International Journal of Mycobacteriology xxx (2016) xxx–xxx

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Full Length Article

Mycobacterial contamination of bronchoscopes: Challenges and possible solutions in low resource settings

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ARTICLE INFO

Article history:
Received 30 July 2016
Accepted 6 August 2016
Available online xxxx

Keywords:
Contaminated bronchoscopes
Pseudo-outbreaks
Mycobacterium tuberculosis
Non-tuberculosis mycobacteria

ABSTRACT

The use of bronchoscopes has increased in tuberculosis (TB) diagnostics to circumvent the diagnostic challenges that are associated with low sputum volume and smear-negative TB. In healthcare facilities situated in low income countries that have a high burden of TB, adequate decontamination of bronchoscopes is a challenge and often overlooked to save on time and costs. This amplifies the risk of outbreaks and pseudo-outbreaks due to *Mycobacterium tuberculosis* and nontuberculosis mycobacteria. In this minireview, we review published literature of contaminated bronchoscopes causing pseudo-outbreaks of *M. tuberculosis* and nontuberculosis mycobacteria in an effort to determine common sources, and possible mitigation strategies in low-resource settings.

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Bronchoscopy is an important diagnostic and therapeutic tool [1,2] in both ambulatory and inpatient healthcare settings [1]. In the context of pulmonary tuberculosis, bronchoalveolar lavage or bronchial biopsy have been proven to be essential diagnostic tools, especially for patients who are unable to expectorate sufficient sputum samples [3]. However, this semicritical medical device [4] has also been reported to be a source of both pseudo-infections and infectious outbreaks [5]. An indication of an improperly disinfected bronchoscope acting as a potential reservoir for contamination of both cultures and patients can be gauged by the fact that the bioburden on bronchoscopes postwashing has been estimated to be around 6.4×10^4 colony forming units/mL [4]. According to a metadata analysis conducted from 1974 to 2004 by Seoane-Vazque et al. [6], the highest number of contaminating incidents was attributed to bronchoscopy and gastrointestinal endoscopy. In the United States, contaminated fiberoptic bronchoscopes are estimated to contribute to *Mycobacterium tuberculosis* (MTB) nosocomial infections in 460–2300 human immunodeficiency virus infected patients annually [7]. Additionally, pseudo-outbreaks due to environmental microorganisms contaminating bronchoscopes have also been reported [8]. However, data related to bronchoscope-associated infections and pseudo-outbreaks is underreported [5], with a dearth of data from low-income and developing countries.

MTB, nontuberculous mycobacteria (NTM), and *Pseudomonas aeruginosa* are the most common pathogens

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Peer review under responsibility of Asian African Society for Mycobacteriology.
http://dx.doi.org/10.1016/j.ijmyco.2016.08.002

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Please cite this article in press as: DK Saeed et al. Mycobacterial contamination of bronchoscopes: Challenges and possible solutions in low resource settings. Int. J. Mycobacteriol. (2016), http://dx.doi.org/10.1016/j.ijmyco.2016.08.002

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Table 1 – Reported pseudo-outbreaks of nontuberculous mycobacteria and *M. tuberculosis* associated with bronchoscopy.

Study design	Sample size (No. cases/No. of bronchoscopies performed)	Reason for suspecting outbreak	Organism	Identified source of contamination	Strain similarity	Refs.
Retrospective study	14/1270	Unique strain of *M. cholnea* isolated + inconsistent culture findings with clinical features of patients	*M. cholonae* subsp. *abscessus*	Rinse water	Not performed	[10]
Retrospective study	7/16 1/16 3/16	Inconsistent culture findings with clinical features of patients	*M. cholonae,* *M. avium* *M. gordonae*	Rinse water Water tank Contaminated glutaraldehyde disinfectant	Not performed	[11]
Retrospective study	17/21	Unusual No. of rapidly growing AFB	*M. xenopi*	Water	RFLP	[12]
Retrospective study	15/76	Not stated	*M. cholonae* & *M. fortuitum*	Mains water supply Disinfectant tank	Not performed	[13]
Retrospective case-controlled study	18/21	Unusual increase in isolation	*M. cholonae*	Suction channel	—	[14]
Surveillance of bronchoscopes	15/19 3/19	In response to previous pseudoinfection	*M. cholonae* *M. avium intercellularae*	Failure of AER disinfection procedure	—	[15]
Prospective-induced study	—	Efficacy of different disinfectants: iodophore, glutaraldehyde, peraceticacid	*M. gordonae*	Normal conditions for disinfection inadequate	—	[16]
Retrospective + prospective study	20	Unusual number of rapidly growing AFB	*M. cholonae*	Automated washer & glutaraldehyde disinfectant	DNA fingerprinting	[17]
Retrospective study	9/57	Isolation at increased frequency	*M. cholonae*	Incoming water, water filters, automated bronchoscope washing machine	REP-PCR	[18]
Retrospective	22/75	Culture isolates were inconsistent with clinical features of patients	*M. avium, M. intercellulare*	Water filter, hot & cold water lines	Nested PCR + RFLP	[19]
Prospective study	5/7	Isolation of *M. gordonae* in BAL	*M. gordonae*	Tap water, water supply channels	PFGE	[20]
Prospective study	4/5	Recurrent cases of mycobacterial cross-contamination	*M. tuberculosis*	Contaminated suction valve	Not performed	[21]
Retrospective cohort study	6/10	High incidence of *M. tuberculosis*	*M. tuberculosis*	Hole in bronchoscope sheath	RFLP	[22]
Retrospective cohort study	2/3	No cases reported in hospital the previous year, suspected nosocomial outbreak	*M. tuberculosis*	Inadequate cleaning & disinfection between patients use. AER was not approved	Spoligotyping + IS6110-based RFLP	[23]

Note. AFB = acid-fast bacilli; BAL = bronchoalveolar lavage; M. = *Mycobacterium*; PCR = polymerase chain reaction; RFLP = restriction fragment length polymorphism.

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