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Two-stage revision of a difficult-to-treat Staphylococcus haemolyticus hip joint Infection with temporary handmade cement spacer and stable Intramedullary fixation while using a Mega prothesis: A case report

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Abstract
Background: Management of extensive bone loss in the proximal or distal femur represents a significant challenge in the context of periprosthetic joint infections (PJI). Both one-stage and two-stage revision strategies have been described in the literature.
Case presentation: In this study, we report our experience with the two-stage approach for the treatment of PJI in the setting of substantial bone loss. Our patient, who presented with radiologically confirmed extensive bone loss of the proximal femur, underwent a two-stage exchange arthroplasty with reconstruction using a megaprosthesis. The diagnosis of PJI was confirmed by positive microbiological cultures.
Management and Outcome: Two-stage-exchange arthroplasty resulting in reconstruction using a megaprothesis. At six-month follow-up, there was no clinical, radiological, or laboratory evidence of persistent infection.
Conclusion: In conclusion, the two-stage revision procedure appears to be an effective treatment option for complex periprosthetic infections, particularly in cases involving *Staphylococcus haemolyticus*.

Keywords: PJI, two-stage-revision, Staphylococcus haemolyticus infection

Introduction

The management of periprosthetic joint infection (PJI) has posed a significant clinical challenge since the introduction of proximal femoral endoprostheses. Reported complication rates range between 21 and 31%, with dislocation and infection being the most common complications (Döring *et al*., 2021; Fenelon *et al*., 2020; Ghanem *et al*., 2023; Grammatopoulos *et al*., 2016; Korim *et al*., 2014; Mancino *et al*., 2021; Wijesekera *et al*., 2025) [4, 7, 9, 11, 12, 14, 22]. Given increasing life expectancy and the rising number of joint replacement surgeries, a further increase in complication rates is anticipated. In particular, the rise in PJI cases with pre-existing significant bone loss due to various causes (Quayle *et al*., 2021) [19], combined with additional osseous defects resulting from implant removal and the necessary aggressive debridement during revision surgery, represents a growing challenge. The internationally established standard for treating PJI includes either a one-stage or a two-stage revision approach, with the choice depending on the individual patient, surgeon experience, and infection type. Currently, the two-stage procedure is the most commonly performed (Dombrowski *et al*., 2020; Goumenos *et al*., 2024; Palmer *et al*., 2020) [3, 10, 18].

Management of extensive bone loss in the proximal or distal femur remains one of the greatest challenges in PJI therapy. Depending on the extent of bone loss, different problems arise. Adequate reconstruction of the proximal femur requires sufficient bone stock at the femoral isthmus. If this is absent, including loss of the femoral diaphysis, it not only complicates secure implantation of the prosthetic stem but also leads to dysfunction of the abductor musculature, resulting in poorer clinical outcomes. The aim of this study is to present our experience with the two-stage exchange procedure in managing extensive bone loss, in the context of a pre-existing massive bone defect due to prior resection of an Ewing sarcoma in the patient's medical history.

Case description

Chief complaints

A 33-year-old female patient presented to our tumor clinic with a 7-month history of load-dependent onset pain in the right knee.

History of present illness

The patient complains of load-dependent pain in the right knee, especially when initiating movement (start-up pain).

History of past illness

In January 2004, the patient was diagnosed with an EWING-sarcoma that necessitated partial resection of the proximal femur. Reconstruction was performed using a Mutars RS Pro tumor prosthesis. In November 2018, a prosthetic head revision was carried out at an external facility due to a hip dislocation. Following a motor vehicle accident in January 2022, the patient sustained a multi-fragmentary periprosthetic femoral fracture, which was treated by re-implantation of the Mutars RS Pro tumor prosthesis with additional stabilization using five cable cerclages.

Family history

There is no relevant family history.

Physical examination

A fistula in the area of the old total hip arthroscopy (THA) scar, present for one year, was noted; it had not been treated due to personal circumstances. No other fresh wounds were observed, the scars were unremarkable, peripheral circulation, motor function, and sensation (pDMS) were intact, and there was no swelling. Range of motion (ROM) of the right hip: flexion/extension 110°–0°–20°, abduction/adduction 30°–0°–20°, internal/external rotation 70°–0°–30°. Right knee: flexion/extension 100°–0°–0°, with stable collateral ligaments.

