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Salmonella montevideo infection in sheep and cattle in Scotland, 1970–81

By J. C. M. SHARP, W. J. REILLY

Communicable Diseases (Scotland) Unit, Ruchill Hospital, Glasgow, G20 9NB

K. A. LINKLATER

Veterinary Investigation Centre, East of Scotland College of Agriculture, Greycrooks, St. Boswells, TD6 0EU

D. M. INGLIS

Veterinary Investigation Laboratory, North of Scotland College of Agriculture, Mill of Craibstone, Bucksburn, Aberdeen, AB2 9TS

W. S. JOHNSTON

Veterinary Investigation Laboratory, North of Scotland College of Agriculture, Newlands of Geise, Janetstown, Thurso, KW14 7XF

AND J. K. MILLER

Veterinary Investigation Centre, East of Scotland College of Agriculture, Bush Estate, Penicuik, EH26 0QE

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SUMMARY

Outbreaks of abortion associated with infection by *Salmonella montevideo* have affected sheep in the east, especially the south-east, of Scotland each year since 1972. Disease in the north and north-east was usually less severe.

Between 1 January 1970 and 31 December 1981, a total of 67 incidents affecting sheep were reported by veterinary laboratories to the Communicable Diseases (Scotland) Unit, 87% of which presented during the main lambing months of February, March and April. Twenty-one episodes of bovine infection were also recorded over the same period, 17 of which involved single animals only, usually an aborted cow or a scouring calf.

Despite intensive investigations, neither the origin nor the mode of spread of *S. montevideo* infection among sheep and cattle in Scotland has been established with any certainty, although there has been considerable evidence indicating the role of scavenging wild birds, particularly seagulls, as vectors transmitting infection to other farms in the same district. Also largely unexplained are the differences in the epidemiology and clinical pattern of disease in the south-east compared to the north and north-east, while sheep in the west of Scotland have remained virtually unaffected throughout.

Table 1. *Isolations of* Salmonella *sp. from sheep, cattle, man and the environment in Scotland, 1970–1981*

	Source			
	Sheep	Cattle	Man	Environment
S. montevideo	232	36	111	31
S. typhimurium	155	4911	8140	300
S. dublin	24	2337	289	16
Other serotypes	143 (23)	1891 (70)	6059 (169)	1161 (51)

Numbers of other serotypes identified given in parentheses.

