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A late-onset infection after total knee arthroplasty cured without the revision of the femoral and tibial components: A case report

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Abstract
Prosthetic joint infection is a complication of total knee arthroplasty (TKA), which needs to eradicate the infection. Management of infected TKA includes debridement, antibiotics administration, implant retention (DAIR), one- or two-stage revision arthroplasty, arthrodesis, and amputation. Usually, DAIR or two-stage revision joint replacement surgery is needed.
A case of a late-onset infection following TKA that was effectively treated with a two-stage surgery was described. The first operation included curettage of infected bone and cement and filling of the defect with antibiotic-containing cement in addition to soft tissue debridement. One month later, fresh antibiotic-containing cement was filled after the cement was removed, and a polyethylene insert was seated. The infection subsided without revision of the femoral and tibial components, and furthermore, the recurrence of the infection was eradicated in the long term. We recommend not only debridement of soft tissue but also curettage of infected bone and cement as an addition to the DAIR procedure.

Keywords: Knee, infected arthroplasty, late infection, implant retention

Introduction
Prosthetic joint infection is a complication of total knee arthroplasty (TKA), which needs to eradicate the infection. Management of infected TKA includes debridement, antibiotics administration, implant retention (DAIR), one- or two-stage revision arthroplasty, arthrodesis, and amputation [1, 2]. Usually, DAIR or two-stage revision joint replacement surgery is needed.
The DAIR procedure involves removing the polyethylene tibial insert, performing debridement and lavage, inserting a new tibial insert, closing the wound, and administering antibiotics [1-3].
If the infection is resolved while the artificial joint is still in place, the surgery will be less invasive, shortening the treatment period, reducing costs, preserving bone stock, fewer complications, and maintaining knee joint functionality [1, 2].
DAIR has a success rate of 20%-80% [1-3, 4, 5]. Rheumatoid arthritis, diabetes, obesity, urinary tract infections, undernutrition, corticosteroid use, delay in treatment of infection, and infective organism, particularly methicillin-resistant *Staphylococcus aureus* are preoperative risk factors [1, 2, 4-6].
DAIR is not recommended for late-onset hematogenous infection [2, 3, 7]. From 1997 to 2011, we performed 487 TKAs in patients with rheumatoid arthritis and osteoarthritis [8, 9]. No patient developed the acute infection within one year after surgery. Four cases of late-onset infection occurred to us, although none of them underwent DAIR.
Soft tissue debridement and bone and cement curettage were performed for late-onset infection in an 81-year-old patient with osteoarthritis who underwent TKA. A new antibiotic-containing cement was filled and a polyethylene component was inserted a month later. We report a case in which eradication of infection has been obtained for approximately 4.5 years.

Case report
An 81-year-old man with controlled diabetes received the primary cemented TKA (Genesis 2, CR, Smith & Nephew, Memphis, TN, USA) on the right knee on August 22, 2016. He began to feel discomfort and swelling in his right knee on November 20, 2017. Body temperature was 37.5 °C. Knee range of motion was −5°–60°. The knee joint puncture yielded 40 cc of fluid, which was ocher yellow and turbid.

A radiolucent zone was visible in the medial tibial component of his right knee on an X-ray. However, no significant change was observed compared to last year's (Figure 1). Bacteriological examination of aspirate fluid detected methicillin-sensitive *Staphylococcus aureus* (MSSA) which was sensitive to almost all antibiotics. C-reactive protein (CRP) was 29.41 mg/dL, white blood cell (WBC) count was 11,600/μL, erythrocyte sedimentation rate (ESR) (1 hour value) was 51 mm, blood sugar level was 157 mg/dL according to the results of the blood test. The patient refused surgical treatment. Therefore, he was hospitalized on the same day and started intravenous drip infusion of cefazolin sodium 2 g three times a day for 14 days. After that, he also received rifampicin 150 mg twice daily and levofloxacin hydrate 500 mg orally once daily until March 5, 2018. On December 7, the bacterial culture of joint fluid was negative, the symptoms of the right knee joint improved, and the patient was discharged.

On March 20, 2018, the patient again experienced pain, swelling, and warmth in his right knee. A blood test showed WBC 6800/μL and CRP 12.0 mg/dL. MSSA was discovered by bacteriological analysis of a right knee aspirate. An X-ray revealed a bone erosion with an enlarged radiolucent zone under the medial basement plate of the tibial component and in the posterior femoral component (Figure 2).

