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Case Report

Persistent Chronic Periprosthetic Joint Infection Treated with Three-Stage Revision Hip Arthroplasty: A Case Report

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ABSTRACT

Background: Periprosthetic Joint Infection (PJI) is a dreadful complication of primary Total Hip Arthroplasty (THA). Following revision THA, up to 17% of revision THA can be complicated with PJI. Three-stage revision should only be done if simple debridement fails to treat PJI. Here we present a rare case of persistent PJI, treated with three-stage revision and bone grafting.
Case Report: A thirty-seven-year-old female patient came with a chief complaint of hip pain four months ago. Four years ago, the patient had a right column femur fracture and was treated with THA. One year afterward, the implant was infected, and the hip was debrided. One year later, the infection symptom recurred, and three-stage revision hip arthroplasty was planned with one year delay for each stage: removal of the implant, replacement of spacer, and reimplantation. The acetabular bone was augmented using autograft from the iliac wing during reimplantation. After reimplantation, the pain subsides, and the patient can walk normally again.
Discussion: Previous studies have found various risk factors that might contribute to the failure of two-stage revision arthroplasty. The infecting bacteria is one of the major risk factors, and therefore appropriate antibiotic is important. Augmentation of bone graft can also supplement acetabular bone loss during failed THA as it helps as a scaffold for bone healing.
Conclusion: Three-stage revision hip arthroplasty after PJI using bone graft for augmentation is possible with a good result.

Keywords: Total hip arthroplasty; Periprosthetic joint infection; Spacer, Debridement; Human and medicine

INTRODUCTION

Total hip and knee arthroplasties (THA and TKA) are one of the most commonly done orthopaedic procedures with a high success rate and low morbidity. Along with the increase of the aging population, so does the procedure volume. It is estimated that, based on data from the year 2000-2014, THA procedures will grow by 85% or to 1.26 million procedures within the US.[1] With such an exponential increase, clinicians should also be ready for the huge increase in complications.

Various complications may occur after a THA procedure, and the management depends on the type and severity of the complication. Heterotopic ossification, wound complication, neural deficit, dislocation, periprosthetic fracture, and periprosthetic joint infection (PJI) are many complications that may occur.[2] PJI is the most dreadful complication of primary Total Hip Arthroplasty (THA), requiring extensive and lengthy management to cure the infection. Approximately 1–2% of primary THA will be complicated with PJI and can be as high as 17% following revision THA.[3]

Treatment decisions for PJI should be individualized and consist of appropriate antibiotic treatment and an appropriate surgical treatment algorithm. For persistent PJI, three-stage revision is the most effective and complicated type of treatment for PJI. Three-stage revision is rarely

needed for initial explantation, and an intravenous antibiotic is enough to treat PJI (82-95% success rate).[4,5] Bone loss during the revision may be supplemented using bone grafts.

Given the rarity of persistent PJI, which require three-stage revision, we present a rare case of persistent PJI treated with three-stage revision and bone grafting.

CASE REPORT

A thirty-seven-year-old female patient came to the orthopedic outpatient ward with a chief complaint of hip pain four months ago. The patient was able to walk with the help of a walker. Four years ago, the patient had a right column femur fracture and was treated with THA.

One year afterward, the patient came to a local hospital with a chief complaint of severe pain in the right hip and severe pain at the site of THA. Laboratory examination revealed an increase in WBC count, ESR, and CRP. The patient was diagnosed with acute PJI and underwent debridement surgery. No data on culture results from the first debridement surgery was available. Upon discharge, the patient could do the daily activities with a walker aid.

One year after the first debridement, symptoms of infection recurred, and therefore, implant replacement with a cement spacer (Figure 1) was done. Six months afterward, signs and laboratory results of PJI were not found. Reimplantation was planned, but the purulent synovial fluid was found during the surgery. Reimplantation was canceled, the spacer was replaced, and antibiotic beads were inserted along the new spacer (Figure 2).

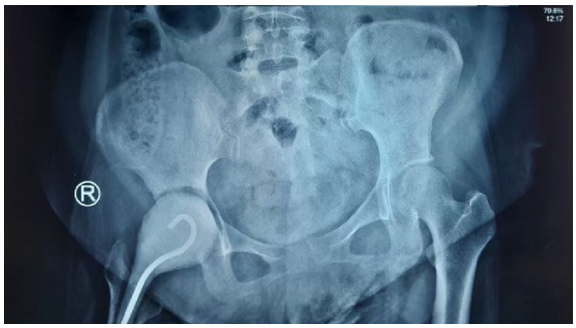

Figure 1. Anteroposterior hip x-ray after insertion of cement spacer (first-stage).

