Association between Various Socio-Demographic and Clinical Parameters with Functional Scores after Open Reduction and Internal Fixation of Acetabulum Fractures

Abstract: Background: The present study was done to evaluate the Association between Various socio-demographic & clinical Parameters with Functional Scores after open reduction and internal fixation of acetabulum fractures.

Material & methods: The present study was done in 44 patients of fracture acetabulum managed by open reduction internal fixation in the Department of Orthopaedic surgery, Indira Gandhi Medical College, Shimla. The functional and radiological outcome was assessed by Modified Merle d’Aubigne Postel score, Modified Harris Hip score and radiological scoring by Matta et al., at every follow up in prospective patients and at last follow up in retrospective patients.

Results: There were 16 prospective (36.4%) and 28 retrospective (63.6%) cases. Incidence more in younger age group (21-60 years). There was Male predominance and more patients had rural background. RSA was the most common mode of injury in 63%. Autogenous bone graft from/Iliac Crest/ Greater trochanter was used for posterior wall impaction/reconstruction. Mean Blood loss was more in anterior approach than posterior. Simple fractures had lesser mean hospital stay. Simple fractures were more common and had significantly better functional outcome than associated fracture types. Functional outcome was significantly better when operated within 2 weeks. Functional Outcome of Anterior approach was significantly better than posterior because of fewer complications. Functional Outcome was significantly better in patients with anatomical reduction. Modified Merle d’Aubigne and postel (MDA) score was excellent in 77% patients, good in 13%, fair in 10%. Matta’s radiological score at final follow up was excellent in 54.55%, good in 36.36%, fair in 4.55% and poor in 4.54% patients. The average Modified Harris Hip score was excellent in 97% & fair in 3% of patients. Complications were seen in only 2(4.45%) patients.

Conclusion: Study concluded that those having Simple fractures, operated within 2 weeks, anterior surgical approach with anatomical reduction had significantly better functional outcome because of less complications.

Keywords: Evaluation, Association, socio-demographic & clinical Parameters, Functional Scores, open reduction and internal fixation, acetabulum fractures.

INTRODUCTION

Acetabular fractures are usually the result of high-energy trauma which is often associated with other life-threatening injuries usually and often affects the young and economically productive population. Previously, treatment of acetabular fracture was grossly inadequate and many patients were left with incapacitating pain, limitation of movement. If left untreated, displaced acetabular fractures can lead to the development of premature osteoarthritis of the hip. Proper management should be given in our set-up to save lives and to minimize long term complications and related disabilities.1,2
The purpose of this study is to evaluate the Association between Various socio-demographic & clinical Parameters with Functional Scores after open reduction and internal fixation of acetabulum fractures.

AIMS AND OBJECTIVES
To evaluate the Association between Various socio-demographic & clinical Parameters with Functional Scores after open reduction and internal fixation of acetabulum fractures.

MATERIAL AND METHODS

Study Background:
This prospective and retrospective study was conducted in the Department of Orthopaedic Surgery, Indira Gandhi Medical College, Shimla. Informed consent was obtained from every patient prior to commencement of the study after ethical committee approval.

Study Period:
The prospective study was done from July 2019 to December 2020 and a total of 16 cases were included in the study. In retrospective study all 28 patients operated in this institution in last 7 years from 2012 to June 2019, whose records could be retrieved from the Medical Record Department and came for final follow as called by telephonic calls were included in the study after fulfilling the inclusion criteria.

Study Subjects:
All the subjects who fulfilled inclusion criteria were included in the study. Patients were assessed in detail regarding the mode of injury, any associated injuries or neurovascular deficit after the injuries.

Inclusion Criteria;
• Age group more than 18 years.

Exclusion Criteria;
• Revision surgery.
• Any active infection.

Data Collection:
An exhaustive general physical and hip examination was done to know the patient’s fitness for surgery, its expected outcome and postoperative rehabilitation plan to be carried out after surgery. After Clinical & radiological assessment, Pre anaesthetic assessment was done on all patients to obtain fitness for surgery from anaesthesiologist.

Surgical Technique:
The below mentioned table acts a guide for choosing the correct surgical approach in different types of acetabular fractures.

