Editorial

Leptospirosis as an occupational disease

The organism causing leptospirosis is a spirochaete belonging to the genus *Leptospira*. It comprises two distinct species, the pathogenic *L interrogans* and the saprophyte *L biflexa*. Within each species are numerous serologically different serovars arranged into major related groups known as serogroups. *L interrogans* consists of 25 major serogroups including 188 serovars (table 1). *L interrogans* is a parasite of animals and man (who is always an accidental host). Leptospirae are harboured in the kidneys of maintenance hosts and excreted into the surrounding environment through their urine. Animals and man become infected either directly with infected urine or indirectly by contact with contaminated fresh water, muddy soil, and, occasionally, animal feedstuffs on farms.

L biflexa is a non-parasite and is commonly found in fresh water (sea water contains salt which kills all leptospirae). The presence of *biflexa* in water is a good indicator that the environmental conditions support the survival of pathogenic leptospirae.

Virulent leptospirae gain entry to the body through cuts or abrasions of the skin or through mucosal surfaces of the mouth, nose, and conjunctiva. The organism becomes blood borne and leptospiiraemia is detected five to 10 days after exposure, during which period the leptospirae may be recovered from routine laboratory blood cultures. Success depends on the quality of culture systems.¹

Direct microscopy of blood and cerebrospinal fluid may give false positive results because of the proteinaceous filaments of red blood corpuscles mimicking "true-leptospirae."² During the first 14 days the central nervous system may be cultured for the presence of leptospirae: after this period the organisms become established in the tubules of the kidneys and may be detected and grown from the urine. The point to remember is that human urine tends to be acidic and therefore in vivo alkalisation with potassium citrate is essential if cultures are to be successful. The presence of leptospiral antibodies is a useful serodiagnostic measurement, particularly in early detection of IgM by the leptospiral ELISA. Using this method leptospirosis can usually be diagnosed within three to five days after onset of illness, an improvement on previous laboratory tests.

Clinical leptospirosis

Leptospirosis is not synonymous with Weil's disease. Other febrile illnesses are more commonly associated

with leptospiral infections found in the British Isles. The degree of severity may vary from hepatorenal failure and meningitis associated with classic Weil's syndrome to a milder flu-like illness with severe headache found in cattle associated leptospirosis (*L hardjo*). There is considerable overlap in clinical presentation (table 2).

Wild life are the natural reservoir for many pathogenic leptospirae, particularly the rodent family (*Icterohaemorrhagiae*). Domestic and farmyard livestock may also become infected either as maintenance hosts of leptospirae specific for their own host species (dogs and *L Canicola*, for example) or many become accidental hosts to leptospirae from other species (dogs suffer a severe clinical syndrome if infected with *Icterohaemorrhagiae*). Man is always an accidental host and rarely transmits leptospirosis from man to man. There is, however, one report from Faine and his colleagues in Australia where the possibility of human abortion was due to *L hardjo*.³

The predominating serogroups found in Great Britain are *L interrogans* var *Icterohaemorrhagiae* (rodent associated); var *Canicola* (dog), and var *hardjo* (cattle associated leptospirosis). Yearly totals of various serogroups are presented in table 3.

Water associated occupations and pursuits

In the past, occupations associated with water or sewage were at particular risk from leptospirosis, particularly Weil's disease. Figure 1 shows that workers such as miners, sewage workers, and fish workers were commonly found to suffer from *Icterohaemorrhagiae* infections. People in these occupations inevitably worked in rat infested, muddy, damp conditions often polluted with leptospire contaminated urine. The worker sustained fresh cuts and abrasions which were ideal routes of leptospiral infection. Not surprisingly, leptospirosis was quite common in this group. Control measures to eliminate these risks included vigorous rodent control programmes, vigilant use of protective clothing, and scrupulous personal hygiene as well as a general awareness that leptospirosis was an occupational hazard and that early diagnosis of the disease usually prevented a fatal outcome. The success of these control measures may be seen in fig 2. The numbers of *Icterohaemorrhagiae* infections in coal miners, sewer workers, and fish workers fell dramatically between 1978 and 1985; only four such cases were recorded in over 600 cases of leptospirosis reported during this period.

