

Case Report

Successful Implant Retention in a Chronified Hematogenous Bilateral Periprosthetic Hip Joint Infection With *Enterococcus faecalis*

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ABSTRACT

We present a case with bilateral hematogenous hip periprosthetic joint infection with Enterococci which could be treated successfully with implant retention despite chronification and partial loosening. A debridement and replacement of the modular components was carried out with replacement of a loose acetabular cup on the right side. Considering poor local infection control, antibiotic treatment was enhanced by local application of vancomycin. In the present case, treatment of chronic enterococcal periprosthetic joint infection while preserving the implants was successful despite unfavorable odds. Considering the duration of infection, causative microorganism, and loosening of one of the implants, staged exchange of both hip replacements would have been the standard procedure. This case illustrates that some concepts have to be challenged from time to time.

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Introduction

Periprosthetic joint infections (PJI) are severe complications in joint replacement [1,2]. *Enterococci* are detected in 2.3%–4.2% of PJI as pathogens [3–5]. Twenty-six percent to 64% of PJI with Enterococci are polymicrobial with other bacteria [4,6–8]. Reported success rates regarding clinical eradication of Enterococci range from 51% to 94% [3,4].

Enterococci are considered as difficult to treat due to limited antibiotic activity against their biofilm formation and their potential for antibiotic resistance [6,9–12]. In general, 2-stage exchange with a long interval between the surgeries is recommended to treat PJI with difficult-to-treat microorganisms [13–15]. A periprosthetic infection can also be successfully treated with debridement, antibiotics, and implant retention (DAIR), if the soft tissues are intact and antibiotic therapy is available that can eradicate the biofilm [13,16,17]. The success rates of DAIR vary widely in the literature

and can be well explained by the heterogeneity of the cohorts, the causative microorganisms, symptom duration, and different definitions of success.

We present a case of bilateral hematogenous hip PJI successfully treated with implant retention despite chronification and partial loosening. In this case, the treatment choice was dictated by various clinical specifications forcing to deviate from standard treatment. As shown in our case, implant-preserving therapy can also be considered for an infection with *Enterococci*.

Case history

The presented patient provided written informed consent for publication of anonymized data. A 68-year-old male presented to his general practitioner due to recurrent fevers and chills. The patient had undergone a total hip replacement 2 years earlier on the right side and 7 years earlier on the left side by a transgluteal approach (Fig. 1). He underwent an aortic arch replacement with a biological aortic valve 3 years earlier for an aneurysm of the ascending aorta with valve insufficiency. Investigations included blood cultures, which revealed *Enterococcus faecalis*. He was hospitalized in a regional hospital for this reason. Echocardiography

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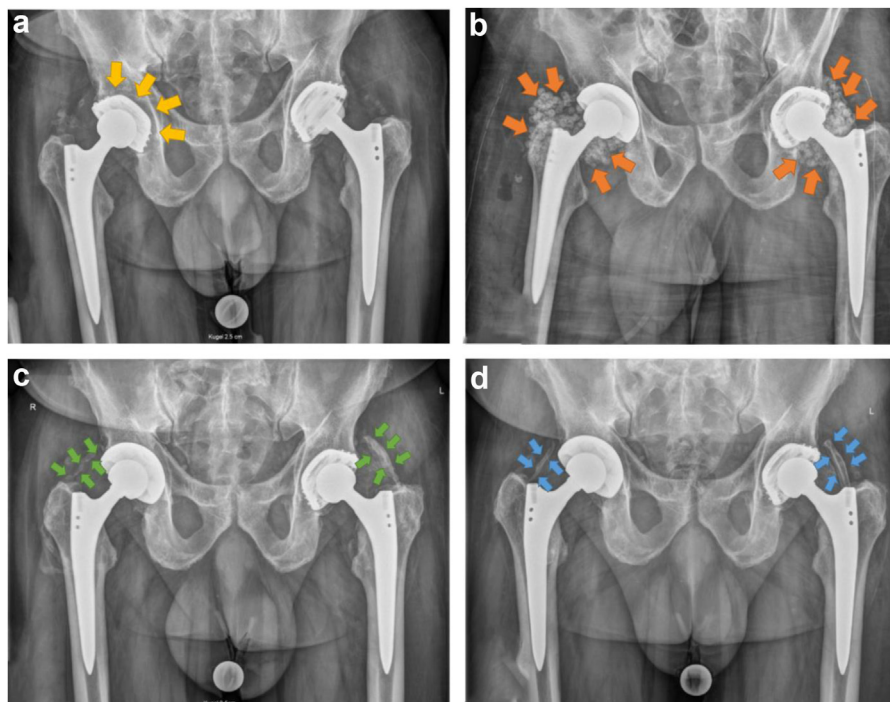


