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Functional Outcome of the Surgical Treatment of Displaced Acetabular Fractures

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Abstract: To assess the functional outcome of early surgical fixation for displaced acetabular fractures and the possible complications associated with the procedure, we evaluated a consecutive series of 30 patients who underwent open reduction and internal fixation for displaced acetabular fractures at our institution. Between April 2013 and August 2017, thirty patients, 24 male and 6 female with a mean age of 37.2 years (range, 15-61) with displaced acetabular fractures were fixed with the plate osteosynthesis and they were retrospectively evaluated. Demographic and perioperative data, fracture pattern, surgical approach and complications were recorded. Simple fractures were noticed in 19 (63.3%) patients and associated fractures in 11 (36.6%). The mean time to surgery was 5.9 days (range, 1-21). About 29 patients (96.6%) were operated within 2 weeks of injury. Ilio-inguinal approach was used in 14 (46.6%) patients, Kocher-Langenback in 13 (43.3%). The twenty eight out of thirty patients were followed for a mean of 2.7 years (range, 6 months to 3.58 years). At final follow up, solid union of all fractures had been achieved. The mean Harris Hip Score (HHS) was 89.2±7.2 points. The clinical outcome was good to excellent in 24 patients (85.7%). Postoperative complications were superficial infection (3.3%), deep infection (3.3%), hip osteoarthritis (6.6%), heterotopic ossification (3.3%) and osteonecrosis (3.3%). In conclusion, early surgical treatment of displaced acetabular fractures will result in good functional outcome despite the presence of anticipated complications.

Key words: Acetabular fracture, harris hip score, surgical stabilization, outcome, demographic, approach

INTRODUCTION

Acetabular fractures occur primarily in young adults as a result of high energy trauma which is often accompanied with other serious injuries. Traffic accidents and falls from a significant height account for majority of cases. However, osteoporotic fragility fractures of the acetabulum can occur in elderly as a result of simple fall from standing height or minor trauma. They are accounting for 2-8% of all bone fractures (Laird and Keating, 2005; Mucha and Farnell, 1984). Fractures of the acetabulum are more complex injuries as compared to other body parts. They are challenging for treating orthopedic surgeons, since, they need more skills to be fixed (Pohlemann *et al*., 1998).

Judet classification for acetabular fractures described five simple fracture patterns (posterior wall, posterior column, anterior wall, anterior column and transverse) and five associated fracture patterns (posterior wall posterior column, transverse posterior wall, T-shape fracture, anterior column posterior hemitransverse and double column). It was based broadly on plain radiographs but recently pelvic CT scanning is the gold standard imaging modality for classification and planning fixation of acetabular fractures. Treatment of acetabular fracture was evolved in the last few decades. In the past, the non-operative treatment was dominant due to lake of knowledge of the normal anatomy of acetabulum and surgical approaches for the pelvis. In 1964, Judet and Letournel found that open reduction and rigid internal fixation of displaced acetabular fractures would lead to a better outcome than conservative treatment. Since, then operative stabilization of such fractures has become the gold-standard modality of treatment for displaced acetabular fractures (Judet *et al*., 1964).

Generally, surgical approaches to the acetabulum can be classified to anterior (ilioinguinal or stoppa), posterior (Kocher-Langenbeck), extensile (Extended iliofemoral) and

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combined anterior and posterior approaches (Cole and Bolhofner, 1994; Goulet and Bray, 1989). Since, the original description by Letournel (1993) the ilioinguinal approach has remained the most popular approach in use for anterior acetabular fixation while the Kocher-Langenbeck is considered as the gold-standard approach for posterior fixation (Judet *et al*., 1964; Letournel, 1993).

The decision of surgical treatment for acetabular fracture, the surgical approach selection and operative reduction accuracy are highly influenced by the surgeon's experience and training (Giannoudis *et al*., 2007). Operative fixation for displaced acetabular fractures significantly reduced hospital stay and resulted in better clinical outcome. Our study is aimed to assess the outcome of surgical stabilization for displaced acetabular fractures.

MATERIALS AND METHODS

Our retrospective study was performed on 30 patients with displaced acetabular fractures at our institution (KAUH) who underwent operative stabilization for displaced acetabular fractures between April 2013 and August 2017. The fractures were classified according to Judet and Letournel classification. The inclusion criteria were as follows, patients with closed displaced acetabular fractures more than 2 mm diagnosed radiologically within three weeks of injury with the age range between 15-61 years, patients with unstable fracture dislocation of hip, no history of previous injury to the hip or acetabulum and no co-existing hip osteoarthritis. Patients who had defaulted follow up patients with associated life threatening injuries, open acetabular fractures those with previous history of hip injuries and preexisting hip osteoarthritis and patients who were treated conservatively for acetabular fracture were excluded from this study. Fracture classification was conducted using standard preoperative radiographs (anteroposterior pelvis, Judet olique views) and Computed Tomography (CT) with 3D reconstruction.

