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Pseudo-outbreaks of *Stenotrophomonas maltophilia* on an intensive care unit in England

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SUMMARY

Background: In June 2014, a cluster of identical *S. maltophilia* isolates was reported in an adult intensive care unit (ICU) at a district general hospital. An outbreak control team was convened to investigate the cluster and inform control measures.

Aim: To identify potential risk factors for isolation of *S. maltophilia* in this setting.

Methods: We conducted a cohort study of ICU patients for whom a bronchoalveolar lavage (BAL) specimen was submitted between October 2013 and October 2014. Cases were patients with *S. maltophilia*-positive BAL. We calculated the association between isolation of *S. maltophilia* and patient characteristics using risk ratios (RRs) with 95% confidence intervals (95% CIs) and univariate logistic regression. Chi-squared or Fisher's exact tests were used. BAL specimens were microbiologically typed using pulse-field gel electrophoresis (PFGE).

Findings: Eighteen patients met the case definition. Two patients had clinical presentations that warranted antibiotic treatment for *S. maltophilia*. All cases were exposed to bronchoscopy. PFGE typing revealed clusters of two strain types. We found statistically significant elevated risks of isolating BRISPOSM-4 in patients exposed to bronchoscope A (RR: 13.56; 95% CI: 1.82–100; $P < 0.001$) and BRISPOSM-3 in patients exposed to bronchoscope B (RR: 16.89; 95% CI: 2.14–133; $P < 0.001$). *S. maltophilia* type BRISPOSM-4 was isolated in water used to flush bronchoscope A after decontamination.

Conclusion: Two pseudo-outbreaks occurred in which BAL specimens had been contaminated by reusable bronchoscopes. We cannot exclude the potential for colonization of the lower respiratory tract of exposed patients. Introduction of single-use bronchoscopes was an effective control measure.

Introduction

Stenotrophomonas maltophilia is a Gram-negative non-fermenting bacterium found widely in aqueous and humid habitats in the environment, including plants, animals, and water sources.[1] It is a well-known multidrug-resistant

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opportunistic pathogen, especially on the ICU, and an important cause of healthcare-associated infections. Patients with prolonged neutropenia, exposure to broad-spectrum antibiotics or mechanical ventilation are at highest risk of infection.[2] *S. maltophilia* can manifest in several ways including skin infections in patients with burns, urinary tract infections in catheterized patients, pneumonia, meningitis after neurosurgical procedures, bacteraemia and disseminated multi-organ infection which can be fatal.[2] Colonization with *S. maltophilia* is known to occur in prolonged stays in critical care, after prolonged exposure to antibiotics and in patients with a tracheostomy.[3,4]

Stenotrophomonas maltophilia outbreaks in critical care settings have been linked to biofilms of *S. maltophilia* in the filters of drinking-water coolers as well as sinks supplying non-potable water.[5,6] Pseudo-outbreaks (episodes of apparent increased disease frequency, due to enhanced surveillance or other factor not related to the disease itself) of *S. maltophilia*, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* related to contamination of bronchoscopes or problems with the reprocessing of bronchoscopes after use have been reported in several countries, including in the critical care setting.[7–9] Outbreaks have been associated with mechanical ventilation and with cross-contamination of ventilators from other contaminated equipment or environmental sources but not with bronchoscopy.[10,11]

From February to May 2014, an identical strain type (BRISPOSM-4) of *S. maltophilia* was isolated in routine bronchoalveolar lavage (BAL) samples collected during bronchoscopy from seven different patients admitted to an adult intensive care unit (ICU) at a district general hospital in England. The only known previous isolate had been identified on the same ICU in October 2013. None of the patients had symptoms suggestive of *S. maltophilia* infection.

A further cluster of *S. maltophilia* from five BAL samples of a second strain type (BRISPOSM-3) then emerged during June to August 2014.

We report findings of a retrospective investigation undertaken to identify risk factors associated with isolation of *S. maltophilia* from BAL samples collected during bronchoscopy on ICU since October 2013, and describe the control measures implemented including the use of disposable bronchoscopes.

Methods

Epidemiological investigations

A cohort study was undertaken with a study population of all ICU patients who had a BAL sample taken in the period October 1st, 2013 to October 31st, 2014.

Three confirmed case definitions were used:

- All strain types: a patient admitted to the adult ICU in the study period from whom *S. maltophilia* of any type was isolated in a BAL sample.
- Strain type BRISPOSM-3: a patient admitted to the adult ICU in the study period from whom *S. maltophilia* strain type BRISPOSM-3 was isolated by pulsed-field gel electrophoresis (PFGE) from a BAL sample.
- Strain type BRISPOSM-4: a patient admitted to the adult ICU in the study period from whom *S. maltophilia* strain type BRISPOSM-4 was isolated by PFGE from a BAL sample.

The exposures considered were:

- exposure to bronchoscopes A, B or C
- location in which the bronchoscope was cleaned
- intubation
- length of admission prior to bronchoscopy
- inpatient administration of antimicrobials
- demographic information (sex and age).

Demographics, admission/discharge details, diagnosis, and clinical information were extracted from the Intensive Care National Audit and Research Centre database (ICNARC). Local paper records for bronchoscope traceability were used to identify which patients had a bronchoscopy, which bronchoscope was used and the date of the procedure. Microbiological reports were provided by the hospital laboratory, including searching for all samples of any type positive for *S. maltophilia*. Bed locations were identified from hospital electronic records.

Attack rates and risk ratios (RRs) were calculated between exposed and unexposed individuals for a range of demographic and clinical characteristics with 95% confidence intervals (95% CIs) for each binary exposure of interest. Median unbiased estimates were calculated using exact logistic regression for those exposures with inestimable odds ratios due to sampling zeros.

Sex, age, and duration of ICU stay were considered *a priori* to be potential confounders or effect modifiers as these are known risk factors for *S. maltophilia* infection.

Logistic regression was used to test association with exposures treated as continuous variables such as age, duration of admission or number of different antimicrobial drugs administered prior to bronchoscopy.

Data analysis was performed using Stata version 12.0 (Statacorp., College Station, TX, USA).

Microbiological investigations

All the BAL cultures were tested using a semiquantitative culture method. The samples were cultured on chocolate agar, blood agar, Sabouraud agar and CLED culture media. The culture plates were kept between 35 and 37°C for 48 h and were read daily.

The isolated organisms were identified by Gram staining, colony appearance, biochemical tests, and matrix-assisted laser desorption/ionization–time-of-flight mass spectrometry. Organisms identified as *S. maltophilia* were sent to the reference laboratory for typing by PFGE.

Environmental investigations

We tested drainage points from all ten handwashing sinks on the ward for the presence of *S. maltophilia*. Water outlet points were in the process of being replaced and were not tested.

The bronchoscopes were flushed with sterile water and the flush water was cultured for microbial studies.