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A milk-borne outbreak due to *Salmonella dublin*

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SUMMARY

Salmonella dublin is primarily adapted to bovines and is a relatively rare cause of human illness. An outbreak is described in which it was estimated that at least 700 persons were infected from milk which had not been subjected to heat treatment. Although the organism was isolated from retail samples of milk, investigations at the dairy farm were inconclusive and a number of questions are posed. Attention is drawn to the value of inter-disciplinary cooperation in the investigation of the outbreak.

INTRODUCTION

Infection by *Salmonella dublin* has been a major problem in veterinary medicine for many years as a cause of acute dysentery, septicaemia, and abortion among adult cattle, and chronic disease in calves.

The organism is primarily adapted to bovines, although other animal species such as sheep may also become infected. In man, however, *S. dublin* is relatively rare as a cause of illness other than as an opportunistic pathogen. Between 1970–75 in Scotland, *S. dublin* was isolated from only 73 patients in contrast to 1673 cattle infections (Communicable Diseases Scotland, 1970–75), representing 4·1% and 38·4% of all salmonella isolations from human and bovine sources respectively. The human infections were invariably sporadic in their occurrence and those persons affected were usually elderly or already in poor health, six of whom died.

Although raw milk has continued to be an important vehicle of salmonella food-poisoning (McCoy, 1975), and *S. dublin* has been responsible for several small milk-borne incidents in England and Wales in recent years (British Medical Journal, 1971; Communicable Diseases Surveillance Centre – personal communication), the last reported outbreak in Scotland was over 30 years ago when 97 persons were affected in an Aberdeenshire village community (Lancet, 1947).

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THE OUTBREAK

On 3 November 1976, general practitioners in two practices in the neighbouring towns of Brechin (population 6760) and Montrose (population 10200) in Angus reported that they had been inundated with calls from patients who had developed diarrhoeal illnesses within the previous 24 h. One week before, another practitioner in Montrose had notified an outbreak of gastro-intestinal illness in a residential home for old people, in which the predominant symptom had been vomiting. Further information from practitioners in both towns and from interviews with a sample of patients indicated, however, that a separate outbreak of gastro-enteritis had simultaneously affected Brechin, Montrose, and landward areas of the district around 2 and 3 November. Data provided by two general practices, one in each town, on the number of domiciliary calls made on account of diarrhoeal illness in the first week of November 1976, illustrate the explosive nature of the outbreak (Fig. 1).

Clinical and epidemiological aspects

Salmonella dublin was isolated from 190 persons in North Angus and adjacent rural communities in South Grampian, although this represented only a small proportion of those affected, as bacteriological investigations were restricted initially to a representative sample of patients and thereafter only to special categories such as food handlers and nursery school children. In addition to those patients from whom *S. dublin* was isolated, 283 notifications of food poisoning were received during the outbreak from practitioners in one of the towns. Although few formal notifications were received from the other town, returns from three of its four practices indicated that over 200 cases had been seen. Claims for sickness benefit in Montrose for the first week of November also increased by 65 % compared with the average for the previous month. In contrast, claims recorded elsewhere in Tayside showed no increase. From these indices and from school sickness absence reports, a conservative estimate of the number of persons affected in the outbreak was at least 700, while an unknown number of others may not have been ill enough to seek medical attention.

The ages of patients with laboratory confirmed infections ranged from 3 days to 87 years, of whom approximately one-third were children under 5 years and a further one-sixth were aged between 5 and 15 years. The main symptom experienced by those investigated was acute diarrhoea, although vomiting, abdominal colic, headache, dizziness and pyrexia were also commonly reported. Treatment was mainly supportive, and only three patients who were severely ill required admission to hospital. After recovery, 82 (62 %) of 133 cases followed up continued to excrete *S. dublin* for several weeks and in one case for 3 months.

