Original Article

Bacteremia associated with bronchoscopy

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Abstract Objective: To assess the incidence of bacteremia following bronchoscopy to determine whether the use of prophylactic antibiotics is warranted in patients at risk of endocarditis.

Design: Prospective nonrandomized clinical study.

Settings: Bronchoscopy Unit of Chest Department and Thoracic Surgery Department, and Microbiology Laboratory of Ain Shams University Hospitals, Cairo, Egypt.

Patients: Forty-five patients undergoing diagnostic and therapeutic bronchoscopy.

Interventions: Blood samples for culture were obtained before and immediately after the procedure.

Results: There were no documented cases of bacterial growth in blood. Two culture bottles yielded contaminant.

Conclusion: Bronchoscopy is a low-risk procedure for the development of bacteremia. This may bear on present practice regarding perioperative antibiotic prophylaxis for endocarditis in the high-risk groups.

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Introduction

Bacteraemia is a well-recognized consequence of invasive medical procedures as well as simple day to day living activities like teeth brushing. In most cases, it is a transient phenomenon without clinical consequences [1]. In certain patients, such as those with structural cardiac abnormalities, it is thought that it may lead to the development of infective endocarditis (IE) [2].

Current NICE guidelines recommend that antibiotic prophylaxis is no longer offered routinely for patients undergoing bronchoscopy because it has not been proven to be effective and there is no clear association between episodes of infective endocarditis and interventional procedures [3].

Furthermore, the predisposing factors for the development of IE in western countries have changed in the past 50 years, mainly with the decreasing incidence of rheumatic heart disease and the increasing impact of prosthetic heart valves, nosocomial infection and intravenous drug misuse. However, the potentially serious impact of IE on the individual has not changed [4].
In a country like Egypt where valvular heart disease secondary to rheumatic fever is not an uncommon finding the benefits from prophylaxis need to be weighed against the costs of administering care, risks of adverse effects for the patient and of the development of antibiotic resistance.

So, the aim of the current study was to assess the frequency of bacteremia following the bronchoscopy procedure.

**Patients and methods**

The study was carried out at the bronchoscopy suite in the Chest Department, Thoracic Surgery Department and Microbiology Laboratory of Ain Shams University Hospitals, Cairo, Egypt. The study population consisted of 45 consecutive patients – all ambulatory – who underwent bronchoscopy during the study period. Patients with current respiratory tract infection or febrile illnesses and those receiving antibiotic therapy within a week prior to the bronchoscopy were excluded.

A total of 14 patients underwent rigid bronchoscopy for foreign body extraction. The remaining patients underwent flexible bronchoscopy for investigation of: non resolving pneumonia (4 patients); hemoptysis (9 patients); stridor (2 patients); bronchiectasis (6 patients); chronic cough (6 patients); suspected upper airway stenosis (3 patients); and mediastinal mass (1 patient).

Rigid bronchoscopy was performed using Bryan Corporation bronchoscopes. Patients were deeply sedated and the bronchoscopy was performed.

Flexible bronchoscopy was performed transnasally using flexible, fibreoptic bronchoscopes (Pentax, EB-18 30T3). The bronchoscope included a systematic review of the tracheobronchial tree. Endobronchial lesions were sampled by brushing followed by lavage with 50 ± 100 mL saline, using sterile negative pressure biopsy specimens, followed by 2 ± 4 brush samples and lavage with 50 ± 100 mL saline, using sterile negative pressure suction. Pulmonary lesions beyond the range of the bronchoscope were sampled by brushing followed by lavage.

Blood sampling: three 10 mL blood samples were taken from the anti cubical fossa one immediately before and two after bronchoscopy 10 min apart under complete aseptic conditions.

**Bacterial cultures**

The 10 mL venous blood samples were inoculated, at bed side, onto the BACTECTM PLUS Aerobic/F blood culture medium which usually contains nutritive elements for microorganisms, anticoagulant, and resins for the adsorption of antibiotics. Bottles were then transported immediately to the Microbiology Laboratory for further processing.

Bottles were put into the BACTEC 9050 series Instrument. Growing microorganisms metabolize substrates in the medium and release CO2. This produced CO2 is detected by a sensor in the bottle which is monitored every 10 min by the BACTEC 9050 series Instrument for an increase in its fluorescence, which is proportional to the amount of CO2 in the bottle. The presence of a positive flag at the bottle position in the instrument denotes the presence of microbial growth whereas the appearance of a negative signal, after 5 days incubation, denotes a negative growth.

Positive bottles were removed from the BACTEC instrument, mixed well by shaking, and a sample of 3–5 mL blood/broth was aspirated from it under aseptic conditions using a sterile syringe.

Routine subculture was done onto a blood agar plate, one MacConkey agar plate and one Chocolate agar plate. The MacConkey agar plate was incubated at 36 ± 1 °C under aerobic conditions, and the blood agar plate as well as the chocolate agar plate were incubated at 36 ± 1 °C under aerobic conditions with added 5–10% CO2.

