International Journal of Research in Orthopaedics
Sehrawat S et al. Int J Res Orthop. 2026 Jul;12(4):1146-1149
https://www.ijoro.org

Case Report

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20262056

Combined acetabulum and femur neck periprosthetic fractures following Birmingham mid-head resection: a case report

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Received: 04 May 2026
Accepted: 12 June 2026

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ABSTRACT

Periprosthetic fractures involving both the acetabulum and femoral neck following Birmingham mid-head resection (BMHR) arthroplasty are extremely rare. We report a case involving both without any evidence of adverse tissue local reaction and metallosis. The patient underwent single-stage revision hip arthroplasty using a cage and bone grafting. At 12-month follow-up, radiographs demonstrated fracture union and a stable implant, with the patient achieving full independent ambulation. Combined acetabular and femoral fractures in BMHR arthroplasty can occur by low energy trauma in rheumatoid arthritis. Revision arthroplasty can yield better results that fracture fixation. BMHR should be avoided in female patients who are on steroid and immunosuppression therapy.

Keywords: Periprosthetic fractures, Revision arthroplasty, BMHR

INTRODUCTION

Young patients with hip arthritis and good bone quality can benefit from bone-preserving Birmingham mid-head resection (BMHR) arthroplasty. This procedure offers lower rates of dislocation and infection compared to standard stems.[1] Though it is not preferred due to metal on metal articulation which can cause metallosis, metal ions in blood, urine and possibly due to its teratogenic effects.[2] Common indications for revision of previously BMHR arthroplasty include periprosthetic fracture, metallosis, aseptic loosening and pseudotumor.[3] Periprosthetic femoral neck fracture is the most common indication in patients with inflammatory arthritis, with an incidence of 3.06%.[4]

While isolated periprosthetic fractures of the femur or acetabulum have been reported, the simultaneous occurrence of both fractures has not been previously documented.[5] When both articulating bones are compromised, single-stage conversion to total hip arthroplasty with acetabular cage reconstruction is a viable solution.[6] This case serves to alert surgeons that a long-standing BMHR construct have significantly lower the threshold for simultaneous multi-column failure during low-energy trauma in a patient with rheumatoid arthritis.

CASE REPORT

A 37-year-old female (BMI 17.2 kg/m²) presented to the emergency department with sudden left groin pain and an inability to bear weight following a low-energy fall four days prior. The patient had a 21-year history of polyarticular juvenile rheumatoid arthritis (JRA), diagnosed by International league of association for rheumatology (ILAR) criteria, with a current Disease activity score (DAS28) of 4.78.

Her surgical history was notable for bilateral BMHR arthroplasty performed 15 years ago when the implant use was at surge without evidence of long-term complications. She was a community ambulator and did not have groin pain before fall. She was attending out-patient clinic annually. Physical examination of the left hip revealed localized swelling and tenderness in the proximal thigh and groin. The limb was externally rotated with 2 cm of true shortening. Range of motion was severely restricted

by pain. Distal neurovascular status was intact. Initial plain radiographs and non-contrast computed tomography (NCCT) demonstrated a simultaneous periprosthetic fracture of the left femoral neck and the acetabulum, specifically involving the anterior column and quadrilateral plate (Figure 1 and 2).

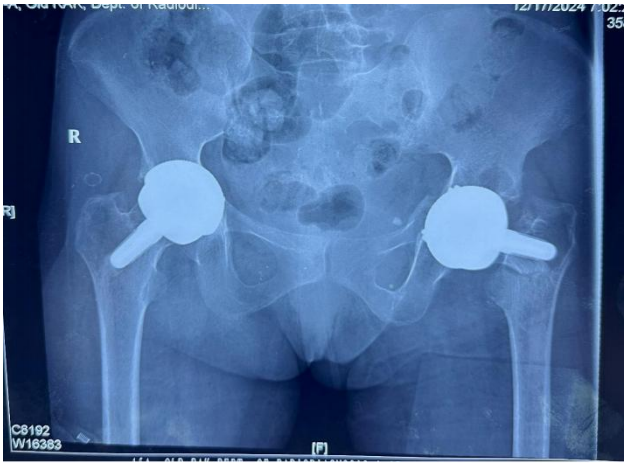

Figure 1: Anteroposterior (AP) plain radiograph of the pelvis and bilateral hips showing the left Birmingham mid-head resection prosthesis with evidence of a periprosthetic femoral neck fracture.

Radiographic signs of aseptic loosening or bone loss were suspected at the superior acetabulum and greater trochanter. Magnetic resonance imaging (MRI) was not suggestive of soft-tissue reactions, metallosis, or pseudotumor. Laboratory studies showed an elevated Erythrocyte Sedimentation Rate (ESR) of 55 mm/h (normal 20-40 mm/h) and C-Reactive Protein (CRP) of 56.9 mg/l (normal <5 mg/l) which may be raised due to inflammatory arthritis. The hip aspiration was sterile and there were no metal ions in serum and urine. Dual-energy X-ray absorptiometry (DEXA) revealed osteopenia (T-score-1.2). The differential diagnosis included osteoporotic insufficiency fracture, pathological fracture secondary to systemic disease and periprosthetic joint infection.

