OPERATIVE TREATMENT OF ACETABULAR FRACTURES

H H Lim, C L Tang, S Krishnamoorthy

ABSTRACT

A retrospective review of 23 patients with acetabular fractures operated upon between January 1985 and December 1990 was conducted. Eighteen patients were available for assessment of functional outcome. Radiological results were also evaluated.

The majority of the patients were male and the average age was 35 years. Three-quarters of the patients had an injury to another system. Three-quarters of the patients were operated upon within two weeks and only two patients had complications directly related to the operation.

Radiological result was excellent or good in 61%, fair in 22%, and poor in 16% of the patients. Functional score was excellent or good in 72%, fair in 16% and poor in 11%.

In summary, operative treatment of acetabular fracture is a safe and acceptable method of managing displaced acetabular fractures.

Keywords: *acetabulum, fracture fixation, postoperative complications, ossification, osteoarthritis.*

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INTRODUCTION

Historically, acetabular fractures were an enormous orthopaedic problem in which the treatment was grossly inadequate and many patients were left with incapacitating pain. Initially many authors advocated conservative treatment[1-5] with early motion until it was observed that displaced fractures consistently gave poorer results than undisplaced fractures[6]. More recently, three factors are identified as essential in determining the final outcome of the treatment. These are the initial displacement of the fracture fragments, involvement of the superior weight-bearing dome[7] of the acetabulum and the accuracy of the reduction[8-11]. In addition, late complications of the fracture like avascular necrosis and heterotrophic ossification[12] play a significant role in determining the final outcome.

In the 1960s, Judet[13] first suggested that open reduction and internal fixation be done in all cases of displaced acetabular fracture to achieve accurate reduction. However, in view of the complicated anatomy of the region, the difficulty of the surgical approaches and problem of fracture communition, accurate reduction is often not possible.

Thus, the aim of this review was to review the displaced acetabular fractures treated operatively in our hospital with regards to the clinical, radiological results, the rate of surgical complications and the rate of successful fracture reduction.

MATERIALS

Eighty-seven patients with acetabular fracture were admitted to Singapore General Hospital between January 1985 and December 1990. Only 23 patients required operation for the reasons below (Table I) and were selected for the review. However, only 18 patients were available for evaluation. They had at least 18 months of follow-up. Five patients were lost to follow-up (Table II).

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Table I – Indications for operations

Indications	No. of cases
1. Displacement of fragment (greater than 3 mm)	11
2. Unstable hip after reduction	5
3. Intraarticular fragment	2

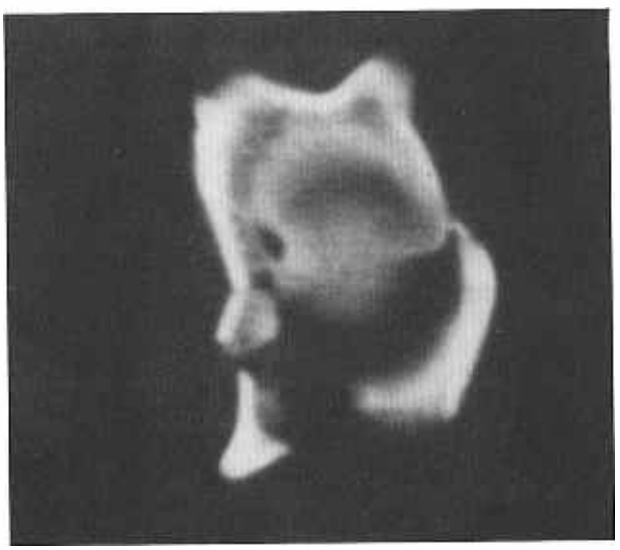
Table II – Lost to follow-up

Reasons	No. of cases
1. Foreign worker	1
2. Overseas study	2
3. Not contactable	2

METHODOLOGY

The case records and X-rays of the patients were reviewed. In all cases, plain antero-posterior, lateral and oblique X-rays were available. CAT scan was done when necessary (Fig 1). Thirteen patients were interviewed in the clinic and five patients were interviewed at home.

Fig 1 – CAT scan of left hip. An acetabular fracture involving the posterior and superior wall.



Assessment protocol

The clinical and radiological outcome were assessed by using the Clinical Grading Criteria and Radiological Grading as outlined by Matta[7,14] (Tables III, IV). Three parameters of pain, level of ambulation and range of motion were assessed in the Clinical Grading Criteria. A modification of this system was used and measurement of absolute value of the range was substituted with activities which require varying degree of hip movement. We felt that this would reflect the functional status of the hip better than the measurement of range of motion.

