

Open Reduction and Internal Fixation of Fractures of the Acetabulum – Local Experience

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ABSTRACT

Introduction: It is now widely accepted that open reduction and internal fixation of displaced acetabular fractures should be the standard of care. This paper reports a case series of acetabular fracture fixation performed at the Changi General Hospital by a single trauma surgeon.

Patients and Methods: A retrospective study was conducted of 15 consecutive cases of displaced acetabular fracture fixation between February 1996 and September 1999. Outcome was assessed radiologically and functionally with the use of a hip scoring system used by Matta.

Results: The patients' age had a mean of 34.9 years. All fractures were a result of high energy trauma. The median duration to operation upon admission was eight days. The mean hospital stay was 24.9 days and the mean medical hospitalisation leave was 159 days. Bony union was achieved in all patients. Two patients (13.3%) had a residual displacement of 1 mm. Four patients (26.6%) had a residual displacement of 2 mm. Of these four patients with 2 mm displacement, two eventually developed osteoarthritis. Subsequently, one of the two with OA required revision to a total hip arthroplasty two years post fracture. Other complications include 1 (6%) wound infection and 2 (13%) deep vein thrombosis. There were no complications of heterotopic ossification or sciatic nerve injury. Functional scores with a minimum follow up of one year and a mean of 22.6 months follow-up were excellent in 13.3%, good in 66.7%, fair in 13.3% and poor in 6.7%.

Conclusion: The number of cases in this paper is insufficient to produce any statistically significant outcome predictors but accuracy of reduction is an important factor. A good to excellent result was attained in 80% of the patients which confirms that open reduction and internal fixation is the treatment of choice for displaced and acetabular fractures.

Keywords: acetabulum, fracture, fixation, open reduction

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INTRODUCTION

The subject of acetabular fractures is one that will interest most trauma surgeons. They pose a challenge both in their diagnosis and their management. Operative treatment of displaced acetabular fractures should now be the standard of care⁽¹⁻⁶⁾. Open reduction and internal fixation is not an easy undertaking. The anatomy of the acetabulum is complex and exposure for fracture reduction is difficult. In addition there are numerous types of acetabular fractures (10, A - J) which demand different surgical approaches and techniques. Specific training and expertise are thus required.

This case series follows the experience of a single surgeon on the operative management of displaced acetabular fractures at the Changi General Hospital during a four year period between 1996 and 1999. Patient profile, operative techniques together with functional and radiological outcome were reviewed. This paper will also include an in-depth study of the topic of acetabular fractures.

PATIENTS AND METHODS

A retrospective study of consecutive acetabular fracture fixation performed by a single trained trauma surgeon at Changi General Hospital was conducted. The patients presented between February 1996 and September 1999.

All had displaced fractures of at least 3 mm. Plain radiographs of the three standard views are obtained upon admission: Antero-posterior, obturator and iliac views of Judet. Computed tomograms were also performed on all these patients. Fractures were classified by Letournel's classification system. Indication for operative management was based on radiographical demonstration of fracture displacement. All patients were put on straight leg traction prior to surgery. The Kocher-Langenbeck approach was used for posterior wall and column fractures while the ilioinguinal approach was used for anterior column fractures. Double column fractures was accessed with combined

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ilioinguinal and Kocher-Langenbeck approaches. The patients were either placed in the supine or floppy lateral position respectively. No prophylaxis against heterotopic ossification was used.

Follow-up data was collected and patients were recalled for assessment of their functional outcome. Functional outcome was assessed with a hip scoring system devised by Matta⁽³⁾ (Table I). Patients with inadequate follow-up data were excluded from this study.

Radiological outcome of fixation was determined through post-operative plain radiographs of the three standard views. Residual displacement was defined as the maximum displacement on any one view.

RESULTS

Eighteen patients underwent open reduction and internal fixation of displaced acetabular fractures in the above mentioned period. Three patients were excluded from the study due to insufficient follow-up data. All were foreign workers who returned to their home country.

