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CHLAMYDIA, MYCOPLSMA AND POXVIRUS INFECTION

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(1) Feline Chlamydia psittaci infection ("Feline pneumonitis")

This was the first respiratory pathogen isolated from cats (Baker, 1942) and at that time it was considered to be the cause of "feline pneumonitis". Since the more recent isolation of the feline respiratory viruses however (see earlier), its importance in the feline respiratory disease complex diminished and its significance has been difficult to assess. In the U.S.A. C. psittaci is thought to account for 5 to 10% of all feline respiratory illnesses (Kahn and Hoover, 1976) and recent evidence from other parts of the world suggests that C. psittaci infection in cats may be more important than has generally been thought. Thus approximately 30% of cats from colonies with respiratory disease problems in the U.K. (Wills, 1983) and 12.7% of random source cat sera in Melbourne (Studdert et al., 1981) have serological evidence of infection. In addition, several isolations of the organism from other parts of the world apart from the U.S.A. have now been made (Darougar et al., Shewen et al., 1978; Studdert et al., 1981; Wills et al., 1984; Johnson, 1984).

The Agent

The feline pneumonitis agent is a feline strain of Chlamydia psittaci, a member of the family Chlamydiacea. Chlamydia are unusual organisms in that like viruses they are obligate intracellular parasites, but unlike viruses they contain both DNA and RNA, have a rigid cell wall and divide by binary fission, and are also susceptible to certain antibiotics. Although all members of the genus share group-specific antigens, there are a variety of strains with different tropisms, pathogenicity and host specificity. Thus generally the cat strain, for example, is species specific, although there are isolated reports of the possible involvement of feline strains of C. psittaci in cases of human conjunctivitis. However, the only species from which isolates of C. psittaci appear to have a clearly established zoonotic potential are birds and sheep.

Chlamydia are relatively unstable outside their host. They are inactivated by a number of lipid solvents and detergents, a 1 in 1000 dilution of a quaternary ammonium compound being recommended for hospital use.

Clinical signs

The term "feline pneumonitis" is a misnomer in that the predominant clinical sign is a persistent conjunctivitis. In the acute states, there is blepharospasm, marked serous and mucopurulent discharges, and the conjunctivae are reddened and swollen (Hoover et al., 1978; Wills and Gaskell, 1985). Initially only one eye may be affected but both eyes are usually involved eventually. Mild nasal discharge, sneezing and coughing may also occur. Mild pulmonary lesions may also be detected occasionally at post-mortem examination, but pneumonitis is not usually clinically apparent. In more severe cases, follicular hyperplasia of the conjunctival lymphoid tissue has been reported, and corneal ulceration and keratitis have also been described (El-Sheikh, 1978).

The conjunctivitis may persist for up to 6 weeks or so, but although most animals eventually recover, recurrent episodes may occur.

There is some evidence that C. psittaci may infect the genital tract of cats (Darouger et al., 1977; El Sheikh, 1978), although the clinical and epidemiological significance of this is not known.

Diagnosis

This may be diagnosed on the characteristic clinical signs, specifically a persistent conjunctivitis, and also indirectly by means of responses to certain antibiotics. Diagnosis may be confirmed in untreated cases by direct examination of a conjunctival scraping for the presence of inclusion bodies, or more reliably, by attempted isolation of the organism in cell culture from a vigorous conjunctival swab. (Wills & Gaskell, 1985; Cello, 1971b). Specialist transport media is required and either rapid transit of the sample to the laboratory, or -70°C storage before collection.

A positive serological response (CFT or more reliably IFT) may also be helpful in diagnosis.

Treatment

Although several antibiotics may have some effect on relieving clinical signs of chlamydial infection, tetracyclines are the drugs of choice. There is no evidence that systemic tetracycline therapy is more effective than topical therapy, but in severe cases, both routes of treatment may be indicated. Oxytetracycline is more effective than chlortetracycline, the latter being more unstable and requiring very frequent application (12 times a day). Erythromycin and tylosin may also be used, and should be used in place of systemic tetracyclines in pregnancy or in young kittens. Treatment should continue for at least two weeks after clinical signs have disappeared.

Epidemiology and control

Chlamydial infection is probably mainly transmitted, as with the feline respiratory viruses, by direct or fomite contact with infectious discharges, and possibly also over short distances by aerosol. Thus, measures designed to stop the spread of the feline respiratory viruses (see earlier) should also help to prevent the spread of Chlamydia.

Once endemic, clinical signs may persist in an individual for weeks, and recurrent episodes are common. It has been suggested that some of the episodes may be induced by stress. Thus natural immunity to the disease appears to be relatively inefficient and incomplete, and infection does appear to be perpetuated in a colony situation for some months if not years. The possible role of natural genital infection in the epidemiology of the disease is as yet unclear.

Vaccination against feline C. psittaci infection has been used in the U.S.A. for some years, although there has been some discussion as to the efficacy of such vaccines (Cello, 1971a). However, more recent studies

have demonstrated significant, though not necessarily complete, protection against the disease, and a reduced period of Chlamydia shedding. (Mitzel and Strating, 1977; Kolar and Rude, 1977; Shewen et al, 1980). Protection appears to last for at least a year (Kolar and Rude, 1981). Thus although they have some limitations, vaccines probably can be a useful adjunct to control. Prolonged antibiotic therapy of affected or possible carrier cats may also be helpful..

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(2) Mycoplasmas

The importance of mycoplasmas in feline diseases is difficult to assess, since they are found in a significant proportion of apparently normal cats (Heyward et al., 1969; Blackmore et al., 1971; Tan et al. 1977). The most common feline isolates are M. gatae, M. felis, M. arginini and Acholeplasma laidlawii, and they have mostly been isolated from upper respiratory and urogenital tracts.