INTRODUCTION

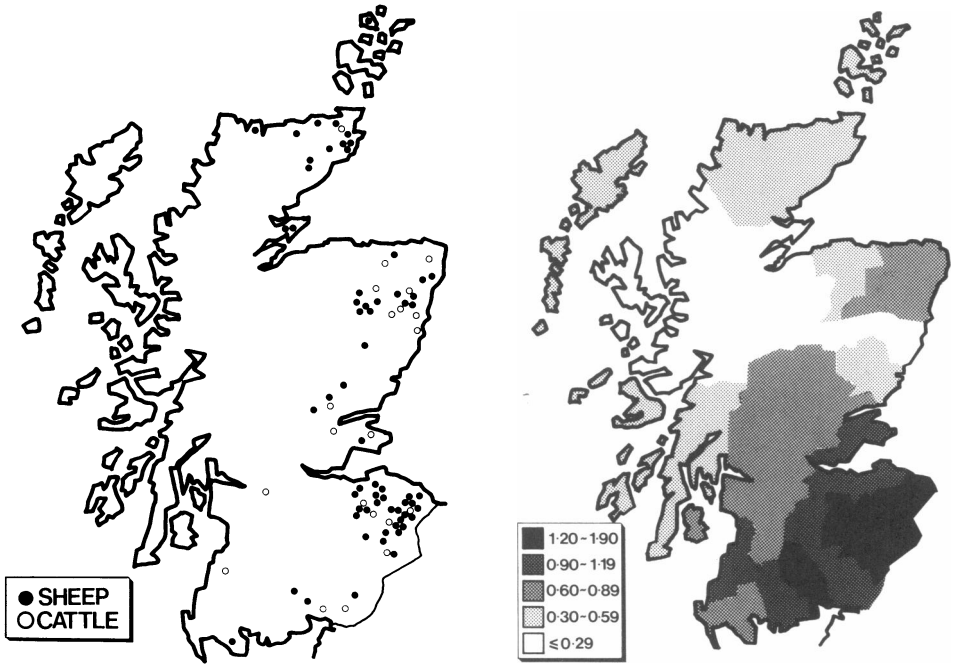
A changing pattern has been seen in the aetiology of human and animal salmonellosis in the United Kingdom since the mid-1960s, particularly so in the increasing importance of serotypes other than *Salmonella typhimurium* and *S. dublin* (Lee, 1974; Sojka *et al.* 1977; Reports, 1970–81). The previously predominant *S. dublin* decreased in importance as a cause of animal infection in Scotland with 105 (9·8%) isolations reported to the Communicable Diseases (Scotland) Unit in 1981 compared with 416 (56·9%) in 1970. The number of veterinary isolations of *S. typhimurium* rose from 266 (34·4%) in 1970 to 667 (62·0%) in 1981, closely paralleled by an increase in the frequency and range of other serotypes. Of these other serotypes *S. montevideo* was the sixth most frequently isolated from cattle, whereas in sheep it was predominant (Table 1). In England and Wales between 1976 and 1981, *S. montevideo* infected cattle in 32 incidents (0·42%) and sheep in 26 (8·07%) (Reports, 1976–81).

S. montevideo has emerged in recent years in Scotland as a sporadic but locally serious cause of abortion and death among ewes and to a lesser extent of enteritis and 'ill-thrift' in lambs, with a total of 67 incidents on 63 farms recorded between 1 January 1970 and 31 December 1981. These were mostly reported from the east side of the country, principally the Borders area in the south-east, but also from Grampian in the north-east and Caithness in the north (Map 1).

EPIDEMIOLOGY

In animals prior to 1970 isolations of *S. montevideo* were reported from an ovine foetus in Lothian in 1963 and from an aborted bovine placenta in Perthshire in 1967. Thereafter there was no further evidence of infection in Scotland until 1970 when single isolations were made from an ovine foetus and a pup in Lothian and from a bovine in Grampian. Although 1971 was apparently free, annually from 1972 onwards (Fig. 1) sheep in the east of the country, particularly in the south-east, experienced at least one outbreak of abortion associated with infection by *S. montevideo*.

Since 1970, a total of 28 farms in the south-east experienced ovine infection, mostly associated with abortion. Seventeen of these farms, including four which experienced a second outbreak between 1 and 5 years later, were located in the Borders. The most extensive outbreak affected 130 of 525 ewes on a Berwickshire



Map 1 Map 2

Map 1. Geographical distribution of *Salmonella montevideo* incidents in Scotland, 1970–81.

Map 2. Breeding ewes per hectare of grazing land (based on Scottish Agriculture Census, June 1981).

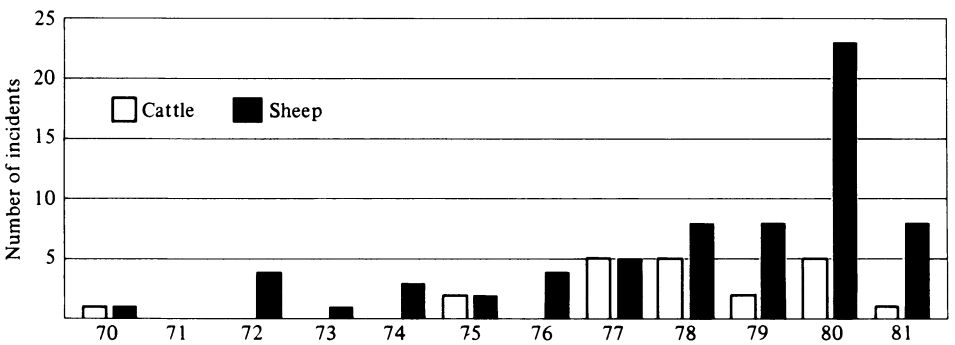


Fig. 1. Annual incidence of *Salmonella montevideo* infection in Scotland, 1970–81.