On April 13, the patient underwent debridement surgery on the right knee. On the intra-articular surface, there was white-yellow necrotic tissue along with thicker, congested synovial-like tissue. However, the posterior cruciate ligament was not injured. Therefore, the polyethylene insert was removed, and an extensive curettage was performed. Between the prosthesis and bone tissue on the medial and lateral facet of the posterior femoral condyles as well as between the medial baseplate of the tibial component and cement, contaminated soft brown tissue invaded. The bone and bone cement surrounding the soft tissue were removed with a chisel and sharp spoon. Then, the joint had a thorough lavage. The medial tibia bone defect, the space where the polyethylene insert was removed, and the bone defects of the posterior femoral condyles were filled with 40 g of bone cement that was combined with 1 g of gentamicin sulfate and 4 g of vancomycin hydrochloride (Figure 3). After surgery, a suction tube was placed for 24 hours. A bacterial examination of the soft tissues and bone biopsies taken at surgery detected MSSA, which was sensitive to almost all antibiotics.

Following surgery, patients received 100 mg of minocycline hydrochloride every 12 hours and 2 g of cefazolin sodium every 8 hours intravenously for 33days. After the operation, a knee extension brace was applied, and 1/3 weight-bearing walking was permitted.

On May 11, curettage and polyethylene tibial insertion surgery were performed. No infectious signs were observed in the joints. The April 13 surgery's bone cement was removed, and the surrounding deteriorated tissue was debrided. Gentamycin bone cement (Depuy Synthes) was filled into the bone defect after irrigation. A 9 mm thick tibial insert was seated. The stability of the artificial joint was satisfactory.

After surgery, 150 mg of rifampicin twice daily and 500 mg of levofloxacin hydrate once daily was administered from May 17 to November 25. From May 17 to September 9, 100 mg of minocycline hydrochloride was given twice daily.

As for postoperative rehabilitation, full weight-bearing gait and range of motion exercises were started two days after, according to the TKA rehabilitation schedule. On May 20, laboratory data showed CRP 0.1 mg/dL, WBC 4300 cells/μL, and ESR 2 mm.

On June 6, 2022, he is under follow-up in an outpatient clinic, but no recurrence of infection has been observed. There is no gait disturbance, and the range of motion is the same as it was before infection (0°–110°). A radiograph showed a thicker layer of cement on the tibia and posterior femur (Figure 4).

Discussion

We experienced an 81-year-old diabetic patient with knee osteoarthritis who developed a late-onset infection after TKA. The infection was cured by debridement of the knee joint and revision surgery with the polyethylene tibial insert alone in two stages.

In operation, the extent of debridement was more comprehensive compared to the conventionally DAIR procedure. That is, the suprapatellar pouch, articular space, and bone defect were filled with bone cement containing antibiotics after the polyethylene tibial insert was removed, the soft tissue was debrided, and a portion of the bone and cement were curettage. Then, one month later, the removal of the filling cement and debridement of soft tissues was performed, the defect was filled with gentamicin bone cement, and a tibial insert was seated. The infection subsided without revision of the femoral and tibial components, and furthermore, the recurrence of the infection was eradicated in the long term.

Since the infection is cured while maintaining the artificial joint, there are advantages such as less invasiveness, shorter treatment period, lower cost, preservation of bone stock, fewer complications, and maintenance of knee joint function (1, 2). DAIR is not recommended for late-onset infection due to its low success rate (2, 3, 5, 7). We are unaware of any reports of DAIR operations that include bone or cement curettage.

The success of this case depended not only on the debridement of the soft tissue but also on the curettage of the bone and cement surrounding the infectious soft tissue that invaded the bone marrow. If the amount of cement removed does not result in aberrant prosthesis motion, this surgical treatment is feasible. In cases with a clear zone preoperatively around the circumference of the artificial joint, two-step surgery with removal of the artificial joint should be considered. To ascertain the location and degree of bone curettage, a thorough radiographic study is necessary. Despite its limitations, comparing radiographic images with previous images is the only method to assess infection-induced bone erosion. Moreover, staining the infected tissue with methylene blue might be useful (4).

In this case, a two-stage method was adopted. One-stage procedure might also have a satisfactory result, although future research will be required to substantiate this. We performed oral administration of antibiotics for about six months. Further investigation is required regarding the administration period (1, 10).

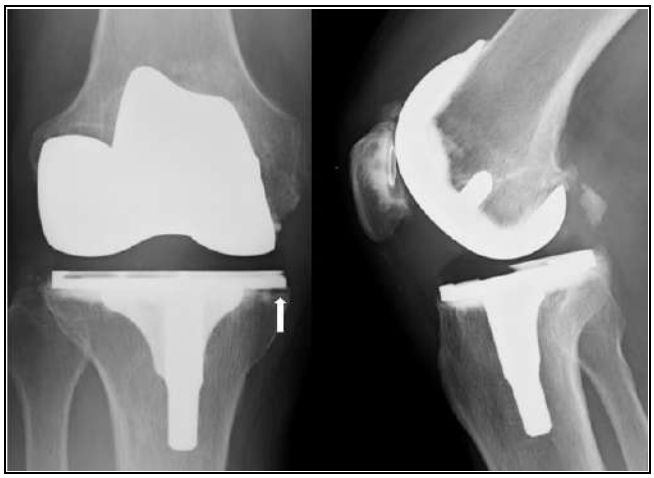

Fig 1: On November 20, 2017, X-ray images of his right knee joint showed a radiolucent zone under the medial basement plate of the tibial component (white arrow), but no noticeable change was observed compared with that taken last year

