Total Knee Arthroplasty Following Mycobacterium Kansasii Septic Arthritis in a Patient with Systemic Lupus Erythematosus and Essential Thrombocythemia.

Reuben A. Falola¹, Victoria K. Shanmugam², Mark R. Abbruzzese³, Brian Evans⁴, Christopher E. Attinger¹ and Karen K. Evans*¹

¹Department of Plastic Surgery, Center for Wound Healing, Medstar Georgetown, University Hospital, USA
²Division of Rheumatology, George Washington University, USA
³Department of Infectious Disease, Medstar Medical Group, USA
⁴Department of Orthopedic Surgery, Medstar Georgetown, University Hospital, USA

Introduction

Arthritis and arthralgias are noted in up to 95% of patients with systemic lupus erythematosus (SLE), but they are typically responsive to immunosuppression and are often transient [1]. The arthritis of SLE is characterized by a non-erosive inflammatory arthropathy (Jacouds Arthropathy); however, in the knee joint osteonecrosis can occur, leading to accelerated articular degeneration. Studies show that patients with SLE require TKA at an average age of 56 compared to age 69 in matched controls, without autoimmune disease [2].

The increased morbidity and mortality seen in SLE is well recognized, and infection is a major cause of death, accounting for approximately 25% of deaths in a British cohort at a large tertiary care center [3]. In-hospital postoperative mortality for patients with SLE undergoing hip and knee arthroplasty was recently investigated using data from the Nationwide Inpatient Sample. The investigators found that patients with SLE had an odds ratio of 4.0 (95% CI 1.9-8.0) for postoperative mortality with hip replacement and odds ratio of 1.2 (95% CI 0.2-7.5) for mortality with knee replacements. In contrast, mortality risk for patients with rheumatoid arthritis was similar to controls [4].

Nontuberculous mycobacterial infection has been reported in patients with SLE [5], and typically presents later in the disease course and in patients receiving more potent immunosuppression. M. kansasi is an atypical mycobacterium that usually causes pulmonary infections, but has a predilection...
for the joints and soft tissue in patients with SLE [5,6]. It is particularly challenging to culture, and a prolonged period of time may pass before a definitive diagnosis is established, thus, leading to treatment delay and the potential for poor outcomes. Wound healing is known to be impacted by autoimmune diseases including lupus [7] and scleroderma [8].

Immunosuppressive therapies used to manage SLE can further impair immune defense and clearance of M. kansasii infections. The authors have obtained the patient’s informed written consent for print and electronic publication of the case report.

Case Studies

The patient is a 56-year-old female with long standing SLE overlap with scleroderma, who had been taking chronic prednisone for management of interstitial lung disease and recurrent pericarditis. She initially presented with chronic recurrent left knee effusion at an outside hospital.

Synovial fluid analysis was initially benign, with a white cell count of 2100 and no crystals present. Anti-inflammatory agents and a trial of intra-articular corticosteroid injections failed to relieve her pain, and the patient was referred for an exploratory arthroscopy. Post-operative analysis of the synovial fluid revealed 56,000 white cells and synovial cultures were positive for acid-fast bacilli (AFB) after 10 days of incubation. It was believed at the time to be an external contaminant. Without a definitive pathogen, the patient was treated empirically with a four-week course of vancomycin and piperacillin-tazobactam.

Her pain slightly improved, although she continued to have difficulties with ambulation. One year later, she developed a new, painful swelling in her left popliteal fossa. An MRI was suggestive of a Baker’s cyst; however, no fluid could be aspirated by the patient. Hemoglobin was 15.4 g/dL, a creatinine 0.52 mg/dl, and an albumin of 2.6. Transaminases were within normal limits. Her erythrocyte sedimentation rate (ESR) was 98 mm/hr and the serum C-reactive protein (CRP) level recorded as 15.9 mg/L. Blood, urine and stool cultures were negative.

Management and Outcome

Our initial impression was that she suffered from septic left knee arthritis, likely related to a history of SLE and immunosuppression. We were concerned that the popliteal wound tracked into the joint. A multidisciplinary team of infectious disease, orthopedics, rheumatology and plastic surgery proceeded with a management strategy beginning with staged debridement and serial cultures to determine a pathogen for targeted antibiotic therapy.

