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Original Article

Acetabular fractures labelled poor surgical choices: Analysis of operative outcome

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ABSTRACT

Purpose: We report the surgical outcome in 52 patients with acetabular otherwise considered as poor surgical choices.

Methods: 43 male and 9 female patients were operated at a mean age of 43 years and followed up for a mean duration of 60.3 months. There were 22 elementary fractures and 31 associated ones according to Letournal and Judet classification. Osteosynthesis was attempted in 48 patients whereas a primary total hip arthroplasty was performed in 4 patients. Outcome was assessed radiologically and functionally employing Harris Hip Score (HHS).

Results: Average HHS in osteosynthesis group was 82.56 ± 12.4 with excellent to good results in 59.6% of the cases. Symptomatic osteoarthritis occurred in 13.5% of cases, avascular necrosis and severe heterotopic ossification in 7.7% each, infection and nerve palsy in 11.5% each.

Conclusion: Although the complication rates in this series is marginally more than that reported in literature, we recommend that the indications of surgical fixation in acetabular fractures need to be extended to those which were considered poor surgical choices.

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1. Brief introduction

Fractures of acetabulum are considered as a surgical problem unless criteria for non operative treatment are fulfilled.¹ However considering the complexity of surgical reconstruction, the decisions should be wisely chosen and carefully

reviewed. A judicious approach would be identifying cases where surgical course would yield a more favourable result than a conservative management plan.

It has been well recognised that surgical results are dependent highly on the quality of postoperative reduction achieved and its maintenance thereof. A study by Matta revealed that the fractures reduced to within 1 mm of

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anatomical reduction had far better results than fractures which had a sub optimal (>2 mm) reduction post-operatively.^{2,3} Achievement of a good reduction depends on many factors both controllable and uncontrollable.⁴ While the former may include timing of surgery, surgical technique and surgeon experience; age, fracture type and femoral head damage constitute the latter. Based on these factors, groups have been identified where outcome might not justify pursuing a surgical course of management. In addition to such cases, a subgroup of patients with poor skin condition also have been described to have a poorer outcome by virtue of increased risk of infection.^{1,5}

Murphy et al found out that the majority of poor prognostic factors in acetabular fractures play their role through an inter-relationship with imperfect quality of reduction.⁶ Amongst our surgically managed cases of acetabular injuries, we identified relative indications where a conservative approach may be indicated due to shear surgical difficulty or a high risk of complications after surgery.

The objective of this research was to analyse critically the results of operative management in acetabular fractures which have been conventionally labelled as poor choices for surgical treatment and hence formed relative indications for conservative management.

2. Patients and methods

Over a period of 12 years (December' 2001 to January' 2013), 223 cases of acetabular fractures were treated surgically by the senior author. Out of these, 64 cases were identified as fulfilling the criteria for being labelled as poor surgical choices; the inclusion criteria were neglected fractures (delay in presentation of more than 3 weeks), osteoporosis (t score > 2.5), highly comminuted fracture (>3 fragments identifiable on radiographs that won't hold any internal fixation device) or poor local skin conditions (Morel-Lavallée lesion, bed sores, suprapubic catheter in situ, open fractures). 52 of the 64 cases have completed a minimum of 24 months follow up and were evaluated in the present study. The medical records, imaging, complications and functional outcome of these cases were reviewed.

There were 43 male and 9 female patients. Mean age of patients was 43 years (20–72 years). All except one case had unilateral acetabular injury.

For objective analysis of results, the patients were divided into four groups; group A constituting neglected injuries, Group B cases presenting with acute osteoporotic or comminuted fractures or both (the main surgical difficulty was poor hold of the internal fixation), Group C containing patients with neglected injuries associated with osteoporosis or comminution or both and Group D was constituted by patients with an increased risk of infection by virtue of poor skin condition irrespective of the other indications. Group A had 24 patients, Group B had 13 patients, Group C had 11 patients and Group D had 8 patients (4/8 patients were also included in other groups) (Table 1).

