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Epidemiology of acetabular fractures and its outcome in Surgical Management

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Abstract
Background: Acetabular fracture remains a challenge to the orthopedic surgeon. It is mainly because of the complexity of these fractures, difficult accessibility, associated other injuries and it requires a long learning curve. In this study epidemiology and surgical out come in acetabular fractures are evaluated.
Methods: 41 patients treated for acetabular fractures over a period of two and half years were studied over a three and half year period between January 2006 and May 2009. Epidemiological details of these patients with acetabular fracture were collected from the medical records. Out of 41 patients, 31 underwent open reduction internal fixation of acetabular fracture. Quality of reduction was assessed based on immediate post-operative x- ray. A minimum post-operative period of one year was kept as cut off point in assessing radiological and clinical score.
Results: There were 41 cases of acetabular fracture among 4261 trauma admissions during this period. Associated sciatic nerve injury was present in 5 patients. Road traffic accident was the cause of injury in 36 patients, and fall from height in 5 patients. In 18 patients, there was associated hip dislocation. 31 patients out of 41 underwent open reduction internal fixation (ORIF). Average day of operation was 5.64 days. Fracture reductions were anatomical in 23 patients, imperfect in 6 patients and poor in 2 patients. Radiological score were excellent in 18 patients, good in 8 patients, fair in 3 patients and poor in 2 patients. Clinical scores were excellent in 10, very good in 14, good in 5, fair in 2
Conclusion: Serious post-operative complications like iatrogenic sciatic nerve injury, joint penetration by implants, avascular necrosis of the femoral head were less, compared with other studies. Clinical evaluation scores, reduction obtained are in par with recent studies. The radiological scores are better in our studies. These are due to early fixation, anatomical reduction and less complications.

Keywords: Acetabular fracture, epidemiology, Open reduction internal fixation (ORIF)

Introduction
'Fractures of acetabulum remain an enigma to acetabular surgeon.' That statement is still true, although great strides have been made to the management of this fracture in the past decade. Acetabulum fractures are complex fractures, and achieving optimum results requires experience. There are not many literatures on epidemiology of acetabular fractures. Gansslen *et al* studied the epidemiology of these injuries to the pelvic ring and found that most of them were the result of road-traffic accidents [1].
In 1964, Judet & Letournel elucidated the interpretation of plain radiographs of the pelvis, presented a classification system for acetabular fractures, and developed operative approaches & tactics for surgical management [2].
Letournel's series of 940 patients (1972) with acetabular fractures is the largest in the literature and is the gold standard [3]. He described about the importance of perfect anatomical reduction of acetabular fractures for better functional outcome.
"Comparison of a relatively undisplaced crack fracture of the acetabulum with a significantly displaced centrally dislocated hip is like comparing an apple to an orange" - Marvin Tile [4].
In 1988, Matta introduced "quality of reduction "in 121 operated cases [5]. He concluded that displacement of 3 mm or more in x ray plane films were unsatisfactory. The articular cartilage of acetabulum is 2.5 mm thick at best and if one accepts a 3 mm step in reconstruction, then no circumstances this will produce satisfactory long term outcome.
Aims and objectives of this research are:

- To study the incidence of acetabular fractures among trauma patients

- To know the most common mechanism of injury
- To know the type of acetabular fractures
- To study complications associated with it
- To study the outcome of surgical management
- Compare the data obtained with other similar studies

Materials & method

Study was conducted in Department of orthopedics, Baby memorial hospital Calicut. This is a tertiary care center with 750 beds. The study is retrospective study of all acetabular fractures treated between January 2006 to May 2008 over a period of 2.5 years. For a final evaluation after a minimum follow-up of 12 months after the surgery were included in the study. Thus the period of study extended over three and half years from Jan 2006 to May 2009.

Inclusion criteria

All cases of acetabular fracture admitted in this hospital from January 2006 to May 2008.

Radiological &Hip function scoring done only after one year of post-operative period.

Exclusion criteria

Those cases admitted before January 2006 and after May 2008.

Radiological & hip function scoring of those patients who hasn't completed one year of postoperative period.