The immediate post-operative X-rays were reviewed and assessed for adequacy of reduction. Satisfactory reduction was defined as displacement of less than 3 mm and a congruent joint line.

Table III – Radiological Assessment Grading – Matta et al[7,14]

Grading	Description
Excellent	essentially normal X-ray
Good	Mild spur formation
	Mild joint narrowing
	Mild sclerosis
Fair	Mild mottling of the head
	Mild subluxation of the head
	Moderate spur formation
	Moderate joint narrowing
	Moderate sclerosis
Poor	Any collapse of femoral head
	Any subchondral cyst
	Moderate-severe mottling of femoral head
	Moderate-severe subluxation of the head
	Severe spur information
	Severe joint narrowing
	Severe sclerosis

Table IV – Clinical Grade Criteria-Matta et al[7,14]

(A) PAIN:	Grading (points)
1. No pain	6
2. Slight or intermittent	5
3. After ambulation but disappears	4
4. Moderately severe, permits ambulation	3
5. Severe with ambulation	2
6. Severe, prevents ambulation	1
(B) AMBULATION:	
1. Normal	6
2. No cane but slight limp	5
3. Long distance with cane/crutches	4
4. Limited even with support	3
5. Very limited	2
6. Bedridden	1
(C) RANGE OF MOTION:	
1. Sit cross-legged	6
2. Able to squat down fully	5
3. Sit on a low chair	4
4. Kneel down on the ground fully	3
5. No problem in climbing stairs	2
6. Walk without limp	1

Grading for total of the three parameters

Excellent	18 points	Fair	12-14 points
Good	15 – 17 points	Poor	less than 12 points

RESULTS

Patients' profile

The mean age of this group of patients was 35 years, range from 23 years to 66 years. There was a male predominance (male to female ratio = 16 : 2). High velocity trauma due to motor vehicle accident is the most common mode of injury accounting for 16 cases. Work-related accident accounted for the remaining two injuries.

Fracture and injury patterns

The fractures were classified according to Judet and Letournel classification[13]. Most of the fractures (14 cases) had involvement of the posterior wall and column (Fig 2a). The remaining cases were two T-fractures, one transverse fracture and one anterior wall fracture (Table V).

High incidence of associated injury to another system was observed. Fourteen of the 18 patients (77%) had significant multiple injuries and head injury was the most common (Table VI). One patient had craniotomy with evacuation of subdural haematoma. Two cases of abdominal injuries were detected and laparotomy was done in both cases. The tibia was the other bone that was most commonly fractured (Table VII). Hip dislocation occurred in 6 patients and this was reduced on an emergency basis and one of these patients required open reduction.

Fig 2a – Acetabular fracture involving the posterior wall and column

Fig 2b – The fracture is reduced and internally fixed with a reconstruction plate.

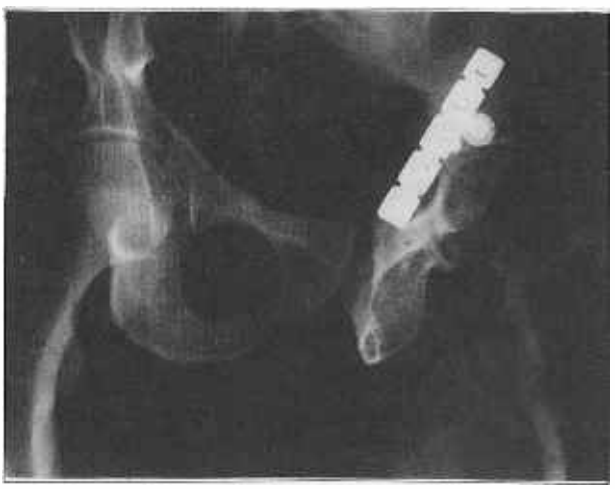


Table V – Fracture pattern according to Judet and Letournel Classification

	No. of cases
1. Posterior wall or column	14
2. Anterior wall or column	1
3. Both anterior and posterior	0
4. T-fractures	2
5. Transverse fracture	1

Table VI – Associated injuries

System involved	No. of cases
1. Head	8
2. Chest	1
3. Abdomen	2
4. Urogenital	none
5. Face	3

Table VII – Associated fractures

	No. of cases
1. Tibia	3
2. Radius/ulna	2
3. Patellar	1
4. Scapular	1
5. Humerus	1
6. Scaphoid	1

Preoperatively, one sciatic nerve injury was detected in a 23-year-old man with a severely displaced posterior wall and column fracture, but this recovered completely three months after the injury.

