

IMPLANT REMOVAL AND ANTIBIOTIC CEMENT SPACER FOR PROSTHETIC JOINT INFECTION FOLLOWING TOTAL HIP ARTHROPLASTY: A CASE REPORT

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ABSTRACT

Background- Periprosthetic joint infection (PJI) is among the most challenging complications following total hip arthroplasty (THA), accounting for significant morbidity, repeated surgeries, prolonged hospitalization, and increased healthcare costs. The diagnosis of chronic PJI requires integration of clinical findings, laboratory parameters, imaging, and histopathological evidence. Two-stage revision arthroplasty remains the preferred treatment strategy for chronic infections.

Case Presentation- A 71-year-old female presented with a two-month history of progressive pain and swelling over the left hip. She had undergone left hemiarthroplasty 18 years earlier, conversion to total hip replacement 16 years earlier, and wound debridement with sinus tract excision in 2022. Clinical examination revealed a fluctuant, tender swelling over the greater trochanter with painful restriction of hip movements. Laboratory investigations showed elevated inflammatory markers (ESR 85 mm/hr, CRP 3.3 mg/dL) with mild leukocytosis (10,600 cells/ μ L). Synovial fluid analysis was suggestive of infection, and PET-CT demonstrated metabolically active peri-prosthetic collections consistent with chronic prosthetic joint infection. The patient underwent implant explantation, thorough debridement, insertion of an antibiotic-loaded cement spacer, and placement of antibiotic-loaded calcium sulphate (Stimulant®) beads. Histopathological examination confirmed chronic prosthetic joint infection with acute suppurative inflammation.

Conclusion- Early diagnosis using a multimodal approach and timely surgical intervention with staged revision remain essential for successful management of chronic prosthetic joint infection following total hip arthroplasty.

KEYWORDS: Prosthetic joint infection, Total hip arthroplasty, Antibiotic cement spacer, Two-stage revision, Hip replacement, Case report

INTRODUCTION

Total hip arthroplasty (THA) is regarded as one of the most successful orthopaedic procedures for restoring function and relieving pain in patients with end-stage hip disorders. Despite excellent long-term outcomes, periprosthetic joint infection (PJI) remains one of the most devastating complications, occurring in approximately 1–2% of primary arthroplasties and up to 4% of revision procedures. PJI is associated with substantial morbidity, repeated surgical interventions, prolonged antibiotic therapy, functional impairment, and increased healthcare expenditure.^(1–3)

Chronic PJI usually develops months to years after arthroplasty and frequently presents with persistent pain, swelling, sinus formation, implant loosening, or reduced joint function. The diagnosis is often difficult because symptoms may be subtle, particularly in elderly patients. Current international recommendations advocate a combination of clinical assessment, inflammatory biomarkers including erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), synovial fluid analysis, microbiological evaluation, advanced imaging, and histopathological examination for accurate diagnosis.^(4–6)

Among various treatment options, two-stage revision arthroplasty remains the gold standard for chronic prosthetic joint infection. The first stage involves implant removal, aggressive debridement, collection of multiple tissue samples, and placement of an antibiotic-loaded cement spacer, followed by culture-directed antimicrobial therapy. Reimplantation is performed once infection control is achieved. This approach provides infection eradication rates exceeding 85–90% in most reported series.^(7–9)

The present case describes chronic prosthetic joint infection occurring sixteen years after total hip arthroplasty in an elderly woman with diabetes mellitus and hypertension. The report highlights the diagnostic challenges, surgical management, and importance of multidisciplinary care in achieving infection control.

Case Presentation

A 71-year-old woman presented to the Department of Orthopaedics with complaints of pain and swelling over the left hip for two months. She was apparently asymptomatic until two months before presentation, when she gradually developed pain around the left hip. The pain was insidious in onset, dull aching in nature, non-radiating, and aggravated by walking while partially relieved with rest. The pain was associated with progressively increasing swelling over the lateral aspect

of the left hip. There was no history of recent trauma, fall, fever, chills, night sweats, weight loss, or any other constitutional symptoms suggestive of systemic infection. Despite the pain, the patient remained ambulatory and was able to bear weight with discomfort.

The patient had a significant orthopaedic history. She underwent a left hemiarthroplasty approximately 18 years before presentation, which was subsequently revised to a left total hip replacement (THR) 16 years earlier because of persistent symptoms. Four years before the current presentation, she underwent wound debridement with sinus tract excision for a postoperative wound complication. She was a known case of type 2 diabetes mellitus and hypertension for the past 15 years and was receiving regular medical treatment. There was no history of tuberculosis, rheumatoid arthritis, chronic kidney disease, malignancy, or long-term corticosteroid therapy.