All patients with acetabular fractures were initially managed as per ATLS protocol. They were thoroughly evaluated for associated injuries. All patients underwent preoperative ultrasound abdomen, x ray pelvis AP, obturator oblique, iliac oblique views and CT scan with reconstruction imaging. Those patients with associated hip dislocation were immediately reduced under anesthesia. Stability was checked under anesthesia. Non-reducible hips, were treated with open reduction.

Fractures were classified based on Letournel Classification.

Indications for conservative treatment

Medical contraindications, pre-existing osteoarthritis, local infections, osteopenia of the innominate bone, undisplaced fractures, very low transverse or anterior column fractures, both column fractures that achieve secondary congruence, congruently reduced hip joint after dislocation which is stable.

Indications for ORIF

Instability, incongruity & soft tissue interposition.

Surgical approaches

Surgical approach for the fixation of acetabular fracture depends mainly on the type of fracture. Kocher-Langenbeck approach, Kocher Langenbeck with trochanteric flip extension, Ilioinguinal approach and Modified Stoppa approach were used depending on the type of fracture.

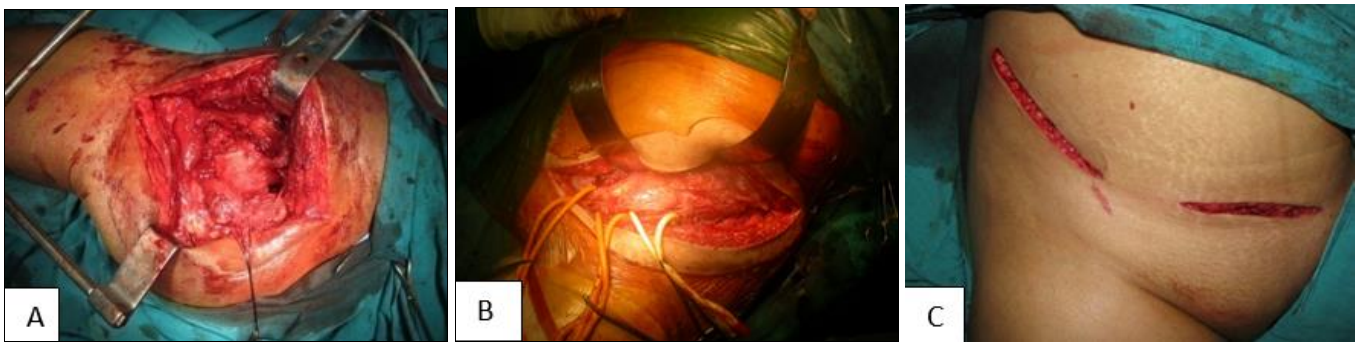


Fig 1: A: Kocher-Langenbeck approach. B: Ilioinguinal approach. C: Modified Stoppa approach

Follow up

X-rays are taken for immediate postoperative control, and at 6 weeks, 12 weeks 6 months and one year after surgery. Post-operative CT scans (fig 2) may be obtained if necessary.

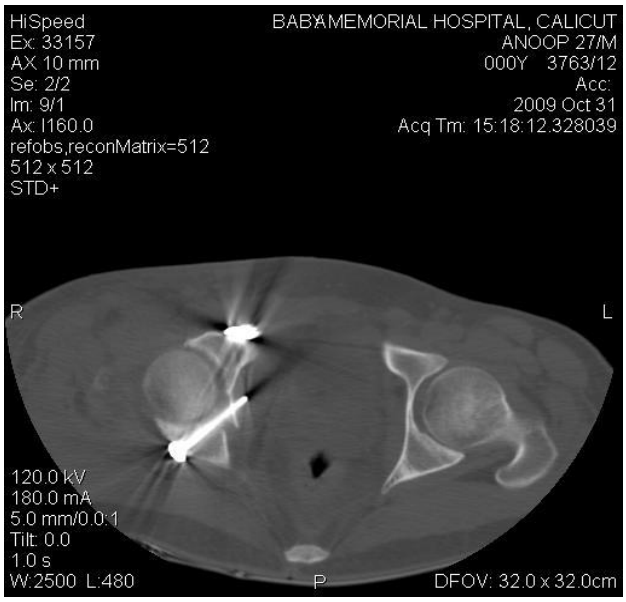


Fig 2: Post-operative CT scan in acetabular fracture which shows reduced fracture with implant insitu

Data collection technique and tools

Retrospective study was carried out, with the help of medical records, scheduled interview and clinical assessment. A minimum post-operative period of one year was kept as cut off point in assessing radiological and clinical score. Quality of reduction was assessed based on immediate post-operative x ray. Scoring methods used for assessment are given below

Modified Robert Merle d' Aubigne clinical scoring for evaluation of hip function.