farm in 1975, although in different incidents the abortion rate varied considerably. Further details relating to abortion associated with *S. montevideo* in this area are being published separately (Linklater, 1983). In eight of the remaining 11 episodes in the south-east, only single animals were affected. Abortion outbreaks also occurred in Tayside (3) and Fife (1) between 1973 and 1981.

In the north of Scotland sporadic infections involving single rams were identified on Caithness farms in 1975 and 1976. Smallscale abortion incidents occurred on

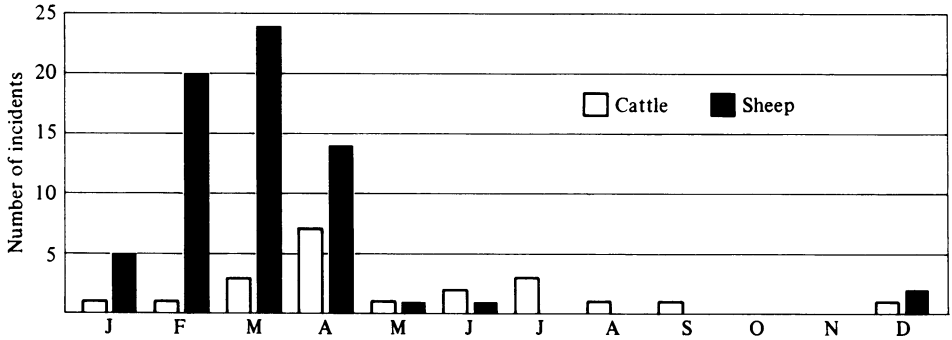


Fig. 2. Seasonal incidence of *Salmonella montevideo* infection by month of onset.

two farms during 1976–7. In the spring of 1978 a single lamb died on premises contiguous to the farm involved in 1975. In the same year abortions were reported on two farms in Easter Ross. 1979 was incident-free but in April 1980 six episodes of abortion and/or lamb deaths occurred in Sutherland (4) and Caithness (2). One other incident was reported concurrently on the island of Rousay, Orkney, where *S. montevideo* was isolated from two lambs although this was thought to be an incidental finding as death was due to the 'starvation/exposure' syndrome. No infections were reported in the north during 1981.

Single episodes in 1977 and 1978 were the first reports from the north-east involving sheep. There was no further evidence of ovine infection until 1980 when 12 incidents of varying severity affected flocks over a wide area of Grampian (11) and adjacent Angus (1) (Communicable Diseases Scotland, 1980). Four of these were associated with abortion and neonatal losses as were single outbreaks of *S. panama* and *S. infantis*, although in this region salmonellas are not usually incriminated as a cause of ovine abortion. The remaining outbreaks involved older lambs and adult sheep, but in these cases the presence of *S. montevideo* appeared to be incidental, with deaths being due to other diseases. During 1981 sheep in the north-east were again apparently free from infection by *S. montevideo*.

In contrast to other areas, the west of Scotland experienced relatively few problems. Sporadic incidents were observed in different districts of the south-west in each of 1972, 1979 and 1981, the first and last of which affected only individual scouring lambs. In the other episode *S. montevideo* was isolated from a foetus on premises in Dumfriesshire where approximately 30 ewes were reported to have aborted, but where there was a previous history of enzootic abortion and listeriosis.

Fifty-eight (87 %) of the 67 sheep incidents presented during the main lambing months of February, March and April (Fig. 2).

