

Case Report

Management of infected megaprosthesis with debridement and implant preservation using glutaraldehydeYogi Prabowo,¹ Paul Steven²^{1,2}Department of Orthopaedic & Traumatology, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia**ABSTRACT****ABSTRAK**

Introduction: Megaprosthesis infection is one of the most feared complications after a prosthesis insertion. It may increase the morbidity of the patients who are already in a dismal condition due to their cancerous condition. However, the prevalence of infection is reported to be between 3% and 31%. Many risk factors have been identified to be associated with increased risk of infection, but currently, no consensus on treatment is accepted.

Methods: We present a series of two cases of megaprosthesis infection. The first one is a 39-year old male, with infected implant of the left distal femur post-wide excision and infected megaprosthesis due to Giant Cell Tumor Campanacci grade III. The second one is a 25-year old female with infected endoprosthesis post-wide excision of osteosarcoma of the right distal femur Enneking IIB. Both came after several months of megaprosthesis surgery. General examinations were within range and local examinations showed typical inflamed thigh. Debridement surgery with implant re-sterilization were performed to both cases. Post-operative results were satisfactory and the patients were relieved of pain.

Results: Although no methods have been accepted as the gold standard, we performed debridement to our cases in order to re-sterilize the implant. This gave the patients the advantage of shorter duration of surgery and less economical burden. We also treated the *S. aureus* infections conservatively. The outcomes for both patients were satisfactory.

Conclusion: Debridement and irrigation with implant retention were effective for infected megaprosthesis cases and the results were favorable. Longer follow-ups are needed to ascertain the survival rate of the cases.

Pendahuluan: Infeksi megaprotesis adalah salah satu komplikasi yang paling ditakutkan pasca-pemasangan prostesis. Infeksi dapat meningkatkan morbiditas pasien yang telah berada pada kondisi buruk akibat kondisi keganasan. Dilaporkan bahwa prevalensi infeksi antara 3 hingga 31%, namun hingga kini belum ada konsensus terapi yang disepakati.

Metode: Kami mempresentasikan serial kasus 2 pasien penderita infeksi megaprotesis. Pasien pertama adalah laki-laki berusia 39 tahun yang menderita infeksi implan pada femur distal kiri pasca-wide excision dan infeksi megaprotesis akibat Giant Cell Tumor Campanacci grade III. Pasien kedua adalah wanita berusia 25 tahun dengan infeksi yang terjadi pada endoprotesis femur distal pasca-wide excision osteosarcoma Enneking IIB. Keduanya datang beberapa bulan setelah operasi megaprotesis. Pemeriksaan umum berada dalam batas normal dan dari hasil pemeriksaan lokalis didapatkan tanda-tanda inflamasi paha tipikal. Kedua pasien menjalani operasi debridemen dan sterilisasi implan ulang. Hasil pasca-operasi memuaskan dan nyeri tidak dirasakan kembali.

Hasil: Walaupun belum ada metode yang disepakati sebagai gold standard, kami melakukan debridemen untuk sterilisasi ulang pada pasien. Hal ini memberikan keuntungan berupa berkurangnya waktu operasi dan beban ekonomi. Kami juga melakukan terapi terhadap infeksi *S. aureus* secara konservatif. Luaran pada kedua pasien memuaskan.

Kesimpulan: Debridemen dan irigasi dengan retensi implan efektif untuk kasus infeksi megaprotesis dengan hasil yang memuaskan. Follow up yang lebih lama dapat memastikan angka harapan hidup pada kasus ini.

