

Acetabular Fracture- Clinical Outcomes of Surgical Management**Md. Qamar Abdul Azeez¹, Buddharaju Suraj Verma², Krishna Teja. K³**¹Associate Professor, Department of Orthopaedics, NRI IMS- Anil Neerukonda Hospital, Visakhapatnam, Andhra Pradesh, India²Assistant Professor, Department of Orthopaedics, NRI IMS- Anil Neerukonda Hospital, Visakhapatnam, Andhra Pradesh, India³Assistant Professor, Department of Orthopaedics, NRI IMS- Anil Neerukonda Hospital, Visakhapatnam, Andhra Pradesh, India

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Abstract:**Aim:** The purpose of this study was to assess the efficacy of anterior and combined approaches for treating acetabular fractures.**Methods:** Retrospective evaluation of 37 acetabular fractures in 35 patients treated with an anterior approach. According to Judet-Letournel, fractures are classified. Initial and final radiological evaluations were based on the criteria of Matta. For functional assessment, modified Merle d'Aubigne and Postel criteria were utilised.**Results:** Eleven fractures (30%) were of the straightforward type, while 26 (70%) were of the mixed type. Two (18%) of the uncomplicated fractures were transverse, while nine (82%) involved the anterior column. Fourteen (54%) of the mixed type fractures were both column fractures, five (19%) were transverse + posterior wall fractures, five (19%) were T-shaped fractures, and two (8%) were anterior column + posterior hemitransverse fractures. In 15 (43%) patients, the surgical approach was ilioinguinal, in 9 (26%) it was Stoppa, and in 11 (31%) it was combined. Our functional outcomes were excellent in ten (27%) hips, fair in twenty (54%) hips, moderate in four (10%) hips, and poor in three (8%) hips. In 15 (40.5%) hips, our radiological findings were flawless, excellent, moderate, or poor.**Conclusion:** In fractures that are amenable to anterior surgical approaches, the results are satisfactory. In some fracture types, a posterior approach can be incorporated. We anticipate that the proportion of acetabulum fractures requiring a concomitant posterior approach will decrease as experience grows.**Keywords:** Acetabulum, fracture, anterior approach, outcomeThis is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Acetabular fractures are rising in developing nations due to the prevalence of high-energy trauma, such as motor vehicle collisions and falls from great heights [1, 2]. According to epidemiological data, the incidence of acetabular fractures is approximately three per one hundred thousand per year [3]. Severe injuries typically cause them and are common among multiple-trauma patients [4]. Nevertheless, fragility acetabular fractures in osteoporotic patients can occur due to simple low-energy falls from standing height or minor trauma [5].

The complicated morphology of the acetabular region makes the treatment of acetabular fractures challenging. These fractures are always a challenge for orthopaedic and trauma surgeons. Prior to the 1964 study [6], the majority of acetabular fractures were treated by closed reduction. The standard treatment for displaced acetabular fractures is

currently open reduction and internal fixation. The ilioinguinal, iliofemoral, extended iliofemoral, Kocher-Langenbeck, triradiate, and combined anterior and posterior approaches [7, 8] are the most common types of surgical approaches to the acetabulum. Due to Letournel's 1961 description [9], the ilioinguinal approach has remained the most common for anterior acetabular fixation, whereas the Kocher-Langenbeck approach [6] is regarded as the gold standard for posterior access. Nevertheless, the decision to use an appropriate approach depends heavily on the type and nature of each acetabular fracture. The chosen approach must provide a sufficient viewing angle, permit anatomic reduction, and permit control of the fracture site. For instance, an extended or combined approach may be utilised in patients with significant displacement in both the anterior and posterior acetabular columns [10, 11].