The fifteen patients included in this case series were aged between 25 and 60 years. Their mean age was 34.9 years. All injuries were the result of high energy trauma. Ten (66.7%) occurred after a road traffic accident and the remaining (33.3%) after a fall from height. All the patients had a maximum revised trauma score on arrival at the hospital and the injury severity score ranged between four and 14. In other words, although all the patients had suffered significant trauma, none of the patients in our series were severely

Table I. Functional Outcome Scoring System by Matta.

Degree of pain		
6 = none		
5 = slight or intermittent		
4 = pain after ambulation but disappears		
3 = moderately severe, permits ambulation		
2 = severe, prevents ambulation		
Degree of ambulation		
6 = normal		
5 = no cane but slight limp		
4 = long distance with cane/crutch		
3 = limited even with support		
2 = very limited		
1 = non ambulatory		
Range of motion (ROM)	Right	Left
Flexion – extension	_____	_____
Abduction	_____	_____
Adduction	_____	_____
External rotation	_____	_____
Internal rotation	_____	_____
Total	_____	_____
Percent of injured hip = (total injured ROM/ total normal ROM)		
6 = 95-100%		
5 = 80-95%		
4 = 70-80%		
3 = 50-70%		
2 = <50%		
Clinical grade: total points (pain + ambulation + ROM)		
18 = excellent		
15-17 = good		
13-14 = fair		
<13 = poor		

Table II. Fracture Classification, Functional and Radiological Outcomes.

Patient	Age	Letournel Classification	Post-operative residual displacement (cm)	Associated Pipkin fracture	Functional Outcome score (3 - 18)
1	43	J	0	–	16
2	36	A	0	–	17
3	44	A	0	–	15
4	39	B	0	–	15
5	60	G	0	–	17
6	48	B	2	Supra-foveal	17
7	32	J	2	–	11
8	33	A	0	–	18
9	25	I	2	–	14
10	25	I	2	–	15
11	25	A	0	Infra-foveal	18
12	29	B	0	–	15
13	32	J	1	–	13
14	26	D	0	–	16
15	27	B	1	–	16

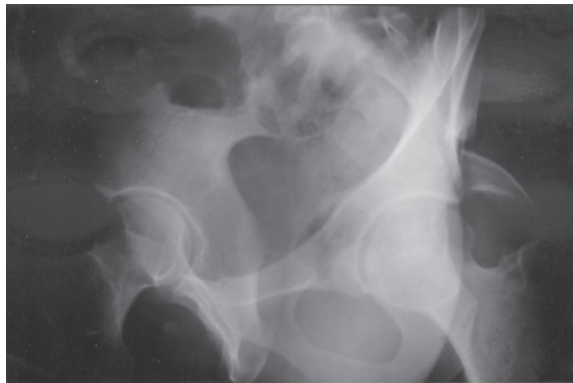


Fig. 1 Judet's view of patient no. 2 who sustained a posterior wall fracture.

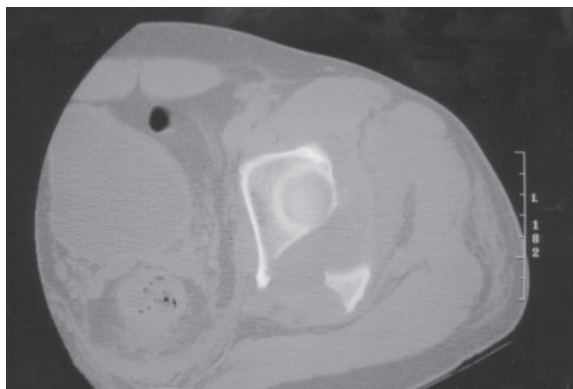


Fig. 2 Computed Tomogram of patient no. 2 left acetabulum shows the posterior wall fracture.



Fig. 3 Post-operative AP radiograph of patient no. 2 shows anatomical reduction.



Fig. 4 AP radiograph of the pelvis of patient no. 10 shows a complex fracture of the left acetabulum.

deranged physiologically on admission and this allowed them to progress to surgery for the acetabulum.

