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Mycobacterium bovis Bacillus Calmette-Guérin Cross-Contamination in the Operating Room: A Case Report

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Abstract

Mycobacterium tuberculosis complex (MTBC) false-positive cultures are commonly attributed to laboratory cross-contamination, but cross-contamination in the operating room (OR) is seldom reported. We report an investigation of cross-contamination in the OR for our case patient, who underwent surgical intervention for a chronic, left-sided breast lesion. Although the case patient had never received *Mycobacterium bovis* bacillus Calmette-Guérin (BCG) vaccine or chemotherapy, a subsequent surgical sample culture was identified as MTBC by high-performance liquid chromatography and *M. bovis* BCG-type by genotyping. A collaborative false-positive investigation was initiated, and we discovered a cross-contamination event in the OR from a source case who received BCG intravesical instillation. Clinicians, public health, and infection control staff should be aware that MTBC cross-contamination in the OR is rare, but possible, and should recognize the importance of conducting thorough false-positive investigations.

Keywords

Mycobacterium tuberculosis, tuberculosis, *Mycobacterium* bovis, BCG, cross-contamination, false-positive

A 48-year-old woman living with HIV ("case" patient) sought care in Georgia, USA for a chronic, left-sided breast lesion. She reported recurrent *Staphylococcus aureus* skin infections, including breast abscesses. She was born in the United States, never lived abroad, intermittently experienced homelessness, was not receiving antiretroviral therapy, and had never received bacillus Calmette-Guérin (BCG) vaccine. Signs of advanced HIV and left breast edema and tenderness were noted. An ultrasound showed an abscess and surgical intervention was warranted for source control. A chest computed tomography showed multiple enlarged intrathoracic lymph nodes and a pulmonary calcified granuloma. The CD4 count was 221 cells/mm^3 and the HIV viral load was 3.74 logs. Multiple breast abscesses were found during operative debridement. Two surgical sample cultures on routine microbiologic media were positive for *S aureus*. The samples were also cultured on BD BACTEC™ MGIT™ and Middlebrook 7H11 agar medium. Breast tissue histopathology showed acute inflammation consistent with abscesses. No granulomas were described, and acid-fast staining was not performed. Forty days later, a single mycobacteria colony was noted on the 7H11 agar identified as *Mycobacterium tuberculosis* complex (MTBC) by high-performance liquid chromatography. The patient was referred to her local health department where treatment for tuberculosis and HIV were initiated. The isolate was subjected to routine, conventional genotyping (spoligotype and 24-locus MIRU-VNTR) by the Centers for Disease Control and Prevention and identified as *Mycobacterium bovis* BCG-type.

We initiated an investigation for cross-contamination because the patient had never received BCG vaccine or chemotherapy. We identified a BCG-positive case ("source" patient) with a similar collection date by reviewing Georgia's State Electronic Notifiable Disease Surveillance System (SendSS) records. The source patient was undergoing surgical management of intra-abdominal infection, a complication of BCG intravesical instillation. The case and source patients' surgeries were performed at the same hospital, prompting review of laboratory records. However, the

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samples were processed at different times and laboratory cross-contamination was ruled out. Upon review of hospital records, we discovered the case patient's surgery was performed 48 hours after the source patient's surgery in the same operating room (OR). The source patient underwent an exploratory laparotomy, over 300 milliliters of pus were drained, and samples grew *M. bovis* BCG-type. Four other patients underwent surgery in the same OR between source and case patients' surgeries. No samples for microbiological tests were collected in the OR for these 4 cases. Review of state surveillance and hospital records as of September 2021 did not uncover any other suspected false-positive BCG cultures. Moreover, there was no documentation of surgical site complications secondary to infections. Of note, these 4 patients had no hardware or device implanted in the OR.

We could not ascertain if any common surgical equipment was used for both patients. Operating rooms in this institution undergo turnover cleaning between cases and terminal cleaning at the end of the day. Turnover cleaning was performed with Sani-Cloth® AF3 wipes and terminal cleaning was performed with Ecolab® A-456 II disinfectant. The first product claims to have activity against *M. bovis* whereas the latter product does not mention *M. bovis* in its technical sheet. Two gaps in the OR cleaning process were identified in this investigation. First, the nurse circulator present during the source patient's surgery was unaware of turnover cleaning policy requiring the circulator to disinfect surgical equipment after each case. Second, the surgical table was disinfected as part of the turnover cleaning process and left draped at the end of the day and excluded as part of the terminal cleaning process. Both gaps were addressed by training the OR personnel who perform these turnover tasks.

Globally, approximately 2% of all MTBC-positive cultures result from laboratory cross-contamination.[1] Furthermore, 9% of all TB diagnoses may be incorrect due to laboratory cross-contamination.[1] In addition to exposing patients to unneeded and potentially harmful treatment, false TB diagnoses may cost an average of $10 000 per patient in the United States.[2] However, cross-contamination does not occur exclusively in the laboratory. We describe a case of a false-positive MTB culture attributed to cross-contamination of the environment from a previous patient who had surgery for a disseminated BCG infection in the same OR. Although fomites are not generally considered a source for transmission of MTBC, given the results of our investigation, it appears plausible that an OR table surface or tool was heavily contaminated with *M. bovis*, which can survive up to 4 months on dry, inanimate surfaces,[3] and contaminated specimens placed on that table or touched by that tool 4 days later.

Although fomite-based transmission following improper cleaning of bronchoscopes or infected cystoscopes is well established and has been associated with both false-positive cultures and potential exposure to *M. tuberculosis*,[4,5] aside from this report, we did not find any other reports of MTBC false-positive cultures due to cross-contamination in the OR. While only our case patient's samples were cross-contaminated in this incident, it is plausible that any material or device on the OR table that was placed into another patient could have resulted in serious complications, including inoculation of *M. bovis* or contamination and infection of wound beds. Our report demonstrates the importance in thorough MTBC false-positive investigations in accordance with the CDC False-Positive Investigation Toolkit[6] and warrants further investigation into OR cleaning protocols and procedures. This report is timely given the recent bone graft-related MTBC outbreak throughout the United States.[7] Clinicians, public health, and infection control staff should be aware that MTBC cross-contamination in the OR, and perhaps fomite-based transmission, is an exceedingly rare, but possible, event.

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Ethics Approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed Consent

Informed consent for patient information to be published in this article was not obtained because the patient has been lost to follow-up.

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