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Diagnosing Mycobacterium Kansasii in Shoulder Periprosthetic Joint Infection: A Rare Case Report

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Learning Point of the Article:

Mycobacterium kansasii PJI is rare and often diagnosed late due to slow growth and culture time. Effective treatment involves extended antimycobacterial therapy and two-stage revision arthroplasty. Advanced diagnostic techniques such as PCR and next-generation sequencing are useful but limited by cost and availability.

Abstract

Introduction: Periprosthetic joint infections (PJIs) of the shoulder complicate approximately 0.7% of primary and 15.4% of revision shoulder arthroplasties. Culture-negative PJIs constitute 5–42% of cases, with fungal and mycobacterial pathogens frequently implicated, often following broad-spectrum antibiotics administration prior to tissue sampling. Mycobacteria are isolated in 43% of culture-negative PJIs and associated with advanced age, chronic steroid therapy, immunosuppression, and retroviral infections. Improved diagnostic techniques have increased the isolation and reporting of non-tuberculous mycobacteria. Mycobacterium kansasii infections in native joints and bursae are documented, but only two cases of M. kansasii PJI, both in knee PJI, are reported. This report presents the first case of a shoulder PJI caused by M. kansasii.

Case Report: A 66-year-old female underwent right reverse total shoulder arthroplasty for glenohumeral osteoarthritis in November 2015. Post-operative recovery was initially uneventful, but 7 months later, she experienced persistent shoulder pain following a fall. Imaging confirmed proper component placement without loosening. In April 2017, extensive workup yielded negative results, including erythrocyte sedimentation rate and C-reactive protein. The patient returned in November 2018 with exacerbated pain, swelling, night sweats, and chills. Blood tests suggested no overt inflammation, but X-rays raised concerns of glenoid component loosening. January 2019 surgery revealed extensive synovitis and necrosis; a vancomycin and tobramycin-impregnated spacer was placed. Cultures identified M. kansasii, and the patient was treated with rifampin, azithromycin, and ethambutol for 12 months. Persistent pain led to multiple surgeries, with cultures confirming no infection. In January 2021, after consultation, long-term antimycobacterial therapy was initiated due to presumed recurrence. By June 2021, the patient reported no pain, and radiographs confirmed well-aligned prosthetic components.

Conclusion: M. kansasii PJI, though rare, requires distinct diagnostic and treatment approaches compared to common pathogens. Diagnosis is often delayed due to the organism's slow growth and culture time, necessitating advanced techniques such as polymerase chain reaction and next-generation sequencing. Effective treatment involves extended antimycobacterial therapy and multiple surgeries. This case underscores the importance of monitoring for mycobacterial growth in suspected culture-negative PJIs and employing aggressive surgical and medical therapy to minimize complications.

Keywords: Periprosthetic joint infection, Mycobacterium kansasii, reverse shoulder arthroplasty.

Introduction

Periprosthetic joint infections (PJIs) of the shoulder complicate approximately 0.7% of primary and 15.4% of revision shoulder arthroplasties [1]. Of all PJIs, culture-negative PJIs constitute 5–42% of cases. Fungal and mycobacterial pathogens are frequently implicated in these infections, often following the

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Author's Photo Gallery


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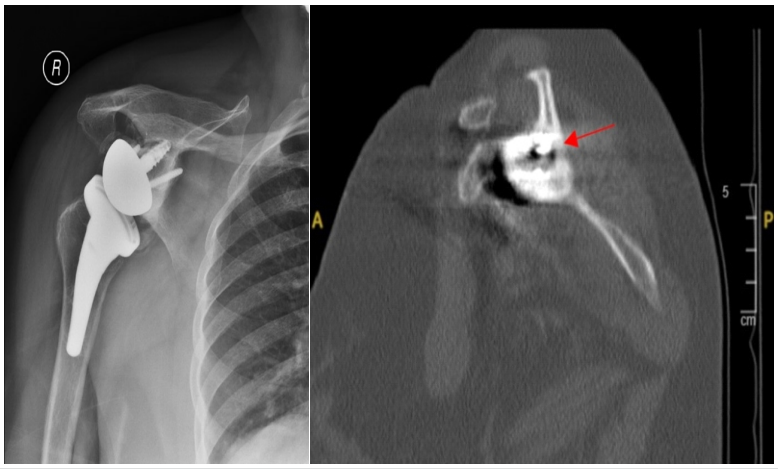

Figure 1: Anteroposterior radiograph of the right shoulder (left) showing loosening of the glenoid component, which was confirmed by a computed tomography scan of the right shoulder without contrast. The sagittal view, taken in November 2018 (approximately 3 years post- reverse total shoulder arthroplasty), demonstrates increased perihardware lucency around the glenoid component (arrow) (right).

