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The bacterial species associated with aspirated foreign bodies in children

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ABSTRACT

Objective: Inhaled foreign bodies in children are common and may be complicated by secondary airway tract infection. The inhaled foreign body may act as carrier of infectious material and the aim of this study was to explore the bacterial species associated with aspirated foreign bodies in a cohort of children.

Methods: Retrospective case series of 34 patients who underwent rigid laryngobronchoscopy because of foreign body aspiration. Each patient had a sample taken from tracheobronchial secretions during the procedure.

Results: The average patient age was 31.2 months and the average hospital stay was 2.5 days. Of the foreign bodies 24 (71%) were organic in nature and 10 (29%) were non-organic. Twenty eight (82.3%) patients had mixed oropharyngeal flora organisms growth. Fifteen (44%) samples were positive for organisms other than oropharyngeal flora with the most common cultured organisms being: *Streptococcus pneumonia* (4/12%), *Haemophilus influenza* (4/12%), *Moraxella catarrhalis* (4/12%). Four samples (12%) grew a fungus; Candida albicans was cultured in 3 patients and Aspergillus glaucus was identified in one sample. Of the non-oropharyngeal organisms 7(47%) demonstrated antibiotic resistance with four having resistance to amoxycillin, two resistant to penicillin and one resistant to cotrimoxazole.

Conclusion: Some children who present with aspirated foreign body may be complicated with secondary airway infection. Antibacterial treatment might be considered in some of these cases. The regimen of antibiotics should aim to cover oropharyngeal flora, *S. pneumonia*, *H. influenza* and Moraxella catarrhalis.

1. Introduction

AFB (Aspirated Foreign Body), be it real or suspected is a common cause for presentation to the Emergency Department in the paediatric population. The majority of cases will be stable at presentation although AFB can be life threatening [1–3]. Rigid laryngobronchoscopy is the most reliable method for removal of airway FBs [4] and is required if there is sufficient suspicion of AFB. The AFB can present acutely soon after the event or later with complications including pneumonia, atelectasis, lung abscess and bronchiectasis [5,6]. The FB may act as a carrier for bacterial colonization and later on possible infection although very limited data is available regarding which bacteria may be involved in these cases.

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To the best of our knowledge, this is the first study in the English literature to provide information regarding the bacterial spectrum associated with AFB in a series of paediatric patients.

2. Methods

Retrospective case series of 34 patients that underwent rigid laryngobronchoscopy for AFB between January 2003 and August 2015. All procedures coded as laryngoscopy and/or bronchoscopy at Starship Children's Hospital (Auckland, New Zealand) from January 2003 to December 2015 were pooled and patients who underwent these procedures for AFB were included. All children who were included in this cohort had samples taken from their bronchial secretions during the procedure. One sample was taken from each patient. A decision whether to take a sample was made by the paediatric otolaryngology consultant in theatre along with a decision to treat empirically with antibiotics. Amoxycillin with clavulinic acid was the antibiotic of choice if no penicilline allergy was previously recorded.

All patients had their FB removed successfully endoscopically and none required open procedures. No deaths occurred. Study parameters included age, ethnicity, type of FB (organic versus non-organic), time interval from episode to presentation, culture results including bacterial susceptibility and length of hospital stay.

Cultures were taken in a sterile manner. A flexible spaghetti catheter was introduced via side-port of the the rigid bronchoscope and a sample was suctioned into a luki trap (Davis and Geck). The suction apparatus was then washed with sterile saline so that all secretions are collected in the trap.

Inclusion criteria: Age below 16 years, rigid laryngobronchoscopy was performed for AFB, bronchial secretions sample was collected.

Exclusion criteria: Symptoms of airway tract infection during one month prior to aspiration episode, immuncompromised condition.

Statistics employed the *students t-test* for continuous data and the *chi-squared test* for binomial data.

Institutional review board approval was obtained for this study (Auckland District Health Board Research Review Committee). Study reference details A + 7096.

3. Results

Total of 34 samples were taken from 34 patients during rigid laryngobronchoscopies. The average patient age was 31.2 months and the average hospital stay was 2.5 days. Ethnicity was European (18/53%), Maori/Pacific Islander (12/35%), Asian (3/9%), Middle-Eastern (1/3%). 24 (71%) FBs were organic and 10 (29%) were non-organic. All patients had a chest X-ray as part of their airway evaluation prior to the procedure. Positive chest X-ray findings were demonstrated in 21 (62%) of the patients. These consisted of atelectasis/consolidation in 8 (23.5%), air trapping/hyperinflation in 7 (20.6%), radio-opaque FB in 6 (17.6%). No antibiotics were given prior to laryngobronchoscopy.

Table 1
Positive culture results (regardless of oropharyngeal flora status).

Bacteria/fungi	#	% of total	% of positive cultures
Haemophilus influenzae	4	12%	27%
Moraxella (*Branhamella*) *catarrhalis*	4	12%	27%
Streptococcus pneumoniae	4	12%	27%
Mixed anaerobes	3	9%	20%
Staphylococcus aureus	2	6%	13%
Pseudomonas aeruginosa	1	3%	7%
Fusarium species	1	3%	7%
Prevotella (*Bacteroides*) *oralis*	1	3%	7%
Candida albicans	3	9%	20%
Aspergillus glaucus group	1	3%	7%

28 (82.3%) samples were positive to growth of mixed oropharyngeal flora. Fifteen (44%) samples were positive for organisms different than oropharyngeal flora. Most common organisms that were cultured were: *Streptococcus pneumonia* (4/12%), *Haemophilus influenza* (4/12%), *Moraxella catarrhalis* (4/12%). See Table 1 for a full list of organisms.

Eight (53.3%) patients out of the positive non-oropharyngeal cultures subgroup grew more than one organism.

Of the positive non-oropharyngeal culture subgroup of patients, 9 had an organic FB and in 6 the FB was non-organic. Sixty percent of the patients that presented with non-organic FB had a positive non-oropharyngeal culture compared to 37.5% of the patients with organic FB.

Four samples were positive for fungal growth; Candida albicans was cultured in 3 patients and Aspergillus glaucus was cultured in one sample. None of the patients in this cohort received anti-fungal medications and none developed long standing pneumonia or suspected fungal pneumonia. None of the patients were immunocompromised.

Spectrum of antibiotic resistance was variable according to each bacterium. See Table 2 for full bacterial susceptibility information. Seven (47%) bacteria out of the non-oropharyngeal organisms demonstrated antibiotic resistance with four that were resistant to amoxycillin, two resistant to penicillin and one resistant to cotrimoxazole. Moraxella catarrhalis was the most resistant organism compared to *S. pneumonia* which did not exhibit antibiotic resistant in any of these cases.

Following laryngobronchoscopy, 26 patients received antibiotic treatment according to clinical findings during the procedure. Sixteen (47%) patients received Intravenous Amoxycillin with clavulinic acid during admission followed by oral course for another week, 10 (29%) patients received oral Augmentin for one week and 8 (23.5%) did not receive any antibiotics. All patients were reviewed by either a Paediatric Otolaryngologist or a Paediatrician/Family practitioner two weeks following hospital discharge. There was no need for further antibiotic treatment following these clinical reviews.

Time to presentation from aspiration episode was less one day in 6 patients, 1–7 days in 13 patients, 7–30 days in 7 patients and more than 30 days in 8 patients. Fifteen (44%) patients of this cohort presented to our service with history of aspiration of more than one week before referral.

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