

CASE REPORT

Infection of a prosthetic knee joint with *Clostridium bifermentans*

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Abstract

We present the first reported case of prosthetic joint infection caused by *Clostridium bifermentans*, which was treated with total joint washout and debridement allowing for the patient to retain his prosthesis and achieve full recovery. *Clostridium bifermentans* is a gram-positive, anaerobic, spore-forming bacterium. This organism was once considered to be non-pathogenic, but has recently been associated with cases of septic arthritis, empyema, osteomyelitis, soft tissue infection, brain abscess, bacteremia and endocarditis.

INTRODUCTION

Clostridium bifermentans is a gram-positive, anaerobic, spore-forming bacterium. It is a commensal in the gut, oral cavity and female genital tract and can be found in soil, sewage, feces and marine sedimentations [1]. This organism was once considered to be non-pathogenic, has recently been found to be associated with septic arthritis, empyema, osteomyelitis, soft tissue infection, brain abscess, bacteremia and endocarditis [1, 2]. A review of literature demonstrates one reported case of septic, non-prosthetic, joint infection caused by isolated *C. bifermentans* in an 18-year-old after meniscectomy [3]. We present the first reported case of prosthetic joint infection (PJI) caused by isolated *C. bifermentans*.

CASE REPORT

A 67-year-old man with past medical history of hypertension, degenerative joint disease, bilateral knee replacement in 2003

and substance abuse with recent history of trauma to his face and chest wall during an altercation presented for new-onset lightheadedness and fatigue.

In the emergency department, laboratory evaluation revealed a leukocytosis of $27 \times 10^3/\mu\text{l}$, hemoglobin of 10.2 g and a venous lactic acid of 2.4 mol/l. A noncontrast computerized tomography of the patient's chest/abdomen/pelvis revealed intramuscular and subpectoral hematoma in the right chest wall with extrapleural extension into the chest, measuring up to 17 cm in length, with acute right second through fifth anterior rib fractures and bilateral lower lobe bronchopneumonia. Blood cultures were obtained, and the patient was started on empiric antibiotics with intravenous piperacillin–tazobactam. The patient was afebrile; however, he was hypotensive with blood pressure of 60/40 mmHg and admitted to the intensive care unit for suspected septic shock and initiation of vasopressors. On Day 2 of hospitalization, antibiotics were broadened to intravenous vancomycin, cefepime and metronidazole as the patient had not improved. In addition, repeat blood, urine and sputum cultures

Received: May 25, 2020; Revised: June 7, 2020; Accepted: June 9, 2020

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were obtained. Blood and urine cultures resulted as negative, and sputum cultures grew methicillin-resistant *Staphylococcus aureus*. Antibiotics were narrowed to intravenous vancomycin on Day 4 of hospitalization.

Five days after initial presentation, the patient complained of left knee pain with notable swelling on physical exam. Due to concern for infection of his prosthetic knee joint, a sterile left knee aspiration was performed on Day 5 of hospitalization. The synovial fluid was cloudy, amber colored and demonstrated white blood cells of $9.28 \times 10^3/\text{mCL}$, $6.0 \times 10^3/\text{mCL}$, and calcium pyrophosphate crystals. The patient underwent a complete washout and debridement of the joint with retention of the prosthesis on Day 6 of hospitalization. The operative note described an infected knee with purulence. Five cultures from the infected area were obtained, including joint specimen, tissue specimen and fluid specimen that were cultured in anaerobic and aerobic media. The antibiotic regimen was then transitioned to intravenous cefazolin on postoperative Day 1, hospitalization Day 7, before the cultures resulted.

After 96 hours, two sets of cultures, from the joint and tissue, grew *C. bifermentans*. The patient's antibiotic regimen was then transitioned to intravenous ampicillin-sulbactam for 2 weeks, to be followed by oral suppression with amoxicillin-clavulanic acid for 6 months. To evaluate for the source of infection, a contrast computerized tomography scan of the abdomen was ordered, which was negative. The patient was also assessed for possible immunodeficiency with human immunodeficiency virus screening, which was negative. The patient continued to clinically improve and was discharged to a rehabilitation facility, 16 days after admission, with a referral to gastroenterology for outpatient colonoscopy.

Following 3 months of physical therapy, the patient followed up with internal medicine. The patient had recovered full range of motion of his left knee and had no signs of lingering joint or systemic infection. The patient was still taking Augmentin at the time of follow-up and reported medication adherence. The patient had not yet opted to undergo colonoscopy to investigate for source of infection.

DISCUSSION

Clostridium bifermentans is one of 200 clostridium species that have been identified. Of the 200 species, only 20 have been noted to cause clinical infection. *Clostridium bifermentans* was once considered to be non-pathogenic, but has recently been associated with cases of septic arthritis, empyema, osteomyelitis, soft tissue infection, brain abscess, bacteremia and endocarditis. One case report documents septic arthritis of the knee in an 18-year-old, which occurred 13 days after meniscectomy procedure to the knee. In this case, the patient underwent arthrotomy and debridement of the joint and was treated with intra-articular and intravenous penicillin for a week. The patient was then discharged on oral penicillin for 2 weeks [3]. PJI with *C. bifermentans* has never been reported in the past, and therefore, there is no specific treatment.

Debridement, antibiotics and implant retention (DAIR) procedure was selected to treat the patient due to the presence of a stable, well-fixed implant with no signs of mechanical loosening or sinus tracts and the uniform susceptibility of *C. bifermentans* to antibiotics [4]. The Infectious Diseases Society of America guidelines for DAIR procedure for treatment of biofilm-associated bacterial infection recommend 2 weeks of intravenous antibiotics

followed by 6 months of oral antibiotics [5]. The purpose of continuing antibiotics for 6 months is to prevent recurrence of infection. *Clostridium bifermentans* is a spore-forming bacterium and is resistant to antibiotics when in spore form and suppressive antibiotics will only effectively kill vegetative bacteria. Another method of treatment to prevent recurrence would be to suspend antibiotics for 3 days to allow spores to colonize and then resume the antibiotics to treat the vegetated bacteria. Of note, data show a 4-fold increased risk of treatment failure when suppression is discontinued [6]. The risk of treatment failure is greatest in the first 4 months after discontinuing oral antibiotics [6]. Thus, this patient is at a great risk of recurrence and will need close follow-up to ensure eradication. If the patient does not respond to the antibiotic regimen or has recurrence he may require a two-stage arthroplasty [4].

PJI with *C. bifermentans* has never been reported. This case demonstrates treatment of the joint with DAIR, allowing for the prosthesis to be retained without complication in the immediate postoperative period. Further case reports and long-term outcome follow-up of this case and future cases is essential to determine if DAIR will successfully treat PJI with *C. bifermentans*.

CONFLICT OF INTEREST STATEMENT

None declared.

ETHICAL APPROVAL

Ethical approval not applicable.

CONSENT

Informed patient consent was obtained using a patient consent form, which is available upon request.

GUARANTOR

Lisa F. Barrett.

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