impacts. The choice of treatment is an area of debate, whether surgical and conservative management should be used, and functional or radiological outcomes represent two important criteria for treatment success. The current study aimed to determine the functional and radiological outcomes of anterior column acetabular fractures treated conservatively and surgically at a tertiary care hospital. **Materials and Methods:** This prospective interventional study was conducted in 20 cases with an anterior column acetabular fracture was conducted. Ten patients underwent open reduction and internal fixation (ORIF) using the modified Stoppa approach, while ten was treated conservatively with traction. Outcomes were assessed using the Harris Hip Score, Merle d'Aubigné–Postel score, and Matta's radiological criteria. Associated injuries, complications, hospital stay, and time to union were also recorded. **Results:** The mean age of the patients was 38.1 years, with males (65%) of cases. RTAs accounted for 80% of cases. 55% of the patients had associated injuries, mostly long bone fractures. Surgical treatment showed Harris Hip Score: mean 86; excellent/good in 90% cases had better functional outcomes than conservative treatment, with a mean score of 77.6; good score in 60% cases. The surgical group also had a higher (mean 15.8 vs. 13.9) Merle d'Aubigné score. Outcomes of radiology were favoured towards surgery, and more anatomic reductions were performed. There was no difference between the radiological union times in the two groups (mean 15.5 weeks). Superficial infections (surgical group) and bedsores (conservative group) were complications recorded. **Conclusion:** Surgical management provides better functional and radiological outcomes in displaced anterior column acetabular fractures, while conservative management remains a viable option for undisplaced fractures or patients unfit for surgery. Individualized treatment selection is essential for optimizing patient outcomes.

Keywords: Acetabular fractures, Anterior column, Open reduction internal fixation, Conservative management, Functional outcome, Matta's criteria.

INTRODUCTION

Acetabular fractures are complex injuries that involve the articular surface of the hip joint and are usually caused by high-energy trauma, including road traffic accidents, falls, or crush injuries. Included in this category are fractures of the anterior column of the acetabulum, which form a specific subgroup, originally named by Judet and Letournel, who described the general system of classification used to describe the patterns of acetabular fractures.[1] The fracture of the anterior column runs through the iliac crest, the anterior acetabular wall,

and rim to the pubic symphysis with a range of articular surface injury.[2] These types of fractures are of clinical significance due to their direct influence on hip joint congruency, stability, and ultimate functional outcome.

Management of anterior column acetabular fractures is a subject of debate. Historically, surgical fixation has been promoted in order to obtain an anatomical reduction and stable fixation, especially in displaced fractures with loss of articular congruency.[3] Development of surgical and instrumentation techniques, such as anterior intrapelvic and minimally invasive surgeries, has enhanced the capability to reconstruct acetabular anatomy.[4] Surgical management is designed to reduce the risk of post-traumatic arthritis and maintain long-term hip activity. However, surgical risks and possible complications such as infection, heterotopic ossification, injury to the neurovascular system, and intraoperative blood loss do exist.[5] These risks require special attention to be given in the selection of patients to be treated using surgical or conservative modalities.

On the other hand, minimal displacement of the anterior column fractures, patients with low functional requirements, or those patients with high comorbidity preventing surgery have traditionally been managed with the use of conservative management. Traction, limited weight bearing, and physiotherapy are generally conservative therapies with the aim of preserving hip mobility and functioning.[6] Conservative management has some concerns with malunion, residual displacement, and ultimately degenerative joint disease,[7] though it is less invasive. However, there are studies that have shown good results with non-operative treatment under selective cases, underlining the value of personalized treatment planning.[8]

The decision between conservative and surgical management often depends on the age of the patient, the level of his/her activity, the extent of the fracture movement, the presence or absence of other injuries, and the availability of the surgical skills. Functional outcome is generally determined by scoring its system, like the Harris Hip Score, Merle d'Aubigny and Postel score, and radiographic grading of arthritis progression.[9] The most important determinants of long-term outcome are restoration of hip joint biomechanics and prevention of secondary osteoarthritis. Acetabular fractures present a clinical and socioeconomic challenge in India, where road traffic accidents are a leading cause of morbidity and health-related resources are limited.[10] Comparison of outcomes of conservative and surgical treatment of anterior column acetabular fractures in a tertiary care environment is essential because it may offer evidence-based information on how to maximize patient care in resource-limited settings. Very limited literature has compared these two modalities in this pattern of fracture, and there is still a gap to investigate the outcome in the Indian population, where mechanisms of injury, patient demographics, and healthcare facilities may vary. With this background, we in the current study aimed to evaluate and compare the functional and clinical outcomes following conservative and surgical management of the acetabular fractures with long-term follow-up.

