Case Report

A case report: Posterior acetabular deficiency treated with femoral head autograft and hybrid total hip arthroplasty

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ABSTRACT

As a choice for treating acetabular deficiencies, total hip arthroplasty (THA) is beset with many drawbacks, particularly in relation to untreated fractures and post-surgery complications. Furthermore, it is hard to ensure long-term fixation of the acetabular shell. In our case, a 52-year-old male manual laborer presented with complaints of a painful limp of the left lower limb with gross restriction of movements in the left hip joint. Previously, the patient had undergone open reduction and posterior acetabular wall plate fixation 2 years back and implant exit had been done 1 year before due to complaints of pain. We treated the patient with hybrid THA. To rectify the acetabular defect, we used a femoral head autograft, securing it with screws, and supporting it with a plate posteriorly. After 1 year, there was good graft consolidation sans acetabular component displacement as evidenced by radiography. A Harris hip score of 79.7 indicated good functionality. Therefore, hybrid THA with reconstruction is a good option for treating post-traumatic arthritis with acetabular wall deficiencies. Although the procedure is difficult to carry out, it yields better results in terms of lessened pain, enhanced stability, and better functionality.

Key words: Acetabular deficiency, Femoral head autograft, Hybrid total hip arthroplasty, Posterior wall, Total hip arthroplasty

In recent years, the incidence of acetabular fracture has increased from 8.7 to 11/100,000 person-years, with the majority of the patients (58%) being male [1]. Although there have been many recent advances in the management of acetabular and pelvic fractures, still there are challenges faced in both developing and developed nations; the challenges include delay in their management or improper articular reduction due to various reasons [2]. The delay in management and improper articular reduction has been shown to have a detrimental effect on the overall outcome in both the elementary and associated fracture patterns [3]. Hence, the way, this case was managed will help in the planning of similar cases in the future. In acetabular fractures, total hip arthroplasty (THA) is warranted in two distinct settings: First, in acute acetabular fracture which predictably has a poor outcome with open reduction and internal fixation (ORIF); and second (and more commonly) after the patient develops post-traumatic arthritis with either previous operative or conservative management. Acetabular fracture leads to post-traumatic arthritis of the hip in a fair number of patients. In such cases, arthroplasty or arthrodesis can be considered salvage treatment alternatives [4].

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THA is definitely indicated in the case of impaction injury of the femur head or acetabulum or complete loss of articular cartilage following an injury [5]. While doing THA in such cases, the following have to be taken into consideration: Cavitary or peripheral bone defect, fracture non-union, hip dislocation, and protrusion.

CASE PRESENTATION

A 52-year-old male came with complaints of a painful limp of the left lower limb with gross restriction of movements of the left hip joint. He met with a road traffic accident 2 years back and was diagnosed with a posterior acetabular wall fracture. He was treated with open reduction and plate fixation in a peripheral hospital (Fig. 1a). 1 year before, the patient developed pain over the left hip which was progressive, and implant exit was done for the same. However, still, the pain continued to progress with the development of a limp and restriction of movements. He had no medical comorbidities and blood parameters were within normal limits.

He was a moderately built manual laborer, and his clinical examination showed his general condition to be fair. In the left hip, we found fixed deformity in two planes with a shortening of 3 cm in the affected limb.

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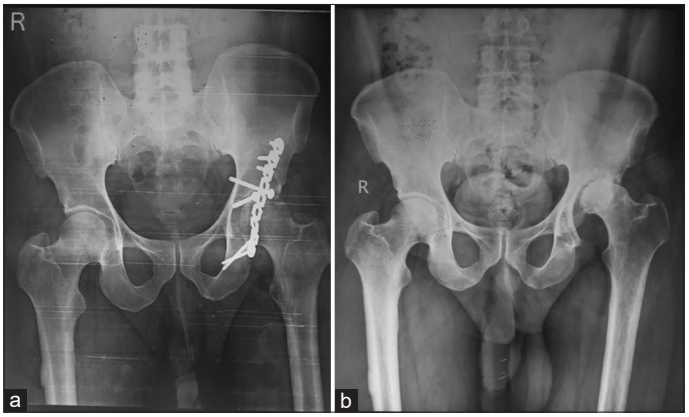

