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A two year follow up study of operative results of fractures of acetabulum

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Abstract

Aims & Objectives: To analyse the operative results of acetabulum fracture with respect to operative technique, clinical and radiological union, time for mobilisation, complications and functional outcome measured by Merle d'Aubigne score and Harris Hip score at the end of follow up.

Materials: 26 patients with acetabulum fracture treated by open reduction and internal fixation were included in the study and evaluated for 2 years between 2013 to 2016. The ages of patients ranged from 21 to 56 years. Elementary fractures had more incidence than associated fractures out of which transverse type and both column type had similar incidences i.e. 15%. 55% of the patients were treated with Kocher Langenbeck's approach and ilioinguinal approach was used in 40% patient. The average follow up duration was 1.8 years ranging from a minimum of one year to maximum of three years.

Results and Observation: In 14 (70%) of the patients radiological union was seen in 4-5 months of surgery. Operative outcome of present study as per Merle d' Aubigne scoring system shows excellent to good result in 17 (85%) of patients and fair to poor result in 3(15%) of patients. In the present study 18 (90%) patients had flexion of more than 90 degrees and 15 (75%) patients had extension of more than 10 degrees. Abduction and adduction of more than 20 degrees and more than 10 degrees was seen in 17 and 18 patients respectively. The internal and external rotation was more than 15 degrees in 14 and 15 patients respectively.

Conclusion: The most common cause of acetabular injury is vehicular accidents and occur in young and active men. The most common type of fracture pattern is posterior wall and then transverse with posterior wall. Kocher Langen beck's approach gives good results for posterior wall involvement and ilio-inguinal approach is excellent for anterior column and anterior wall-posterior hemi transverse fracture. Result of surgery of acetabulum fracture is directly proportional to amount of initial trauma, surgeon's experience and skill.

Keywords: Acetabulum fractures, posterior wall, anterior column

1. Introduction

Acetabular fractures are life altering injuries that commonly occur in young, active and productive members of society although the number of elderly patients sustaining acetabulum fracture has increased. The operative treatment of acetabular fracture is technically challenging. The incidence of acetabular fracture is about 1 in 50000 population per year in UK ^[1] and 3 in 100000 in USA. It constitutes approximately 2% to 3% of all fractures ^[2, 3]. There is also increase in incidence of acetabulum fracture in our country due to rising number of high speed vehicular accidents. The surgical approaches and reduction techniques must be thoroughly understood to properly manage this three-dimensional problem. The complicated anatomy of the acetabular region, frequent severe associated injuries, and long-term complication, all contribute to management difficulties ^[4]. Open reduction and internal fixation is suitable for most patients with incongruity or instability of the hip ^[5]. Failure to achieve anatomical reduction, rigid internal fixation leads to a poorer functional outcome and an increase in post-traumatic arthritis ^[6]. We have done a retrospective study of 20 patients with acetabulum fracture treated by open reduction and internal fixation and evaluated for two years between 2013 to 2016.

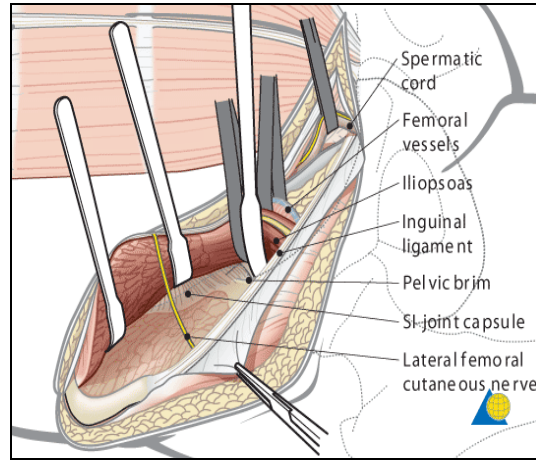
2. Materials and Methods

A retrospective study was conducted in our institute, and data of all the patients having acetabulum fractures admitted to our orthopaedic unit between 2013 and 2016 was collected using a standard Proforma. We included in our study all operated cases of displaced fractures of acetabulum in adult while excluding those with pubic ramus and pelvic fractures not involving the acetabulum. Patients with age less than 18 years

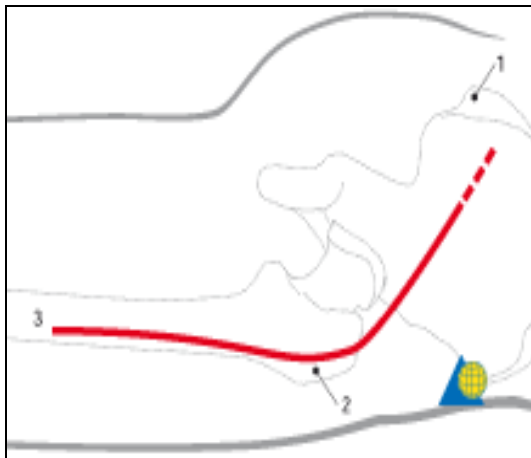
and open fractures were also excluded. Most of the patients were operated between 3-7 days of injury depending on the general and local condition.