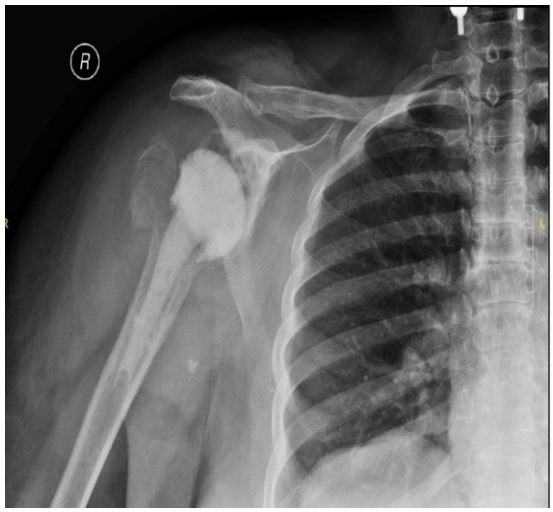

Figure 2: Anteroposterior radiograph of the right shoulder post vancomycin and tobramycin-containing antibiotic spacer placement in January 2019.

administration of broad-spectrum antibiotics before tissue sampling [2]. Mycobacteria are isolated in 43% of culture-negative PJIs [2] and associated with advanced age, chronic steroid therapy, immunosuppression, and retroviral infections [3-6]. With improvements in diagnostic techniques have led to an increase in the isolation and reporting of non-tuberculous mycobacteria. Infections in native joints and bursae with Mycobacterium kansasii are well-documented in the literature [7-12]. To the best of our knowledge, only two previous reports of M. kansasii PJI exist, both in patients with a knee PJI [13,14]. This report presents an inaugural case of a shoulder PJI caused by M. kansasii. The patient was informed, and consent was taken to the submission of their case data for publication.

Case Report

A 66-year-old female underwent right reverse total shoulder arthroplasty (rTSA) for glenohumeral osteoarthritis in November 2015, performed by a high-volume shoulder surgeon in the US. Initially, the post-operative course was uneventful, with excellent progressive improvement in range of motion and pain management. However, 7 months after surgery, she experienced persistent right shoulder pain subsequent to a fall. Clinical examination revealed pain-limited forward flexion to 90°. Imaging, including shoulder X-ray and computed tomography (CT), confirmed proper placement of the components with no evidence of loosening.

In April 2017, the patient returned to the clinic with persistent right shoulder pain. At this time, an extensive workup including a bone scan, erythrocyte sedimentation rate (ESR) (10 mm/h; 0–20), and C-reactive protein (CRP) (<0.5 mg/L; 0–8.0) yielded negative results. The ESR was 10 mm/h (Normal: 0–20) and CRP was <0.5 mg/L (Normal: 0–8 mg/L). The pain was managed by analgesics. The patient presented again in November 2018 with exacerbated pain during movement, shoulder swelling, and intermittent night sweats and chills. Active forward flexion was possible to approximately 100°, and passive movement reached 160°. Blood tests, including white blood cell (WBC) count, ESR, and CRP, were within normal limits, suggesting no overt inflammation. The value of WBC was 5900/UL (Normal: 0–12,000), ESR was 8 mm/h and CRP was 2.1 mg/L. The CRP level showed an elevation to 2.1 mg/L, indicating an increase from the values recorded in the previous episode.

Due to concerns raised by shoulder X-rays indicating potential glenoid component loosening, differential diagnoses of aseptic loosening versus periprosthetic infection were considered. A repeat CT of the right shoulder without contrast demonstrated perihardware lucency involving the glenoid component raised the suspicion of either progressive loosening since the last evaluation or the presence of an infection (Fig. 1).