Keywords: Megaprosthesis, infection, debridement.**Corresponding author:** Paul Steven, MD. bta_punk83@yahoo.com

INTRODUCTION

Treatment of malignant bone tumor is extremely difficult and has a poor prognosis. Before 1970s, dismal results have been shown with only 15-20% of survival rate for osteosarcoma, the most common bone malignancy. Afterwards, significant advances have occurred causing the 5-year survival rate to increase to 70-80%. Since better imaging modalities and wide arrays of treatments are currently available, patients with malignant bone tumors have been experiencing higher survival rate than ever.¹ A wide diagnosis procedures have been introduced in order to increase the accuracy of treatment, and consequently this will make a lot of treatment choices available as the condition of each patient will be different. The choice of treatment is essential for treating malignant bone tumors, especially in term of functions. As osteosarcoma is frequently found in population below 20 years of age, it is essential to have limb sparing as the main goal of treatment besides survival of the patient.^{1,2,3}

Megaendoprostheses have been one of the best choices of treatment for patients with malignant tumors. Megaprosthesis is a choice that will sustain for a long term and together with adjuvant therapies, will increase functional outcome of patients. The advantages include early stability, rapid restoration of function, good long-term functional outcomes and patient's high satisfaction. However, the complication is high with the prosthesis, i.e. up to 5 to 10 times higher than the usual total joint arthroplasties. The fundamental problem in determining the prevalence of the disease is to define the criteria by which the disease can be diagnosed with certainty. Currently, periprosthetic infection is most often diagnosed by the isolation of one or more organisms from periprosthetic tissue or fluid by using conventional microbiological culture techniques, and microbiological culture results are usually regarded as the standard by which other diagnostic tests compared.⁴

Prevalence of the infected joint replacements has tripled mostly between 1995 and 2005. The incidence of infection in megaprosthesis has been reported between 3% and 31%. Some risk factors have been identified to be associated with the increased risk of infection, such as anatomic region (implant in pelvis is the most common place to be infected, followed by tibia and femur and humerus), implant materials and both aseptic and aseptic revision arthroplasty. The infection rate in megaprosthesis was comparable to that associated

with other methods of reconstruction after limb salvage surgery, such as autograft or allograft reconstruction⁵. Options of treatment, in general, consisted of antibiotic suppressive together with a combination of debridement and irrigation. Implant retention or implant removal is different from each other in term of indication^{1,6}. Treatment of infected megaprosthesis requires both compliance with generally accepted principle of implant-related infections (e.g., the operating time of the infection, the infecting microorganism) and consideration of individual patient factors (e.g., tumor disease, life expectancy).⁷ The insertion of foreign objects that will be in the patient's body for many years increases the risk of infection that ultimately may grow into biofilm. Infection in patients can acutely and/or chronically persist for years after surgery, and diagnosis of the infection and the type of growth of the bacteria (e.g., planktonic vs. biofilm) remains a difficult task for doctors^{8,9,10}. The complications include mechanical failure (instability due to loosening or fracture of implant), infection, septic loosening and wound or soft tissue breakdown. Aseptic loosening is one of the main complications that is feared. About 20% of patients experienced aseptic loosening after 5 years. This kind of complication requires further revision and additional treatment, thus possibly increase the morbidity of the patient.^{2,3}

We present a series of two cases of infected megaprosthesis that were treated with implant retention using re-sterilization method.

METHODS

Case 1

Preoperative Illustration

A 39-year old male has been admitted because of pain on his left knee for the last 1 week before admission. Two months prior to admission, megaprosthesis operation was done. He was diagnosed as having Giant Cell Tumor of left distal femur and performed wide excision and reconstruction using megaprosthesis. No complain of pain or swelling for 1 month after the surgery. The patient can ambulate using a double crutch (non-weight bearing) 1 week after the operation. After 1 month, the patient can walk with a partial weight bearing and went back to his hometown, Manado.

Around one week before admission, the patient felt pain and swelling on his left knee. He also had a symptom of fever. The patient was then brought to a hospital in

Manado and there, knee aspiration was done (400 cc of pus was aspirated). The patient was then referred back to RSCM for further treatment. The patient denied any history of infection disease since the first operation.

Clinical Findings

In local examination, swelling was found on the left thigh together with erythema surrounding the wound. Pain after palpation was felt with VAS score of 4. Circumferential diameter of the left knee was 42 cm compared to 38 cm of the right knee, and felt warm. No neurovascular disturbance was found at the distal sites of the lesion. Fluid was found intraarticularly. Knee flexion was limited to 10-45° with pain after movement.