Surgical management

The main indication for operation was the displacement of fragment greater than 3 mm. Five patients had unstable hip after reduction of hip dislocation and required fixation of the fracture fragments to restore stability (Table I). Stability was determined by Larson's hip stability test[16].

Eighty percent of our patients was operated within two weeks. Three cases were operated between two and three weeks after the accident. They were admitted in shock and had a period of initial stabilisation (Table VIII).

Sixteen of the patients were operated through the posterior approach. (Fourteen through Kocher-Langenbach and two through extended ilio-femoral incision). One case of anterior column fracture was operated through an ilio-inguinal incision.

Sixteen fractures were internally fixed by reconstruction plates (Fig 2b) and two fractures with cancellous screws alone.

Table VIII – Time to operation after accident

	No. of cases
1. Within 24 hours	1
2. 1 day to 1st week	6
3. 1 week to 2 weeks	8
4. More than 2 weeks	3

The mean operating time was 2 hours 20 minutes (range: 1 hour 20 minutes to 4 hours 15 minutes). The average hospital stay was 29 days (range: 14 days to 64 days).

Complications

The complication rate was low. Only two complications (11%) were directly related to the operation. One patient had a partial sciatic nerve neuropraxia which recovered four months after operation. One wound infection required surgical exploration, however the infection was superficial and the implant was not involved. Two cases with heterotrophic ossification were noted in the post-operative X-rays but both patients were asymptomatic and had full range of motion.

Clinical and radiological results

Clinical Grade Criteria assess mainly the functional status of the hip in daily usage. Seventy-two percent of the patients had scored excellent or good results, only 11% had poor results (Table IX).

Table IX – Clinical Grade Criteria

Results	No. of patients (%)
Excellent	5 (28%)
Good	8 (44%)
Fair	3 (17%)
Poor	2 (11%)

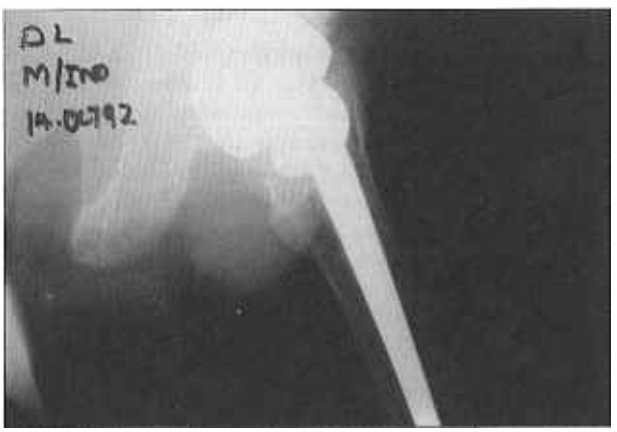
Table X – Radiological Results

Results	No. of patients (%)
Excellent	3 (17%)
Good	8 (44%)
Fair	4 (22%)
Poor	3 (17%)

Radiologically, 61% of the patients had excellent or good results, 17% had poor results. One patient who had avascular necrosis of the hip, had a bipolar hemiarthroplasty performed (Fig 3a and 3b). Review of the immediate postoperative X-rays showed satisfactory reduction was achieved in 94% of the cases.

Fig 3a – A 55-year-old man with avascular necrosis of femoral head (implant removal at 2-year post injury)

Fig 3b – The same patient with bipolar hemi-arthroplasty 4-year post injury.



DISCUSSION

Displaced acetabular fracture is one of the more difficult fractures in Orthopaedics not only because of the complex nature of the fracture but also because it is often associated with severe trauma. The incidence of multiple injuries is high and Hofmann et al reported a mortality rate of 20%[8]. In our series, 77% of the patients had injuries to another system. Three patients were admitted in shock and this underlines the need to be mindful of major injuries to another system when evaluating these patients.

In the early part of this century, acetabular fractures were often feared and treated with much pessimism because of the poor outcome in many patients treated non-operatively. In the 1960s, Judet and others[17] recommended surgery for all displaced acetabular fractures because close reduction failed to reduce the fracture fragments in many cases. However, many authors continued to report good results with conservative treatment and problem of operative treatment such as heterotrophic ossification and inadequate reduction were highlighted.

Recently, it has become obvious that accurate reduction of the fracture is an important factor in achieving satisfactory outcome and open reduction is better than closed reduction in achieving this aim. Many centres which reported high percentage of good and excellent results are mostly well equipped tertiary referral centres or trauma centres with vast experience in treating such fractures. Doubt exists as to whether less specialised units can perform just as well.

