

The Q-Net™ Monthly

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What's News

On the front page of its December 24th (2004) issue, "The Wall Street Journal" published an important article about the FDA, its oversight of endoscope reprocessing, and the risk of disease transmission during flexible endoscopy.

Q-Net welcomes this month's newest subscribers from: *Germany, India, Japan, Jericho, and Saudi Arabia*. All back issues of this newsletter, including last month's, are available at:

<http://www.myendosite.com>

Editor-in-Chief

All of the articles published in this newsletter are written by: **Lawrence F. Muscarella, PhD**, Chief, Infection Control; Editor-in-Chief at: Custom Ultrasonics, Inc.

What is 'Q-Net'?

Q-Net is a technology-assessment network of questions and answers. Its newsletter is: *The Q-Net™ Monthly*.

Q-Net's mail goal is to encourage the infection control, endoscopy and O.R. communities to not only ask good questions but to also require well referenced responses.

Q-Net addresses the needs of both the health care provider whose goal is to provide the best care possible and the patient who deserves affordable quality health care.

Factors responsible for "positive" respiratory specimens

~ Part 2 ~

This is the second in a series of articles that discusses the clinical significance of true and pseudo outbreaks associated with bronchoscopes. This article focuses on factors linked to the contamination of respiratory specimens with M. tuberculosis and atypical mycobacteria, including MAI.

Background and introduction: This is the second in a series of articles that provides a response to a hospital's question about the clinical significance of "positive" respiratory specimens. This hospital identified an increase in the number of respiratory specimens contaminated with mycobacteria. These specimens were collected from patients during bronchoalveolar lavage (BAL) using bronchoscopes that were reprocessed by an automated machine. (The first article in this series was published in this newsletter last month and can be read

on the Internet at: www.myendosite.com/htmlsite/2005/pseudo_infection05.pdf)

The medical literature was reviewed to reply to this hospital's question and to discuss the clinical significance of respiratory specimens contaminated with mycobacteria (and other types of microorganisms). Attention during this review focused on:

- (1) the characteristics of the two types of mycobacteria: (a) *Mycobacterium avium-intracellulare* (MAI) and other species of "atypical" mycobacteria that are opportunistic, ubiquitous in the environment, and do *not* cause tuberculosis; and (b) *M. tuberculosis* and other species of contagious mycobacteria that cause tuberculosis;
- (2) the potential sources, and modes of nosocomial transmission, of these two types of mycobacteria; and
- (3) the definitions of, and differences between, a true (or "real") outbreak and a pseudo outbreak (or, positive laboratory results in the absence of clinical evidence of disease; also sometimes described as a "cluster of 'false' infections").

A table provided in last month's issue of
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FOCAL POINTS: ■ A discussion of factors linked to the contamination of respiratory specimens. ■ A discussion of factors associated with true and pseudo outbreaks. ■ A table of reports of true and pseudo outbreaks of MAI, atypical mycobacteria. ■ A table of reports of true and pseudo outbreaks of *M. tuberculosis*.

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this newsletter lists the different characteristics of the two types of mycobacteria.

An example of a pseudo outbreak of *M. tuberculosis* was also provided in last month's issue of this newsletter, to underscore and clarify the differences between a true outbreak and a pseudo outbreak. This example demonstrates that laboratory results that indicate contamination of respiratory specimens with mycobacteria (or another type of microorganism) do not necessarily indicate a true outbreak (or infection), and may instead suggest a pseudo outbreak.

Whereas a **true (nosocomial) outbreak** is a result of disease transmission and is associated with patients who display clinical symptoms of infection, a **pseudo outbreak** is a result of the contamination of respiratory specimens by an environmental source, such as hospital tap water, a bronchoscope, or an automated bronchoscope reprocessor or system, and is not associated with disease transmission or patient infection.

(A pseudo infection is to be distinguished from "patient colonization," a condition in which a patient harbors, and is a "carrier" of, a pathogen, but is not infected by the pathogen and, therefore, does not display symptoms of disease.)