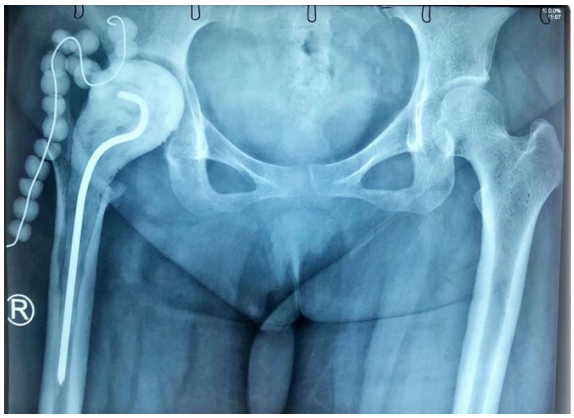

Figure 2. Anteroposterior hip x-ray after insertion of antibiotic-impregnated spacer (second-stage).

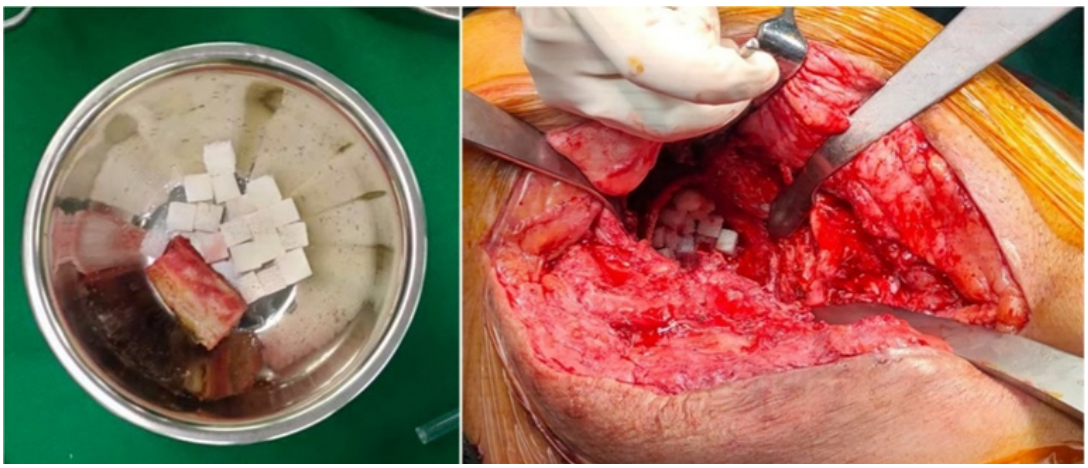

Figure 4. Use of autograft from the iliac wing and bovine cancellous bone graft to fill the acetabular bone defect.

Six months after the spacer replacement, a confirmatory laboratory examination was done. ESR, CRP, and WBC were normal; the patients had no symptoms leading to PJI (pain in motion, pain on palpation on the hip, fever, etc.). A second attempt for reimplantation was conducted. No purulent synovial fluid was found upon hip joint exploration, but substantial acetabular bone loss was found after spacer removal. The acetabular bone defect was filled with autograft from the iliac wing and also using bovine cancellous bone graft (Figure 3). Afterward, reimplantation of THA was done (Figure 4). Synovial samples for confirmatory culture were collected. The synovial culture result was positive with Corynebacterium propinquum and was levofloxacin sensitive. The patient was discharged and continued with oral levofloxacin 500 mg every 12 hours for four weeks. The pain subsided four weeks after the surgery, and the patient could walk normally again.

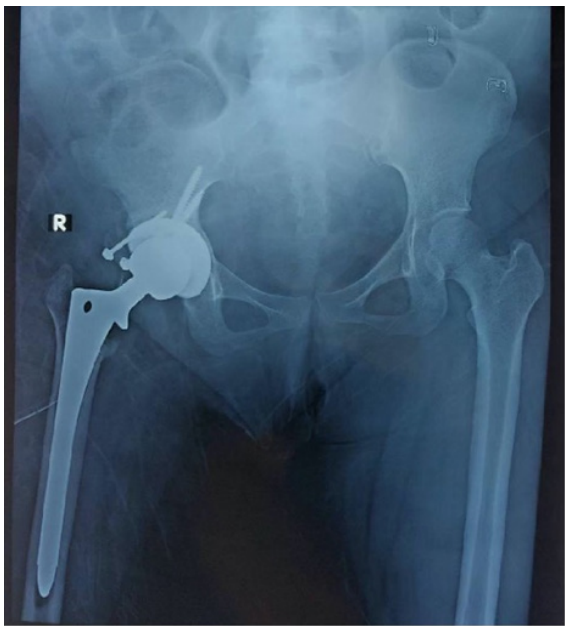

Figure 4. Anteroposterior hip x-ray after reimplantation of prosthesis (third-stage).