Clinical Examination

On general examination, the patient was conscious, cooperative, and haemodynamically stable. No pallor, icterus, cyanosis, clubbing, or generalized lymphadenopathy was observed.

Local inspection revealed a well-healed longitudinal surgical scar measuring approximately 10 × 1 cm over the lateral aspect of the proximal third of the left thigh, corresponding to the previous surgical approach. A diffuse swelling was noted over the proximal third of the thigh with fullness around the greater trochanteric region. The overlying skin appeared normal without erythema or active sinus formation.

Palpation demonstrated localized warmth and fluctuation within the swelling, indicating a fluid-filled collection. Diffuse tenderness was elicited over the tip of the greater trochanter. No active discharge or purulent drainage was observed. The range of motion of the left hip was painful and markedly restricted in all planes because of pain and soft tissue inflammation, whereas the ipsilateral knee demonstrated full, painless range of motion. Distal neurovascular examination was normal.

Laboratory Investigations

Initial laboratory investigations demonstrated elevated inflammatory markers consistent with an infective process.

Table 1. Baseline laboratory investigations

Investigation	Patient Value	Reference Range
Total leukocyte count	10,600 cells/ μ L	4,000–10,000 cells/ μ L
ESR	85 mm/hr	0–20 mm/hr
C-reactive protein	3.3 mg/dL	<0.6 mg/dL

The markedly elevated ESR and CRP strongly suggested ongoing chronic inflammation and raised suspicion for chronic prosthetic joint infection.

Synovial Fluid Analysis

Ultrasound-guided aspiration of the peri-prosthetic collection yielded turbid fluid for laboratory evaluation.

Table 2. Synovial fluid analysis

Parameter	Result
Appearance	Turbid
Total leukocyte count	Approximately 10,800 cells/mm ³
Neutrophils (PMN)	98%
Protein	5.7 g/dL
LDH	7776 U/L



Fig 1- Synovial Fluid Aspiration

The markedly elevated synovial leukocyte count with neutrophilic predominance fulfilled accepted diagnostic thresholds for chronic prosthetic joint infection.

Radiological Evaluation- Plain radiographs of the pelvis with both hips demonstrated a previously implanted left total hip prosthesis without evidence of acute periprosthetic fracture. Mild peri-prosthetic osteolytic changes were noted around the femoral component, raising suspicion of chronic loosening secondary to infection.

PET-CT Findings- Whole-body ¹⁸F-FDG PET-CT demonstrated intense FDG uptake surrounding the femoral component of the left hip prosthesis. A metabolically active peri-prosthetic fluid collection was identified extending into the surrounding soft tissues, suggestive of chronic prosthetic joint infection with associated abscess formation. No distant infective focus was identified. The PET-CT findings correlated with the patient's clinical presentation and inflammatory markers, further supporting the diagnosis of chronic prosthetic joint infection.



Fig 2- Pet Scan of Hip Joint

Cytological and Histopathological Examination- Fine-needle aspiration cytology of the peri-prosthetic collection revealed abundant neutrophils with inflammatory debris, consistent with acute suppurative inflammation. No malignant cells were identified.

Histopathological examination of the excised peri-prosthetic tissue demonstrated dense fibrocollagenous tissue infiltrated by sheets of neutrophils, lymphocytes, plasma cells, and histiocytes with areas of necrosis. These findings were consistent with chronic prosthetic joint infection associated with acute suppurative inflammatory changes.

Final Diagnosis- Based on the patient's clinical presentation, elevated inflammatory markers, synovial fluid analysis, PET-CT findings, cytological examination, and histopathological confirmation, a final diagnosis of chronic prosthetic joint infection (PJI) following left total hip arthroplasty was established according to the 2018 International Consensus Meeting (ICM) and EBJIS diagnostic criteria.

Operative Technique

After obtaining informed consent, the patient was positioned in the right lateral decubitus position under combined spinal and epidural anesthesia. Following standard sterile preparation and draping, the previous posterior incision over the left hip was utilized.

The fascia lata and gluteus maximus were split in line with their fibers to expose the hip joint. Approximately 30 mL of serosanguineous fluid was aspirated and sent for microbiological analysis. Extensive infected granulation tissue and fibrous membrane surrounding the prosthesis were identified and thoroughly debrided. Multiple tissue specimens were obtained from the acetabular, femoral, and periprosthetic regions for culture, sensitivity testing, and histopathological examination.