Bovine infections were less frequent and considerably less extensive in effect, with 21 farms involved over the 12 year period. With four exceptions, these all occurred in the east of the country (Map 1). Seventeen of the 21 episodes involved single animals only, usually an aborted cow or scouring calf. Following one incident in the north-east in 1970, no further cattle infections were identified until 1975 when two episodes were reported in the west of Scotland. In one of these, *S. montevideo* was isolated from 13 stirks during an outbreak of scouring at a farm in Ayrshire which the previous year had experienced infection by *S. typhimurium*

thought to have originated from a septic tank effluent. From 1977 onwards however an increase was observed in the frequency of bovine incidents in Scotland (Fig. 1), seven of which were located in Grampian during 1977–8. In early 1979 abortions associated with infection by *S. montevideo* occurred on two farms in Berwickshire (4 cows) and Dumfriesshire (1) respectively. Between January and December 1980, five episodes of single abortions or scouring calves were identifed over a wide area between Dumfriesshire in the south and Caithness in the north, followed in May 1981 by the isolation of *S. montevideo* from one animal and *S. infantis* from two others on a farm in Tweeddale.

Other species from which *S. montevideo* was isolated since 1970 included poultry, guinea fowl, seagulls, mink and dogs. In several instances these were identified in the same locality as affected sheep. Human infections were relatively infrequently reported with a total of 111 cases identified over the 12-year period. None of these were related to any of the farm episodes and in many instances were associated with the consumption of poultry or with overseas travel.

From 1973 onwards, *S. montevideo* was isolated most years from various other sources, particularly abattoir drains in Glasgow. Other isolations were made from water-courses during investigations into outbreaks of disease, and also from a stream in Berwickshire unassociated with any known animal infection. Occasional isolations were made on affected farms from home-produced and purchased concentrate feed samples, and also from feeding-troughs and bird faeces.

DISCUSSION

The increase in isolation of *S. montevideo* in Scotland in recent years associated with aborting ewes is of considerable significance, although not yet comparable with the three major causes of ovine abortion, namely enzootic abortion (chlamydia), toxoplasmosis and campylobacter infection.

S. montevideo was introduced into the United Kingdom during the early years of World War II in contaminated spray dried eggs imported from America. consignments of which considered unfit for human consumption were utilized for animal feeds (Report, 1947). Since then this serotype has regularly been isolated in Britain from human foods, particularly imported eggs and meat from several different countries (Report, 1965) and became increasingly associated with episodes of food poisoning in England and Wales (McCoy, 1975). Throughout the 1970s and into the 1980s isolations of the organism have continued to be made from man, poultry meat and egg products, and from various meal ingredients for animal feedstuffs (Personal communication, Communicable Diseases Surveillance Centre, London).

Poultry sources accounted for 476 of the 540 incidents of *S. montevideo* reported in England and Wales under the Zoonoses Order in the 6-years 1976–81. This was not the case in Scotland where there were only seven poultry incidents during the same period (Reports, 1976–81). However in the period under review in four of the 10 incidents in upper Tweeddale the animals affected were in close association with poultry although the organism was not isolated from the birds themselves.

Amongst other animals in England and Wales, *S. montevideo* was periodically identified in bovines, pigs and sheep between 1957 and 1963 (Report, 1965), became

the fourth most frequently isolated serotype from sheep (Sojka *et al.* 1977) and was also reported from horses every year from 1976 to 1979 (Wray, Sojka & Bell, 1981). Meanwhile the serotype became more frequently isolated from sheep and cattle in Scotland.

Eighteen of the 21 bovine incidents in Scotland occurred since 1977, mainly in the east, although they did not always coincide in time and location with infection in sheep. Isolations were reported most frequently during the spring, but also were made during most other months, possibly as a consequence of extended calving patterns. Generally the disease was less severe than in sheep and the fact that in the majority of incidents only a single animal was involved would suggest that *S. montevideo* may have a lower virulence for cattle. One notable exception was the outbreak in Ayrshire in 1975 where scouring stirks were the problem.