Quality of reduction achieved after surgical procedure is assessed based on immediate postoperative x rays. Used a previously described method of categorizing radiographic displacement, severity scale described by Matta. Anatomical (0-1mm), Imperfect (2-3mm), Poor (>3 mm) [6].

Radiological outcome measurement done using Matta radiological grading system after one year of surgery.

Excellent grade	Normal appearance of hip
Good	Mild changes with small osteophytes, moderate narrowing of joints(1mm)minimal sclerosis
Fair	Intermediate changes with moderate osteophytes, 50% narrowing of joint space, moderate sclerosis
Poor	Advanced changes with large osteophytes,> 50% narrowing of joints, collapse of femoral head

Data analysis

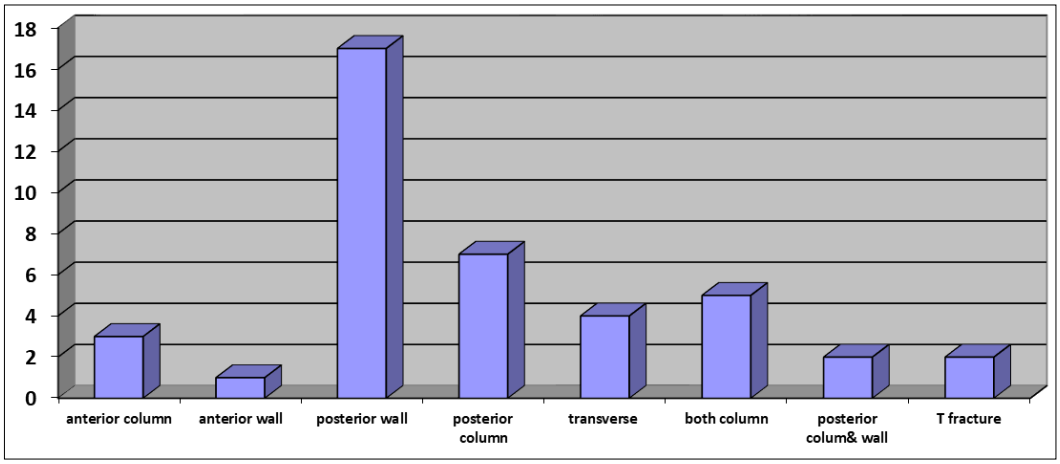
Various datas are collected and they are analyzed in terms of percentage. T test was used for statistical analysis. These datas are compared with similar other international studies

Observations

1. Period of study- from January 2006 to May 2009. 0ut of the 4261 trauma admissions during this period in the Department of Orthopedics, 41 patients had acetabular fracture. This is 0.96 % of the total admissions during this period.
2. Age group of patients with acetabular fractures- lowest 13 yrs, highest-69 yrs and average age 40.33.
3. Sex distribution- 37 male (90%) and 4 female (10%).

Type of accident: 36 cases (88 %) due to road traffic accidents (RTA) and 5 cases (12%) due to fall.

5) Type of Acetabular fracture



6) Dislocation associated with fracture: out of 41 cases of acetabular fracture, 18 cases (43.9%) were associated with dislocation and 23 cases (56.1%) were not associated with dislocation. Out of the 18 cases with associated dislocation, 17cases were closely reduced and one required open reduction.

