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BRIEF REPORT

Mycobacterium Mucogenicum Bacteremia and Nodular Soft Tissue Infection in a Person Who Uses Tap Water to Inject Drugs

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The ongoing North American epidemic of intravenous opioid and methamphetamine use increases the occurrence of bacteremia from environmental organisms. In this study, we report a case of *Mycobacterium mucogenicum* bacteremia and associated nodular soft tissue infection in a person who uses tap water to inject drugs.

Keywords. injection drugs; *Mycobacterium*; tap water.

CASE

A 50-year-old female presented to a community hospital with a 24-hour history of fever and a right forearm abscess at the site of drug injection. The forearm abscess was incised and drained, and a sample was obtained for bacterial culture. Two peripheral blood cultures were collected before treatment with meropenem. The patient's forearms demonstrated subcutaneous nodules that she maintained had increased in size slowly during the 2 years preceding her current hospital presentation.

The patient has psychiatric illness, of which intergenerational trauma is a probable factor [1, 2]; her parents attended Canada's Indian Residential School system. She had been diagnosed with bipolar disorder, borderline personality disorder, and polysubstance use disorder. Her home medications included risperidone, quetiapine, fluoxetine, amitriptyline, and hydromorphone. Our patient injects cocaine on a daily basis and methamphetamine and opioids when cocaine is difficult to obtain. The patient injects her drugs using unfiltered tap water as sterile water ampules and filters are rarely accessible; she has a history of bacteremia from environmental organisms, including *Sphingomonas* spp, *Microbacterium* spp, *Chryseobacterium indologenes*, and *Sphingobacterium spiritivorum*. She denied sharing her injection paraphernalia and reusing her needles. At baseline, our patient is on home oxygen (2 L/minute) due to chronic obstructive pulmonary disease and pulmonary talcosis. Additional medical history includes inactive hepatitis C and fibromyalgia; she is human immunodeficiency virus negative. She lives in an apartment with her son in Winnipeg, Manitoba, Canada.

Her temperature was 38.2°C, her pulse 121 beats-per-minute, her blood pressure 92/59 mmHg, and her oxygen saturation was 94% while receiving 2 L/minute oxygen via nasal prongs. Physical examination revealed bilateral nodular lesions extending from the dorsum of her hands to her elbows (Figure 1). The nodules were firm and nontender with no overlying erythema. No epitrochlear or axillary lymphadenopathy was present, inconsistent with lymphangitic spread and more suggestive of distinct inoculation of different sites on the hands and forearms. A grade 2 systolic ejection murmur was heard at the right-upper-sternal border with no radiation. Other than clubbing, no peripheral signs of endocarditis were present.

The plastic surgery service was consulted to perform an excisional biopsy of one of the patient's forearm nodules, which revealed necrotizing granulomas (Figure 2). Blood cultures were positive.

One of 2 original sets of blood cultures grew *Mycobacterium mucogenicum* and *Stenotrophomonas maltophilia*, identified by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF; Bruker Biotyper, Bruker Daltonics). *Stenotrophomonas maltophilia* was reported 2 days after blood draw and was susceptible to levofloxacin, trimethoprim-sulfamethoxazole, minocycline, and ceftazidime as determined by broth microdilution method and interpreted according to current Clinical and Laboratory Standards Institute (CLSI). *Mycobacterium mucogenicum* was reported 5 days after initial blood draw. Pathology from the patient's excised forearm nodule demonstrated suppurative necrotizing granulomas associated with acid-fast bacilli on Fite's stain, a peanut oil/xylene modification of Ziehl-Neelsen (see Figure 3). Within the nodule, foreign crystalline material was identified under examination with polarized light. Gram stain from the nodule revealed scant Gram-positive cocci and Gram-negative bacilli, but no organism grew on aerobic, anaerobic, or mycobacterial culture. Culture of fluid from her forearm abscess grew *S maltophilia* and *Streptococcus pneumoniae*. Transthoracic echocardiogram did not reveal any valvular vegetations or regurgitation.

