Leptospirosis in European livestock*

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Summary: Leptospirosis occurs, at least in its inapparent form, in the majority of European countries. Clinical incidence is generally low. However, the disease has created problems in pigs in Central Europe and in cattle infected by serovar hardjo in some areas of the United Kingdom and Italy.

Hardjo infection in cattle is mainly demonstrated by a precipitous drop in milk yield and in some animals by abortions and infertility.

Laboratory diagnosis is the only means of confirming clinical suspicions and of screening the many cases of inapparent infection. Immunofluorescence is the most valid method for demonstrating leptospires in the kidney in acute cases. The isolation of the most fastidious serovars such as hardjo, necessitates the Tween 80-bovine albumen medium (EMJH) of Ellinghausen and McCullough as modified by Johnson and Harris, supplemented with rabbit serum; growth of cultures may take up to 16 weeks. In serological diagnosis the microscopic agglutination (MA) test with a live antigen is most common; it enables satisfactory screening of acute infections but is of limited value in the diagnosis of chronic cases, such as abortions and renal carriers in cattle infected by hardjo. If a reliable and simple method for diagnosing renal carriers cannot be developed, the use of antibiotics should be considered to cure the animals.

The role of cattle as carriers of hardjo infection has been accepted and modes of transmission have been established.

Dihydrostreptomycin is considered to be the most effective drug. The vaccine should give satisfactory results when administered in good conditions and it is possibly the only practical method for the control of hardjo infection in cattle.

Eight papers including a total of ninety-six different references were presented for Item II of the Xth Conference of the O.I.E. Regional Commission

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for Europe. These papers and other information have been used to draft this review.

Papers received are identified by their O.I.E. reference number.

BACKGROUND AND SIGNIFICANCE

Leptospirosis was reported in livestock between 1935-1960 in various European countries, namely: Netherlands, France, Switzerland, Italy, U.S.S.R., Bulgaria, Hungary... At the very least, the disease is recognised in most parts of the continent in its inapparent form as proved by serology (Schonberg, 1981) but clinical incidence remains low in general (F.A.O./W.H.O./O.I.E., 1980).

However, leptospirosis in cattle has posed an economic and even hygienic problem due to the risks the disease implies for public health in some countries. This has been the case in Hungary (1), Bulgaria (2) and Italy (8) with pigs mainly infected by serovars (serotypes) pomona and tarassovi. Nonetheless, papers from these countries do confirm an improvement in recent years. This has also been the case in some areas of the United Kingdom (5) with cattle infected by serovar hardjo and in Italy (8) with serovars hardjo and pomona. An outbreak in cattle was also reported in Spain (3) with positive serological reactions toicterohaemorrhagiae and pomona.

Leptospiral infections of not only pigs and cattle but also of horses and sheep have been serologically identified in recent years (1, 2, 6, 7, 8; Prokopcakova et al., 1981). Infection of buffaloes has also been reported (8; Khalaicheva and Sherkov, 1981).

CLINICAL FINDINGS

Although inapparent forms of leptospirosis are more common, clinical symptoms may also be demonstrated.

In pigs infected by L. pomona or tarassovi, reproduction disorders are most common: abortions generally occurring late in pregnancy, still-births, farrowing of weak piglets (1, 7, 8). Jaundice was also reported in infection caused by a strain belonging to serogroup icterohaemorrhagiae (Hathaway and Little, 1981).

A detailed survey was conducted in the United Kingdom on hardjo infection in cattle (5). This serovar has a dramatic effect when it enters a herd for the first time with clinical signs mainly accompanied by a precipitous drop in milk yield and in some animals, abortions and infertility. The udder was flaccid and the milk of affected animals was thickened almost like colostrum; hyperthermia was moderate. Cows recovered rapidly and the milk yield returned to normal over a two-week period. Abortions were often limited to
heifers which were reared away from the herd and most abortions occurred in the last third of pregnancy, with a peak incidence between October and January.