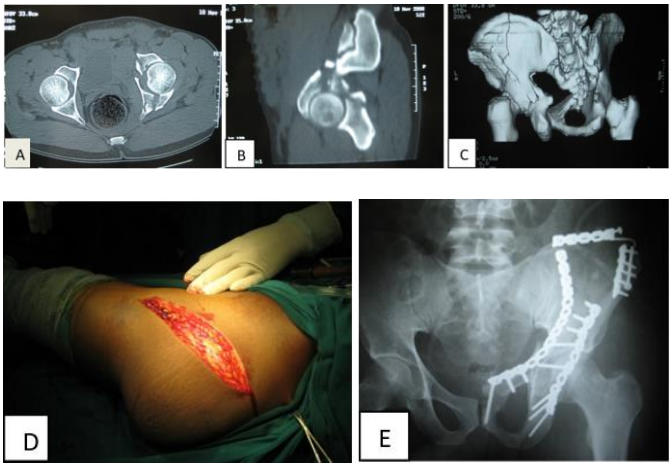


Fig 3: A, B: 36 yr. old male with fracture both column & associated fracture of posterior wall of acetabulum in CT pelvis. C: 3D reconstruction image of CT scan. D: It was treated with fixation of both columns through Kocher-Langenbeck and Ilioinguinal approach E: Post op x ray.

7) Post reduction stability in dislocated hips: out of the 18 cases of acetabular fracture associated with dislocation, 10 were stable after reduction and 8 were unstable

8) Management: 31 cases underwent open reduction internal fixation (ORIF) and 10 cases were treated conservatively

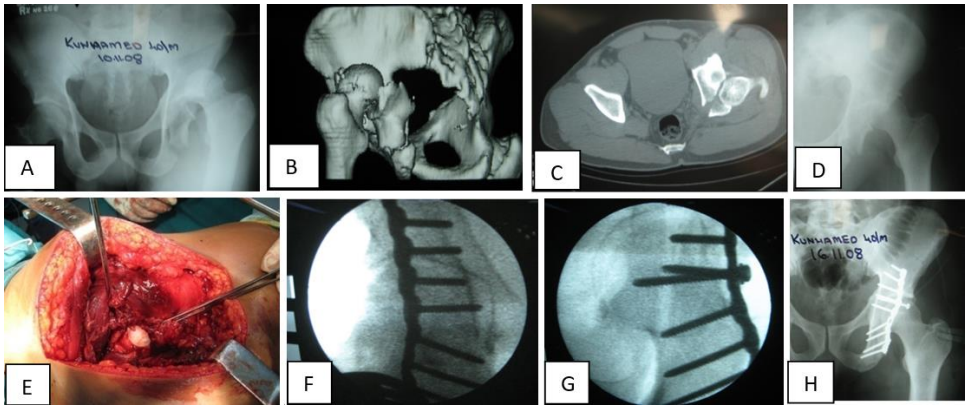


Fig 4: A: X ray pelvis with both hips- dislocation left hip with Posterior column fracture. B, C: CT scan shows posterior dislocation with posterior column fracture of left hip. D: Patient underwent emergency reduction of left hip. Post reduction x ray. E: Posterior column was fixed through Koher -Langenbeck approach. F, G: Intra operatively joint penetration of hard ware is ruled out by taking AP and oblique views of the hip using C arm. H: Post-operative x ray.

9) Day of operation: minimum was day one and maximum day 20. A

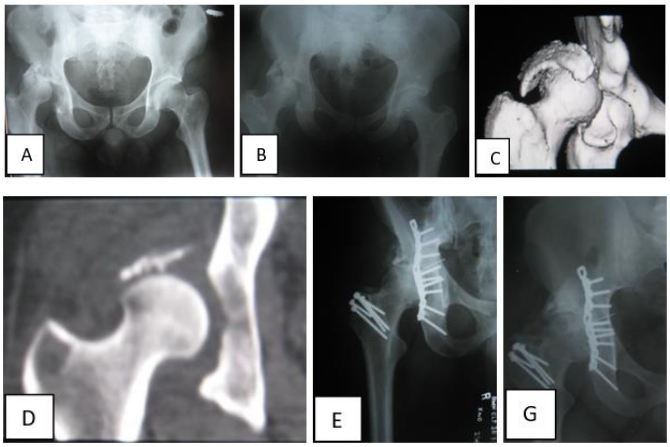


Fig 5: A: X ray pelvis with both hips in a 36 yr old male – shows fracture dislocation of right hip mainly involving posteriosuperior wall. B: He underwent emergency reduction of right hip. Post reduction x ray shows subluxation. C, D: CT scan shows posterior superior wall fracture with subluxation. E: Treated by ORIF posterior wall through Kocherlangenbeck approach with trochanteric flip extension. F: Follow up x ray shows features of Myositis ossificans.

