

Debridement, Antibiotics, and Implant Retention for a Rare *Serratia marcescens* Infection after Total Knee Arthroplasty: A Case Report

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Learning Point of the Article:

Remission of *S. marcescens* infection was achieved without removing the implant by cleaning, debridement, and use of sensitive antimicrobial agents.

Abstract

Introduction: Recently, *Serratia marcescens* was reported to cause nosocomial infections.

Case Report: In this study, we report a case of *S. marcescens* infection occurring after total knee arthroplasty (TKA) in a 72-year-old woman. The patient had undergone TKA for knee osteoarthritis. She had a past medical history of diabetes mellitus, for which she was receiving cefazolin sodium. Six days after surgery, redness and effusion were observed in the wound, and post-operative infection was suspected. Thus, the patient was treated with linezolid, clindamycin, and tazobactam/piperacillin hydrate post-operatively. Twelve days after TKA, reinfection was suspected; hence, washing and debridement were repeated.

Conclusion: In this case, remission of *S. marcescens* infection was achieved without the need to remove the implant by cleaning, debridement, and the use of sensitive antimicrobial agents.

Keywords: Total knee arthroplasty, *Serratia* infection, antibiotics, debridement, implant retention.

Introduction

Infection after total knee arthroplasty (TKA) is a serious complication that is often difficult to treat and can severely affect the subsequent activities of daily living (ADL). In particular, surgical site infection (SSI) is a major cause of unexpected readmission [1, 2], requires prolonged treatment, decreases patient satisfaction, and leads to other complications. In recent years, nosocomial infections caused by *Serratia marcescens* have become a major problem [3]. Most post-operative infections in orthopedic surgery are caused by gram-positive bacteria, and periarticular infections caused by *S. marcescens* are extremely rare. We report a valuable and relatively rare case of *S. marcescens* infection after TKA and its successful management by two

rounds of debridement, antibiotics, implant retention (DAIR), and culture-guided antimicrobial therapy.

Case Report

A 72-year-old woman was referred to our hospital for surgery because of severe and progressive left knee pain for the past decade. Her pre-operative ADLs ranged from walking with a single cane to walking with a silver car. Her medical history included diabetes mellitus, with a glycosylated hemoglobin level of 7.6%. Pre-operative radiographs of the right lower extremity were shown (Fig. 1).

The patient was placed under general anesthesia, and iodine was used to disinfect the knee area during surgery. TKA was

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Author's Photo Gallery



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Figure 1: Pre-operative X-rays. (a) Frontal view, (b) Lateral view, (c) Axial view, (d) Entire length of the right lower extremity.

performed using a medial parapatellar approach (Fig. 2). The operative time was 1 h and 39 min, and an air tourniquet was used to avoid massive bleeding. Cefazolin sodium was given intra-operatively as a single dose of 2 g intravenously and was continued post-operatively at an infusion dose of 3 g/day for 3 days. On post-operative day 6 (POD), increased exudates and erythema on the wound and fever were noted. Blood tests revealed a normal white blood cell count (7.47×10^3 cells/ μL) and neutrophil count (5.93×10^3 cells/ μL), but an elevated C-reactive protein (CRP) level at 19.51 mg/dL, indicating an increased inflammatory response. Examination of the joint fluid was positive for α -defensin [4, 5].

Considering the extremely high possibility of infection, the patient underwent an initial cleaning procedure after obtaining

samples for culture studies. Surgery was performed by opening the previous skin incision. Intra-operatively, tissue perfusion was poor in some areas, but abscess formation was scant, and contaminated tissues were removed as much as possible. The soft tissue and other replaceable inserts were replaced, and a drain was placed. At our hospital, the antimicrobial regimen for SSIs is an intravenous three-drug combination of linezolid (LZD) to cover MRSA; tazobactam/piperacillin hydrate to cover gram-positive and gram-negative bacteria, especially *Pseudomonas aeruginosa*; and clindamycin (CLDM) to address the possibility of intracellular transfer of bacteria [6]. Post-operatively, the patient was started on infusions of the following antimicrobials: 600 mg of LZD 2 times daily, 4.5 g of tazobactam/piperacillin hydrate 3 times daily, and 600 mg of CLDM 3 times daily.