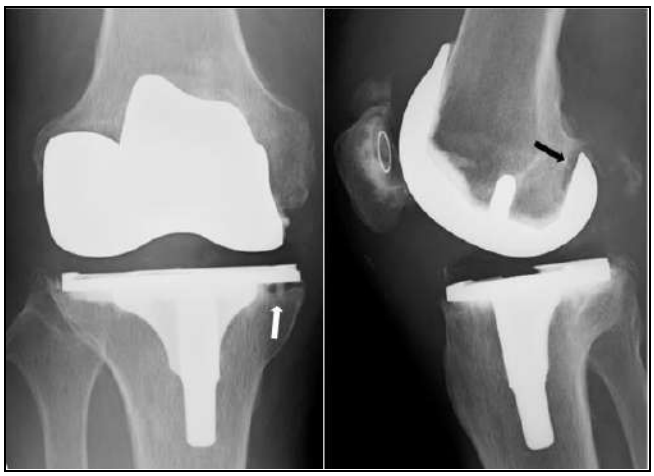

Fig 2: The radiograph was on April 9,2018. Anterior-posterior view of his right knee joint revealed a bone absorption area under the medial basement plate of the tibial component (white arrow), and a lateral view revealed an enlarged radiolucent zone in the posterior femoral component (black arrow)

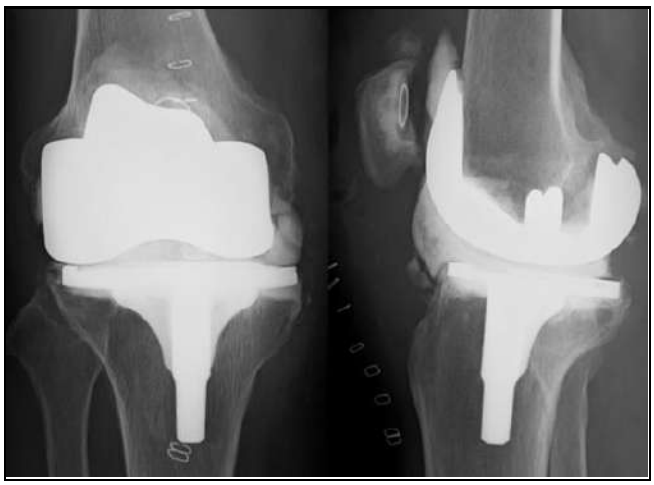

Fig 3: Bone cement containing antibiotics was filled into the bone defect of the medial and lateral condyles of the posterior femur, the bone defect of the medial tibia, and the site where the polyethylene insert was removed

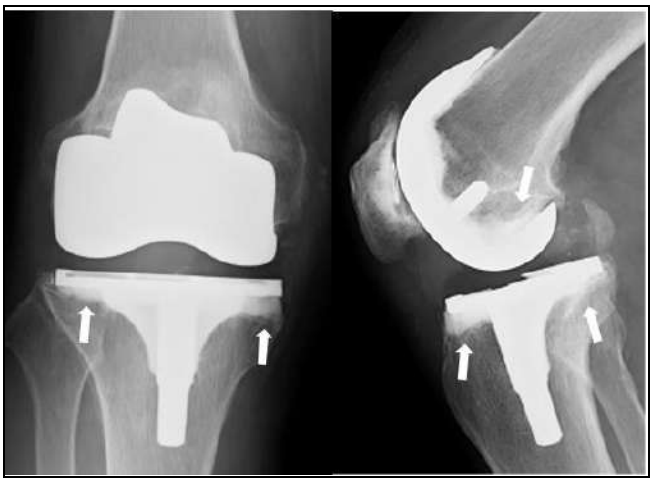

Fig 4: The radiograph was on June 6, 2022. In the AP view, a thicker layer of cement can be seen on the medial and lateral sides of the tibia. In the lateral view, a thicker cement layer can be seen from the front to the back of the tibial baseplate than before surgery. Moreover, thickened cement is observed on the posterior femoral condyle (white arrow)

Conclusion

A case of a late-onset infection following TKA that was effectively treated with a two-stage surgery was described. The first operation included curettage of infected bone and cement and filling of the defect with antibiotic-containing cement in addition to DAIR. One month later, fresh antibiotic-containing cement was filled after the cement was removed, and a polyethylene insert was seated. We recommend not only debridement of soft tissue but also curettage of infected bone and cement as an addition to the DAIR procedure.

Conflict of Interest

Not available

Financial Support

Not available

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