In January 2019, the patient underwent a right shoulder exploration, during which a spacer impregnated with vancomycin and tobramycin was placed. The combination of vancomycin and tobramycin is the ideal choice for antibiotic-coated cement spacers, as it covers a broad spectrum of Gram-positive and Gram-negative bacteria, and its elution is not dependent on the type of cement used [15, 16] (Fig. 2). Intraoperative assessment revealed extensive synovitis and necrosis, suggestive of infection. A frozen section analysis showed an absence of polymorphonuclear leukocytes per high-power field, and tissue samples were sent for culture. The post-

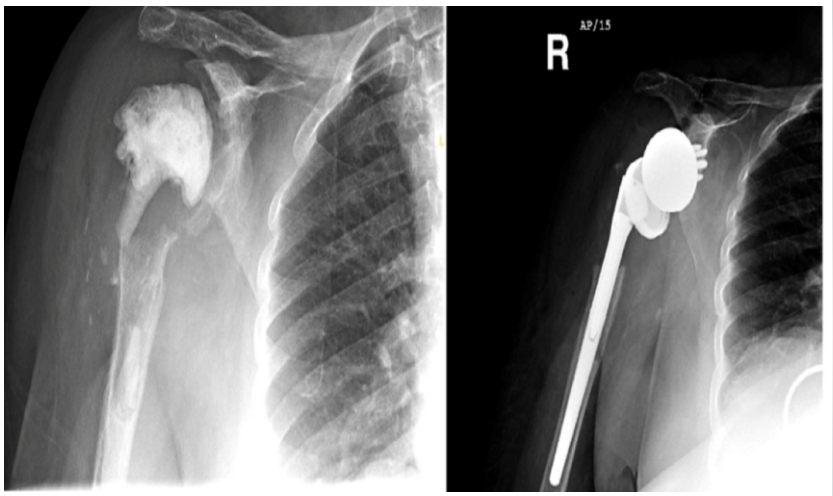

Figure 3: Anteroposterior radiographs of the right shoulder. 2 months post antibiotic spacer placement, demonstrating fracture through the humeral stem of the antibiotic spacer (left). Subsequently, the patient underwent successful removal of the antibiotic spacer and re-implantation of reverse total shoulder arthroplasty components in September 2020 (right).

operative hospital stay was uneventful, and the patient was discharged on oral clindamycin (500 mg, oral, 2 times a day) and cephalexin (500 mg, oral 4 times a day) for 42 days. Four weeks after the operation, the cultures obtained intraoperatively identified M. kansasii. Antimicrobial sensitivity profiles were not established at that juncture. Chest radiography ruled out any pulmonary involvement. The patient was started on an empiric antimycobacterial regimen of rifampin 600 mg, azithromycin 500 mg, and ethambutol 1200 mg taken daily every Monday, Wednesday, and Friday, for a planned duration of 12 months.

In May 2019, the patient's antibiotic spacer was replaced with one containing rifampin. Intraoperative assessment revealed synovitis and subsequent cultures for aerobic, anaerobic, fungal, and acid-fast bacterial cultures were negative. For the next 9 months, the patient was closely monitored. She experienced persistent right shoulder pain and limited range of motion during this time. In February 2020, the decision was made to take the patient back to surgery for either a revision of the rTSA or another spacer exchange. Given the intraoperative discovery of extensive synovitis and inflammation, a decision was made in favor of replacing the rifampin-containing spacer once more. Intraoperative frozen sections provided inconclusive results regarding the presence of infection Nevertheless, the final battery of cultures, including aerobic, anaerobic, fungal, and acid-fast bacterial, confirmed the absence of PJI. The patient continued the oral antimycobacterial regimen, which was completed in May 2020 after a 15-month course.