All surgical procedures were performed by the same senior trauma and pelvic surgeon. The primary goal of treatment was anatomical reduction with rigid fixation as soon as possible. The surgical approach selection was decided based on fracture pattern, soft tissue status and surgeon's decision. Stabilization of fracture was achieved using pelvic reconstruction plates (3.5 mm) and cortical screws. Intraoperative fluoroscopy was used to assess the quality of reduction and to confirm that no metal inside the hip joint. The reduction was considered anatomical if all fracture gaps and steps had been removed intra-operatively and postoperative films showed restoration of all 5 anatomical radiographic lines (iliopectineal, ilioischial, dome, posterior wall and anterior wall) with the head centered and parallel beneath the roof of acetabulum. An acceptable reduction was considered where the hip was congruent but residual small gaps have been presented due to bone loss or comminution. A poor reduction was defined when there was poor restoration of the 5 pelvic lines, medial subluxation of the hip and loss of parallelism.

Following induction of anesthesia, broad spectrum antibiotics were administered prophylactically and continued for two days postoperatively. All patients were administered low molecular weight heparin for prophylaxis against Deep Vein Thrombosis (DVT) started preoperatively and continued after surgery for 4 weeks. Postoperatively, all patients received indomethacin 25 mg 3 times a day for 6 weeks as prophylaxis against heterotopic ossification. All patients were assessed and reviewed during follow up in the outpatient clinic at 6 weeks, 3 and 6 months, 1 year and then yearly. At each outpatient visit, clinical progress were recorded including postoperative complications, standard radiographs of pelvis and CT scans were done only in the presence of complications.

At final follow-up, functional outcome was estimated using Harris Hip Scoring system (HHS) which takes into account 4 parameters. These are pain which was given 44 points, function 47 points, range of movements 5 points and absence of deformity 4 points. Normal hip score according to this system is 100, scores <70 poor, between 70-79 as fair, between 80-89 as good and scores above 90 are regarded as excellent (Harris, 1969).

All statistical analysis was performed using SPSS (SPSS Statistical Package; Version 23.0.0). Case characteristics were summarized using Descriptive Statistics including the mean (SD) or median (minimum-maximum) for continuous variables. Independent samples t-test was used to measure the differences in bi-variate analyses. For all comparisons, statistical significance was assigned at $p<0.05$.

RESULTS AND DISCUSSION

Of the total of 30 patients, 28 were followed for a mean of 2.7±1.40 years (range, 6 months-3.58 years), 2 patients (6.6%) were lost to follow-up, one died 2 months postoperatively due to pulmonary embolism while the other one died one year postoperatively due to RTA. The 30 patients had a mean age of 37.2±13.05 years (range, 15-61) with a gender distribution of 24 male and 6 female patients. The mechanism of injury in majority of cases was road traffic accident in 24 patients and only six patients had fall from height. The right acetabulum was involved in 16 (53.3%) patients and the left in 14 (46.6%). We noticed simple fractures in 19 (63.3%) patients and associated fractures in 11 (36.6%) patients (Table 1).

Commonest pattern of acetabular fractures was posterior wall in 7 patients followed by posterior wall and posterior column in 6 patients (Fig. 1). The mean time to surgery was 5.9 days±4.71 (range, 1-21). The 22 (73.3%) patients were operated within the first week from injury while 8 (26.6%) patients after 7 days. Ilio-inguinal approach was used in 14 (46.6%) patients while Kocher-Langenback in 13 (43.3%) patients (Table 2) (Fig. 1 and 2). The mean hospital stay was 11.9±6.40 days (range, 5-32).

Post-surgical complications recorded were superficial infection in one patient 3.3%, deep infection in one patient 3.3%, hip osteoarthritis in two patients 6.6%, heterotopic ossification in one patient 3.3% and osteonecrosis in one patient 3.3%.

Reviewing functional outcome, 15 patients 53.5% of the simple acetabular fractures and 9 patients 32% of the associated acetabular fractures had HHS equal or more than 80 points (considered as good/excellent). Remaining 3 patients 10.7% with simple acetabular fracture and one patient (3.6%) with associated type fracture had fair (<80) score. No patients had poor score <70 points (Table 3) (Fig. 3).

