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Case Report

Investigation of Bronchoscopy Associated Pseudo-infections

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Abstract

Introduction: Bronchoscopy could lead to local spread of pre-existing infection, spread of infection from one patient to another if the bronchoscope is disinfected inadequately, or, isolation of microorganisms from bronchoscopic specimens in a patient who is clinically not infected, i.e., pseudo-infection. 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 MacConkey Agar 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 mL - 10 mL of sterile water was flushed through the channels of disinfected bronchoscope and collected in a sterile container. The samples were centrifuged and inoculated onto MacConkey 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 bronchoscope fluid samples were also contaminated with *Klebsiella pneumoniae*. Among the swabs collected from bronchoscope unit, *Klebsiella pneumoniae* was isolated from the detergent box of the endowasher.

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

More Information

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Keywords: Bronchoscopy; Pseudo-infections; Outbreak

Introduction

Bronchoscopy can result in three potential outcomes: 1) Endogenous spread of pre-existing infection; 2) Cross infection from one patient to the other 3) Pseudo-infection, i.e. isolation of microorganisms from bronchoscopic specimens in a patient who is clinically not infected with that organism [1]. Failure of sterilization causes outbreaks of cross infections and pseudo-infections [2]. This study is one such investigation of an outbreak of bronchoscopic pseudo-infections in a tertiary care hospital. This study did not require approval of ethics committee as it was conducted using pre-existing samples and samples from hospital equipment and did not involve any direct participation.

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 that patient 1 had a consolidating patch in the lower lobe of left lung, probably infectious in nature. The patient's temperature spiked on the day of specimen collection, prior to the procedure, indicating it to be a true infection. However, patients 2 and 3 were clinically asymptomatic with no abnormal radiological images. They had undergone bronchoscopy as part of the follow up protocol of their previous surgical interventions. 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 pseudo-infection 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 cm - 15 cm in 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 the 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 pseudo-infection.

Bronchoscopes must be thoroughly cleaned manually and must undergo high level disinfection to prevent spread of microorganisms. Reusable bronchoscopes 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 biofilm to surfaces, especially within constricted internal tubing, crevices, fissures, or abnormalities of the instrument, makes elimination of the biofilm difficult [4]. Following 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 harbor microorganisms, like the internal channels of the bronchoscope, sample collection tubing, 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 pseudo-infections caused by Proteus species, *Serratia marcescens*, fungi like Penicillium species, Cladosporium species, and non-tuberculous mycobacterial species have been reported [5]. In a study by Kakoullis, et al. 52 pseudo-outbreaks were reviewed with pathogens identified as *Pseudomonas aeruginosa*, *Mycobacterium tuberculosis*, Nontuberculous Mycobacteria (NTM), *Klebsiella pneumoniae*, *Serratia marcescens*, *Stenotrophomonas maltophilia*, *Legionella pneumophila*, and fungi [9]. Sterilization is the most effective method to eliminate microorganisms from the instrument, however, the current sterilization methods are incompatible with bronchoscopes. While retrieving the instrument from ethylene oxide sterilization takes 24 hours, fibre-optic components of bronchoscopes are prone to damage with autoclaving. Thereby, only high level disinfection is left as the choice of disinfection for bronchoscopes [10].

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 [11]. 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 [12]. In a study conducted at an Endoscopy Centre, China, 240 endowashers, of which 160 samples grew various microorganisms such as *Pseudomonas aeruginosa, Stenotrophomonas* spp, *Acinetobacter* spp, *Staphylococcus aureus*) etc. [13]. Similar to this study, 79% of 24 endowashers from 18 hospitals of Northern Germany were contaminated with organisms like *Pseudomonas aeruginosa, Serratia species, Staphylococcus aureus* and *Candida albicans* [14]. The European Society of Gastrointestinal Endoscopy recommends that the bottles used in endowashers be autoclaved [15]. In this study, the detergent box was subjected to ETO sterilization, which had eliminated the source of contamination completely. However, the disadvantages associated with ETO sterilization makes sterilization of internal components of the endowasher particularly challenging, especially in settings with limited endowasher availability and high patient volumes. Logan N, et al. noted that single-use flexible bronchoscopes are an effective way to curtail the risk of device associated infections, especially in centres with high volumes of procedures [16]. However, in developing countries like India where the cost of healthcare has been privatized, the implementation of this practice is yet to be considered.

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

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