The investigation

Interviewing a sample of patients in 18 households indicated that the only common factor in their dietary histories was raw milk purchased from a large producer/retailer dairy (farm X) which supplied both towns and the surrounding district. Only two households with confirmed cases of infection by *S. dublin* did

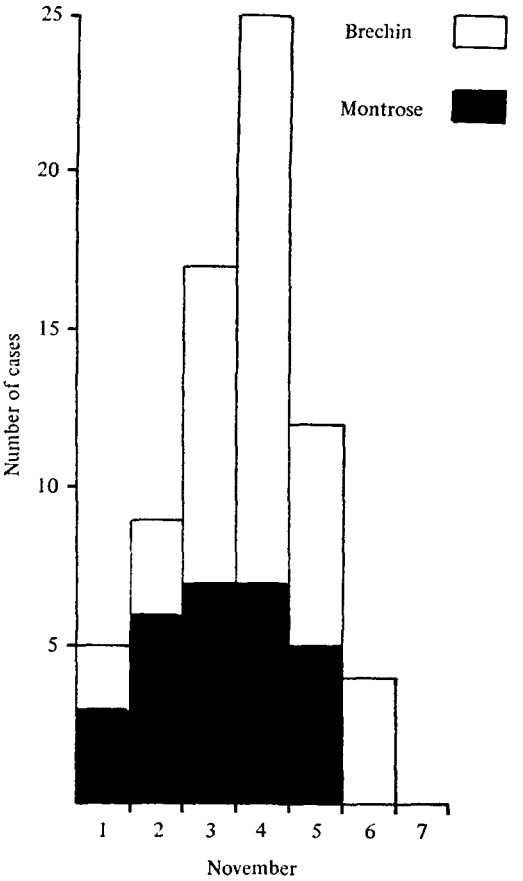

Figure 1. Domiciliary calls for diarrhceal illuess reported by two general practices in the first week of November 1976. Note. The peak dates for domiciliary calls, 3–4 November, relate to peak dates for onset of symptoms, 2–3 November.

not have this milk as their regular supply, but one had obtained a pint on Sunday, 31 October, 2 days before the onset of symptoms, and in the other was a child who attended a playgroup where milk from farm X was supplied. Subsequent inquiries also revealed the absence of diarrhoeal illness in residents or groups who drank only pasteurized milk, in contrast to those consuming raw milk such as at the playgroup where 32 of 54 children examined were found to be infected by *S. dublin*, and also at a factory canteen where 61 of 400 employees were reported to have had diarrhoea, 25 of whom had bacteriologically confirmed *S. dublin* infections.

On Monday, 8 November, samples of premium grade raw milk in pint sachets from the farm dairy and from retail shops in Brechin and Montrose were sent for bacteriological examination. A heavy growth of *S. dublin* was readily obtained from 2/2 of the shop samples; those from the farm were negative. When the results became available on 10 November, the farmer readily agreed to divert all milk for pasteurization. By this time, however, the outbreak was clearly over, with the incidence of cases reported after 4 November having subsided spontaneously.

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The dairy farm

The farmer kept 900 cattle on several different farms, including 240 dairy cows with a daily milk production of approximately 600 gallons. Rectal swabs taken on 11 November from the dairy cows were all reported negative as were milk filter pads examined on the same day. Four days later, rectal swabs from approximately 400 'dry' cows and calves, and pooled milk samples from dairy cattle examined in batches of seven were also negative.

The farm complex and its dairy were well managed and of a good standard throughout, maintaining its own stock of animals. The general health of the cattle prior to the human outbreak had been satisfactory, other than one cow which had calved on 28 October and died on 6 November from suspected hypocalcaemia. A post-mortem examination was not carried out, but the calf from this cow was bacteriologically and serologically negative and in good health. Two other cows had been removed from the dairy herd on 7 November during the normal culling process at the end of lactation, and were sent for slaughter before there was an opportunity to examine them.

Altogether 15 employees, resident on two of the farms, worked regularly or occasionally in the dairy over the period of the outbreak. Between 31 October and 2 November, six dairy workers and six of their children had gastro-enteritis, 11 of whom were shown to be excreting *S. dublin*.

On 27 November an outbreak of scouring began in a group of 10-day-old calves, two of which died; *S. dublin* was isolated from the rectal swabs of five of 52 calves and from one adult cow which had calved on 20 November with the loss of her calf.

A representative sample of cultures of *S. dublin* isolated from persons infected on the farm and the two towns, from the positive milk samples and from infected calves, was sent to the Department of Veterinary Preventive Medicine, University of Liverpool, for phage-typing and biotyping. All were reported as belonging to the same phage type (DT-3) and biotype (F) (J. R. Walton, personal communication).