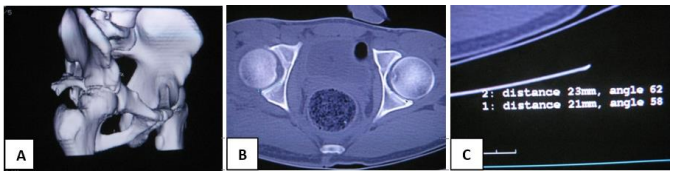


Fig 6: A, B: CT scan shows fracture of posterior wall of acetabulum. C: CT scan shows the distance measured from acetabular notch to the posterior border of the acetabulam. Distance is reduced on the fractured side.

11) Pre-operative sciatic nerve injury

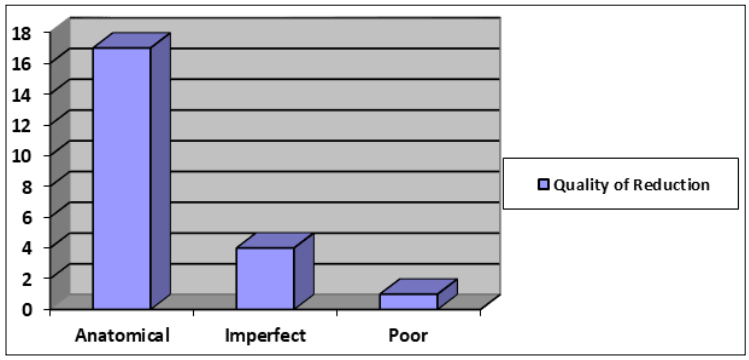
Five patients with acetabular fracture had sciatic nerve injury on presentation. On follow up, none of the patients had complete recovery.

12) Post-operative complications

Post-operative complications		
Complications	**Frequency**	**Percent**
Myositis ossificans	4	12.9 %
Osteoarthritis	2	6.20 %
Meralgia paraesthaetica	1	3.2 %
Iatrogenic sciatic nerve injury	0	0%
No complications	24	77.41 %
Total	31	100%

13) Quality of reduction (immediate post-operative)

Quality of reduction		
Quality	**Frequency**	**Percent**
Anatomical	23	74.19 %
Imperfect	6	19.35 %
Poor	2	6.4 %
Total	31	100 %