The patients were evaluated pre-operatively with standard anteroposterior and Judet views of the pelvis in addition to computerized tomographic scans. The fracture classification

was done according to Letournel and Judet.⁷ There were 22 elementary and 31 associated fractures. Femoral head fracture was part of the injury in 2 patients while femoral head impaction was seen in 3 patients. Persistent dislocation was present in 12 cases out of which posterior type occurred in 9 and one each of anterior, superior and central types.

Patients were counselled about pros and cons of internal fixation versus primary hip replacement. An osteosynthesis was attempted in 48 patients whereas a primary total hip arthroplasty was performed in 4 patients. A column/wall specific approach was undertaken for osteosynthesis. An isolated Kocher Langenbeck or an ilioinguinal approach was used in 20 cases each, a combination of both was done in 8 patients and the triradiate approach was used in 1 patient. Moore's approach was taken in all patients where a primary total hip replacement was done.

Mechanical calf pumps were used in all cases to prevent deep venous thrombosis; however no agents for thromboprophylaxis were used. Indomethacin 75 mg twice a day was used for 4 weeks in the later half of the study for neglected cases.

Postoperatively patients with osteosynthesis were kept in-bed for 3 weeks followed by non weight bearing mobilisation for 3 months. However, in bed mobilisation was encouraged for all patients. Patients were followed initially at 6, 10 and 14 weeks and subsequently at 3 months for initial 1 year. Later on they were called for follow up biannually. Patients who underwent primary arthroplasty were mobilised from first post operative day and were followed up 3 monthly for a year then biannually.

At every follow up, radiographs were taken and functional evaluation was done using Harris Hip Score (HHS).⁸ Radiologically the cases were assessed for maintenance of reduction and appearance of secondary osteoarthritic changes, if any. Functionally, a score of 91–100 was labelled as excellent, 81–90 good, 71–80 fair and 70 or less HHS was regarded as a poor outcome. Any complication arising perioperatively or during the course of follow up was separately noted.

Statistical analysis: Statistical analysis was carried out using SPSS version 19 (SPSS Inc., Chicago, Illinois); statistical significance was set with a p-value of 0.05.

3. Results

All patients except one (who had perioperative mortality) were available for follow up. Mean duration of follow up ranged from 26 to 136 months (mean 60.3 months).

3.1. Functional outcome

In osteosynthesis group, 47 patients (includes two patients which were subsequently converted into total hip replacement) were available for follow up. Mean HHS in this group was 82.56 ± 12.4 (range 55–100). Excellent results were seen in 11 (23.4%) patients, good results in 17 (36.2%) patients, fair results in 9 (19.1%) patients and poor results in 10 (21.3%) patients. Mean HHS of 4 patients with hip replacement was 86.75 (range = 75–97). A typically good clinical result of osteosynthesis in a neglected injury is shown in Fig. 1a–d.

Table 1 – Demographic constitution of the various groups.

Group	Indication	No. of cases	Mean age (years)	Mean follow up (months)
A	Neglected injuries	24	36.6	62.4 (in 23 patients)
B	Surgical difficulty in terms of osteoporosis and comminution	13	51.9	48.6
C	Both neglected and difficult surgical cases	11	49.4	72.8
D	Poor skin condition	8 (Four exclusive and 4 with concomitant indications)	44.3	47.6

Mean HHS was not different among different surgical groups (Table 2). Patients in Group A were operated after a delay of 46 ± 20.2 days since injury. The correlation between time since injury and the functional outcome was negative although a weak one (Pearson correlation coefficient = -0.27 , coefficient of determination = 0.07).

3.2. Surgical complications

One patient had peri-operative mortality due to disseminated intravascular coagulation. Two patients had massive bleeding during the surgery. One patient amongst these had to be shifted to intensive care surgery after abandoning the surgery and packing of the wound. Surgery in this patient was completed on 3rd day after achieving haemodynamic homeostasis. Internal fixation in the other patient with bleeding was carried out during the primary surgery only. Deep venous thrombosis occurred in one case and was managed with anticoagulation.

