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Pseudo-outbreak of *Stenotrophomonas maltophilia* and *Acinetobacter baumannii* by a Contaminated Bronchoscope in an Intensive Care Unit

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ABSTRACT

Background: *Stenotrophomonas maltophilia and Acinetobacter baumannii are serious offending agents of nosocomial pneumonia and of serious morbidity and mortality in intensive care units (ICU). We report an unexpected sudden surge in cases of pneumonias caused by the above organisms in an intensive care unit of a community hospital in a span of two months. The source was traced back to a contaminated bronchoscope.*

Materials and Methods: *The records from the patients with diagnosis of pneumonia with the above organisms were retrospectively reviewed. Specimens from the ports and channels of the bronchoscope that was suspected to be the cause were taken and microbiologically analyzed.*

Results: *Two patients with Acinetobacter and four patients with Stenotrophomonas positive bronchoalveolar lavage (BAL) fluid cultures were identified within a 2-month period in one of our two intensive care units. All of the patients were mechanically ventilated, and had clinical features of pneumonia. Their bronchoscopies were performed and their BALs were obtained by a scope with an identical serial number. The microbiologic evaluation of samples taken from the suspected scope revealed that it was improperly decontaminated between procedures. After implementation of strict and revised decontamination protocol, there were no further cases of pneumonia caused by the above organisms in a span of several months in mechanically ventilated patients.*

Conclusion: *Inadequate disinfection of bronchoscopes and cross contamination between patients could be a potential cause of ventilator-associated pneumonia. Strict implementation of infection prevention guidelines in bronchoscopies of mechanically ventilated patients could prevent cases of ventilator-associated pneumonias by nosocomial agents including S. maltophilia and A. baumannii.* ***(Tanaffos2010; 9(3): 44-49)***

Key words: *Stenotrophomonas maltophilia, Acinetobacter baumannii, Bronchoscopy, Intensive care unit*

INTRODUCTION

Nosocomial and in particular ventilator-associated pneumonias (VAP) are not only enormous financial burdens, but also significant causes of morbidity and mortality in intensive care units throughout the world. There are times that nosocomial pneumonias in mechanically ventilated patients are caused by a contaminated and/or malfunctioning bronchoscope (1).

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Bronchoscopy has become a high volume procedure in intensive care units and is considered to be generally uncomplicated, safe, and with low morbidity and mortality. However, outbreaks of pneumonias have been reported in intensive care units with resulting high financial burdens that could have been easily prevented. These were traced back to bronchoscope defects, improper handling and operation of the scope, and infection prevention breaches during decontamination of the scope (1,2).

We report a cluster of critically ill and mechanically ventilated patients in one of our intensive care units who had positive BAL cultures for *S. maltophilia* and/or *A. baumannii*. The unexpected surge of these isolates with identical antibiograms in one intensive care unit was caused by one bronchoscope that was also used in our other intensive care unit in the same institution. Since the type of pneumonia caused by the above agents was a rare occurrence in one of our intensive care units (ICUs) but had been seen previously in our other ICU, we strongly suspected either cross contamination or breach in infection control protocols of our bronchoscopes. Further microbiologic analysis revealed improper handling and lack of rigorous implementation of disinfection protocols in between bronchoscopies. Our objective is to demonstrate in patients who are critically ill and are mechanically ventilated that a) during bronchoscopy extreme precautionary means needs to be undertaken to prevent occurrence of nosocomial pneumonia and b) meticulous decontamination and cleaning of the bronchoscopes between the procedures is paramount in prevention of pneumonias caused by cross-contamination.

MATERIALS AND METHODS

Our hospital has two ICUs. One is a combined medical and surgical ICU (GICU). The other is an ICU housing critically ill patients with significant burn injuries (BICU). We retrospectively studied the mechanically-ventilated patients that their obtained BAL cultures during bronchoscopy were positive for *S. maltophilia* and *A. baumannii* in our GICU during the suspected 2 month period. Their records were reviewed under supervision of our Infection Control Director and diagnosis of pneumonia was ascertained in all of the patients using published guidelines in two previous publications (3,4) and also Center for Disease Control National Healthcare Safety Network (CDC/NHSN) of health care associated infections (5). Using the above 3 publications, the VAP diagnosis was made by using BAL cultures and other criteria including, but not limited to, body temperature, leukocyte count, volume and character of tracheal secretions, worsening arterial oxygenation, chest X-ray, and blood cultures. The decision making chart is comprehensively outlined in the CDC publication (5).