The patient would then be closed surgically with the aid of a graft or soft tissue reconstruction. TKA would follow after stabilization of the soft tissue. Optimization of her SLE medication regimen was paramount for successful management at all stages.

The patient underwent three excisional debridements and final closure of the wound. Multiple, purulent deep tissue abscesses were identified within the wound in popliteal fossa, and were incised and drained. The wound bed was debrided down to healthy appearing tissue, leaving a 9 x 3 cm defect. Copious irrigation prepared the wound for placement of a NPWT device. Cultures of the wound were obtained before and after debridement to determine organism speciation, sensitivities, and assess for clean margins. Cultures from the first two debridements were positive for methicillin resistant’s staphylococcus aureus (MRSA), but not AFB.

The infectious disease team was consulted and the patient was placed on intravenous vancomycin and cefepime. Three days later the patient was taken to the OR for a final debridement and closure with a split thickness skin graft. A peripherally inserted central catheter (PICC) line was placed and the patient was discharged one day later to receive daptomycin 300 mg IV daily for 30 days. Azathioprine and prednisone were continued for management of SLE, per rheumatology. Post-debridement cultures in cluding AFB yielded no growth.

She required another “take-back” one month later due to poor graft adherence and renewed drainage. Cultures remained negative.
After 5 months of follow up and difficulty healing, the patient was reevaluated for new drainage from the wound. An MRI of the left lower limb was concerning for osteomyelitis in the distal femur. The patient was taken back to the OR for debridement and culture of the involved tissues. Methylene blue was injected to identify the joint-space during the surgical approach. A posterior knee incision was made into the popliteal fossa, and multiple specimens, including the capsule, were sent for culture and pathology. A 3 x 2 cm, cheesy, caseating mass, adjacent to the left medial femoral condyle was evacuated (Figure 1).

Two draining sinuses within the 10 x 2 cm wound bed were debrided with sharp curettage. The gram stain was unhelpful and the cultures again returned with no growth on AFB media. The patient was sent home on moxifloxacin 400 mg PO daily and instructed on daily dressing changes with gauze dressings.

She presented one month later with a fever, and was reevaluated for the source of this indolent and heretofore unexplained infection. There was a suspicion that mycobacterium could be involved because mycobacterium species are known to cause a tenosynovitis and persistent wounds, with cultures often being negative. This hypothesis was supported, by the caseous nature of the drainage, the history of chronic immunosuppressive therapy, and the prior positive AFB culture from the outside hospital. Mycobacterial infection had long been suspected but without subsequent cultures, a definitive diagnosis could not be made. A decision was made to discontinue azathioprine, and the patient underwent subsequent evacuation of the re-accumulated caseating mass from the joint space in the left knee. AFB cultures were sent again; this time the cultures returned positive for *M. kansasii*, and the patient was started on a triple therapy with rifampin 150mg BID, isoniazid 300mg daily, and azithromycin 500mg daily. NPWT was maintained after discharge.

The antimycobacterial drugs were discontinued two weeks postoperatively, and the patient is ambulating without significant pain. Rifampin was continued perioperatively, and discontinued six months for TKA, after a total of 33 months of treatment.

**Discussion**

This case demonstrates the challenging diagnosis and treatment of *M. kansasii* septic arthritis, osteomyelitis, and a fistulous chronic wound, in a patient with SLE. There should be a high degree of suspicion for atypical mycobacterial disease in patients presenting with persistent septic arthritis, with autoimmune disease, and who are significantly immunosuppressed [9].

*M. kansasii* infections typically involve soft tissues, bones, bursae, tendon sheaths and large or medium-sized joints [10]. Patient with SLE are especially predisposed to extrapulmonary involvement [5,11]. A study by Mok et al analyzed a cohort of 725 SLE patients with previous NTM infections and found that compared to mycobacterium tuberculosis infections, NTM infections such as *M. kansasii* were more likely to present in extrapulmonary sites (*P*=0.006), in those with a longer duration of SLE (*P*=0.001), and in those managed with a cumulatively higher dose of corticosteroids (*P*=0.01) [5].