Our review of 18 cases of operatively treated acetabular showed that adequate reduction can be achieved in 94% of the fractures. This illustrates that high rate of successful operation is possible even in less established centres and this compares well to the rate of successful reduction of 73% and 90% reported by Letournel[13] and Matta[14] respectively.

Good or excellent radiological and clinical results were achieved in two-thirds of our patients after 18 months follow-up. Our result is compatible to the 74% and 77% good or excellent outcome reported by Kebaish et al[18] and Goulet et al[19] recently.

There were only two post-operative complications directly related to the operation. The complications ie wound infection and sciatic nerve palsy were temporary and easily treated.

Heterotrophic ossification was found in the most recent X-rays of two patients but both had full range of hip movement. Heterotrophic ossification was found to be higher in operated than non-operated cases and reported to be between 30% to 100%[9,14]. Routt et al reported the presence of heterotrophic ossification in all their patients but only 8% were symptomatic[20]. Our series shows a low rate (11%) of heterotrophic ossification and both were of Broker's class I.

The average hospital stay was 29 days. This is the same if not better than conservative treatment which usually requires traction for six weeks.

In conclusion, though the surgical approaches of this region are complicated and fracture configuration is often complex, adequate reduction is achievable in the majority of cases. Therefore, we reaffirm our recommendation that open reduction be performed if closed methods cannot achieve adequate reduction of the fracture[3].

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REFERENCES

1. Heeg M, Oostvogel HJM, Klasen HJ. Conservative treatment of acetabular fractures: The role of the weight-bearing dome and anatomic reduction in the ultimate results. J Trauma 1987; 27:555-9.
2. Steward MJ, Lee WM. Fracture-dislocation of the hip. J Bone Joint Surg 1954; 36A: 315-41.
3. Carnesale PG, Steward MJ, Barnes SN. Acetabular disruption and central fracture-dislocation of the hip. J Bone Joint Surg 1975; 57A: 1054-9.
4. Ylinen M, Santavirta S, Slatis P. Outcome of acetabular fractures: A 7-year follow-up. J Trauma 1989;29: 19-24.
5. Tipton WW, Ambrosia RD, Ryle GP. Non-operative management of central fracture-dislocations of the hip. J Bone Joint Surg 1975; 57A: 888-93.
6. Barnes SN, Stewart MJ. Central fracture of the acetabulum – A critical analysis and review of literature. Clin Orthop 1976; 114: 276-81.
7. Matta JM, Anderson LM, Epstein HC, Hendricks P. Fractures of acetabulum – A retrospective analysis. Clin Orthop 1986; 205: 230-40.
8. Hofmann AA, Dahl C, Wyatt RW. Experience with acetabular fractures. J Trauma 1991; 31: 1615-75.
9. Pennal GF, Davidson J, Garside H, Plewes J. Results of treatment of acetabular fractures. Clin Orthop 1980; 151: 115-23.
10. Pennal GF, Massaih KA. Non-union and delayed union of fractures of the pelvis. Clin Orthop 1980; 151: 124-9.
11. Rowe CR, Lowell JD. Prognosis of fractures of the acetabulum. J Bone Joint Surg 1961; 43A: 30-9.
12. Bosse MJ, Poka A, Reinert CM. Ellwanger F, Slowson R, McDevitt ER. Heterotrophic ossification as a complication of acetabular fractures. J Bone Joint Surg 1988; 70A: 1231-7.
13. Judet R, Judet J, Letournel E. Fractures of the acetabulum: Classification and surgical approaches for open reduction J Bone Joint Surg 1964; 46A: 1615-75.
14. Matta JM, Mehne DK, Roffi R. Fractures of the acetabulum – Early results of a prospective study. Clin Orthop 1986; 205: 240-51.
15. Mayo KA. Fractures of acetabulum. Orthop Clin North Am 1987; 18: 43-57.
16. Larson CB. Fracture dislocation of the hip. Clin Orthop 1973; 92: 147-54.
17. Pantozopoulos T, Mousafiris C. Surgical treatment of central acetabular fractures. Clin Orthop 1989; 246;57-64.
18. Kebaish DS, Roy A, Rennie W. Displaced acetabular fractures: Long-term follow-up. J Trauma 1991; 31: 1939-42.
19. Goulet JA, Bray TJ. Complex acetabular fractures. Clin Orthop 1989, 240. 9-20.
20. Routt MLC, Swiontkowski MF. Operative treatment of complex acetabular fractures. J Bone Joint Surg 1990; 72A: 897-904.