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RESPONSIBLE EDITORS FOR THIS ISSUE
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One-stage revision arthroplasty in a patient with ochronotic arthropathy accompanied by joint infection: A case report

Xiao-Chao Wang, Xiao-Min Zhang, Wan-Ling Cai, Zhen Li, Chao Ma, Yi-Hai Liu, Qi-Lian He, Tian-Sheng Yan, Xue-Wei Cao

BACKGROUND
Ochronotic arthropathy (OcA) is a rare disease, which is caused by the accumulation of homogentisic acid in the joint. Patients with OcA have obvious joint pain and the disease progresses rapidly, eventually resulting in disability. Arthroplasty is an efficacious treatment in patients with OcA. However, when OcA patients have joint infection, is joint replacement an option? In the present report, we performed total knee arthroplasty in a patient with OcA and knee infection under the guidance of one-stage revision theory.

CASE SUMMARY
A 64-year-old male was referred to our hospital due to severe left knee pain with limited mobility for 2 years. On physical examination, the patient was found to have dark brown pigmentation of the sclera and auricle. Laboratory test results showed elevations in C-reactive protein level (65.79 mg/L) and erythrocyte sedimentation rate (90.00 mm/h). The patient underwent debridement of the left knee joint, during which the cartilage surface of the knee joint was found to be black-brown in color. Bacterial culture of synovial fluid revealed Achromobacter xylosoxidans. We then carried out arthroplasty under the guidance of the theory of one-stage revision. After surgery, the patient's left knee joint pain disappeared and function recovered without joint infection.
CONCLUSION

OcA accompanied by joint infection is rare. One-stage revision arthroplasty may be a treatment option for this disease.

Key Words: Ochronotic arthropathy; Arthroplasty; One-stage revision; Alkaptonuria; Homogentisic acid; Case report

INTRODUCTION

Alkaptonuria (AKU) is a rare autosomal recessive hereditary metabolic disease\[1\], resulting from the absence of homogentisate 1,2-dioxygenase (HGD). HGD, an intermediate in the tyrosine degradation pathway, is responsible for the breakdown of homogentisic acid (HGA). As a result of this defect, a large amount of HGA cannot be metabolized normally and accumulates in the body over a long period, resulting in the formation of pigment-like polymers, which are deposited in connective tissue and cause ochronosis\[2\]. In patients with AKU, some HGA is excreted in the urine. Characteristically, excess HGA causes sufferers to pass dark urine, which upon standing turns black. Some HGA is also deposited in a variety of connective tissues, such as cartilage, sclera, and tendons, resulting in blue-black tissue changes, causing local lesions. Typically, the pigment is clearly seen in the sclera and auricle of patients. The disease usually progresses from simple AKU to alkaptonuric ochronosis and finally to ochronotic arthropathy (OcA)\[3\]. With advancing age, renal excretion of HGA decreases, and the accumulation of HGA gradually increases in the body. HGA can damage articular cartilage and cause joint degeneration, leading to OcA. The disease first affects the spine and then the peripheral joints. The patient’s symptoms usually begin around the third or fourth decade with low back pain and stiffness\[4\]. In the peripheral joints, the knee is most commonly involved, followed by the hip and shoulder\[5\]. OcA develops rapidly and tends to result in disability within a short time.

A literature review showed that arthroplasty in patients with OcA can be a good treatment choice\[6\]. However, arthroplasty for the treatment of OcA with joint infection has not been reported in the literature. Periprosthetic infection (PJI) is a catastrophic complication after arthroplasty, and two-stage exchange arthroplasty is the most common operation for patients with PJI\[7\]. However, the cost of this treatment is high\[8,9\], the mortality and morbidity rates are high, and the long-term function is poor\[10\]. A study found that by selecting appropriate patients and optimizing surgical procedures, one-stage exchange arthroplasty has significant benefits for patients with joint infection\[11\]. Zahar et al\[12\] found that the success rate of one-stage exchange arthroplasty was approximately 85%-90%. Based on the theory of one-stage revision, we treated a patient with OcA accompanied by knee infection with arthroplasty, and achieved satisfactory clinical results.

CASE PRESENTATION

Chief complaints

A 64-year-old man was admitted due to left knee pain and limited mobility.
**History of present illness**
The patient presented with left knee pain and limited mobility 2 years ago. He visited a local hospital several times and was diagnosed with left knee osteoarthritis. His left knee pain was only relieved by oral analgesics. His symptoms improved with medication, and relapsed when the analgesics were stopped. During the past 2 years, his symptoms gradually progressed. The patient was admitted to our department 4 mo prior with severe pain in the left knee and limited knee motion.

**History of past illness**
The patient had hypertension, but he did not take medicine regularly in the last month.

**Personal and family history**
The patient had no relevant personal or family history.

**Physical examination**
Dark-brown pigment was clearly seen in the sclera and ears of the patient (Figure 1). The patient’s spine was stiff, and a major reduction in movement of the vertebral column was noted. Atrophy of the left quadriceps femoris and slight swelling of the left knee were observed. The left knee had a flexion contracture of 10°, and the range of motion of the left knee was 10° (extension) to 90° (flexion). The left knee patella grinding test and McMurray sign were positive.

**Laboratory examinations**
Routine blood tests were normal and showed the following results: White blood cell count: $6.14 \times 10^9$ L$^{-1}$; neutrophils: 63.9%; hemoglobin: 104 g/L; platelet count: $310 \times 10^9$ L$^{-1}$. C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were elevated at 65.79 mg/L and 90.00 mm/h, respectively.