The management of displaced fractures of the acetabulum is technically challenging to the treating trauma surgeons. The goal of treatment of such fractures is early stable anatomical reduction which facilitates early functional recovery (Bircher *et al*., 2006; Madhu *et al*., 2006; Matta *et al*., 1986). The accuracy of reduction strongly correlates with the treatment outcome (Mears *et al*., 2003). The presence of residual displacement >2 mm and marginal impaction are known to be associated with hip osteoarthritis development. Complications are not uncommon with reported rate of 20-25% of patients having a poor clinical outcome in the medium term follow-up (Giannoudis *et al*., 2005). Several factors affect the predicted outcome of treatment of acetabular fractures and they were classified into two groups, surgeon-dependent and surgeon-independent

Table 1: The demographic and perioperative characteristics of patients with displaced acetabular fractures who were fixed surgically

Variables	Values
Patients no.	30
Mean age (years)±SD	37.2±13.05
Gender: male/female	24/6
Side: right/left	16/14
Mechanism of injury	
Traffic accident	24
Fall from height	6
Fracture pattern	
Simple	19
Associated	11
Mean time to surgery (days)±SD	5.9±4.71
Mean hospital stay (days)±SD	11.9±6.40 sec

Table 2: Distribution of surgical approaches in 30 patients

Surgical approach	Number (%)
Kocher-Langenback (KL)	13 (43.3)
Ilio-Inguinal (II)	14 (46.6)
Stoppa	1 (3.3)
2 approach (KL+II)	1 (3.3)
KL+Trochanteric flip osteotomy	1 (3.3)

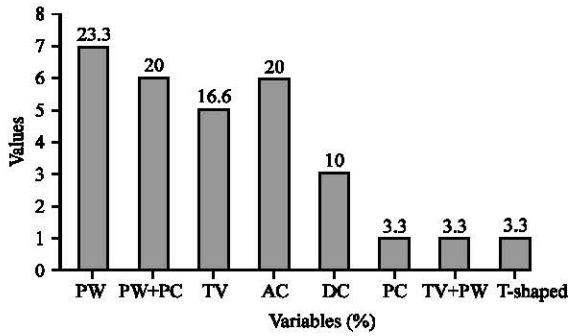

Fig. 1: The various sub-types of acetabular fractures in 30 patients

Table 3: Functional outcome with respect to age groups

Age groups (years)	N	Excellent N (%) 16 (57.1)	Good N (%) 8 (28.6)	Fair N (%) 4 (14.3)	Poor N (%) 0 (0)
15-24	4	4	0	0	0
25-34	8	5	1	2	0
35-44	6	2	2	2	0
45-54	7	3	4	0	0
55-61	3	2	1	0	0

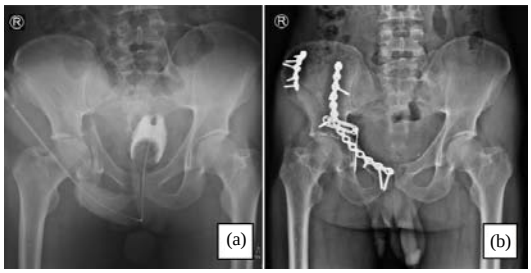

Fig. 2: a) Double column acetabular fracture and b) 8 months follow up X-ray

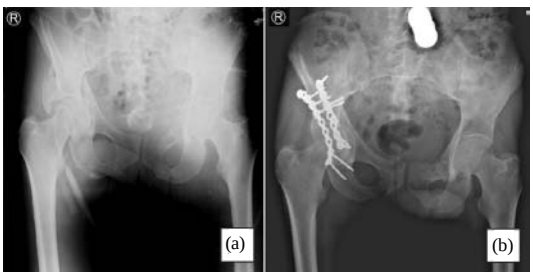

Fig. 3: a) Posterior wall and posterior column fracture and b) 4 months follow up X-ray

variables (Briffa *et al.*, 2011). Factors such as injury mechanism, osteochondral defect in either the head of the femur or the acetabulum, the fracture pattern, osteoarthritis, osteonecrosis of the femoral head, sciatic nerve injury, the age of the patient and pre-existing comorbidities are surgeon-independent predictors. But surgical timing, surgical approach selection and perfect reduction and fixation are surgeon dependent factors (Letournel, 1980; Glas *et al.*, 2001).