Figure 1. Anteroposterior pelvic radiographs from the follow-up of the 68-year-old male affected by bilateral hematogenous periprosthetic joint infection of the hip. (a) Radiograph before revision, illustrating bilateral uncemented total hip arthroplasty. While the components on the left showed no sign of loosening, the cup on the right side was surrounded by radiolucency indicative of loosening (yellow arrows). (b) Radiograph after bilateral revision arthroplasty. On the right side, a major partial revision had been performed, with debridement, replacement of the cup and the head. On the left side, debridement with exchange of the liner and the head was performed, as both the cup and the stem were well-fixed. Both joints were filled with vancomycin-loaded CaSO₄ pellets (orange arrows). (c) Two months after the revision, the CaSO₄ pellets had dissolved. The first signs of heterotopic ossification are visible on both sides (green arrows). (d) Radiograph 2 years after the revision. The components were stable on both sides with no evidence of loosening. Heterotopic ossifications matured in the meantime, being sharply demarcated, without increasing in volume (blue arrows).

showed no evidence of endocarditis nor another source of the bacteremia, such as urogenital or gastrointestinal tract infection. Antibiotic treatment with amoxicillin and gentamicin was initiated parenterally for a total of 2 weeks for a bacteremia with *E. faecalis* of unknown origin.

One month after the end of the antibiotic therapy, bacteremia with *E. faecalis* recurred. Repeated transthoracic and transesophageal echocardiography showed no signs of endocarditis. Again, a synergistic treatment with amoxicillin and gentamicin was administered intravenously for 10 days, but thereafter, gentamicin had to be stopped due to nephrotoxicity. A positron emission tomography–computed tomography showed no signs of an infection of the aortic prosthesis but effusions in both hip joints and an abscess in the left psoas. The abscess was aspirated, but no pathogens could be detected, perhaps due to the already established antibiotic therapy. Clinical examination of both hips was unsuspecting. Aspiration was therefore not taken into account. Intravenous amoxicillin therapy was continued for 4 weeks, followed by another 2 weeks of oral administration. To find a potential source of the recurrent bacteremia, a colonoscopy was conducted during the treatment with amoxicillin, which revealed solely some polyps. Magnetic resonance imaging follow-up after discontinuation of the antibiotics showed complete regression of the abscess in the left psoas.

A few weeks after discontinuing the oral antibiotic therapy, fever and chills returned, and *E. faecalis* was detected again in blood cultures. Antibiotic therapy with amoxicillin was started again, without a combination of aminoglycoside due to renal impairment. The patient was then transferred to our hospital, and both hip joints were aspirated at admission. Aspiration showed an elevated synovial fluid leukocyte count on the right side (13,380 leukocytes/ μ l

with 94% polymorphonuclear granulocytes). On the left side, the results were interpreted as normal despite relevant pathological features (1,839 leukocytes/ μ l with 74% polymorphonuclear). However, phenotypically identical *E. faecalis* was cultured in both hip aspirates. While the uncemented hip implants were well-fixed on the left side, the cup was loosened on the right side (Fig. 1).

Due to the synchronous bilateral hip infection and a history of repeated bacteriemia, a hematogenous etiology had to be considered, with an endocarditis and endovascular graft infection as the most likely origin despite negative results from previous investigations. The cardiac surgeons however considered revision of the ascending aortic prosthesis as impossible. Without definitive source control of bacteriemia, treatment of PJI was jeopardized. For this reason, a limited treatment of the PJI of both hips was chosen to reduce the septic burden, while allowing mobilization of the patient. On the left side, debridement and replacement of the modular components were carried out through an anterior approach. In the same surgery, a major partial revision was performed on the right side, with debridement and exchange of the loose cup as well as of the head, also through an anterior approach (Fig. 1a).

The anterior approach was chosen so that the patient could be mobilized immediately postoperatively. Considering poor local prognosis, antibiotic treatment was enhanced by local application of vancomycin-loaded calcium sulfate (CaSO₄) into both joints, with a total of 50 ml of Osteoset (Stryker, Portage, MI) with 4 g of vancomycin in each joint (Fig. 1b). Amoxicillin was administered parenterally for 4 weeks postoperatively, followed by an oral therapy enhanced with probenecid for 3 months. Probenecid inhibits the renal tubular excretion of amoxicillin and leads therefore to higher blood levels of it. Suppression therapy with amoxicillin

was continued for another 9 months. The decision for a total of 12 months of antibiotic therapy was based on the circumstance that the hypothesized infection of the aortic prosthesis had not been addressed surgically.

The follow-up was uneventful. No microorganisms were detected anymore in the blood cultures sampled every 3 months under therapy. The oral antibiotic therapy was discontinued after 1 year as planned. The last follow-up 2 years after the revision showed no sign of loosening nor persistent infection (Fig. 1). The newly formed heterotopic ossifications limited mobility only slightly. No aspiration was performed, as clinical findings and a positron emission tomography–computed tomography, repeated after 1 year of antibiotic treatment, showed no sign of persistent infection.

Discussion

In the present case, implant-retaining therapy of a bilateral, chronic hip PJI with enterococci was successful despite unfavorable odds. The debridement with exchange of the modular components (DAIR procedure) and the major partial revision performed were initially intended as temporary measures to decrease the septic burden at administration. As the limited surgical treatment appeared to be successful, it was pursued as definitive treatment of the infection. Such a scenario with eradication of the organism can of course also be regarded as a coincidence. However, this case should nevertheless illustrate a few important aspects of infection treatment.