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior Wall</td>
<td>Kocher Langenbeck</td>
</tr>
<tr>
<td>Posterior Column</td>
<td>Kocher Langenbeck</td>
</tr>
<tr>
<td>Transverse</td>
<td>Ilioinguinal or AIP with lateral Window or iliofemoral or Kocher-Langenbeck depending upon fracture displacement</td>
</tr>
<tr>
<td>Anterior wall</td>
<td>Ilioinguinal or AIP with lateral Window or iliofemoral</td>
</tr>
<tr>
<td>Anterior column</td>
<td>Ilioinguinal or AIP with lateral Window or iliofemoral</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior column and Wall</td>
<td>Kocher Langenbeck or combined Dual Approach with Ilioinguinal or Ganz Surgical Hip Dislocation</td>
</tr>
<tr>
<td>Transverse with Posterior Wall</td>
<td>Kocher Langenbeck or combined Dual Approach with Ilioinguinal or Ganz Surgical Hip Dislocation</td>
</tr>
<tr>
<td>Anterior column with Posterior hemitransverse T Type</td>
<td>Ilioinguinal or AIP with lateral Window</td>
</tr>
<tr>
<td>Both Column</td>
<td>Ilioinguinal or AIP with lateral Window or combined Dual Approach</td>
</tr>
</tbody>
</table>

Results were assessed for pain relief, range of motion of hip joint and improvement of mobility and Postoperative scoring & functional outcome in relation to Modified Merle d’ Aughigneand Postel score, Modified Harris hip score and radiological scoring by Matta et al., was done.

Every patient was advised to come for follow up clinical and radiological assessment on outdoor basis at 6 weeks interval for first 6 months till fracture union and further at 9 months and 12 months.

Statistical Analysis:
Data was entered into Microsoft excel spreadsheet, cleaned for errors and was analyzed using the latest version of Statistical Package for Social Sciences Software. Qualitative variables were presented as frequencies and their percentages. Quantitative variables were described as means and their standard deviations. Chi-square / Fischer exact test was used for analysis of associations between different variables. Odds ratio for associations were also be calculated along with their 95% confidence interval. A p value of less than 0.05 was considered as statistically significant.
OBSERVATIONS AND RESULTS

The present study was done to evaluate the Association between Various socio-demographic & clinical Parameters with Functional Scores after open reduction and internal fixation of acetabulum fractures. A total of 44 patients were included in the study. Prospective series included 16 patients (36.4%) from July 2019 to December 2020. Retrospective study included 28 patients (63.6%) operated between 2012 to June 2019 whose records could be retrieved from Medical Record Department and came for final follow-up in outdoor patient department (OPD) of Orthopaedics IGMC Shimla as called telephonically.

The mean age was 45.07 years (range 22 to 74 years) with maximum number of 39 (88%) patients in the age group of 21-60 years. Majority (77.3%) of the patients were males and 22.8% were females. Male to female ratio was 3.4:1 with male predominance as males are more involved in outdoor activity.

Forty three (97.7%) patients belonged to rural area and remaining 1 (2.3%) patient belonged to urban area. Road traffic accidents was the mode of injury in 63.6% patients followed by fall from height in 36.4%. Eighteen (41%) patients had posterior wall fracture, posterior wall with posterior column fracture was seen in 12 (27%). 4 patients each had bicolumnar and anterior column fracture. Anterior wall fracture was found in 3 patients, 2 patients had anterior column with posterior hemi-transverse fracture and T-type was least common seen in 1 patient. Average time interval between injury and surgery was 15 days (range 3-55 days). Thirty six percent of the patients were operated between 8-14 days and 34% of patients between 0-7 days.

Thirty (68%) patients were operated by Kocher-Langenbeck approach in lateral position followed by 7 (15%) patients with ilioinguinal approach in supine position. Combined Kocher-Langenbeck with ilioinguinal approach had to be done in 2 (4.5%) patients, 2 (4.5%) patients required iliofemoral, 2 (4.5%) by Modified Stoppas intrapelvic approach and one patient was managed by Ganz surgical dislocation of hip with trochanteric flip osteotomy.