Last month's issue of this newsletter emphasized that prior to ordering medications for patients who may (or may not) be infected with mycobacteria, it is essential to first confirm a true outbreak by correlating and matching each contaminated respiratory specimen (or other type of clinical specimen, such as a tissue specimen) with a specific patient displaying symptoms of infection.²⁴

Failure to differentiate and distinguish a **true outbreak** from a **pseudo outbreak** may result in the mismanagement of limited financial resources and personnel time, misdiagnosis of disease, confusion, and the inappropriate treatment of "un-infected" patients with an aggressive course of expensive and unwarranted medications that may be harmful to the patient.^{10,11,24-28,32,34}

Factors linked to the contamination of respiratory specimens: In addition to discussing the potential significance of "positive" respiratory specimens, this article investigates specific factors linked to the contamination of respiratory specimens with mycobacteria. Five important issues warrant clarification. **First**, contaminated respiratory specimens may indicate a true outbreak, a pseudo outbreak, or both. **Second**, some of the conclusions regarding atypical mycobacteria that are provided in this article and each of the others in this series also apply to other types of waterborne microorganisms, including gram-negative bacteria such as *Pseudomonas aeruginosa*. **Third**, most infection control practices that prevent true and pseudo outbreaks linked to bronchoscopes also apply to gastrointestinal (GI) endoscopes, cystoscopes,

