Branhamella catarrhalis respiratory infections

B. Barreiro*, L. Esteban*, E. Prats*, E. Verdaguer**, J. Dorca*, F. Manresa*


ABSTRACT: Branhamella catarrhalis is an aerobic Gram-negative diplococcus. It has been traditionally regarded as an oropharyngeal commensal and until recently was only identified as a pathogen in cases of bronchopulmonary infections. The aim of this study was to analyse the characteristics of the respiratory infections caused by B. catarrhalis and to know the antibiotic susceptibility of this microorganism.

We retrospectively studied 32 lower respiratory tract infections, caused by B. catarrhalis (20 cases of bronchial infection and 12 cases of pneumonia), diagnosed between 1988-1989 in our hospital. All patients had an underlying disease: chronic obstructive pulmonary disease (COPD) and chronic heart disease being the most frequent. The aetiological diagnostic procedures were: sputum culture in 28 cases (15 in pure culture and 13 mixed), protected specimen brush (PSB) in three cases and transthoracic needle aspiration (TNA) in one case. Twenty B. catarrhalis isolates were penicillin and ampicillin-resistant, 11 in the pneumonia group and 9 in the bronchial infection group. All isolates were sensitive to amoxycillin-clavulanic acid and second generation cephalosporin. In our group four patients died.

We conclude that B. catarrhalis is a not infrequent cause of respiratory infection, particularly in COPD patients, and that the high incidence of antibiotic resistance to penicillin and ampicillin should be taken into account before considering an empirical antibiotic treatment.


B. catarrhalis is a Gram-negative coccus, commonly found in the upper respiratory tract. Although it has long been considered a nonpathogenic commensal, some sporadic cases of sinusitis, laryngitis, otitis media, sepsis, endocarditis and pneumonia have been reported in children and adults [1-4].

Nowadays, however, B. catarrhalis is third after Haemophilus influenzae and Streptococcus pneumoniae [1,5] as the causative organism in lower respiratory tract infections, and various degrees of antibiotic resistance for B. catarrhalis have been reported [6-9].

We have retrospectively analysed the lower respiratory tract infections caused by B. catarrhalis seen in our hospital.

Materials and methods

We have reviewed all of the B. catarrhalis isolates obtained from the respiratory samples (sputum, transthoracic needle aspiration (TNA) and bronchoscopic protected specimen brush (PSB)), blood and pleural fluid of those patients admitted into the hospital with respiratory infection and from all those who had nosocomial pneumonia, during a period of two years, from January 1988 until December 1989.

We used the criteria described by Murray and Washington [10] for microscopic examination of sputum cytology. If specimens demonstrated a preponderance of polymorphonuclear leucocytes and less than 25 squamous epithelial cells per high-power field (HPF), we cultured on general purpose media (blood agar, chocolate agar and on differential medium McConkey agar). Isolates from protected catheter brush were cultured quantitatively in aerobic and anaerobic media: cut-off point to separate colonization and infection was 10³ colony forming units (CFU)/ml [11,12]. B. catarrhalis was identified as intracellular or extracellular Gram-negative diplococci with a positive oxidase-catalase reaction [13,14]. The samples were tested for antibiotics using a disk diffusion test, Bauer et al. [15], and the penicillin-resistant samples were tested for the production of beta-lactamase using a chromogenic cephalosporin test (Nitrocefin disk*) [16]. The isolates were separated into mixed and pure, but all of them were considered for the study.

The diagnosis of pneumonia was accepted when clinical symptoms of respiratory tract infection (cough, purulent phlegm, chest pain and fever) were present in association with a pulmonary infiltration. When no radiological abnormalities accompanied the clinical symptoms, the case was considered a bronchial...
infection. We collected the following information from each of the patients: age, sex, underlying disease, clinical symptoms, origin of collected samples, bacteriological results with beta-lactamase production, chest X-ray findings and clinical outcome.

Results

During this two year period, *B. catarrhalis* was isolated from respiratory secretions of 32 patients: 12 had pneumonia and 20 bronchial infection. Table 1 shows the general characteristics of the patients with pneumonia and bronchial infection caused by *B. catarrhalis*.

The mean age was 68 yrs (range 49–81 yrs), and 21 were men. All patients had some sort of underlying disease: chronic obstructive pulmonary disease (COPD) (defined as a disorder with lowered expiratory flow rates unchanged during several months of observation) [17] was present in 12 of the 32 patients; 4 patients had diabetes mellitus; 6 suffered from chronic heart disease; 4 patients had lung cancer; and 5 cerebral vascular disease (CVD) (figs 1 and 2).