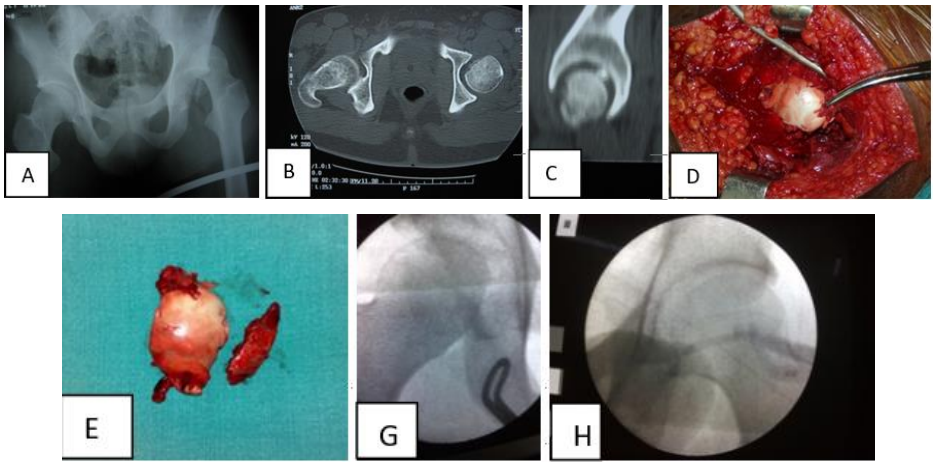


Fig 7: A: X ray pelvis in a 30 yr. old male shows fracture posterior wall of left hip with dislocation. B, C: Same day, patient underwent CMR. Hip reduced but incongruous reduction. CT scan shows intraarticular fragments with fracture femoral head. D: Open reduction through Kocherlangenbeck approach. E: Hip dislocated, fragments removed. F: Fractured side, incongruous reduction. G: Normal side, congruous reduction. Underwent, re-dislocation and removal of intraarticular fragments. Recon plate used for posterior wall fixation.

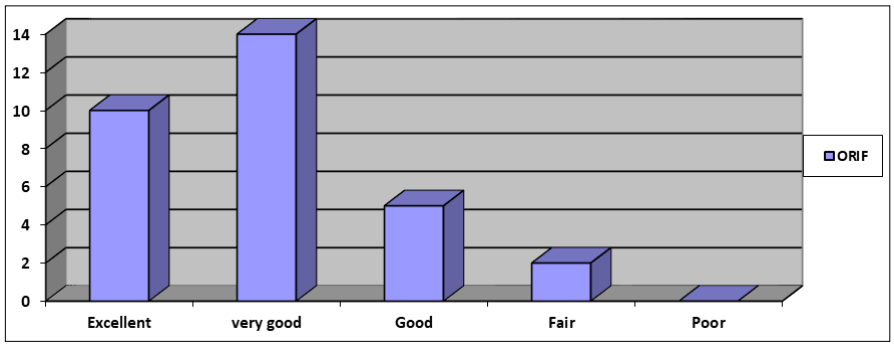
13) Clinical score

	Clinical Score						**Total**
	13	14	15	16	17	18	
frequency	1	1	1	4	14	10	31

	N	**Mean**	**Std Deviation**
ORIF clinical score	31	16.90	1.19317

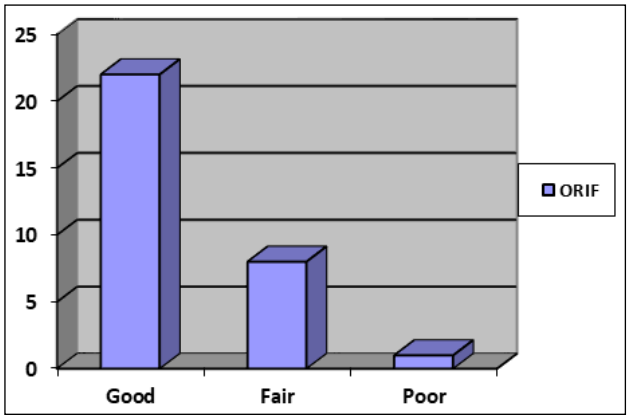
14) Clinical score comment

Management	**Clinical Score Comment**					**Total**
	Excellent	**Very Good**	**Good**	**Fair**	**Poor**	
ORIF	10	14	5	2	0	31



15) Radiological score (one year post ORIF)

	Excellent	Good	Fair	Poor
Frequency	18	8	3	2
Percentage	58 %	25.8 %	9.6 %	6.4 %



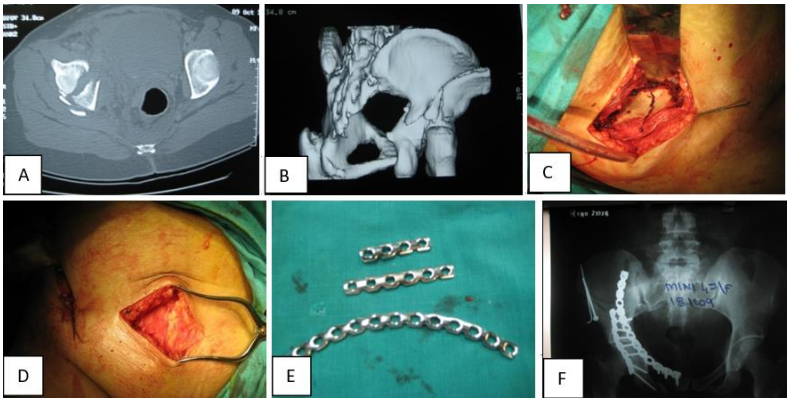


Fig 8: A, B: CT scan shows both column fractures. C: Anterior column was fixed first. ORIF started with fixation of iliac crest. D: Anterior column fixed through modified Stoppa approach with lateral window. E: 14 hole recon plate used to fix anterior column. F: Post-operative x ray.