The median duration to operation upon admission was eight days (range, 2 - 18 days). Mean surgical time was 2 hours and 50 minutes (range, 1 hour 25 minutes - 5 hours 40 minutes). The mean hospital stay was 24.9 days (range, 10 - 59 days) and the mean hospitalisation medical leave was 159 days (range, 73 - 237 days).

The variety of fractures are indicated in Table II. There were four posterior wall (A) and four posterior column (B) fractures. They were all accessed through the Kocher-Lagenbeck approach except for one patient. She had an associated dislocation of the sacro-iliac joint and exposure was deemed better using an ilioinguinal approach. One patient had an anterior column fracture (D) that was operated through the ilioinguinal approach. There were three double column fractures (J) and two anterior and posterior hemitransverse fractures (I). Combined anterior and posterior approaches were used in these patients. The last patient had a transverse and posterior wall fracture for which the Kocher-Langenbeck approach was adequate for exposure. Two patients had associated Pipkin fractures of the femoral head.

Bony union was achieved in all patients. Anatomical reduction was achieved in nine patients. Figs. 1-3 show a patient with a posterior wall fracture that was anatomically reduced and fixed. Two patients (13.3%) had a residual displacement of 1 mm. Four patients (26.6%) had a residual displacement of 2 mm. Of these four, two patients eventually developed osteoarthritis of which one had good functional outcome score and the other fair. Figs. 4-7 show the preoperative images of a patient with a double column fracture. A residual displacement of 2 mm was present post-reduction and fixation (Figs. 8, 9). Fig. 10 shows a subsequent X-ray with reduced joint space and development of osteoarthritis. A further one of these four patients had a total hip arthroplasty done two years later after suffering rapid erosion of the femoral head. We believe that this problem arose due to secondary collapse of the roof of the acetabulum (which was a free fragment) exposing the femoral head to a fixation plate. The plate subsequently eroded the femoral head. Other complications include 1 (6%) superficial wound infection and 2 (13%) deep vein thrombosis, none of which developed pulmonary embolism. There was no heterotopic ossification or iatrogenic sciatic nerve injury as a result of surgery. There were no mortalities.

Functional scores with a minimum follow-up of one year and a mean of 22.6 months follow-up were excellent in 13.3%, good in 66.7%, fair in 13.3% and poor in 6.7%. All the patients who had no residual

