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Case Report

Bilateral knee prosthetic joint infection: a case report

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ABSTRACT

Bilateral prosthetic joint infection (PJI) is considered rare and its treatment can be challenging. We present this case report of a 70-year-old male with acute presentation of simultaneous bilateral knee prosthetic joint infection. Initially managed with debridement and implant retention with six weeks of intravenous antibiotics. Six months later presented with left knee pain and swelling with investigations showing left knee prosthetic joint infection and was taken for staged revision arthroplasty. Three weeks following staged revision surgery patient presented with left knee progressive pain and open sinus which then was taken for debridement and polyethylene exchange followed by six weeks of intravenous antibiotics. This case report highlights the prevalence, etiologies and risk factors of simultaneous bilateral PJI. Also discussing available treatment options, antimicrobial therapy durations and some encountered difficulties like infection recurrence.

Keywords: Antimicrobial therapy, Culture negative prosthetic joint infection, Debridement and implant retention, Hematogenous spread, Infected total knee replacement, Infection recurrence, Prosthetic joint infection, Staged revision arthroplasty

INTRODUCTION

Prosthetic joint infection (PJI) remains one of the most challenging complications following primary knee arthroplasty. The incidence of knee PJI is ranging from one to two percent.[1,2] Several risk factors have been identified which predispose to PJI, including immunocompromised patients, morbid obesity, smoking and medical comorbidities like diabetes and chronic kidney disease. The exact etiology may be related to direct invasion, local dissemination or hematogenous spread, with the common isolated organisms being *S aureus*, *S epidermidis*, Coagulase-negative staphylococcus and fungal pathogens like *Candida albicans*.[3] Bilateral knee prosthetic joint infection is considered rare, with few studies describing the simultaneous involvement of both knees at presentation. It has been reported that one to four percent of all PJIs can present simultaneously with limited data regarding the etiology and treatment guidelines.[4] We present this case report of an old male with acute presentation of bilateral infected total knee arthroplasty to describe the surgical intervention and the duration of antimicrobial therapy in addition to the hypothesized etiology of hematogenous spread.

CASE REPORT

This is a 70-years-old male came with three days history of bilateral knee pain and difficult ambulation, with history of preceding upper respiratory tract infection (URTI) six days from his presentation which was treated with five days course of oral Amoxicillin. Patient reported no history of fever, trauma, previous knee pain, exposure to brucellosis, recent dental work, recent hospitalization, urinary or gastrointestinal symptoms. His past medical history was significant for diabetes, hypertension, chronic kidney disease (CKD) stage-3 and chronic obstructive pulmonary disease (COPD). Patient

underwent right total knee arthroplasty two years ago and left total knee arthroplasty seven years ago. Laboratory studies illustrated in Table 2. Knee radiographs showed no periosteal reaction, osteolysis, bone resorption or implant loosening.[5-7] Knee aspiration was done under sterile technique for both sides draining around 40 ml of clear pus from each knee, samples were sent for cell count, gram stain, culture and sensitivity as shown in figure 1. Results are showed in Table 2. Given the symptoms duration and the laboratory results, diagnosis of bilateral knee prosthetic joint infection was confirmed as per the MSIS criteria.[8]

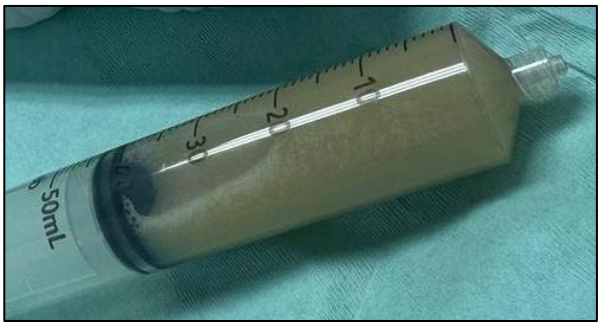

Figure 1: Joint aspiration from both knees showing clear pus.

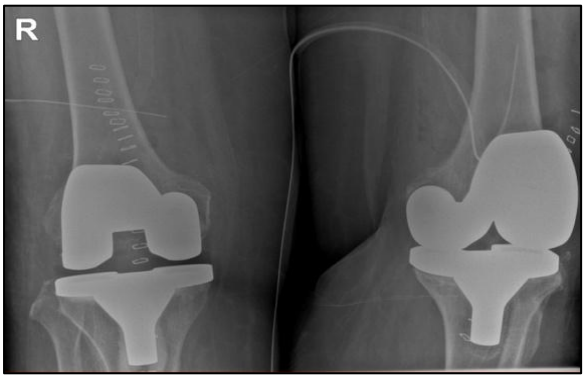

Figure 2: AP X-ray of both knees following DAIR surgery showing intracapsular drains. Also showing no signs of implant loosening, bone resorption or periosteal reaction.