Discussion

Comparison of this study with other similar studies done.

a) Complications

Complications in %	**Our study**	**Giannondis *et al.*** [10]	**Matta *et al.*** [7]	**p value**
Myositis ossificans	25.80%	Nil	27%	0.880375
Meralgia paraesthetica	3.20%	Nil	Nil	
Pulmonary embolism	Nil	11%	Nil	
Intra articular penetration	Nil	5.50%	Nil	
Infection	Nil	Nil %	4.90%	
Iatrogenic sciatic, femoral, peroneal, nerve injury	Nil	Nil	3.40%	
Osteo arthritis	6.20%	NIL	5%	0.759178
AVN	Nil	Nil	3%	

In myositis ossificans and osteoarthritis, the p value is larger than the desired level of significance .05, so the test is not significant in both cases. I.e., there is no significant difference in the proportion of values with the international data. So

these two complication rates are comparable with other studies. One of our complications was unique in such that meralgia paraesthetica was not seen in other studies. It was the complication of ilioinguinal approach. Other complications like pulmonary embolism, AVN, Infection, intraarticular penetration are nil in our study

b) Clinical score

		Our study	Berton *et al.* [11]	
	Management	**Mean**	**Mean**	**P value**
Clinical Score	ORIF	16.9	16.8	0.64619954

Using the t test we compared the mean of our study with mean of study by Berton *et al.* [11] The p value obtained is .6462 (which is less than .05). The test is not significant, i.e. there is no significant difference in the mean values. (for testing this we used the following values -standard deviation of our study is 1.19316 and the sample size is 31.).So clinical score obtained is in par with other studies.

c) Radiological score in ORIF after one year

				P value	
	Our study	**Matta *et al.* [7] (A)**	**Minne Heeg *et al.* [9] (B)**	**with A**	**with B**
Excellent	58.06%	54%	40%	0.65	0.0401
good	25.81%	23%	32%	0.71	0.46
Fair	9.68%	11%	20%	0.81	0.1509
Poor	6.45%	3%	8%	0.26	0.7504

If p value is less than .05 the test is significant (i.e. there is significant difference), Otherwise the test is not significant (i.e. there is no significant difference). In our study by comparing the proportion of data with the international studies the p values obtained are given in the table. Comparing our study with study B for excellent, the P value is .0401 so the test is significant. That means there is radiological score of excellent in our study is significantly more than other studies. In all other cases the test is not significant, that is there is no significant difference in the values.

d) Reduction obtained in ORIF

				P value	
	Our study (in %)	**Matta *et al.* [7] (in %)**	**Miller *et al.* [8] (in %)**	**with Matta *et al.* [7]**	**with Miller *et al.* [8]**
Anatomical	74	71	58	0.713	0.0711
Imperfect	19	20	29	0.889	0.2198
Poor	6.4	7	13	0.896	0.2745

In all the cases the test is not significant (since p value is greater than .05), so there are no significant differences in the values. So the reduction obtained in our study is in par or even better than other studies.

Conclusion

Forty one patients admitted with acetabular fractures during the period from JAN 2006 to MAY 2008, out of which 31 underwent surgical management. Age distributions, dislocation associated with acetabular fracture, type of fracture, preoperative sciatic nerve injury were comparable with other studies. Serious post-operative complications like iatrogenic sciatic nerve injury, joint penetration by implants, avascular necrosis of the femoral head were less, compared with other studies. Clinical evaluation scores, reduction obtained were in par with recent studies. The radiological scores were better in our studies. These are due to early fixation (average 5 days), anatomical reduction and less complications.

Ethical Approval: This study was approved by institutional ethics committee

Conflict of interest: None

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