

Neonatal meningitis caused by *Flavobacterium meningosepticum* type F

K. C. WATSON, J. G. KROGH, AND D. T. JONES

From Sub-department of Microbiology, University of Natal, Durban, South Africa

SYNOPSIS Two infants, one premature and one full-term, died from meningitis due to *Flav. meningosepticum* type F. Careful bacteriological studies are required to prevent possible confusion with other Gram-negative bacilli which may cause meningitis in this age group.

Neonatal meningitis is caused commonly by members of the family *Enterobacteriaceae*. However, Brody, Moore, and King (1958) recorded two outbreaks in this age group, involving 12 and seven patients respectively, where the causative organism was classified in the genus *Flavobacterium*. A similar organism was isolated from patients with neonatal meningitis in the Congo (Vandepitte, Beeckmans, and Buttiaux, 1958). The species name, *Flavobacterium meningosepticum*, was suggested by King (1959), who described the morphological, cultural, biochemical, and serological aspects in greater detail.

The present paper reports two further examples of this rare form of meningitis and is the first account of its occurrence in southern Africa. One purpose in recording these cases is to stress that the causative organism may be confused with other species.

CASE REPORTS

CASE 1 A 7-day-old African baby girl was admitted to hospital on 26 October 1964 with a history of convulsions of two days' duration. She had been born at term with a birth weight of 5 lb. 12 oz. and satisfactory breast feeding was established for the first five days of life. No further details could be elicited.

Laboratory findings Lumbar puncture was performed and cloudy fluid under increased pressure was obtained. The cell count was 6,500 per c.mm., protein 800 mg.%, chloride 660 mg.%, and sugar 5 mg.%. The globulin level was raised. The fluid was centrifuged and stained films of the deposit revealed large numbers of polymorphonuclear leucocytes with numerous Gram-negative slender bacilli, both intracellular and extracellular.

Progress The patient was almost moribund on admission and died a few hours later. A limited necropsy showed signs of well-marked meningeal reaction.

CASE 2 An 8-day-old African baby girl was born prematurely on 23 September 1964 with a birth weight of

4 lb. 3 oz. Progress was satisfactory for the first seven days when she developed jerky convulsive movements of all limbs and pyrexia of 99.8°F. On admission to hospital she was thought to have neonatal tetany but a lumbar puncture revealed cloudy fluid under increased pressure. The fluid contained 3,600 cells per c.mm., protein 130 mg.%, chlorides 700 mg.%, and sugar 6 mg.%. The globulin level was raised and again the Gram-stained film showed numerous polymorphonuclear leucocytes with large numbers of intracellular and extracellular bacilli. In neither of the two patients was blood sent for culture.

Progress Antibiotic therapy was started with penicillin and a sulphonamide before a sensitivity report. However, there was no response to treatment and the child died 30 hours later. No necropsy was carried out.

BACTERIOLOGICAL FINDINGS

The centrifuged deposits of the cerebrospinal fluids were cultured and the organisms isolated were identified as conforming to the description of *Flav. meningosepticum* as given by King (1959) and as being applicable to the requirements for inclusion in the genus *Flavobacterium* as laid down in the seventh edition of *Bergey's Manual*. Accordingly, the cultures were submitted to the Communicable Disease Centre, Atlanta, Georgia, for confirmation and serological typing.

Morphologically the organisms appeared as long, slender, slightly curved Gram-negative rods, although variant forms, smaller and straighter and occasional filaments, were observed. Growth occurred readily on simple types of culture media. On nutrient agar colonies about 2 to 3 mm. in size were present after 18 hours' growth. These were smooth, glistening, and circular with an entire edge and butyrous consistency. No haemolysis was observed on blood agar plates. Growth was most marked at 37°C. but also occurred at 30°C. and at room temperature but only poorly at

