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BOVINE PARATUBERCULOSIS – EPIDEMIOLOGICAL, CLINICAL AND LABORATORY OBSERVATIONS ON EIGHTY–NINE CASES

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SUMMARY

Some epidemiological, clinical and laboratory features of 89 cases of bovine paratuberculosis have been presented. It was observed that the incidence of the disease was higher in beef than dairy cattle. The latter was a reverse of what commonly used to be the case. Possible explanations for this have been presented. It was further noted that a high proportion (55%) of cases were detectable by examination of faeces for clumps of acid–fast organism morpholologically similar to *Mycobacterium paratuberculosis*. This proportion was far higher than the 25–30% widely documented in veterinary medicine standard texts. Reason for this has been advanced. None of the many routine haematological and blood biochemical tests were found to be of any value in confirming the disease.

INTRODUCTION

Bovine paratuberculosis has been described throughout the world following its initial description and demonstration of acid–fast bacilli in diseased intestines in 1895 by Johne and Frothingham (Chiodini *et al.*, 1984). Despite being recognised as one of the most serious infectious diseases affecting the cattle industry, it has not received intensive investigations to underline its importance (Chiodini *et al.*, 1984).

The objective of this study was to present some of the observations on epidemiological, clinical and certain laboratory features of 89 cases of bovine paratuberculosis.

MATERIALS AND METHODS

Animals

Eighty–nine cases out of 304 adult cattle presenting clinically with diarrhoea which were used as a part of Master of Veterinary Medicine (MVM) study (Shoo 1984) were confirmed as bovine paratuberculosis cases.

Epidemiological, clinical, pathological and laboratory investigations

Clinical examinations, collections of samples in the living animal (blood, faeces and urine) for laboratory investigations, pathological examinations and the procedures used in the different tests were carried out as described by Shoo (1984).

Blood samples were examined for packed cell volume (PVC), haemoglobin concentration, total numbers of red and white cells and differential white cell counts. Concentrations of blood urea, bilirubin, inorganic phosphate, alkaline

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phosphatase, aspartate transaminase (AST), alanine transaminase (ALT), total protein, albumin, globulin, potassium, sodium, chloride, calcium and magnesium were also examined. Urine samples were examined for protein concentration.

Faecal samples were examined for the presence of clumps of acid-fast bacteria which morphologically resembled *Mycobacterium paratuberculosis*.

RESULTS

Epidemiological observations

There was a history of chronic loss of body weight, diarrhoea and lack of detectable clinical response when therapy had been instituted. These cases almost invariably presented as single animal incidents. The ages of 81 cases were known and the mean age was 5.3 ± 2.1 years (range 2-14 years). The other eight animals were old cows. The condition was most common in middle-aged adults, 58 cases (65%) were from 3 to 6 years old. Beef cattle represented 70% of the cases. This was the only disease in 59 animals (66%) while the remaining 30 individuals were found at necropsy to be suffering from at least one other disorder.

Clinical observations

The 59 cases which were affected with the diseases, presented with profuse homogenous diarrhoea. Almost all animals were emaciated, alert, non-pyrexic and with a good appetite. Six cases were considered to be dull, three had a reduced appetite or were anorexic and one was pyrexic (temperature = 40.1°C). The mucous membranes were pale in 14 animals while submandibular oedema was detected in two cases. Poor hair coat with variable degrees of alopecia was also a common finding.

Laboratory observations

Following faecal smear examinations of 76 cases for acid fast bacilli, (55%) were found positive. Of the positive cases, 40 were positive on first examination while the remaining two were positive on either second or third examination.
Haematological results were available in 45 cases with paratuberculosis alone. There was a reduction in the PCV in 18 of 36 cases (50%), a lowered haemoglobin concentration in 18 of 26 cases (69%) and a raised neutrophil/lymphocyte ratio in all 22 cases in which it had been determined.

Blood biochemistry results were available from 43 of the animals with paratuberculosis. The most common abnormalities were a raised AST concentration in 36 cases (84%), a reduced albumin concentration in 27 cases (63%), a low albumin/globulin ratio in 31 cases (72%) and reduced calcium and sodium levels in 24 (56%) cases, respectively.

