

Posterior Acetabular Reconstruction Can Sometimes Lead To Retroverted Cup Placement In Complex Total Hip Arthroplasty

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Learning Point of the Article:

Uncontained posterosuperior acetabular bone loss predisposes the acetabular component to retroversion during total hip arthroplasty even after femoral head structural autograft reconstruction, so cup version must be verified intraoperatively and stability-enhancing bearings kept available.

Abstract

Introduction: Acetabular fractures with uncontained posterior wall and posterior column bone loss make orientation of the acetabular component difficult during total hip arthroplasty (THA). When the posterior buttress is deficient, the socket tends to settle in retroversion, which alters hip biomechanics, promotes edge loading and accelerated polyethylene wear, and predisposes to anterior impingement and instability. Structural femoral head autograft restores bone stock in such defects, but its influence on final cup version is seldom documented. To our knowledge, this is the first series to specifically highlight persistent cup retroversion despite anatomic autograft reconstruction of the posterior wall.

Case Report: Three men of Indian ethnicity, aged 47, 35, and 59 years, presented with post-traumatic arthritis 2–8 months after acetabular fractures sustained in road traffic accidents; all had been managed conservatively elsewhere. Imaging showed uncontained posterosuperior defects classified as Paprosky grade 2B, American Academy of Orthopaedic Surgeons segmental posterior and superior, and Gross type 3. Associated injuries included femoral head fracture with posterior dislocation, of Pipkin type 4 in two patients. All were treated by primary THA through the posterior approach. The posterior wall defect was reconstructed with femoral head structural autograft secured with partially threaded cannulated cancellous screws, supplemented by a reconstruction plate in one patient, followed by a porous-coated hemispherical shell with a 10° elevated-rim liner and an uncemented femoral stem. Post-operative radiographs showed stable fixation in all patients. Computed tomography at follow-up demonstrated cup retroversion of 5°, 19°, and 7° from neutral. Pain relief and functional improvement were achieved in all three patients; one sustained a posterior prosthetic dislocation at 2 months, treated by closed reduction, and the other two had mild residual discomfort and a mild gait abnormality.

Conclusion: Posterior acetabular bone loss predisposes to retroversion of the acetabular component during THA even after structural autograft reconstruction, with attendant risks of impingement, edge loading, and dislocation. Meticulous pre-operative planning, intraoperative verification of cup version against bony landmarks and fluoroscopy, and readiness to use stability-enhancing bearings are recommended, with cross-sectional imaging to document final component orientation.

Keywords: Acetabular fracture, total hip arthroplasty, posterior bone loss, cup retroversion, structural autograft, hip instability.

Author's Photo Gallery



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Introduction

Acetabular fractures are complex injuries that can substantially complicate subsequent total hip arthroplasty (THA). One critical challenge is the management of posterior acetabular bone loss, which predisposes the acetabular component to retroversion. Retroversion, defined as posterior tilt of the acetabular component relative to the sagittal plane, adversely affects implant stability, hip biomechanics, and overall patient outcomes [1].

Posterior bone loss strongly influences acetabular cup orientation. When posterior bone support is compromised, the acetabular component tends to retrovert, increasing contact stresses and edge loading, accelerating polyethylene wear, and predisposing the joint to instability [2,3,4,5]. Retroverted acetabular components are also linked with a heightened risk of anterior impingement, contributing to dislocation and a reduced range of motion [6,7].

Addressing posterior acetabular bone loss requires meticulous pre-operative planning, usually including computed tomography (CT) to assess bone stock and to plan the orientation of the acetabular component. Intraoperative options include structural bone grafting, augmented acetabular components, and custom implants to restore orientation and secure stable fixation [8]. Despite these measures, the long-

term outcome of THA in patients with severe posterior bone loss remains a concern, with a higher reported risk of complications than in hips with adequate acetabular bone stock [9].

In this series, we describe three patients in whom uncontained posterosuperior bone loss after an acetabular fracture resulted in retroversion of the acetabular cup at THA despite femoral head structural autograft reconstruction of the posterior wall.