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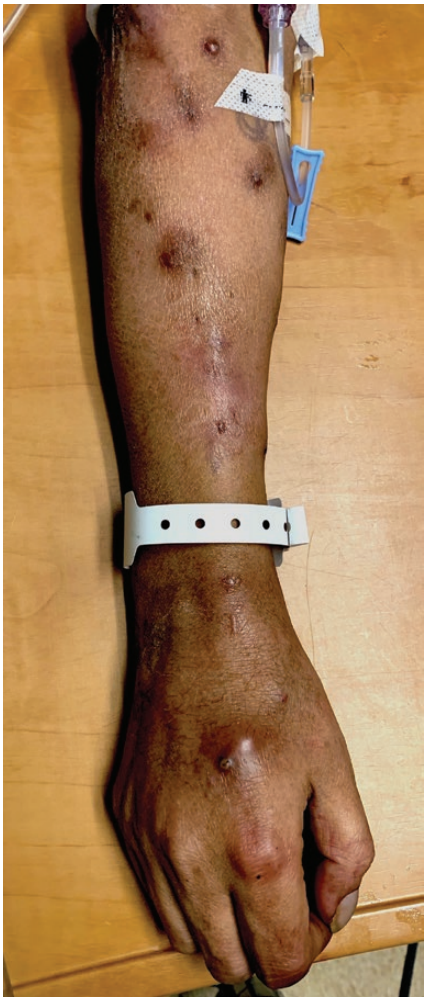

Figure 1. Nodular lesions along the patient's dorsum of her hand and along her forearm. The largest nodule is on the dorsum of her hand, reflecting the oldest nodule in the location of her earlier injection sites. The absence of lymphadenopathy and the presence of nodules in many locations beyond a single lymphatic drainage reflect separate inoculation events rather than lymphangitic spread.

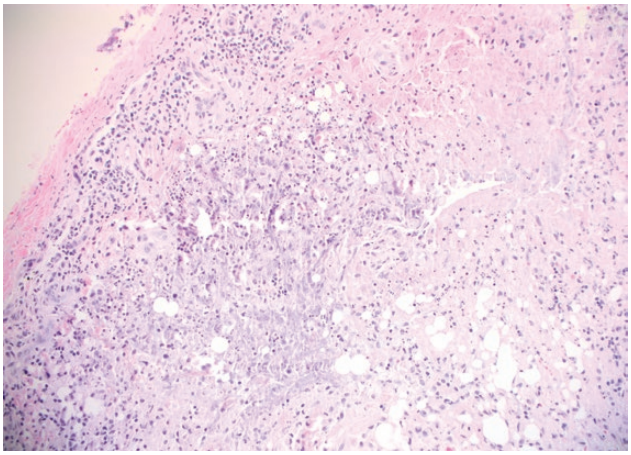

Figure 2. Suppurative granuloma with central necrosis and neutrophilic infiltration.

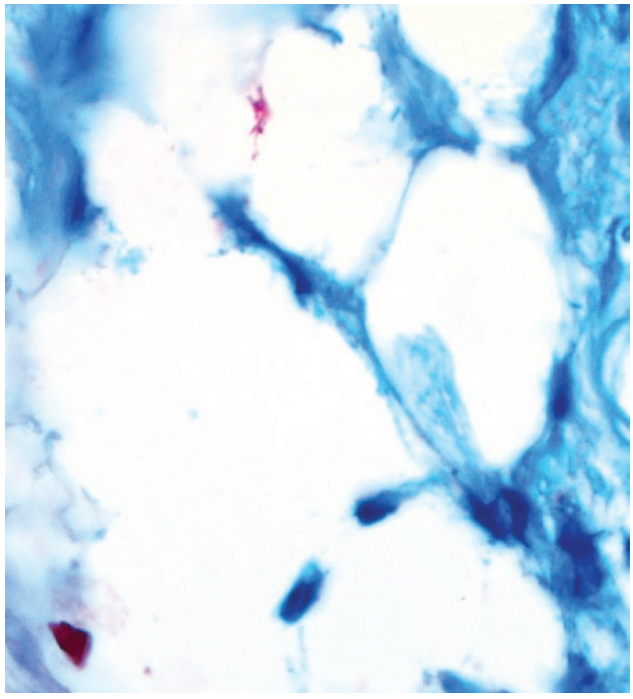

Figure 3. Acid-fast bacilli (Fite's stain) in the upper central part of the image. Crystalline material is seen in the lower left of the frame.

Although *M mucogenicum* susceptibilities were pending, the patient was treated with trimethoprim-sulfamethoxazole ([TMP-SMX] 4.5 mg/kg of the TMP component twice a day) and clarithromycin (500 milligrams orally twice a day), a regimen intended to treat *S maltophilia* as well as *M mucogenicum*. Treatment became complicated by a prolonged QTc on electrocardiogram after clarithromycin initiation; clarithromycin was changed to doxycycline (100 mg PO BID). Psychiatry was consulted to wean QTc-prolonging medications.