In sheep the picture was quite different. Flocks in the south-east experienced each year since 1974 outbreaks of abortion of varying severity, whereas sheep in the north and north-east were generally less seriously affected, did not always abort and asymptomatic excretion was not uncommon. On some farms, *S. montevideo* appeared to be only an incidental finding in other disease conditions. In contrast, the west of Scotland remained remarkably free other than the occasional sporadic incident. These geographic differences may reflect different types of sheep husbandry and breed with less intense hill farming in the west presenting fewer opportunities for disease introduction and dissemination (Map 2).

Despite considerable investigation, neither the origins nor the modes of spread of *S. montevideo* in cattle or sheep in Scotland have been established with any certainty. Among sheep disease appeared to spread rapidly on some farms and on others did not. In some outbreaks infection was confined to single groups in large enterprises, yet in others sheep on neighbouring farms or on different premises under the same management were also affected.

Infection is known to have been present sporadically in sheep in the south-east since 1963, but during the later 1970s may have become established in endemic form in some flocks. Several farms experienced a second outbreak in subsequent years, while there has also been retrospective evidence that some farms had previous episodes of abortion which were not investigated. In the early weeks of 1982 a serious epidemic of *S. montevideo* abortions affected many flocks, with the south-east again being particularly severely affected. Details will be reported elsewhere, but it is of interest to note here that 10 of the 46 premises identified in 1982 had experienced infection between 1970 and 1981, including two that had been involved on two previous occasions.

Animal movements did not appear to be relevant to the epidemiology, although it is possible that latently infected animals, especially replacement breeding stock, could introduce infection with the disease remaining dormant until the stresses of later pregnancy. Severe weather conditions or concurrent immunosuppressive disease such as toxoplasmosis (Reid *et al.* 1982) could exacerbate the position.

Contaminated feedstuffs were identified at two of the affected farms, but the order of events remains in some doubt. In those incidents investigated no universally common feedstuff or ingredient was involved. Indeed the regional pattern of disease would appear to be inconsistent with a nationally distributed contaminated feed concentrate.

The role of wildlife in spreading infection to neighbouring flocks appears to have been of some importance. Wildbirds were frequently present in large numbers on pastureland and around feeding troughs, with *S. montevideo* isolated on occasion from bird faeces at several of the affected farms. Although it again remains uncertain whether these infections preceded ovine disease or vice versa, it seems probable that birds or other wildlife scavenging aborted material could readily spread infection to animals on other farms. The findings of *S. montevideo* on the island of Rousay, 35 miles from the north coast of Caithness, and the fact that six of the 12 sheep incidents in that area occurred on coastal farms with the others within 12 miles of the sea, would appear to further implicate birds as vectors of infection. There is considerable evidence that seagulls feeding at sewage outfalls can transmit salmonellas to animals and to pasture (Johnston, MacLachlan & Hopkins, 1979; Johnston *et al.* 1981; Fenlon, 1981), although *S. montevideo* was not amongst the many serotypes recovered.

Sewage effluents and the application of sludge onto pastureland and water-courses have also been recognised as a source of animal salmonellosis (Reilly *et al.* 1981). The isolations of *S. montevideo* from abattoir drains also indicated the possibility of re-cycling through sewage. This means of transmission of infection must be considered, although the evidence appears to be somewhat tenuous considering the wide geographical distribution of the incidents. In view of the relative infrequency of human infection in Scotland since 1970, a sewage source would not readily explain the predominance of *S. montevideo* and the rarity of other serotypes among aborting sheep.

It may be that there is more than one cycle of infection and different strains of the organism, reflecting the experience in sheep in the south-east compared to the north and north-east, which might account for the different clinical pictures. Bovine infection appeared in most instances to have been unrelated to sheep and neither showed any relationship to human disease. As more definitive typing of *S. montevideo* becomes available, the epidemiology may be clarified.

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