MATERIALS AND METHODS

This cross-sectional interventional study was conducted in the Department of Orthopedics, Osmania Medical College and Hospital, Hyderabad, Telangana. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Inclusion Criteria

1. All ipsilateral and bilateral fractures of the anterior column of the acetabulum in adults (18-60) years
2. Associated with other acetabular fractures in weight-bearing areas.
3. Males and Females.
4. Signed the consent form
5. Available for follow-up analysis

Exclusion Criteria

1. Acetabular fractures not involving the anterior column of the acetabulum.
2. Patients with associated spine injuries.
3. Patients having ipsilateral shaft of femur fractures or neck of femur fractures
4. Patients having fractures >45 degrees of roof arc angle

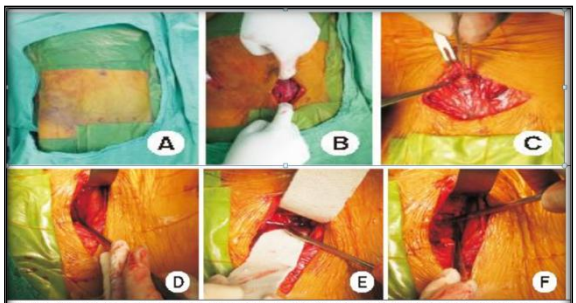
Based on the inclusion and exclusion criteria, a total of n=20 consecutive cases of fracture of the anterior wall of the acetabulum in the age group 18-60 years were admitted, managed, and analyzed. After routine investigations, including antero-posterior, inlet, outlet, and Judet view skiagrams and Computerised Axial Tomograms, 10 patients were operated on, and the remaining 10 patients were treated conservatively, by below-knee skeletal traction. Ethical clearance was obtained from the Institute's ethics committee. Functional outcomes are compared using radiologic methods as described by Matta. J,[3] and by joint range of movements, scored based on the Harris Hip Score,[11] and Merle d'Aubigne and Postel score for functional outcome.[12] Clinical follow-up at 4 weeks, 8 weeks, 12 weeks, and 6 months intervals regarding pain, range of movements, signs of sepsis, and assessment with reference to functional outcome scores assessed by the Harris hip score and Merle D'Aubigne Postel score. Radiological follow-up at 8 weeks and 6 months intervals regarding heterotopic ossification and radiological outcome by Matta, in accordance with symptoms if needed.

Procedures Used in Conservative Treatment: Only in minimally displaced anterior wall or column fractures, i.e., < 3 mm stepping, we have used bilateral below-knee skeletal tractions for 6 weeks.

Following this traction period, patients were encouraged to do hip and knee movements in sitting posture and supine positions for another six weeks. Bilateral axillary crutch-assisted partial weight bearing was the next step in the rehabilitation period. Meticulous nursing care was imperative to prevent pressure sores. Patients would be made to sit up in bed to prevent hypostatic pneumonia. Lung physiotherapy, including deep breathing exercises, was advised. Static and dynamic knee exercises were encouraged as the pain waned. Anticoagulants were not administered in this series. Only 10 patients had been treated conservatively.

Procedure used in Operative Treatment: In 10 patients, we used the modified Stoppa's approach. Reconstruction plates were bent and aligned along the curvature of the bone; fracture fragments were reduced gently with bone spikes, and fractures were fixed rigidly. Occasionally, buttressing of the quadrilateral surface of the acetabulum was done using buttress plates or reconstruction plates.