LABORATORY DIAGNOSIS

Clinical symptoms may help in suspecting leptospiral infection but only laboratory diagnosis can confirm this and above all, it is the only means of screening the many cases of inapparent infection. One important paper dealt with tests used (4).

Bacteriological diagnosis.

Microscopical examination can be used to demonstrate leptospires in sections and smears of internal organs (kidney in particular) from adult animals and aborted foetuses in acute cases. Direct immunofluorescence (Ellis et al., 1982a) is the most useful method but silver impregnation methods may also be used. Conversely, the dark-ground microscopy method to detect leptospires in blood and urine has proved worthless (4).

For cultures, material collected from live animals, vary depending on the phase of disease: during the first 10-15 days, samples of blood and milk should be collected before contemplating antibiotic treatment, and preferably during a febrile period; thereafter, urine samples should be taken. In dead animals, the ideal sample is taken from fresh renal tissues. In aborted foetuses the kidney as well as the eye can be used (Ellis et al., 1982a).

Traditional media, such as Stuart’s and Fletcher’s media, are suitable to isolate strains of the less fastidious serovars icterohaemorrhagiae and pomona but are totally inadequate for the isolation of the more fastidious leptospires such as serovar hardjo strains. The Tween 80-bovine albumen medium (EMJH) of Ellinghausen and McCullough as modified by Johnson and Harris supplemented by low levels of rabbit serum (1-2%) is the best medium available for fastidious strains. The presence of inhibitory substances in host tissues has made recovery from low dilutions of tissue difficult and for recovery to occur a dilution of at least 1,000 to 5,000 fold in culture medium is needed. Long delays can occur between inoculation of media and detectable growth of leptospires; cultures should be kept for 16 weeks at 30°C at least and examined at two-week intervals.

Serological diagnosis.

Among the many serological tests proposed for leptospirosis, the microscopic agglutination (MA) test with a live antigen or agglutination-lysis is definitely the more common method used; furthermore, it is the reference method (1, 4, 7, 8; Schonberg, 1981). The other tests are the macroscopic (plate) agglutination (3, 4; Trap and Gaumont, 1980) and the complement
fixation (CF) tests (4); ELISA has also undergone recent study (Adler et al., 1981; Volina et al., 1981).

The advantages and disadvantages of the MA and CF tests, as well as their capacities and restrictions were discussed (4). The MA test shows specificity and sensitivity which makes it the reference test for serological studies; however, it is time-consuming and live antigens are difficult to standardise. Provided an adequate antigen is used, the CF test is useful for initial screening but it is less sensitive than the MA test. After infection, amboceptors disappear more rapidly than agglutinins both in pigs (Hodges, 1973) and in calves (Hodges and Ris, 1974).

Both MA and CF tests can be used in providing satisfactory diagnosis of acute leptospirosis by demonstrating a rise in antibody titre in paired acute and convalescent sera. However, these tests have a limited value for diagnosing chronic cases, as in abortions and renal carriers of hardjo infection in cattle.

In regard to abortions, the interval between the acute phase and abortion varies with the animal species and the leptospiral strain involved. In hardjo infections, from 6-12 weeks can pass between the first clinical signs (mastitis or agalactia) and abortion (Hoare and Claxton, 1972). It is often found that the antibody titre declined considerably at abortion: the titre is less than 1:10 in 23% of cows (Ellis et al., 1982b). However, a similar study showed that when an aborted foetus was not available, the dam's serum could be used for detecting antibodies since 81% of aborting cows which had antibody titres of 1:1000 or greater had infected foetuses. Furthermore, there is no value in examining paired serum samples since there is no rise in antibody titre following abortion.

The testing of aborted foetal sera can be useful for diagnosis since a proportion of leptospire infected foetuses will have detectable levels of circulating antibody (Ellis et al., 1982a).

A previous study of renal carriers (Ellis et al., 1981) showed that almost half of the animals had antibody titres of less than 1:100 and almost 20% titres of less than 1:10 to serovar hardjo. Many countries indicated that cattle showing antibody titres of 1:100 or more were considered to be potential renal carriers and those presenting titres of less than 1:100 were not considered as carriers. However, this study in fact shows that this criterion does not enable distinction between carrier and non-carrier animals. Presently, the only reliable serological method of eliminating carriers would be to pass only seronegative animals from seronegative herds of origin (4).

