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FUNCTIONAL OUTCOME ANALYSIS OF OPEN REDUCTION AND INTERNAL FIXATION OF COMPLEX ACETABULAR FRACTURES

Orthopaedics

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KEYWORDS

INTRODUCTION

Over the last 20 years, Improvements in automobile safety, prehospital care, resuscitation, and transport as well as standardized protocols for treatment have all contributed to improved survival after severe pelvic injuries. Only 10% of the pelvic disruptions involve acetabulum.

Posterior wall fractures are most common, comprising 24% of acetabular fractures. The primary cause in younger individuals is high-energy trauma.

Acetabular fractures generally occur in conjunction with other fractures.

The treatment of acetabular fractures is an enigmatic area of orthopaedics that is being continually refined. It involves a definite learning curve [1].

Acetabular fractures are generally associated with other injuries of the pelvis and lower limbs which may influence treatment options, surgical approach and clinical outcomes . Patient age, fracture stability, the presence of comorbidities and osteoporosis, combined with surgeon experience also influence treatment options.

The goals of the treatment should be anatomic reconstruction of articular surface and early mobilisation. This goal can be achieved only when acetabulum is adequately exposed and rigid internal fixation is done. Displaced fractures of the pelvis that involve the acetabulum are difficult to treat. Withclosed methods, it is difficult, if not impossible, to restore the articular surfaces completely and obtain sufficient stability for early motion of the hip.

The treatment of simple fractures of acetabulum is well known and studied. Treatment of complex Acetabular fracture is difficult as it involves both the column of the acetabulum, For reduction and fixation, both columns have to manipulated and fixed.

The purpose of this study is to analyse the results and functional outcome of open reduction and internal fixation of fracture involving both acetabular columns (Complex Acetabular Fractures) with the use of Kocher Langenbeck , ilioinguinal or both approaches .

MATERIALS

This is a prospective study done to assess the functional and outcome of complex acetabular fractures treated by open reduction and internal fixation in 20 patients over a period of two and half years from July 2016 - December 2018 at Our Institute, Sree Balaji medical college and hospital, Chromepet, Chennai.

Inclusion criteria :

1. Age greater than or equal to 18 years ,
2. Closed fractures,
3. Complex acetabular fractures including Transverse fractures, Transverse with posterior wall fracture, T Type fracture, Anterior column or wall with posterior hemitransverse fracture , Both column fractures.

Exclusion criteria :

1. Open injuries,
2. simple fractures,
3. fracture greater than 3 weeks old ,
4. patient operated within last six months. Patients were put on skeletal traction.

In our study , on receiving the patients in emergency room, general assessment and resuscitation was done . After stabilization of vital parameters, complete skeletal survey and associated injuries especially vascular and nerveinjuries was assessed. Radiological assessment was done with anteroposterior, judet views of acetabulum and computed tomography with 3-d reconstruction of acetabulum if needed.

Closed reduction was done in dislocated patients under i.v sedation and skeletal traction was applied in all patients. Patients were operated between 5 to 10 days based on Damage Control Orthopaedics.

After completing clinical and radiological examination pre operative planning regarding approach and implant to be used was made on basis of fracture type, displacement and associated injuries.

Surgical exposure was decided preoperatively based on fracture displacement. Kocher Langen-beck approach was used for posterior fractures and anterior ilio-inguinal approach was used for anterior fractures . After reducing and fixing one column the reduction of other column was assessed by image intensifier and need for exposing the other column was made.

After exposure reduction poses the challenge. Reduction cant be

achieved easily as in any long bones and maneuvers are not the same . In posterior approach, schanz pins was placed in trochanter, ischial tuberosity and iliac crest for simultaneous manipulation . Various reduction clamps are available to facilitate reduction and holding. In anterior approach a farabeuf clamp or a schanz pin was placed in iliac crest to manipulate and reduce. Matta's Quadrangular clamp of various sizes and with offsets and Picador ball spike pusher are very important instruments in Acetabular surgery. Reduction was fixed with lag screws whenever possible. Lagging was done with 4mm cancellous screws or 3.5 mm cortical screw with washer. 3.5mm Reconstruction plates are used as neutralisation plate .

All patients were given pre operative antibiotics and post operatively for 5 days. Drain removal done on 2nd post operative day . Suture removal was done on post operative day 12 to 14. Indomethecin 25mg TDS was prescribed orally for 6 weeks from next day after surgery. Low molecular weight heparin was given for 7 days when anterior approach is used as DVT prophylaxis .

Passive mobilization was started on post operative day 2. Active movements started gradually in accordance with pain. Weight bearing was allowed as the fracture consolidates mostly on the 3rd or 4th month.Radiological and functional examination was done on monthly review for first 6 months and third monthly there- after.

Patients in our study were analysed by the Matta's radiographic assessment post operatively and modified Merle d' Aubigné and postel Hip Score at each follow up.