Figure 1: (a) Open reduction and internal fixation with plate fixation for posterior acetabular wall fracture and (b) posterior acetabular wall deficiency with flattened femoral head

Pre-operative evaluation included X-ray pelvis with bilateral hip joint anteroposterior and computed tomography both 2D and 3D reconstruction. X-ray showed high riding greater trochanter with flattening of the femoral head (Fig. 1b). The contour of the acetabulum was lost, and it was shallow and widened. Computed tomography clearly demonstrated both segmental and cavitary deficiency which was Type III by the American Academy of Orthopedic Surgeons classification with posterior subluxation of the femur head (Fig. 2). The 3-D reconstruction demonstrated peripheral wall loss, which accounted for a loss of more than 50% of peripheral support.

The patient was placed in the lateral decubitus on the radiolucent table and the Kocher–Langenbeck approach was used. After careful dissection into the deeper layers, the *in situ* femur neck cut was made, and the femoral head was saved for later use as an autograft. The acetabular margins were clearly exposed to reveal the posterosuperior defect of the wall (Fig. 3a). The head was denuded of its cartilage and contoured for the shape of the defect in the acetabulum (Fig. 3b). The graft was fixed adjacent to the deficient posterior edge of the remaining acetabular cavity. The graft was secured onto the acetabulum with the help of 4.5 mm cancellous screws and was buttressed posteriorly with a 3.5 mm reconstruction plate (Fig. 4a). The graft was then gently reamed with the acetabular reamer and the constructed cavity became one unit and was sequentially reamed thereon. The direction of the screws was kept such that they did not interfere with the reaming. After this, the cemented acetabular shell (Smith and Nephew) of size 50 mm was fixed with cementation. A polyethylene liner of size 48 mm was fitted. The femoral canal was then prepared and an uncemented femoral stem (Smith and Nephew Polar Stem) of size 4 was placed. A metallic head of size 28 mm was used and the hip was reduced (Fig. 4b). The hip was stable with a good range of movement. The rotators were reattached to the posterior greater trochanter. Immediate post-operative check X-rays were taken (Fig. 5). Knee and ankle mobilization were started from post-operative day 2. The range of movements started as tolerated. Injection heparin was given for 10 days.

The strict non-weight bearing was followed for 6 weeks. Regular hip abduction and quadriceps strengthening exercises

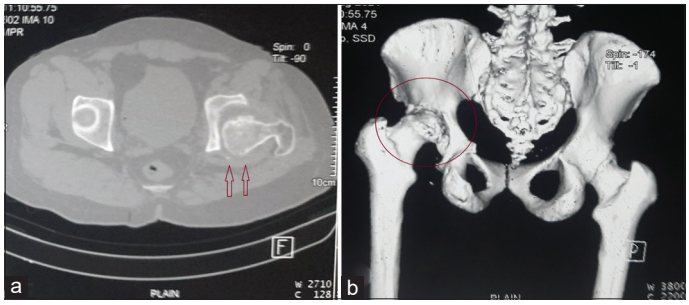

Figure 2: Computed tomography image showing (a) deficient posterior acetabular wall; (b) posterior acetabular wall deficiency with flattened femoral head

