Pasteurella Pneumonia: Report of a Case and Review of the Literature

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A case of pneumonia due to *Pasteurella ureae* was encountered in a 57-year-old man who developed bilateral pulmonary infiltrates and respiratory insufficiency while convalescing in the hospital from a hip fracture and multiple rib fractures. Cultures of his sputum grew an essentially pure growth of *Pasteurella ureae*. This organism, a small gram-negative rod, could be differentiated from the other *Pasteurella* species by its ability to hydrolyze urea and failure to produce indole. The literature on *Pasteurella* infections is briefly reviewed, and the recent taxonomic revisions of the genus *Pasteurella* are discussed.

Pasteurella respiratory infections are limited mainly to those caused by *Pasteurella multocida*, an opportunistic pathogen. The other species of this genus are rarely encountered clinically. Although both *P. pneumotropica* and *P. ureae* have been cultured from the human respiratory tract (8, 9, 12), their role as pathogens has not been established. We report a case of pneumonia caused by *P. ureae*.

CASE REPORT

O.F., a 57-year-old white man suffering from previous alcoholism, as well as chronic organic brain syndrome and emphysema, was admitted to the Seattle Veterans Administration Hospital on 16 December 1974 because of a fracture of the right hip and multiple rib fractures on the left side incurred during a fall in his nursing home. Chest X ray revealed hyperinflated lungs in addition to the rib fractures. There were no infiltrates and no pneumothorax. The patient was treated with analgesics and bed rest. On the 15th day of hospitalization he was noted to be wheezing but was without fever or cough. By the 20th hospital day the patient had become cyanotic, markedly tachypneic, hypothermic, and obtunded. Examination of the chest at that time revealed diffuse bilateral wheezing. No rales were heard. Arterial blood gases while the patient was breathing room air showed a pH of 7.33, paO_2 of 53 mm of Hg, and paCO_2 of 44. An extensive infiltrate in the right mid-lung field and a smaller one at the left base were seen on portable chest X ray (Fig. 1). Gram stain of sputum obtained by nasotracheal suctioning showed many short, plump, gram-negative rods. The patient was intubated and mechanically ventilated and then given oxygen, aminophylline, and cephalothin. On this regimen he slowly improved; his chest X ray cleared, and he was extubated 4 days later. While convalescing on the general medical ward, the patient was noted to aspirate food frequently during meals. Each episode of

aspiration resulted in a prolonged bout of dyspnea and wheezing. On the 46th hospital day the patient vomited and aspirated a large quantity of stomach contents and died in spite of efforts to clear his airway by suction. Postmortem examination showed diffuse cerebral atrophy, aspiration pneumonitis, severe panlobular emphysema, and generalized atherosclerosis.

RESULTS

Gram stain of two sputum samples, both obtained by nasotracheal suctioning, showed moderate numbers of leukocytes and many small, plump, gram-negative rods. Each sputum culture yielded a heavy and essentially pure growth of tiny nonhemolytic translucent colonies growing on both blood and chocolate agar. No growth was noted on MacConkey agar. Gram stain of these colonies revealed small, vacuolated, gram-negative rods. The organism was oxidase and catalase positive, reduced nitrate to nitrite, and strongly alkalized Christensen urea slants at 24 h (Table 1). It fermented dextrose, mannitol, sucrose, and maltose, but failed to attack lactose, xylose, trehalose, sorbitol, arabinose, raffinose, rhamnose, adonitol, inositol, or salicin. Indole was not formed, and the organisms failed to liquefy gelatin or to grow on Simmons citrate agar. Lysine, ornithine decarboxylase, and arginine dihydrolase tests were negative. The organism was nonmotile, and electron microscopy revealed it to be atrichous.

Antibiotic sensitivity tests revealed that the bacteria were sensitive to all the commonly used antimicrobial agents including ampicillin, carbenicillin, cephalothin, chloramphenicol, clindamycin, erythromycin, gentamicin, kanamycin, penicillin, polymyxin B, streptomycin,

FIG. 1. X ray of lung patient O.F., taken on the 20th hospital day.

sulfonamides, and tetracycline. Based on the above characteristics, the organism was identified as *P. ureae* both in our laboratory and in the Special Microbiology Unit of the Center for Disease Control (R. E. Weaver, personal communication).

Serological studies of the patient's serum obtained in the 2nd week after the onset of the pneumonia revealed agglutinins in a titer of 1:2 to a suspension of the heat-killed bacteria.

Pooled normal human serum served as a negative control. Unfortunately, later convalescent serum from the patient was not tested for agglutinins.

