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CASE REPORT

Investigation of Bronchoscopy Associated Pseudo-infections

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ABSTRACT

Introduction: During bronchoscopy, a bronchoscope traverses into the bronchial tree to visualise the respiratory tract and send the washings for various investigations. This event could lead to local spread of pre-existing infection, spread of infection from one patient to the other if the bronchoscope is disinfected inadequately, or, isolation of microorganisms from bronchoscopic specimens in a patient who is clinically not infected, i.e. pseudoinfection. This study is one such investigation of an outbreak of bronchoscopic pseudo-infections in a tertiary care hospital.

Materials and methods: Bronchoalveolar lavage (BAL) samples were inoculated onto MacConkeyAgar and 5% Sheep Blood Agar and incubated at 37°C overnight. The growths obtained on culture media were processed for identification and antimicrobial susceptibility on Vitek 2 Compact as per manufacturer's instructions. To investigate the outbreak, 5-10mL of sterile water was flushed through the channels of disinfected bronchoscope and collected in a sterile container. The samples were centrifuged and inoculated onto Mac Conkey Agar and 5% Sheep Blood Agar. The growths obtained were further processed similarly as the BAL samples were processed. Environmental swabs collected from the bronchoscopy unit were also processed as the procedure mentioned above.

Results: Bronchoalveolar lavage of 3 patients in a period of 1 week were contaminated with multidrug resistant *Klebsiella pneumoniae*. Two out of five bronchschope fluid samples were also contaminated with *Klebsiella pneumoniae*. Among the swabs collected from bronchoscope unit, *Klebsiella pneumoniae* was isolated from the endowasher detergent box.

Conclusion: The risk of propagation of infection via a bronchoscope can be evaded by proper reprocessing and improving the sterilization practices.

KEYWORDS

• Bronchoscopy • Pseudo-infections • Outbreak

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Bronchoscopy could lead to 3 potential consequences: 1) Endogenous spread of infection, i.e. further local spread of pre-existing infection; 2) Cross infection, i.e. spread of infection from one patient to the other if the bronchoscope is contaminated; 3) pseudo-infection, i.e. isolation of microorganisms from bronchoscopic specimens in a patient who is clinically not infected with that organism.[1] Cross infections and pseudo-infections occur due to damage or inadequate sterilization of the bronchoscope.[1] Bronchoscopes are classified as semi-critical devices which must undergo a high-level disinfection (HLD) or sterilization, failure of which causes outbreaks of cross infections and pseudoinfections.[2] This study is one such investigation of an outbreak of bronchoscopic pseudo-infections in a tertiary care hospital.

On Day 1, patient 1 underwent bronchoscopy for airway visualization to obtain bronchial washings. The specimen was sent for culture and sensitivity. *Klebsiella pneumoniae* was isolated from the specimen which was sensitive to Tigecycline and moderately sensitive to Colistin.

On day 2, bronchial washings of patients 2 and 3 were sent for culture, from which the same organism with the same sensitivity pattern as that of patient 1 was isolated. Suspecting an impending outbreak, the infection control team visited the bronchoscopy suite for investigation on Day 2. It was found each bronchoscope is used only after routine cleaning and disinfection. During the field investigation, no major deviations from standard disinfection protocol were observed. Sterile water was flushed through the channels of 5 bronchoscopes and collected in a sterile container. Samples of Cidex solution and detergent used in the endowasher were collected in a sterile container. Swabs from transport box, UV chamber and endowasher detergent box were collected. All these samples were processed for culture and sensitivity test. The growths obtained on culture media were identified as multi-drug resistant *Klebsiella pneumoniae,* sensitive to Tigecycline and moderately sensitive to Colistin. This proved that colonization of *Klebsiella pneumoniae* in the bronchoscopes and detergent box led to pseudoinfection in 3 patients.

It was noticed that the detergent box of the endowasher was a rectangular shaped box with a narrow circular opening of about 10-15 cm diameter. This narrow opening does not allow proper manual cleaning of the detergent box. Inadequate cleaning of this box may have contributed as a source of contamination of the bronchoscopes as well.

