Mycobacterium chelonae Infection Following Silicone Arthroplasty of the Metacarpophalangeal Joints: A Case Report

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Received: 14 July 2008 / Accepted: 17 September 2008 / Published online: 9 October 2008
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Abstract We present a case of infection caused by an uncommon pathogen, *Mycobacterium chelonae*, in a patient that underwent Swanson silicone arthroplasty of the metacarpophalangeal joints for rheumatoid arthritis. This is the first report of an infection caused by nontuberculous Mycobacteria in flexible silicone implants in the hand. The patient was successfully treated with implant removal, debridement, and antimicrobials tailored to the results of in vitro susceptibility testing.

Keywords Infection · Nontuberculous mycobacteria · *Mycobacterium chelonae* · Silicone arthroplasty · Swanson

Introduction

Rheumatoid arthritis is a common condition affecting 0.5% to 1% of the population [6]. Involvement of the metacarpophalangeal joints occurs frequently in this condi-

tion, and various treatment options can be used based upon the stage of the disease. In stage III rheumatoid arthritis, arthroplasty of the metacarpophalangeal or proximal interphalangeal joints is indicated [5]. The most popular arthroplasty option is the use of flexible silicone implants [10], as it is successful in improving ulnar deviation and the range of motion of the metacarpophalangeal joints in this patient population [3]; however, it is not devoid of complications [7]. Infection has been reported in 0% [12] to 3.5% [8] of operated joints, with the most common pathogens being *Staphylococcus aureus* and Streptococcal species. There are, however cases, in which the infecting organism cannot be isolated, necessitating empiric therapy targeted at the most common pathogens [16].

Herein, we wish to report an infection caused by an uncommon pathogen: *Mycobacterium chelonae*.

A few factors contribute to the importance of this report. This is the first time in which a nontuberculous Mycobacteria (NTM), causing an infection of a small joint silicone implant, was isolated and successfully treated. Secondly, obtaining initial negative laboratory cultures in a clinical setting that suggests an infected implant, should make one aware of the possibility of atypical bacterial pathogens causing the prosthetic joint infection. It is thus vital to obtain cultures to look for unusual pathogens, and to provide susceptibility testing results, to guide the appropriate antimicrobial therapy. Finally, there has been a recent surge in interest in nontuberculous Mycobacteria. Numerous reports indicate that both the isolation of NTM and the diagnosis of clinical disease are increasing worldwide. They affect not only the immunocompromised hosts but have been reported increasingly in the immunocompetent population [13]. The immunosuppressed rheumatoid arthritis patients, which undergo silicone prosthetic arthroplasties, may be particularly prone to develop nontuberculous Mycobacterial infections.

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Case Report

A 66-year-old woman, with a 20-year history of rheumatoid arthritis, was referred by her rheumatologist for surgical treatment for deformity and functional impairment in both her hands. Despite escalating disease-modifying antirheumatic drug therapy (including etanercept and methotrexate), her condition had progressed to the point that she was unable to grip objects and had difficulties dressing. The patient was otherwise healthy, but reported allergies to both sulfonamides and clindamycin.

The physical examination revealed relatively normal wrists. The metacarpophalangeal joints, on the other hand, were severely involved, with ulnar drift varying from 45° to 80°. Radiographs of the right hand indicated volar dislocation of the metacarpophalangeal joints.

The patient underwent Swanson metacarpophalangeal arthroplasties of the index through small fingers of the right, dominant hand, via a standard technique [5]. Both etanercept and methotrexate were withheld for 2 weeks prior to the surgery. One dose of cefazolin was administered preoperatively followed by two additional doses after the procedure. For preparation, we used a two-stage technique, including Betadine scrub and solution as per standard protocol.

The surgery was initially uncomplicated, and the patient was discharged home on the same postoperative day. The wound continued to heal well until the tenth postoperative day, when swelling and erythema appeared adjacent to the operative incision over the fifth metacarpophalangeal joint. She was afebrile and systemically well. Empiric treatment with oral cephalexin was initiated, and she was able to continue her postoperative hand therapy program. Despite 6 weeks of treatment, her symptoms persisted, and an aspiration of the fifth metacarpophalangeal joint was performed. A small amount of purulent material was obtained; the initial results of the aspiration were negative for bacterial growth. Fungal and Mycobacterial cultures were pending. At this time, the antibiotic treatment was changed to oral cloxacillin.