Functional Outcome :
Modified Merle'd Aubigné And Postel Grading System :

Pain :
None - 6
Slight or intermittent -5 After walking but resolves -4
Moderately severe but patient is able to walk -3
Severe, prevents walking -2

Walking
Normal -6
No cane but slight limp -5
Long distance with cane or crutch -4
Limited even with support -3
Very limited -2
Unable to walk -1

Range of motion*
95-100% -6
80-94% -5
70-79% -4
60-69% -3
50-59% -2
<50% -1

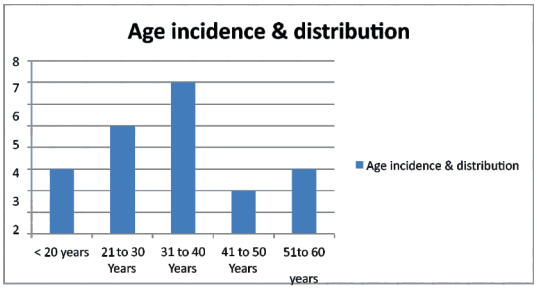
Clinical score
Excellent -18
Good -17,16,15
Fair 13 or 14
Poor <13*

The range of motion is expressed as the percentage value for the normal hip. This is calculated by obtaining a total of the ranges, in degrees, of flexion- extension, abduction, adduction, external rotation, and internal rotation for the injured hip and dividing it by the total for the normal hip.

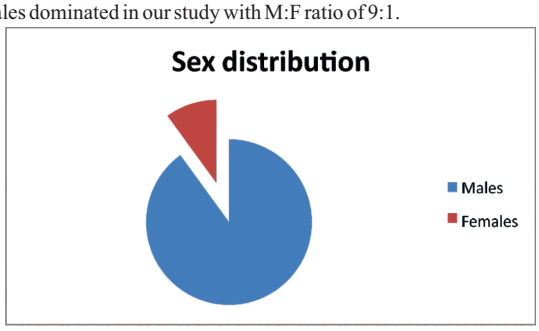
Post operative Radiological assessment :
Matta's criteria:
Anatomic reduction <1mm;
Imperfect 1–3mm;
Poor >3mm.

RESULTS
Age Incidence and Distribution :
The Mean age of the patients was 35.45 year ranging from 18 to 60 years.

Age	No of Patients	Percentage
< 20 Years	03	15 %
21 to 30 Years	05	25%
31 to 40 Years	07	35%
41 to 50 Years	02	10%
51to 60 years	03	15%

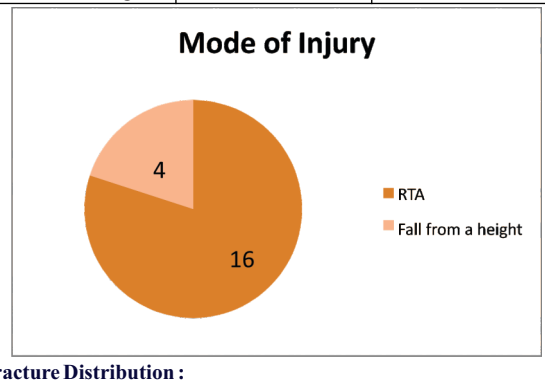


Sex Incidence :
Males dominated in our study with M:F ratio of 9:1.



Mode of Injury :
Majority of the patients suffered Road Traffic Accidents followed by Fall from Height.

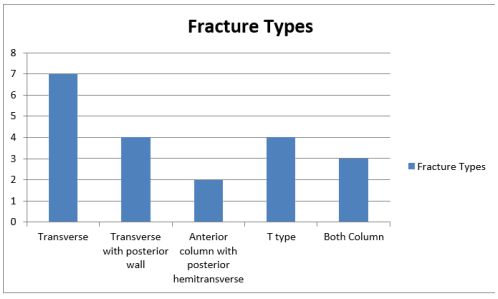
Mode of injury	No . of Patients	Percentage
RTA	16	80%
Fall from Height	4	20



Fracture Distribution :

Fracture type (Judet and Letournal)	No. of Patients	Percentage
Transverse	7	35%
Transverse with posterior wall	4	20%
Anterior column with posterior hemi-transverse	2	10%
T type	4	20%
Both column	3	15%

Fracture Distribution :



ASSOCIATED INJURIES :
In our study 8 patients had associated injuries.