DISCUSSION

The microorganisms of the genus *Pasteurella* have been reclassified recently to conform with the new knowledge of their biochemical and cultural characteristics (19, 24). As a result, *P.*

TABLE 1. Biochemical characteristics of *Pasteurella* species^a

Organism	Characteristic ^b						
	Beta-hemolysis	Growth on MacConkey agar	Production of H ₂ S	Indole	Ornithine decarboxylase	Urease	Mannitol
From patient O.F.	—	—	—	—	—	+	+
<i>P. ureae</i>	—	—	—	—	—	+	+
<i>P. pneumotropica</i>	—	—	+	+	d	+	—
<i>P. haemolytica</i>	+	+	d	—	d	—	+
<i>P. multocida</i>	—	—	+	+	+	—	+

^a All species were positive for catalase and nitrate; all failed to alkalize Simmons citrate agar; and none required X and V growth factors.

^b Symbols: +, 90% or more strains positive; —, 10% or less strains positive; d, 89 to 11% strains positive.

pestis, the plague bacillus, has been included in the genus *Yersinia* along with the former *Pasteurella pseudotuberculosis* and *Yersinia enterocolitica*, both of which cause yersiniosis, a syndrome of diarrhea, abdominal pain, fever, and often arthritis (14). In addition, the organism causing tularemia, *P. tularensis*, is now classified in the separate genus *Francisella* (19).

The species of microorganisms remaining in the genus *Pasteurella* are not well known. *P. multocida*, commonly isolated from a variety of wild and domestic animals, is a well-documented opportunistic pathogen of man (7, 11). Infections in man generally present in one of three ways: local soft-tissue infection, usually following an animal bite or scratch; chronic respiratory infections, including bronchiectasis and pneumonia; and systemic infection with meningitis or bacteremia. However, a number of other types of infections caused by this organism have been reported as well, including pyogenic arthritis (1), brain abscess (20), pyelonephritis, endocarditis (21), and peritonitis (2).

The three other *Pasteurella* species have rarely been isolated in humans. Recently, four cases of infection due to *P. pneumotropica* have been reported, including a case of meningitis (3), and three cases of local infection following animal bites (15, 16). In addition, the case of endocarditis reported by Gump and Holden (6) was probably due to this organism as well. A single case of endocarditis due to *P. haemolytica* has been reported (4).

P. ureae was initially isolated from the human respiratory tract in 1960 by Hendriksen and Jysum, who felt it was a variant of *P. hemolytica* (9, 10). Jones (12) found it in the sputum in large numbers and sometimes as the predominant organism in 17 patients with chronic bronchitis and bronchiectasis. On the basis of distinct cultural and serological characteristics, he felt it should be classified as a sepa-

rate species (12, 22). Other authors have reported isolation of *P. ureae* in sputum from patients with a variety of chronic respiratory disease, including bronchitis, tuberculosis, and carcinoma of the lung (13, 17). Because the organism was isolated with other respiratory pathogens such as *Streptococcus pneumoniae* and *Haemophilus influenzae*, its role in causing disease was questioned. However, *P. ureae* has been isolated in pure culture from a patient with sinusitis (13), from the cerebrospinal fluid in a patient with meningitis (18), and from the blood of a child with septicemia (23), thereby establishing its pathogenicity for man.

We feel that *P. ureae* caused our patient's pneumonia since it was isolated in essentially pure growth from two consecutive sputum samples. Although the organism was not cultured from the patient's blood, these conditions meet the criteria for diagnosis used by Tillotson and Lerner in their study of pneumonias caused by gram-negative bacilli (22). Furthermore, agglutinins, albeit in low titer, were demonstrated in the patient's serum. Although sputum cultures were not obtained before the development of pneumonia, it appears most likely that our patient had an endogenous infection in view of his chronic bronchitis and the finding by several authors of *P. ureae* in sputum from patients with chronic respiratory disease (13, 17, 18).

P. ureae, like other species of this genus, is a small, nonmotile, bipolar-staining, gram-negative rod that grows well on media containing blood. If care is not taken, the small nonhemolytic colony can be confused with other more commonly isolated bacteria including enterococci, *Neisseria*, and *Acinetobacter* (*Mima*). On rabbit blood agar it closely resembles *H. influenzae*. The first three organisms can be differentiated by careful Gram staining, catalase reaction (enterococci), and growth on MacConkey

agar (*Acinetobacter*). *H. influenzae* will not grow on sheep blood agar and requires both X and V growth factors. *P. ureae* can be differentiated from the other *Pasteurella* species on the basis of its ability to rapidly hydrolyze urea and its failure to produce indole. Additional confirmatory reactions are listed in Table 1. The sensitivity of the organism to a wide variety of antibiotics including penicillin was confirmed in our case (5, 17). In contrast to the other species of *Pasteurella*, *P. ureae* has not been isolated from animals, nor had our patient had known exposure to animals.

Since *P. ureae* appears to have a predilection for patients with chronic respiratory disease, awareness of the organism may lead to more frequent identification in clinical specimens.

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