There is clearly a need for a more simple and reliable method of identifying renal carriers and if this is impossible, the elimination of infection using antibiotic treatment in affected animals should be considered.
EPIDEMIOLOGY

The common reservoirs have been identified for some serovars: rodents for *icterohaemorrhagiae* and *grippotyphosa*; hedgehogs for *australis*, dogs for *canicola*; and pigs for *pomona* and *tarassovi*. Since a number of years, it is recognised that cattle also serve as reservoirs of *hardjo* (Ellis *et al.*, 1981): transmission from cow to cow may occur through direct contact with infected urine or indirectly by contact with contaminated water or mud. The proportion of other domestic animals with antibodies to *hardjo* is low, for horses (Hathaway *et al.*, 1981), pigs (Hathaway and Little, 1981) and sheep (Hathaway *et al.*, 1982): these species appear to be accidental hosts rather than reservoirs of infection.

Most abortions caused by *hardjo* occur between October and January and among factors which may promote infection is the winter housing of cattle (5). Infection does not occur from January to September although carriers continue to shed leptospires in their urine during this period. If heifers fail to acquire natural immunity following *hardjo* infection before their breeding age, they may be infected when pregnant and then show the acute clinical syndrome. This occurs commonly with young replacement stock in dairy herds in Great Britain (5).

TREATMENT

Treatment with antibiotics eliminated into the urine appears to be the only means of curing carriers.

Good results were obtained in cattle by administering tetracycline or one of its derivatives at 10-20 mg/kg either intramuscularly or intravenously for 3-5 days (3).

However, the most effective drug is generally considered to be dihydro-streptomycin (DSM) (Stalheim, 1976). Treatment should cover the entire herd and surroundings should be carefully disinfected to prevent reinfection of recovered animals.

CONTROL

Control was discussed in depth in many papers (1, 2, 5, 6).

Measures against reservoirs of infection and the contaminated environment were mentioned but will not be repeated in this report as they are widely known.

For the past ten years, special emphasis has been placed on control of leptospirosis in pigs and cattle by using DSM to eliminate infection in carriers, as indicated above. Immunising animals at risk is another control method
performed either by putting them in contact with infected animals (Blackmore et al., 1981) or by vaccination (Hanson et al., 1972).

The immunisation to hardjo of young stock before they reach breeding age by exposure to infected cattle comes up against disease transmission irregularities. Furthermore, cattle may continue to shed hardjo in their urine for up to 20 months following infection, thus representing a risk for other cattle and man (5).

Vaccination is based on the use of inactivated vaccines prepared from pomona and possibly other serovars such as tarassovi, icterohaemorrhagiae and canicola for pigs, and from hardjo for cattle. Recommendations require two initial injections at one-month intervals and annual or bi-annual booster injections thereafter. Some of these vaccines are of undeniable value, avoiding in particular reproduction disorders in sows; reducing the number of susceptible pigs and carriers (Hanson et al., 1972). Vaccination trials against hardjo also proved satisfactory in cattle (5).

**REFERENCES**

a) **Papers received for Item II of the Xth Conference of the O.I.E. Regional Commission for Europe**:
1. GÖNYE M. and HALMOS G. — Leptospirosis of animals in Hungary (Occurrence, diagnosis and control).
2. SHERKOV S. and HALATCHEVA M. — Leptospirosis in farm animals in Bulgaria.
4. ELLIS W.A. — An evaluation of the tests used to diagnose leptospirosis in domestic animals.
6. MALAKHOV I.A. — Leptospirosis in domestic animals: Epizootiology and control measures.
7. TRAP D. and GAUMONT R. — A serological survey of leptospiral infection in livestock in France.
8. FARINA R. and ANDREANI E. — Spread and epidemiology of leptospirosis among animals in Italy.

b) **Additional references.**
(see p. 63).