Using the abovementioned guidelines, we further reviewed the mechanically-ventilated patients with diagnosis of pneumonia caused by *S. maltophilia* and *A. baumannii* in our BICU. All of these patients had also undergone bronchoscopy during the same time period.

The BAL fluid of mechanically-ventilated patients was prepared and grown on sheep blood, MacConkey, and chocolate agar plates using aseptic techniques according to outlined protocols (6). The colonies were identified to the species level by *SIEMENS Microscan* instrumentation panels. The minimum inhibitory concentration (MIC) for the tested organism was determined by the lowest antimicrobial concentration exhibiting inhibition of growth.

Our microbiologic investigation included obtaining samples from bronchoscopy carts, bronchoscopy suite cabinets, bronchoscope bodies, and suction ports of the scopes used in doing BALs in the suspected patients. The Johns Hopkins

Hospital Procedure for culturing bronchoscopes was used by our team to determine whether a bronchoscope was contaminated or not (7). The specimens were plated onto sheep blood, MacConkey, and chocolate agar plates using aseptic techniques according to the outlined protocols (6).

RESULTS

A sudden surge in bronchoalveolar cultures of mechanically-ventilated patients positive for *S. maltophilia* (4 patients) and *A. baumannii* (2 patients) was noticed within span of a few weeks in both of our intensive care units which had been unprecedented. All patients were critically ill. The antibiogram was identical for all the isolated organisms in all of the affected patients. One bronchoscope was suspected to be the source of cross contamination. Microbial analysis from the ports and the channels of the suspected bronchoscope revealed identical antibiograms for *S. maltophilia.* The 2 patients that were suspected to be the sources of cross contamination were identified based on review of bronchoscopy records. These patients were on mechanical ventilation at the time of initial bronchoscopy. The organisms isolated from their lungs at the time of bronchoscopy had an antibiogram identical to microbial cultures of the contaminated bronchoscope. All four bronchoscopes in our suite were investigated by the manufacturer and an independent laboratory. There were no mechanical or structural defects.

None of the 6 patients that were infected with the contaminated bronchoscope died because of the ensued complications.

After the outbreak, investigation of infection control practices was carried out. Our investigation showed that there were breaches in disinfection of the scopes. Specimen analysis from ports, channels, and surfaces of the involved bronchoscope identified it as the source of contamination. Visual testing and leakage testing of the scopes revealed no significant leakage. Finally, the steps that were breached during disinfection were identified.

DISCUSSION

From our results we reach the following conclusions that: 1) In an intensive care unit, a bronchoscope must be solely dedicated to be used in the designated unit and not be used at other places in the hospital; 2) cross-contamination between subjects can cause serious morbidity; and 3) diligent disinfection and antiseptic interventions are exceedingly important in prevention of nosocomial and ventilator associated pneumonias caused inadvertently by a bronchoscope.

Contamination of bronchoscopes in an intensive care unit has been identified as a major cause of nosocomial pneumonias in particular ventilator-associated pneumonias. Outbreaks of *Pseudomonas aeruginosa* (8), *Legionella pneumophila* (9), and *Stenotrophomonas maltophilia* (10) have been reported in medical literature.

Acinetobacter species have become a very important cause of nosocomial pneumonia in ventilated patients. Risk factors for infection with this organism, the second commonest etiological agent amongst gram negatives, include prolonged hospitalization, medical debilitation with higher Acute Physiology and Chronic Health Evaluation II (APACHE II) scores, prior use of antibiotics, and use of mechanical ventilation (11,12). Exposure to bronchoscopy is reported to carry a high risk for the infection with an odds ratio of 22.7 (12).

In case of *Stenotrophomonas maltophilia*, report of an abrupt increase in cases reported in a hospital was traced back to a fiber optic bronchoscope suction channel which was inadequately cleaned and disinfected (10).

The majority of causative organisms in nosocomial pneumonias are introduced by cross

transmission or from the environment other than the endogenous sources. This is in particular true about gram negatives such as *Acinetobacter* (11). Bronchoscopy in ventilated patients carries a high risk for colonization and eventually infection with the organism (12).