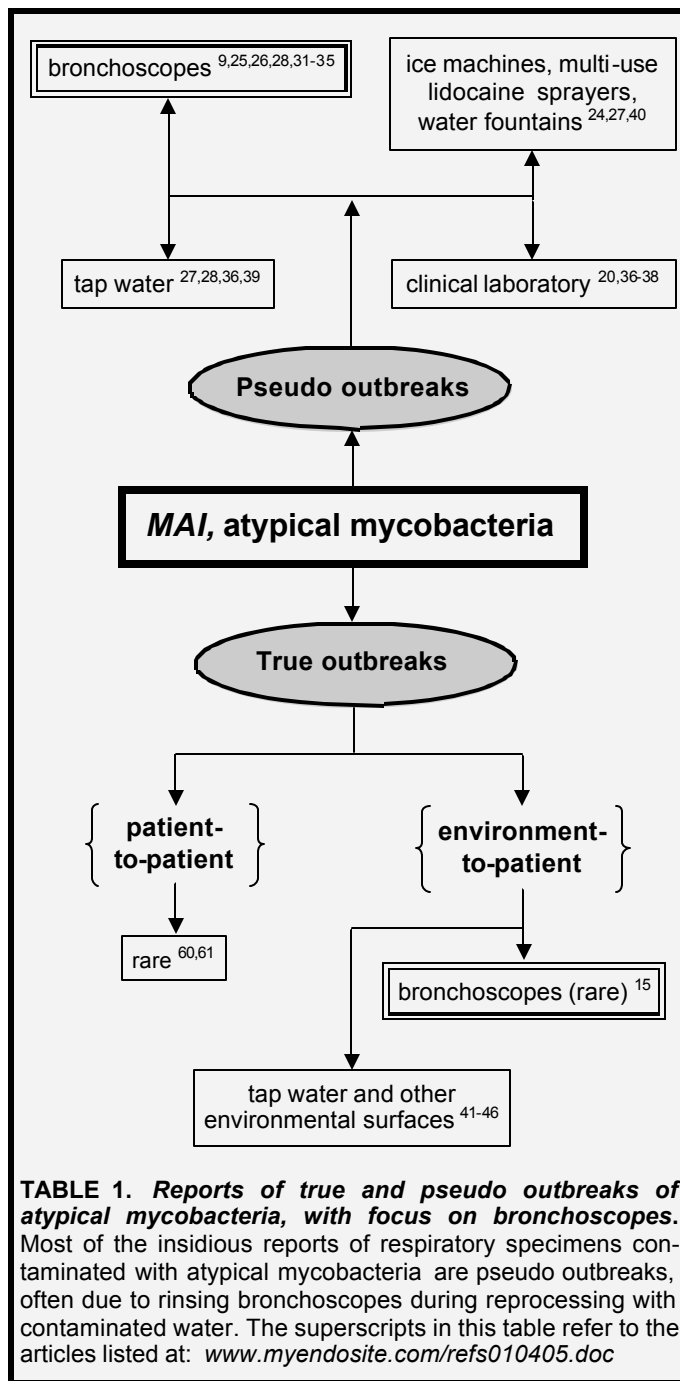


TABLE 1. Reports of true and pseudo outbreaks of atypical mycobacteria, with focus on bronchoscopes. Most of the insidious reports of respiratory specimens contaminated with atypical mycobacteria are pseudo outbreaks, often due to rinsing bronchoscopes during reprocessing with contaminated water. The superscripts in this table refer to the articles listed at: www.myendosite.com/refs010405.doc

laryngoscopes, and other types of flexible endoscopes, whether reprocessed manually or by an automated reprocessor or system.⁵⁹ (All of these types of flexible endoscopes are classified as *semi-critical* devices.) **Fourth**, infection control practices that prevent the nosocomial transmission of MAI and *M. tuberculosis* via a contaminated bronchoscope—high-level disinfection of the bronchoscope is an example—also prevent the transmission of all other species of mycobacteria,

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as well as virtually every other pathogenic microorganism and virus encountered in the endoscopic setting, including *Clostridium difficile*, a spore-forming bacterium.

And, fifth, whereas some factors linked to the contamination of respiratory specimens are associated with both types of mycobacteria, others are associated with only one type of mycobacteria (Tables 1, 2). Ineffective cleaning and disinfection (or “sterilization”) of bronchoscopes, for example, is a factor that has been linked to the contamination of respiratory specimens with *M. tuberculosis*, but not *MAI* or another species of atypical mycobacteria.^{5,8,13,14,21} This finding is understandable, because atypical mycobacteria are environmental, and their transmission from patient-to-patient is rare.^{60,61}

By way of another example, several reports have linked the water used to rinse bronchoscopes after high-level disinfection (or “sterilization”) to the contamination of respiratory specimens with *MAI* and other species of atypical mycobacteria—but not *M. tuberculosis*.^{9,25,26,28,31-35} These reports identify, among other sites, hospital tap water and automated bronchoscope reprocessors or systems with flawed designs as sources of the contaminated water. The lack of data identifying and culturing *M. tuberculosis* in water used to rinse bronchoscopes is not surprising, because the primary mode of transmission of *M. tuberculosis* is patient-to-patient; nosocomial transmission of *M. tuberculosis* from the environment to the patient is rare.^{3-5,55,64}

There are some factors linked to the contamination of respiratory specimens, however, that are associated with both types of mycobacteria. For example, collection, improper handling, processing, and/or analysis of respiratory specimens in the clinical microbiology (or pathology) laboratory; damage to the internal sheath of the bronchoscope’s working channel; and inadequate drying of the bronchoscope after reprocessing have each been linked to the contamination of respiratory specimens with both atypical mycobacteria and *M. tuberculosis* (Tables 1, 2).^{5,7,10-12,15-17,20,25,26,33,35-38}

Factors associated with true, pseudo outbreaks: These findings demonstrate that some factors linked to the contamination of respiratory specimens may be associated with one or both types of mycobacteria. Some of these factors may also be associated with one or both types of outbreaks of mycobacteria. For example, ineffective cleaning and disinfection (or “sterilization”) of bronchoscopes has been associated with both true and pseudo outbreaks of *M. tuberculosis*.^{5,8,13,14,21} Similarly, inadequate drying of the bronchoscope after reprocessing has been associated with both true and pseudo outbreaks of atypical mycobacteria and *M. tuberculosis* (Tables 1, 2).^{5,25,26,33,35,59}

Some factors linked to the contamination of respiratory specimens, however, are associated with either true or pseudo outbreaks of mycobacteria, but not both. For example, the improper handling, processing, and/or analysis of respiratory specimens in the clinical microbiology laboratory is a factor

responsible for cross-contamination and, therefore, pseudo outbreaks (and not true outbreaks) of atypical mycobacteria and *M. tuberculosis*.^{7,10-12,17,20,36-38} In addition, contaminated water used to rinse bronchoscopes after disinfection (or “sterilization”) has been associated with pseudo outbreaks of atypical mycobacteria, due, first, to contamination of the bronchoscope during water rinsing and then, in sequence, to contamination of respiratory specimens during BAL.^{9,25,26,28,31-35} (As previously mentioned, hospital tap water and automated bronchoscope reprocessors or systems with flawed designs may be sources of the contaminated water.)