After 18–24 h incubation, plates were examined for the presence of any relevant growth. The recovered organism was then identified and their antimicrobial susceptibility was determined in accordance to the Microbiology Laboratory procedures.

If no growth appeared after 18–24 h incubation, plates were re-incubated for additional 48 h and re-examined thereafter.

Negative bottles, as evidenced by the appearance of a negative signal, were removed from the instrument and examined for the presence of any evidence of microbial growth (turbidity, hemolysis). If there was any evidence of microbial growth, bottles were treated as positive bottles. If no evidence of microbial growth exists bottles were discarded and reports were discharged as no growth after 5 days incubation.

We defined true bacteremia as episodes in which two post bronchoscopy positive blood cultures yielded the same organisms.

**Results**

**Patient characteristics**

Past medical history, comorbidity: 5 patients had cardiovascular disease, but none had clinical evidence of a cardiac valvular deformity; 4 had impaired immunity due to diabetes, 8 had chronic obstructive lung disease; 14 had no defined comorbidity (Tables 1 and 2).

**Bronchoscopy findings**

Twenty-two patients had a normal study 2 had subglottic stenosis and 19 patients showed inflamed bronchial mucosa.

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<th>Table 1 Characteristics of studied patients.</th>
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<tbody>
<tr>
<td>Children</td>
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<td>----------</td>
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<tr>
<td>Males</td>
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<td>Females</td>
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<td>Total</td>
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Nine patients were children (under 16 years of age) and 36 were adults. There were 37 males and 8 females.

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<th>Table 2 Age of studied population.</th>
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<td>Mean (years)</td>
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<td>Children</td>
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<td>Adults</td>
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The age of patients ranged from 8 to 65 years. Children had a mean age of 12.3 ± 2.8 while adults had a mean age of 48 ± 13.75.
Bacteriological findings

Two culture bottles yielded contaminant. Overall no patients had documented bacterial growth in blood.

Discussion

This study examined the frequency of bacteraemia following bronchoscopy in 45 consecutive patients. We hypothesized that during bronchoscopy, bacteria are driven by the bronchoscope from the upper to the lower airways. Mucosal damage induced by the bronchoscope and/or the associated procedures may facilitate penetration of bacteria into the blood stream. True bacteraemia was recorded only for those patients in whom two consecutive blood cultures showed the same organism. This led to the exclusion of 2 bacteraemia episodes (Staphylococcus coagulase negative) as contaminants. This interpretation is supported by published data showing that 70% of all staphylococcus coagulase negative blood culture isolates are regarded as contaminants [5]. Otherwise no positive blood cultures were noted.

The rationale for prophylaxis against IE is: endocarditis usually follows bacteraemia, certain interventional procedures cause bacteraemia with organisms that can cause endocarditis, these bacteria are usually sensitive to antibiotics; therefore, antibiotics should be given to patients with predisposing heart disease before procedures that may cause bacteraemia [2].

The evidence base for the use of antibiotic prophylaxis for infective endocarditis has relied heavily on extrapolation from animal models of the disease [6] and the applicability of these models to people has been questioned. With a rare but serious condition such as IE it is difficult to plan and execute research using experimental study designs. Consequently, the evidence available in this area is limited, being drawn chiefly from observational (case–control) studies. Experimental animal models have shown that bacteraemia can cause IE. However, the intensity of bacteraemia used has been very high when compared with those detected in both adults and children following interventional dental procedures [7].

While in humans there is no consistent association between having an interventional procedure, dental or non-dental, and the development of IE, regular teeth brushing almost certainly presents a greater risk of IE than a single dental procedure because of repetitive exposure to bacteraemia with oral flora [8,9]. The clinical effectiveness of antibiotic prophylaxis is not proven, though it was noted that cases of IE have been reported to follow these procedures.

As a result guidelines by the British Society for Antimicrobial Chemotherapy [17] and the American Heart Association [16] have highlighted the prevalence of bacteraemias that arise from everyday activities such as tooth brushing, the lack of association between episodes of IE and prior interventional procedures, and the lack of efficacy of antibiotic prophylaxis regimens.

Our cohort of patients was consecutive and should be an adequate representation of the population that undergoes various types of bronchoscopy. However we do realize that the spectrum of bronchoscopic invasive procedures has increased off late some of which involve a substantial degree of mucosal injury. Also a study that attempts to estimate the incidence of a relatively infrequent phenomenon, such as bacteraemia following bronchoscopy, should include a larger number of patients.

A lack of data on upper airway flora before the bronchoscopy and the lack of correlation between the results of blood and nasal and bronchial lavage cultures may be of significance if future studies focusing on more invasive procedures pick up a relevant incidence rate of bacteremia.

Retrospective studies of patients with infective endocarditis and whether they have undergone any procedure can expand our knowledge should we attempt to recommend a best practice guideline.

Conflict of interest

None declared.

References


