



Tuberculosis Infection after Prosthetic Knee Surgery

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Tuberculosis infection of the knee after prosthetic knee surgery is very rare. The diagnosis depends on high clinical suspicion, especially in the setting of persistent joint swelling with negative cultures. Patients with suspected tuberculosis infection after prosthetic knee surgery should have appropriate tissue specimens sent for acid-fast bacillus staining, mycobacterial culture, and histology. With early diagnosis and prompt anti-tuberculosis therapy, the original prosthesis may be retained.

Key Words: prosthetic joint infection, total knee arthroplasty, tuberculosis

INTRODUCTION

Tuberculosis (TB) synovitis has been called “the great imitator” because of its variable presentation. Misdiagnosis is common, and arthroplasty performed on an affected joint can cause reactivation of the disease. Additionally, it is exceedingly difficult to diagnose TB infection after prosthetic knee surgery. We herein present a case of *Mycobacterium tuberculosis* prosthetic joint infection following total knee arthroplasty in a patient with no prior history of TB, and review the literature.

CASE REPORT

The patient is an 81-year-old Chinese woman with right knee pain for 5 years. Radiographs revealed severe degenerative changes of right knee with advanced osteoarthritis. Chest radiographs were normal. Initially, she underwent conservative medical treatment with non-steroidal anti-inflammatory drugs (NSAID) and rehabilitation. Due to failed conservative treatment, the patient

received total knee arthroplasty (TKA) of the right knee.

However, 2 months after surgery, she complained of right knee pain and swelling. On examination, the knee joint was stable with full extension and 120° flexion. Radiographs showed no signs of loosening of the prosthesis. Laboratory studies revealed a white cell count of 5.9×10^9 cells per liter, erythrocyte sedimentation rate (ESR) of 69 mm after 1 hour, and a C-reactive protein (CRP) level of 2.93 mg/L. Tests for rheumatoid factor and antinuclear antibodies were negative. Aspiration of the joint produced fluid that was bloody in appearance and synovial fluid analysis indicated a white cell count of 110 cells/ μ l and a red cell count of 570,000 cells/ μ l. No organisms were seen microscopically and cultures and Gram stain were negative.

Under the impression of prosthetic joint infection, arthrotomy and debridement were performed. At surgery, 150-200 ml of bloody fluid was found in the joint. Implants were not removed because there was no periprosthetic loosening. Histological examination of synovial tissue showed chronic granulomatous inflammation with granuloma formation in the presence of multinucleated giant cells, epithelioid histiocytes, and central necrosis. Acid-fast bacilli were identified with histochemical staining. Tissue cultures were negative for bacteria, but were positive for *M. tuberculosis* 4 weeks after surgery.

Anti-tuberculosis treatment with rifampicin 600 mg, isoniazid 400 mg, pyrazinamide 1250 mg, and ethambutol 800 mg daily was begun immediately after surgery. After continuous treatment for 12 months, CRP had re-

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turned to a normal level and the painful swelling of the knee was greatly improved.

DISCUSSION

The rate of prosthetic joint infections is <1% for the hip and between 0.5% and 2% for the knee.^{1,2} The most common bacterial etiologies of infection include coagulase-negative *Staphylococci*, *Staphylococcus aureus*, aerobic Gram negative bacilli, and anaerobes.³ *M. tuberculosis* is a rare cause of prosthetic joint infection. In a 22-year period retrospective study of 2116 episodes of prosthetic joint infection, only 7 (0.3%) were due to *M. tuberculosis*.⁴

Prosthetic joint infection with *M. tuberculosis* usually involves the hips or the knees, and results most commonly from local reactivation, and occasionally from hematogenous spread.⁵ The risk of reactivation of *M. tuberculosis* in patients undergoing total hip arthroplasty (THA) or TKA for quiescent *M. tuberculosis* native septic arthritis varies from 0% to 31%. It is higher for patients receiving a TKA (27%) than for those receiving a THA (6%).⁴ Local reactivation can occur as long as 42 years after initial infection, and may be related to trauma associated with surgery.⁶ Of 16 cases reported by Khater et al., 13 were due to reactivation and 3 were from hematogenous spread.⁷ Diseases and conditions that predispose prosthetic joints to tuberculosis infection include previous tuberculosis infection, rheumatoid arthritis, pulmonary disease, and chronic steroid use.⁸

Diagnosis of osteoarticular TB of the knee can be extremely difficult. Monoarticular involvement is common, and systemic signs (e.g., fever, weight loss) or a history of pulmonary TB are seldom found.⁹ Pain is the most common sign, and joint swelling and/or a draining sinus tract are the most common physical findings.⁶ Bone scan findings are nonspecific. Technetium-99m scanning may show diffuse changes in uptake, similar to that found in metastatic diseases, but findings can also be negative in the presence of active disease.¹⁰ The ESR is typically checked, but after surgery results are not specific. The purified protein derivative (PPD) skin test is not useful in areas with a high rate of *Bacillus Calmette-Guerin* (BCG) vaccination. The use of polymerase chain reaction (PCR) testing for detecting *M. tuberculosis* in extrapulmonary specimens, such as synovial fluid, has limitations and may produce false-negative results.¹¹ Though the diagnosis can be made by positive bacteriologic cultures, there often isn't enough synovial fluid obtained with aspiration, and culture specimens are frequently contaminated

from draining sinuses.¹² Synovial tissue biopsy and culture are usually required to make an accurate diagnosis.