71% to 88% of patients with acetabular fractures reported good to outstanding functional outcomes following surgical treatment, according to the majority of studies [12-15]. Important prognostic factors that influence clinical prognosis include associated fracture type, femoral head damage, associated injuries, dislocation at the time of injury, inadequate fracture reduction, age, development of heterotopic ossification, and delay in surgical treatment [16-21]. In addition, the surgeon's education and experience are essential. The surgeon's practical skills enable him to select the most effective method for obtaining favourable treatment outcomes.

To treat fractures associated with the anterior aspect of the acetabulum, an ilioinguinal approach is utilised. This method has appropriate rates of complications. It affords a broad view from the iliac fossa to the pubic symphysis [4]. The modified Stoppa approach is a modification of an approach for hernia correction as described by Rives and Stoppa [5, 6]. Cole and Hirvensalo introduced this modification [7, 8]. This is an alternative to the ilioinguinal approach to the anterior acetabulum. The modified Stoppa approach guarantees access to the acetabular medial wall, quadrilateral surface, and internal pelvis [9]. The objective of this investigation was to assess the complications and functional and radiological outcomes of our anterior surgical approaches (modified Stoppa and ilioinguinal) for displaced acetabular fractures.

Methods

In our department, 74 patients diagnosed with acetabular fractures underwent surgery between three years. Sixty-four out of seventy-four patients were found to have attended regular follow-ups. 25 (42%) of the 60 patients received posterior approaches, 24 (40%) received an anterior approach, and 11 (18%) received a combined (anterior + posterior) approach. This retrospective study evaluated 35 cases in which an anterior approach was utilised alone or in conjunction with posterior approaches. The study material consisted of 37 acetabular fractures in 35 patients undergoing anterior surgical approaches. Other than the form of fracture, surgeon preference was the primary determinant of the surgical approach in our study. Fixation was achieved with titanium alloy reconstruction plates (Zimed Medikal San. ve Tic. Ltd. ti., Gaziantep, Turkey).

We evaluated pelvic posteroanterior (PA) and pelvic oblique radiographs obtained before and after surgery and during clinical follow-ups. The Judet-Letournel classification was applied to these X-rays and preoperative computed tomography images [3] to classify fractures. The postoperative reduction was determined using the Matta reduction criteria on pelvic PA and oblique X-rays; 0-1 mm displacement was deemed anatomical, 2-3 mm was deemed effective, and >3 mm was deemed inadequate. At final checkups, functional evaluation was conducted using control forms based on Matta's modified Merle d'Aubigne and Postel criteria [10]. Radiological evaluations were performed using Matta's radiological assessment scale [11]. The Brooker classification was applied to evaluate heterotopic ossification [12].

Statistical Analysis

The statistical analysis was conducted with SPSS 18 (SPSS Inc., Chicago, IL, USA). For hypothesis testing, ANOVA, the chi-square test, and Fisher's exact test were utilised. A p value of less than 0.05 was considered significant.

Results

We evaluated 37 acetabular fractures in 35 patients who had undergone an anterior surgical approach. The study included 10 female patients (29%) and 25 male patients (71%). The average age of the patients was 38.3 years (range: 17-71), and the average duration of follow-up was 21.3 months (12-47). Twenty (54%) fractures occurred on the right hip, while seventeen (46%) occurred on the left.

Acetabular fractures were caused by traffic accidents in 17 (48%) patients, falls from elevated places in 15 (43%) patients, and other causes in 3 (9%) patients; one patient dropped a heavy object on himself, and two fell from horses. Two patients exhibited dislocation of the hip. These were reduced in the emergency department, and skeletal traction was administered until surgery using a supracondylar region-passed wire. At the time of presentation, two patients had sciatic nerve symptoms. At the final checkup, these had resolved completely in one patient and partially in the other.

In 13 patients, an acetabular fracture was the only injury, whereas 22 patients (63%) had additional injuries, such as pelvic injuries, genitourinary system injury, upper and lower extremity fractures, and vertebral compression fractures (Table 1).

