



Case report

Native joint septic arthritis due to *Kingella kingae* in an adultBenjamin Chen^{a,*}, Takaaki Kobayashi^b, Hasan Samra^c, Poorani Sekar^b^a Department of Internal Medicine, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, Iowa City, IA, 52242, USA^b Division of Infectious Diseases, Department of Internal Medicine, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, Iowa City, IA, 52242, USA^c Department of Pathology, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, Iowa City, IA, 52242, USA

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ABSTRACT

A 65-year-old woman with chronic osteoarthritis of the knees presented with a one-week history of acutely worsening right knee pain and swelling. Arthrocentesis was performed and synovial fluid was indicative of septic arthritis with a negative Gram stain for bacteria. Magnetic Resonance Imaging (MRI) was obtained, revealing a large anterior periarticular abscess with concomitant septic arthritis. Orthopedic surgeons performed urgent incision and drainage of the abscess and washout of the joint. Synovial fluid culture grew *Kingella kingae* and the patient was treated with four weeks of ceftriaxone with improvement in both clinical symptoms and laboratory values. *Kingella kingae* is a common cause of pediatric bone and joint infection but remains an exceedingly rare cause of native joint septic arthritis among immunocompetent adults. *Kingella spp* are largely susceptible to beta-lactam antimicrobials.

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Background

Kingella spp are fastidious, Gram-negative, facultative anaerobic coccobacilli commonly found among the normal oropharyngeal flora of young children. *Kingella kingae*, a member of the HACEK group of organisms, is known to cause endocarditis in adults and musculoskeletal infections in young children. It remains an exceedingly rare cause of bone and joint infection in immunocompetent adults. Herein we describe a case of native joint septic arthritis due to *Kingella kingae* in an otherwise healthy immunocompetent adult woman.

Case

A 65-year-old woman with chronic osteoarthritis of the knees presented to the hospital with a one-week history of worsening right knee pain and swelling. Her medical co-morbidities included major depressive disorder and anxiety. She was seen one week prior in another Emergency Department (ED) where an X-ray and venous duplex ultrasound were obtained and were negative for fracture and thrombus, respectively. She presented again to the ED a few days prior to the current hospitalization with worsening pain described as sharp, with significant pain in the posterior aspect of the knee. She also denied fevers, chills, sweats, and respiratory tract, urinary tract, or skin infections. She denied history of trauma,

surgery, or crystal arthritis in the knee, reporting that prior to this illness she was visiting her grandchildren, one of whom was quite ill with a respiratory tract infection. She self-limited her activity due to knee pain and was using a cane for assistance with ambulation.

On presentation to the ED her temperature was 37.4 °C (99.3 °F) and physical examination revealed marked swelling of the right knee without erythema or warmth (Fig. 1). There was tenderness to palpation of the knee over the medial joint line, and active and passive range of motion were limited by swelling and discomfort. Laboratory tests revealed a white blood cell count of 7700/μL (normal 3700–10,000/μL), an Erythrocyte Sedimentation Rate (ESR) of 60 mm/hr (normal 0–20 mm/hr), and a C-Reactive Protein (CRP) of 15.3 mg/dL (normal <0.5 mg/dL). The ED physician had low clinical suspicion for septic arthritis despite non-specific elevation in inflammatory markers, and the patient was discharged home with instructions to follow up in the Orthopedics clinic.

Orthopedic surgeons evaluated the patient two days later in their clinic and performed an arthrocentesis of the right knee with 15 mL of turbid yellow synovial fluid removed (Fig. 2). Laboratory analysis revealed 82,324/μL total nucleated cells with 98 % neutrophils; no organisms were seen on Gram stain and no crystals were seen on microscopy. MRI was obtained which revealed a large 5.9 × 2.6 cm rim-enhancing fluid collection within the vastus intermedius, consistent with abscess (Fig. 3). There was also enhancement of the synovium with a small joint effusion at the knee, concerning for concomitant septic arthritis in the presence of abscess. The patient was taken to the operating room for urgent incision and drainage of the abscess and debridement