**Imaging examinations**
Radiographic evaluation revealed that the patient’s left knee joint showed a similar appearance to that of osteoarthritis, such as joint space stenosis and osteophyte formation (Figure 2). Magnetic resonance imaging of the knee showed bone marrow edema (Figure 3).

**Further diagnostic work-up**
We first carried out debridement of the left knee. During surgery, it was found that the cartilage of the knee joint was black-brown in color and there was a lot of synovial fluid in the joint cavity. We collected the synovial fluid for bacterial culture and the results showed the presence of *Achromobacter xylosoxidans* (*A. xylosoxidans*).

**FINAL DIAGNOSIS**
The final diagnosis in this patient was OcA and left knee infection.

**TREATMENT**
We decided to carry out arthroplasty immediately under the guidance of the theory of one-stage revision. The patient underwent left cementless total knee replacement. During the operation, we found that all cartilage surfaces of the patient’s left knee joint were black-brown (Figure 4), and a large amount of normal saline and iodophor were used to wash the joint cavity. We collected the synovial fluid for bacterial culture and the results showed the presence of *Achromobacter xylosoxidans* in synovial fluid.

**OUTCOME AND FOLLOW-UP**
The patient’s left knee pain was considerably relieved after surgery, and he was able to walk the day after surgery. One week postoperatively, the anteroposterior and lateral radiographs of the left knee joint showed that the prosthesis was in a good position (Figure 5). Routine blood tests, CRP and ESR were monitored after surgery. Both ESR and CRP decreased gradually, and eventually returned to normal. After 4 mo of postoperative follow-up, the patient’s left knee joint function was normal without pain, and both ESR and CRP were normal.
DISCUSSION

AKU is an extremely rare disease that most clinicians have not seen before. The worldwide prevalence of AKU is 1 case in 250000-1000000 births[13]. It has three distinct clinical features: homogentisic aciduria, ochronosis, and ochronotic osteoarthropathy[14]. Patients initially have asymptomatic black urine, which has no significant impact on their life. They are usually over 40 years old when joint symptoms develop[15]. At this time, it is easy to misdiagnose OcA as osteoarthritis. The pathological changes due to knee osteoarthritis are characterized by degeneration of articular cartilage and periar-
ticular hyperosteogeny. Inflammatory indicators such as ESR and CRP are generally normal. The main symptoms are knee pain and limited mobility. The pain is often dull, involving the whole knee or more localized, increases with joint use, and abates with rest[16]. Rheumatoid arthritis, which is a chronic, systemic inflammatory disease, frequently causes knee joint lesions. The most prominent feature is symmetric pain and swelling of the hands, wrists, feet, and knees (polyarthritis)[17]. Knee joint lesions are often accompanied by systemic symptoms such as low-grade fever, anemia, and weight loss.

Arthroplasty is an effective treatment in patients with OcA[18]. Ozmanevra et al[6] reviewed 13 studies on OcA. In the study, 21 cases of OcA were treated with arthroplasty, and achieved excellent clinical efficacy. However, no study has reported the use of arthroplasty in the treatment of patients with OcA and knee infection. A. xylosoxidans is a gram-negative aerobic bacterium that was first described in 1971[19]. This bacterium has been identified as the cause of meningitis, pneumonia, central catheter infection, sepsis, mediastinitis, and other diseases[20,21]. It was found in our patient's knee joint, which is rare. This species is drug-resistant and widely distributed in both indoor and outdoor environments, especially in humid areas[22]. Elderly people living at home can be affected by the bacterium. The patient's infection with A. xylosoxidans may have been related to living in an old neighborhood.

PJI is a common complication after joint replacement, which is difficult to treat. There are many surgical strategies for the treatment of PJI, including surgical debridement and retention of a prosthesis, one-stage exchange arthroplasty or two-stage exchange arthroplasty. One-stage exchange arthroplasty is a method used to treat patients with a joint infection. This method resolves the patient's problem with only one operation, avoiding a second operation. This surgical method has many advantages for
patients, such as early walking, avoiding multiple surgical trauma, cost savings, and resuming daily life at an early date. In patients with OcA, not all have only joint degeneration, and inflammatory indicators such as ESR and CRP can also be elevated[23]. A study found that the production of HGA products may lead to the activation of inflammatory pathways in patients and an increase in inflammatory factors above normal levels[24]. Compared to patients with osteoarthritis, if examination results in OcA patients show increased inflammatory factors, then the possibility of infection is greatly increased. Our patient with OcA had left knee joint infection, and combined with the theory of one-stage revision, total knee arthroplasty was performed in this patient. Postoperative inflammatory indicators such as white blood cell count, ESR, and CRP decreased gradually, and finally returned to normal. At the patient's review 4 mo after surgery, we observed that the left knee joint incision had healed well, local skin temperature was normal, and the range of motion of the left knee joint was 0°-110°. In addition, pain in the left knee joint had disappeared.

In this case, the short-term effect after operation was satisfactory. However, the follow-up period was short, and additional long-term follow-up is needed to clarify the long-term efficacy of this treatment.

CONCLUSION

We report a patient who developed OcA and left knee joint infection. This disease is rare, but should not be overlooked by clinicians. It is easily misdiagnosed as osteoarthritis, but it has clinical manifestations different from arthritis. Under the guidance of the one-stage revision theory, we treated a patient with OcA accompanied by knee infection with arthroplasty, and achieved satisfactory clinical results. This approach can be applied in patients with OcA and joint infection.

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FOOTNOTES

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