Infection complicated the course to recovery in 6 patients; one patient had a superficial infection in the form of delayed wound healing which resolved by antibiotics and repeated dressings. Deep infection occurred in 5 patients (9.6%). Four patients were cured of infection after surgical debridement. One patient with deep infection refused debridement and is still having an intermittently discharging sinus.

The most common complication was secondary symptomatic osteoarthritis occurring in 7 patients (13.5%). One patient with HHS of 50 was subsequently converted to total hip replacement (Fig. 2a–e), rest 6 patients were not willing for a repeat surgery and had a mean HHS of 77.8. Avascular necrosis occurred in 4 patients. One patient was converted into total hip replacement, and the rest of the patients were not willing for surgery.

Myositis of Brooker grades III and IV occurred in 4 patients, all were managed conservatively.

Post traumatic sciatic nerve palsy occurred in 5 patients. Three of the 5 patients had a recovery of nerve function with complete recovery in 2 cases and partial recovery in one. No recovery of nerve function occurred in two cases; both these cases had neglected injuries. Iatrogenic sciatic nerve injury was seen in 1 case which recovered partially with restoration of the common peroneal function of the nerve. This patient presented 3 months after the injury and had a fracture of the posterior wall with persistent dislocation.

Non union of anterior column due to implant failure was seen in 1 patient. It was seen in a case of transverse fracture which presented 60 days after injury and was osteoporotic.

The patient denied any further surgery and is able to walk with support at present with a HHS of 55/100.

4. Discussion

The management of acetabular injuries has gradually evolved from conservative management to operative one; a similar evolution is mirrored during the span of career of an orthopaedic trauma surgeon. The indications for surgical management of an injury continue to expand as the experience of the surgeon increases. Our earlier report included majorities of simple fracture patterns in contrast to the present one which includes complex ones.⁹ The availability of good imaging facilities, gain in surgical expertise, better instrumentation, novel advances in perioperative care together with our experience of uniformly poor results after conservative management led us to believe that the surgical fixation of these difficult fractures would yield better results that can be expected by conservative treatment alone.

Neglected fractures ($n = 24$) formed majority of the cases in these series. The delay in surgical management has a multifaceted detrimental effect on the outcome. Mears et al found significantly fewer reductions if the surgical fixation was attempted beyond 11 days.¹⁰ A less than optimal reduction predisposes to the development of osteoarthritis in acetabular injuries.^{4,11} Besides the concern about inability to achieve congruent reduction, we feel that many other factors contribute to poorer outcomes in this subgroup of patients. We found that out of 4 patients who had heterotopic ossification, 3 were neglected injuries. This was probably related to the extensive dissection required at the time of surgery as well as the severity of initial injury. All 4 cases of avascular necrosis in our study occurred in patients with a delay of more than 4 weeks. The initial insult, persistent misplacement of the head and vascular compromise during surgery might have contributed to the same. Infection occurred in three cases in this group; an overall incidence of 12.5% in this group. We found that as the surgical delay increased, the results progressively deteriorated although the relationship between the two was not strong. However the relative excellent to good results obtained in 57% of (12/21) neglected cases who underwent internal fixation in our series indicate that the cut off of 3 weeks needs to be advanced.

Extremely comminuted fractures having multiple fragments that defy internal fixation have been classically labelled as bag of bones in other areas of the skeletal system. To our knowledge this is the first paper reporting the outcome of bag

Fig. 1 – (a) Anteroposterior view of the pelvis showing a bicolunar fracture pattern presenting at 90 days to us; (b & c) CT scan images with better definition of fracture morphology; (d) Maintenance of reduction and absence of osteoarthritic changes at 47 months follow up.

of bones fracture of the acetabular region. Before venturing into the fixation of such fractures, the pros and cons were thoroughly discussed with the patients and relatives. Osteoporosis contributes to poorer outcome by means of poorer reduction, fixation and poor maintenance of reduction.¹² These two sets of patients: with highly comminuted fractures and those with osteoporosis or both were together grouped into one - cases with high surgical difficulty in terms of poor hold of internal fixation devices. The outcome of this group was marginally better as compared to the neglected fractures in terms of mean HHS. The group (C) where cases had both the indications of Group A and B fared worst in terms of functional outcome.

