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Fatal meningitis in a calf caused by *Mannheimia varigena*

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Abstract

Mannheimia varigena was identified as the etiologic agent of meningitis in a young Belgian White Blue heifer calf. Species identification of the bacterium was done by phenotyping and molecularly confirmed by tDNA-PCR. Standard bacteriological examination might fail to differentiate species belonging to the genus *Mannheimia*.

Keywords: *Mannheimia varigena*; *Pasteurellaceae*; Meningitis; Cattle; Calf

Since the introduction of the new genus *Mannheimia*, little is known about the relevance of *Mannheimia* (*M.*) organisms other than *Mannheimia haemolytica* in bovine diseases. The present case report describes a fatal case of meningitis in a calf likely due to *Mannheimia varigena*.

A 10-day-old female Belgian White Blue calf (43.5 kg) was delivered for autopsy. The animal was found the previous morning in lateral recumbency. A mild diarrhoea was present. Immediate therapy consisted of intravenous administration of 3 mg dexamethasone (Rapidexon, Eurovet) and 5 mg/kg enrofloxacin (Baytril; Bayer), sustained by intravenous fluid therapy. Despite the intensive treatment, the calf died during the afternoon.

Autopsy revealed anaemic muscles mostly pronounced in the area of the chest and the limbs. The mucosae and serosae of the abomasal stomach and small intestines were hyperaemic and hemorrhagic. In both the carpal and tarsal joints, a suppurative polyarthritis was found. Both on macroscopic and histological examination of the central nervous system, purulent meningitis was recognized. Bacteriological examination of the tarsal joints and the intestinum was negative for pathogenic *Escherichia coli* and *Salmonella* organisms. In the meninges *M. varigena* was recognized as a pure culture. Identification of the bacterial species was done by phenotyping and genotyping as described earlier (Catry et al., 2004). Antimicrobial susceptibility testing (Kirby Bauer diffusion according to NCCLS guidelines) showed no acquired resistance for fluoroquinolones and other commonly used veterinary antibiotics. Supplementary laboratory investigation consisted of a direct identification test for antigens of Rota- and Coronavirus, *E. coli* F5, and *Cryptosporidium parvum* in the faeces (Bio-X Digestive ELISA Kit; Bio-X Diagnostics). All four ELISA tests were negative.

In young calves, meningitis can mostly be attributed to a generalized septicaemia caused by failure of passive transfer or insufficient intake of colostrum. Hence, diarrhoea, septic arthritis, and omphalophlebitis are frequently reported concurrent clinical symptoms. In the present case, a systemic infection was indicated by the pathological findings in distinct anatomical sites. Early clinical symptoms of meningitis, e.g., lethargy and recumbency, are non-specific. Ante-mortem diagnosis is therefore difficult and consists of macroscopic inspection of the cerebrospinal fluid along with determination of the differential leucocyte count and glucose concentration (Smith, 1996; Nazifi et al., 1997).

Several bacteria are recorded as playing a pathogenic role in bovine meningitis. In calves coliforms, *Salmonella* spp., streptococci, *Mycoplasma* spp. and *Pasteurellaceae* have been reported (Smith, 1996). While some

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authors report an association with septicaemia and mastitis, bovine pathogenic *Pasteurellaceae* are mostly associated with respiratory disease. In 1999, the trehalose negative [*Pasteurella*] *haemolytica* complex was transformed into a new genus *Mannheimia* (Angen et al., 1999). Extensive phenotyping is required to differentiate the members of this new genus. Consequently, routine bacteriological investigations do not cope with the delineation of these new species. It is therefore not clear which *Mannheimia* species were involved in previous reports on bovine meningitis in which [*Pasteurella*] *haemolytica* was identified.

Mannheimia varigena has been isolated in bovine pneumonic lungs, mastitis and septicaemia, and in the commensal upper respiratory and intestinal tract of ruminants (Blackall et al., 2002; unpublished results). In this case, *M. varigena* was isolated as a pure culture from purulent meninges, strongly indicating pathogenicity during this fatal course of septicaemia. Inflammation of the meninges occurs most commonly as a complication of a pre-existing disease. Since antigen detection for common intestinal bovine pathogens and bacteriological examination of the tarsal joints and intestines were negative, it is unclear whether other pathogens (e.g., *Mycoplasma* spp.) might have been primarily involved. Leukotoxin (LKT) is an important ruminant-specific virulence factor in *M. haemolytica*, reported to be correlated with the presence of ruminant-specific haemolysis (Fisher et al., 1999). Because *M. varigena* is also haemolytic on ruminant blood (Catry et al., 2004), it is likely that *M. varigena* possesses a similar LKT. Vaccination based on immunization against LKT or other *Mannheimia* related virulence factors may therefore contribute to the prevention of septicaemia in young calves in which (haemolytic) *Mannheimia* spp. are involved.

Considering the fatal course of the disease in this calf, the sustaining and antimicrobial therapy might have come too late. Based on positive results in human medicine, a combination therapy of fluoroquinolones and third generation cephalosporins or aminoglycosides may be more appropriate (Owusu-Ofori and Scheld, 2003).

Finally, because of the high mortality rate of bacterial meningitis, prevention through satisfactory hygiene around parturition and adequate colostrum intake is essential. Vaccination and pathogenesis studies dealing with *M. haemolytica* should also focus on whether cross-resistance against other *Mannheimia* spp. might be expected.

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