Figure 3: a) AP and lateral X-ray of the left knee following first stage revision TKR with cement spacer. b) AP and lateral X-ray of the left knee following second stage revision TKR with cementless hinged prosthesis.

Surgical intervention

Patient was consented for bilateral knee irrigation and debridement with polyethylene exchange. After prepping and draping of both lower limbs, starting with the left knee given its lower cell count of synovial WBC, utilizing the same surgical scar for medial parapatellar approach. Upon opening the joint capsule clear pus drained out, tissues were healthy and implant was in place with no signs of loosening. Irrigation and debridement were done with exchange of polyethylene and closure of the wound after inserting intracapsular drain. Same procedure was done to the right knee which showed same findings of clear pus drainage, healthy tissues and stable implant. Irrigation and debridement with polyethylene exchange was done, wound closed after intracapsular drain insertion as shown in Figure 2. Multiple intraoperative tissue, bone and fluid samples were taken from each knee and sent for culture and sensitivity.

Postoperative care

Patient was started empirically on intravenous cefazolin 1g twice daily as the dose was adjusted according to his creatinine clearance. Clinically, patient was showing improvement from first week post operatively, with controlled knee pain and stable vital signs, started physiotherapy for mobilization and range of motion from third postoperative day, knee range of motion improved to 0-90 degrees of flexion and was mobilizing full weight bearing with walker frame assistance. The result of microbiologic examination was negative on the fifth postoperative day. Both drains were draining around 50-100 ml/24 hours, which were both removed after 10 days as the drain output reached minimal. Inflammatory markers were monitored and repeated twice weekly showing gradual improvement. The patient was discharged from the hospital after completing six weeks of intravenous antibiotics with CRP level of 22.6 mg/dl.

Early follow-up

Upon follow up visit six weeks after discharge, patient's general condition improved with no knee pain and was able to mobilize with no assistance, inflammatory markers were trending down. Patient was seen in clinic frequently and was doing well, he was mobilizing pain-free with no assistance and both knees range of motion 0-110 degrees of flexion.

Long follow-up

In his postoperative six months visit, patient reported left knee pain and swelling for one week duration, his CRP level was 138 mg/dl. Joint aspiration was done and showed high WBC count with negative culture result, a decision of staged left knee revision arthroplasty was offered and commenced. Patient underwent left knee implant removal and cement spacer application as shown in Figure 3a, received six weeks of IV antibiotics

followed by a three months period off-antibiotics while patient was pain-free and CRP levels were trending down to 23 mg/dl. A second stage revision surgery with cementless hinged total knee replacement was done, patient was showing marked improvement and discharged home in good condition after six days of IV antibiotics. Final x-rays are shown in Figure 3b. During his third postoperative week following staged revision surgery, patient reported left knee progressive pain, examination revealed dehiscence of distal surgical wound and draining pus sinus. Patient was taken for irrigation and debridement with polyethylene exchange, cultures showed *Escherichia coli* growth which was targeted with six weeks of IV meropenem based on microbiological susceptibility. Patient was discharged later in good condition with healed surgical wound and trending down inflammatory markers. Upon his four weeks and eight weeks postoperative visits, patient was not complaining of knee pain, mobilizing with no assistance and was happy with the outcome.

Table 1: Physical examination findings.

Parameter	Result	Reference range
Heart rate	75 bpm	60-100 bpm
Blood pressure	130/78 mmHg	90/60-120/80 mmHg
Respiratory rate	18 bpm	12-18 bpm
Temperature	36.4℃	36.5-37.3℃
Oxygen saturation	97% RA	95%-100%
General appearance	In pain, no respiratory distress	
Musculoskeletal examination	Both knees swelling, healed surgical scars, warm to touch, diffuse tenderness, range of motion 20-50 degrees, unable to bear weight, intact neurovascular examination. No redness or open sinuses.	

Table 2: Laboratory results.