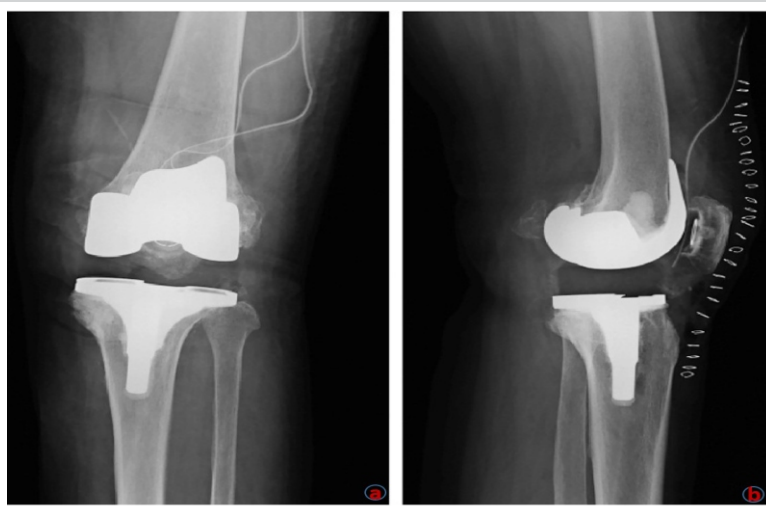


Figure 2: Post-operative X-rays. (a) Frontal view, (b) Lateral view.

The culture results from the initial surgery became available only on POD 12 and revealed *S. marcescens*. At this time, the drainage increased, and a fever of 38°C appeared (Fig. 3a). In addition, the CRP level was 9.7 mg/dL, and the white blood cell and neutrophil counts increased to 9.11×10^3 cells/ μL and 7.95×10^3 cells/ μL , respectively. The presence of erythema around the wound and purulent drainage indicated that the TKA infection had not completely subsided and had even worsened. With the identification of the causative organism, retreatment with DAIR was deemed likely to be effective. The same skin incision site was used for the procedure. After obtaining joint fluid for culture examination, further washing and debridement were performed.



Figure 3: Course of the knee wound after total knee arthroplasty. (a) During the second cleaning procedure on POD 12, redness is observed around the wound. (b) On POD 34, the drain is removed, and the stitches are partially removed. There is less amount of fluid. (c) On POD 126, the wound is completely closed. POD, post-operative day.

Considering reinfection, the area was washed with 10 L of saline solution, and hemochromatic tissues were removed as much as possible. The implant was not loosened and was retained, but the insert was replaced, and a drain was placed. Culture-guided antimicrobial treatment with intravenous levofloxacin and sulfamethoxazole was administered. After the second cleaning, the CRP level rapidly decreased.

After the detection of *S. marcescens*, DAIR led to a rapid decrease in the CRP level. Four weeks after the initial TKA, the CRP level decreased to 0.8 mg/dL. Subsequently, all antimicrobials were switched to oral therapy. At 34 days after TKA, the wound (Fig. 3b). At 16 weeks after TKA, the CRP level further decreased to 0.03 mg/dL, and the symptoms of erythema and burning sensation gradually improved. The

wound was completely closed (Fig. 3c), and the patient was able to walk with a silver car for short distances. The entire course after TKA is shown in Fig. 4. There was no recurrence of infection at the time of the last follow-up, 2 years after TKA.

Discussion

S. marcescens is a gram-negative rod bacterium that is widely distributed in water and soil [1] and is characterized by resistance to many antimicrobial agents [7, 8]. It has been reported to cause some nosocomial infections in pregnant women and at neonatal intensive care units [9, 10], but it more commonly causes opportunistic infections in immunocompromised patients [11]. In Japan, more than

110,000 cases of hip replacement are performed annually [12], and the reported incidence of deep SSI after initial arthroplasty was 2.2% (40 of 1837 cases) [13]. Furthermore, culture studies of 50 superficial SSI cases after orthopedic surgery revealed that most of these infections were caused by gram-positive bacteria, with *Staphylococcus aureus* accounting for 64% [14]. Patient factors, such as body mass index and history of diabetes [15, 16], and environmental factors, such as surgical environment and hygiene