There is some evidence that M. felis may be a primary aetiologic agent in the feline respiratory disease complex, particularly in conjunctivitis (Cole et al, 1967; Tan and Markham, 1971; Tan and Miles, 1973; Campbell et al, 1973; Tan, 1974). Abortion has also been reproduced in cats experimentally infected with ureaplasmas (Tan and Miles, 1974). Recently M. gatae has been associated with a case of arthritis and tenosynovitis in cats, and the disease was also successfully reproduced experimentally by intravenous inoculation of specific pathogen free cats (Moise et al; 1983).

Other workers however have been unable to produce any clinical signs with various mycoplasma species (Blackmore and Hill, 1973; Povey, 1974) and this, together with their frequent isolation from clinically normal cats, suggests that mycoplasmas should be considered perhaps as more opportunist pathogens which may cause disease under certain circumstances.

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(3) Feline Orthopoxvirus infection

Feline Orthopoxvirus infection was first detected in 1977 in cheetahs and other big cats in English and Moscow zoos (Marrenikova et al, 1977, Baxby et al, 1982). Further cases in cheetahs (Baxby et al, 1979) and a domestic cat (Thomsett et al, 1978) were seen the following year. No further cases were then detected until 1981, when over a period of five years, over fifty cases in domestic cats have been reported from widely separated geographical areas in the U.K. (Gaskell et al, 1983; Martland et al., 1983; Bennett et al, 1986). There have also been reports of the disease from mainland Europe (Schönbauer et al, 1982; Willemse and Egberink, 1985).

In the majority of cases, the only clinical signs are skin lesions, although respiratory or other systemic signs may be seen occasionally (Bennett et al., 1986). Approximately half of the cats have a history of a single primary lesion, usually on the head, neck, or forelimb, which in virtually all cases is followed by the development of multiple widespread secondary lesions over a period of several weeks. Primary lesions vary from small ($1cm^2$) plaque-like, ulcerated or granulomatous lesions, to the occasional case of extensive cellulitis. Secondary lesions start as small firm nodules, progressing to discrete, circular, ulcerated or scabbed lesions, 0.5 to 2.0 cm in diameter: red, hairless, moist lesions may also be seen. In some cases pruritis may occur. The lesions generally resolve over a period of about four to five weeks, and mortality is low.

Diagnosis may be confirmed by laboratory examination of a fresh portion of separated scab or biopsy material sent in a sterile dry container and examined for the presence of virus by electron microscopy or in tissue culture (Bennett et al, 1985). In some cases, fixed biopsy material in formol saline may also yield a positive diagnosis. A serum sample is also helpful in confirmation, especially where the animal is convalescent and scab material is no longer available. However the maintenace of antibody titres after clinical recovery could lead to a false positive diagnosis where diagnosis is based on serology alone.

The majority of cases of poxvirus infection recover uneventfully, and no treatment is necessary. In general, secondary bacterial infection is not a problem except as an occasional complication of the primary lesion. Where treatment is indicated, a broad spectrum antibiotic should be used and supportive fluid therapy given if necessary. Although corticosteroids and oral progestagens are commonly used in cases of skin disease in cats, their use in suspect poxvirus infection is probably contraindicated, since there is some evidence that corticosteroid treatment may in some cases lead to more severe disease and virus generalisation (Bennett et al, 1986).

The causative virus of poxvirus infection in the cat is a member of the vaccinia/variola (orthopoxvirus) genus, and indistinguishable so far from cowpox virus (Baxby et al, 1979, Gaskell et al., 1983; Bennett et al, 1985). Little is known of the epidemiology of cowpox, although it is generally accepted that it is not endemic in cattle. Baxby (1977; 1984) has suggested that the natural reservoir of infection might be a small wild mammal, with cattle, humans and possibly cats as indicator hosts. There is

some serological evidence of orthopoxvirus infection in wild mammals in the U.K. to support this hypothesis (Kaplan et al., 1980) and a virus closely related to cowpox, isolated in the U.S.S.R., is believed to have a rodent reservoir (Marrenikova et al, 1977; Marrenikova, 1979).

To a large extent, this theory accords with the disease as seen in the cat. Although cowpox is an increasingly recognised condition of the domestic cat, there is little evidence of cat-to-cat transmission, and no serological evidence to suggest that cowpox virus is endemic in the species (Bennett et al., 1986). Most cats with the disease appear to have access to a small wild mammal reservoir in that they are from a rural or suburban environment and are known to hunt rodents (Bennett et al., 1986). In the majority of cases there is also a primary lesion, often described as a "bite-like" wound on the anterior part of the body, which the cat could have acquired through hunting.

There is also a markedly increased incidence of feline poxvirus infection in the Autumn (September/October/November) of each year, which may reflect increased contact with the reservoir host. Many small mammal populations are at their largest and most active at this time of the year (Walton, 1983, Gibson and Delaney, 1984). Nevertheless the true epidemiology of feline poxvirus infection is still an enigma, and the possibility of greater cat-to-cat-transmission, or the involvement of another reservoir host cannot be ruled out.

Finally, the possible zoonotic implication of feline poxvirus infection should be considered, for although cat to human transmission (or vice versa) is apparently rare (Bennett et al., 1986), a small number of cases have occurred (Willemse and Egberink, 1985; Pether et al., 1986) and cowpox in humans may be relatively severe. Thus precautions should be taken when handling infected cats, especially by young children and those with a pre-existing skin complaint.

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