For reasons that are not entirely clear, reports associating contaminated water used to rinse bronchoscopes with true outbreaks of atypical mycobacteria are lacking. This finding

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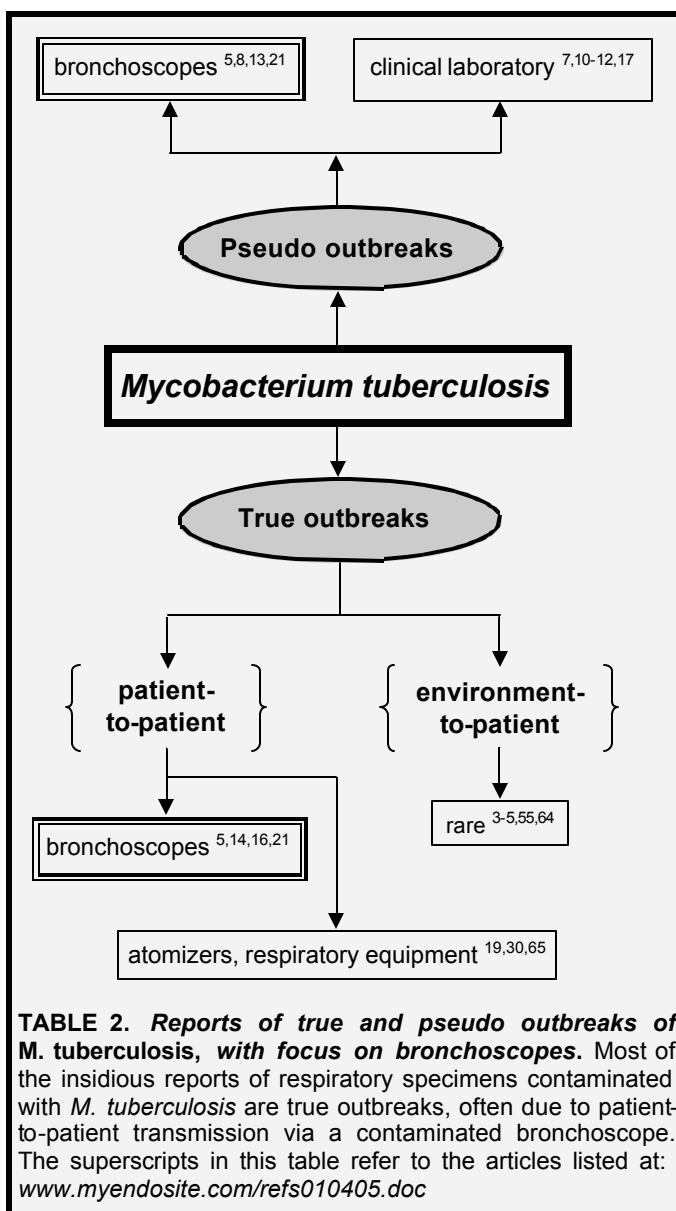


TABLE 2. Reports of true and pseudo outbreaks of *M. tuberculosis*, with focus on bronchoscopes. Most of the insidious reports of respiratory specimens contaminated with *M. tuberculosis* are true outbreaks, often due to patient-to-patient transmission via a contaminated bronchoscope. The superscripts in this table refer to the articles listed at: www.myendosite.com/refs010405.doc

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is somewhat unexpected, for a number of reasons. First, reports link true outbreaks of atypical mycobacteria to contaminated water independent of bronchoscope reprocessing.^{41-43,45,46} Second, water used to rinse bronchoscopes during reprocessing has been associated with true (and pseudo) outbreaks of gram-negative bacteria.^{9,47-52,55,62,63} And, third, true outbreaks of atypical mycobacteria caused by contaminated rinse water would seem possible—due, first, to contamination of the bronchoscope during water rinsing (just like for a pseudo outbreak) and then, in sequence, to the introduction of atypical mycobacteria into the patient's lungs during BAL.