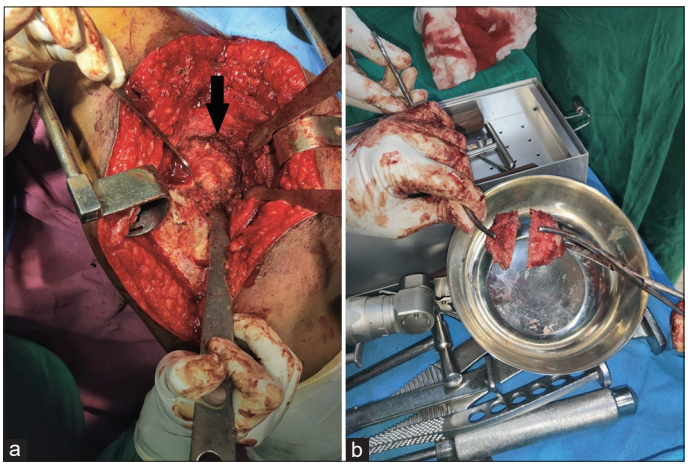

Figure 3: (a) Posterosuperior acetabular wall defect and (b) native femoral head contoured for the size of the defect

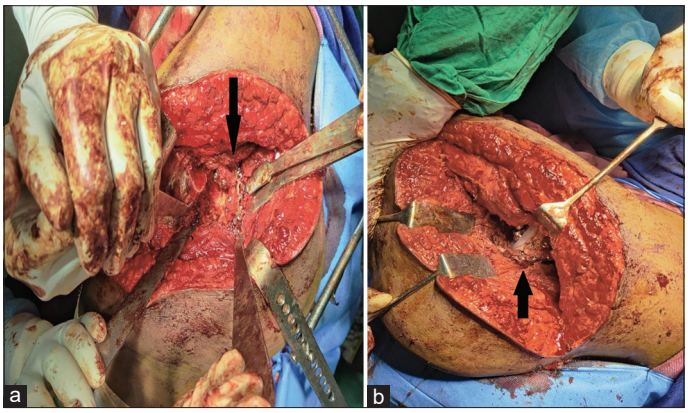

Figure 4: (a) Graft fixed and stabilized with screws and reconstruction plate and (b) cemented cup placed and metallic head reduced into the joint

were advised. Toe-touch weight bearing was followed from 6 weeks to 3 months. The patient was allowed to walk with gradual weight bearing from the 3rd month onward. On 1-year follow-up, there was good uptake of graft (Fig. 6) and good functional outcome with a Harris hip score of 79.7. Preoperatively the patient had a Harris hip score of 32.9 and a shortening of 3 cm on the affected limb. Postoperatively the shortening was reduced to 1 cm. The patient's functional outcome improved with a Harris hip score 59.5 on 3-month follow-up, 69.7 on 6 months, and 79.7 on 1 year.