In April 2020, the patient presented with increased pain and decreased range of motion of the right shoulder after sustaining a fall. A subsequent workup revealed a fracture through the antibiotic spacer (Fig. 3). The patient's active abduction was limited to 30°. At that time, care was delayed by the coronavirus pandemic. In September 2020, the patient underwent the removal of the antibiotic spacer and revision rTSA in the setting of prior evidence of eradication of PJI. Intraoperatively, no gross signs of infection were noted. The frozen sections and final tissue cultures for aerobic, anaerobic, and fungal agents were negative, confirming the absence of infection. At 6-week postoperatively, the patient was recovering uneventfully while performing self-directed physical therapy exercises at home. Radiographs demonstrated appropriately positioned rTSA components.

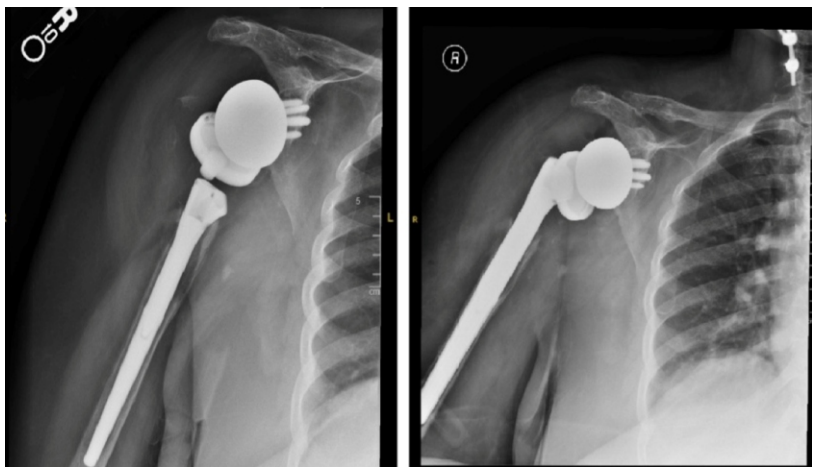

Figure 4: Anteroposterior radiographs of the right shoulder in December 2020. Radiographs demonstrate loosening of the humeral stem with subsidence and dissociation of humeral cup from metaphyseal segment (left), followed by subsequent revision of the humeral component resulting in appropriate alignment (right).

In December 2020, the patient underwent a revision of the humeral component due to the loosening of the humeral stem, resulting in dissociation of the humeral baseplate from the stem (Fig. 4). Intraoperative analysis, including frozen sections, showed more than 10 lymphocytes per high power field and no mycobacteria on acid-fast staining, with negative results for aerobic and anaerobic cultures. Regrettably, due to a laboratory oversight, acid-fast bacterial cultures were not obtained. Four-day postoperatively, the patient's recovery was progressing well, with no significant issues in terms of pain or incision healing.

In January 2021, after consultation with infectious disease specialists, the patient began a long term chronic suppressive anti mycobacterial therapy

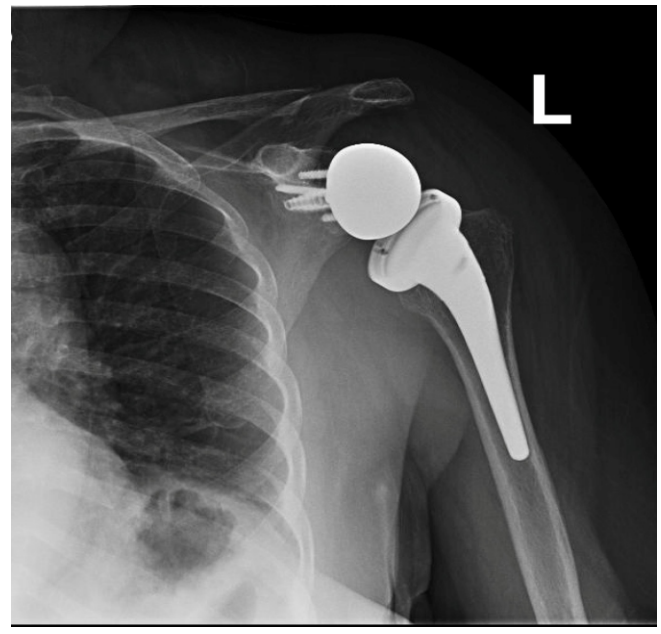

Figure 5: Anteroposterior radiographs of the right shoulder in February 2022 showing normal reverse total shoulder arthroplasty.

course comprising rifampin 300 mg, azithromycin 500 mg daily, and ethambutol 1200 mg on alternate days, due to a presumed recurrence of M. kansasii infection. Subsequently, rifampin was replaced with isoniazid 300 mg daily because of intolerance.

