Bordetella bronchicanis (brachiseptica) infection in man: review and a case report

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SUMMARY Bordetella bronchicanis is a common respiratory tract commensals of mammals. Rarely it causes whooping cough in children. Compromised adults in hospitals may be colonised, and one terminal pneumonia is on record. The fatal pneumonia of a malnourished alcoholic described here was contracted at home.

Ferry (1910) isolated a Gram-negative coccobacillus from enzootic distemper of laboratory dogs and named it Bacillus bronchicanis. It was later placed successively in the Brucella, Haemophilus, Alcaligenes and, finally, Bordetella genus, because it resembles the pertussis and parapertussis bacilli in habitat (mammalian upper respiratory tract), antigens, toxins, metabolism, and phage-susceptibility, although it is motile, grows on the selective salmonella-shigella (SS) agar, and has a different GC ratio in the DNA (Pittman, 1974). The species name bronchicanis has precedence over the popular bronchiseptica (Johnson and Sneath, 1973; Gilardi, 1976).

Canine distemper turned out to be a viral infection. Bordetella bronchicanis is a global respiratory tract commensal of wild as well as domestic mammals, occasionally causing outbreaks of fatal rhinitis, otitis, tracheobronchitis, or pneumonia with septicaemia. A priming viral infection may not be essential (Bemis et al., 1977a).

Stressed captive primates may die of bronchopneumonia (Seibold et al., 1970), but adult men seem to be resistant (Switzer et al., 1966). The mild cold-like infection in handlers of infected laboratory animals (Winser, 1960) is probably superimposed on a viral infection. Gardner et al. (1970) detected nosocomial colonisation of the respiratory tract in 'compromised' hosts and reported one case of terminal pneumonia.

The following case report shows that adults can be infected in the community.

Case report

A 73-year-old man, who lived alone in a slum and had been attending clinics over several years for alcoholic malnutrition, was admitted with respiratory and peripheral circulatory failure, hypothermia, dehydration, mental confusion, Hb 120 g/l, and WBC 17 x 10^9/l with neutrophilia. A chest x-ray showed an abscess in the right mid-zone.

Intravenous methicillin, ampicillin, and gentamicin were started after taking blood cultures which yielded B. bronchicanis. The next day the x-ray showed bilateral bronchopneumonia. He was put on a respirator. The trachea was full of pus. Gram stain and cultures showed profuse aerobic and anaerobic bacteria consistent with aspiration pneumonia. Subsequently B. bronchicanis alone was seen in smears and cultures of pus obtained daily by tracheal suctions until he died three days later. There were no viral studies or necropsy.

BACTERIOLOGY

Tiny, non-haemolytic, catalase- and oxidase-positive colonies grew aerobically on sheep blood agar after 24 hours at 35°C. The organisms were motile, short Gram-negative coccobacilli and bacilli. Only citrate utilisation and urease reaction occurred in the API 20E kit (Denver Laboratories). Results of macrotests (Cowan, 1974) and antibiotic susceptibility by a disk-diffusion method (Stokes and Waterworth, 1972) are summarised in the Table.

Discussion

Procedures for phenotyping non-fermenting bacteria are recent and insufficient. Tatum et al. (1974) could name only 13% of strains referred to the Centre for Disease Control (CDC) in America after using a wide range of tests. Such groupings are necessarily tentative.

The descriptions of B. bronchicanis before 1950 are inadequate (Gardner et al., 1970). Cowan (1974) preferred to include it in the genus Alcaligenes.
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Table  Biochemical reactions and antibiotic susceptibility of the isolate: composite positive results in percentage of 71 strains, mostly stock, in parentheses (Johnson and Sneath, 1973; Snell, 1973; Gilardi, 1976)

<table>
<thead>
<tr>
<th>Positive reactions</th>
<th>Negative reactions</th>
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<tbody>
<tr>
<td>Peritrichate flagella</td>
<td>Haemolysis, sheep blood (10)</td>
</tr>
<tr>
<td>Catalase (100)</td>
<td>Pigment in King’s medium A/B (0)</td>
</tr>
<tr>
<td>Oxidase (100)</td>
<td>Anaerobic growth on nitrate agar (0)</td>
</tr>
<tr>
<td>Growth on nutrient agar (100)</td>
<td>Growth on 9-32 g/l tellurite agar (0)</td>
</tr>
<tr>
<td>Growth on SS agar (82)</td>
<td>Acid in 1 % glucose, sucrose, mannitol, maltose, inositol, or salicin in peptone water (0)</td>
</tr>
<tr>
<td>Growth on KCN broth (100)</td>
<td>Acid in 10% lactose tellurite (0)</td>
</tr>
<tr>
<td>Pellicle on nutrient broth (100)</td>
<td>ONPG reaction (0)</td>
</tr>
<tr>
<td>Urease production in 1 h (98)</td>
<td>Indole (0)</td>
</tr>
<tr>
<td>Alkali in litmus milk</td>
<td>H₂S in TSI slope (0)</td>
</tr>
<tr>
<td>Citrate utilisation (100)</td>
<td>Phenylalanine deamination (5)</td>
</tr>
<tr>
<td>Tetrazolium reduction (97)</td>
<td>Lysine/ornithine decahydroxylase (0)</td>
</tr>
<tr>
<td>Tyrosine hydrolysis (100)</td>
<td>Arginine dehydrase (see text)</td>
</tr>
<tr>
<td></td>
<td>Malonate utilisation (0)</td>
</tr>
<tr>
<td></td>
<td>Digestion of casein/gelatin (0)</td>
</tr>
<tr>
<td></td>
<td>Hydrolysis of starch/asculin (0)</td>
</tr>
<tr>
<td></td>
<td>Nitrate reduction (85)</td>
</tr>
</tbody>
</table>