Laboratory Test

Laboratory examination revealed a marked increase of Leukocyte of 11,730 /uL, ESR of 115 mm/hr, LDH of 382 U/L, CRP of 46.9 mg/L, and Procalcitonin of 0,12 ng/mL. The patient was assessed with infected implant of left distal femur post-wide excision and infected megaprosthesis due to Giant Cell Tumor Campanacci grade III.



Figure 1. Local state of the Left Thigh showed previous operation scar, swelling was prominent with erythematose skin surrounding the surgical wound.

Radiologic Examination

Knee X-Ray was performed to the left knee in anteroposterior and lateral view. Sign of inflammation, which is showed by effusion, can be seen in the X-ray images.

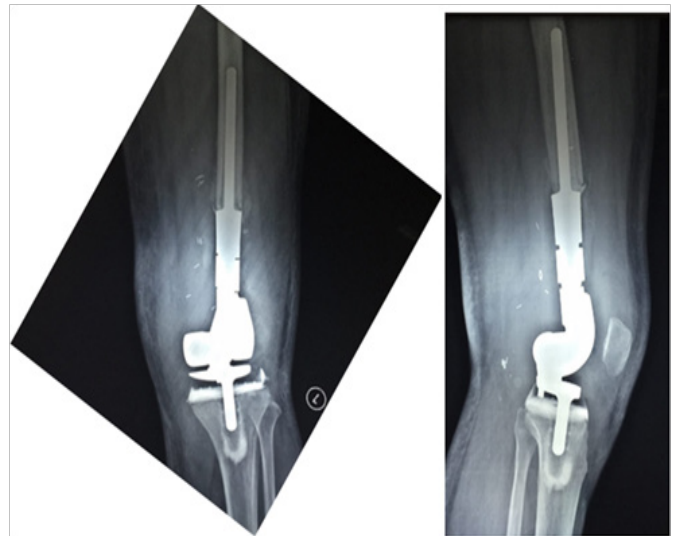


Figure 2. Initial radiograph of Left Knee AP and Lateral view showed that the prosthesis was held in position with suspected periprosthetic effusion.

Afterwards, we planned to perform debridement and irrigation with implant re-sterilization using glutaraldehyde in one stage. Intra-operatively, we aspirate the knee for culture and antibiotic sensitivity tests. Then we incised the overlying skin and the surrounding soft tissues medially in accordance to the previous scar.

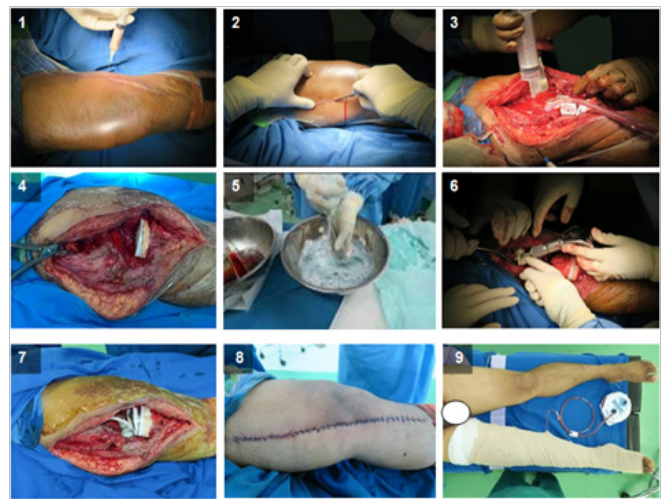


Figure 3. (1) joint effusion was aspirated; (2) skin incision was made as the prosthesis was approached; (3) irrigation and debridement was performed thoroughly; (4) prosthesis was then removed; (5) re-sterilized with glutaraldehyde; (6) reimplanted into position; (7) the prosthesis was functioned well intra-operatively; (8) the wound was closed; (9) encircled with elastic bandage.