Case Report

Case 1

A 47-year-old male presented 8 months after a road traffic accident that had resulted in a posterior wall fracture of the acetabulum with an associated femoral head fracture and posterior hip dislocation. He had been managed conservatively elsewhere and had no neurological deficit.

Pre-operative radiographs and CT (Fig. 1a, b, c, d) showed a healed posterior wall fracture with significant posterosuperior bone loss (Paprosky grade 2B, American Academy of Orthopaedic Surgeons [AAOS] segmental posterior and superior, Gross type 3). The acetabulum had collapsed posteriorly, and there was dense periarticular fibrosis. THA was planned in view of post-traumatic arthritis and a restricted range of motion.

Intraoperatively, the periarticular fibrosis made exposure and positioning of the acetabular cup difficult. C-arm guidance and anatomical landmarks, in particular Ranawat's triangle, were used to determine cup position. The posterosuperior defect was reconstructed with a femoral head autograft fixed with two partially threaded cannulated cancellous (CC) screws, after which a porous-coated hemispherical acetabular shell with a 10° elevated-rim liner was implanted. An uncemented femoral stem was used, and the hip was reduced.

Post-operative radiographs confirmed stable fixation (Fig. 2a). At 12 months, the patient reported good functional recovery with mild discomfort during certain activities, and CT demonstrated mild retroversion of the acetabular cup (Fig. 2b and c).

Case 2

A 35-year-old male presented 3 months after a road traffic accident in which he had

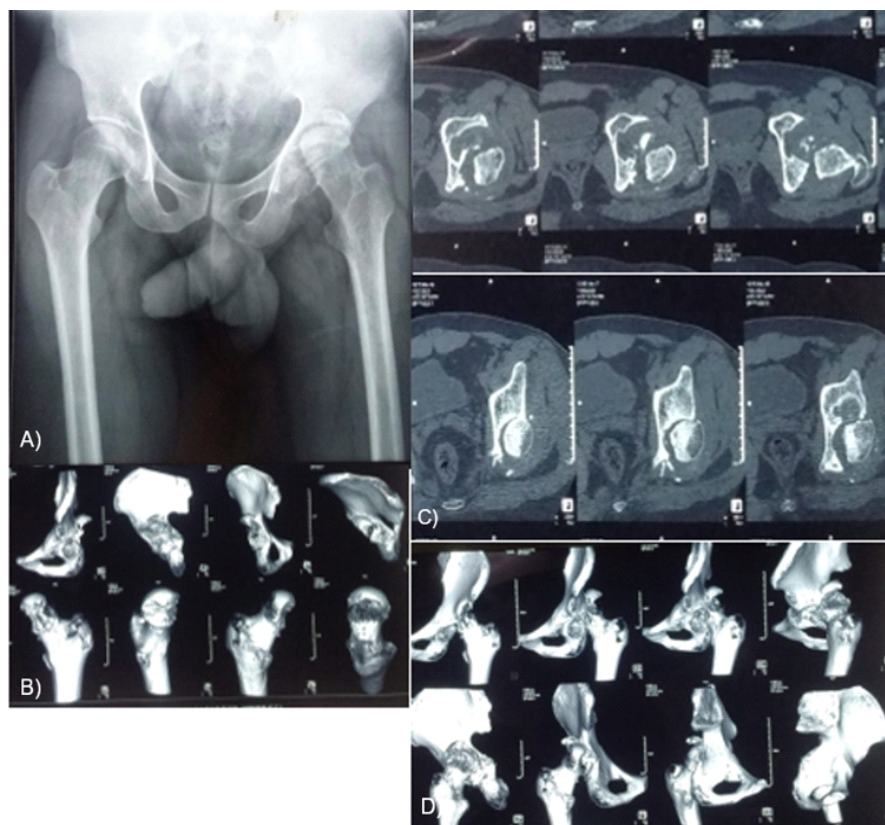


Figure 1: (a, b, c and d) Pre-operative radiograph and computed tomography scans of patient (Case 1) at presentation.

