J. clin. Path., 1975, **28**, 741-743

Meningitis caused by *Pseudomonas maltophilia*

SHARON PATRICK, J. M. HINDMARCH, R. V. HAGUE, AND D. M. HARRIS

From the Departments of Bacteriology and Medicine, Royal Hospital and Royal Infirmary, Sheffield

SYNOPSIS A case of meningitis caused by *Pseudomonas maltophilia* is described, which was unusual in that it appeared to lack the predisposing factors commonly associated with this organism. Attention is drawn to the difficulties which may be encountered in the identification of *Ps. maltophilia*.

Since the first description of the species by Hugh and Ryschenkow (1961) infections caused by *Pseudomonas maltophilia* have frequently been reported from the United States. However, the organism does not appear to be a common cause of infection in Britain; in particular, we have been unable to find any record of meningitis occurring in this country. This paper describes such a case, which was also unusual in some other respects.

Case Report

A 70-year-old retired miner was admitted to hospital on 23 November 1973 with a 12-hour history of severe headache and increasing drowsiness. His relatives stated that he had had symptoms suggestive of influenza for several days, but no cough.

For many years he had been breathless on exertion as a result of emphysema and he had had an exacerbation of cough and sputum three months previously which had been successfully treated with a short course of co-trimoxazole. Four years before admission he had had a subtotal thyroidectomy for thyrotoxicosis.

On examination he was semiconscious and disorientated with a temperature of 38·2°C. There was marked neck stiffness, and Kernig's sign was positive. The fundi were normal. The chest was emphysematous but there was no clinical evidence of pulmonary infection, and the only other abnormal physical sign was an enlarged prostate.

Preliminary investigations revealed a peripheral blood leucocyte count of 13 000 per mm^3, 90% of the cells being neutrophil polymorphonuclears; the ESR was 18 mm in 1 hour. The urine was sterile, and a chest radiograph revealed emphysema and changes consistent with industrial exposure to dust. The cerebrospinal fluid was faintly turbid; it contained 30 RBC and 92 WBC per mm^3 (95% of the WBC being polymorphs), 200 mg protein per 100 ml, and 70 mg glucose per 100 ml. A Gram-stained film of the CSF deposit showed many Gram-negative rods, some of which were intracellular.

On the basis of these findings immediate therapy with intravenous fluids and intramuscular sulphadimidine and chloramphenicol was instituted; both drugs were given in a dosage of 4 g per day for 12 days. The patient responded dramatically and within 24 hours was fully conscious and well orientated. His progress was complicated by an episode of acute retention of urine, and a urinary infection with *Klebsiella aerogenes* following catheterization. After a course of gentamicin and cephaloridine he underwent retropubic prostatectomy three weeks after admission and subsequently made an uninterrupted recovery. He was well when last seen six months after admission.

BACTERIOLOGY

After overnight incubation aerobically at 37°C, cultures on blood agar and MacConkey agar yielded a moderately heavy growth of a motile Gram-negative rod. The appearance of the colonies on blood agar at this time was unremarkable, but on further incubation they became rather granular and greyish-violet in colour, with a surrounding area of greenish-brown discolouration in the medium. No evidence of lactose fermentation was seen on MacConkey's medium. Growth was slow at room temperature and absent at 4°C.

The organism gave positive results in the following tests: catalase, gelatin liquefaction and lysine decarboxylase. Negative results were obtained for citrate utilization, H_2S, urease and indole production, Voges-Proskauer reaction, ONPG, reduction of nitrate, production of ornithine and tryptophan deaminase and arginine dihydrolase. None of the following sugars was fermented: glucose, mannitol, inositol, sorbitol, rhamnose, sucrose, melibiose, amygdalin, arabinose. The oxidase test (using 1%

Received for publication 10 March 1975

tetramethyl paraphenylenediamine dihydrochloride) was also negative, but a weak oxidative reaction was obtained in the Hugh and Leifson O-F test. An absolute growth requirement for methionine was demonstrated.

Dr L. R. Hill of the National Collection of Type Cultures confirmed these results, demonstrated production of acid from maltose, aesculin hydrolysis and caseinase production, and identified the organism as *Ps. maltophilia*.

Sensitivity to antibiotics was determined by the disc diffusion method on Wellcome nutrient agar inoculated with a suspension of organisms adjusted to give rise to near confluent growth. The Oxford staphylococcus was used as control organism. The strain of *Ps. maltophilia* was adjudged to be sensitive to discs containing the antibiotics stated in the following amounts: tetracycline (5 μg), chloramphenicol (10 μg), polymyxin B (10 μg), and gentamicin (5 μg). It was resistant to ampicillin (200 μg) and streptomycin (10 μg). Sensitivity to sulphamethoxazole and trimethoprim individually, and to co-trimoxazole, was determined on Wellcome sensitivity test agar containing appropriate concentrations of the agents, with a very light bacterial inoculum. The strain was considered to be fully sensitive to co-trimoxazole and to both components when tested individually.