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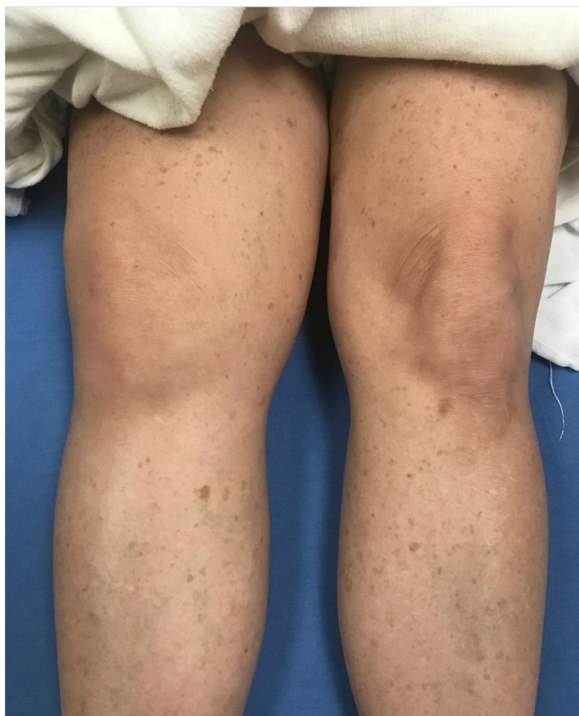


Fig. 1. Right knee on presentation demonstrating diffuse swelling compared to the left.

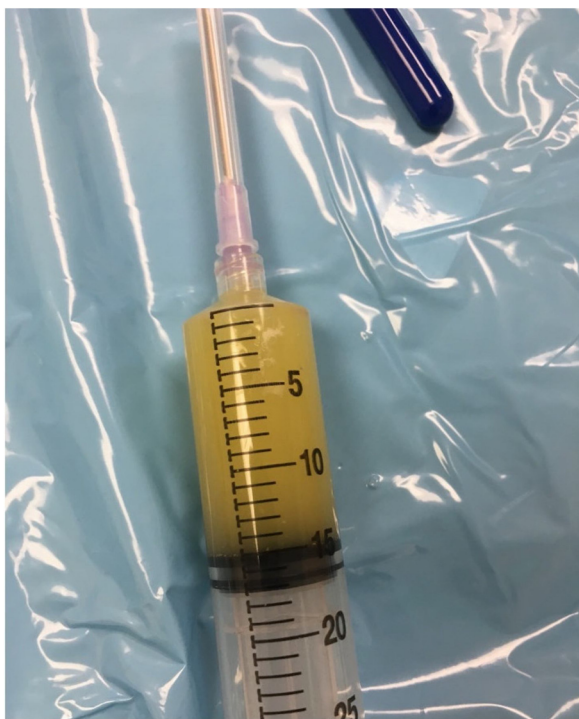


Fig. 2. Joint aspirate demonstrating turbid yellow synovial fluid.

and washout of the joint. Frank purulence was encountered in the joint space and culture samples were taken from the joint fluid, synovial membrane, and periarticular fat. The patient tolerated the procedure without complication, and she was empirically started on vancomycin post-operatively. On post-operative day 2, the initial synovial fluid aspirate culture was identified as Gram-

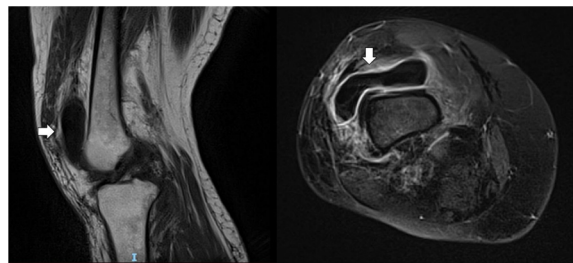


Fig. 3. Right Knee MRI demonstrating 5.9 × 2.6 cm rim-enhancing fluid collection in the sagittal plane (A) and axial plane (B) indicated by solid white arrows.

negative rods on light microscopy and piperacillin-tazobactam was added to vancomycin.

On post-operative day 4, the initial synovial fluid aspirate grew *Kingella kingae* and antimicrobial was changed to ceftriaxone monotherapy. All other intra-operative cultures remained negative. Peripheral blood cultures were also negative. Transthoracic echocardiogram was obtained (given the propensity for this organism to cause endocarditis) and did not reveal valvular vegetations. A peripherally inserted central catheter was placed, and the patient was discharged from the hospital on post-operative day 7 to complete four weeks of intravenous ceftriaxone.

