AN AVIRULENT STRAIN OF TREPONEMA HYODYSENTERIAE ISOLATED FROM HERDS FREE OF SWINE DYSENTERY

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Spirochaetes resembling Treponema hyodysenteriae were isolated on one occasion from each of 3 herds known to be free of swine dysentery. These herds had a common source of breeding stock. This report describes the characterization of these spirochaetes, studies on their pathogenicity, and the immune response of pigs to them.

Materials and Methods

Characterization. Spirochaetes designated FW10, FW12 and BB310/81 were examined for haemolysis, their reaction in the APIZYM system (Hunter and Wood, 1979) and indole production. Serological tests used for identification were slide agglutination (SA) (Burrows and Lemcke, 1981), disc growth-inhibition (GI) (Lemcke and Burrows, 1979), microtitre agglutination (MA) (Lemcke and Burrows, 1981) and indirect fluorescent antibody (IFA) (Hunter and Saunders, 1977; Lysons and Bew, unpublished).

Pathogenicity tests and immune response. Blood agar cultures of spirochaetes were given orally on at least three occasions to 5-7 week-old conventional pigs. In Experiment 2, the control group was given uninoculated blood agar. Experiment 1 was carried out at 2 different institutes using two different sources of pigs. Pigs were killed at the following intervals after the first oral dose: Experiment 1, 24 to 37 days; Experiment 2, 13 or 14 days (1 or 2 pigs per group). The remaining 3 pigs in each group in Experiment 2 were observed for a further 23 days before oral challenge on two occasions with 2×10^9 colony-forming units of P18A, a virulent strain of T. hyodysenteriae. Serum antibody titres were determined by an enzyme-linked immunosorbent assay (ELISA) using supernates from sonicated cells of P18A or FW10 as antigens.

Results

On sheep blood agar, FW10, FW12 and BB310/81 were slightly less haemolytic than P18A and other virulent strains of T. hyodysenteriae, though considerably more haemolytic than non-pathogenic spirochaetes such as T. innocens strain B256. FW10 and FW12 were indole-positive and gave the same APIZYM reactions as T. hyodysenteriae. BB310/81 was not subjected to these tests.

In SA and GI tests, the reactions of the three strains were indistinguishable from those of reference strains of T. hyodysenteriae. Only FW10 and FW12 were subjected to IFA tests; both reacted with T. hyodysenteriae antiserum absorbed with various combinations of non-pathogenic spirochaetes. Fluorescence occurred at dilutions which gave positive reactions with T. hyodysenteriae and negative reactions with non-pathogenic spirochaetes. In MA tests, FW10 reacted to high titre with antisera against 8 strains of T. hyodysenteriae. Strains FW10, FW12 and BB310/81 were thus indistinguishable from T. hyodysenteriae. However, agglutinin cross-absorption tests using hyperimmune sera against FW10 and P18A absorbed with P18A or FW10 showed that FW10 is not antigenically identical with P18A. Using these absorbed sera in SA tests, all three strains could be distinguished from P18A.

None of the 18 pigs dosed orally with FW10 or FW12 showed signs of diarrhoea or dysentery (Table 1). Furthermore, there was no significant difference in growth rates in the 3 groups of pigs in Experiment 2. The spirochaetes were isolated infrequently from faeces, but more often from mucosal scrapings, i.e. from 7 of the 11 pigs examined. In Experiment 1, the response was the same in both groups despite differences in location, origin and husbandry. The serum antibody titres of pigs in Experiment 2 to P18A and FW10 rose slightly with age, but there was no difference between pigs in the different groups.

One pig belonging to the group which received FW10 in Experiment 2 developed clinical swine dysentery after challenge with P18A. FW10 was not isolated from 15 samples of rectal faeces taken from this pig before challenge. A second pig in the same group did not develop diarrhoea or dysentery, but had colonic lesions of swine dysentery at post-mortem. FW10 was isolated from this pig on two occasions before challenge with P18A. No clinical signs or colonic lesions developed following challenge of pigs which received FW12 or blood agar. Therefore no conclusions can be drawn from this experiment about protection by avirulent strains of T. hyodysenteriae.

Conclusions

Spirochaetes identified biochemically, serologically and by their pattern of haemolysis as T. hyodysenteriae were isolated from one pig in each of 3 herds. All 3 herds had good records of health with no history of swine dysentery. The spirochaetes produced no clinical disease when given orally to conventional pigs, although they were shown to have colonised the colonic mucosa of some of the pigs.

These organisms appear to be avirulent strains of T. hyodysenteriae and as such could confuse the laboratory diagnosis of swine dysentery. These strains may be useful in the identification of virulence determinants in T. hyodysenteriae.

Selected references: Burrows, M. R. and Lemcke, R. M.: Vet. Rec. 1981, 108, 187; Hunter, D. and Saunders, C. N.: Vet. Rec. 1977, 101, 303; Hunter, D. and Wood, T.: Vet. Rec. 1979, 104, 383; Lemcke, R. M. and Burrows, M. R.: Vet. Rec. 1979, 104, 548; Lemcke, R. M. and Burrows, M. R.: J. Hyg. Camb. 1981, 86. 173.

Table 1. Pathogenicity studies with T. hyodysenteriae strains FW10 and FW12

Experiment	Organisms by oral dosing	Pigs affected / pigs examined			
		Mucoid diarrhoea	T. hyodysenteriae from faeces	T. hyodysenteriae from colonic mucosa	Colonic lesions
1	FW10	0/3	0/3	1/2	0/2
	FW10	0/5	0/5	3/5	0/5
2	FW10	0/5	3/5	1/2+	0/2
	FW12	0/5	3/5	2/2	0/2
	nil	0/4	0/4	0/1	0/1

+Remaining 3 pigs in each group challenged with T. hyodysenteriae P18A.