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What's News

Q-Net's website has been revised and updated to provide quick access to all of its published articles. Visit it at: ? <http://www.myendosite.com>

The articles in this series provide healthcare staff with a basic understanding of the significance of the contamination of respiratory specimens with mycobacteria. This series can be used to update a facility's policies and procedures and prevent true and pseudo outbreaks associated with bronchoscopy.

Editor-in-Chief

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What is 'Q-Net'?

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

The main goal of **Q-Net** is to encourage the infection control, endoscopy, and OR communities to not only ask good questions but to also demand 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.

Measures to prevent pseudo outbreaks of mycobacteria

~ Fourth in a series ~

This article is the fourth in a series and provides recommendations to prevent the contamination of respiratory specimens with mycobacteria due to a pseudo outbreak.



Introduction and background: This is the fourth article in a series that discusses the clinical significance of respiratory specimens contaminated with mycobacteria. The first two articles in this series, which were published in the *January-February, 2005*, and *March-April, 2005*, issues of this newsletter, focus on: (a) the differences between, and characteristics and examples of, the two types of mycobacteria— "atypical" mycobacteria and tuberculocidal mycobacteria; (b) the differences between and char-

acteristics of true and pseudo outbreaks; and (c) associations between the type of mycobacteria and the type of outbreak. The first and second articles in this series can be read at: ► www.myendosite.com/htmlsite/2005/pseudo_infection05.pdf and ► www.myendosite.com/htmlsite/2005/Factors05.pdf.

In addition to focusing on bronchoscope reprocessing, the third article in this series, published in the *May-June, 2005*, issue of this newsletter and available at: ► www.myendosite.com/htmlsite/2005/recsbronchs05.pdf, provides recommendations to prevent true outbreaks of mycobacteria associated with bronchoscopy. Similarly, this current article—the fourth in this series—provides recommendations to prevent pseudo outbreaks associated with the contamination of respiratory specimens with mycobacteria.

The articles in this series provide healthcare professionals with a basic understanding of the clinical significance of, factors associated with, and measures that prevent, the contamination of respiratory specimens with mycobacteria, due to true and pseudo outbreaks. While this series of articles focuses on mycobacteria and bronchoscopy, its discussions and recommendations also apply to other types of microorganisms, such as *Pseudomonas aeruginosa* and other gram-negative bacteria, and to other types of

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~ HIGHLIGHTS OF EACH OF THE FOUR ARTICLES IN THIS SERIES ~

- **ARTICLE 1:** Background discussion and an example of a pseudo outbreak.
- **ARTICLE 2:** Discussion of factors associated with true and pseudo outbreaks.
- **ARTICLE 3:** Recommendations to prevent true outbreaks of mycobacteria.
- **ARTICLE 4:** Recommendations to prevent pseudo outbreaks of mycobacteria.

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endoscopic procedures, including gastrointestinal (GI) endoscopy, cystoscopy, hysteroscopy, and laryngoscopy. Moreover, in addition to respiratory specimens, this series of articles can be used to understand, investigate, and resolve true and pseudo outbreaks associated with the contamination of gastric and endotracheal aspirates, urine, tissue biopsies, and other types of patient specimens.

A review of factors associated with true and pseudo outbreaks: The third article in this series, published last month in this newsletter, not only provides recommendations to prevent disease transmission during bronchoscopy, but it also reviews important factors that have been associated with the contamination of respiratory specimens with mycobacteria due to true and pseudo outbreaks. As discussed in this series of articles, whereas some of these factors are associated with true and pseudo outbreaks of both types of mycobacteria, other factors are associated with either true or pseudo outbreaks, but not both, of only one type of mycobacteria.