Eight cases with poor skin condition were operated in our series; four had a Morel-Lavallée lesion, two had suprapubic catheter in situ due to urethral injury, one had an open fracture with wound opening into perineum, one had a bed sore. Two patients (25%) had infection, one had superficial infection managed by repeated dressings; other had deep one requiring surgical debridement. We neither went for immediate fixation of the fracture nor operative debridement of the Morel-Lavallée lesion; instead waited for the soft tissues to heal after which surgical fixation was done.¹³ In cases with concomitant urethral injury it is recommended to do internal fixation of the fracture before doing a suprapubic cystostomy wherever possible. However in developing countries, due to delay in referrals a suprapubic cystostomy becomes imperative before fixation can be done. In both our cases a suprapubic catheter

had been inserted before referral. We painted the abdomen and the catheter with an antiseptic solution the night before and tied the catheter to the trunk on the contralateral side in such cases (Fig. 3). The parts were then draped in a sterile manner; the drapes being opened in operating room only (see Fig. 4). One (out of two with suprapubic catheter in situ) patient thereafter had some serous superficial discharge from the incisional site; however the wound healed with repeated dressings and antibiotics. Although the literature reports the infection rate after surgical management of acetabular fractures to be around 4.4% which is conspicuously less as compared to the infection rate in this group⁴; we feel that operative reconstruction should be offered to such patients considering the poor results of conservative management.

We compared the complication rate in this series with those reported in literature. The most common complication encountered by us was osteoarthritis of the hip either primarily due to incongruence or femoral head damage. Matta described the radiological results after acetabular fracture surgery into four types; a near normal appearance of the hip depicting excellent results, mild changes including moderate narrowing (<1 mm) indicating good results, moderate osteophytes with less than 50% narrowing of joint with sclerosis constituting fair results and large osteophytes with severe joint space narrowing with head or acetabular wear representing poor results.² Matta in his series of 259 acetabular fractures operated within 3 weeks of injury had a 24% incidence of fair and poor radiographic results.² In a Meta analysis

Table 2 – Outcome comparison of the different groups.

Group	Number of cases	Elementary (E)/Associated (A)	Harris hip score	Outcome				Complication rate
				Excellent	Good	Fair	Poor	
A	21 ^a	E – 9 A – 13	82.1 (11.5)	4	8	6	3	10/21
B	12 ^b	E – 7 A – 6	84 (10.7)	4	2	3	3	7/12
C	10 ^c	E – 3 A – 7	79 (17.6)	2	4	—	4	7/10
D	8	E – 2 A – 6	83.5 (8.1)	1	4	2	1	3/8

^a 1 died and 2 primary THR patients excluded out of outcome analysis.

^b 1 primary THR excluded.

^c 1 primary THR excluded.

Fig. 2 – (a) A comminuted bicolumnar fracture pattern, the patient was operated 42 days after injury, had a t-score of -3.1 ; (b) The CT reconstruction image; (c) Depicting the post operative reduction; (d) Radiograph showing follow up at 8 months depicting loss of reduction and arthritic changes; (e) Radiograph after conversion to THA and retention of implants.

conducted by Giannoudis et al it was determined that the overall incidence of osteoarthritis was 26.6%. In our series we had many patients who had a good or fair radiographic result, however the clinical symptoms were nil or only minimal.⁴ Only those cases with poor radiographic results with moderate or severe clinical symptoms were included in the category of osteoarthritis in our study. We had 13.5% (7 patients)

incidence of symptomatic osteoarthritis. One patient had been converted to total hip replacement prior to the final review. Although osteoarthritis was not associated with fracture type in our series, three of the cases had an associated femoral head damage – one had a fracture of head of femur and 2 others had femoral head impaction.