Some other factors linked to the contamination of respiratory specimens are associated with only true outbreaks of mycobacteria. For example, damage to the internal sheath of a bronchoscope's working channel has been associated with true, but not pseudo, outbreaks of atypical mycobacteria and *M. tuberculosis* (Tables 1, 2).^{15,16} This finding is also somewhat unexpected, because pseudo outbreaks of either type of mycobacteria caused by a bronchoscope's damaged internal sheath would seem possible, due to contamination of respiratory specimens during BAL. (Next month's issue of this newsletter will provide recommendations to prevent true and pseudo outbreaks of mycobacteria caused by these factors.)

Likely causes of true, pseudo outbreaks: Atypical mycobacteria and *M. tuberculosis* have different characteristics and modes of transmission that distinguish one from the other. An understanding of these distinguishing characteristics is important during an outbreak investigation to the prompt identification of the cause of the true or pseudo outbreak, as well as the mycobacterium's type, species, and source. The likelihood that the identified mycobacterium is responsible for a true or pseudo outbreak depends in part on whether it is "atypical" or causes tuberculosis (Tables 1, 2).

Atypical mycobacteria are ubiquitous in the soil, and their mode of disease transmission is ordinarily environment-to-patient (Table 1).^{15,41-46} In contrast, an index patient, not the environment, is usually the source of *M. tuberculosis*, whose primary mode of transmission is patient-to-patient (Table 2).^{5,14,16,21} The different characteristics of atypical mycobacteria compared to *M. tuberculosis* explain why factors linked to the contamination of respiratory specimens with one type of mycobacteria, whether a true or pseudo outbreak, may not necessarily be linked to the contamination of respiratory specimens with the other type of mycobacteria.

➔ *The identification of a significant increase in the number of respiratory specimens contaminated with atypical mycobacteria usually suggests a pseudo outbreak due to environmental contamination, although true outbreaks of atypical mycobacteria due to environment-to-patient transmission have been reported (Table 1).*^{15,41-46}

A pseudo outbreak of atypical mycobacteria linked to a

bronchoscope is likely to be caused by contaminated rinse water from, for example, the hospital's tap or automated bronchoscope reprocessors or systems with flawed designs.^{9,25,26,28,31-35} Cross-contamination of respiratory specimens in the microbiology laboratory during their handling, processing, and analysis,^{20,36-38} as well as contaminated lidocaine sprayers,²⁷ water sources,^{27,28,36,39} fountain water,²⁴ and ice machines,⁴⁰ have also been cited as factors responsible for pseudo outbreaks of atypical mycobacteria.²⁷ Other possible causes include improper drying of the bronchoscope, a damaged internal sheath of the bronchoscope's working channel, and a recalled bronchoscope model whose design or manufacturing is flawed or defective.^{15,25,26,33,35,48}

➔ *The identification of a significant increase in the number of respiratory specimens contaminated with M. tuberculosis may indicate a true outbreak due to patient-to-patient transmission, although pseudo outbreaks of M. tuberculosis have been reported (Table 2).*^{5,7,8,10-13,17,21}

A true outbreak of *M. tuberculosis* linked to a bronchoscope is likely to be caused by inadequate cleaning and disinfection (or "sterilization") of the bronchoscope, or its valve or other accessory.^{5,14,21} Improper drying of the bronchoscope and a damaged internal sheath of a bronchoscope's working channel are other possible causes.^{5,16} Contaminated atomizers and respiratory equipment have also been cited as factors responsible for true outbreaks of *M. tuberculosis*.^{19,30,65} ■ LFM

To be continued ...

REFERENCES are available at the following website:
<http://www.myendosite.com/refs010405.doc>

Thank you for your interest in this newsletter. I have addressed each issue to the best of my ability. Respectfully,
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