For example, clinical use of an inadequately dried (wet) bronchoscope to collect respiratory specimens is a risk factor for both true and pseudo outbreaks of both types of mycobacteria.^{5,25,26,33,35,59} Contaminated rinse water used during bronchoscope reprocessing is also a risk factor for contamination of respiratory specimens, but it has only been linked to pseudo outbreaks of atypical mycobacteria.^{9,25,26,28,31-35} (Although it would seem possible, if not likely, that contaminated rinse water used to reprocess bronchoscopes would also have been linked to true outbreaks of atypical mycobacteria, none have been reported.) ► *A thorough understanding of the factors that can contribute to, or be responsible for, the contamination of respiratory specimens with mycobacteria (or another type of microorganism) is important to the prevention of true and pseudo outbreaks during bronchoscopy.*

In general, prompt identification of the type (and, ideally, species) of mycobacteria cultured from a contaminated respiratory specimen is important to the determination of the *type* of outbreak—a true or pseudo outbreak—and its likely *cause* and *source*—an index patient or environmental contamination. *Mycobacterium tuberculosis* and other species of tuberculo-cidal mycobacteria are contagious, do not ordinarily colonize environmental surfaces, and are transmitted from patient-to-patient. A significant increase in the number of respiratory specimens contaminated with tuberculo-cidal mycobacteria, therefore, typically suggests a *true* outbreak due to cross-infection.⁷³ (Reports of either a true or pseudo outbreak of tuberculo-cidal mycobacteria linked to contaminated rinse water are lacking.) Improper reprocessing and inadequate drying of the bronchoscope, as well as inadequate service and maintenance of the bronchoscope resulting in undetected damage to the internal sheath of its suction channel, have both been linked to true outbreaks of tuberculo-cidal mycobacteria.^{5,8,14,16,21} Improper reprocessing of respiratory therapy equipment, lidocaine sprayers, and atomizers (or nebulizers) have also been linked to true outbreaks of tuberculo-cidal

mycobacteria.^{19,65} (Refer to Table 1 in the May-June, 2005, issue of this newsletter for a listing of important factors linked to contamination of respiratory specimens.)

Unlike tuberculo-cidal mycobacteria, atypical mycobacteria, including *M. avium-intracellulare* (MAI), are ubiquitous in the environment, opportunistic, and rarely transmitted from patient-to-patient. Moreover, the normal flora of the respiratory tract do not ordinarily include atypical mycobacteria. It is primarily for these reasons that a significant increase in the number of respiratory specimens contaminated with atypical mycobacteria most often indicates a *pseudo* outbreak due to environmental contamination. In addition to inadequate drying of the bronchoscope, contaminated rinse water, used during bronchoscope reprocessing and originating from either the medical facility's tap water supply or an automated endoscope reprocessor (AER) or "system," are two factors that have been linked to pseudo outbreaks of atypical mycobacteria.^{9,25,26,28,31-35}

Improper handling, processing, and analysis of respiratory specimens in the clinical microbiology (or pathology) laboratory, improper reprocessing of lidocaine sprayers and atomizers, and contaminated water unrelated to bronchoscope reprocessing have also been linked to pseudo outbreaks of atypical mycobacteria.^{15,20,36-38} Several recalled models of bronchoscopes have been linked to true and pseudo outbreaks of gram-negative bacteria.^{18,48,76} Reports linking these bronchoscope models to true and pseudo outbreaks of atypical mycobacteria, however, are lacking. (For a detailed discussion of this recent bronchoscope recall, refer to the April-May, 2002, and June-July, 2002, issues of this newsletter.)

Automated endoscope reprocessors (AERs): Any discussions about outbreaks associated with bronchoscopes and contaminated respiratory specimens would be incomplete were it not to address the potential contribution of contaminated rinse water used to reprocess bronchoscopes to pseudo outbreaks of atypical mycobacteria. Several published reports identify contaminated rinse water used during bronchoscope reprocessing as the cause of pseudo outbreaks of atypical mycobacteria (and gram-negative bacteria).^{9,25,26,28,31-35,47,49,75} (Reports of true outbreaks of atypical mycobacteria linked to contaminated water used to rinse bronchoscopes are lacking.) In addition to the medical facility's tap water supply,^{28,36,42,45} the internal surfaces of poorly designed and recalled AER models (or systems) in contact with rinse water can become colonized with bacteria and be sources of environmental contamination.^{25,50,78,79} Bacterial colonization of the AER's internal surfaces can occur even if the AER is connected to a water filtration assembly that includes a 0.1 or 0.2 micron bacterial filter, even though the intended use of the filter is to prevent contamination of the rinse water and the AER.

