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Short report

Source-case investigation of *Mycobacterium wolinskyi* cardiac surgical site infection

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SUMMARY

The non-tuberculous mycobacteria (NTM) *Mycobacterium wolinskyi* caused bacteraemia and massive colonization of an aortic prosthesis in a patient 16 days after cardiac surgery, necessitating repeat surgery and targeted antimicrobial chemotherapy. The infection control team investigated the source and conditions of infection. Peri-operative management of the patient complied with recommendations. The environmental investigation showed that although *M. wolinskyi* was not recovered, diverse NTM species were present in water from point-of-use taps and heater-cooler units for extracorporeal circulation. This case and increasing evidence of emerging NTM infections in cardiac surgery led to the implementation of infection control procedures in cardiac surgery wards.

Introduction

Non-tuberculous mycobacteria (NTM) are ubiquitous bacteria isolated from various environments such as soil and water.[1] The ability of NTM to infect immunocompromised patients has long been recognized, and their prevalence has increased over recent years.[1] *Mycobacterium wolinskyi* is a rapid-growing NTM (within seven days on artificial media) that belongs to the *Mycobacterium smegmatis* group. It was recently described as

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an emerging pathogen in healthcare-associated infections, particularly after surgery,[2] and infection reports include skin and soft tissue infections, bone and joint infections, and bacteraemia.[2] An outbreak of *M. wolinskyi* with six cases of surgical site infection (SSI) after cardiothoracic surgery over a six-year period was reported recently.[3] In addition, a three-year survey of hospital water distribution revealed that all studied sites were positive for NTM at least once during the study period, suggesting that water may act as a vector for NTM transmission to humans within the hospital.[1] In this context, heater-cooler units of heart-lung machines used during cardiac surgery are under increasing suspicion.[3] This article reports a case of *M. wolinskyi* SSI in cardiac surgery, and the source-case investigation undertaken to identify a reservoir and the mechanisms of transmission.

Clinical case

A 48-year-old non-diabetic male patient without significant risk factors for SSI (body mass index 24.6, non-smoker, no comorbidities) underwent surgical reduction of a symptomatic aneurysm of the ascending aorta. Surgical treatment consisted of aortic valve replacement with a mechanical prosthesis (Medtronic ATS n°27, Dublin, Ireland) associated with aortic reconstruction using an Intergard Silver Woven tube (Maquet, Germany). The procedure lasted for 244 min, including 152 min of extracorporeal circulation with a heart-lung machine (3T model, Stockert, Sorin Group, München, Germany). The patient had showered with 10% povidone-iodine scrub on the evening before surgery and on the morning of surgery. Pre-operative skin antisepsis was performed by scrubbing with 10% povidone-iodine, rinsing with sterile water, drying with sterile compresses, and antisepsis with povidone-iodine-alcohol left to air dry. Antibiotic prophylactic treatment consisted of cefamandole 1500 mg injected 45 min before incision and cefamandole 750 mg injected every 2 h during the intervention, in accordance with hospital recommendations. On Day 13 post surgery, the patient was mildly febrile but was discharged in good general status. He was re-admitted on Day 15 post surgery because of fever (39°C). In the diagnostic work-up, transoesophageal ultrasonic cardiography revealed a peri-prosthetic collection. In the face of likely SSI, empirical antibiotic therapy was initiated with cefotaxime 4 g tid plus gentamycin 5 mg/kg/day and vancomycin 30–60 mg/kg/day in continuous intravenous perfusion. Six blood culture sets were collected on Days 16–18 post surgery, five of which were positive (on Days 19–21 post surgery) for a slow-growing Gram-positive rod. Only aerobic bottles were positive. The antimicrobial susceptibility pattern of the not-yet-identified Gram-positive rod showed resistance to vancomycin and cefotaxime. As such, antibiotic therapy was shifted to meropenem 2 g tid, ciprofloxacin 400 mg tid and cotrimoxazole 320 mg tid. Two days later, further reading of susceptibility tests led to meropenem being changed to imipenem/cilastatine 1 g tid plus amikacin 15 mg/kg/day. A transient ischaemic attack led to another transoesophageal echocardiogram, and this showed a mobile image inside the prosthetic aortic tube, warranting emergency surgical revision on Day 23 post surgery. This consisted of replacement of a bioprosthetic aortic valve and an aortic prosthesis (silver tube) with a vascular homograft. Prosthesis and vegetation samples obtained during revision surgery were submitted to direct 16S rRNA gene polymerase chain reaction and sequencing, and this revealed the presence of *M. wolinskyi* DNA (100% identity on 861 base pairs with the type strain ATCC 700010^T). Culture on to aerobic blood agar plates was positive for four out of six other deep samples, including the aortic prosthesis, confirming the diagnosis of deep organ space SSI (Table I). Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF), using Microflex and MALDI Biotyper database (Bruker, Billerica, MA, USA), failed to identify the isolates recovered from the blood cultures and surgical samples. The 16S rRNA gene sequence[4] of each of the five positive cultures matched the sequence of *M. wolinskyi* ATCC 700010^T at 100% on 859 base pairs, and *M. peregrinum* was the most closely related species in the 16S rRNA gene sequence (99.3%). Consistent with this result, the *hsp65*[4] gene sequence also showed high similarity (97.9%) with *M. wolinskyi* ATCC 700010^T, and significantly lower similarity with other NTM species, including *M. peregrinum* (95.6%), thereby confirming the affiliation of the SSI strains to the species *M. wolinskyi*. Sequences affiliated to *M. wolinskyi* (99.9–100% identity in 16S rRNA gene) in the National Center for Biotechnology Information database (http://www.ncbi.nlm.nih.gov/) originated from landfill surface soil (India), antecubital fossa skin microbiota and prosthetic breast implants.

After expert discussion, imipenem/cilastatin was replaced with linezolid 600 mg bid. Revision surgery and antibiotic therapy improved the patient's status. He was discharged from hospital after 16 days, with treatment with amikacin 15 mg/kg/day IV, oral linezolid 600 mg bid, moxifloxacin 400 mg/day and doxycycline 100 mg bid for at least six months with regular clinical follow-up.

Source-case investigation

Retrospective analysis of the patient's medical and nursing records revealed no deviation from recommendations relevant to peri-operative infection control measures. Culture and 16S rRNA gene polymerase chain reaction performed on a prosthetic device with the same trademark but from another batch was negative. Nevertheless, an alert was issued concerning this device, and no other reported cases were found in national surveillance databanks.

During his hospital stay, the patient had occupied five different locales: bedroom n°1 on admission, pre-anaesthesia cubicle n°2 in the operating theatre (OT), operative room (OR) n°3, postoperative intensive care unit (ICU) room n°4, and bedroom n°5 in the surgery department before discharge. These five locales and the decontamination room of the OT were sampled in search of an environmental source of *M. wolinskyi*. Eighteen surface sites of OR n°3, including heart-lung machines (N=3), were sampled using dry swabs. Two swabs were collected for each site and were cultured on to blood agar, either by direct plating or after pre-incubation in a nutrient broth for 18 h at 30°C. Plates were incubated aerobically at 30°C and 37°C for at least seven days. No NTM were cultured from any of the surface samples.

A total of thirty-eight water samples were collected. Tap water samples were recovered before and after a 2-min purge from the shower and the sink of bedroom n°1, as well as from six sinks located in rooms 2, 4, 5 and 6. The heater-cooler unit