Figure 5: Immediate post-operative X-ray anteroposterior view

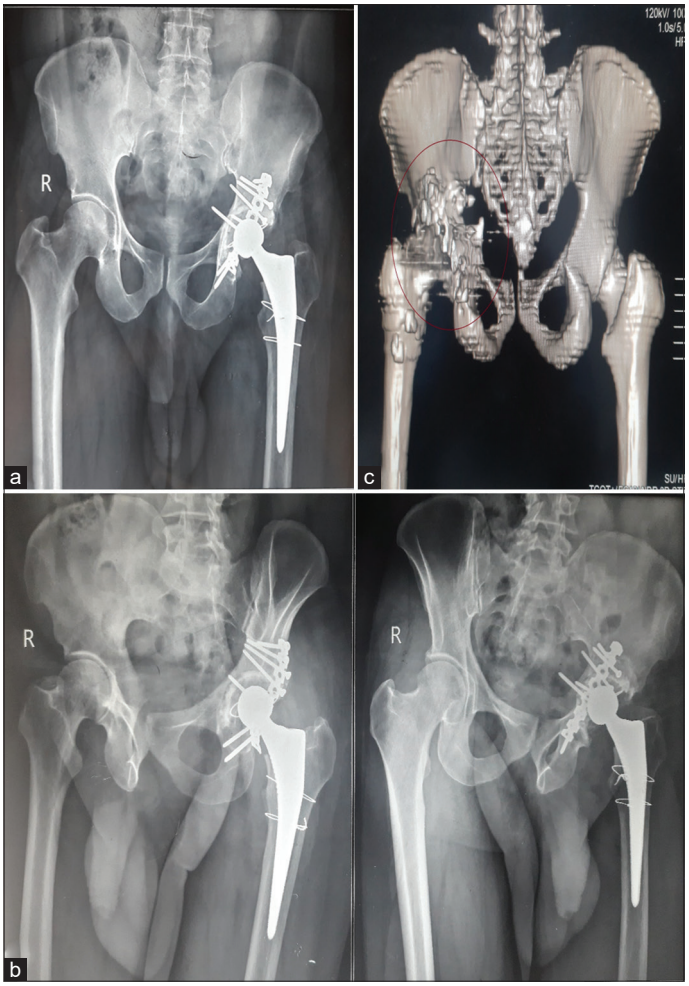

Figure 6: On 1-year follow-up. (a) X-ray anteroposterior view; (b) X-ray obturator oblique and iliac oblique views; and (c) 3D computed tomography image showing good incorporation of graft and adequate posterior coverage for the acetabular cup

DISCUSSION

According to Hamlin *et al*., cartilaginous damage, hip instability, age factor (>40 years), posterior acetabular wall involvement, and significant initial displacement (more than 20 mm) may lead to the development of post-traumatic osteoarthritis in acetabular fractures [5,6]. Isolated posterior acetabular deficiencies have very rarely been met within the context of revision and complex primary THA. Despite their occasional occurrence in several acetabular revisions and the treatment of end-stage developmental dislocation, the literature lacks specific guidance on the assessment and treatment of such deficiencies. Due to their rarity and variability, there is currently no agreement on the optimal and most enduring approach to addressing these defects. Posterior wall/column deficiencies may occur in isolation, or in combination with other areas of acetabular bone loss. Identification and appreciation of the magnitude of the posterior defect is of paramount importance in planning acetabular reconstruction. Deficiencies in this portion of the acetabulum should be treated differently from those encountered in anterior, superior, or medial locations. Using a telemetric endoprosthesis, Sparks *et al*. have demonstrated great mechanical force transmission through the posterior and posterosuperior acetabulum. In the first post-operative year, posterior forces can reach up to 9 times body weight when patients climb stairs and rise from a seated to a standing position [7]. In cases of defects in this high-stress area not being fully supported during reconstruction, pre-mature or accelerated failure has been observed. Lack of posterior support has been identified in numerous studies as a cause of failure in revision and complex primary acetabular reconstruction. Posterior plating techniques to address these forces have been presented, and successful use of this method has been included in reports addressing acetabular deficiencies [8]. Stiehl *et al*. identified and reconstructed nine posterior segmental defects in a series of 106 acetabular revisions. Of these nine allograft reconstructions, the five that were supported with a buttress plate did better and showed graft incorporation [9].

Structural autogenous grafts as well as structural allografts, used in acetabular reconstruction in THA, do well in the first 5–10 years. However, the extent of the acetabular component coverage by the graft has a positive correlation with the increased risk of late failure. Autograft has considerable advantages over allograft. Uncemented porous-coated acetabular cups do not usually develop bone in-growth in areas where they are in contact only with the graft. Only a fibrous membrane forms between the two and it is unreliable to produce a long-term stable fixation [10,11]. Hence, it is better to cement the acetabular component when more than 50% of the peripheral support is established by the graft [12].

CONCLUSION

The most important stage of the surgery is the creation of a sufficiently stable bone stock for the acetabular shell. Adequate planning and detailed pre-operative imaging are essential for better surgical outcomes in these types of acetabular deficiencies. Identification and appreciation of the magnitude of posterior defect is of paramount importance. Autograft is better than allograft as it has earlier incorporation. Buttressing with a posterior plate gives better durability for the implant. The cemented acetabular

component is to be used if the deficit is more than 50% of the acetabular rim.

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