Table 1. - Characteristics of *B. catarrhalis* pneumonia and bronchial infection patients

<table>
<thead>
<tr>
<th></th>
<th>Pneumonia (n=12)</th>
<th>Bronchial infection (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (range) yrs</td>
<td>68 (49–81)</td>
<td>68 (52–81)</td>
</tr>
<tr>
<td>Males/females</td>
<td>10/2</td>
<td>11/9</td>
</tr>
<tr>
<td>Underlying disease</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Smokers</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Duration of illness before admission days</td>
<td>5–7</td>
<td>5–7</td>
</tr>
</tbody>
</table>

Fig. 1. - *B. Catarrhalis* pneumonia and underlying disease. The figures represent the number of patients suffering each of the different underlying diseases. Chronic obstructive pulmonary disease: heart disease; diabetes; cancer; cerebral vascular disease; asthma.

Table 2. - Symptomatology of *B. cararrhalis* bronchopulmonary infected patients

<table>
<thead>
<tr>
<th></th>
<th>Pneumonia (n=12)</th>
<th>Bronchial infection (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Chest pain</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Cough</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Purulent sputum</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Death</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

In all of the patients clinical symptoms of lower respiratory tract infection were present 5–7 days prior to admission. The symptomatology of the two groups (pneumonia and bronchial infection) is contrasted in table 2.

The aetiological diagnostic procedures employed were: a) sputum culture in 28 cases - 15 in pure culture and 13 in mixed culture (*B. catarrhalis*, *Haemophilus influenzae* and *Streptococcus pneumoniae* in 2 cases; *B. catarrhalis* and *H. influenzae* in 5; *B. catarrhalis* and *Streptococcus pneumoniae* in 6); b) protected specimen brush (PSB) in 3 cases; and c) transthoracic needle aspiration (TNA) in one case. Blood culture and pleural fluid culture were performed in 32 and 3 cases, respectively, and all of these were negative.

In the pneumonia group (12 patients), 10 were community-acquired pneumonia (CAP) and two nosocomial pneumonia (NP). Eleven were unilateral and one was a bilateral pulmonary infection.

In the CAP group, 9 of the 10 *B. catarrhalis* samples were penicillin and ampicillin-resistant. All of the samples were sensitive to amoxyccilin-clavulanic acid and second generation cephalosporin.

In the NP group, one patient suffered from Wallenberg's syndrome and the other had COPD.
The first patient was treated with amoxycillin and cefonicid and died from his underlying disease within the first four days of treatment. The patient with COPD was treated with cefotaxime and recovered from the pneumonia. All samples in this group were penicillin and ampicillin-resistant, but sensitive to amoxycillin-clavulanic acid and second generation cephalosporin.

In the group of bronchial infection caused by 
*B. catarrhalis*, 9 of the 20 
*B. catarrhalis* samples were penicillin and ampicillin-resistant. All of the 
*B. catarrhalis* obtained from the respiratory samples in this group were amoxycillin-clavulanic acid and second generation cephalosporin sensitive organisms.

The bacteriological results of our study were as follows: 1) 20 of the 
*B. catarrhalis* recovered from the respiratory samples were penicillin and ampicillin-resistant organisms; 2) 16 were trimethoprim-sulphamethoxazole resistant microorganisms; and 3) all strains were amoxycillin-clavulanic acid and second generation cephalosporin sensitive (fig. 3).

**Discussion**

Most reports establish the aetiological diagnosis of a respiratory tract infection caused by 
*B. catarrhalis* on the results of the sputum culture. Several authors support the view that when the 
*B. catarrhalis* is obtained in pure (or with great predominance) culture of the sputum, the use of other bacteriological procedures is not necessary for the aetiological diagnosis [1, 5, 18, 19]. In the literature we can find arguments in favour of the causative role of 
*B. catarrhalis* in a respiratory infection such as: a) 
*B. catarrhalis* has been observed in histological preparations of patients who had died of pneumonia [18]; b) previous studies have demonstrated that the finding of 
*B. catarrhalis* in large numbers in expectorated sputum specimens correlate well with recovery of the organism by transtracheal aspiration [5]; c) in many cases the pathogenic role of 
*B. catarrhalis* in respiratory infections has been demonstrated by the isolation of the microorganism in a respiratory sample (pure or predominant culture), a favourable clinical outcome and the disappearance of the microorganism from the sputum with the appropriate antibiotic [9, 20].