Postoperative Report

A one-stage debridement of soft tissues surrounding the prosthesis with re-sterilization of the prosthesis was done for this patient. The surgical site was reopened and the implant was extracted. A thorough debridement and irrigation was done to the soft tissues surrounding the implant. For the implant itself, a re-sterilization procedure was done. After extraction, the implant was then dipped into a diluted povidone-iodine. After several minutes, it was then rinsed using Stabimed®. After cleansing the implant, the implant was then re-implanted into the area. Postoperatively, the patient was given antibiotic in accordance with the culture of the knee aspirate.

Clinical Findings

After ten days, the patient felt decreased pain of his left thigh, the swelling got smaller, and erythematous had subsided.

Laboratory Test

In laboratory examination, marked decrease in laboratory markers were found, leukocyte to 7,230 /uL, ESR 67 mm/hr, and CRP 5.9 mg/L.

Radiologic Examination

X-ray images of the left knee were taken postoperatively and showed no sign of periprosthetic effusion.



Figure 4. Post-operative radiograph showed that the prosthesis was held in position. Joint effusion was no longer seen.

Case 2

Preoperative Illustration

A female, 25 years old, with chief complain of swelling on her right thigh for the last 4 months before admission came to our hospital. Two years before admission, the patient had a wide excision surgery of her right distal femur tumor. The patient had a mass 3 years before and after several examinations, the patient was diagnosed with osteosarcoma. The wide excision was done and replaced using an endoprosthesis (megaprosthesis). Since then, the patient can mobilize, and she gained her partial weight bearing after the 3rd month. However, the last 4 months before admission the patient complained swelling on her right knee. At first, the patient thought it was normal. But it was just getting worse over time. Two weeks ago, the reddish and the swelling scar became a sinus and produce seropurulent exudate.



Figure 5. Local state of the right thigh. Swelling with sinus and seropurulent pus was evident.

Clinical Findings

On local state of the right knee, a sinus was present near the surgical scar along with local swelling and erythematous. On palpation, there was tenderness with a VAS of 3-4. The movement of the knee was limited due to pain.

Laboratory Test

No marked increase in leukocyte was observed in the laboratory examination. The LDH was the only marker that was increased (308 U/L). After collecting the pus, it was confirmed that the bacteria found was *S. aureus*.

Radiologic Examination



Figure 6. Initial radiograph of the Right Knee AP and Lateral view showed that the prosthesis was held in position with suspected periprosthetic effusion.

Postoperative Report

As this patient was assessed with infected endoprosthesis post-wide excision of osteosarcoma of right distal femur Enneking IIB, similar to case 1, a one-stage debridement surgery with implant re-sterilization was done. The different is, however, the implant was not extracted. A thorough debridement was done to this patient using saline together with sinus excision.



Figure 7. Intraoperatively, saline was used to debride the local area.

Clinical Findings

A few days postoperatively, the sinus track did not produce any more pus, the pain and the erythematous were subsided. Antibiotic regimen was given to the patient.

Laboratory Test

The laboratory test from the blood serum collected after the surgery resulting in leukocyte level of 13,450 / μ L and ESR of 50 mm/hr.

Radiologic Examination

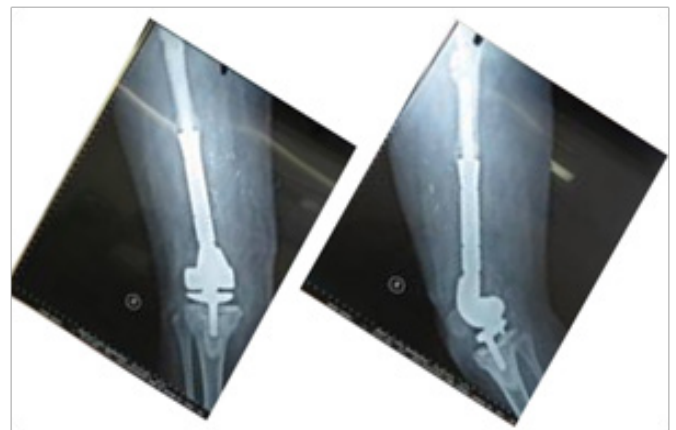


Figure 8. Post-operative radiograph showed that the prosthesis was held in position. Sign of inflammation was no longer seen.