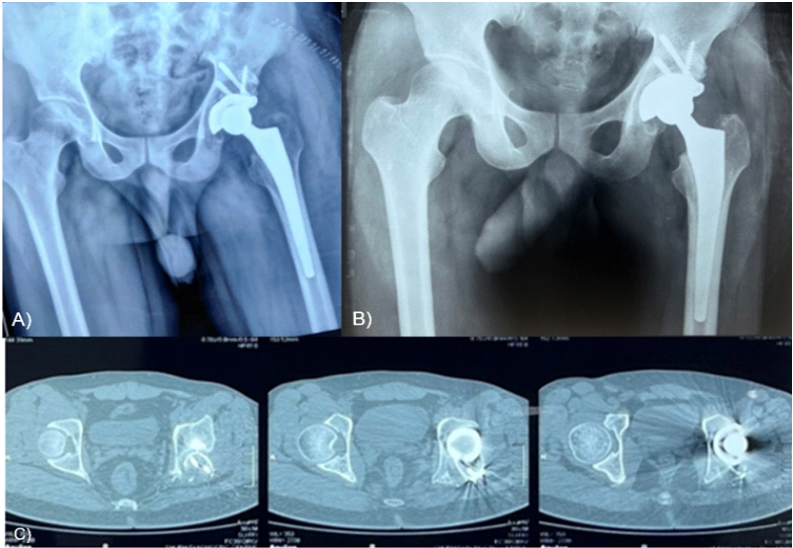


Figure 2: (a, b and c) Post-operative radiograph of patient (Case 1) and follow-up radiograph and computed tomography scan showing a retroverted acetabular cup of patient (Case 1) at 12 months.

sustained a posterior wall and posterior column fracture of the acetabulum with a femoral head fracture and dislocation. He complained of persistent pain and restricted hip mobility.

He had been managed conservatively elsewhere, but because of progressive pain and difficulty in ambulation, THA was planned. Pre-operative imaging (Fig. 3a, b, c) showed significant bone loss of the posterosuperior wall (Paprosky grade 2B, AAOS segmental posterior and superior, Gross type 3) with residual deformity from the column fracture.

The posterior wall was reconstructed with femoral head autograft and partially threaded CC screws. A porous-coated hemispherical acetabular shell with a 10° elevated-rim liner was implanted, and the procedure was completed with an uncemented femoral stem and reduction of the hip.

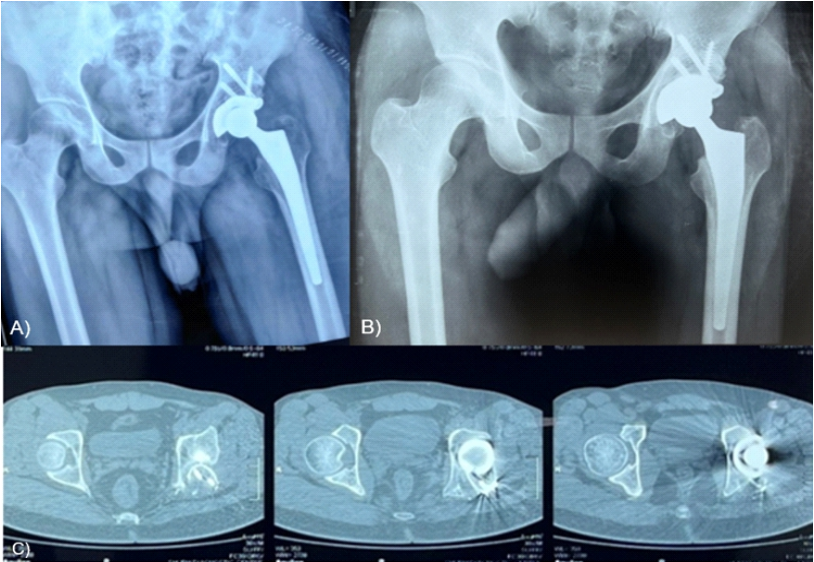


Figure 3: (a, b and c) Pre-operative radiograph and computed tomography scans of patient (Case 2) at presentation