As a corrective measure, the detergent box was sent to the central sterile supply department (CSSD) for Ethylene oxide (ETO) sterilization. After the ETO sterilization, a swab was collected from the box again and processed for culture and sensitivity. No growth was obtained from this specimen. All the in-use disinfectants were discarded and new ones were opened. Using the ETO sterilised detergent box in the endowasher, all the bronchoscopes were reprocessed for a contact time of 20 minutes. Repeat microbiological analysis of samples collected from same sites was found to be sterile. The bronchoscopy unit re-started procedures and bronchial washings of patients were sterile unless truly infected, thereby, marking end of the spread of pseudoinfection.

Bronchoscopes must be thoroughly manually cleaned and must undergo high level disinfection to prevent spread of microorganisms. Reusable endoscopes have been associated with outbreaks. A consensus statement from 2005 states that the risk of bronchoscope-related infections was under recognized and under reported as it lacks active surveillance to find post-procedure infections[3].

When bronchoscopes are inadequately cleaned after usage, microorganisms and extracellular matter can accumulate to form a biofilm in the instrument. Firm attachment of a biofilm to a surface, especially the inner constrictive tubes, crevices, fissures or abnormalities of the instrument, makes elimination of the biofilm difficult.[4] After routine bronchoscopy, the internal channels of the instrument are contaminated with approximately 6.4×10^4 cfu/mL of bacteria.[5] There are multiple sources within the bronchoscope which can harbour microorganisms, like the internal channels of the bronchoscope, sample collection tubings, suction valves and suction channels[6]. Inadequate manual cleaning of the instrument has been attributed to several episodes of contamination. In a study, 23 patients were exposed to multi-drug resistant isolates of *Pseudomonas aeruginosa* and

Klebsiella pneumoniae following the usage of a common bronchoscope which later showed a luminal defect upon investigation[7]. In a study done in 2013, contamination of a flexible bronchoscope leading to an outbreak caused by carbapenem resistant *Klebsiella pneumoniae* has been reported.[8] Bronchoscope associated pseudoinfections caused by Proteus species, *Serratia marcescens*, fungi like Pencillium species, Cladosporium species, and non-tuberculous mycobacterial species have been reported.[5] Sterilisation would be the most effective way to eliminate microorganism from the instrument, however, the methods of sterilisation available today are not compatible with bronchoscopes. While it takes 24 hours to retrieve the instrument from Ethylene oxide sterilisation, fibre optic parts of the bronchoscope are prone to damage with autoclaving. Thereby, only high level disinfection is left as the choice of disinfection for bronchoscopes.[9]

The automated bronchoscope reprocessor also acts as a reservoir of microorganisms, as it did in this report. Common sources of contamination include water supply tanks, tubings and pumps.[10] In this study, the detergent box was a source of contamination. Similar to this study, a nosocomial transmission of *Pseudomonas aeruginosa* was reported with improper connections in the endowasher.[11] In a study conducted at an Endoscopy Centre, China, 240 endowashers of which 160 samples grew various microorganisms like *Pseudomonas aeruginosa, Stenotrophomonas* spp, *Acinetobacter* spp, *Staphylococcus aureus*) etc.[12] Similar to this study, 79% of 24 endowashers from 18 hospitals of Northern Germany were were contaminated with organisms like *Pseudomonas aeruginosa, Serratia species, Staphylococcus aureus* and *Candida albicans*.[13] The European Society of Gastrointestinal Endoscopy recommends that the bottles used in endowashers be autoclaved.[14] In this study, the detergent box was subjected to ETO sterilisation, which had eliminated the source of contamination completely. However, disadvantages associated with ETO sterilisation makes sterilisation of internal parts of endowasher practically challenging, especially in settings with limited endowashers and high patient load.

This emphasizes the need for monitoring disinfection practices, water quality, and maintenance of the instruments. Periodical monitoring of the disinfection process of both the bronchoscopes and the endowashers by microbiological analysis must be practiced.

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