As reported in most series, a high percentage of these patients had an underlying disease, and the frequent presence of other pathogens in the upper respiratory samples could complicate the interpretation of bacteriological results [18, 21]. In fact, all of the polymicrobial samples in our study showed the most common organisms usually found in the upper respiratory tract of COPD patients.

The diagnostic value of the transtracheal needle aspiration is about 80% in bacterial pneumonia and anaerobic pulmonary infections [22, 23]; but the specificity is reported to be low in some circumstances: 22% of patients with lung cancer and 40% of patients with chronic bronchitis show false positive results due to contamination of the bronchial tree [24, 25]. For these reasons other invasive procedures could be useful in the diagnosis of 
*B. catarrhalis* pneumonia. In our study, four patients were diagnosed by means of non-conventional bacteriological procedures (three by PSB and one by TNA).

Table 3 shows a comparative analysis of the clinical and microbiological features of 
*B. catarrhalis* bronchopulmonary infections. During a period of two years 12 cases of pneumonia due to 
*B. catarrhalis* have been diagnosed. As has been observed in other studies, 
*B. catarrhalis* infection commonly affects patients with underlying disease, particularly COPD [2, 9, 20, 26–28].
Table 3. – Comparison with other reports on the clinical and microbiological features of *B. catarrhalis* pulmonary infection

<table>
<thead>
<tr>
<th>Year</th>
<th>Patients n</th>
<th>Underlying disease</th>
<th>Antibiotic treatment</th>
<th>Beta-lactamase producing</th>
<th>Mortality n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>11</td>
<td>COPD</td>
<td>Amp</td>
<td>10%</td>
<td>1(10)</td>
</tr>
<tr>
<td>1984</td>
<td>101</td>
<td>Emphysema</td>
<td>Amp</td>
<td>30%</td>
<td>5(5)</td>
</tr>
<tr>
<td>1990</td>
<td>42</td>
<td>COPD</td>
<td>Ery/Cef(3)</td>
<td>67%</td>
<td>9(21)</td>
</tr>
<tr>
<td>1991</td>
<td>32</td>
<td>COPD</td>
<td>Tetr/Cef(2)</td>
<td>62%</td>
<td>4(12)</td>
</tr>
</tbody>
</table>

Amp: ampicillin; Ery: erythromycin; Cef(2): second generation cephalosporin; Cef(3): third generation cephalosporin; A-cla: amoxycillin-clavulanic acid; TMP-SMZ: trimethoprim-sulphamethoxazole; Tetr: tetracycline; COPD: chronic obstructive pulmonary disease.

In our study four patients died, a figure similar to the studies of Ninane et al. [1] and Slevin et al. [5] but lower than that obtained by Wright et al. [9], probably because this last study included patients with cancer.

The respiratory infections are commonly treated with beta-lactam antibiotics [7]. The antibiotics administered in other reports were frequently beta-lactam antibiotics, erythromycin, tetracycline and trimethoprim-sulphamethoxazole. These antibiotic treatments are similar to those used in our study, except for the last two antibiotics.

In our material, a large number of microorganisms are resistant to commonly used antibiotics: 20 were penicillin and ampicillin-resistant. This antibiotic resistance frequently leads to therapeutic failure. The indirect pathogenicity of *B. catarrhalis* has been definitely demonstrated by Brook [29] in his overview on the failure of penicillin to eradicate a Group A beta-haemolytic streptococcal infection in the presence of beta-lactamase producing bacteria, including *B. catarrhalis*.

When treating these diseases it is essential to know the minimal inhibitory concentration (MIC) of the different antibiotics. From table 3 it is evident that the increasing rate of beta-lactamase production by *B. catarrhalis* over the last 20 yrs is probably due to the routine use of commonly used antibiotics for respiratory infections.

According to our results, and those of other series, the therapeutic alternatives to the resistant microorganisms may be: amoxycillin-clavulanic acid [30], erythromycin, second or third generation cephalosporins and ciprofloxacin [31]. The selection of the appropriate antibiotic will reduce the morbidity and mortality of the patients with *B. catarrhalis* respiratory infections even though in most cases the underlying disease is the most important prognostic factor [5, 8, 9].

We believe that: 1) *B. catarrhalis* respiratory tract infections are not uncommon in the community; and 2) in our geographical area the level of antibiotic resistance has important therapeutic implications.

References


17. ATS. - Standards for the diagnosis and care of patients with chronic obstructive lung disease (COPD) and asthma. Am Rev Respir Dis, 1986; 2: 225-228.