Diagnostics

In March 2024, conventional X-rays of the pelvis and right femur in two planes were performed. These revealed hypertrophic callus formation as well as fractures of the two distal screws of the osteosynthetic material. Further implant fractures were excluded. There were no signs of prosthetic loosening or periprosthetic fracture (Fig. 1 A+B).

Due to progressive clinical symptoms, a follow-up computed tomography (CT) scan was conducted in April 2024. This showed a perifocal radiolucent zone in the distal prosthesis bed as well as increasing heterogeneous sclerosis of the distal femur. Subsequent examinations also revealed progressive heterogeneous sclerosis in the proximal femoral region (Fig. 2 A+B).

For further evaluation, a radiologically guided joint aspiration was performed in April 2024. The synovial leukocyte count was 6,500/µl, of which 5,195 were polymorphonuclear granulocytes/µl.

Laboratory findings confirmed the suspicion of a periprosthetic joint infection (PJI). The C-reactive protein (CRP) was initially elevated at 30.3 mg/L and increased to over 75 mg/L over time, while the leukocyte count remained within the normal range (<10/nL). All other laboratory parameters were unremarkable.

Final diagnosis

Based on the clinical findings, imaging, and synovial analysis, the diagnosis of a periprosthetic joint infection (PJI) was made according to the EBJIS criteria (McNally *et al*., 2021) [15].

Treatment

In August 2024, a two-stage revision arthroplasty was initiated for a confirmed periprosthetic joint infection (PJI) of the right hip joint caused by Staphylococcus haemolyticus.

Stage One – Explantation and infection control

The patient was admitted as an inpatient. For preoperative pain management, a PENG block with 0.2% ropivacaine was administered. Intraoperatively, the proximal femoral replacement was explanted via an extended transvastus approach. Due to diffuse osteomyelitis and extensive septic soft tissue changes, a longitudinal osteotomy of the proximal femur was necessary to safely remove the stem. The radical debridement also included removal of the acetabular cup (which was already approximately 80% loosened with significant substance loss in the context of pre-existing hip dysplasia), opening and evacuation of the fistula up to the joint capsule, as well as extensive jet lavage irrigation.

For temporary management, a long AO rod spacer and a hand-shaped Palacos cement spacer (160 g with 6 g vancomycin) were implanted. Intraoperative sonication diagnostics confirmed the presence of an infection with Staphylococcus haemolyticus.

The calculated antibiotic therapy started with Unacid (ampicillin/sulbactam) and vancomycin. Due to an allergic reaction to Unacid, therapy was switched on postoperative day 8 to vancomycin and linezolid (2×600 mg). Therapeutic drug monitoring of vancomycin was performed closely. The resistance profile showed sensitivity to vancomycin, linezolid, daptomycin, tigecycline, and fusidic acid.

The patient received standardized pain therapy and thrombosis prophylaxis (tilidine, etoricoxib, metamizole, pantoprazole, fraxiparine). Mobilization was initiated with partial weight-bearing of 15 kg for 12 weeks, followed by gradual increase considering the increased risk of dislocation.

Stage Two – Reimplantation

Forty-eight days after the first procedure, elective readmission for definitive prosthesis implantation took place in October 2024. Preoperatively, persistent sclerosis of the distal femur with metal debris as well as ipsilateral gonarthrosis were present. The operation was performed via a lateral transgluteal approach with distal extension. Multiple microbiological samples were again taken. After removal of the spacers and comprehensive debridement, the prosthetic reconstruction was performed as a hybrid reconstruction using the Link Megasystem-C stem (60+30+30 mm) and a modular SL cup with a 28-mm dual-mobility head (B. Braun). For local antibiotic prophylaxis, a vancomycin-/gentamicin-containing stimulant was applied.

The procedure included a corrective osteotomy for leg length equalization (2.5 cm), reaming of the medullary canal, cerclage replacement, and final wound closure with insertion of Redon drains. Intraoperative irrigation was performed multiple times with polyhexanide and jet lavage.

No microorganisms were detected microbiologically, indicating successful infection eradication.
Perioperatively, Unacid was administered again, but an allergic reaction with exanthema occurred once more. Consequently, Unacid was discontinued from postoperative day 8, while vancomycin was continued. Clinically, the presentation corresponded to a non-immunologic "Red-Man" syndrome, which improved after discontinuation of Unacid.