2.1 The approaches used during the study were

- a) Iliinguinal approach
- b) Kocher langenbeck approach



Iliinguinal Approach-Incision Site and Structures



Kocher Langenbeck's Approach- Incision

- Provisional fixation usually is established by means of kirschner wires. Definitive fixation is established with the help of screws and plates. The primary fixation is by means of an interfragmentary screw. This is usually a 3.5-mm cortical screw used as a lag screw or a 4-mm cancellous screw. The 3.5-mm reconstruction plate either curved or straight, DCP, is also ideal for this purpose. Post-operative physiotherapy was started 2nd post op day and the patient was evaluated at regular interval. Final functional evaluation of all patients was done using Harris hip score and Merle D'Aubigne score

roof-arc angle of 70° or less across the weight-bearing portion of the acetabulum, according to Vrahas *et al*, on the basis of a cadaveric study; persistent instability after closed reduction.

Incarcerated intra-articular fragments or impaction of the articular surface.

3. Management

3.1 Operative Management

3.1.1 Indications

- All displaced fractures (>2 mm articular step).
- Intact roof-arc angle less than 30°.
- Failure to achieve or maintain concentric reduction by closed means.
- Fractures that have a medial roof-arc angle of 45° or less, an anterior roof-arc angle of 25° or less, or a posterior

- Emergency open reduction and internal fixation (ORIF) if associated vascular injury or sciatic palsy develops after a closed reduction.
- Contraindications:
- General-Severe systemic illness or secondary multi-organ failure secondary to polytrauma; systemic infections or sepsis.
- Local-Local infection; extreme osteoporosis
- Relative-Severe comminution
- Deep vein thrombosis

3.2 Functional Criteria

1. Pain and tender point: present/absent
2. Minimal/Moderate/Sever

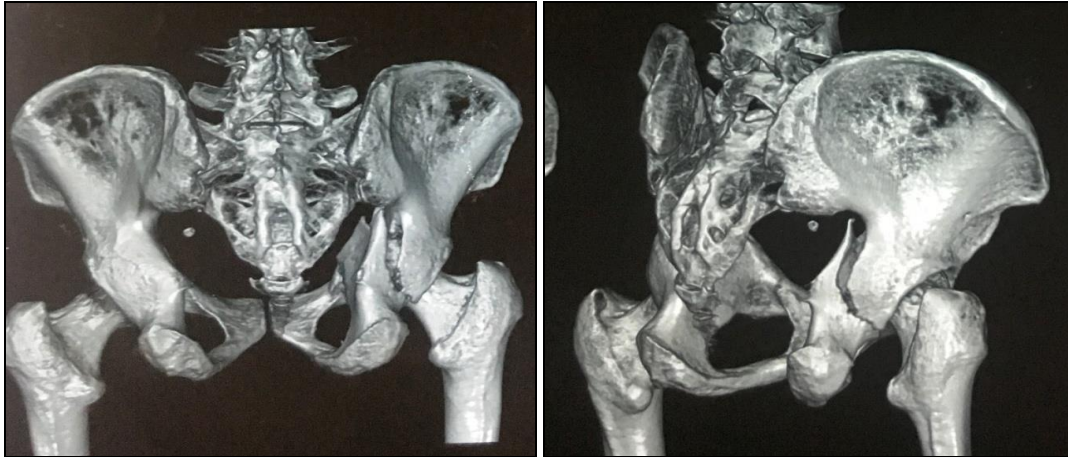
3. SLR
4. Knee bending
5. Squatting and standing
6. Walking and limp
7. Limb length
8. Range of motion: Flexion & Extension
Abduction & Adduction
Internal rotation & External rotation
9. Activities of daily living

3.3 Radiological Criteria

1. Union/Non-union
2. Heterotopic ossification
3. Implant Position
4. Joint Space
5. Head congruency

4. Clinical Cases

Case 1: 55 YR/M, H/O Rta With Acetabular Of Both Columns Operated With Both Inguinal And Kocher Langenbeck Approach



3 D Ct Scan



Pre-Op X-ray



Post-Op X-ray



1 Year Follow up



2 Year Follow Up



Harris Hip Score: 96
Merle D' Aubigne Scale: Excellent

5. Observation and Results

In my study, 26 patients were included during the period of 2013-2016, out of which 6 patients were lost to follow up, leaving 20 patients for evaluation. The average follow up duration was 1.8 years ranging from a minimum of one year to a maximum of three years. The ages of the patients ranged from 21 to 56 years.