Table 1: Clinical characteristics, reconstruction details, and outcomes of the three cases

Case	Age (years)/Sex	Fracture pattern	Bone defect (Paprosky/AAOS/Gross)	Reconstruction	Cup retroversion	Complication	Outcome
1	47/M	Posterior wall+femoral head fracture+dislocation (Pipkin 4)	2B/Segmental posterior and superior/Type 3	FH autograft+two CC screws	5°	Mild discomfort	Good function at 12 months
2	35/M	Posterior wall+column+femoral head fracture+dislocation (Pipkin 4)	2B/Segmental posterior and superior/Type 3	FH autograft+two CC screws	19°	Slight gait abnormality	Improved pain and mobility; under observation
3	59/M	Posterior wall+column+dislocation	2B/Segmental posterior and superior/Type 3	FH autograft+CC screws+reconstruction plate	7°	Posterior dislocation at 2 months (closed reduction)	Improved ROM and pain; under regular review

AAOS: American Academy of Orthopaedic Surgeons, CC: Cannulated cancellous, FH: Femoral head, M: Male, ROM: Range of motion, THA: Total hip arthroplasty



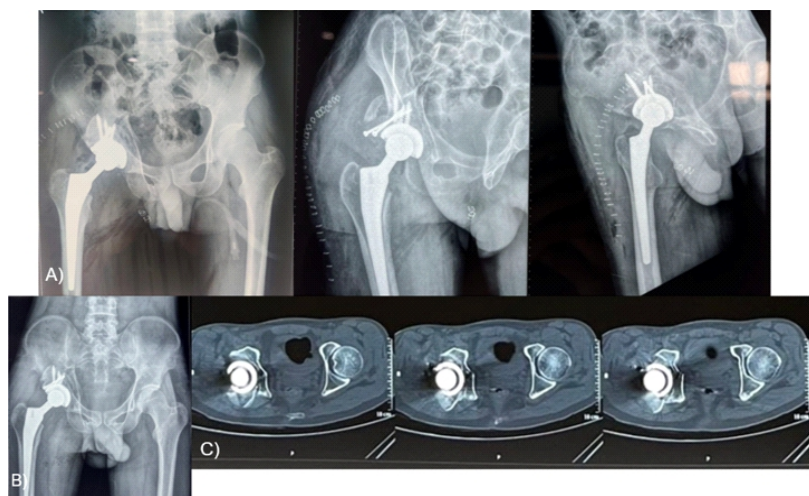


Figure 4: (a, b and c) Post-operative radiographs of patient (Case 2) and follow-up radiograph and CT scan showing retroverted acetabular cup of patient (Case 2) at 12 months.

displacement of the posterior column. At surgery, the absence of a stable posterior wall necessitated reconstruction with a femoral head autograft fixed with partially threaded CC screws and a reconstruction plate (Fig. 5c).

Recovery was uneventful, and at follow-up he reported significant improvement in pain and range of motion. Two months after THA, however, he presented with posterior dislocation of the prosthetic hip. CT showed retroversion of the acetabular cup (Fig. 5d). Closed reduction was performed, and the patient was kept under regular review.

The key characteristics of the three cases are summarized in Table 1.

Discussion

A search of MEDLINE through PubMed (from inception to August 2026) using the keywords “acetabular fracture”, “total hip arthroplasty”, “posterior bone loss”, “acetabular cup version”, “retroversion”, and “structural autograft”, together with a review of the bibliographies of the retrieved articles, did not identify any report specifically addressing persistent cup retroversion after femoral head autograft reconstruction of an uncontained posterior wall defect.