Treatment

The patient underwent single-stage implant removal and revision to an uncemented total hip arthroplasty via a posterior approach. Intraoperatively, the acetabulum component was found to be unstable with moderate bone loss (Paprosky classification II B). There was no evidence of adverse tissue local reaction (ATLR) or metallosis. There was no pelvis discontinuity clinically. Reconstruction was performed using a Burch-Schneider cage and autograft harvested from the femoral neck remnants. The femoral side was stabilized using a cementless double-wedge femoral stem (Figure 3).

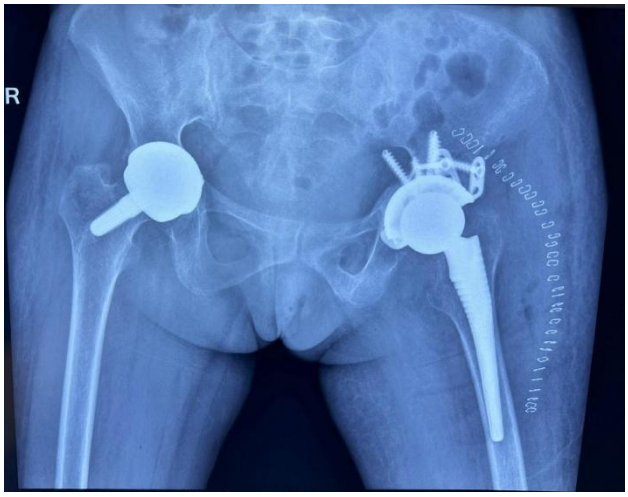

Figure 2: Immediate postoperative AP radiograph of the left hip following single-stage revision to a total hip arthroplasty. The construct includes a Burch-Schneider cage for acetabular reconstruction with femoral neck autograft and a cementless double-wedge femoral stem.

Follow-up

Postoperatively, the patient remained non-weight-bearing with a walker for three months. The post-operative histopathology was not suggestive of ATLR. Progressive weight-bearing was then initiated with a cane after 3 months. Radiographs at 12-month post op confirmed fracture union and a stable implant construct (Figure 4). The patient had returned to full independent ambulation without support.

Figure 3: AP radiograph of the left hip at ten-month follow-up showing consolidated fracture union, stable implant positioning and incorporation of the bone graft. The patient had returned to full independent ambulation at this stage.

DISCUSSION

The BMHR prosthesis was designed as a bone-conserving bridge between hip resurfacing and traditional THA, specifically for younger, active patients with compromised femoral head bone stock. While periprosthetic femoral fractures typically subtrochanteric or spiral are well-documented following minor trauma, the simultaneous occurrence of acetabular and femoral neck fractures represents a unique surgical challenge not previously detailed in the literature.[7]

In our patient, radiographic evidence of aseptic loosening at both the acetabulum and the greater trochanter likely created significant stress risers. Because no previous radiograph were available, based on intra-operative and no serum/ urine metal ion levels we concluded that trauma caused the fracture and loosening of cup. Due to the patient's rheumatoid arthritis and long-term usage of steroids and immunosuppressants, trival trauma resulted in two peri-implant fractures. Although internal fixation has shown success in isolated BMHR acetabular fractures, a combined fracture pattern complicates this approach.[8] Addressing the quadrilateral plate, anterior column and femoral neck simultaneously would have required multiple surgical exposures (e.g., combined ilioinguinal and posterior approaches and prolonged operative time. Furthermore, the patient's chronic polyarticular JRA significantly complicates fracture healing. Systemic inflammation, coupled with long-term corticosteroid use, promotes osteoclast activity and osteopenia, leading to poor outcomes with conservative or fixation-based treatments.

Consequently, we opted for a single-stage revision to THA. The lack of acetabular integrity necessitated a reconstructive solution capable of managing potential pelvic discontinuity and massive bone loss. The Burch-Schneider cage provides immediate mechanical stability by bridging the defect and providing a stable environment for bone grafting. This strategy aligns with findings by Liaw et al regarding acute THA for new acetabular fractures and Madanipour et al, who demonstrated favourable 10-year survivorship and patient-reported outcomes using cage reconstruction for pelvic discontinuity.[9,10]

The primary advantage of cage reconstruction in this rare BMHR failure is the conversion of a complex, non-contained defect into a stable construct that allows for earlier weight-bearing a critical factor for recovery in patients with systemic inflammatory disease. We also believe that big porous implants, particularly 3-D printed implants, could provide even better results, but they take time to manufacture, especially in developing countries, and rapid stabilization is necessary in these combined fracture patterns. This case underscores the need for a formal classification system for periprosthetic fractures involving the BMHR prosthesis to guide standardized management.

CONCLUSION

Combined acetabular and femoral periprosthetic fractures following BMHR arthroplasty are rare events in previously operated patients. For loose implants, we recommend revision arthroplasty over fixation.

Low-energy trauma can cause peri-implant fractures in patients with inflammatory arthritis. These cases can be prevented by avoiding hip resurfacing in females on chronic steroids and immunosuppressants. This case also adds to the literature regarding a specific pattern of periprosthetic fractures unique to the BMHR prosthesis.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Sehrawat S, Adhitya BV, Kumar V. Combined acetabulum and femur neck periprosthetic fractures following Birmingham mid-head resection: a case report. Int J Res Orthop 2026;12:1146-9.