DISCUSSION

Periprosthetic infections remain to be one of the most common complications that cause failure in hip and knee arthroplasty. It is a leading cause of failure, morbidity, and mortality in non-oncologic primary joint arthroplasty. Infection in tumor reconstruction was documented in 5.7%-15% cases. A study documented that the infection rate will likely to increase up to 43% due to endoprosthesis revision cases. Infection will also cause an increase in the likelihood of amputation after an endoprosthesis insertion.¹¹

Tsukuyaman divided the classified periprosthetic infections into four types: Type I infections are characterized by positive microbiological culture at the time of revision surgery without other signs of infection. Infections occurring within one month of index surgery are classified as early Type II infections. Hematogenic infections after bacteremia and acute onset of symptoms

at the site of the implant characterize the Type III infections, whereas Type IV are defined by late and chronic infections with an interval of at least one month after surgery.^{12,13}

Implant retention is indicated for patients without other signs of infection as in the Type I infections with prolonged systemic antibiotic treatment is recommended. If the arthroplasties are stable in Type II or III, it is also recommended to do implant retention.¹³ Some studies still state that the management options for treatment of periprosthetic are unclear. Gosheger et al. reviewed 197 patients with megaprotheses, and those with cobalt chrome implants had more infections than those with titanium implants.¹⁴

Management strategies include debridement without prosthesis revision, one-stage surgery and two-stage surgery, and amputation. All of these methods have proven to be effective in some cases but failed in the others. In this study, however, we still perform the debridement in order to re-sterilize the implant. A disinfectant solution that is commonly used for disinfecting instruments was used and afterwards, the implant was rinsed using saline so that it would not destroy the surrounding tissues. For the second case, a thorough debridement without explanting the implant was done. A study by Fukagawa et al¹³ postulated that a thorough debridement will destroy the biofilm associated with the resistance to treatment of bacterial infections. Bacteria that can adhere to the implanted material can encapsulate themselves in a hydrated matrix of polysaccharide and protein, and form a slimy layer known as biofilm. Antibiotic can kill free floating bacteria but may fail eradicate bacterial cells that are still embedded in the biofilms.

Conservative treatments may be effective in early infections, patients with a short duration of symptoms, a well-fixed and functional implant, and ideally with a well-characterized microbiology demonstrating a highly susceptible pathogen. Some reported that arthroscopic debridement is as effective as open debridement in prosthetic knee joints that are well fixed with little cement^{15,7}. We did an open surgery for this patient as it ensured the exposure of the whole local site of the infection so that debridement will yield better results. It gave the patient advantages of shorter duration of surgery and less economical burden.

The bacteria found in both studies were *S. aureus*. It has

been established that this genus of bacteria is the most common cause of periprosthetic infection, occurring in more than 50% of cases. *S. aureus* and *S. epidermidis* are the most common bacteria reported in literature.¹⁶

The outcomes for both patients were clinically satisfactory. They both experience pain-free period right after the surgery, with swelling and erythematous local area slowly disappeared. Laboratory result for the first case was better than the second, but the increase were not significant and clinically, the patient felt better. Outcomes for the patients treated with conservative open debridement have been known to be good, but reinfection number is still higher than those treated with implant revision or amputation. Successful eradication of the infection has been reported in 98% to 100% of the cases with amputation, 72% to 91% of those with two-stage revision, and 42% of those with one-stage revision.^{16,17}

CONCLUSION

Debridement and irrigation with implant retention was effective for both of our patients, yielding in favorable results. These could be an alternative for surgeons to treat uncomplicated infected megaprotheses cases, thus correcting morbidities and increase patient's functionality. Long term survival rate is still debatable in literature, and this study does not follow the patient long enough.

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