Operative Technique: In the ilioinguinal approach, the patient is placed supine on a radiolucent table. A skin incision is made two finger breadths above the symphysis pubis, extending to the anterior superior iliac spine and then along the iliac crest. The external oblique aponeurosis and inguinal ligament are incised in line with the skin incision. Three windows are created: the first by retracting the iliopsoas and femoral nerves medially, the second by retracting them laterally with medial displacement of the external iliac vessels, and the third by lateral retraction of the vessels. In the modified Stoppa approach, a Pfannenstiel incision 2 cm above the symphysis is used. The linea alba is split, the rectus abdominis dissected, and the corona mortis ligated. Access is gained along the pelvic brim by elevating the iliopectineal and obturator fascia. Retractors are positioned to expose the quadrilateral surface and posterior column, while carefully protecting the obturator neurovascular bundle and lumbosacral trunk.



Modified Stoppa approach. (A) Skin incision-like Pfannelstiel incision; 10 cm transverse incision 2 cm above the symphysis pubis. (B) Subcutaneous dissection. (C) Incision of the fascia (linea alba) of the rectus abdominis. (D) Deep blunt dissection along the superior pubic ramus. (E) Identification of the obturator nerve. (F) Exposure of the quadrilateral surface.

Complications of acetabular fracture management include infections (0–3%), particularly with open fractures or soft tissue injuries, managed with antibiotics and hardware removal if late. Iatrogenic sciatic nerve injury is seen with posterior approaches, requiring meticulous positioning and retraction. Intra-articular screw placement may lead to arthritis if uncorrected, hence careful imaging is vital. Venous thromboembolism is common; prophylaxis with heparin/enoxaparin and postoperative anticoagulation is advised. Heterotopic ossification (2–90%) is reduced by indomethacin or radiotherapy. Post-traumatic arthritis and femoral head osteonecrosis depend on reduction quality, sometimes requiring THR. Posterior approaches may also cause hip abductor weakness.

Post-Operative Care: All patients were given preoperative antibiotics and postoperatively for 7 days. Drain removal was done on the 2nd postoperative day. Suture removal was done on postoperative day 12 to 14. Indomethacin 25mg TDS was prescribed orally for 6 weeks from the next day after surgery for selective cases. Low molecular weight heparin was given for 7 days for DVT prophylaxis. Passive mobilization was started on postoperative day 2. Active movements started gradually in accordance with pain. Weight bearing was allowed as the fracture consolidated mostly in the 3rd or 4th month. Radiological and functional examination was done on a monthly review for the first 6 months and every third month thereafter. Quality of fracture reduction was assessed with radiographs and classified as anatomic, imperfect, and poor reduction depending on residual displacement of the fracture according to Matta's criteria.

RESULTS

A total of n=20 cases were included in the duration of the study. The mean age of the cohort was 38.1 years, ranging from 19 to 62. The mean age of patients undergoing surgical management is 37.9 years, and the mean age of patients undergoing conservative management is 38.3 years. The study involved a total of 13 males, of whom 7 were managed by surgery and 6 were managed conservatively. Of the 7 females involved in the study, 3 were managed surgically and 4 were managed conservatively.

[Table 2] highlights the concomitant injuries sustained by the patient. In this study, it has been noted that 11(55%) patients out of 20 had other associated injuries along with an acetabular fracture. 9 patients had no other associated injuries, 1 patient had posterior dislocation of the hip joint, 4 patients sustained concomitant long bone fractures, 3 patients had concomitant pelvis fractures, 2 patients had sustained chest injuries, 1 patient had sustained abdominal injury, and 1 patient had sustained head injury.

It has been noted that acetabular fractures are commonly associated with other bone fractures or other system injuries, possibly due to high-impact/velocity trauma. The most common

associated injuries are long bone fractures, followed by pelvic fractures. In this study, 10 of 20 patients underwent open reduction and internal fixation using the modified Stoppa approach. Patients with associated posterior wall/posterior column fractures were treated conservatively or surgically with open reduction and internal fixation using the Kocher-Langenbeck approach in a different sitting. Ten patients were treated conservatively with bilateral traction therapy. Patients with associated long bone fractures were treated either conservatively or surgically in a different setting. The time of presentation to the emergency room from the time of injury ranged from a minimum of 1 day to a maximum of 14 days, with an average time of presentation of 3.5 days.