Associated injuries	No. of Patients
Fracture of clavicle	1

Fracture of Distal radius	2
Fracture of superior pubic rami B/L	1
Fracture of Inferior pubic rami B/L	1
Fracture Neck Of contralateral Femur	1
Intertrochanteric Fracture of ipsilateral Femur	1
Fracture shaft of contralateral Femur	1
Fracture supracondylar femur ipsilateral side	1
Fracture both bone contralateral leg	2
Fracture Medial malleolus	1
contralateral side	
Fracture Metacarpal	1
Sciatic Nerve palsy	1
Urethral injury	1

SURGICALAPPROACHES :

Procedure	No.of Patients
Kocher Langenbeck Approach	14
Ilioinguinal Approach	3
Ilioinguinal approach Followed by Kocher langenbeck Approach	1
Kocher Langenbeck Approach followed by ilioinguinal approach	2

Radiologic assessment was done post operatively by Matta's criteria and Functional status of the patient was assessed by Modified Merle'd Aubinge and Postel score .

Twenty patients with complex acetabular fractures were treated surgically and analysed with average follow up of 10.5 months ranging from 6 months to 2 ½ years .

75% belong to less than 40 years. 35% patients belong to 4th decade followed by 3rd decade (25%). Males dominated our study group with a ratio of 9: 1. Road traffic accidents contributed to the injury in 80% of our patients and rest sustained by fall from height. Transverse fracture was the most common type in our study (7 cases). Anterior column with posterior hemitransverse was least common type (2 cases).

Eight patients had associated skeletal injuries. One patient had sciatic nerve injury and one patient had urethral injury. Most of the patient were operated by Kocher langen-beck approach (17 Patients). Three patients was operated by ilioinguinal approach. Three patients was operated by combined approach. In contrast to pelvic injuries, all patients were hemo-dynamically stable at the time of admission.

Figure 1 : Before surgery

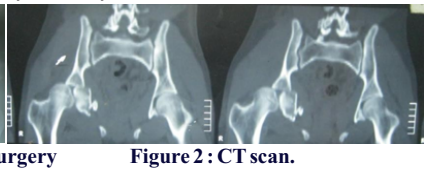
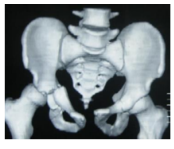


Figure 2 : CT scan.



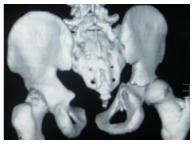
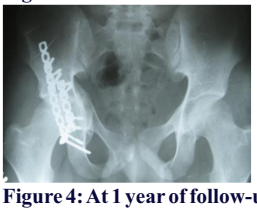
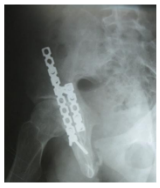


Figure 3: 3D - CT scan





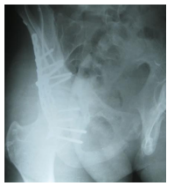


Figure 4: At 1 year of follow-up.

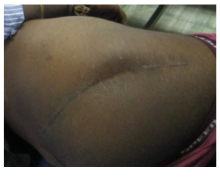


Figure 5: Mobility after surgery & Scar.

In our study the average surgical time delay was 6 days ranging from 5 to 11 days. The average surgical time was 127 minutes ranging from 60 minutes to 4 hours.Four patients have encountered operative complications. One patient operated by ilioinguinal approach had superficial infection which settled with antibiotics. One patient had a deep circumflex vein tear managed by ligation following which he developed DVT that resolved with heparin. One patient was found have intra-articular screw after being operated via anterior approach. One patient operated by posterior Kocher langenbeck approach developed sciatic nerve palsy.

No patient had sacroiliac disruption or pubic diastasis. No patient died during treatment or follow up.

According to Matta's criteria, 6 patients had anatomic reduction, 7 patients had satisfactory reduction and 7 patients had poor reduction (>3mm gap). The mean score in anatomically reduced fractures was 15.1 , in imperfect reduction is 15.8 and in poorly reduced fracture is 14.5. Out of 18 patients, four patients had excellent , eight patient had good , five patient had fair and 1 patient had a poor results. 60% patient are having near normal life and 94% patient are having satisfactory result in our study. Function outcome score for the patients ranged from 10 to 18 (Maximum Score- 18).

The poor result (Score-10) in one patient was due to Avascular necrosis of femoral head . Patient had transverse with posterior wall fracture operated by posterior Kocher Langenbeck approach. Total hip replacement was done for this patient at 8 months after surgery.

There are seven patients with transverse fracture . one was lost to follow up. All patients with transverse fracture had excellent or good result except one patient who had fair result due to associated multiple skeletal injuries in lower limb .

Two patients with both column fracture was operated by anterior Ilioinguinal approach and one patient had excellent and other had good result. Associated posterior wall fracture had reduced the outcome score.

T type fracture , Anterior column with posterior hemitransverse and Transverse with posterior wall fracture had reduced outcome score than other two types .

