PROTOCOL

*Mycobacterium avium* complex (MAC) Infections following Cardiovascular Procedures
Provincial Protocol

IPC Surveillance and Standards

Approved by Provincial Surveillance Committee: January 2018
Revised: April 2019
CONTENTS
Introduction....................................................................................................................................................................................... 4
Goal..................................................................................................................................................................................................... 4
Objectives.......................................................................................................................................................................................... 4
Methodology..................................................................................................................................................................................... 5
Case definition ................................................................................................................................................................................. 5
  Inclusion criteria ........................................................................................................................................................................... 5
  Exclusion criteria ......................................................................................................................................................................... 5
Data source ..................................................................................................................................................................................... 6
Data analysis ................................................................................................................................................................................ 6
Reporting........................................................................................................................................................................................... 6
Limitations...................................................................................................................................................................................... 6
Timelines and accountability ....................................................................................................................................................... 7
Communication ................................................................................................................................................................................ 7
Stakeholders..................................................................................................................................................................................... 7
References........................................................................................................................................................................................ 8

*Mycobacterium avium Complex (MAC)*
Introduction

Bacteria of the *Mycobacterium avium* complex (MAC) play an important role among infections caused by nontuberculous mycobacteria. MAC consists of two well-established species *M. avium* (having four subspecies) and *M. intracellulare*, as well as other closely related mycobacteria (Schweikert et al., 2008). Recently, a new species derived from the group of unnamed members of the MAC commonly found in soil and water (Perkins et al., 2016) has been defined and named *M. chimaera* (Schweikert et al., 2008).

In the spring of 2015, investigators in Switzerland reported a cluster of six patients with invasive infection with *M. chimaera*. The infected patients had undergone open-heart surgery that used contaminated heater-cooler devices during extracorporeal circulation (Perkins et al., 2016). Subsequently, a Pennsylvania hospital also identified a cluster of invasive nontuberculous mycobacteria infections among open-heart surgery patients. A field investigation identified an association between invasive MAC species including *M. chimaera*, infections, and exposure to contaminated heater-cooler devices manufactured by LivaNova PLC (formerly Sorin Group Deutschland GmbH). Although heater-cooler devices are used to regulate patients’ blood temperature during cardio-pulmonary bypass through water circuits that are closed, these reports suggested that aerosolized *M. chimaera* from the devices resulted in the invasive infections (Perkins et al., 2016; Sommerstein et al., 2016). In response, the U.S. Food and Drug Administration (2016) issued a safety communication to provide information on the patient risk to infections associated with heater-cooler devices. Similarly, a voluntary medical device recall notice for Bard Arctic Sun Temperature Management System was released on October 18, 2016 by AHS in response to the possible risk of infection by nontuberculous mycobacteria.

MAC can incubate in a patient for years before symptoms present, therefore it can be difficult linking an infection to the cardiac procedure exposure using other traditional, prospective surveillance methods. In October 2016, an internal Infection Prevention and Control (IPC) review of provincial laboratory MAC positive results from January 1, 2015 to October 25, 2016 was conducted. Ninety-five patients were reviewed, and fourteen specimens were sent for further identification. Two isolates were identified as *M. chimaera* but not linked to the global outbreak strain. Although this lab-event surveillance approach is not useful for active case-finding, it is an efficient way to identify patients with the outcome of interest (MAC positive cultures) and the potential healthcare exposure (cardiac procedures). This approach will inform whether a potential association exists, can help to guide further inquiries through chart reviews, and can also guide future prospective surveillance activities for this infection outcome.

Goal

To determine whether patients with positive MAC cultures are associated with cardiovascular procedures performed in Alberta.

Objectives

1. To identify all positive specimens for MACs in Alberta since November 2016, and to continue monitoring MAC positive patients until further investigation of recalled devices has been completed.
2. To link the positive specimens to administrative data to determine whether patients had cardiovascular procedures prior to the positive specimens.
3. To conduct chart reviews on patients with an apparent association between a cardiovascular surgery and a positive specimen, to identify epidemiological links between the procedure and culture.
4. To identify isolates requiring further lab testing (speciation and/or whole genome sequencing) to rule-out association with the global outbreak strain.

Methodology

Patient population
All patients who had a mycobacterial culture performed in Alberta who also had a cardiac surgery within five years of their first positive specimen. Patients with a positive specimen result may present at any healthcare setting in Alberta.

Study design
A retrospective lab-event surveillance will be conducted by linking laboratory data to administrative data. Twice a year, patients with MAC positive specimens (from all body sources) beginning with the next date following the last data linkage will be linked to the Discharge Abstract Database (DAD) to identify all cardiovascular procedures performed in the five years prior to the positive specimen’s collection date.