Table 1: Mode of Injury

Mode of injury	No. Of patients
Rta	17 (85%)
Fall from height	2 (10%)
Fall from stairs	1 (5%)

Table 2: Complications

Complications	No. Of patients
Infection	2
Inguinal hernia	1
Avn	1
Palsy	1
Ho	0

Table 4: Range of Motion at Final Follow Up

Range of motion		Number of patients
Flexion	>90 deg.	18
	70-89 deg.	2
Extension	10 deg.	15
	0 deg.	5
Abduction	>20 deg.	17
	<15 deg.	3
Adduction	>10 deg.	18
	< 5 deg.	2
Internal rotation	>15 deg.	14
	<10 deg.	6
External rotation	>15 deg.	15
	< 10 deg.	5

In the present study 18 (90%) patient had flexion of more than 90 deg, and 1 (75%) patient had extension of more than 10 deg. Abduction and adduction of more than 20 deg and more than 10 deg. was seen in 17 and 18 patients respectively. The internal rotation and external rotation was more than 15 deg. in 14 (70%) patient and 15 (75%) respectively.

Table 5: operative outcome of our study (merle d'aubigne scale)

Score	Result	No. Of patients
18	Excellent	8
15-17	Good	9
13-14	Fair	2
<13	Poor	1

Table 6: Distribution of Clinical Results According To Fracture Type by Merle D'aubigne Score

Fracture type	Excellent	Good	Fair	Poor
Elementary fracture				
Posterior wall	3	2	-	-
Posterior column	-	2	-	-
Anterior wall	-	-	-	-
Anterior column	-	1	-	-
Transverse	-	1	1	1
Associated fracture				
T-shaped	-	1	1	-
Posterior wall-posterior column	-	1	-	-
Transverse-posterior wall	2	-	-	-
Anterior wall with posterior hemi transverse	-	1	-	-
Both column	3	-	-	-

As per Merle d'aubigne scores the present study shows 40% excellent result and 50% good result. One patient had poor and one had fair outcome as both of them had associated injury of femur and tibia, affecting the outcome scores. However, both of them had normal range of motion of the hip

Table 7: Comparison of Outcome of Our Study with Other Studies (Merle D'aubigne Score)

Various studies	Excellent	Good	Fair	Poor	Total
Letournel and Judet ^[40]	307 (62.4%)	90 (18.29%)	30 (6.1%)	65 (13.2%)	492 (100%)
Matta ^[41]	104 (40%)	95 (36%)	21 (42%)	42 (16%)	262 (100%)
Mustufa <i>et al.</i> ^[50]	12 (36.4%)	13 (39.4%)	8 (24.2%)	0 (0%)	33 (100%)
Sagar <i>et al.</i> ^[42]	27 (49.1%)	15 (27.3%)	9 (16.4%)	4 (7.3%)	55 (100%)
Our study	8 (40%)	9 (45%)	2 (10%)	1 (5%)	20 (100%)

The above table shows the comparison of operative outcomes of the present study with other studies and it is clearly evident

that the present study have almost 40% patient with excellent scores similar to Matta's study and Mustufa's study. 45% patients in the present study had good scores, which is highest compared to all the studies, and we have the least number of patients with poor outcome when compared to other large patient studies

6. Discussion

- Hip joint is the most important joint for weight bearing, thus acetabulum fracture fixation is a necessity when it comes to achieve a normal functioning hip. To achieve this, we need to make decisions regarding fracture management. The principle of operative management of acetabular fracture^[64] is Socket restoration, Socket stabilisation, congruent reduction, early mobilisation and Delayed weight bearing.
- Acetabular fracture are as a result of high energy trauma, thereby we expect bleeding from the cancellous bone in the initial days after trauma. So primary management is of utmost importance where in the principle of advanced trauma life support (ATLS) comes into play. Initial immobilization, fluid therapy and correction of hypovolemia, injection tranexamic acid all help in initial stabilization of patient as well as the fracture. With advancement of radiological technology, preoperative planning has become easier. With newer devices of 3D prints, one can get the 3D model of fracture of bone and we can exercise fixation before the actual surgery.
- Availability of new implants and plates like Precontoured 'C' plate and spring plates have made life easier for orthopaedic surgeons. Use of instruments like pelvi-acetabular clamps, flexible drill bits and contouring devices are helpful in better management of these fractures. Anatomical reconstruction of the pelvi-acetabular complex is essential to prevent further complication like arthritis and AVN. Less than 2 to 2.5 mm step is acceptable in these fractures.
- Most common cause of acetabular fracture is high energy road traffic accidents
- Our study average age is 36.9 years. 13 (65%) of these patients are of 21 to 40 year age group similar to observation in the study of Matta *et al.* since young and active individual are involved more in high energy accidents.
- It is also observed that 16 (80%) of the patients are male since males are more exposed to road traffic accident
- Most common fracture pattern in our study is posterior wall (25%). This is because of position of hip joint at the time of accidents. Dash board injury is the cause for posterior wall fracture and posterior dislocation. Elementary fractures had slight more incidence than associated fractures. Both transverse type and both column type had similar incidences i.e. 15%. We had no patient with anterior wall fracture pattern in our study.
- The accurate identification of a fracture is the cornerstone of proper management of injury. As outlined by Letournel, "the fractures must be perfectly known before the operation because the type of fracture dictates the choice of approach"⁵¹. Many reports have demonstrated the importance of the Letournel and Judet classification system⁵¹⁻⁵⁵. It is generally assumed that the Kocher-Langenbecks approach must be used for the elementary posterior wall and posterior column fractures and for the associated posterior column + posterior wall and transverse + posterior wall fractures. Conversely, the ilio-