In our series, two patients had femoral head fractures associated with acetabular wall and column fractures (Pipkin type 4), and one had a posterior wall and column fracture alone. As all three presented late, THA was the more viable option, and the posterior (Kocher–Langenbeck) approach was used

throughout. A recent meta-analysis showed that primary THA after an acetabular fracture is associated with notably lower rates of post-operative complications and better functional outcomes than conversion THA [10].

All three hips had uncontained posterosuperior defects (Paprosky grade 2B, AAOS segmental posterior and superior, Gross type 3). Gross and Goodman noted that uncontained defects involving <50% of the acetabulum (type III) can be managed with a structural graft; alternatives include a high hip center, an oblong or asymmetric cup, and metal augments. The advantage of a structural graft is that it restores the anatomical center of rotation and preserves bone stock for future surgery. Because such grafts support <50% of the acetabular component, uncemented cups can be used without

the additional support of a ring or cage. These minor column or shelf grafts have shown excellent long-term results, with a 94% survival rate at 10 years [11].

We used femoral head autograft fixed with two partially threaded CC screws in all three hips. Superior and posterosuperior segmental defects usually retain a residual bony shelf that supports the graft, and lag-screw fixation alone is generally sufficient. In the third patient, the autograft and the remaining posterior wall were supplemented with a reconstruction plate for additional support. After fixation, the

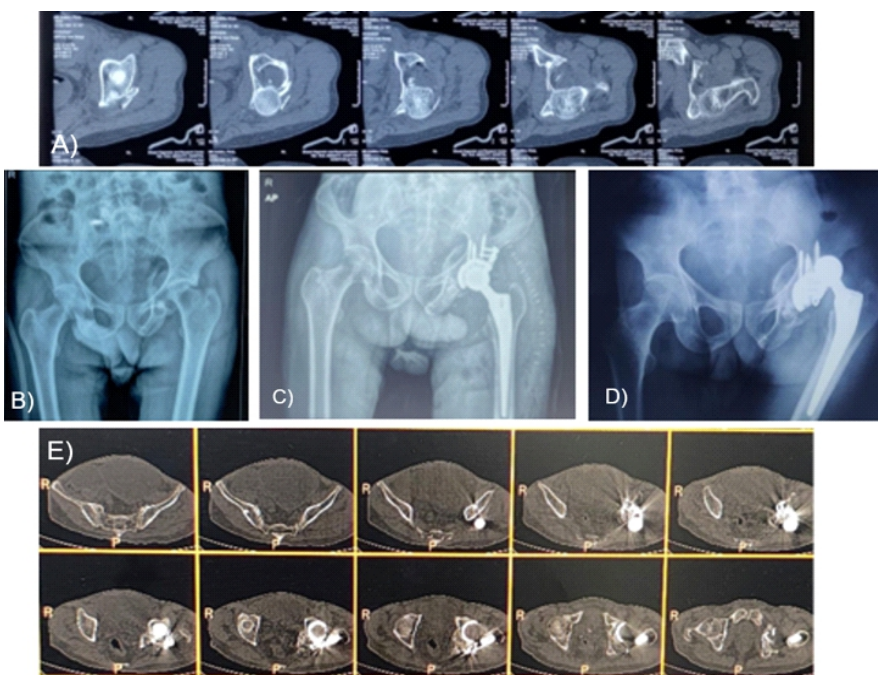


Figure 5: (a, b, c, d and e) Pre-operative computed tomography (CT) scans and radiograph of the patient (Case 3) at presentation and post-operative radiograph of the patient and 2-month follow-up radiograph and CT scans of the patient.