Discussion

The species *Ps. maltophilia* was first defined by Hugh and Ryschenkow, who in 1961 described 28 strains isolated since 1953 from water, human and rabbit faeces, human body fluids, oropharyngeal swabs, and contaminated tissue cultures. Since then, the species has frequently been isolated from clinical material in the United States (Sutter, 1968; Sonnenwirh, 1970; Gardner *et al*, 1970; Pedersen *et al*, 1970; Gilardi, 1969, 1971, 1972). It has chiefly been associated with nosocomial infection, often in debilitated or immunosuppressed patients. As in the case of *Ps. aeruginosa*, the clinical spectrum ranges from trivial colonization of epithelial surfaces to severe infection. For example, Gilardi (1972) found that between 1965 and 1971 *Ps. maltophilia* was the most frequently encountered *Pseudomonas* species in postoperative and traumatic wound infections, as well as in urinary tract infections. However, of the 112 isolates reported, there were only three in which the pathogenicity of the organism seemed undoubted. Although *Ps. maltophilia* was demonstrated in the hospital environment, no specific source or route of infection could be detected.

The more serious recorded manifestations of *Ps. maltophilia* infection include bacteriaemia, septicaemia and pneumonia (Pedersen *et al*, 1970; Sonnenwirth, 1970; Gardner *et al*, 1970), epididymitis and purulent conjunctivitis (Sutter, 1968), wound sepsis (Gilardi, 1972), and acute mastoiditis (Harlowe, 1972). Gardner *et al* found the species to be a major cause of infection in patients subjected to tracheostomy, endotracheal intubation, and assisted ventilation. We have been unable to find any case of meningitis due to this organism in the literature; one of the 28 strains described by Hugh and Ryschenkow was isolated from cerebrospinal fluid but their report does not state whether the isolation was associated with clinical evidence of infection.

Ps. maltophilia is not recognized as a common cause of infection in British hospitals. It may be, as Hugh and Ryschenkow have suggested, that the organism is sometimes misidentified as *Alcaligenes faecalis* or *Bordetella bronchiseptica*. The species is certainly not typical of the genus *Pseudomonas* in that a proportion of strains give negative or equivocal results in the oxidase test, as in the present case. A negative result was produced by 10 of the strains examined by Hugh and Ryschenkow.

The identification of non-fermenting Gram-negative bacilli has recently been facilitated by the work of Snell (1973), who uses 13 biochemical tests selected for their ability to give more positive results with organisms of this group than those used conventionally. It is thus possible to produce a much clearer division into genera and species.

Variation in the antibiotic susceptibility of different strains of *Ps. maltophilia* is common (Gilardi, 1972); however, the species is generally more sensitive to antibacterial drugs than is *Ps. aeruginosa*. Gilardi (1972) records that, of 112 strains, 99% were sensitive to polymyxin B, 86% to chloramphenicol, and 63% to gentamicin. Smaller numbers of strains were susceptible to the tetracyclines, streptomycin, and ampicillin.

The pathogenesis of the meningitis in the present case is difficult to explain. The patient had no recent contact with hospitals and, apart from the co-trimoxazole three months previously, no history of recent antibacterial therapy which might have predisposed to opportunistic infection; the urine examined on admission showed no evidence of infection from which bacteriaemia might have arisen. Since *Ps. maltophilia* is said to be widespread in the environment, it is possible that initial entry into the body was through the gastrointestinal or respiratory tracts. The latter may be the most likely source in view of the patient's pre-existing chronic bronchitis and emphysema; however, there was no clinical evidence of a pulmonary infection, and it

proved impossible to obtain a sample of sputum for examination at the time of the patient's admission. We are indebted to Dr L. R. Hill for the final identification of the organism and to Mr C. Fox who carried out the antibiotic sensitivity tests.

References

Gardner, P., Griffin, W. B., Swartz, M. N., and Kunz, L. J. (1970). Non-fermentative Gram-negative bacilli of nosocomial interest. *Amer. J. Med.*, **48**, 735.

Gilardi, G. L. (1969). *Pseudomonas maltophilia* infections in man. *Amer. J. clin. Path.*, **51**, 58.

Gilardi, G. L. (1971). Characterization of *Pseudomonas* species isolated from clinical specimens. *Appl. Microbiol.*, **21**, 414.

Gilardi, G. L. (1972). Infrequently encountered *Pseudomonas* species causing infection in humans. *Ann. intern. Med.*, **77**, 211.

Harlowe, H. D. (1972). Acute mastoiditis following *Pseudomonas maltophilia* infection: case report. *Laryngoscope*, **82**, 882.

Hugh, R. and Ryschenkow, E. (1961). *Pseudomonas maltophilia*, an *Alcaligenes*-like species. *J. gen. Microbiol.*, **26**, 123.

Pedersen, M. M., Marso, E., and Pickett, M. J. (1970). Nonfermentative bacilli associated with man. Pathogenicity and antibiotic susceptibility. *Amer. J. clin. Path.*, **54**, 178.

Snell, J. J. S. (1973). *The Distribution and Identification of Non-fermenting Bacteria*. Public Health Laboratory Service Monographs No. 4. HMSO, London.

Sonnenwirth, A. C. (1970). Bacteremia with and without meningitis due to *Yersinia enterocolitica*, *Edwardsiella tarda*, *Comomonas terrigena* and *Pseudomonas maltophilia*. *Ann. N. Y. Acad. Sci.*, **174**, 488.

Sutter, V. (1968). Identification of *Pseudomonas* species isolated from the hospital environment and human sources. *Appl. Microbiol.*, **16**, 1532.