

Total Hip Arthroplasty with Acetabular Bone Graft Reconstruction in Neglected Fractures of the Acetabulum: A preliminary report of sixteen cases

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Abstract: *Background:* Neglected acetabular fractures is a challenging to treat. Total hip arthroplasty with bone-graft reconstruction is among the most popular methods of providing bony support in cases of acetabular bony deficiencies during total hip arthroplasty. Controversy still exists on the best method for bony reconstruction.

Patients and Methods: Sixteen patients having neglected acetabular fracture or fracture dislocation were operated for total hip arthroplasty using autograft from the femoral head. The average age of the patients was 50 years (range 36-58 years). There were 12 males and 4 females. Average time of follow up was 3 years.

Results: There was graft resorption in two cases with subsequent revision. Average Harris hip score pre-operatively was 46, which improved to an average of 84 post-operatively.

Conclusion: Our study has shown that total hip replacement with bone grafting in form of auto graft of the femoral head provide good results in reconstruction of acetabular bony deficiencies due to neglected acetabular fracture.

Keywords: Total Hip Arthroplasty-Acetabular fractures-Bone graft.

1. INTRODUCTION

Acetabular fractures are complex fractures and should be managed primarily by experienced surgeons with a fair experience of such injuries. The conversion of a previously improperly treated or untreated acetabular fracture to a total hip replacement is extremely challenging even for the most experienced surgeons. Various investigators use different methods for operative treatment of old unreduced acetabular fracture or fracture-dislocations including arthrodesis, and total hip replacement [1].

The clinical results of operative management of fractures of the acetabulum are positively affected by the anatomical reduction and postoperative congruity between the femoral head and the acetabular roof. The rate of anatomical reduction decreases with increases in the complexity of the fracture, the age of the patient, and the interval between the injury and the reduction [2]. Up to two weeks following the injury the fracture fixation can be done in the standard way. When patients present late for treatment the problems are compounded. From two to four weeks following the injury the fracture fixation becomes more difficult, but is still possible. Any acetabular fracture, which is more than six weeks old, should not be attempted for primary fixation, as the surgery is formidable and the outcome is not very good. In such fractures salvage procedures

like total hip arthroplasty if patient has severe pain should be considered [3].

This prospective study asked whether a reconstruction with structural bone grafts will provide a durable and pain-free function in extensive acetabular defects. We specifically determined the (1) survival rates with the end point of revision for any reason, aseptic revision, and radiographic loosening; (2) Harris hip score (HHS); (3) complications; and (4) Graft incorporation or resorption.

2. PATIENTS AND METHODS

This is a prospective study of sixteen patients (16 hips) who had total hip replacement to treat neglected fracture acetabulum and fracture dislocation. The average age of the patients was 50years (range 36-58years).

In three cases the diagnosis of fracture acetabulum was missed at primary management while in thirteen cases the preceding treatment was conservative. The presenting symptom was pain, limping and inability to bear weight in all cases.

Column fracture non-union was not recognized in any cases, union of the fracture column was considered as a must for inclusion in the study so that no internal fixation was done in any of the cases. Patient with infection, pathological fracture, neglected central dislocation with medial wall defects or resorbed femoral head were excluded from the study. The average time from acetabular fracture to the hip

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replacement operation was 6 months (range 3-12 months). Preoperatively, acetabular bone deficiency and fracture pattern was assessed based on Antero-posterior and lateral view X-rays supplemented by CT scan. Preoperative laboratory investigations in the form of complete blood picture, ESR and CRP were done to rule out infection.

All operations were performed through a postero-lateral approach. Removal of the femoral head allowed for excellent exposure of the acetabulum. The posterior wall defect was debrided to bleeding bone with removal of all fibrous tissue. The femoral head was used for the graft with fashioning to fit the defect. The graft is reamed with the acetabulum (usually 2mm undersize), while it is temporary fixed with K-wires to avoid loosening of the definitive fixation during the reaming process. After reaching the last reamer size, the cortico-cancellous grafts were definitively fixed to the postero lateral aspect of the acetabular rim with screws (Figure 1A and B).

Screw orientation is of significance. Screw orientation for graft fixation was done close or parallel to the ideal resultant hip force to allow for axial compression of the graft. Horizontal or close to horizontal screw placement increases screw fracture and graft resorption or migration. Axial compression of the graft and the reconstructed acetabular roof by correct screw placement enhances bone remodelling and graft incorporation [3]. Final cup was then

implanted. Cementless THA with screw fixation of the cup was used in all cases.