Age and fracture pattern were not found to affect the outcome significantly. The mean age group in this study was 37.2 years with a range of 15-61 years. Our evaluated patients were in young or middle age groups, the impact of age on the clinical outcome cannot be established. Previous studies have clearly mentioned that outcomes of treatment for acetabular fractures correlated with age as poorer clinical results were expected in elderly who have weak bone stock that can result in compromised fracture fixation. Moreover, they may have preexisting degenerative hip arthritis. Moed *et al.* (2000, 2002) reported that with the presence of simple fracture patterns, results were inferior due to increasing age and fracture comminution.

Surgical timing has been shown to be very important as several studies recorded poor results when operative reduction and rigid fixation was delayed beyond three weeks post injury. Johnson *et al.* (1994) found poor clinical outcomes in delayed reconstruction of acetabular fractures of more than 3 weeks compared to early intervention. Letournel's *et al.* (1993) series showed significantly worse outcome of acetabular reconstructions which were done beyond 3 weeks. Our study revealed better clinical outcomes with higher HHS, since, majority of our patients had undergone operations earlier than 2 weeks. Gupta *et al.* (2009) also showed good results when surgery was performed within 2 week time. The infection rate in our study was 6.6% (2 patients), one developed superficial infection while the other one developed deep infection. Wound debridement was performed and treated with intravenous antibiotic therapy for 2 weeks. This rate is acceptable and comparable with other studies which reported infection rate of 4-11% (Giannoudis *et al.*, 2005; Briffa *et al.*, 2011; Gupta *et al.*, 2009).

Post-traumatic osteoarthritis is the primary late complication following a fracture of the acetabulum (Matta *et al.*, 1986). We found 6.6% patients developed secondary osteoarthritis which is almost comparable to that reported by Matta *et al.* (1986) 23.9%, Giannoudis *et al.* (2005) 26.6% and Meena *et al.* (2013) 28.8%. However, Briffa *et al.* (2011) found post-traumatic osteoarthritis in 38% patients with more than 10 years of follow-up. They concluded that even though fracture is perfectly reduced initially an increasing number of patients may present with osteoarthritis on long term follow-up (Briffa *et al.*, 2011). Our study reported avascular necrosis rate of 3.3%. The incidence of Avascular Necrosis of the femoral head (AVN) was reported in 18 studies with 2010 patients with an overall incidence of 5.6% (Giannoudis *et al.*, 2005). There was one patient who had heterotopic ossification of the hip joint and the main contributing factor was the amount of periosteal stripping during the double surgical approach used for fracture fixation. Surprisingly, the clinical outcome in this case was excellent. The low rate here is attributed to the fact that a thorough debridement was under taken before wound closure and we routinely use prophylactic indomethacin as there was noticed efficacy of reduction in heterotopic ossification formation postoperatively (Burd *et al.*, 2001).

Our results showed about 86% good to excellent clinical outcomes at minimally 6 months postoperatively. Our clinical results compare favorably with other published outcomes. For example, Briffa *et al.* (2011) reported 72%, Gupta *et al.* (2009) reported 74%, Madhu *et al.* (2006) reported 76%, Anizar-Faizi *et al.* (2014) reported 70% and Ruesch *et al.* (1994) reported 83% good to excellent results.

In our study, there were limitations inherent in the methodology used because it was a retrospective, case series study with no control group and the number of patients was small due to rarity of acetabular fractures compared to other trauma cases.

CONCLUSION

The operative fixation of displaced acetabular fracture gives a favorable clinical outcome despite its known complications. A good to excellent functional outcome was seen in more than 80% of the patients. Moreover, the rate of complications was acceptable in our study. Age and fracture pattern were not found to affect the outcome significantly. Good clinical results correlate closely with anatomical reduction and stable fixation, especially, when surgery was performed within 2 week time from injury. Adequate preoperative assessment and good surgical planning result in reduced rate of complications.

REFERENCES

Anizar-Faizi, A., A. Hisam, K.P. Sudhagar, M. Moganadass and C. Suresh, 2014. Outcome of surgical treatment for displaced acetabular fractures. Malaysian Orthopaedic J., 8: 1-6.

Bircher, M., A. Lewis and S. Halder, 2006. Delays in definitive reconstruction of complex pelvic and acetabular fractures. Bone Joint J., 88: 1137-1140.

Briffa, N., R. Pearce, A.M. Hill and M. Bircher, 2011. Outcomes of acetabular fracture fixation with ten years' follow-up. Bone Joint J., 93: 229-236.

Burd, T.A., K.J. Lowry and J.O. Anglen, 2001. Indomethacin compared with localized irradiation for the prevention of Heterotopic Ossification following surgical treatment of Acetabular Fractures. J. Bone Joint Surg., 83: 1783-1788.