Avascular necrosis occurred in 7.7% of our cases as against an overall incidence of 5.6% reported worldwide.⁴ Highest rates of avascular necrosis have been reported in literature for acetabular fractures with concomitant hip dislocation.^{14–16} Another factor which dictates the development of avascular necrosis after hip dislocation is the time elapsed between the injury and reduction of the hip. Hougaard and Thomsen reported that the rates of avascular necrosis increase from 4.8% to 52.9% if the reduction is delayed beyond 6 h.¹⁷ We had 9 cases of fracture posterior wall with persistent dislocation of head; two had a primary total hip arthroplasty done while osteosynthesis was attempted in 7, subsequently 3 patients had developed avascular necrosis at final review; an incidence of 42.9% in persistently posterior dislocated hips.

We had a 9.6% (5/52) incidence of traumatic nerve palsy and 1.9% (1/52) incidence of iatrogenic nerve palsy. The incidence of traumatic peripheral nerve palsy has been stated to be 16.4% in a review of acetabular fractures.⁴ Whereas these included sciatic as well as femoral nerves, we encountered injury of sciatic nerve only in our series. All the five cases which had a sciatic nerve injury were posterior wall fractures

Fig. 3 – Preoperative preparation in a patient with suprapubic catheter in situ. The catheter was tied to opposite side of trunk and the abdomen painted with povidone iodine the day before.

Fig. 4 – The preoperative draping effectively taking the catheter out of the surgical field.

either alone or in combination. Various series have reported the incidence of traumatic sciatic nerve injury in posterior fractures to be higher as compared to other fracture types sometimes as high as 40.3% in cases with dislocation of hip.^{4,6,18,19} In the present series the incidence of traumatic sciatic nerve palsy was 28.6% in isolated fractures of the posterior wall and 11.1% in cases of persistent dislocation. Sciatic nerve recovered fully in 2 cases, partially in one with recovery of common peroneal part while no recovery occurred in two cases. We had one case (1.9%) where sciatic nerve was injured iatrogenically. The nerve recovered partially at a latest follow up of 25 months. Giannoudis reported the incidence of iatrogenic nerve palsy to be higher (8%) as compared to our study⁴; however they had included injury to lateral cutaneous femoral nerve as well which was not taken into account in our study. Heterotopic ossification (Brooker grades III and IV) developed in 4 of our cases; an incidence of 7.7% as opposed to 5.7% reported worldwide.⁴ We found that a surgical delay was present in 3 cases. Studies have shown that the incidence of heterotopic ossification is more related to the type of surgical approach used; maximum being reported with the use of iliofemoral approach.^{2,4,20–22} However a small sample size in this series doesn't permit comment in this aspect of pathogenesis of heterotopic ossification. Although we started Indomethacin as a prophylactic measure in cases which had a surgical delay operated in the latter half of the series, recent analysis indicate that the incidence of heterotopic ossification is not affected by any prophylactic measure including pharmacologic and radiation therapy or both.⁴

Infection rate in the present series was 11.5% which is slightly higher than reported previously 0–4%.^{4,23,24} Suzuki et al found that higher Injury Severity Score, longer intensive care unit (ICU) stays, larger amount of packed red blood cells transfused, longer operative time, larger estimated operative blood loss, higher body mass index (BMI), more frequent performance of combined approach, association of urinary tract injury, and Morel-Lavallée lesion predisposed to development of infection after surgical management of acetabular fractures.²⁵ The results published from developing countries

earlier also report a similar incidence of infection suggesting that the factors leading to increased infection in our series might be attributable to causes like poor hygiene, poor infrastructure and operating room conditions as compared to the western world.⁹

The inferences that can be drawn from the present study show that the complication rates in the acetabular injuries otherwise labelled as poor surgical choices are marginally higher as compared to the world literature for fractures which are recommended to be routinely operated. Although a longer follow up is required, midterm outcome suggests that in these fractures a satisfactory outcome can be achieved in more than 50% of cases, hence not all patients should be treated with a conservative approach which usually leads to an inferior outcome.

Conflicts of interest

All authors have none to declare.

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