The patient was evaluated in the Infectious Diseases clinic at the conclusion of four weeks of intravenous ceftriaxone. She reported improvement in knee pain and swelling and she noted some improvement in activity tolerance. Repeat inflammatory markers had improved to ESR of 30 mm/hr and CRP of 0.67 mg/dL. Antibiotics were stopped at that juncture. At three-, seven-, and nine-month post-operative evaluations with her Orthopedic surgeons she continued to report improvement in pain. She recovered full range of motion on exam, was able to walk without assistive devices, and was able to perform her activities of daily living.

Discussion

Kingella spp. consist of fastidious, facultatively anaerobic, Gram-negative coccobacilli that are found as commensal flora of the oropharynx of young children [1]. Child-to-child transmission has been observed via respiratory droplets and it is postulated that systemic infection occurs after a breach of the oral mucosa that allows bacterial entry into the bloodstream which can then travel to distant sites [2]. *Kingella kingae*, the pathogen described in our case, was first isolated in 1960 by American microbiologist Elizabeth O. King. The organism was initially named *Moraxella kingae* due to its morphological characteristics and in 1976 it was recognized as belonging to a separate genus and renamed *Kingella kingae* in honor of its discoverer [1].

Much of the literature reported on invasive *K. kingae* infections has been described in children below the age of 5 years. Septic arthritis caused by *K. kingae* commonly afflicts healthy children below the age of 4 years and rarely occurs in older children and adults. Yagupsky described osteoarticular infection as the most common manifestation of invasive *K. kingae* infection, occurring in 62.4 % (53 of 85) of cases among children in a large referral center in Israel from 1988 to 2002 [1]. The first case of *K. kingae* native joint septic arthritis in an otherwise healthy adult was described by Esteve et al. in 2001 [3], with a second case described by Ricketts et al. in 2015 [4]; both cases involved the knee. A review of the English language literature demonstrates cases of *K. kingae* osteoarticular infection in adults with severe rheumatoid arthritis with Felty's syndrome [5] and recent upper respiratory infection [6]. One case described concomitant infective endocarditis with

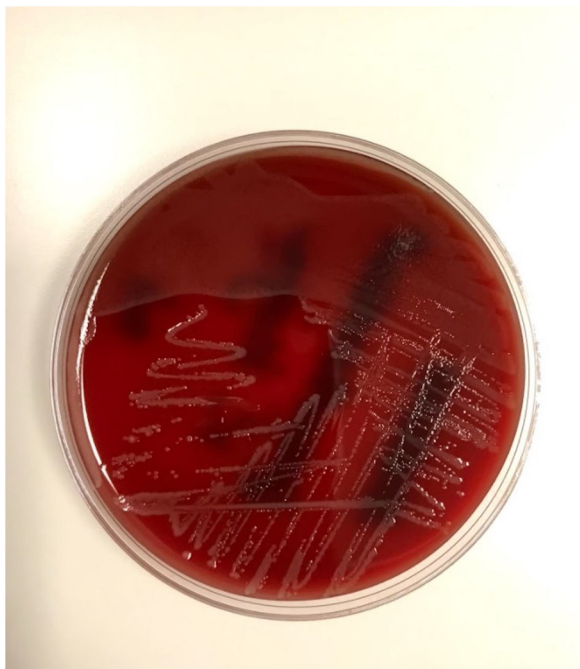


Fig. 4. Culture specimen demonstrating mild rim of beta-hemolysis on 5% sheep's blood agar.

septic arthritis [7]. Cases of *K. kingae* native joint infection continue to be rarely reported in adults without predisposing conditions. We postulate that our patient may have acquired the pathogen from her grandchild who recently had a severe upper respiratory infection.