DISCUSSION

Diagnosis of PJI after THA can be established if either one of two major criteria (two positive periprosthetic cultures with phenotypically identical organisms and the finding of sinus tract communicating with the prosthesis) or three of six minor criteria are fulfilled (Table 1). In determining each of the criteria, it is imperative to ensure appropriate samples are taken and rule out the possibility of another source of infection that might fulfill the criterion (such as infection from the site).[4]

After the diagnosis has been established, there are various surgical strategies for treating PJI. Determining acute or chronic (>90 days) PJI is an important first step as it can predict whether mature biofilm has been made. A more aggressive treatment is warranted if a mature biofilm is assumed to have been established.[4] For acute PJI, a simple debridement with implant retention can be done as

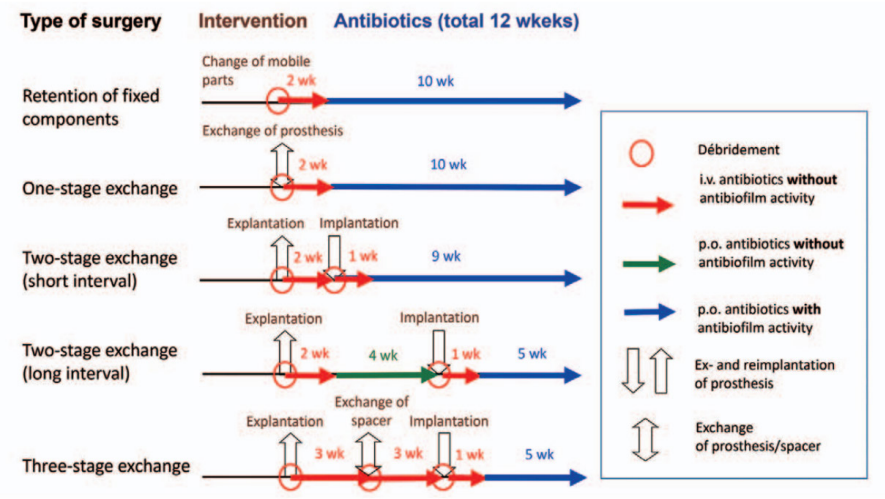

Figure 5. Surgical treatment algorithm of periprosthetic joint infection (PJI).[7] wk: week; i.v.: intravenously; p.o.: per oral.

Table 1. Diagnostic criteria for PJI.[6]

Criterion	Score	Decision
Major Criteria		
Two positive cultures of the same organism		
Sinus tract with evidence of communication to the joint of visualization of the prosthesis		Infected
Minor criteria (preoperative)		
Elevated CRP or D-dimer (serum)	2	
Elevated ESR (serum)	1	≥6 = Infected
Elevated synovial WBC count or LE (synovial)	3	2-5 = Possibly infected
Positive alpha-defensin (synovial)	3	0-1 = Not Infected
Elevated synovial PMN (%) (synovial)	2	
Elevated synovial CRP (synovial)	1	
Intraoperative diagnosis		
Preoperative score	-	
Positive histology	3	≥6 = Infected
Positive purulence	3	4-5 = Inconclusive
Single positive culture	2	≤3 = Not Infected

initial treatment. For chronic PJI or acute PJI with known highly resistant microorganism infection (e.g., rifampin-resistant staphylococci, ciprofloxacin-resistant gram-negative bacteria, or fungi/candida), bad soft tissue, or unstable prosthesis, one-stage implant replacement, two-stage implant replacement, or three-stage implant replacement can be a reasonable option.[7] The difference in each surgical method is summarized in Figure 5.[7] In short, the difference between different replacement stages is based on the amount of surgery needed before reimplanting the implant and/or using a spacer.[7]

In this case, reimplantation was initially planned on the second surgery. Still, the purulent synovial fluid was found upon opening the joint space, and, therefore, reinsertion of the spacer was done along with antibiotic beads. The surgeries were done by an orthopedic surgeon specializing in the hip and knee field.

Previous studies have found various risk factors that might contribute to the failure of two-stage revision arthroplasty. These risk factors include delayed diagnosis, inappropriate infection diagnosis method, disregarding distant sources of infection, conservative treatment with antibiotics in early infection, arthroscopic lavage for treatment of PJI, and inappropriate antibiotic treatment.[8] The infecting bacteria is one of the major risk factors, and therefore appropriate antibiotic is important.

Due to the multitude of surgeries conducted on the patient and the removal of the initial implant, bone loss is a major hurdle in treating PJI. Bone defects, especially on the acetabular side, might severely affect component stability and the overall success of replantation. Therefore, bone-restoring techniques are used. Options include autograft, allograft, or xenograft bone. These bone grafts mainly act as scaffolds (osteogenic) to help fill the defect and strengthen the overall structure.[9] In our case, initially, only autograft was planned to fill the defect, but upon exploring the hip joint, the bone defect was larger than expected. Consequently, a bovine cancellous bone graft was also used to help fill the defect.

To help with the osteogenic and osteoinductive properties, enhancers may also be added to augment the graft. Materials that have been tested to enhance bone healing are demineralized bone matrix (DBM), platelet-rich plas-

ma (PRP), mesenchymal stem cells (MSC), or bone morphogenetic protein (BMP).[9] Main role of these materials is to carry helpful cells and/or growth factors that may help in bone proliferation.[10]

CONCLUSION

PJI is a rare but dreadful complication of THA. Its diagnosis requires detailed and careful laboratory examination. Many surgical strategies are available; three-stage revision is usually reserved for persistent PJI. Using bone grafts to fill bone defects can also be done with a good outcome.

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