The optimal surgical treatment for *M. tuberculosis* prosthetic joint infection is still unknown. The necessity for removal of the infected prosthesis during anti-TB treatment remains controversial. Two-stage exchange,^{4,5} partial one-stage exchange,^{4,5,13} debridement with retention of the prosthesis and medical management^{4,6} have all been used. Failure has been reported to have occurred in 3 out of 6 (50%) patients treated with debridement and retention.^{4,6,14} A 6- to 9-month regimen (2 months of isoniazid, rifampin, pyrazinamide, and ethambutol, followed by 4 to 7 months of isoniazid and rifampin) is recommended as initial therapy for extrapulmonary TB, unless a delayed treatment response or resistant to first-line drugs has occurred.¹⁵

CONCLUSION

M. tuberculosis infection following arthroplasties is an uncommon occurrence. Patients undergoing a total joint arthroplasty should be asked if they or any family members have a history of TB. High clinical suspicion is the key to diagnosis, particularly in the setting of persistent drainage with negative cultures. Patients with signs of infection undergoing total joint replacement should have acid-fast stain smears and TB cultures of potentially involved tissue. Prompt diagnosis and initiation of anti-tuberculosis therapy can result in salvage of the prosthesis and good long-term results.

REFERENCES

1. Harris WH, Sledge CB. Total hip and total knee replacement (1). *N Engl J Med*. 1990;323:725-731.
2. Harris WH, Sledge CB. Total hip and total knee replacement (2). *N Engl J Med*. 1990;323:801-807.
3. Atkins BL, Athanasou N, Deeks JJ, Crook DW, Simpson H, Peto TE, McLardy-Smith P, Berendt AR. Prospective evaluation of criteria for microbiological diagnosis of prosthetic-joint infection at revision arthroplasty. The OSIRIS Collaborative Study Group. *J Clin Microbiol*. 1998;36:2932-2939.
4. Berbari EF, Hanssen AD, Duffy MC, Steckelberg JM, Osmon DR. Prosthetic joint infection due to *Mycobacterium tuberculosis*: a case series and review of the literature. *Am J Orthop*. 1998;27:219-227.
5. Ueng WN, Shih CH, Hseuh S. Pulmonary tuberculosis as a source of infection after total hip arthroplasty. A report of two cases. *Int Orthop*. 1995;19:55-59.

6. Tokumoto JI, Follansbee SE, Jacobs RA. Prosthetic joint infection due to *Mycobacterium tuberculosis*: report of three cases. *Clin Infect Dis*. 1995;21:134-136.
7. Khater FJ, Samnani IQ, Mehta JB, Moorman JP, Myers JW. Prosthetic joint infection by *Mycobacterium tuberculosis*: an unusual case report with literature review. *South Med J*. 2007;100:66-69.
8. Wolfgang GL. Tuberculosis joint infection following total knee arthroplasty. *Clin Orthop Relat Res*. 1985;201:162-166.
9. Watts HG, Lifeso RM. Tuberculosis of bones and joints. *J Bone Joint Surg Am*. 1996;78:288-298.
10. Nocera RM, Sayle B, Rogers C, Wilkey D. Tc-99m MDP and indium-111 chloride scintigraphy in skeletal tuberculosis. *Clin Nucl Med*. 1983;8:418-420.
11. Cheng VC, Yew WW, Yuen KY. Molecular diagnostics in tuberculosis. *Eur J Clin Microbiol Infect Dis*. 2005;24:711-720.
12. Gillespie WJ, Mayo KM, Johnstone V. Skeletal tuberculosis in New Zealand since the introduction of chemotherapy. *Aust N Z J Surg*. 1987;57:727-232.
13. Krappel FA, Harland U. Failure of osteosynthesis and prosthetic joint infection due to *Mycobacterium tuberculosis* following a subtrochanteric fracture: a case report and review of the literature. *Arch Orthop Trauma Surg*. 2000;120:470-472.
14. Spinner RJ, Sexton DJ, Goldner RD, Levin LS. Periprosthetic infections due to *Mycobacterium tuberculosis* in patients with no prior history of tuberculosis. *J Arthroplasty*. 1996;11:217-222.
15. Treatment of tuberculosis. *MMWR Recomm Rep*. 2003;52:1-77.