The patient continued to recover uneventfully following revision on the right shoulder. In February 2022, 14 months after the most recent revision procedure, the patient reported no pain or issues with her right shoulder and had 90° of forward flexion, 90° abduction, and 40° of external rotation. The radiographs confirmed that the prosthetic components were well-aligned (Fig. 5). A comprehensive overview of the patient's clinical course is detailed in Table 1.

Discussion

M. kansasii is a non-tuberculosis mycobacterium that produces yellow pigment upon exposure to light, a characteristic first described in 1953 [17]. It presents as cavitary lung disease in immunocompromised individuals, resembling Mycobacterium tuberculosis [18]. Infections of bone and soft tissue by M. kansasii are less frequent, but there have been numerous reports of native joint infections, especially during 1980s in the context of the human immunodeficiency virus (HIV) epidemic, before the advent of widespread antiretroviral therapy [7]. However, there has been a notable resurgence of reported M. kansasii native joint and periarticular infections in the past decade [8, 9, 10, 18]. While PJIs with M. tuberculosis have been well-documented [3, 5, 6], the only two published cases of M. kansasii PJI were reported by Neuberger et al. [13] and Dasari et al. [14].

M. kansasii, often found in tap water and transmitted via aerosols, is rarely spread from person to person and is most prevalent in the southern and central U.S. and urban areas [18]. While musculoskeletal infections with M. kansasii can affect healthy adults, the majority of cases are reported in individuals with systemic conditions such as HIV, systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), or those who have undergone organ transplants [7, 8, 10]. Additional risk factors include previous joint trauma, systemic steroid therapy, and local steroid injections to the joints. Our patient's history included a glenohumeral corticosteroid injection and an arthroscopic procedure, and her residence in an urban area of the central US may have contributed to her risk profile. Interestingly, Neuberger et al. reported that their 82-year-old patient with M. kansasii knee PJI also did not have a history of any known M. kansasii joint infection risk factors [13]. With few reports of M. kansasii PJIs, delineating pathogen-specific risk factors remains challenging. When suspecting M. kansasii infection, which primarily affects the lungs, it is important to check for signs of it. Our patient had a fever at one point, but thorough testing confirmed that the infection had not disseminated.

Bernard et al. conducted a systematic review of 40 M. kansasii native joint infection cases, as well as a retrospective chart review of 10 cases that occurred at their center. They found that, in patients without underlying systemic disease (HIV, SLE, RA, renal transplant, polymyositis, progressive systemic sclerosis, and myelodysplasia) the infection manifested as polyarthritis in 92% of cases and affected the wrist (38%), knee (19%), finger (19%), and elbow (8%). In patients with underlying systemic disease, 46% of patients presented with polyarthritis, while the rest presented with monoarthritis of the wrist (21%), knee (17%), or elbow [13].

The diagnosis of M. kansasii PJI is likely to be complicated by significant delays. Standard tests like ESR and CRP are useful for diagnosing typical Gram-positive PJIs, but they may not be specific for mycobacterial PJIs, often showing normal results as in our case [3, 18]. Imaging is nonspecific for mycobacterial PJI and, ultimately, isolating the microorganism is required for the diagnosis, as it occurred in the present case [2, 3, 18]. There is an average delay of 14 months from when symptoms start to the diagnosis of native joint M. kansasii infections, which is often made using synovial fluid and tissue cultures [7]. In our case, M. kansasii grew on post-operative day 21 from the intraoperative tissue sample. Minimal time to culture M. kansasii is 7 days and clinical reports have described that shows culture and identification time between 2 and 4 weeks [8, 12, 13, 18]. Diagnosis of the infection can be delayed due to the slow growth