The average amount of intra-operative blood loss was 490ml (range 320-1400ml). Autogenous Bone graft was used in 31.7% of patients. It was harvested from Iliac crest in 12 patients and from greater trochanter in 02. Mean duration of hospital stay was 24 days (range 7-35 days).

At final follow up the average Modified Harris score was 94 in 44 patients (range 72-96). Patients with anterior column fracture had mean HHS of 96; in posterior wall fracture mean HHS of 92 at final follow up was found. The mean Modified Merle d’Aubigne postel (MDA) score was excellent in 77% of patients, good in 13% and fair in 10%.

The fair result in one patient as assessed by Modified Harris Hip and Modified Merle d’Aubigne and Postel score was 72 and 14 respectively. It was due to avascular necrosis of femoral head. This patient had fracture femoral head with posterior wall fracture and was operated by Ganz surgical dislocation of hip with trochanteric flip osteotomy. Total hip replacement was planned for this patient at 10 months after surgery.

Mattas’ radiological outcome and Merle d’Aubigne clinical criteria were found to have no correlation. Thus it can be inferred that radiological outcome as interpreted by Matta’s criteria has no association with the clinical outcome as assessed by Modified Merle d’Aubigne score.

Two patients had complications. One patient had femoral head fracture along with fracture of posterior wall developed AVN and also had subsequently Secondary OA with post-operative subluxation of femoral head. Thus three complications were seen in this patient. Another patient with fracture dislocation with fracture of posterior wall developed AVN and subsequently secondary OA 5 year after surgery. No patient developed sciatic nerve injury post operatively.

Table-1: Association between Various Parameters and Functional Scores.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Values</th>
<th>Significance</th>
<th>P-value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>42 ± 8 Years</td>
<td>Non-significant</td>
<td>0.323</td>
<td>Incidence more in younger age group (21-60 years)</td>
</tr>
<tr>
<td>Sex (Male:female)</td>
<td>3:4:1</td>
<td>Non-significant</td>
<td>0.432</td>
<td>Male predominance</td>
</tr>
<tr>
<td>Rural /urban</td>
<td>9:1</td>
<td>Non-significant</td>
<td>0.444</td>
<td>More patients had rural background</td>
</tr>
<tr>
<td>Mode of injury</td>
<td>2:1</td>
<td>Non-significant</td>
<td>0.274</td>
<td>RSA was the most common mode of injury in 63%</td>
</tr>
<tr>
<td>RSA: Fall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fracture type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple</td>
<td>27</td>
<td>Significant</td>
<td>0.045</td>
<td>Simple fractures were more common and had better functional outcome than associated fracture types</td>
</tr>
<tr>
<td>Associated</td>
<td>19</td>
<td>Significant</td>
<td>0.126</td>
<td></td>
</tr>
<tr>
<td>Time between injury and surgery (days)</td>
<td>15</td>
<td>Significant</td>
<td>&lt;0.001</td>
<td>Functional outcome better when operated within 2 weeks</td>
</tr>
<tr>
<td>Approach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior</td>
<td>11</td>
<td>Significant</td>
<td>&lt;0.001</td>
<td>Functional Outcome of Anterior approach was better than posterior because of less complications</td>
</tr>
<tr>
<td>Posterior</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24
Combined
Use of bone graft
Quality of reduction
Blood loss
Hospital stay
Matta Radiological score on check x-ray
Matta radiological score on final x-ray
Merle d’aubigné score
Modified Harris hip score
Complications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Significant</th>
<th>0.008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined</td>
<td>02</td>
<td>31.7%</td>
<td></td>
</tr>
<tr>
<td>Use of bone graft</td>
<td></td>
<td>Significant</td>
<td>0.005</td>
</tr>
<tr>
<td>Quality of reduction</td>
<td>&lt; 1mm in 93 %</td>
<td>Significant</td>
<td>0.005</td>
</tr>
<tr>
<td>Blood loss</td>
<td>490ml</td>
<td>Non-significant</td>
<td>0.657</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>2 weeks</td>
<td>Non-significant</td>
<td>0.640</td>
</tr>
<tr>
<td>Matta Radiological score on check x-ray</td>
<td>Anatomical in 93%</td>
<td>Significant</td>
<td>0.005</td>
</tr>
<tr>
<td>Matta radiological score on final x-ray</td>
<td>Excellent/good 91%</td>
<td>Significant</td>
<td>0.036</td>
</tr>
<tr>
<td>Merle d’aubigne score</td>
<td>Excellent/good In 90%</td>
<td>Non-Significant</td>
<td>0.472</td>
</tr>
<tr>
<td>Modified Harris hip score</td>
<td>Excellent/good In 97%</td>
<td>Non-Significant</td>
<td>0.825</td>
</tr>
<tr>
<td>Complications</td>
<td>In 4.45% only</td>
<td>Non-significant</td>
<td>0.232</td>
</tr>
</tbody>
</table>