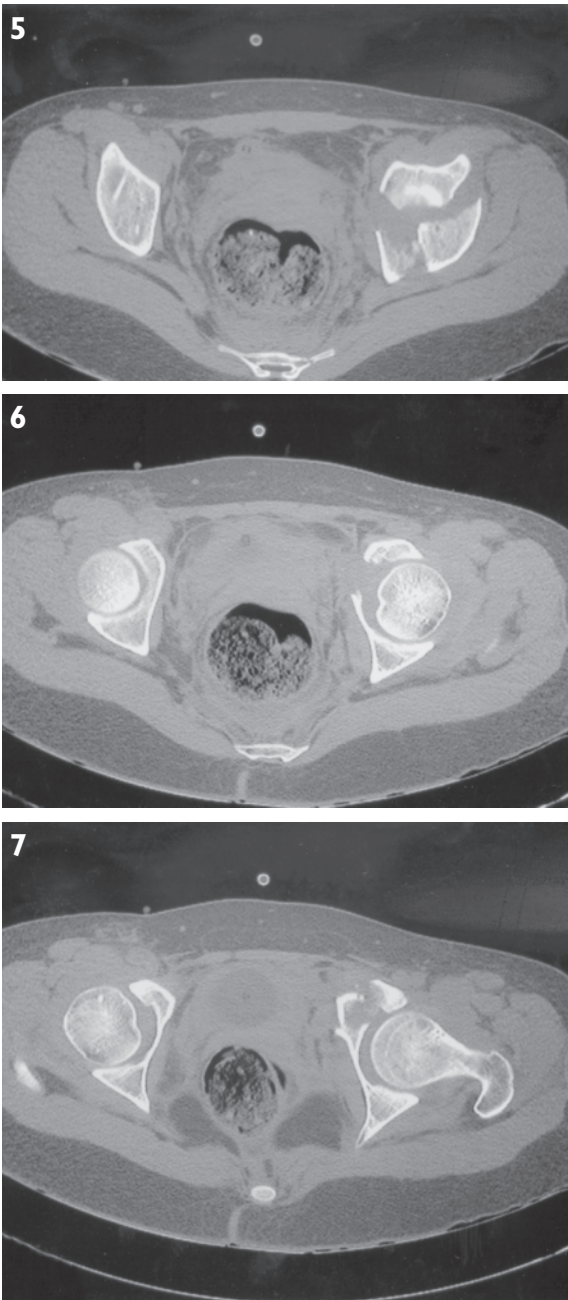


Fig. 5-7 Computed Tomograms of this complex fracture shows a double column fracture.

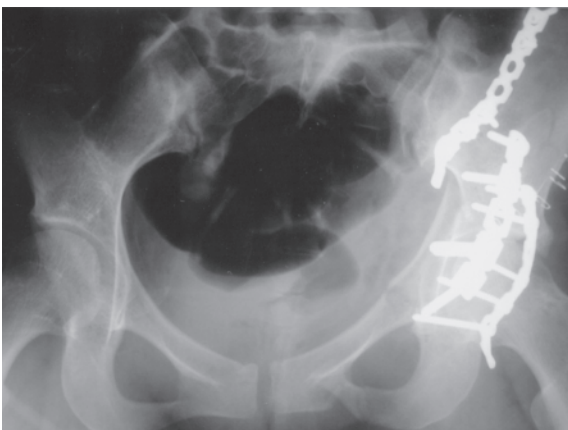


Fig. 8 Post-operative AP radiograph shows a residual 2 mm displacement.

bony displacement after operative fixation had either a good or excellent outcome. These results are reflected in Table II.

DISCUSSION

Since Letournel and Judet first suggested in 1961 that operative reduction and fixation of displaced fractures will likely lead to a better outcome^(1,7), there have been a number of papers that support this claim. Matta reported 40% excellent and 36% good outcome in 262 displaced fractures⁽³⁾. Good to excellent outcome was related to anatomical reduction demonstrated radiographically. Ruesch et al found 81% acceptable outcome in 102 fractures treated operatively⁽⁴⁾ and Mayo also reported 75% good to excellent outcome in 163 operatively treated fractures⁽⁵⁾. These results, together with the findings from 30 years of work by Judet and Letournel confirmed the place of operatively management of displaced acetabular fractures as the standard of care.

In our series, good to excellent results was achieved in 80% of patients, which is similar to what was reported in these larger series. One significant feature of our series is that all patients in whom anatomical reduction was achieved had good to excellent functional outcome on follow-up. On the other hand, of the four patients in whom there was residual fracture displacement of 2 mm, three developed either osteoarthritis or suffered destruction of the femoral head. As already emphasised by authors of larger series⁽³⁻⁶⁾, the accuracy of fracture reduction is an important predictor of functional outcome. It seems that the complexity of the fracture affects the ease of anatomical reduction of the fracture. Of the six patients that had either 1 mm or 2 mm residual displacement, four were complex double column fractures.

Other factors that have been suggested to affect functional outcome are patient age and damage to the femoral head. There were only four patients in our series who were aged above 40 and all had good functional outcome. Only two patients in this series had associated Pipkin fractures of the femoral head, one developed osteoarthritis while the other had a good outcome. The numbers in this series are insufficient to comment on the effect of these two factors on outcome.