Seeding of deep tissues by *M. kansasii* can occur via hematogenous spread, but is more frequently caused by trauma and contaminated medical instrumentation or solutions, such as injections of anesthetics and steroids [10,12,13]. Tap water is believed to be a major reservoir and source of contamination for *M. kansasii* [13,14]. Diagnosis of *M. kansasii* septic arthritis is made with culture of synovial fluid or biopsy of the synovium; however, cultures are often negative. This may be due to poor
inoculums yielded from synovial fluid or the fact that *M. kansasii* is slow-growing and fastidious in vitro[11]. An abundance of neutrophils is often the only finding on diagnostic work up of affected tissues, and thus diagnosis can be difficult [14].

Corticosteroids and immunosuppressive agents, which are commonly used to manage SLE, can mask the inflammatory response, which may further delay diagnosis. There are documented reports of patient with destructive arthritis of unknown origin persisting for 11 years after presentation, until the infection converted to a granulomatous lesion, from which positive cultures were ultimately obtained [11].

Combination pharmacotherapy is the cornerstone of treatment of mycobacterial infections and monotherapy is not recommended due to the potential for development of drug resistance [15]. *M. kansasii* is usually susceptible to isoniazid, ethambutol, rifampin, ethionamide, streptomycin, and clarithromycin. Combining rifampin specifically with the other drugs significantly improves the potency of the regimen, and lowers rates of resistance and subsequent relapse [14].

The recommended treatment for patients with rifampin susceptible *M. kansasii* is a daily regime of rifampin 10 mg/kg/day (maximum 600 mg), ethambutol 15 mg/kg/day, isoniazid 5 mg/kg/day (maximum 300 mg), and pyridoxine 50 mg/day until 12 months of negative cultures are obtained. Rifampin resistant *M. kansasii* should be treated with a three-drug regimen consisting of clarithromycin or azithromycin, moxifloxacin, ethambutol, sulfamethoxazole, or streptomycin as the susceptibility data allows [14]. However, some patients may develop reactions to one or a few of these antimicrobial drugs, making optimal treatment difficult.

Often times, the microbiology data in the immunocompromised host can be unclear, with multiple microbes contributing to the overall clinical presentation. Bacteria can form dense colonies within biofilm that can subvert host defenses and antibiotic drugs. Further, corticosteroids used to treat SLE, aside from impairing wound healing [16] and systemic response to infection, have been found alter biofilm formation in animal models. While the total production of biofilm can be reduced with corticosteroid use, such therapy may alter the biofilm in such a way that resistance of bacteria to certain antibiotics is enhanced [17]. As a result, patients with deep tissue involvement should be managed pharmacologically and surgically, with aggressive antimicrobial therapy, staged debridement, and washout of all compromised tissues [17-20].

**Conclusion**

In conclusion, although rare, *M. kansasii* should be added to the differential diagnosis in patients with SLE and other immune diseases, and persistent septic monoarthritis. This diagnosis should especially be considered in patients receiving chronic immunosuppressive therapies. Since immune diseases are known to impact wound healing, and immunosuppression can contribute to impaired host defenses, it is crucial to both optimize immunotherapy and aggressively treat the infected joint. A multidisciplinary approach to the care of patients with autoimmune disease and septic arthritis can be used to minimize risks and improve outcomes.

**Financial Disclosures**

There are no financial disclosures, commercial associations, or any other conditions posing a conflict of interest to report for any of the above authors.