Table 1 *Serogroups of the L interrogans species*

<i>Serogroup</i>	<i>No of serovars within the group</i>	<i>Serogroup</i>	<i>No of serovars within the group</i>
Australis	11	Javanica	11
Autumnalis	13	Kenya	1
Ballum	3	Louisiana	3
Bataviae	9	Manhoa	2
Bufois	1	Mini	6
Butembo	1	Panama	3
Canicola	13	Pomona	5
Celledoni	3	Pyrogenes	14
Cynopteri	4	Ranarum	2
Grippotyphosa	6	Sejroe	20
Hebdomadis	11	Shermani	2
Huanuco	1	Tarassovi	21
Icterohaemorrhagiae	20		

Table 2 *Classic symptoms associated with leptospirosis*

<i>Icterohaemorrhagiae</i>	<i>Canicola</i>	<i>Sejroe (hardjo)</i>
<i>Severe hepatorenal failure</i>	<i>Jaundice</i>	<i>Flu-like illness</i>
<i>Conjunctivitis</i>	<i>Meningitis</i>	<i>Severe headache</i>
<i>Meningitis</i>		<i>Lethargy</i>
Flu-like illness	Conjunctivitis	<i>Myalgia</i>
Myalgia	Myalgia	<i>Jaundice</i>
	Flu-like illness	<i>Renal failure</i>
<i>Death (5–10% of total cases)</i>	<i>Death (<1% of total cases)</i>	<i>Rarely death</i>

Most common symptoms in italics.

Table 3 *Human leptospiral serogroups confirmed between 1980 and 1985*

	1980	1981	1982	1983	1984	1985	Total
Icterohaemorrhagiae	27 (56%)	39 (54%)	23 (37%)	39 (32%)	37 (41%)	29 (27%)	194 (39%)
Hardjo	13 (27%)	18 (25%)	13 (21%)	55 (46%)	32 (36%)	54 (51%)	184 (37%)
Canicola	2 (4%)	4 (6%)	7 (11%)	8 (7%)	6 (7%)	7 (7%)	34 (7%)
Others	6 (13%)	11 (15%)	19 (31%)	18 (15%)	15 (16%)	17 (15%)	86 (17%)
Total	48	72	62	120	90	107	498

The major occupational risk today is among farm-workers. Of the 250 cases of *Icterohaemorrhagiae* infections diagnosed between 1978 and 1985, 70 occurred in the farming industry and deaths have been recorded. Contact with rat urine on food stuffs was a major factor when individual risk factors were analysed. Similar protective clothing as used by the water authorities to protect sewermen cannot be easily applied to current farming practices. Rodent control would certainly help to eliminate the risk of *Icterohaemorrhagic* leptospirosis.

Today the main risk of exposure to Weil's disease is the rapid emergence of the use of fresh water rivers, canals, lakes, and docks to cater for the explosion in water related activities. These include canoeing, windsurfing, and even swimming (fig 2).

During the past decade there have been several

reports from various developing Western countries showing the increasing frequency of leptospirosis due to water associated exposure. This trend has also been noticed in Britain. Figure 2 shows that 80 cases of leptospirosis due to *L. Icterohaemorrhagiae* were linked to water exposure and of these most were canoeists. The main danger of this sport is the practice of doing "eskimo" rolls to simulate capsizing. Because inexperienced participants need to be able to deal with a capsized canoe they are usually trained in this drill in slow moving canals and rivers—ideal conditions for leptospirosis in waters polluted with rat urine. A much safer venue would be the local swimming pool where total immersion in water does not present any infectious hazard.

Leptospiral infections due to the serogroup *Canicola* are usually isolated incidents and present little

Fig 1 Human leptospirosis (*Icterohaemorrhagiae*) Britain 1933–48.

Fig 2 Human leptospirosis: Britain 1978–85.

risk as an occupational industrial disease in Britain. This low incidence probably results from immunisation given to dogs.