Outcome and Follow-up

Postoperatively, radiological and clinical findings were satisfactory, showing a dislocation-stable joint position and correct implant placement (Fig. 7 A–D). The patient is still undergoing physiotherapeutic mobilization under infectious disease follow-up and continued oral antibiotic therapy (linezolid). The consistent microbiological diagnostics and differentiated antibiotic management formed the basis for the successful two-stage reconstruction.

Discussion

Periprosthetic joint infection (PJI) represents one of the most serious complications following joint arthroplasty and can manifest at different time points postoperatively. Based on the time elapsed since surgery, PJIs are classified as early (within 3 months), delayed (3 to 12 months), or late infections (beyond 12 months) (Gbejuade *et al*., 2015; Slullitel *et al*., 2018) [18, 20]. This temporal classification is clinically relevant, as it correlates with the likely pathogenic mechanisms and causative microorganisms. Early PJIs often result from intraoperative contamination or early postoperative wound complications, while late infections typically arise from hematogenous spread from distant foci.
The incubation period of a PJI is highly variable and depends significantly on the virulence of the infecting microorganism and the mode of bacterial transmission (Tande & Patel, 2014) [21]. Highly virulent pathogens, such as Staphylococcus aureus, tend to cause acute symptoms soon after surgery, while less virulent organisms, particularly coagulase-negative staphylococci (CoNS), can cause indolent infections that remain clinically silent for extended periods, complicating early diagnosis. Even minimal bacterial inocula are sufficient to initiate infection, highlighting the importance of strict aseptic technique during arthroplasty procedures (Tande & Patel, 2014) [21].
The majority of PJIs are believed to originate from intraoperative contamination of the prosthesis. This contamination can occur via airborne particles, aerosolized bacteria, or through direct handling of the implant or surgical site (Tande & Patel, 2014) [21]. Once bacteria colonize the implant surface, they employ virulence factors that enable adhesion and persistence. Among these, adhesins facilitate bacterial attachment to biomaterial surfaces, while biofilm formation represents a critical pathogenic mechanism. Biofilms consist of bacterial communities embedded within an extracellular polymeric substance matrix, which protects the microbes from host immune responses and antibiotics, thereby promoting chronic infection and resistance to eradication (Fantoni *et al*., 2019; Lebeaux *et al*., 2014; Tande & Patel, 2014) [6, 13, 21].
Diagnosing PJI is complex and necessitates an integrative approach combining clinical assessment, laboratory evaluation, radiological imaging, and microbiological as well as pathological analyses. No single diagnostic modality achieves perfect sensitivity and specificity. Clinical signs such as pain, swelling, erythema, or sinus tract formation raise suspicion, but these can be subtle, especially in chronic cases. Laboratory markers including elevated inflammatory parameters (CRP, ESR) aid diagnosis but lack specificity.
Radiological imaging, including plain radiographs, computed tomography (CT), magnetic resonance imaging (MRI), and nuclear medicine techniques, can reveal signs suggestive of infection such as osteolysis, implant loosening, or periosteal reaction. Among these, synovial fluid analysis remains a cornerstone for diagnosis, providing critical data such as leukocyte count, differential, and culture results (Cipriano *et al*., 2012; Cyteval *et al*., 2002; Osmon *et al*., 2013; Otto-Lambertz *et al*., 2017) [1, 2, 16, 17].
Microbiological cultures obtained from synovial fluid, periprosthetic tissue biopsies, or sonication fluid from explanted prostheses enhance pathogen detection rates. Sonication disrupts biofilms on implants, improving bacterial yield and guiding targeted antimicrobial therapy (McNally *et al*., 2021) [15].
Early initiation of targeted antibiotic therapy based on culture and resistance profiles is paramount for effective infection control and improved clinical outcomes. Empirical therapy is generally broad-spectrum but should be de-escalated promptly to avoid antibiotic resistance and adverse effects (Cipriano *et al*., 2012) [1].
In summary, the management of PJI requires a multidisciplinary approach, careful diagnostic evaluation, and timely initiation of appropriate surgical and antimicrobial therapies to prevent implant failure and preserve patient function.

Conclusion

Periprosthetic joint infection (PJI) is an increasingly common and serious complication of arthroplasty. This case illustrates the challenges in the management of PJI and emphazizes the importance of early diagnosis and interdisciplinary collaboration.