A retrospective chart review or review of electronic medical records will be conducted among patients with MAC and a previous cardiovascular procedure to determine whether a true epidemiological link exists. Isolates of interest will be identified for further testing at the National Microbiology Laboratory.

Case definition
An incident (i.e. Initial) case is a laboratory confirmed MAC from a body site and
Is identified as positive with MAC within five years following a cardiac surgery procedure involving a heater-cooler unit and
Is identified as an M. chimaera with whole genome sequencing results matching the global outbreak strain.

Inclusion criteria
All patients in Alberta, including both adult and pediatric patients. Only the first positive specimen per patient will be included.

Exclusion criteria
All subsequent positive specimens for a patient will be excluded given the latent period of MAC infections and to exclude positive specimens prior to any cardiac or cardiovascular surgery.
In coordination with the ProvLab, Laboratory Process Excellence will extract all positive specimens with MAC positive specimens for the requested time period. These will include respiratory and non-respiratory sources from adult and pediatric patients.

Linkage to the Discharge Abstract Database will extract admission/discharge information within acute care facilities, facility information, procedure codes and dates and diagnosis codes for the previous five years.

The procedure codes for cardiac and cardiovascular surgeries will be codes listed in the Canadian Classification of Health Interventions (CCI) under Therapeutic Interventions on the Heart (and related structures) (codes 1HA – 1HZ). The codes are broad and sensitive to ensure all potentially relevant cardiac/cardiovascular procedures that occur in acute care facilities. Only the admissions with these codes will be extracted from DAD back to the previous five years. Information on patient risk factors including surgery within past three years, procedure involved graft, valve or transplant, and whether blood or tissue specimen was cultured will be collected.

Data analysis
Descriptive analysis will be done to determine the proportion of patients with a positive MAC culture that had a previous cardiovascular procedure, presence of risk factors, and time between procedure and positive culture date will be reported.

Reporting
The results from the initial data linkages will be shared with IPC and ProvLab for further discussions on whether to continue with routine data queries and/or to conduct further investigation through the review of patient medical records. Depending on the results of this investigation, further investigation of the heater-cooler systems may be required or a temporary recall of specific devices will be released.

Limitations
Only patients with a lab positive result will be reviewed, so patients who were not cultured for mycobacteria in Alberta will not be detected.

Given the long incubation period of MACs before the development of an infection, it will be difficult to confirm an epidemiological link between the infections to a particular cardiovascular procedure identified in the Discharge Abstract Database.
Timelines and accountability

<table>
<thead>
<tr>
<th>Task</th>
<th>Deadline</th>
<th>Person responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request laboratory data from Laboratory Process Excellence</td>
<td>Early April and November</td>
<td>Epidemiologist, IPC Surveillance and Standards</td>
</tr>
<tr>
<td>Submit laboratory data to AHS Analytics for DAD linkage</td>
<td>Mid-April and November</td>
<td>Epidemiologist, IPC Surveillance and Standards</td>
</tr>
<tr>
<td>Analyze linked data</td>
<td>Early May and December</td>
<td>Analyst, IPC Surveillance and Standards</td>
</tr>
<tr>
<td>Review patients’ electronic medical records for initial assessment of epidemiological links</td>
<td>Mid-May and December</td>
<td>Epidemiologist, IPC Surveillance and Standards IPC Physicians</td>
</tr>
<tr>
<td>Report initial results of linked data to IPC &amp; ProvLab</td>
<td>Mid-May and December</td>
<td>Epidemiologist, IPC Surveillance and Standards</td>
</tr>
</tbody>
</table>

Communication

The results of the project will be communicated as a formal report distributed to IPC physicians, IPC directors and staff, and the program leader for mycobacteriology at ProvLab via email followed by teleconference communications between all relevant stakeholders. The report will be presented for information at the IPC Surveillance Committee.

Stakeholders

IPC Senior Medical Officer  
ProvLab Program Leader for Mycobacteriology  
IPC Medical Director, University of Alberta Hospital/Mazankowski Alberta Health Institute  
IPC Medical Director, Calgary & South Zones  
IPC Senior Program Officer  
Co-Chairs, IPC Provincial Surveillance Committee  
Executive Director, Edmonton Zone Director and Edmonton Zone Senior Clinical Practice Coordinator  
Executive Director, Calgary Zone Director and Calgary Zone Senior Clinical Practice Coordinator  
IPC Surveillance and Standards Director
References