Two months after the procedure, the erythematous area over her hand still persisted, and three new erythematous nodules developed along the ulnar border of her forearm. The Mycobacterial cultures of the aspirate yielded growth of a nontuberculous Mycobacteria, later identified as *M. chelonae*.

A treatment plan was formulated in concordance with the Infectious Diseases Service and after a review of the available literature regarding arthroplasty infections with this particular organism. The implants were removed, and thorough debridement and irrigation were performed. The hand was splinted in mild radial deviation of the fingers. The patient was started on an induction regimen of

intravenous tobramycin and oral clarithromycin for 2 weeks. Under this regimen, the local symptoms and the erythematous nodules on the forearm gradually resolved. Susceptibility testing results subsequently confirmed that the organism was susceptible to tobramycin, clarithromycin, trimethoprim–sulfamethoxazole, and linezolid, but resistant to cefoxitin, doxycycline, and ciprofloxacin. Attempts to select a combination oral regimen were further hampered by the patient's sulfa allergy and poor tolerance of linezolid therapy. Therefore, clarithromycin monotherapy was continued for the remainder of her planned 6-month treatment course.

Ten months after the implant removal and 4 months after discontinuing the antimicrobial therapy, the patient was asymptomatic from the infection point of view. She had no pain and reported moderate limitations in the hand function. The fingers were well aligned, and no ulnar deviation had occurred. The average flexion arc of the metacarpophalangeal joints, which measured 40° at the 3-month follow-up, decreased to 10° by 10 months. The grip strength, measured with the Jamar dynamometer was 4 kg for the right (involved) hand and 6 kg for the contralateral hand. There were no findings consistent with infection on the follow-up radiological evaluation (Fig. 1). The DASH score was 20.8. The patient was advised to continue a home exercises program, supervised by a hand therapist.

Discussion

Over the last decade, impressive advances in the medical treatment of rheumatoid arthritis have been made. Early treatment with appropriate disease-modifying antirheumatic drugs (DMARDs) has been shown to slow the progression of the disease [18]; however, the presence of hand deformities caused by the disorder is still common. In the cases involving moderate to severe deformities of the metacarpophalangeal joints, the use of silicone flexible prostheses is considered the gold standard of treatment [9].

Infections following these procedures are rare, averaging 0.6% and 1% in reviews of 15,556 and 6,982 arthroplasties, respectively [3, 7]. In 1975, Millender et al. [16] reported a series of ten silicone prosthesis infections in 2,105 silicone prosthetic arthroplasties in 1975. Of these infections, seven were Staphylococcal, two were Streptococcal and one was attributed to *Pseudomonas* species. Recent series evaluating silicone flexible prosthesis report a low incidence of postoperative infections with *S. aureus* [1, 19], which is consistent with Millender's initial report. The usual treatment after diagnosing an infection is local debridement and removal of the implant combined with appropriate systemic antibiotic treatment. Successful reimplantation and two-staged revision of the infected joints has been reported [8].

Figure 1 Resection arthroplasty of the metacarpophalangeal joints. Anteroposterior and lateral views of the hand at 3 months (a, b) and 10 months (c, d) following the procedure. Ankylosis of the third to fifth metacarpophalangeal joints became evident at 10 months. There were no findings consistent with ongoing infection.

The initial negative culture results in this case were not surprising, given that culture-negative prosthetic joint infections accounted for 60 (7%) of 897 prosthetic joint infections in a recent series focused on total hip and knees arthroplasties [2]. The authors attributed many of these cases to antibiotic treatment administered prior to microbiologic testing (as in our patient), but they noted that mycobacterial and fungal cultures had been sent in only half of these patients. However, in this report, the patients treated with first-generation cephalosporins had a similar result compared to those treated with broad-spectrum antimicrobial agents, suggesting that most were Staphylococcal or Streptococcal in origin. The results were improved in patients treated with removal of the implants and subsequent reimplantation versus those treated with antimicrobial therapy alone.