Postoperatively weight bearing was restricted for 6 weeks, and then partial weight bearing was allowed for the following 6 months. Clinical evaluations were performed at all follow-up intervals using HHS. A score of 90 to 100 was considered as excellent, 80 to 90 as good, 70 to 80 as fair, and below 70 as poor. Success of procedure was defined as an increase in the scores by 20 or more points, a stable cup, with no additional surgery on the acetabulum.

Radiological evaluation was done through antero-posterior and lateral radiographs at all follow-up intervals. Radiolucent lines adjacent to the acetabular component were identified as described by DeLee and Charnley [4]. Acetabular hip centre, and migration of acetabular component were considered after the method proposed by Callaghan *et al.* [5]. The vertical distance from the centre of femoral head to the inter-teardrop line and the horizontal distance to the perpendicular to this line at the teardrop figure were calculated. A normal hip centre is reported to be 12 to 14mm above the inter-teardrop line and 33 to 43mm lateral to the acetabular teardrop [6]. A high hip centre was arbitrarily defined as having the centre of rotation on an antero-posterior radiograph greater than 35mm proximal to the inter-teardrop line [7]. A component was described as radio-graphically unstable if a 1mm or greater lucent line occurred across all 3 acetabular

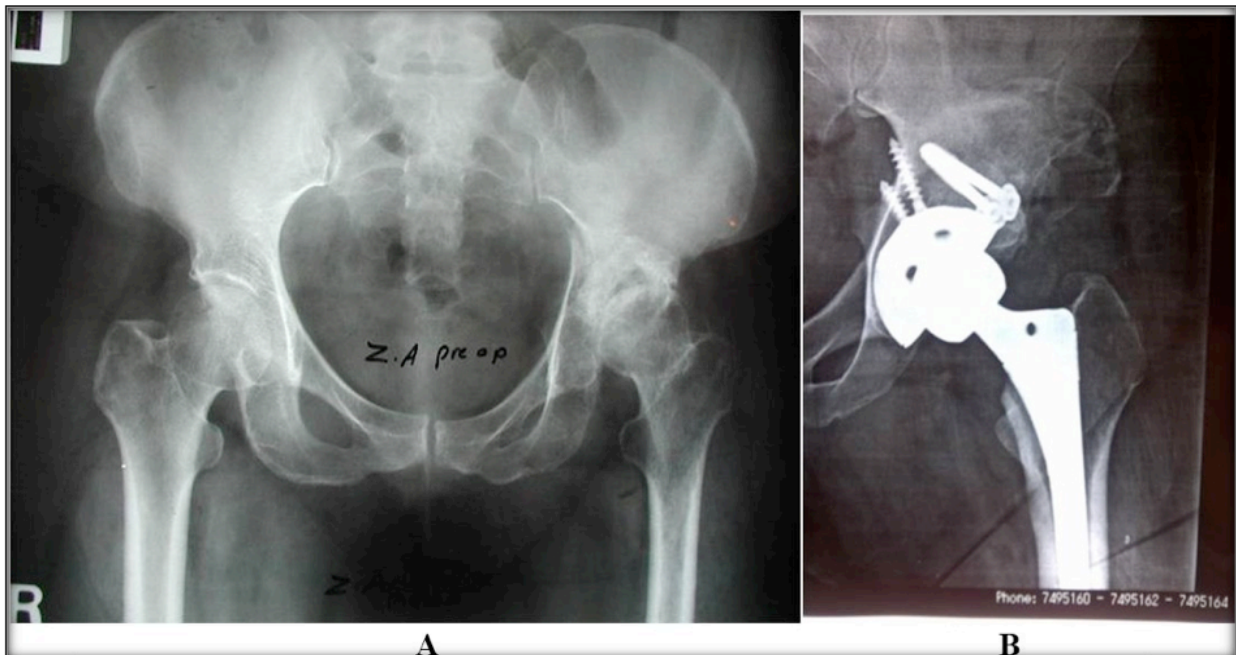


Figure 1: (A) 46 years patients with neglected posterior wall fracture acetabulum. (B) Follow up 3 years after acetabular reconstruction with femoral head auto-graft and cementless THA.

zones or if any measurable cup migration occurred [8]. Loosening was characterized by a change in the component abduction angle of greater than 10° or in the horizontal or vertical position of greater than 6mm observed in successive radiographs, after correcting for magnification [9]. Radiological signs of bony non-union, severe radiolucencies at the host-graft interface or significant resorption of the graft were noted [3].