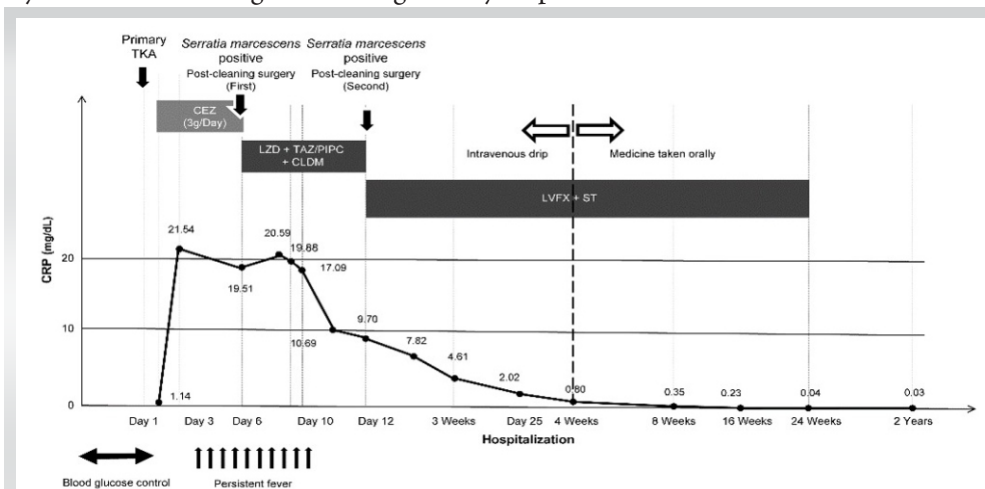


Figure 4: Post-operative antimicrobials and the course of inflammatory reactions. The patient received intravenous antibiotics for 4 weeks after the initial operation and went in remission during oral antibiotic intake.

techniques, have been considered to increase the risk for periprosthetic infections [17]. In the study by Anagnostakos et al. on 165 cases of periprosthetic infections after total hip arthroplasty and TKA, 2 (1.4%) were caused by *S. marcescens* [18]. In that report, the choice was a two-stage treatment, but the details of the treatment were not provided, except for the use of ciprofloxacin. There had been only one case report on *S. marcescens* infection in an artificial knee joint [19]. Although epidural abscesses [20] and osteomyelitis [21] caused by *S. marcescens* have been previously reported, there have been no reports of *S. marcescens* infection after TKA in Japan.

Because this patient had underlying diabetes mellitus, the risk of infection was presumably high. In addition, this case was resistant to the drugs for gram-positive bacteria, which are commonly targeted during the peri-operative period. *S. marcescens* is known to be resistant to penicillins and first-generation cephalosporins but has good susceptibility to third- and fourth-generation cephalosporins, carbapenems, quinolones, and tetracyclines [22]. Similarly, in this case, the culture studies revealed resistance to first- and second-generation cephalosporins. If cephalosporins are ineffective, a change in therapy should be considered. One-stage surgery has been reported to yield satisfactory results for post-arthroplasty infections [23]. At our institution, if there is no implant loosening, we employ DAIR to preserve the implant and replace components as necessary. Early cleaning procedures are usually performed, and ineffective pre-operative antimicrobials are changed as appropriate. Long-term administration of antimicrobials has gained positive opinions in terms of effectiveness [24] and, in this patient, resulted in remission and

no recurrence. This case was considered valuable to report because it described the early diagnosis of a *Serratia* infection after TKA in a patient with poor immune status and the successful use of DAIR for remission without implant removal. Considering the physical burden on the patient, our policy is to perform a two-stage surgery after filling the cement bead using antimicrobials if the infection recurs for the 3rd time. In general, repeated DAIR is not recommended because of its low success rate [25], but it may have value if the causative organism can be identified for appropriate changes to the antimicrobial agents.

Conclusion

S. marcescens infection after TKA has not been reported in Japan and is considered rare. In cases of active infection, antimicrobial therapy that targets only gram-positive bacteria is likely ineffective and should include coverage for gram-negative bacteria, including *Serratia* species. In this case, remission of *S. marcescens* infection was achieved without the need to remove the implant by cleaning, debridement, and the use of sensitive antimicrobial agents.

Clinical Message

S. marcescens infection after TKA is considered rare and has not yet been reported in Japan. Although DAIR is generally not recommended because of its low success rate, it can be useful to determine whether the pathogen can be identified for appropriate antimicrobial treatment.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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