**References**

1. Cronin ME (1988) Musculoskeletal manifestations of systemic lupus erythematosus. Rheum Dis Clin North Am 14(1): 99-116.
2. Mertelsmann-Voss C, Lyman S, Pan TJ, Goodman S, Figge MP et al. (2014) Arthroplasty Rates Are Increased Among US Patients with Systemic Lupus Erythematosus: 1991-2005. J Rheumatol 41(5): 867-874.
3. Goldblatt E, Chambers S, Rahman A, Isenberg DA (2009) Serious infections in British patients with systemic lupus erythematosus: Hospitalisations and mortality. Lupus 18: 682-689.
4. Domsic RT, Lingala B, Krishnan E (2010) Systemic Lupus Erythematosus, Rheumatoid Arthritis, and Post arthroplasty Mortality: A Cross-sectional Analysis from the Nationwide Inpatient Sample. J Rheumatol 37(7): 1467-1472.
5. Mok MY, Wong SSY, Chan TM, Fong DYT, Wong WS, et al. (2006) Non-tuberculous mycobacterial infection in patients with systemic lupus erythematosus. Rheumatology (Oxford) 46(2): 280-284.
6. Neuberger A, Sprecher H, Oren I (2006) Septic Arthritis Caused by Mycobacterium kansasii in a Prosthetic Knee Joint. J Clin Microbiol 44(7): 2648-2649.
7. Shanmugam VK, Schilling A, Germinario A, Mete M, Kim P, et al. (2012) Prevalence of immune disease in patients with wounds presenting to a tertiary wound healing centre. Int Wound J 9(4): 403-411.
8. Shanmugam V, Price P, Attinger C, Steen V (2010) Lower Extremity Ulcers in Systemic Sclerosis: Features and Response to Therapy. Int J Rheumatol pii:747946.
9. Brutus J, Lamraski G, Zirak C, Hauzuer J, Thys J, et al. (2005) Septic monoarthritis of the first carpo-metacarpal joint caused by Mycobacterium Kansasi. Chir Main 24(1): 52-54.
10. Falkinham JO, George KL, Parker BC (1989) Epidemiology of Infection by Non-tuberculous Mycobacteria: VIII. Absence of Mycobacteria in Chicken Litter. Am Rev Respir Dis 139(6): 1347-1349.
11. Nakamura T, Yamamura Y, Tsuruta T, Tomoda K, Sakaguchi M, et al. (2001) Mycobacterium kansasii Arthritis of the Foot in a Patient with Systemic Lupus Erythematosus. Intern Med 40(10): 1045-1049.
12. Bernard L, Vincenot, O Lortholary, L Raskine, C Vettier, et al. (1999) Mycobacterium kansasii septic athritis: French retrospective study of 5 years and review. Clin Infect Dis 29(6): 1455-1460.
13. De Groote MA, Huitt G (2006) Infections Due to Rapidly Growing Mycobacteria. Clin Infect Dis 42(12): 1756-1763.
14. Griffith DE, Aksamit T, Brown-Elliott BA, Catanzaro A, Daley C, et al. (2007) An Official ATS / IDSA Statement: Diagnosis, Treatment, and Prevention of Non-tuberculous Mycobacterial Diseases. Am J Respir Crit Care Med 176(4): 367-416.
15. Wei MC, Banaei N, Yakrus MA, Stoll T, Gutierrez KM, et al. (2009) Non-tuberculous Mycobacteria Infections in Immuno compromised Patients. J Pediatr Hematol Oncol 31(8): 556-560.

16. Wicke C, Halliday B, Allen D, Roche NS, Scheuenstuhl H, et al. (2000) Effects of steroids and retinoids on wound healing. Arch Surg 135(11): 1265-1270.

17. Goggin R, Jardeleza C, Wormald PJ, Vreugde S (2013) Corticosteroids directly reduce Staphylococcus aureus bio film growth: An invitro study. Laryngoscope 124(3): 602-607.

18. Earl CS, Keong TW, An SQ, Murdoch S, McCarthy Y, et al. (2015) Haemophilus influenzae responds to glucocorticoids used in asthma therapy by modulation of biofilm formation and antibiotic resistance. EMBO Mol Med 7(8): 1018-1033.

19. Schulze-Röbbecke R, Fischerer R (1991) Growth and inactivation of Mycobacteria in biofilms. Water science and technology 24(2): 153-156.

20. Islam MS, Richards JP, Ojha AK (2012) Targeting drug tolerance in mycobacteria: a perspective from mycobacterial biofilms. Expert Review of Anti-infective Therapy 10(9):1055-1066.

Your next submission with JuniperPublishers will reach you the below assets

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats (Pdf, E-pub, Full Text, audio)
- Unceasing customer service
- Track the below URL for one-step submission

http://juniperpublishers.com/online-submission.php