Clinical timeline	
2015	Diagnosed with right glenohumeral AC joint arthritis, subacromial bursitis
	Right shoulder corticosteroid injection
	Right shoulder arthroscopy for glenohumeral and AC joint arthritis
	November : Right reverse total shoulder arthroplasty
Jun-16	Right shoulder pain following a recent fall
	Workup unremarkable, including radiograph (X-ray) and CT
Apr-17	Persistent right shoulder pain
	Workup unremarkable, including bone scan, WBC, ESR, and CRP
Nov-18	Worsening painful range of motion and swelling of the shoulder
	Intermittent night sweats and chills
	Radiograph concerning for loosening of glenoid component
	CT shoulder demonstrates perihardware lucency involving glenoid component
	Diagnosis of aseptic loosening or infection
Jan-19	Right shoulder and rTSA exploration
	Vancomycin and tobramycin-containing antibiotic spacer placement
	Discharged on oral clindamycin 500 mg PO (2 times a day) for 42 days and cephalexin 500 mg PO (4 times a day) for 42 days
Feb-19	Intraoperative cultures grow Mycobacterium kansasii
	Chest radiograph negative for pulmonary process
	Started on empiric rifampin, azithromycin, and ethambutol for 12 months, stopped clindamycin and cephalexin .
May-19	Antibiotic spacer exchanged for a spacer containing rifampin
	Interval laboratory workup including AFB negative
Feb-20	Exploration of shoulder revealed severe synovitis in-situ. Rifampin-containing spacer exchange
	Interval laboratory workup including AFB negative
May-20	15-moth oral anti-mycobacterial course was completed in setting of PJI eradication on prior tissue culture
Sep-20	Removal of antibiotic spacer and re-implantation of revision rTSA components
	Intraoperative frozen sections and cultures negative, mycobacterial cultures not obtained
Dec-20	Revision of the humeral component due to loosening of humeral stem
	Intraoperative frozen sections show >10 lymphocytes per hpf, cultures negative
	Acid-fast bacterial cultures not obtained
Feb-22	January: Patient placed on long term chronic antimycobacterial suppressive therapy, which includes azithromycin, ethambutol, and isoniazid
	June : Patient recovering well on post-operative visit, radiographs show well-positioned components
PJI: Periprosthetic joint infections, CT: Computed tomography, CRP: C reactive protein, ESR: Erythrocyte sedimentation rate, WBC: White blood cell, rTSA: Reverse total reverse shoulder arthroplasty, AC joint: Acromioclavicular joint, AFB: Acid-fast bacteria	

Table 1: Summary of clinical timeline.

of the organism, prior use of broad-spectrum antibiotics, sampling errors, low bacterial count, or co-infection with more common pathogens [2]. Modern polymerase chain reaction and next-generation sequencing offer quick diagnosis of mycobacterial infections like M. kansasii [2, 3, 13, 18], but their use is restricted by limited availability and cost.

Based on the available literature describing native joint infection of M. kansasii and M. tuberculosis PJI, a combination of oral antibiotics and surgical procedures is preferred. Effective antibiotic regimens for native joint infections typically include rifampin and ethambutol, as well as isoniazid, streptomycin, cycloserine, erythromycin, or clarithromycin, for a total of a 3 or 4 drug combination for 18–24 months [7, 8, 11, 18, 19].

In general, shoulder PJIs require surgical treatment, with two-stage revision arthroplasty being the most effective [1]. For M. tuberculosis PJI, the two-stage revision was effective in 60–90% of hip and knee cases and is typically required for all late-onset infections, occurring 8-week postoperatively. Vancomycin,

streptomycin, and rifampin spacers have been used effectively [3, 5]. Other techniques, including medical therapy only, one-stage revision arthroplasty, and debridement with prosthesis preservation may be considered.

Conclusion

M. kansasii PJI, while rare, has clinical similarities to M. tuberculosis but requires different diagnosis and treatment approaches than more common pathogens. Diagnosis can be slow due to the organism's gradual progression and the time needed for cultures. Treatment often involves extended antimycobacterial therapy and multiple surgeries, leading to a cautious prognosis.

Clinical Message

This case underlines the importance of monitoring for mycobacterial growth in suspected culture negative PJIs and the need for aggressive surgical and medical therapy to minimize the complications.

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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