The time interval between injury and surgery was a minimum of 6 days and a maximum of 11 days. The mean time interval for surgery is 7 days. The duration of surgery ranged from a minimum of 110 min to a maximum of 220 min. The mean duration of surgery was 146 min. The average estimated blood loss was approximately 500 ml, and eight patients required intraoperative blood transfusion. The Criteria for conservative management were patients who were not fit for surgery, patients who were not willing to undergo surgery, and undisplaced acetabular fractures. The conservative management included distal femoral pin traction along with contralateral skin traction (to balance the forces) for 4 weeks, followed by physiotherapy and gradual weight bearing as tolerated.

Table 1: Distribution of cases in the study

Characteristic	Frequency	Percentage
Age in Years		
< 20	1	5%
21-30	3	5%
31-40	10	50%
41-50	4	20%
51-60	1	5%
>60	1	5%
Sex Distribution		
Surgically Managed		
Male	7	70%
Female	3	30%
Conservatively Managed		
Male	6	60%
Female	4	40%
Side		
Right	8	40%
Left	12	60%
Mode of Injury Sustained		
RTA	16	80%
Fall From Height	4	20%

Reduction: Quality of fracture reduction was assessed with radiographs and classified as anatomic, imperfect, and poor reduction depending on residual displacement of the fracture according to Matta's criteria.

Duration of Hospital Stay: Among the surgically managed patients, the duration of hospital stay ranged from a minimum of 5 days to a maximum of 28 days, with an average duration of hospital stay being 10.4 days. Among the conservatively managed patients, the duration of hospital stay ranges from a minimum of 3 days to a maximum of 7 days, the mean duration of hospital stay being 4.7 days.

Functional outcome: The functional outcomes of all patients were assessed using the Harris hip and Merle Aubigne scores at the end of the study period. Among the patients who were surgically managed, the Harris hip score ranged from 65 to 95, with a mean score of 86. 5 had excellent outcomes, four had good outcomes, and 1 patient had poor outcomes.

[Table 4] presents the outcome assessment of cases by various scoring systems. Among the patients who were conservatively managed, the Harris hip score ranged from 65 to 80, with a mean score of 77.6. Patients had good outcomes, three patients had fair outcomes, and one patient had a poor outcome. Among the patients who were surgically managed, the Merle D'Aubigne score ranged from 12 to 18, with a mean score of 15.8. Four patients had excellent outcomes, and 6 patients had good outcomes. Among the patients who were conservatively managed, the Merle D'Aubigne score ranged from 12 to 17, with a mean score of 13.9. One patient had excellent outcomes, nine 9 patients had good outcomes.

According to Matta's Radiological Outcome, among the surgically managed patients, excellent outcomes were noted in three patients, good outcomes in six patients, and fair outcomes in one patient. Among the conservatively managed patients, good outcomes were noted in seven patients, and fair outcomes were noted in three patients.

Radiological Union in Weeks: Among the patients treated surgically, radiological union was noted in a minimum of 12 weeks and a maximum of 22 weeks, with a mean duration of radiological union of 15.8 weeks. Among the patients treated conservatively, radiological union was noted at a minimum of 12 weeks and a maximum of 18 weeks, with a mean

duration of radiological union of 15.2 weeks. The overall average time to radiological union was 15.5 weeks.

Complications: Among the patients who underwent ORIF, two developed superficial surgical site infections, which were resolved with antibiotic coverage, and one developed bedsores. Among the conservatively managed patients, three developed bedsores, which resolved once weight bearing was started along with local hygiene. No other complications were observed in this study.

Table 2: Associated Injuries in the cases of the study

Associated Injury	Frequency	Percentage
None	9	45%
Dislocation	1	5%
Long Bone Fracture	4	20%
Pelvis Fracture	3	15%
Chest Injury	2	10%
Abdominal Injury	1	5%
Head Injury	1	5%

Table 3: Radiological outcome in the cases based on Matta's Criteria

Matta's Criteria	Radiological Outcome According to Matta's Criteria	
	Surgically Managed	Conservatively Managed
Anatomic Reduction (<1mm)	5	7
Imperfect Reduction (1-3mm)	5	2
Poor Reduction (>3mm)	0	1