3. RESULTS

Sixteen hips in sixteen patients (12 males, and 4 females), with mean age 50 years (range 36-58) were operated upon. At presentation, the hip was persistently dislocated in addition to the displaced fractured posterior wall acetabulum in six patients. Four patients had displaced posterior wall fracture and the remaining had transverse-posterior wall fracture. Ten patients had their injury due to motor vehicle accident while six had fall from height. Seven patients were having associated head injury at the time of accident but no residual neurological insult was detected at time of operation. No associated fractures were present. The mean follow up period was 3 years (range 2-4.5). No patient was lost to follow up in this series.

Radiological results at latest follow up and by comparing serial radiographs showed that 14 cases

had a well fixed implant without evidences of loosening or malorientation. Hip centre was restored in these cases. All but two of the grafts showed complete consolidation within three months and they had become structurally integrated with the iliac bone, as evidenced by the trabecular reorientation by serial radiographs. Heterotopic ossification (HO) was present in 3 hips (18.75%). Two hips had Brooker grade I HO, one hip grade II HO with no sequel on the final clinical outcome. There was no infection, dislocation, neurological complications or deep venous thrombosis during the follow up period (Table 1).

Table 1: Complications of the Study Group

| Complications | Total |
|--------------------------|-------|
| Infection | 0 |
| Dislocation | 0 |
| Sciatic nerve palsy | 0 |
| Aseptic loosening | 2 |
| Heterotopic Ossification | 3 |
| Deep venous thrombosis | 0 |

Leg length equality was achieved in thirteen cases, and mean Leg Length Discrepancy (LLD) decreased

Table 2: Demography of the Patients, LLD, and HHS

| No | Gender | Age (Years) | Fr Classification | Mode of Trauma | Time to Operation(m) | FU(y) | Preop LLD | Postop LLD(cm) | Preop HHS | Postop HHS |
|----|--------|-------------|--------------------------|----------------|----------------------|-------|-----------|----------------|-----------|------------|
| 1 | M | 46 | Posterior wall | MVA | 7 | 3 | 4 | 0 | 57 | 92 |
| 2 | F | 47 | Transverse post wall | FFH | 5 | 2.5 | 3 | 0 | 33 | 81 |
| 3 | M | 36 | Fr dislocation post wall | MVA | 6 | 4.5 | 3 | 0 | 54 | 90 |
| 4 | F | 48 | Transverse post wall | FFH | 3 | 2.5 | 4 | 0 | 33 | 86 |
| 5 | M | 53 | Fr dislocation post wall | MVA | 4 | 2 | 6 | 2 | 31 | 72 |
| 6 | F | 56 | Posterior wall | MVA | 12 | 3 | 3 | 0 | 56 | 86 |
| 7 | M | 51 | Transverse post wall | FFH | 9 | 2.5 | 3 | 0 | 35 | 83 |
| 8 | M | 47 | Fr dislocation post wall | MVA | 6 | 2 | 6 | 2 | 33 | 75 |
| 9 | M | 44 | Fr dislocation post wall | MVA | 7 | 4 | 3 | 0 | 35 | 81 |
| 10 | F | 49 | Transverse post wall | FFH | 4 | 2.5 | 3 | 0 | 53 | 90 |
| 11 | M | 58 | Posterior wall | MVA | 4 | 4 | 4 | 0 | 54 | 86 |
| 12 | M | 50 | Posterior wall | MVA | 3 | 2.5 | 3 | 0 | 57 | 92 |
| 13 | M | 54 | Fr dislocation post wall | MVA | 6 | 2.5 | 5 | 1.5 | 35 | 81 |
| 14 | M | 48 | Transverse post wall | FFH | 8 | 4 | 3 | 0 | 59 | 87 |
| 15 | M | 53 | Fr dislocation post wall | MVA | 9 | 3 | 4 | 0 | 56 | 83 |
| 16 | M | 55 | Transverse post wall | FFH | 6 | 3 | 4 | 0 | 53 | 81 |