Of the 34 cases suffering from the disease alone in which urine analysis had been undertaken, 21 (62%) had proteinuria with a wide variation in the protein concentration with a mean of 24.4 ± 25.9 mg/100 ml (range 0 - 90 mg %).

Pathology

In the 59 cases suffering from bovine paratuberculosis alone, all the carcasses were found to be emaciated. The characteristic lesions, which were found in the alimentary tract, were generally confined to the distal part of the small intestines, especially the distal ileum, and in about 50 per cent of the animals, the caecum and the proximal colon were also involved. Only rarely were the lesions confirmed proximally in the jejunum and distally in the rectum. The affected mucosa was thickened and there was usually an increased granularity giving a "cobble-stone" appearance.

Enlargement of the mesenteric lymph glands was also a common feature.

On microscopic examination, there was infiltration of submucosa and lamina propria by macrophages, plasma cells and lymphocytes in all cases and about 50 per cent had giant cells. The picture was similar in the lymph glands. Acid-fast bacilli were demonstrated in the macrophages and giant cells as a constant finding when stained with Ziehl-Nielsen (ZN) method. Mucosal smears had been taken and stained by the Z/N method in 5 cases and clumps of acid-fast bacilli were demonstrated.

DISCUSSION

The wide age range of the affected cattle together with the peak age incidence and lack of obvious breed susceptibility were similar to the findings of Doyle and Spears (1951). However, the higher incidence of disease in beef rather than in dairy cattle was contrary to what had been reported earlier by Withers (1959). Possible explanations for this difference may firstly, be due to the higher proportion of beef cows in the country in which this study was done than was the case 30 years ago, or secondly, the differing numbers of beef and dairy cases might simply reflect the changing population of animals in the areas from which the cases were admitted. Thirdly, because beef calves are allowed to stay for at least six months with their dams, the probability of their becoming infected at the most susceptible age is much higher than is the case with dairy calves which are removed from their mothers and, therefore from infection, usually after two to three days.

The clinical findings in the cases suffering from bovine paratuberculosis alone were similar to those reported by other workers (Julian, 1975; Blood *et al.*, 1983).

Of the laboratory tests undertaken, only faecal smears and necropsy findings appear to be of diagnostic significance. The proportion of cases (55%) in which the faecal smears were positive was much higher than the 25 to 30 per cent reported by Soltys (1951) and by Doyle (1956) but considerably lower than the 80 per cent found by Majok (1977). The comparatively high proportion found by Majok (1977) may have arisen because only ten cases were investigated. Both in this study and in that reported by Majok (1977), the technique of Cunningham and Gilmour (1959) was used; this method has been shown to be considerably more efficient than the "direct smear method" used by Soltys (1951) and by Doyle (1956); this may be the only explanation for their relatively poor results.

Although there was a significant elevation of AST, it is not considered to be useful in the diagnosis of bovine paratuberculosis because this enzyme lacks tissue specificity (Cornellius *et al.*, 1959; Patterson *et al.*, 1965). The other changes (low albumin, calcium, sodium) occurred almost certainly as a direct consequence of the diarrhoea (Shoo, 1984).

The reduction in the PCV and haemoglobin concentration and the raised neutrophil/lymphocyte ratio were also reported by Allen *et al.* (1967) and Merkal *et al.* (1970).

Proteinuria was common in the cases presented by Merkal *et al.* (1970) and they suggested that there could be a positive relationship between the protein concentration and the degree of clinical illness. However, the wide variation in the concentration of urine protein in the animals discussed here would suggest that this type of relationship is very unlikely.

The only confirmatory test for bovine paratuberculosis in the living animal is the finding of clumps of acid fast bacilli

in the faeces and, even when these are not found, a significant proportion of cases (45%) are still confirmed at necropsy. The characteristic pathological lesions found in these cases were identical to those reported by other research workers (Julian, 1975; Blood *et al.*, 1983).

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