Following dislocation of the hip, the femoral head and acetabular components were explanted using standard osteotomes and extraction instruments. Residual acetabular cement and membrane were completely removed. The femoral stem was noted to be well fixed; therefore, a cortical window was created over the mid-femoral shaft to facilitate complete removal of the distal cement mantle and cement restrictor. Thorough intramedullary canal debridement was performed.

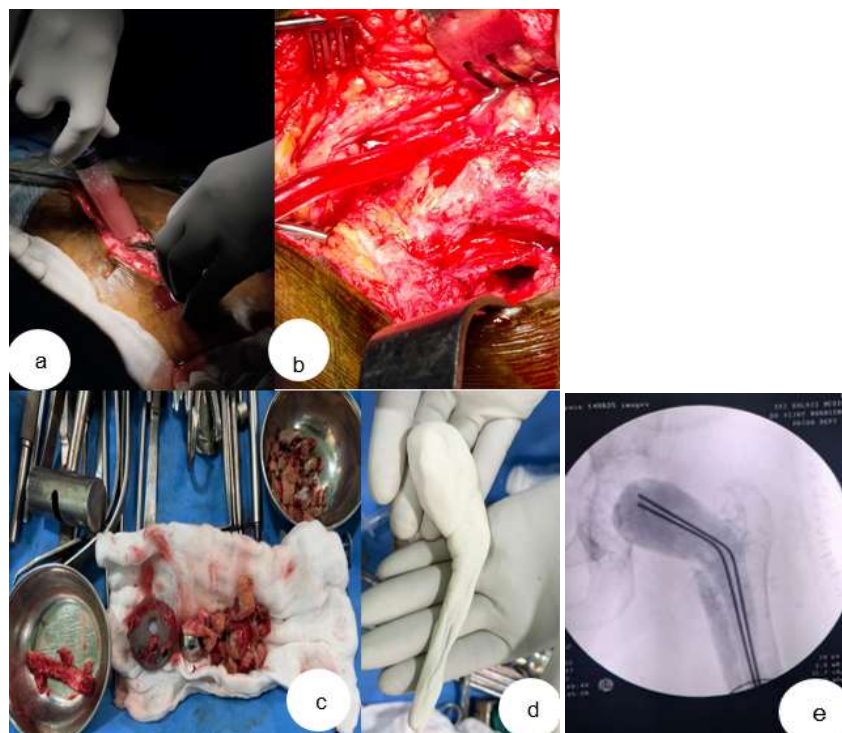


Fig 3- Intraoperative procedure showing (a) Surgical exposure and drainage of abscess, (b) thorough debridement of infected tissue, (c) Implant removal with excised infected tissue, (d) Preparation of antibiotic-impregnated beads, (e) Fluoroscopic confirmation of antibiotic bead placement.

The surgical field was irrigated extensively using pulsatile lavage with normal saline and povidone-iodine solution. The cortical window was repositioned and stabilized with two stainless-steel cerclage wires. An antibiotic-loaded cement spacer was inserted into both the femoral canal and acetabular cavity and secured with two Kirschner wires. Implant position and stability were confirmed intraoperatively using fluoroscopy. Finally, antibiotic-loaded calcium sulfate (Stimulan®) beads were placed within the femoral canal. After meticulous hemostasis and copious irrigation, a closed-suction drain was inserted. The wound was closed in layers, and a sterile dressing was applied.

Postoperative Management

The patient received intravenous antibiotics, adequate analgesia, thromboprophylaxis, and strict glycaemic control. Serial ESR, CRP, and leukocyte counts were monitored to assess infection resolution. The postoperative wound healed without complications.

Physiotherapy was initiated on the first postoperative day and included breathing exercises, ankle pump exercises, quadriceps and gluteal isometrics, knee range-of-motion exercises, bed mobility, and transfer training. Progressive gait training with a walker was started as tolerated, followed by strengthening exercises and a home rehabilitation programme. Outcome- The postoperative recovery was uneventful. Pain and swelling improved, and the surgical wound healed satisfactorily without recurrent discharge. The patient was discharged with walker-assisted ambulation, continuation of antibiotic therapy, and regular follow-up. A second-stage revision total hip arthroplasty was planned after complete eradication of infection.

