Mycobacterium chelonei Infection of a Broviac Catheter Insertion Site

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***Mycobacterium chelonei* infection developed at the insertion site of an indwelling Broviac catheter in a child with erythroleukemia. Direct adherence to and colonization of the intra- and extra-luminal surfaces of the catheter, with extension to the adjacent subcutaneous tissue, by this rapidly growing mycobacterium may have been the primary factor underscoring the infection. Nontuberculous mycobacteria such as *Mycobacterium chelonei* grow readily on routine bacteriologic media and resemble *Corynebacterium* spp. (diphtheroids) in their Gram staining and microscopic characteristics. The persistence of the infectious process and a diphtheroid-like microorganism despite antimicrobial therapy should raise the suspicion for a mycobacterial species.**

Despite their multiple beneficial qualities, indwelling catheters serve as a major focal point for infections, either as a consequence of colonization of the cannula wound or of the surface and/or luminal side of the catheter itself, or by the administration of contaminated infusates. In most instances the offending microorganisms have been species of *Staphylococcus, Streptococcus* (enterococcus), gram-negative enteric and non-enteric bacilli, *Candida,* and gram-positive bacilli of the genera *Corynebacterium* and *Bacillus* (1–4). The recognition of nontuberculous mycobacteria, especially *Mycobacterium fortuitum* and as reported herein, *Mycobacterium chelonei,* as causes of infection in the setting of long-term indwelling intravascular catheters has only recently gained the appreciation of clinicians and microbiologists alike (5, 6). Non-catheter-associated bacteremia caused by *Mycobacterium chelonei* has also been described (7). Although *Mycobacterium fortuitum* complex wound infections subsequent to cardiac (8–10) or plastic surgery (11) have been well documented, nontuberculous mycobacterial infection of indwelling catheter sites is a rare event (3, 4).

In the present report, we describe a 2.5-year-old child with erythroleukemia who developed a Broviac catheter site infection with *Mycobacterium chelonei.* The microbiologic attributes of this nontuberculous mycobacterium are stressed as an aid to its initial recognition and subsequent isolation. Additionally, pathogenetic mechanisms underscoring nontuberculous mycobacterial infections in the setting of indwelling intravascular catheters are discussed.

Case Report. A 2.5-year-old boy with trisomy 21 and erythroleukemia in remission presented with an infection at the insertion site of his indwelling central (Broviac) catheter, which had been placed six months earlier. A leak that had developed in the tubing adjacent to the insertion site several months earlier had been repaired, however, the catheter continued to leak whenever fluid was forcibly injected.

The child's most recent chemotherapy had been administered two weeks prior to admission. Three days before admission, while an outpatient, he developed fever, and erythema was noted at the catheter insertion site. Blood (10 ml) for culture was drawn through the catheter; 5 ml was inoculated into 50 ml of Trypticase Soy Broth and 5 ml into Thiol Broth supplemented with sodium polyanetholsulfonate and CO_2 (Difco, USA). The flask containing Trypticase Soy Broth was vented. Cultures of the catheter site were also obtained and the boy was placed on oral cephalexin therapy. The infection did not improve over the next two days and the patient was admitted.

On physical examination the child had fever of 38.3 °C, and tenderness, swelling and erythema were noted in the subcutaneous tissue surrounding the insertion site. A serous discharge was exuding from the involved area. The white blood cell count was 3,800/mm^3, with an absolute neutrophil count of 2,200/mm^3. Cultures of the catheter site grew diphtheroids. Repeat wound and blood cultures were obtained and the child was started on intravenous vancomycin therapy.

When the diphtheroid-like organisms from the original catheter site culture were later identified as belonging to the *Mycobacterium fortuitum* complex group, a direct smear of the wound drainage was done, and upon Kinyoun staining, acid-fast bacilli were seen. The Broviac catheter was then removed; cultures of the tip also yielded the nontuberculous mycobacterium. Therapy with amikacin and cefoxitin was started, and vancomycin treatment was discontinued. The site continued to ooze grey-brown fluid, and a drain was surgically placed into the site. During the next two days, the wound site became dry, with resolution of the erythema and swelling. At the end of two weeks, all evidence of infection had resolved, and after four weeks of therapy the child was discharged. The Broviac catheter was not replaced at that time.

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The mycobacterium, further identified as *Mycobacterium chelonei* ssp. *abscessus*, was isolated from multiple cultures of the catheter insertion site. This same organism was also isolated from the surface and lumen of the catheter tip. Blood specimens for culture repeatedly taken from the Broviac catheter and from a peripheral vein were negative.

Microbiological Investigations. Initial plating of the catheter insertion site specimen onto a variety of media resulted in growth of dry, rough, nonpigmented colonies on 5 % sheep blood and chocolate agars after three days incubation. Upon more prolonged incubation the colonies developed radial striations that imparted a spreading, feathery aspect to the colonies (Figure 1). Additionally, agar growth was accompanied by an odor reminiscent of damp soil. In Dubos liquid medium, growth was flocculant beneath a surface pellicle. Gram-stained smears of colonies showed irregular staining and slightly curved, beaded, gram-positive rods and filaments arranged singly and in small bundles, suggestive of a *Corynebacterium* species.