Susceptible to:
- Ampicillin 10 μg (30)
- Cephalothin 5 μg (75)
- Cotrimoxazole 25 μg (78)
- Gentamicin 10 μg (80)
- Nalidixate 30 μg (86)
- Nitrofurantoin 200 μg (54)
- Sulphafurazole 100 μg (86)

Resistant to:
- Benzylopenicillin 1·5 μg (7)
- Clindamycin 2 μg (0)
- Erythromycin 10 μg (93)
- Kanamycin 30 μg (65)
- Tetracycline 10 μg (100)

Johnson and Sneath (1973) distinguished it from Alcaligenes by tetrazolium reduction, growth on potassium tellurite agar, and antigenic distinctiveness. All their strains hydrolysed arginine, but Snell (1973) and the API Computer Manual (Denver Laboratories) recorded a negative reaction. All these workers considered nitrate reduction a characteristic of this organism, but only half the strains examined by Gilardi (1976) and Bemis et al. (1977b) reduced nitrate.

Our strain had all the essential diagnostic characters of B. bronchicanis (Johnson and Sneath, 1973; Bemis et al., 1977b) viz, morphology, oxidase reaction, rapid urease production in Christensen’s medium, citrate utilisation, tetrazolium reduction, failure to grow on tellurite agar, growth on SS agar, and tyrosine hydrolysis. CDC group IVe bacteria (Tatum et al., 1974) do not grow on SS agar or have peritrichous flagella, and they are usually citrate negative. Resistance to erythromycin and tetracycline in our strain was unusual, but an R factor has been reported in animals (Hedges et al., 1974).

B. bronchicanis affects mostly young animals (Battey and Smits, 1976). Rarely it has caused parapertussis in American children (Brown, 1926; Chang, 1950; Brookscaler and Nelson, 1967) and also possibly about 1:10³ cases of whooping cough in England (Lautrop and Lacey, 1960). Kristensen and Lautrop (1962) described a Danish farmer whose pet rabbit and subsequently cats died of the infection. Two of his younger children developed pertussis, another simple bronchitis; three older children became asymptomatic carriers while the eldest and the parents were unaffected. Krepler and Flamm (1958) cured with tetracycline a subacute tuberculous cavity in the lung of a 14-year-old boy whose sputum yielded B. bronchicanis repeatedly on culture. Chang et al. (1975) reported that the organism caused meningitis in a child with a closed fracture of the skull after being kicked by a horse; the microbe was not detected in the horse.

Cooper and Gibbs (1967) did not isolate the organism in Australia in a prospective study of whooping cough. The possibilities of its being missed, or classified as Alcaligenes sp, is high (Lautrop and Lacey, 1960; Cowan, 1974).

As stated already, normal adult man seems resistant to infection with B. bronchicanis. Pedersen et al. (1970) isolated 12 strains from hospital inpatients and considered them to be harmless. Gardner et al. (1970) regarded 16 strains isolated in 19 weeks from the respiratory tracts of intubated patients as well as another culture from urine as nosocomial colonisation in compromised hosts. However, they isolated B. bronchicanis and a pneumococcus from the blood of another man with terminal pneumonia, who was being treated for staphylococcal endocarditis after splenectomy and corticosteroid therapy.

In none of the isolations from adults was the source of the microorganisms established.

Snell (1973) has shown a bacillus isolated by Khaled (1923) from a typhoid-like fever in Egypt to be B. bronchicanis. The clinical details are not
available. Apart from this possible exception, our case seems to be the first record of domiciliary human disease due to *B. bronchiseptica* in an adult. The case confirms the organism as an opportunistic pathogen which is probably overlooked because of its close resemblance to *Alcaligenes* (Cowan, 1974).

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References


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