Specific internal surfaces of an AER (or system) that have been reported to become colonized with atypical mycobacteria (and gram-negative bacteria) include internal water reservoirs, water filters and their housings, plumbing fixtures,

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tubing, and other internal components.^{25,26,33-35,50,52,78,79} Once the AER's internal surfaces become colonized with bacteria, the rinse water used by the AER can become contaminated and re-contaminate the bronchoscope, resulting in true and/or pseudo outbreaks.^{9,25,26,33-35,51,77} Nevertheless, AERs and other types of endoscope reprocessing systems have their benefits and are frequently used to assist overburdened healthcare staff by automating several essential reprocessing steps, as well as reducing exposure of the staff to the liquid chemical sterilant.

Recommendations

Recommendations that prevent the contamination of respiratory specimens due to a *true* outbreak of mycobacteria were published in last month's issue of this newsletter and focus on bronchoscope reprocessing and service and maintenance of the bronchoscope. As a complement to these previously published recommendations, the following set of recommendations is provided to prevent the contamination of respiratory specimens due to a *pseudo* outbreak of mycobacteria. These recommendations focus on: (a) the quality of the rinse water used during manual and automated bronchoscope reprocessing; (b) service and maintenance of the AER (or "system"), its filters, and its filter housings; and (c) techniques for handling, processing and analyzing respiratory specimens. The combination of the following set of recommendations with those published last month provides an all-inclusive set of recommendations to prevent contamination of respiratory specimens and bronchoscopes due to both true and pseudo outbreaks of atypical and tuberculocidal mycobacteria (and other types of microorganisms).

II. PSEUDO OUTBREAKS OF MYCOBACTERIA:

The following recommendations focus on the prevention of the contamination of respiratory specimens due to a pseudo outbreak of mycobacteria. These recommendations are divided into three sub-sections: (1) bronchoscope reprocessing; (2) handling, processing and analysis of respiratory specimens; and (3) quality assurance. The first two of these are published, below. The third sub-section—quality assurance—is published in next month's issue of this newsletter.

Many of these recommendations apply whether manually reprocessing bronchoscopes or using an AER (or "system"). In addition to mycobacteria, many of these recommendations prevent the contamination of respiratory specimens with gram-negative bacteria and other types of microorganisms. Moreover, in addition to pseudo outbreaks, some of these recommendations prevent true outbreaks and, therefore, may also appear in last month's issue of this newsletter. Although these recommendations focus on prevention of contamination of respiratory specimens collected during bronchoscopy, many of them may also prevent contamination of other types of patient specimens collected during other types of flexible

endoscopic procedures, such as GI endoscopy, cystoscopy, hysteroscopy, and laryngoscopy.

1. Bronchoscope reprocessing:

A. Leak test the bronchoscope in accordance with its manufacturer's instructions. This initial reprocessing step is important to detect endoscope damage, which has been linked to true outbreaks of both types of mycobacteria.^{5,15,16} Refer to last month's issue of this newsletter, section I.I.A.

B. Clean and high-level disinfect (or "sterilize") the bronchoscope and related accessories in accordance with their respective operator's manuals and published guidelines, such as those published for reprocessing GI endoscopes.^{5,14,21,54,55} Refer to last month's issue of this newsletter, sections I.I.B. – I.I.F. Proper reprocessing of the bronchoscope, whether performed manually or using an AER, is essential to the prevention of true and pseudo outbreaks.

C. Rinse the bronchoscope after chemical immersion with bacteria-free (or "sterile") water.

a. Use bacteria-free or bottled, sterile water to rinse the bronchoscope during manual reprocessing. **Note:** Tap water may be acceptable for rinsing bronchoscopes, provided the bronchoscope is thoroughly dried after *each* reprocessing cycle. The use of contaminated water to rinse bronchoscopes during reprocessing has resulted in bacterial outbreaks.^{9,25-28,31-36,39,47,50-52,67,68,71,72,78,79} Refer to section II.I.D., below, and to the January-February, 2004, issue of this newsletter.

b. During automated reprocessing, ensure that the AER is connected to a water filtration assembly that includes, in addition to a sediment filter (5.0 micron), a 0.1 or 0.2 micron bacterial filter, to prevent re-contamination of the bronchoscope with atypical mycobacteria during terminal water rinsing, and to prevent bacterial colonization of the AER's internal surfaces and components.^{33,36,68,78,79}