Bone and joint infections due to *Kingella kingae* tend to present more subtly than with other pathogens such as *Staphylococcus aureus*. Patients can present without fever, and classic signs and symptoms of septic arthritis such as painful, swollen joint with decreased range of motion may be less pronounced or altogether absent [2]. Therefore, a high degree of suspicion must exist to suspect *K. kingae* as a cause of infection. Williams et al. report that among 27 PCR-positive synovial fluid samples for *K. kingae* collected over a 3-year study period at a tertiary referral hospital in Australia, only 2 samples (7.4%) identified *K. kingae* growth on routine cultures and only 5 samples (18.5%) had bacteria seen on Gram stain [2]. *K. kingae* is uniquely difficult to identify for a variety of reasons: the organism resists decolorization in Gram staining and consequently may be misidentified as Gram-positive, and standard culture techniques using solid media rarely yield successful growth [1,2]. Due to these two factors it is believed that *K. kingae* had been underrecognized as a cause of musculoskeletal infections until laboratories started inoculating specimens in aerobic blood culture systems and adopted nucleic acid amplification techniques [2]. When culture is successful, the organism exhibits beta-hemolytic colonies on 5% sheep's blood agar (Fig. 4) and Gram stain yields pairs or chains of plump coccobacilli (Fig. 5). It is notable that in our case the synovial fluid inoculated in aerobic blood culture bottles yielded the organism at 4 days, which is the median incubation reported in the literature [1], and none of the samples inoculated on solid media yielded the organism.

The management of *K. kingae* septic arthritis involves a combination of surgical debridement and antimicrobial therapy. *K. kingae* is highly susceptible to beta-lactam antibiotics including penicillin, ampicillin, and second- and third-generation cephalosporins, with rare reports of beta-lactamase production. With rare exceptions, *K. kingae* is also susceptible to aminoglycosides,

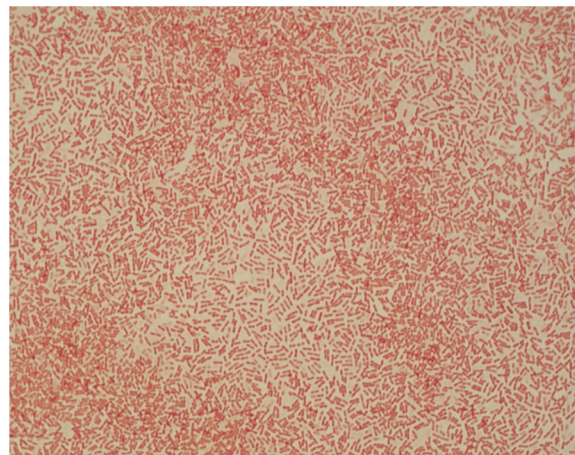


Fig. 5. Gram stain of *Kingella kingae* demonstrating pairs and chains of plump Gram-negative coccobacilli.

macrolides, trimethoprim-sulfamethoxazole, fluoroquinolones, tetracyclines, and chloramphenicol [8]. *K. kingae* exhibits relatively high minimum inhibitory concentrations (MICs) to oxacillin (MIC₅₀ 3 µg/mL, MIC₉₀ 6 µg/mL), and 40% of invasive isolates are not susceptible to clindamycin, while all strains are highly resistant to glycopeptides such as vancomycin [8].

At present, the Infectious Diseases Society of America (IDSA) does not issue evidence-based practice guidelines on the optimal treatment duration for native joint septic arthritis due to organisms other than methicillin-resistant *Staphylococcus aureus*, for which drainage or debridement followed by four weeks of antimicrobial therapy is considered optimal treatment [9]. A review of the rheumatology literature suggests an accepted treatment duration of 2–4 weeks of parenteral antibiotics for non-gonococcal bacterial arthritis [10], although rigorous randomized controlled trials are severely lacking to determine optimal treatment duration [11]. The optimal antimicrobial treatment duration for *K. kingae* septic arthritis is even less understood, owing to the inherent rarity of the condition. Previous cases of *K. kingae* septic arthritis in adults were successfully treated with anywhere from 10 days to 3 months of oral or parenteral antibiotics, with or without surgical washout [3–6]. Our patient was successfully treated with surgical debridement and four weeks of ceftriaxone, with improvement in both clinical symptoms as well as laboratory values.

Funding

No funding.

Ethical approval

A case report is a medical/educational activity that does not meet the definition of “research”, which is: “a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.” Therefore, the activity does not have to be reviewed by ethics committee.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Benjamin Chen: Writing-original draft. Takaaki Kobayashi: Writing- review & editing. Poorani Sekar: Writing - review & editing. Hasan Samra: Writing - review & editing.

Declaration of Competing Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgement

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