Table 1: Additional injuries observed in patients with acetabulum fractures

Additional injury	No. of patients (%)
Pulmonary contusion	3 (8.6)
Ureter injury	1 (2.9)
Urethra injury	2 (5.7)
Hepatic laceration	1 (2.9)
Rib fracture	2 (5.7)
Vertebral compression fracture	2 (5.7)
Femoral fracture	3 (8.6)
Distal end radius fracture	2 (5.7)
Humerus fracture	2 (5.7)
Calcaneus fracture	2 (5.7)
Double forearm fracture	2 (5.7)
Medial malleolus fracture	1 (2.9)
Other injury in the pelvis	12 (34.3)

Eleven fractures (30%) were of the basic type, while 26 (70%) were of the complex type. Two (18%) of the uncomplicated fractures were transverse, while nine (82%) were anterior column fractures. Fourteen (54%) of the complex fractures

involved both columns, five (19%) were T-shaped, five (19%) were transverse + posterior wall, and two (8%) were anterior column + posterior hemitransverse. The varieties of fractures and methods used to treat them are detailed in Table 2.

Table 2: Distribution of surgical approaches selected by type of fracture

Fracture classification	Ilioinguinal	Stoppa	Combined
Anterior column	2 (22%)	7 (78%)	0
Transverse	1 (50%)	1 (50%)	0
Both columns	9 (64%)	0	5 (36%)
T-shape	1 (20%)	2 (40%)	2 (40%)
Anterior column + posterior hemitransverse	1 (50%)	1 (50%)	0
Transverse + posterior wall	1 (20%)	0	4 (80%)

The average number of days between trauma and surgery was 6.3 (2-17) days. In 15 (43%) patients, the surgical approach was ilioinguinal, in 9 (26%) it was modified Stoppa, and in 11 (31%) it was a combination of ilioinguinal and Kocher-Langenbeck. Combined methods were executed on the same day and during the same session. In cases where adequate reduction was not achieved with a single approach, the second surgical approach (Kocher-Langenbeck) was performed concurrently. In every instance, screws and plates were used for fixation; screw fixation alone was never employed. In 15 (40.6%) of 37 acetabulum fractures, anatomical reduction was determined, while successful displacement was determined in 16 (43.2%), and inadequate displacement was determined in 6 (16.2%). One patient undergoing ilioinguinal surgery exhibited paresthesia in the lateral hip due to injury to the nervus cutaneus femoris lateralis, which persisted at 12 months of follow-up. Following ilioinguinal surgery on a patient with a transverse and posterior wall fracture, an intra-articular screw was identified; on the second postoperative day, the incision was reopened, and the screw was removed.

One (2.9%) of the 35 patients developed a superficial (ilioinguinal) infection, which was treated with a dressing and antibiotics. In all cases,

no deep vein thrombosis was observed, and no radiological screening was performed. In 3 (or 8.6%) of the 35 patients, heterotopic ossification was detected. In one case, grade 1 (combined approach) heterotopic ossification was observed, grade 2 (combined approach) in one case, and grade 4 (ilioinguinal) in one case. On three (8.1%) hips, posttraumatic arthritis was identified.

Based on the modified Merle d'Aubigne and Postel criteria, functional evaluation of fractures at final checkups revealed perfect functional outcomes in 10 (27%) hips, excellent outcomes in 20 (54%) hips, moderate outcomes in 4 (10%) hips, and poor outcomes in 3 (8%). When the final radiological examinations were evaluated using Matta's criteria, the radiological outcomes were excellent in 15 (40.5% of the hips), good in 15 (40.5%), moderate in 4 (11%) and poor in 3 (8%) hips. There was no statistically significant correlation between the time between trauma and postoperative reduction (Spearman's test, $p=0.089$). In our study, a significant correlation was found between the quality of reduction attained after surgery and radiological outcomes ($p=0.001$).