Suggestive significance (p value 0.05-0.10), Strongly significant (p value<0.01), Non-significant (p value>0.05)  

DISCUSSION

This study was conducted in the Department of Orthopaedics Indira Gandhi Medical College Shimla to study the functional outcome after open reduction and internal fixation of fracture acetabulum using Modified Harris Hip score, Modified Merle d’Aubigne Postal scoring and Matta’s radiological score.

In a total of 44 patients, the mean age was 45.07 years (Range 22 to 74 years) with maximum number of 39 (88%) patients falling under 60 years. Laird et al.,5 analyzed 153 patients and the mean age was 46.8 years in their series. Gunaseelan Pet al.,6 studied 47 patients with average age as 35.6 years ranging from 19 to 53 years. Thus the mean age of 45.07 years in present study is comparable to the others studies done in the past.

In the present study 34 (77.3%) were males with 10 females (22.7%). Male to female ratio was 3.4:1 with male preponderance. Marcelo C C et al.,7 in 87 patients analyzed 75 (77.3%) male and 10 females cases with fracture acetabulum. Boudissa M et al.,8 assessed 156 cases and had a majority of 126 (81%) male patients. In present study males outnumbered female patients because males are more involved in outdoor activities and hence more susceptible to sustain injury.

The most common mode of trauma was road side accident in 63.6% patients followed by fall in remaining 36.4%. Fall from height was the second major cause of trauma because of the mountain hilly terrains and people have to go for their earnings to far flung area. Sudhik K et al.,9 found road traffic accident as the most common cause of these fractures in 66.67% and fall from height as the second most common cause in 27.78% patients. Thus the results of present study are comparable to others studies done in the past.

There were 18 patients with posterior wall fractures that constituted about 41% of the cases while 12 patients had posterior wall with posterior column fracture forming 27% of cases. Navid Z et al.,10 analyzed that posterior wall acetabular fractures were the most common acetabular fracture patterns treated, followed by fracture of posterior wall and posterior column. Seyed A M et al.,11 observed that 43% patients had posterior wall fracture.

The average time interval between injury and surgery was 15 days (range 3-55 days). Sixteen (36%) patients were operated between 8-14 days and fifteen (34%) patients were operated between 0-7 days. It was found that patients operated between first 2 weeks had significantly better functional outcomes according to Modified Merle d’ Aubigne & HHIS.

In present study about 66% patients were operated one week after injury. This is due to the fact that some patients present late because of mountain hilly terrain, lack of knowledge, ignorance, some prefer to go private practioners and also some time is lapsed in arranging the finances. Matta et al.,2 studied 262 fractures treated within 21 days and found that most (80%) of them had good functional outcome at final follow up.

In present study, 30 (68%) patients were operated with Kocher-Langenbeck approach in lateral position followed by 7 (15.9%) patients with iliostigma approach in supine position, 2 (4.5%) with iliiofemoral, 2 (4.5%) by Modified Stoppas intrapelvic approach, 2 (4.5%) with combined (Kocher-Langenbeck and Ilioininguinal) approach and one with Ganz surgical dislocation of hip with trochanteric flip osteotomy. Chiu
F Y et al.,” on retrospective evaluation of 80 patients found that excellent reduction and satisfactory functional outcome were achieved by single Kocher-Langenbech approach. They also said that restoration of joint function is purely based on the accuracy of articular reduction.