On the basis of prior experience with the colonial and microscopic morphology of rapidly growing nontuberculous mycobacterial species (12), and because the diphtheroid-like microorganism was recovered in pure culture and was refractory in vitro and in vivo to routine antimicrobial agents, it was strongly suspected that the isolate was a nontuberculous mycobacterium. This impression was confirmed by staining smears of colonies by the Kinyoun method, which revealed acid-fast pleomorphic bacilli. The intensity of the carbol fuchsin staining was related to culture age; young (48 to 72 h old) cultures were faintly acid-fast (pink), while older colonies showed intensely red-staining bacilli. These tinctorial qualities may be related to the quantitative presence of mycolic acids in the cell wall, which entrap the red carbol fuchsin on the cell interior (13).

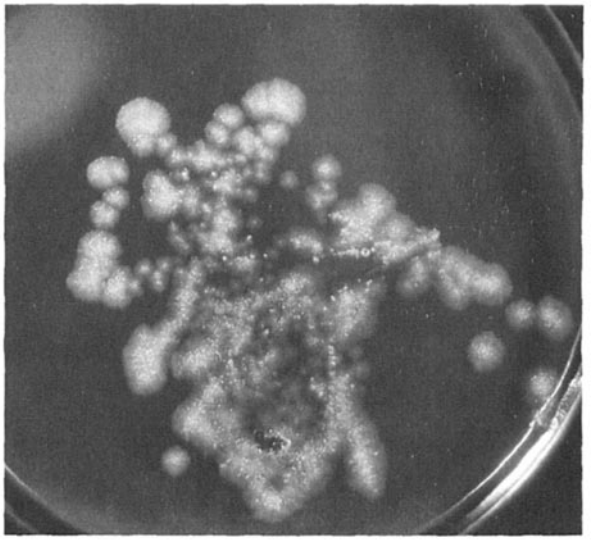

Figure 1: Roll culture of Broviac catheter tip on sheep blood agar demonstrating feathery, spreading, irregularly textured colonies of *Mycobacterium chelonei.*

The insertion site isolate and subsequent catheter isolates were shown to be identical and characterized as *Mycobacterium chelonei* ssp. *abscessus* on the basis of growth on MacConkey's agar, negative niacin and nitrate reductase activities, positive tellurite reduction, urease, catalase and arylsulfatase production, Tween 80 hydrolysis, and growth in the presence of 5 % sodium chloride (12, 14). Although antimicrobial susceptibility testing of the *Mycobacterium chelonei* isolate was not performed, this species has been found to be susceptible to amikacin and cefoxitin (15), agents that were administered to our patient with successful outcome.

Discussion. There are several important attributes of the present case that underscore the epidemiology and pathogenesis of *Mycobacterium chelonei* infections in patients with long-term intravascular catheters. First, *Mycobacterium chelonei* is widely distributed in environmental sources such as water, soil and dust, and could easily have gained access to the catheter through contamination of the luminal surface through the perforated site. Introduction in this manner is in contradistinction to acquisition through trauma, e.g. injection of a medication (12, 16–18), or through the presurgical use of contaminated gentian-violet skin-marking solutions (19) or the skin disinfectant 2′, 7′-dibromo-4′-hydroxymercury fluorescein (merbromin) (20).

Traumatic introduction of *Mycobacterium chelonei* into subcutaneous tissues through contaminated materials allows for the direct implantation of bacteria into sterile body sites, thereby precluding initial interaction with host epithelial surfaces to which *Mycobacterium chelonei* may not colonize as a prerequisite to infection. In the present case, however, as *Mycobacterium chelonei* was recovered from the Broviac catheter tip, lumen and extra-luminal surface, we postulated that this rapidly growing nontuberculous mycobacterium has the requisite surface properties to adhere to and colonize silicone surfaces. Cooper et al. (21) recently reported ten patients with *Mycobacterium chelonei* infection. One of their patients was also a child with trisomy 21 who developed *Mycobacterium chelonei* bacteremia secondary to a Broviac catheter insertion site infection with this species.

Studies conducted in our laboratory have shown that *Mycobacterium chelonei* adheres markedly to silicon Broviac catheters, such as the one used in our patient

(Engler, H. D., et al., Annual Meeting of the American Society for Microbiology, Miami Beach, 1988, Abstract no. D147). Thus, infection in our patient may have ensued by the direct contamination of the intra- and extra-luminal surfaces, with extension to the adjacent subcutaneous tissue.

The negative cultures found for blood drawn through the colonized catheter and inoculated into media capable of supporting the growth of *Mycobacterium chelonei* may reflect inadequate microbiological processing because of discarding of subcultures prior to recognizable growth of the isolate. Alternatively, adherence of *Mycobacterium chelonei* to the catheter may have precluded dislodgement, thereby contributing to negative blood cultures. Although unproven, support for this concept may be the lack of systemic spread of the mycobacteria in our immunosuppressed patient.

Correlative to the above, it is strongly emphasized that the routine processing of a wound site infection in the absence of suspicion of a nontuberculous rapidly growing mycobacterial species often will not recover these microorganisms. Additionally, in those situations wherein a more common pathogen such as *Staphylococcus aureus* has been isolated along with a diphtheroid-like organism, erroneous clinical attribution may be accorded the staphylococcus and the true etiologic agent dismissed. In such a circumstance, significance of the diphtheroidal isolate may be delayed until the staphylococcus has been eliminated by antimicrobial therapy without resolution of the infectious process but with persistence of the diphtheroid (unpublished observation). Heightened awareness that the diphtheroid-like isolate is indeed a mycobacterial species may be derived initially from its antibiogram (resistance to most antimicrobial agents except aminoglycosides) and true acid-fast staining characteristic.

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