The contamination at our institution was mainly due to cross contamination of bronchoscopes. A scope that was used in one intensive care became the source of contamination when it was used at our other intensive care unit. We found that several of the steps in disinfection of the scopes outlined in appendix 1 were not being implemented entirely. These were as follows: A) Brush for hand washing a scope between procedures was shared between several scopes and was not disposed after washing a scope. Single use brushes were subsequently used. B) Towels on which the scopes were placed and were carried on the transportation cart were not changed in between procedures. We stopped using towels and started to use disposable drapes. C) Every bronchoscope must have been covered in a carrying bin covered with individual plastic wrap in between procedures. We later on discovered that some scopes were not appropriately covered during transportation of the scope to the site of procedure. D) Disinfection and cleaning of the bronchoscope should be ideally started immediately after completion of bronchoscopy at the bedside with a cleaning enzyme through the suction port. There were times that this practice was delayed. Furthermore, bronchoscopy ports were not flushed with disinfectant detergent thoroughly as recommended and outlined in appendix 1 of this manuscript. E) The dilution of the enzymatic cleaner was not carried out precisely as outlined by manufacturer. F) The scopes should not have been left uncovered before the procedure for an extended period of time. G) A scope should have been stored in a fully extended position so that there remained no residual water on the surface and in its ports and channels. But at times they were not stored in such position and were curled up.

After the pseudo outbreak, we implemented a rigorous maintenance inspection and surveillance culture protocol in addition to careful execution of steps outlined in the appendix 1. The above interventions resulted in elimination of nosocomial VAPs caused iatrogenically by a contaminated bronchoscope in our intensive care units over a span of one year by the aforementioned organisms.

Appendix 1:

Bronchoscopy cleaning, storage, transport, and infection control policies

a) Monthly culture swab of all bronchoscopes must be performed.
b) "Contaminated scope protocol" must be implemented in case cross-contamination is suspected.
c) Bronchoscopy cultures will be performed in accordance with the Johns Hopkins procedure for culturing bronchoscopes. Both reverse and forward flow cultures will be performed with sterile water and captured in a sterile specimen container and Lukin's trap. Additionally, the biopsy channel and cap will be tested with a microbiology swab every 3 months.
d) Quarterly cultures of bronchoscope storage cabinets and carrying carts must be performed. The carriage carts is thoroughly disinfected with a solution composed of n-Alkyl Dimethyl Benzyl Ammonium Chloride and Didecyl Dimethyl Ammonium Chloride (trade name *Virex; Johnson Wax Company; Sturtevant, Wisconsin, USA*) after each use.
e) Scopes must be stored hanging in a straight vertical position to optimize drying without any bending in a cabinet dedicated only for scopes. Scopes must not be allowed to come into contact with any internal surfaces of the cabinets.

f) Immediately after completion of each bronchoscopy, the enzymatic cleaner will be aspirated through the bronchoscope at the scene and also upon arrival to the processing center. The cleaner reconstitution includes one package of Steris Enzymatic Cleaner (*Steris Company; Mentor, Ohio, USA*) per gallon of water and it will be prepared in the processing area.

g) The scope is then transported to a processing center. First, the scope should be checked for any leakage. Suction must be applied when bronchoscope is submerged in water for a leak test (the waterproof cap should not be opened). The scope should be hand-washed with the enzymatic cleaner with a single-use brush thoroughly and not be left to dry before completion of cleaning in the next step **(h)**. The operator should wear eye protection, and sterile gloves with gown.

h) Next, high-level disinfection should be carried on with all connections (biopsy channel and suction port) of the scope being tight and secure. The scope is then placed in washer for the full *first-cycle* (25 minutes) to complete followed by injection of 10 to 20 cc's of 70% isopropyl alcohol into all parts of the bronchoscope (*second cycle*).

i) After completion of both cycles, the scope is flushed and dried with high-flow oxygen to remove any excess moisture. Then the scope is stored with the cap off in a dedicated storage cabinet.

j) Prior to bronchoscopy, bronchoscopes are to be placed in clean bins for transportation and sterile drapes must be used to cover the transportation cart and the patient.

k) Common items in between patients or units should never be used and are for single time use only.

l) Disposable items, i.e. water, saline, specimen cups, enzymatic cleaner syringes, tubing, Lukin's traps, brushes, must be placed in a bag and immediately discarded after completion of the procedure.

m) Dirty bronchoscopes must be transported in plastic-covered containers. The container must be cleaned after each use with disinfectant. Towels should not be used for transportation.

n) The personnel involved in bronchoscopy should wear protective gown, mask, and eye-cover and strictly abide by the protocols of hospital infection-control committee during and after bronchoscopy.

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