DISCUSSION

From the clinical, epidemiological, and bacteriological evidence there would appear to be little doubt that the immediate source of the outbreak in Brechin, Montrose, and surrounding districts was raw milk contaminated by *S. dublin* and produced at dairy farm X. The outbreak was notably explosive in its occurrence with its peak incidence over the 2-day period 2–3 November, and receding quickly thereafter. As far as is known from the available literature, it is the largest recorded human outbreak in the United Kingdom caused by *S. dublin*, a serotype normally adapted to bovines, and which infrequently causes infection in man.

Nevertheless, a number of questions remain unanswered in relation to the aetiology of the outbreak. What was the source of infection on the farm, why did the outbreak subside spontaneously 1 week before the milk was diverted for pasteurization on 11 November, and what was the source of infection which affected a batch of young calves 4 weeks later?

All animals at farm X were born and bred within the farm complex, with no

live-stock introduced from outside sources. The animal health and conditions on the farm were of a high standard, and yet an extensive human milk-borne outbreak caused by *S. dublin* was related to the farm dairy. Was it exclusively of bovine origin, deriving perhaps from the cow which died from suspected hypocalcaemia on 6 November, from one or both of the other two cows removed from the milking herd on 7 November, or from some other undetermined animal source? The calf of the first cow remained well and there was also some uncertainty whether any milk from this cow entered the dairy bulk supply between calving on 28 October and death on 6 November, and the two culled animals were not observed to have been ill. Almost certainly some event of significance would appear to have taken place at the dairy during these few days, which saw the onset and termination of the human outbreak, allied to the isolation of *S. dublin* from the shop milk sampled on Monday, 8 November, and the negative results from milk at the farm on the same day.

In the circumstances, was it significant that the shop samples were from an earlier day's milking than those obtained at the farm?

There was also evidence suggesting a possible human source contaminating the milk supply at the farm. The onset of illnesses in the infected dairy personnel and their children occurred between 31 October and 2 November. This was approximately 24 h earlier than those affected in the general population, but farm workers and their families would normally obtain milk 1 day before the same consignment was received by consumers elsewhere. One farm family however, whose mother was working in the dairy and with calves immediately before the outbreak, had quite a different experience with gastro-intestinal symptoms between 17 and 28 October. On subsequent investigation none of this family had positive bacteriological findings, but nearly 4 weeks elapsed between their illnesses and the obtaining of faecal specimens.

If it were accepted that this family was the means of contaminating milk at the farm before distribution, was it also possible that a human source such as a convalescent farm employee, subsequently infected the group of young calves in the process of training for suckling and also the one infected cow which calved *after* the outbreak? Conversely, the extent of the outbreak and the weight of contamination of the milk by a bovine-adapted salmonella would more likely suggest an animal source than a human one, but this question remains unanswered.

The extensive investigations into this outbreak were greatly facilitated by the fact that most of the medical, veterinary, and environmental health personnel involved were closely associated with the regional liaison committee, a body which has functioned with success since 1973. Inter-disciplinary liaison groups of this nature operate throughout Scotland (Sharp, 1977).

In Scotland 10% of milk produced is still consumed raw, and 3·5% in England and Wales (United Kingdom Dairy Facts and Figures, 1977). It is expected however that by 1980 virtually all milk produced in the United Kingdom will be heat-treated before sale to the public (Hansard, 1975), and that milk-borne outbreaks thereafter will no longer present a threat to the public health, other than perhaps on occasion in farming communities and other rural areas where an alternative supply of heat-treated milk may not be readily available.

Our thanks are due to our medical, veterinary, and environmental health colleagues on the Eastern Regional Medical-Veterinary Liaison Committee, to the general practitioners and community nurses in Brechin, Montrose and district, to the laboratory staffs at Stracathro Hospital, Brechin, the East of Scotland College of Agriculture Veterinary Investigation Laboratory, Perth, and the Scottish Salmonella Reference Laboratory, Stobhill Hospital, Glasgow; to Dr J. R. Walton, Department of Veterinary Preventive Medicine, University of Liverpool, the District Medical Officer, Angus, and his staff, and in particular, for their contributions made to the investigations, to Dr Margaret Hird and Mr V. Connor, Area Environmental Health Officer.

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