DISCUSSION

Periprosthetic joint infection (PJI) is one of the most serious complications following total hip arthroplasty (THA), with an incidence of approximately 1–2% after primary arthroplasty and a higher incidence following revision procedures. It is associated with increased morbidity, repeated surgeries, prolonged antibiotic therapy, and significant healthcare costs.^{1,2} Advanced age, diabetes mellitus, previous hip surgeries, and prior wound complications are well-recognized risk factors for chronic PJI, all of which were present in our patient.³

Chronic PJI usually presents with persistent pain, swelling, implant loosening, or sinus formation, while systemic symptoms may be absent. In the present case, the patient presented with pain and progressive swelling over the left hip without fever or constitutional symptoms, which is consistent with the typical presentation of chronic infection. Elevated ESR (85 mm/hr) and CRP (3.3 mg/dL), together with synovial fluid leukocytosis and neutrophil predominance, strongly supported the diagnosis. These findings satisfy the current diagnostic recommendations of the International Consensus Meeting (ICM) and the European Bone and Joint Infection Society (EBJIS).^{4,5}

Advanced imaging also played an important role in this case. ¹⁸F-FDG PET-CT demonstrated metabolically active periprosthetic collections suggestive of infection. Although PET-CT is not routinely recommended as a first-line investigation, it may be valuable when conventional investigations are inconclusive or when the extent of infection needs to be defined.⁶

Histopathological examination further confirmed acute suppurative inflammation, thereby strengthening the diagnosis of chronic prosthetic joint infection.

The gold standard treatment for chronic hip PJI remains two-stage revision arthroplasty. This approach involves complete removal of the infected prosthesis, extensive debridement, placement of an antibiotic-loaded cement spacer, targeted antimicrobial therapy, and delayed reimplantation after eradication of infection. Previous studies have reported infection eradication rates ranging from 85% to 95% with this strategy.^{7,8} In our patient, removal of the prosthesis with extensive debridement and insertion of an antibiotic-loaded cement spacer, combined with antibiotic beads, was performed successfully, followed by postoperative antibiotic therapy and structured rehabilitation.

Early physiotherapy is essential following spacer insertion to prevent complications related to prolonged immobilization, maintain muscle strength, improve mobility, and optimize functional recovery before definitive reimplantation. A multidisciplinary approach involving orthopaedic surgeons, infectious disease specialists, microbiologists, and physiotherapists is therefore crucial for achieving favourable clinical outcomes.⁹

This case highlights that chronic PJI should always be considered in elderly patients presenting with persistent pain and swelling around a previously replaced hip, even many years after arthroplasty. Prompt diagnosis using clinical assessment, laboratory investigations, imaging, and histopathological confirmation facilitates timely intervention and improves patient outcomes.

CONCLUSION

Chronic prosthetic joint infection remains a challenging complication after total hip arthroplasty, particularly in elderly patients with multiple comorbidities. Early recognition using a combination of clinical examination, inflammatory markers, synovial fluid analysis, advanced imaging, and histopathological evaluation is essential for accurate diagnosis. Two-stage revision arthroplasty with thorough debridement and insertion of an antibiotic-loaded cement spacer remains the treatment of choice for chronic infection and offers high rates of infection eradication. Early postoperative rehabilitation further contributes to functional recovery and prepares the patient for definitive reimplantation. This case emphasizes the importance of a multidisciplinary approach in achieving successful management of chronic PJI.

Equally consequential was the realisation that plasticity is a double-edged sword¹⁰. The same activity-dependent rules that consolidate a motor skill can consolidate a pain state; the same reward-circuit potentiation that supports goal-directed learning can entrench compulsive drug seeking^{11,12}. Plasticity is therefore not synonymous with recovery, and a demonstrable change in cortical excitability, activation pattern or connectivity may equally reflect efficient restitution, inefficient compensation, disinhibition or frank maladaptation¹. This directional neutrality is the single most important framing device for clinical translation, and it structures the present review.

This article offers a condensed but integrative synthesis. It delineates the mechanistic taxonomy of plasticity and its supporting tissue and molecular substrates; traces its lifespan trajectory and hormonal modulation¹³; examines maladaptive plasticity as a unifying pathophysiological concept; appraises the interventional landscape by evidence maturity; and identifies methodological, biomarker and ethical bottlenecks. The aim is to provide researchers, clinicians, pharmaceutical scientists and policymakers with a compact, critically appraised framework rather than an exhaustive catalogue.

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