Test	Result	Reference range
White blood cell count (WBC)	10,400 cells per cubic millimeter	4500-11,000 cells per cubic millimeter
C-reactive protein (CRP)	134 mg/dl	<0.3 mg/dl
Erythrocyte sedimentation rate (ESR)	84 mm/h	0-15 mm/h in men
Right knee synovial WBC	61,500 cells per cubic millimeter	<200-2000 cells per cubic millimeter
Left knee synovial WBC	6000 cells per cubic millimeter	<200-2000 cells per cubic millimeter
Right knee synovial fluid culture	No growth	No growth
Left knee synovial fluid culture	No growth	No growth

DISCUSSION

Risk factors

Several risk factors related to PJI have been described in literature which are present in our patient, including smoking and medical comorbidities like uncontrolled diabetes mellitus and chronic kidney disease.[9,10] Another risk factor is the history of preceding URTI prior to his presentation which was managed with oral antibiotics.[11]

Culture negative PJI

In the current case, microbiological tests including synovial fluid culture and tissue cultures from the first debridement showed no growth. This can be explained by the preceding antimicrobial therapy administration as described in literature.[12] Also, joint aspirations taken during clinic visits and multiple tissue cultures collected during each debridement showed no growth. This made the management of PJI more difficult especially in postoperative antimicrobial therapy regimen. Berbari et al, showed variable prevalence of culture-negative PJI ranging from 7 to 15%.[13]

Etiologies

There are different etiologies of PJI including direct invasion during primary surgery, localized dissemination and hematogenous spread.[14]

As our patient developed infection more than two years after surgery and involving both knees simultaneously, the possible explanation is hematogenous spread providing the history of recent URTI. Valerie et al,

concluded in a retrospective cohort study that although simultaneous PJIs are considered rare, they are often due to hematogenous spread from distant infection.[15]

Debridement, antibiotics and implant retention

Patient was managed as acute bilateral knee PJI during the first presentation with debridement, polyethylene exchange and six weeks of intravenous antibiotics. Many studies showed the efficacy of debridement, antibiotics and implant retention (DAIR) in the setting of acute PJI. This treatment protocol is indicated when the symptoms duration is short in presence of stable implant.[16] The duration of antimicrobial therapy is preferred to be for two to six weeks following DAIR procedure with controversy about oral suppressive antimicrobial therapy upon discharge.[17]

Two-stage revision

On the other hand, multiple studies showed optimum results when treating PJI with Two-stage revision surgery in terms of definitive infection eradication particularly in chronic PJI or acute PJI which failed previous surgical management. Following first stage, patient must be evaluated for signs of active infection with correlation of CRP levels to ensure complete infection eradication for a period of two to six weeks off-antibiotics.[18] Gausden et al, showed unplanned reoperation rate of 25% at one year in patients with simultaneous PJIs.[4] Our patient underwent left knee two-stage revision surgery six months following DAIR as infection recurred. Following the first stage, patient was followed for a period of 14 weeks antibiotic-free during which he showed no signs of ongoing infection with low inflammatory markers. A second stage revision was done after complete infection eradication.

Infection recurrence

Failure after two-stage revision surgery may be due to infection relapse with previous pathogen or a new microorganism. A large study showed that more than two thirds of infections following prior two-stage revision surgeries for PJI are caused by new pathogens rather than relapse infections.[19]

In this case, all previous cultures taken at different times were negative with positive culture following two-stage revision surgery growing *E Coli* for the first time. Managing infections following prior two-stage revision surgery can be done in form of suppressive antimicrobial therapy, DAIR procedure, second revision surgery, resection arthroplasty, arthrodesis or amputation.[20] Our patient underwent DAIR surgery and received six weeks of IV Meropenem. During his hospital stay, patient was showing gradual improvement and was discharged home after complete wound healing and decreasing CRP levels. Upon his postoperative follow up visits until eight weeks, patient was showing marked improvement of his left knee pain and an acceptable CRP level.

CONCLUSION

Bilateral simultaneous knee PJI is considered rare with limited evidence about its incidence or management protocols. Patient's comorbidities play an important role in treating infection as the renal impairment in our case which made major dose adjustments of the antimicrobial therapy. Presence of culture negative PJI will make the management more challenging and need a multidisciplinary approach with individualized management plan. The etiologies of simultaneous PJI vary in each patient, with hematogenous spread being the most common cause.

Management with DAIR was implicated as the implants were stable before proceeding with left knee staged revision surgery as infection recurred. Failure following staged revision surgery is most likely due to a new microorganism which can be managed with suppressive antimicrobial therapy or other surgical options. The duration of antimicrobial therapy is debatable with most evidence showing optimum outcome with six weeks duration following operative intervention. More research is needed in this topic to identify the appropriate treatment protocols and to know the prognosis of such cases which will help in providing the best patient care.

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