Cattle associated leptospirosis

The new emerging hazard is undoubtedly those infections associated with cattle leptospirosis; cattle associated leptospirosis (CAL). In the cow *L interrogans* var *hardjo* is a common bacterial pathogen. It causes mastitis, abortion, and premature calving not only in the United Kingdom, but also in America,⁴ New Zealand,⁵ Australia,⁶ and Israel.⁷ In New Zealand 90% of all cattle are infected. In Britain the condition is commonly known as milk drop syndrome and Ministry of Agriculture figures show that between 30% and 50% of all cattle herds in England and Wales are infected.⁸ It is therefore not surprising that man comes in contact with the disease. Figures in Britain (fig 3) illustrate that the major occupation at risk for CAL is the dairyworker. When cows are milked the animal may urinate, thus creating a mist of aerosol droplets containing leptospires. The cowman is normally situated in a "herring bone" parlour and is placed at eye level to the cow's udder. He is therefore in the direct "firing line" of excreted urine. The cows, like other maintenance hosts, carry leptospires in their kidneys and excrete them in their urine. The leptospires enter either through the mucosal surfaces of the eye, nose, and throat, or through direct contamination of cuts with leptospires in the urine.

Human *hardjo* infections usually present as a flu-like illness with fever and severe headache and often with mental confusion (table 2). In untreated

Fig 3 Distribution of *L hardjo* infections in various occupational groups.

Table 4 Occupations at risk from *L hardjo* infections between 1983 and 1985

Occupations	No			Total
	1983	1984	1985	
Farming:				
Arable	0	0	0	0
Dairy	42	18	42	102
Beef	1	3	2	6
Sheep	1	2	0	3
Others:				
Veterinarian	2	1	2	5
Meat inspectors	1	1	0	2
Butchers	1	1	2	4
Abattoir workers	0	1	1	2
Artificial inseminator	0	0	1	1
Miscellaneous	7	5	4	16
Total	55	32	54	141

Table 5 A retrospective study of leptospirosis in dairymen

Farming area	No of people tested	No with positive serological evidence
Beef cattle farming (1983-4)	400	15 (3.7%)
Arable farming (1984-5)	125	2 (1.6%)
Dairy farming (1984-5)	184	21 (11.5%)
Total	709	38 (5%)
Urban population	500	0 (0%)

Fig 4 Seasonal variation of leptospirosis.

patients full recovery may take several months and lethargy is the most common symptom during the convalescent period. In a few cases the infection progresses to lymphocytic meningitis, occasionally hepatorenal failure, and, sometimes, though rarely, death⁹ (table 2). Laboratory studies have indicated that there are two different strains of *L hardjo*: one which is associated with the "milder" flu-like syndrome and a second strain which causes the more severe meningitis disease and is found in abortion of cows.¹⁰ Amoxycillin is the antibiotic of choice for *hardjo* infections and may be given even after symptoms have appeared (500 mg three times a day for five days).

Although farmers in the dairy industry are the most like occupational group to suffer from *L hardjo* infections, other workers such as abattoir workers, veterinary surgeons, and butchers who do their own slaughtering are also at risk. Table 4 shows that there are few cases of *hardjo* infection each year from this group of workers.

Seasonal variation of leptospirosis in Britain is illustrated in fig 4. Infections due to *Ictero-haemorrhagiae* reflect the summer time occupations of swimming, canoeing, and water sports in general. The slight increase in the winter months is due to *Ictero-*

haemorrhagiae infections found in farm workers where rats and other rodents have found shelter for the winter months in barns and food stores. Farm workers need to be particularly vigilant during the autumn and winter for rat contaminated animal food stuffs. *Hardjo* infections are usually found most often in the autumn months when the cattle are brought in to cattle sheds for overwintering. Stress caused by being confined in barns causes the cows to shed leptospires in great numbers in their urine and thus man is more often infected in the autumn. With the wide spread of *Leptospira* var *hardjo*, however, the incidence of CAL is increasingly found throughout the year.

An indication of the seriousness of *hardjo* infections in animal associated occupations may be seen in table 5. In a recent survey we showed that 11% of all sera tested retrospectively for *hardjo* antibodies in the live microscopic agglutination test were positive for this serogroup. When further investigations were made on the patients tested, they recalled clinical syndrome similar to the flu-like illness in the previous 12 to 18 months. This indicates massive underdiagnosis of this condition in dairy workers. Although not a serious disease it can be debilitating but is easily treated.

Conclusion

Leptospirosis is not a new disease in Britain but the epidemiological spread of the disease has changed. No longer are traditional occupations such as miners, sewer workers, and fish factory workers at risk but

today's emerging hazard is the farmer and the serogroup *hardjo* infection.

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