Antimicrobial susceptibility testing of the *M mucogenicum* isolate susceptibility testing demonstrated susceptibility to TMP-SMX, amikacin, cefoxitin, ciprofloxacin, clarithromycin, imipenem, linezolid, and moxifloxacin but resistance to doxycycline. Antimicrobial susceptibility was determined by broth microdilution and interpreted according to CLSI breakpoints. The patient's prolonged QTc and psychiatric medications precluded the use of 2 oral agents with in vitro activity, and thus the patient was maintained on her existing regimen with a plan to change doxycycline to clarithromycin once QTc normalized. Multiple repeated blood cultures and mycobacterial blood culture were negative. Over the course of 12 weeks of therapy, the patient clinically improved and her nodules decreased in size and eventually disappeared altogether. Although the patient's *M mucogenicum* bacteremia and nodular soft tissue infection resolved, she was subsequently diagnosed with endocarditis from other environmental organisms, including *S maltophilia*, and she was hospitalized for 6 weeks before being discharged home.

During her admission for endocarditis, she was treated with TMP-SMX in addition to meropenem that would likely have therapeutic effect on residual *M mucogenicum*. Her most recent blood cultures 6 weeks after discharge are negative.

Patient Consent Statement

Written informed consent was obtained from the patient to describe her case and include pictures of her arms and nodule pathology. The design and publication of this work has been approved by the University of Manitoba Bannatyne Research Ethics Board (HS23928:H2020:227, approved May 4, 2020) and conforms to standards currently applied in Canada.

DISCUSSION

Mycobacterium mucogenicum is a rapidly growing nontuberculous mycobacterium (RGM) that routinely inhabits tap water [3, 4]. *Mycobacterium mucogenicum*'s ability to form biofilms and reproduce in environmental amoeba enables it to tolerate various forms of sanitization including mild chlorination [3]. Due to this fitness advantage in disinfected aqueous ecosystems, *M mucogenicum* is the most commonly identified RGM in tap water [5].

Mycobacterium mucogenicum infection has diverse clinical manifestations in both immunocompetent as well as immunocompromised hosts, although it is notorious for causing outbreaks of catheter-related blood stream infections among hemodialysis and oncology patients [3, 4, 6]. The ongoing North American epidemic of intravenous opioid and methamphetamine use increases the occurrence of bacteremia from environmental organisms. To our knowledge, this is the second reported case of *M mucogenicum* infection associated with the injection of drugs [7]. Our patient's polymicrobial bacteremia was due to injection of tap water from the same contaminated source that caused the granulomatous nodular inflammation in her forearms.

The concurrence of *M mucogenicum* and *S maltophilia* in the blood culture as well as the nodule may reflect a novel manifestation of mycobacterial coinfection with a Gram-negative bacillus. This phenomenon has been commonly described in patients with cystic fibrosis where horizontal gene transfer from pseudomonads contributes to the virulence of *Mycobacterium abscessus* [8]. Although polymicrobial culture positivity often suggests contamination, here the coexistence of RGM and Gram-negative bacillus may suggest the simultaneous inoculation of environmental symbionts.

Optimal treatment for *M mucogenicum* bacteremia and soft tissue infection remains unclear. If a single skin lesion is present, surgical excision should be considered. A combination of 2 agents, to which the isolate demonstrates in vitro susceptibility, is recommended to prevent the development of drug resistance [9, 10]. *Mycobacterium mucogenicum* is commonly susceptible to many antimicrobials including amikacin, cefoxitin, clarithromycin, imipenem, and TMP-SMX [3]. However, like other RGM, it remains resistant to first-line antituberculous medications.

CONCLUSIONS

As our case illustrates, among persons who inject drugs, bacteremia with RGM should not be considered a contaminant and may in fact point to other sites of infection. People who inject drugs often experience physical, psychiatric, and socioeconomic difficulties that limit their access to sterile injection equipment. Expanding harm reduction programs to increase accessibility of sterile paraphernalia could mitigate infectious complications of injection drug use and subsequent hospital admission. Antimicrobial options were significantly limited by our patient's polypharmacy. This case further emphasizes the need for coordinated infectious disease, psychiatric, and addictions care. It is essential for infectious diseases specialists to incorporate harm reduction strategies into their patient interaction to prevent further infectious complications from intravenous drug use.

Acknowledgments

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