Discussion

Since acetabulum fractures are caused by high-energy trauma, they are frequently accompanied by other injuries. 63 percent of our patients exhibited additional injuries. Generally, the treatment of concomitant injuries takes precedence. Typically, acetabulum surgery is not a procedure that must be performed immediately, but superfluous delays must be avoided. When surgery is delayed, chondrolysis and osteonecrosis are known to increase [3]. In our study, the average amount of time between trauma and surgery was 6.3 (2-17) days. 30 patients were operated on within the first 9 days, while 5 patients were operated on after 10 days. We attribute the absence of a statistically significant relationship between time from trauma to surgery and functional and radiological outcomes to the small number of cases undergoing late procedures.

An ilioinguinal approach can be used for fractures of both columns, as well as fractures of the anterior column+posterior hemitransverse, anterior column, transverse, T-shaped, and anterior wall [11]. The ilioinguinal approach has a number of benefits, including rapid recovery of muscle function in the postoperative period, excellent cosmetic results and rare ectopic bone formation, suitability for a variety of fracture types, and few complications. However, it also has disadvantages, such as the inability to visualise the joint and the propulsion of debris into the joint during reduction [11].

The modified Stoppa approach is a prospective alternative to the classic ilioinguinal approach when anterior acetabular access is required. The modified Stoppa approach can be utilised for anterior wall, anterior column, both columns, anterior column, posterior hemitransverse, and certain transverse and T-shaped fractures. This method is applicable for transverse and T-shaped fractures if the fracture line in the posterior column is near to the sciatic notch and located high up. Since the inguinal canal and its contents are not accessed, this surgical procedure is less invasive than the inguinal approach [13]. In our study, the surgeon's personal preference was the deciding factor between ilioinguinal and modified Stoppa.

Letournel reported a 10% requirement for a combined approach in their series [4]. In our series, ilioinguinal or Stoppa was selected as the initial approach for all fracture types affecting the anterior column. When the posterior component was not sufficiently reduced or corrected by the anterior approach, 31% of cases required the addition of a posterior approach. We believe that as experience increases, this disparity in combined approach requirement rates will diminish.

Up to 7% of intra-articular screw malposition has been reported in acetabular fracture surgery [14, 15]. One patient in our series who underwent an

ilioinguinal approach was found to have an intra-articular implant. At the 12-month follow-up, functional outcome was unsatisfactory. This was one of the initial cases, and the complication has not been encountered since.

In the absence of prophylaxis, heterotopic ossification occurs at a rate of 14% to 50% following extensile approaches and at a rate of 25% following the Kocher-Langenbeck approach [16]. In the ilioinguinal approach, it is extremely rare that the outer tabula of the ileum is not dilated. In the vast majority of cases, heterotopic ossification occurs within the first three months following trauma [17]. It has been reported that indomethacin and low-dose radiotherapy are efficacious in reducing clinically significant heterotopic ossification [18]. Nevertheless, some investigations have questioned the efficacy of prophylaxis. Matta and Siebenrock found that indomethacin was ineffective compared to a placebo [19]. Karunakar et al. [20] reported comparable findings in an identical study. None of our patients received heterotopic ossification prophylaxis. Two of our patients were diagnosed with grade 1-2 (combined surgical approach) heterotopic ossification, while one patient was diagnosed with grade 4 heterotopic ossification. In our patient with grade 4 heterotopic ossification, the ilioinguinal approach was utilised. This patient had additional pelvic injuries and was intubated and monitored in intensive care for four days.

Avascular necrosis has been reported to occur at a rate of 5.6% in patients undergoing surgery for acetabulum fracture and to be more prevalent in subjects with traumatic hip dislocation than in those without hip dislocation [21]. One of the 37 acetabular fractures in our study developed this condition. In this instance, traumatic hip dislocation was evident.

Conclusion

In fractures that are amenable to anterior surgical approaches, the success rate is exceptionally high. As experience grows, we anticipate that the proportion of acetabulum fractures requiring a concomitant posterior approach will decrease. Considering the region's anatomy and the nature of the trauma, the complications encountered during these procedures are within acceptable limits.

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