Fracture	No	Average score	Result			
			Excellent	Good	Fair	Poor
Transverse	6	16.5	2	3	1	0
Transverse with posterior wall	4	14.5	0	2	1	1
Anterior column with posterior hemitransverse	2	14.5	0	1	1	0
T type	4	15	1	1	2	0
Both column	2	17	1	1	0	0

DISCUSSION

The treatment of simple acetabular fractures has been studied in detail and there has not been much of change over time. The options for treatment of complex acetabular fractures are wide and are continuously refined over time. The treatment of complex acetabular fracture is difficult because it involves both the columns and reduction of the both by single or double approach is must.

The mean age group in our study was 35.4 years which is comparable with Swiontkowski et al[3] on complex acetabular fracture. Males predominated as in other studies[3] . Road traffic accident forms the major mode of injury .

The highlight of open reduction and internal fixation is anatomic reduction, rigid fixation and early mobilization which will keep the joint functional as described by Matta[4]. Pennal et al[5] reported that the quality of the clinical result depends directly on the quality of the reduction that was achieved when open reduction and internal fixation were performed . In our study , there is decreased mean functional score (14.5) in the fracture group with poor reduction compared to rest (Anatomical Reduction 15.1 and Imperfect reduction -15.8).

Management of displaced acetabular fracture requires adequate exposure with minimal morbidity. An ideal approach would allow visualisation of both columns and the joint surface with minimal complications. We used only twonon extensile approaches - Posterior

Kocher Langenbeck approach and anterior Ilioinguinal approach.

We used single approach in most of the patients except in 3 patients .

With this single approach we are able to get 65% of satisfactory reduction and 94% of favorable result in short term. According to Tile , even with best hands depending on the type and complexity of fracture , anatomic reduction can be obtained in 70% cases of acetabular fractures . In our study we included only complex fractures and we were able to get satisfactory reduction in 65% patients.

H. J. Kreder et al listed factors influencing the outcome[6]- degree of initial displacement, damage to the superior weight bearing dome or femoral head, degree of hip joint instability caused by posterior wall fracture, adequacy of open or closed reduction and late complications like AVN, heterotrophic ossification, chondrolysis or nerve injuries are assessed. In our study associated posterior wall fracture has reduced the functional outcome .

Giannoudis et al[7] in his meta-analysis reported 5.6 % of AVN in posterior approaches . In our study , We had a case of avascular necrosis of femoral head leading to poor outcome (5%) . Patient came with AVN at 8 month follow up for whom total hip replacement was done .

Extensile approaches around the hip joint have reported a high rate of complications. Alonso et al. reported 53% incidence of heterotopic ossification with Triradiate approach and 86% incidence with the use of Extended iliofemoral approach. No case of heterotopic ossification has been encountered till date in our study . Heterotopic ossification was reported as high as 20% in non extensile approaches used for complex fractures accoording to Jiong Jiong Guo, et al .We used Indomethacin for patients for 6 weeks as prophylaxis for heterotopic ossification.

Giannoudis et al[7] reported 8% of iatrogenic sciatic nerve palsy in posterior approaches. In Our Study ,We report one case of sciatic nerve palsy in posterior approach (5.8%) . Swiontkowski et al[3] also showed 8.3 % iatrogenic sciatic nerve palsy in his study. one case of DVT in anterior ilioinguinal approach .We had a case of intra articular screw penetration in anterior approach, but the patient was asymptomatic and had excellent functional outcome.The complication rate is very low when compared to Matta[8] and Swiontkowski studies[3].

The non-extensile approaches which we advocated have operating time and average blood loss which are similar to those reported by others (Matta et al ı986;Goulet and Bray 1988 ; Reinert et al 1988 ; Routt and Swiontkowski 1990 ; Helfet et al 1992).

The mean functionl outcome score is 15.4 ranging from 10 to 18 (Maximum—18). The least score is seen in a patient with transverse with posterior hemitransverse fracture operated by Kocher langenbeck approach and developed Avacular necrosis of femoral head .

According to Marwin M Tile , Transverse has the best and T Type and anterior column and posterior hemitransverse fracture has worst prognosis . In our study Transverse fractures and both column fractures showed better results. T Type and anterior column with posterior hemitransverse had reduced outcome.

Even though our study comprised of small group of 20 patients with good pre operative planning , use of non extensile approaches and early rehabilitation , we have been able to produce 94 % good to satisfactory result according to modified Merle d Aubigne and Postel scoring systems. However, further follow up is needed to comment on long term outcome .

CONCLUSION

From our study , We conclude that Complex acetabular fractures treated by open reduction and internal fixation have a satisfactory functional outcome .

Use of non extensile approaches itself is sufficient to produce adequate fracture reduction with reduced complications.

Every chance of reducing the fragments anatomically, fixing rigidly and mobilizing early must be done for better function which is not possible by conservative means.

Treatment of acetabular fractures is a challenging task for any orthopaedic surgeon. With definite learning curve , proper pre operative planning , non extensile exposure , accurate reduction , rigid fixation and early rehabilitation , it is possible to produce a improved outcome.

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