D. Dry the bronchoscope after every completed reprocessing cycle,^{5,14,24-26,32,33,35,49,78,79} whether using tap, bacteria-free, sterile, or "sterile" filtered water to rinse the bronchoscope. Flush the suction channel with 70% alcohol to facilitate drying, followed by forced or compressed air. Wipe the bronchoscope's exterior and valve with a clean, lint-free, cloth moistened with 70% alcohol. Refer to last month's issue of this newsletter, section I.I.H., and to this newsletter's January-February, 2004, issue.

a. Clinical use of a wet bronchoscope is contraindicated. Wet bronchoscopes can transmit bacteria during bronchoscopy resulting in a true outbreak. Moreover, wet bronchoscopes can contaminate with waterborne micro-

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organisms respiratory specimens during BAL resulting in a pseudo outbreak and the subsequent misdiagnosis of respiratory tuberculosis and improper administration of aggressive and expensive antibiotics to “un-infected” patients.²⁷ The cost to investigate and to “treat” a pseudo outbreak can be significant.

- b. The requirement to dry the bronchoscope after every reprocessing cycle may have significant implications for medical facilities whose policies and procedures, especially in the operating room setting, currently instruct medical staff, instead of drying, to use the (wet) bronchoscope (and other types of endoscopes) immediately after reprocessing.^{59,63} Refer to the *January-February, 2004, issue of this newsletter.*

E. Store the bronchoscope in a dry, clean, and well-ventilated area or cabinet hanging freely and vertically with its valve and biopsy cap removed.⁵ Refer to last month's issue of this newsletter, section I.1.I.

- a. Whenever the bronchoscope is removed from storage and: (a) is wet or otherwise determined to have been improperly stored; (b) assurances cannot be made, and documentation is not available to confirm, that after its last use the bronchoscope was properly reprocessed, dried, and stored in accordance with published guidelines; or (c) the rinse water used during bronchoscope reprocessing contains a large concentration of atypical mycobacteria (or gram-negative bacteria), it is necessary to reprocess the bronchoscope (again) before its reuse, to reduce the risk of true and pseudo outbreaks.⁸⁰ Refer to the *October-November, 1998, issue of this newsletter.*

F. Clean and disinfect (or sterilize) lidocaine sprayers, atomizers, nebulizers and other instruments and respiratory equipment used during the procedure in accordance with their respective operator's manuals and/or published guidelines.^{19,27,65} Use of single-use disposable items during bronchoscopy may minimize the risk of an outbreak.

G. Use a cleaner/disinfectant to routinely decontaminate all environmental surfaces (e.g., the external surfaces of the AER, the sink, counter tops) in the reprocessing (and procedure) room, to prevent re-contamination of the bronchoscope.

2. Processing and analysis of respiratory specimens:

A. Collect, handle, process and analyze respiratory specimens using aseptic technique and other appropriate practices as required,⁷⁴ to prevent environmental contamination and pseudo outbreaks of either type of mycobacteria.^{7,10-12,17,20,36-38} Only use properly reprocessed, dried, and stored bronchoscopes to collect respiratory specimens during bronchoscopy. Refer to sections II.1.B.—II.1.E., above.

a. For example, use single-use gloves and a sterile container to collect respiratory specimens during BAL.

b. Use sterile or bacteria-free water to collect respiratory specimens during BAL.^{28,36,69,75} Do not use tap water, because it can contaminate the specimens.

c. Consider using individual, single-use, sterile aliquots of water, buffers, reagents, and other solutions during the processing of respiratory specimens.^{7,12,17,36,73,74}

B. Clean and disinfect (or sterilize) all reusable instrumentation (e.g., BACTEC culture system for mycobacteria) used during the collection, processing, and analysis of respiratory specimens, in accordance with standard guidelines and manufacturers' recommendations,^{11,20,74} to prevent false-positive cultures, or pseudo outbreaks, due to re-contamination of the respiratory specimens.

C. Use a cleaner/disinfectant to routinely decontaminate all environmental surfaces (e.g., counter tops) in the clinical microbiology (or pathology) laboratory, to prevent pseudo outbreaks due to environmental contamination of respiratory specimens. ■ © LFM ... Continued in next month's issue.

► This set's third sub-section—*quality assurance*—is published in next month issue of this newsletter—the fifth and final article in this series.

References

The 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, the Publisher: *Lawrence F. Muscarella, Ph.D.* Please direct all correspondence to:

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