inguinal approach must be used for the elementary anterior wall and anterior column fractures and for the associated anterior wall/column + posterior hemitransverse fractures. The remaining three patterns (elementary transverse fracture and associated "T"-type and both-column fractures) must be exposed on the basis of the degree of fracture displacement. Combined exposures and less commonly extensile approaches are usually reserved for associated fracture patterns.

- The operative outcome according to Merle D' Aubigne score is excellent to good in 17 (85%) patients and fair to poor in 3 (15%) of patients, similarly, outcome according to Harris hip score is excellent to good in 18 (90%) of the patients and fair to poor in 2 (10%) of the patients.
- The primary complication after fracture of the acetabulum is posttraumatic arthritis. The quality of the fracture reduction appears to be the main determinant for the risk of late traumatic arthritis [56-58]. Long-term studies have demonstrated that fracture reductions to within 1 mm of residual displacement have better long-term outcome and a lower prevalence of arthritis than those with greater than 1 mm of displacement. In addition, if arthritis develops after a perfect reduction, the onset tends to be later and the progression slower than arthritis that develops after a poor reduction [56]. Damage to the femoral head at the time of initial injury is another important factor [57]. Osteonecrosis of the femoral head is known to result from acetabular fracture associated with hip dislocation and can be a cause of posttraumatic arthritis. However, posttraumatic arthritis more commonly occurs because of wear of the femoral head against a malreduced fracture and may often be incorrectly attributed to osteonecrosis [56, 57]. One patient operated with KL approach developed AVN. AVN is most commonly seen in posterior column fracture since main blood supply to head of the femur passes just posterior to the neck of femur through ascending branch of medial circumflex femoral artery, reticular artery and ascending cervical artery. Although the rate of AVN after acetabular fracture is 3-10% [59-62] the initial surgery in the form of acetabular reconstruction will provide a foundation in the form of acetabular congruity and bony stalk for future revision hip arthroplasty surgeries. In our series avascular necrosis was seen in one patient (5%) had AVN as compared to 4.1% patients in Kumar *et al.* series.
- As we compare our study with other study it is clearly evident that posterior column is the most common fracture in all the three studies followed by both column fracture. The least common fracture is anterior wall fracture followed by posterior wall and posterior columnar fracture.
- The results of our study were on par with other studies. Most common fracture pattern in most of the studies is posterior column, and majority of the posterior column fracture is associated with posterior dislocation. Infection rate was slightly higher in our studies as compared to previous studies, but we had less incidence of heterotopic ossification and sciatic nerve palsy patient while comparing to previous studies. On comparing our study with studies having high number of patients the operative outcome was excellent to good in almost 80% of the patient with less than 10% of the patient with poor outcome.

7. Limitations in Our Study

1. Sample group was small.
2. Duration of study was less to study the long term outcome.
3. Due to variability of injury patterns, it is difficult to make definite quantitative conclusions of outcome.
4. Patients included in this study are operated by different surgeons leading to change in operative technique and follow up result.
5. We are not able to comment on the requirement for conversion of THR at long term follow up.

8. Conclusion

- The most common cause of acetabular injury is vehicular accidents and occur in young and active men.
- The most common type fracture pattern is posterior wall and then transverse with posterior wall.
- Radiographic imaging in the form of 3D CT scan and availability of pelvi-acetabular reconstruction plates makes life easier for the orthopaedic surgeon
- The best time for surgery is within a week.
- Kocher Langenbeck's approach gives good result for posterior wall involvement.
- Ilio-inguinal approach is excellent for anterior column and anterior wall-posterior hemitransverse fracture.
- In acetabular surgery for fracture, if we follow established protocols, we get good outcome in patients.
- Result of surgery of acetabulum fracture is directly proportional to amount of initial trauma, surgeon's experience and skill.
- Although the rate of AVN after fixation is 3-10% the pelvi-acetabular fixation provides a bony base for future replacement arthroplasty.

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