Fig 1 A, B: The images show hypertrophic callus formation and fractures of the two distal screws, in March 2024

Fig 2 A, B: Follow-up images from April 2024, one month later. They show progressive heterogeneous sclerosis of the proximal femur with suspected chronic osteomyelitis

Fig 3: Shows the postoperative conventional X- ray with an inserted AO rod spacer and a hand-shaped cement spacer.

Ampicillin	R
Oxacillin	R >=4.0
Cefoxitin-Screen	+
Ampicillin/Sulbactam	R
Piperacillin	R
Piperacillin/Tazobactam	R
Cefazolin	R
Cefuroxim	R
Ceftriaxon	R
Imipenem	R
Meropenem	R
Levofloxacin	R >=8.0
Gentamicin	R 4.0
Tobramycin	R
Vancomycin	S 1.0
induc.Clindamycin Resi	ne
Erythromycin	R >=8.0
Clindamycin	R >=4.0
Doxycyclin	R 4.0
Tigecyclin	S <=0.12
Linezolid	S 2.0
Daptomycin	S 0.25
Fosfomycin	. >=128
Fusidinsäure	S <=0.5
Rifampicin	R >=32.0

Fig 4: Resistance profile of Staphylococcus haemolyticus. It shows resistance to various antibiotics. R = Resistant to the tested antibiotic. S = Sensitive to the tested antibiotic. Ne = Negative.

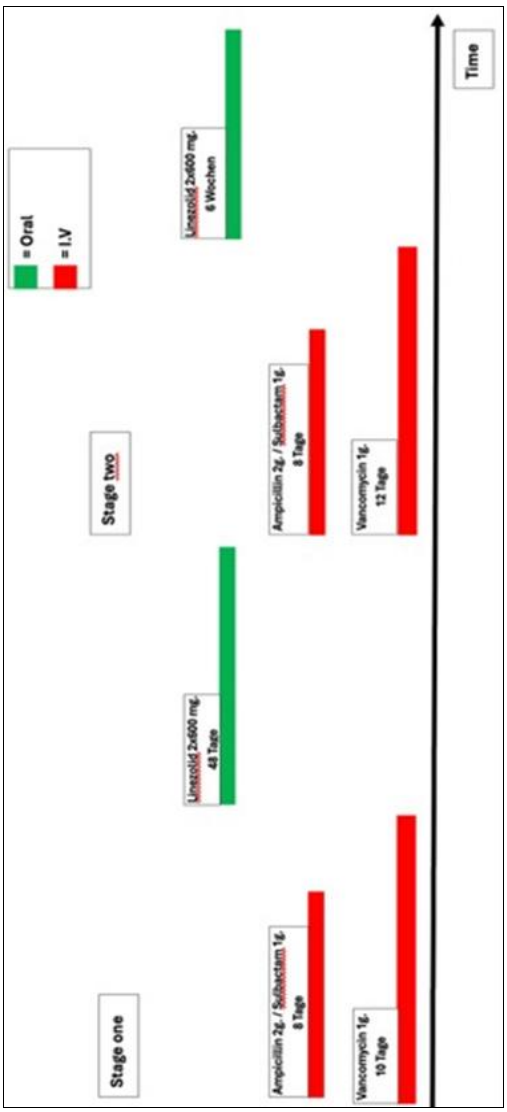

Fig 5: Timeline of antibiotic treatment. Figure 5 is an original creation based on: (Fischer *et al*., 2024).

Fig 6: Preoperative image before the planned second procedure.

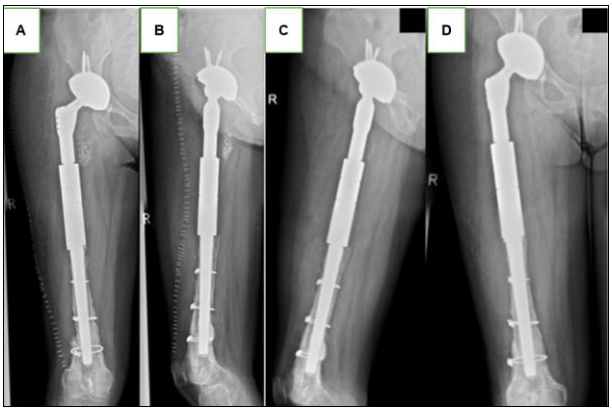

Fig 7 A, B, C, D: Images A and B show the result on the 10th postoperative day with antibiotic-loaded beads still in place. Images C and D show a follow-up examination 6 weeks postoperatively

Conflict of Interest
Not available

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