In the case of our patient, though, multiple clues suggested the possibility of an atypical pathogen, including the poor response to cephalosporin treatment, as well as the patient's immunocompromised status. In particular, her antitumor necrosis factor therapy (etanercept) is

associated with significant impairment of cell-mediated immunity, and numerous case reports of Mycobacterial infection [23].

Indeed, reaspiration revealed the presence of *M. chelonae*. This pathogen is a nontuberculous Mycobacteria species, belonging to the rapidly growing Mycobacteria (RGM) group. To our knowledge neither *M. chelonae* nor other nontuberculous Mycobacteria have been reported to cause an infection of a silicone arthroplasty; however, NTM are recognized to be responsible for increasing morbidity in both immunosuppressed and immunocompetent patients.

The number of catalogued species of NTM has risen dramatically from 50 in 1997 to 125 in 2007, mainly attributed to better laboratory techniques, but also to an increased awareness of the presence of these agents [11].

NTM are widely distributed in nature, mainly in soil and water, and human disease is caused by environmental exposure. NTM give rise to both symptomatic and asymptomatic infections. The most common site of infection is the lung, but the lymph nodes, skin, soft tissue, and bone may also be involved.

The affinity of NTM for the upper extremity has been well documented. More than ten species have been described to cause tenosynovitis [24], the most common being *M. marinum* and *M. kansasii*. Most infections were related to exposure to contaminated water sources, trauma, or iatrogenic procedures such as steroid injections [17, 24]. Infections with *M. Chelonae* have also been reported to occur without an inciting event [14].

The RGM group, including *M. fortuitum*, *M. abscessus*, and *M. chelonae*, are characterized by rapid growth in subcultures—usually less than 7 days. These pathogens have been reported to infect puncture wounds, open fractures, and also to be the cause of nosocomial infections [4, 11, 14, 20]. Surgical site infections postliposuction and laparotomies were related in the past to breaks in instrument sterilization procedures [15, 21]. There were no other *M. chelonae* infections within our institution in the months preceding or following this case.

Eid [4] reviewed and reported 19 cases of prosthetic joint infections caused by RGM. Ten of them involved hip replacements, eight knee replacements, and an additional case involving the elbow. *M. fortuitum* was responsible for ten cases and *M. chelonae* for six. The median time from the implantation to the onset of symptoms was 3.5 weeks, and the clinical manifestations were similar to those of infections due to common pathogens. The authors recommended the removal of the prosthesis as essential to the healing process, since patients with retained prosthetic components had a high incidence of relapse. Reimplantation was successful in five cases after time lapses of 3.5–29 months, but led to relapse in one case when inserted prematurely after only 7 weeks of therapy [4].

Antimicrobial susceptibility should guide the choice of the antibiotic treatment in cases involving RGM [4, 11], as there is variation in susceptibility between species and resistance to antimicrobial therapy. As a group, RGM will not be sensitive to the first line antituberculous agents, but clarithromycin, tobramycin, imipenem, quinolones, sulfonamides, linezolid, doxycycline, and cefoxitin may be effective.

The guidelines for treatment of bone infection recommend the use of combination antimicrobial therapy for at least 4 to 6 months [11]. In our case, both of tobramycin and clarithromycin were provided during the induction period, when a high burden of organisms was present. Due to patient's intolerance, we were unable to continue a combination oral regimen, and monotherapy with clarithromycin was applied for 6 months. Emergence of resistance to clarithromycin during monotherapy has been described [22]. No evidence of relapse was present in this case during our 10-month follow-up. This is consistent with Eid's series of large prosthetic joint infections in which cure was reported with macrolide monotherapy [4]. We consider combination antimicrobial therapy preferable when it can be applied.

Our knowledge of the microbiologic profile of the infections occurring in rheumatoid patients following silicone metacarpophalangeal arthroplasty is derived from the work of Millender et al. more than 30 years ago. There are reports of infections in recent reviews [1, 19]; however, we could not find any additional series focused on this topic. We believe that silicone joint implant infections should be regarded as a dynamic process, which is influenced by the emergence of more virulent bacterial strains, and can be better defined using refined laboratory techniques that were developed in the interim.

Infections with NTM will be encountered more often in the clinical setting, which emphasizes the importance of these agents as human pathogens. Awareness of the spectrum of their clinical presentation may prevent delays in diagnosis and lead to the institution of appropriate antibiotic and surgical therapy.

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