MVA Motor Vehicle Accident, FFH Fall from Height, LLD Limb length discrepancy, m months.

from 3.8cm (range 3-6) preoperatively to 0.3cm (range 0-2) postoperatively. One patient had positive Trendelenburg sign at follow up (presented with neglected fracture dislocation). Mean HHS improved from 46 (range 31-59) preoperatively to 84 (range 72-92) postoperatively at last follow-up. Four patients had an excellent score (90 to 100), 10 were good (80 to 90), two were fair (70 to 80). Two hips (12.5%) had failure due to graft resorption with subsequent aseptic loosening and cup migration after 1 year (case 5), and 1.5 years (case 8). Both cases were revised with reconstruction of the defects with cementless cup and trabecular metal Augments (Zimmer), with no further revision and fair HHS at last follow up at 2 years (Table 2).

Following the definition for successful treatment outcomes, 14 of 16 patients were treated successfully, with an overall success rate of 87.5%.

4. DISCUSSION

Unreduced fracture or fracture-dislocation of the hip for more than 3 months is considered an old neglected one. Conservative treatment becomes impossible to achieve stable concentric reduction due to unreduced wall fracture leading to instability and fibrous tissue covering the fracture. On the other hand, operative reduction after long time shows equivocal results due to irregular and persistent pain. Hence, the operative treatment remains the only chance to reduce the hip or reconstruct with arthroplasty [1].

The presented data show that acetabular bony defects due to neglected acetabular fracture or fracture dislocation can be successfully reconstructed biologically. The use of autologous femoral head and neck grafts with total hip arthroplasty can achieve promising short to midterm results in this group of patients.

In the study of Harris and Crothers [10], they performed total hip replacement in twenty-seven hips of twenty-two patients with osteoarthritis secondary to congenital dislocation, congenital dysplasia, or acetabular insufficiency due to persistent fracture dislocation. The femoral head was used as a bone graft, attaching it to the acetabular wall to provide bone stock for reconstruction. There were few postoperative complications. In thirteen hips followed for over one year, all grafts appeared to be united and none showed evidence of resorption. Eleven of the thirteen hips were pain-free and two were slightly painful. Eleven hips had a range of motion of 90 degrees or more.

Malkin *et al.* [11], Ilyas *et al.* [12] and others have shown good functional outcome with THR for old unreduced fracture-dislocation of the hip. Similar to our cases with postero-superior acetabulum wall deficiency due to old unreduced dislocation, the investigators recommend acetabulum reconstruction prior to acetabulum cup fixation. They used either bone graft augmentation for the deficient wall or a cage for stability. Hansen E and colleagues used cemented cage with allograft for reconstruction of acetabular defect, and they found favourable results in total hip arthroplasty [13].

Differing failure rates in the literature also seem to depend on the follow-up time. Mulroy and Harris [14] emphasize that a late failure of bulk allograft is to be expected. They found a total of 46% of loose cups after a mean follow up of 11.8 years. Five years earlier, all sockets seemed to be stable. A longer follow-up of the presented series will show if the yet promising results can be confirmed. So far, a failure rate of 12.5% in the current study is encouraging.

Acetabular bone defects are most common following posterior wall fractures, or fracture dislocations. It is common to underestimate the extent of the defect on initial inspection, however persistent probing and debridement of the bone must be done to find and remove all necrotic and unhealed segments. Use of the femoral neck and head as a bulk auto-graft contoured is advised to fit the defect and fix it with screws. The fixed graft is reamed with the acetabulum (usually 2mm undersize) [15]. According to the results of the current study and primary follow-up studies, it was found that good clinical results can be achieved with total hip replacement and femoral head bone-grafting as a salvage procedure in treatment of neglected acetabular fracture or fracture-dislocation.

However, the current study has some limitations. First, the number of patients is relatively small. Second, the follow-up is relatively short, and there is little known on the long term survival of these complex arthroplasties.

In conclusion, THA in cases with neglected acetabular fracture is technically demanding procedure and considered a complex arthroplasty due to presence of acetabular defects that may compromise the long term survival of the arthroplasty. Reconstruction of the defects with bone graft presents a good solution to restore bone stock that is advantageous for future revisions. Although the technique is difficult, the short term results are good,

and the complication rate is low, yet long term studies are encouraged. We recommend the technique in management of such complex cases.

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