In present study the mean duration of hospital stay was 24 days (range 7-35 days). Gunaseelan P et al.,6 analysed 47 patients and found that the post-operative hospital stay was 14 days. The post operative stay was significantly shorter for patients with simple fracture; the maximum stay was 14 days with a median of 7 days. Kim et al.,13 observed that the duration of hospital stay was 5 days. Shaukat H K et al.,14 found the average hospital stay as 7 days.

The mean duration of follow up was 18 months (range 6-96 months) in present study. The mean duration of follow up albeit on lower side in present study is similar to previous study by Matta et al.,7.

Modified Merle d’Aubigné Postel (MDA) score was initially developed by d’Aubigne and Postel in the 1950s to determine the functional results after THA, but gained popularity as a score for surgically treated acetabular fractures after Letournel published the results of their series in 1980.15,16 Kim et al.,13 found that the modified Merle D’Aubigne and Postel score at final follow-up was excellent in 55.7%, good in 15.3%, and poor in 30.3% patients. Suresh C P et al.,11 reported good to satisfactory result in 94% of their patients according to this score. The results seem to be comparable or even better than the past studies; however a large sample size can be of more value in arriving at a better conclusion.

According to Matta’s radiological score the accuracy of the fracture reduction strongly correlated with the clinical outcome. Kim et al.,7 reported that according to the radiologic criteria of Matta et al., 30.3% patients had excellent results, 42.4% good, 4 (12.1%) fair and in 5 (15.2%) results were poor. Sagar K Vet al,15 observed that the 49.1% of patients had excellent results, 27.3% good, 16.4% fair and 7.3% patients had poor results at final follow up. In present study Matta’s radiological score at final follow up was excellent in 54.55%, good in 36.36%, fair in 4.45% and poor in 4.54% patients. The scores are better than other studies because of anatomical reduction which was achieved post-operatively was the most important factor in the prognosis in acetabular fractures.

Modified Harris Hip Score is the most commonly used hip specific score for assessing the clinical result after operative treatment of acetabular fractures. Harris developed this score in the 1960s to assess the results for THA after debilitating osteoarthritis due to acetabular fractures.18 Letournel and Judet19 reported 350 fractures of the acetabulum with excellent results in 75%, good results in 8%, and poor results in 17% at final follow up based on HHS. Clarke-Jhenson J et al.,20 found that the average HHS was 88 with 81% having good or excellent results. The presence of femoral head injury caused a significantly reduced HHS to 84, anterior column fractures had a significantly better HHS of 94 and they found no differences for other fracture types. The results of study in view of Harris hip score are comparable to others studies done in the past.

In present study, 2 (4.54%) patients had complications. A total of 2(4.54%) patients had avascular necrosis of femoral head. One patient with fracture dislocation with fracture of posterior wall developed AVN and subsequently secondary OA 5 year after surgery. Another patient had femoral head fracture along with fracture of posterior wall developed AVN and also had subsequently secondary OA with post-operative subluxation of femoral head. Thus three complications were seen in this patient. Giannoudis P et al.,9 in his meta-analysis reported AVN in 20 (5.6%) patients operated by posterior approach. While in present study it was 4.54% which is less as compared with others studies.

LIMITATIONS

The limitation of the study is small sample size and short follow up especially in prospective patients. A large sample size with longer follow up may make us wiser and would be helpful for future studies.

CONCLUSION

Study concluded that the functional outcome in patients with acetabular fractures treated by open reduction and internal fixation depends on multiple factors. Those having Simple fractures, operated within 2 weeks, anterior surgical approach with anatomical reduction had significantly better functional outcome because of less complications. Thus, open reduction and internal fixation as a gold standard for acetabulum fractures which is indicated with excellent to good results in majority of the patients as assessed by Modified Merle d’Aubigne score, Modified Harris hip score and Matta Radiological score with minimal complications at final follow up.

REFERENCES

3. Briffa N, Pearce R, Hill AM, Bircher M. Outcomes of acetabular fracture fixation with ten years’