The subject of approaches to complex fractures has been a topic of much discussion. Some authors advocate the use of extensile or combined approaches for complex fractures while others recommend the ilioinguinal route^(6,9,10). Current data are based only on retrospective studies and randomised prospective studies may give an insight into this area. The other area of contention is whether an extensile or a combined approach is superior. The extended iliofemoral approach

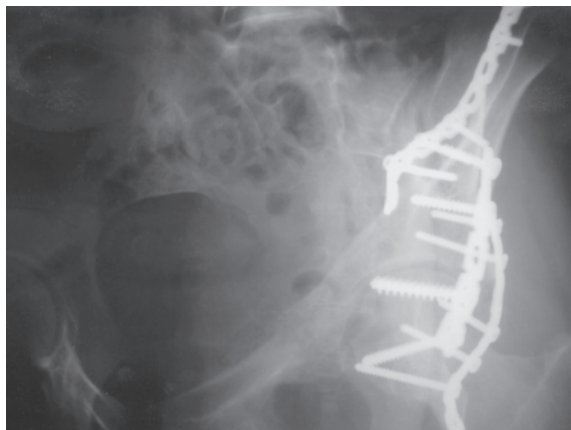


Fig. 9 Post-operative Judet's view.



Fig. 10 AP pelvic radiograph after 1 1/2 years shows loss of joint space and development of osteoarthritis.

has been implicated to be associated with a high incidence of complications and has thus fallen from favour⁽¹⁰⁾. In our series, we found that the combined ilioinguinal and Kocher-Langenbeck affords adequate exposure for complex fractures and this has been important for accurate fracture reduction. Furthermore, complications of extensile approaches are avoided. The floppy lateral position, although is not ideal for either anterior or posterior approach^(5,10), has been used successfully in our series.

The incidence of deep vein thrombosis as a complication has been reported to be between 5 to 30%^(10,11). The incidence in our series of 13% falls within that range. The use of mechanical foot pumps on admission in pelvic fracture patients is routine in our unit. Subcutaneous low molecular weight heparin is also used for prophylaxis in the post-operative period. These measures would seem adequate for deep vein thrombosis prophylaxis.

The problem of heterotopic ossification is one that will crop up during any discussion of acetabular fracture management. The incidence of heterotopic ossification is much higher in patients treated operatively^(2,11-13). The most notable risk factor is the stripping of the gluteal

muscles from the external ilium^(2,11,13), and thus the use of the extended iliofemoral or triradiate approaches will have greatest risk of heterotopic ossification formation while the ilioinguinal approach will carry with it the least risk. Incidence of this complication has been reported between 18 and 90%⁽²⁾. However, those who reported high incidence were series where the extensile approach was used. When heterotopic ossification is defined as significant bone formation that limits motion by greater than 20%, the overall incidence is 7%⁽²⁾. In our series, we did not experience any heterotopic ossification even in patients in whom the Kocher-Lagenbeck approach was used. Neither indomethacin nor low dose radiation was used as prophylaxis. Perhaps, the numbers are too small in our series and cases of heterotopic ossification will show up when more data is collected.

Meticulous aseptic techniques and haemostasis we believe have contributed to our low infection rates. None of the patients in our series had associated open pelvic fractures, which may have adverse effects on infection rates. Deep infection is always associated with a poorer outcome^(2,7) and infection rates should be kept as low as possible.

Iatrogenic sciatic nerve injury is a complication that has been reported. There has been some controversy about whether or not to use nerve monitoring devices intraoperatively. However, there is no randomised prospective evidence to support nerve monitoring so far and this procedure does increase operative time and cost. In experienced hands and with proper positioning, the incidence of this complication is low^(2,10). In our series, this complication was not experienced, routine intraoperative sciatic nerve monitoring was not used.

CONCLUSION

This series of 15 cases of displaced acetabular fracture fixation reports our experience at the Changi General Hospital. The outcome results are similar to those that have been published in previous larger studies and confirm the place of operative treatment in the management of displaced acetabular fractures. The accuracy of the reduction is an important predictor of functional outcome. The approximation to normal anatomy will depend on the complexity of the fracture and the expertise of the surgeon. Some controversies still await the data from large randomised prospective studies.

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