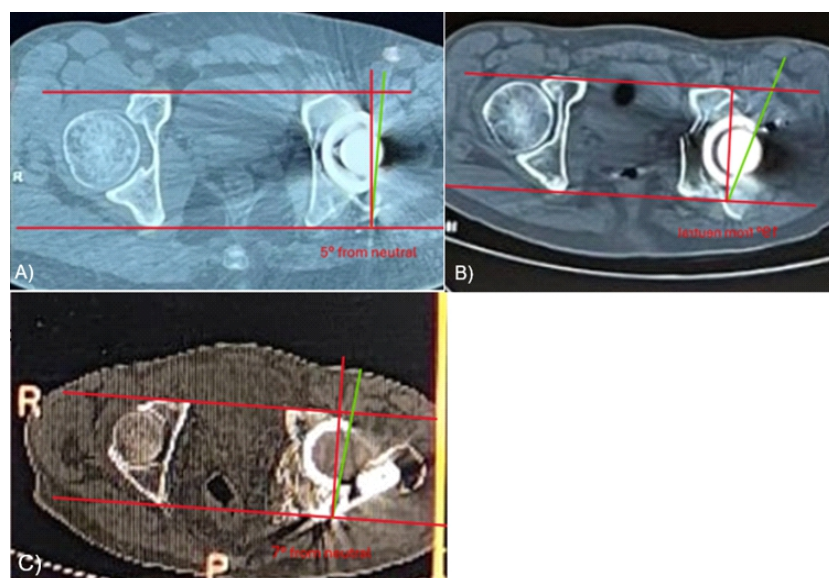


Figure 6: (a, b and c) Measuring retroversion in computed tomography scans of Case 1, Case 2, and Case 3.

inner surface of the autograft and the acetabular bed were contoured with reamers. A porous-coated hemispherical acetabular cup supplemented with screws, an uncemented femoral stem, and a 10° elevated-rim liner were used in every case.

Loss of posterior support has several implications for THA, including difficulty in maintaining correct cup orientation and a tendency for the acetabular component to assume a retroverted position. Retroversion most probably occurs when the surgeon attempts to obtain a press fit from the superior and posterior walls in an inadequately reconstructed posterior wall. Retroversion was confirmed by CT in all three hips, which showed mild-to-moderate retroversion of the acetabular cup (Case 1, 5°; Case 2, 19°; and Case 3, 7° from neutral) (Fig. 6).

A retroverted cup can result in several mechanical problems. Anterior impingement may occur between the femoral neck and the anterior rim of the acetabular component during flexion, and the altered mechanics of the joint increase the risk of dislocation, particularly during activities involving hip flexion and internal rotation [12,13]. One of our patients developed a posterior prosthetic dislocation 2 months after THA. Lai et al. similarly reported three dislocations among 31 hips after THA for acetabular fracture [14]. A retroverted cup

also alters the distribution of forces across the joint, potentially accelerating wear of the acetabular liner and contributing to early loosening of the implant [15].

Although the short-term outcomes in this series were relatively favorable, the long-term consequences of cup retroversion remain a concern. Retroversion has been associated with increased wear, liner edge loading, and impingement, and these patients may therefore face a higher risk of dislocation and of revision surgery for wear-related problems or loosening. Prosthesis durability and the occurrence of late complications in this cohort will be addressed in a future study.

Conclusion

Posterior bone loss in acetabular fractures presents a significant challenge during THA, particularly in achieving correct orientation of the acetabular component. Retroversion of the cup is a frequent outcome in these hips and is associated with increased mechanical risk, including impingement, instability, and altered load distribution. This series underlines the importance of thorough pre-operative planning and of intraoperative techniques that minimize the degree of retroversion. Future work should focus on surgical techniques and implants that better address posterior bone loss in acetabular fractures.

Clinical Message

In acetabular fractures with substantial posterior bone loss, surgeons performing total hip arthroplasty should anticipate a high likelihood of cup retroversion even after structural autograft reconstruction. Intraoperative confirmation of cup version using fluoroscopy and anatomical landmarks such as Ranawat's triangle is essential. Where posterior support is inadequate, additional measures such as enhanced posterior buttress reconstruction, navigation assistance, or stability-enhancing implants, including dual-mobility bearings, should be considered to reduce the risk of impingement and dislocation. Close post-operative monitoring with cross-sectional imaging is advisable in these complex reconstructions.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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