Table 4: Assessment of cases based on various scores and radiological outcome

Functional Outcome of Surgical Management: Harris Hip Score		
Outcome	**Frequency**	**Percentage**
Excellent	5	50%
Good	4	40%
Fair	0	0%
Poor	1	10%
Functional Outcome of Conservative Management: Harris Hip Score		
Excellent	0	0%
Good	6	60%
Fair	3	30%
Poor	1	10%
Comparison of management using Merle d'aubigné and Postel score		
	Conservatively managed	Surgically managed
Excellent	4	1
Good	6	9
Fair	0	0
Unsatisfactory	0	0
Evaluation of the cases based on Matta's Radiological Outcome		
	Conservatively managed	Surgically managed
Excellent	0	3
Good	7	6
Fair	3	1
Poor	0	0

DISCUSSION

The treatment of anterior column acetabular fractures remains a controversial issue in terms of the best treatment approach between conservative and surgical treatment. The current research compared the functional outcomes using surgical and conservative treatment methods with the outcome measures assessed using the Harris Hip Score, Merle d'Aubigné Postel score, and Matta radiological criteria. Our cohort(mean age 38.1 years, mostly males) was a uniformly representative demographic of past researches, which show that acetabular fractures frequently occur in young adults, especially males, because of the high-energy trauma, including road traffic accidents (RTAs).[8,13] Eventually, RTAs were the cause of 80% of injuries in our series, consistent with previous reports of RTAs as the most common cause of acetabular fracture in developing nations.[14] Associated injuries were sustained by a considerable percentage (55%) of patients, the most frequent being long bone fractures, followed by pelvic fractures. This finding is in line with the results of Giannoudis et al., who underlined that an acetabular fracture is frequently present in polytrauma because of high-energy processes.[15] The presence of other concomitant injuries makes the fractures more complex and has the potential to affect prognosis. In our series, surgical treatment was mainly carried out by the modified Stoppa technique, which has become the most popular method because of the better exposure of the quadrilateral plate and less morbidity in comparison with the old ilioinguinal techniques.[4] The mean duration of operation was 146 minutes, and blood loss approximated 500 ml, which falls within the range of reported similar studies.[16] Radiologic evaluation of Matta criteria showed that

surgical fixation had greater rates of anatomic correction, which have been significantly linked to better long-term functional results.[3] Although with conservative management, acceptable results were obtained in cases of minimum displacement fractures, poor reductions were more prevalent, highlighting the weakness of traction and non-operative solutions in the face of intricate patterns of fractures.

Harris Hip Scores, as a functional assessment tool, showed that surgical management produced excellent or good outcomes in 90 percent, and conservative management produced good or fair outcomes in most cases. It is consistent with the results of Letournel and Judet, who determined that anatomical shrinkage as a result of surgery is a major determinant of hip functioning.[17] In line with this, Merle d'Aubigny scores were better in the surgical group, which further supports the utility of operative fixation. Nevertheless, the conservative therapy continued to portray good results in those patients who were selective and especially those with undisplaced fractures or who were medically unsuitable to undergo surgery. There was no significant difference in the meantime to radiological union between the two groups (15-16 weeks), indicating that union per se is not an important determinant of the outcome of treatment, but the quality of reduction and rehabilitation determines the final functional outcome.[18] There were differences in complications between groups, where surgical patients got infected with superficial infections, whereas conservative patients had a higher risk of getting bedsores. These results highlight that the two modalities are associated with dangers and should be taken into account to adapt treatment according to the profile of patients. Finally, our research confirms the current literature that surgical management produces better functional and radiologic results in displaced anterior column acetabular fractures, and conservative therapy is a plausible solution in the undisplaced fractures or high-risk surgical patients.[19,20] These observations should be confirmed by larger studies with long-term follow-ups, which are multicenter studies

CONCLUSION

This present study demonstrated that surgical treatment of anterior column displacement acetabular fractures offers better radiographical/functional results than conservative treatment, especially when anatomical restoration is attained. Surgically treated patients had better Harris Hip and Merle d'Aubigné scores and had improved radiological outcomes by Matta's criteria. However, conservative management provided acceptable results in the chosen patients of undisplaced fractures or those who are not operable. Approach-specific complications were more likely to affect surgical patients, who were more likely to become infected and less likely to develop bedsores than conservative patients. In general, bespoke treatment planning, taking into account fracture pattern, patients' comorbidity, and surgical health, is indispensable to the best results.

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