The standard treatment in this situation should have been a 2-stage exchange with a long interval on both sides [13–15]. Due to the lack of symptoms, the infection of the prostheses was not detected for several months, which led to a chronic infection. *Enterococci* are considered as difficult-to-treat pathogens, as no antibiotic with true antibiofilm activity is available. In addition, a major partial replacement, as performed on the right side as the cup was loosened, is the worst option in PJI according to a study from the Norwegian arthroplasty registry [18]. Recent case series show that a major revision can still be successful on well-integrated implants, although a strict indication must be made in these cases [19,20]. Finally, the original source of the infection could not be definitively determined, but an infected vascular prosthesis at the aortic root was most likely. As any surgical treatment for the vascular prosthesis was rejected, eradication was considered as being impossible. Bacteremia recurred despite previous antibiotic treatment.

The reported success rates with a 2-stage revision in infection with enterococci vary between 66% and 94% [3–5,7–10,21]. However, treatment of enterococcal PJI with DAIR procedures can also achieve success rates of up to 80% [7,10,21]. In addition, mortality and morbidity from DAIR procedures are far better than those for 2-stage revisions [22–26]. Prosthesis-preserving therapy hardly affects the functional outcome. A second DAIR can also be considered if the implant is stable, as it still can achieve satisfactory treatment results [27,28]. If loosening still occurs in the course of the treatment due to a persistent infection, a 2-stage exchange may still be performed later, with the advantage of postponing major surgery, after control of systemic sepsis. In our case, we did not want to perform a 2-stage change because of the bilateral infection, as this would have made it impossible to mobilize the patient for several weeks, and as the general outcome was questionable, considering prosthetic endocarditis as the most probable source. The DAIR procedure, extended on the right side to a full cup exchange, could be carried out via an anterior approach, so that the patient could be mobilized with full weight-bearing immediately after the operation.

One reason for success could be the prolongation of the antibiotic treatment up to 1 year, instead of the usually recommended 12 weeks. In a study with streptococcal infections, the risk of reinfection was significantly reduced with longer therapy [29]. Another study also showed that the success rate of DAIR procedures can be improved significantly with prolonged oral antibiotic therapy [30]. However, in our case, the 3 months of treatment followed by 9 months of suppression therapy was done because the probable source of the infection was an inoperable aortic vascular prosthesis. There was no recurrence until 2 years after the end of treatment. However, although even a matured biofilm can be completely eradicated with appropriate antibiotic therapy and a sufficiently long duration of therapy [31], it usually just is impossible to maintain the necessary concentrations without local administration.

The application of local antibiotics can improve the chances of success of DAIR procedures [32,33]. Antibiotic-loaded CaSO₄ may provide high concentrations of vancomycin or ceftriaxone over several weeks [34,35]. However, it should be noted that the application of the calcium-containing carrier material can induce hypercalcemia, limiting the quantity of antibiotic-loaded CaSO₄ applied in this case [36]. Monitoring for hypercalcemia is recommended when resorting to this option. The often discussed and feared complication of prolonged wound drainage after application of antibiotic-loaded CaSO₄ appears to affect only 4% of the cases in a systematic review of the literature [37]. However, 2 other studies show no difference in the success of a DAIR when using antibiotic-loaded CaSO₄ [38,39]. One possible explanation usually disregarded may be the type of CaSO₄ used, as both studies reporting success used Osteoset, while Stimulan (Biocomposites, Keele, UK) was used in both studies failing to identify any benefit [32,33,38,39].

This case shows that when planning treatment for a PJI, it is not only the causative microorganism and the duration of symptoms which should be considered but also the patients' status and comorbidities. In this case, the cardiac source of infection was inaccessible for final treatment. Because of this persistent source of infection, a major surgical revision in the sense of a bilateral 2-stage exchange, which is usually recommended for PJI with enterococci, was contraindicated. Although the success of joint-preserving treatment decreases with longer duration of infection, the chances of success are still higher than the failure rates [17,40]. Joint-preserving therapy should be considered, especially if the implant is stable, even in the case of chronic infection. Better functional outcomes and reduced morbidity of DAIR procedures compared to a 2-stage exchange must also be taken into account in the choice of therapy, not only the eradication rate regarding infection. Local application of antibiotic-loaded CaSO₄ may at least help obtaining local infection control considering the known drug release kinetics. In case of failing initial DAIR, a subsequent repetition thereof may be a useful option [27,28]. Prolonged antibiotic treatment may be also a key to success in treating enterococcal PJI [29].

Conflicts of interest

The authors declare there are no conflicts of interest.

For full disclosure statements refer to <https://doi.org/10.1016/j.artd.2023.101313>.

Authors' contributions

P.W. and V.B.-Z. reviewed and edited this article. P.W. and E.B. contributed to supervision. P.W. and H.W. contributed to conceptualization. V.B.-Z. performed the investigation. H.W. wrote the original draft.

Informed patient consent

The author(s) confirm that written informed consent has been obtained from the involved patient(s) or if appropriate from the parent, guardian, power of attorney of the involved patient(s); and, they have given approval for this information to be published in this case report (series).

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