Cole, J.D. and B.R. Bolhofner, 1994. Acetabular fracture fixation via a modified Stoppa limited intrapelvic approach: Description of operative technique and preliminary treatment results. Clin. Orthopaedics Relat. Res., 305: 112-123.

Giannoudis, P.V., M. Bircher and T. Pohlemann, 2007. Advances in pelvic and acetabular surgery. Injury, 38: 395-396.

Giannoudis, P.V., M.R.W. Grotz, C. Papakostidis and H. Dinopoulos, 2005. Operative treatment of displaced fractures of the acetabulum: A meta-analysis. Bone Joint J., 87: 2-9.

Glas, P.Y., M.H. Fessy, J.P. Carret and J. Bejui-Hugues, 2001. Surgical treatment of acetabular fractures: Outcome in a series of 60 consecutive cases. Chirurgie Orthopedique Reparatrice L'appareil Moteur, 87: 529-538.

Goulet, J.A. and T.J. Bray, 1989. Complex acetabular fractures. Clin. Orthopaedics Relat. Res., 240: 9-20.

Gupta, R.K., H. Singh, B. Dev, R. Kansay and P. Gupta *et al*., 2009. Results of operative treatment of acetabular fractures from the third world-how local factors affect the outcome. Intl. Orthopaedics, 33: 347-352.

Harris, W.H., 1969. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mold arthroplasty; An end-result study using a new method of result evaluation. J. Bone Joint Surg., 51: 737-755.

Johnson, E.E., J.M. Matta, J.W. Mast and E. Letournel, 1994. Delayed reconstruction of acetabular fractures 21-120 days following injury. Clin. Orthopaedics Relat. Res., 305: 20-30.

Judet, R., J. Judet and E. Letournel, 1964. Fractures of the Acetabulum: Classification and surgical approaches for open reduction; Preliminary report. J. Bone Joint Surg., 46: 1615-1646.

Laird, A. and J.F. Keating, 2005. Acetabular fractures: A 16-year prospective epidemiological study. Bone Joint J., 87: 969-973.

Letournel, E., 1980. Acetabular fractures: Classification and management. Clin. Orthopaedics Relat. Res., 151: 81-106.

Letournel, E., 1993. The treatment of acetabular fractures through the ilioinguinal approach. Clin. Orthopaedics Relat. Res., 292: 62-76.

Letournel, E., R. Judet and R.A. Elson, 1993. Operative Treatment Between Three Weeks and Four Months after Injury. In: Fractures of the Acetabulum, Elson, R.A. (Ed.). Springer, Berlin, Germany, ISBN:978-3-642-75437-1, pp: 591-633.

Madhu, R., R. Kotnis, A. Al-Mousawi, N. Barlow and S. Deo *et al*., 2006. Outcome of surgery for reconstruction of fractures of the Acetabulum: The time dependent effect of delay. Bone Joint J., 88: 1197-1203.

Matta, J.M., D.K. Mehne and R. Roffi, 1986. Fractures of the Acetabulum: Early results of a prospective study. Clin. Orthopaedics Relat. Res., 205: 241-250.

Mears, D.C., J.H. Velyvis and C.P. Chang, 2003. Displaced acetabular fractures managed operatively: Indicators of outcome. Clin. Orthopaedics Relat. Res., 407: 173-186.

Meena, U.K., S.K. Tripathy, R.K. Sen, S. Aggarwal and P. Behera, 2013. Predictors of postoperative outcome for acetabular fractures. Orthopaedics Traumatology Surg. Res., 99: 929-935.

Moed, B.R., S.E. WillsonCarr and J.T. Watson, 2002. Results of operative treatment of fractures of the posterior wall of the acetabulum. J. Bone Joint Surg., 84: 752-758.

Moed, B.R., S.E.W. Carr and J.T. Watson, 2000. Open reduction and internal fixation of posterior wall fractures of the acetabulum. Clin. Orthopaedics Relat. Res., 377: 57-67.

Mucha, J.P. and M.B. Farnell, 1984. Analysis of pelvic fracture management. J. Trauma, 24: 379-386.

Pohlemann, T., A. Gansslen and C.H. Stief, 1998. Complex injuries of the pelvis and acetabulum. Orthopade, 27: 32-44.

Ruesch, P.D., H. Holdener, M. Ciaramitaro and J.W. Mast, 1994. A prospective study of surgically treated acetabular fractures. Clin. Orthopaedics Relat. Res., 305: 38-46.