41°C. The organisms were facultative anaerobes. On nutrient agar pale yellow pigment was formed slowly after six to seven days but was more obvious on potato medium and at room temperature rather than at 37°C. The pigment was insoluble in water, and repeated subculture in the laboratory led to a considerable decrease in the amount produced. On McConkey agar growth was noted after 48 hours but the organisms failed to grow on S.S. agar or on desoxycholate-citrate agar. Methyl red and Voges-Proskauer tests were negative and there was no growth in Koser's citrate. Urea was not split and nitrate reduction was negative. Gelatin was liquefied. Catalase production was strongly positive and H₂S production was demonstrated by lead acetate paper but not in the butt of triple sugar iron agar (Difco). Indole reaction was weakly positive. Acid was produced slowly in seven days in peptone water sugars containing glucose, lactose, mannitol, mannose, trehalose, laevulose, and maltose, but not from xylose, sucrose, arabinose, rhamnose, dulcitol, salicin, adonitol, and galactose. Acid production was considerably more rapid (one to two days) when the organisms were grown in the O.F. medium of Hugh and Leifson (1953; and E. King, personal communication). The oxidase test was strongly positive. Peptonization occurred in litmus milk with an alkaline reaction. Both isolates were sensitive to chloramphenicol, neomycin, triacetyloandomycin, and gentamicin sulphate and resistant to benzylpenicillin, methicillin, oxacillin, cloxacillin, ampicillin, streptomycin, tetracycline, colistin, and polymyxin.

Serological typing of the strains at the Communicable Disease Centre Atlanta, Georgia, showed that they were *Flav. meningosepticum*, type F.

DISCUSSION

Organisms of the genus *Flavobacterium* are found normally as saprophytes in water and soil but the mode of transmission to neonates has not been established in most instances. However, Cabrera and Davis (1961) traced the source of their outbreak to a faulty tap in a sink in a nursery for prematures. In this particular outbreak 10 deaths occurred amongst 14 patients (serological type C). Nasal colonization with *Flav. meningosepticum* was observed in a further 30 healthy infants. Seligmann, Komarov, and Reitler (1963) described an outbreak in Israel involving seven infants and cultured the same organism from the throats of eight of 110 healthy infants. The latter group included four isolations from 15 premature infants and four from 95 full-term infants, indicating a higher rate of colonization in the premature group. A further example of the

condition was reported from Ceylon by Sugathadasa and Arseculeratne (1963). The disease would appear to be very rare in adults. King (1959), in an addendum to her paper, described one such example, a 69-year-old woman whose nose had been packed because of epistaxis and who developed meningitis on the fourteenth day.

It seems possible that meningitis due to *Flav. meningosepticum* may occur in neonates more frequently than is realized, since the organisms may be confused with other species in the absence of careful bacteriological studies. Late carbohydrate fermentation may lead to confusion with *Pseudomonas aeruginosa* or with *Bacillus faecalis alkaligenes*. The organisms have also been mistaken for members of the tribe *Mimeae* and for haemophilus species. Differentiation is also required from pigment-producing strains of *Cloaca* and *Hafnia* groups. Two strains of the former have been isolated from neonatal meningitis by Urmenyi and Franklin (1961).

Post-operative bacteraemia due to *Flav. meningosepticum* serological type F has been described in eight patients by Olsen, Frederiksen, and Siboni (1965). In none of these was there evidence of meningeal involvement. In addition, none of these eight strains showed pigmentation at any time.

Pigment production by *Flav. meningosepticum* may be minimal, and, as mentioned, our own strains have almost lost this characteristic on subculture. Indole formation may also be weak and the usual methods of testing may give negative results. King (1959) found Kovac's reagent to be quite unsuitable for this purpose. Positive results were obtained following extraction of 48-hour tryptose broth cultures with xylene and overlaying with Ehrlich's reagent.

Both our patients were born in the same obstetric unit but almost one month apart. No further infections have been reported and attempts to ascertain the probable source of infection have been unfruitful.

We wish to thank Miss Elizabeth King, Communicable Disease Centre, Atlanta, Georgia, for undertaking the confirmation and serological typing of these organisms.

REFERENCES

- Brody, J. A., Moore, H., and King, E. O. (1958). *Amer. J. Dis. Child.*, **96**, 1.
 Cabrera, H. A., and Davis, G. H. (1961). *Ibid.*, **101**, 289.
 Hugh, R., and Leifson, E. (1953). *J. Bact.*, **66**, 24.
 King, E. O. (1959). *Amer. J. clin. Path.*, **31**, 241.
 Olsen, H., Frederiksen, W. C., and Siboni, K. E. (1965). *Lancet*, **1**, 1294.
 Seligmann, R., Komarov, M., and Reitler, R. (1963). *Brit. med. J.*, **2**, 1528.
 Sugathadasa, A. A., and Arseculeratne, S. N. (1963). *Ibid.*, **1**, 37.
 Urmenyi, A. M. C., and Franklin, A. W. (1961). *Lancet*, **1**, 313.
 Vandepitte, J., Beeckmans, C., and Butiaux, R. (1958). *Ann. Soc. belge. Med. trop.*, **38**, 563.