

Enteric fever in Scotland, 1967-1974

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SUMMARY

A review of 194 cases of enteric infection in Scotland during 1967-74, is reported. Diagnosis was confirmed by the laboratory isolation of *Salmonella typhi* (64 cases), *S. paratyphi A* (3) and *S. paratyphi B* (127), from blood or faeces; 174 persons were clinically ill and 20 were symptomless infections.

Most patients (81.0%) were under 35 years of age, with the highest incidence occurring among young adults of 15-24 years, many of whom had been travelling overseas. One-third of all cases (65) were imported infections; the remaining 129 patients had not been outside the United Kingdom. A significantly greater proportion of typhoid infection (54.7%) was contracted overseas, in contrast to paratyphoid B with only one-fifth of cases (21.2%) being imported; all three cases of paratyphoid A were imported. The geographic distribution of origin of imported infections is discussed, along with the frequency of organisms belonging to different phage types.

Two deaths occurred, one of which was the result of complications of paratyphoid fever. All other patients responded well to treatment, although two persons continued to excrete and became chronic carriers.

A few examples are given of episodes of particular epidemiological interest.

It is expected that in future years there will be a continued increase in the proportion of imported infections as more persons travel overseas, concurrent with the continuing decline in the number of chronic carriers resident in the British Isles.

INTRODUCTION

During the early 1960s, several outbreaks of enteric fever occurred in Scotland, largely due to contaminated imported foodstuffs such as frozen Chinese egg or canned meat. The most notable of these episodes were paratyphoid fever in Edinburgh in 1963 (Sharp, Brown & Sangster, 1964) and typhoid in Aberdeen in 1964 (Report, 1964; Anderson & Hobbs, 1973).

Since then there has been a considerable reduction throughout the United

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Table 1. Annual distribution of enteric infections in Scotland, 1967-74

	1967	1968	1969	1970	1971	1972	1973	1974	Totals
<i>S. typhi</i>	11	12	7	8	4	9	7	6	64
<i>S. paratyphi A</i>	—	—	—	—	—	1	—	2	3
<i>S. paratyphi B</i>	12	18	8	10	17	20	19	23	127
Totals	23	30	15	18	21	30	26	31	194

Kingdom in the number and size of outbreaks reported, with notifications of enteric fever in Scotland decreasing to 41 by 1966 in contrast to an aggregate total of 1197 cases (annual average of 239) over the previous five years (Scottish Health Statistics, 1961-66). This resulted largely from the introduction of legislation in 1964 requiring the pasteurization of liquid or frozen egg (Statutory Instruments, 1963*a*) and to stricter controls in the production of imported foods.

In 1967, a national surveillance programme for communicable disease was established in Scotland, since when epidemiological information has been available in greater detail.

The present study is a review of 194 cases of enteric infection reported in Scotland from 1967 to 1974, where *Salmonella typhi* (64 cases), *S. paratyphi A* (3), and *S. paratyphi B* (127) were isolated from the blood or faeces of patients. Following laboratory isolation, cultures were sent to the Scottish Salmonella Reference Laboratory, Glasgow, for confirmation of diagnosis, and to the Enteric Reference Laboratory, Colindale, London, for phage-typing.

The review does not include eight other cases, where a diagnosis of enteric fever was based on clinical, serological, and epidemiological evidence, but from which no organisms were isolated. Also excluded are isolations of *S. typhi* or *S. paratyphi B* from chronic carriers, and from sewer and river water samples examined in the course of environmental investigations.

ANALYSIS OF CASES

Between 15 and 31 cases of enteric infection were diagnosed and confirmed bacteriologically each year in Scotland from 1967 to 1974 (Table 1); an attack rate varying between 0.29 and 0.59 cases per 100,000 of population.

The seasonal distribution of cases shows a predominance of both imported and indigenous infections occurring during the summer and early autumn (Fig. 1).

More than four-fifths of the patients (81.0%) were under 35 years of age (Table 2). The highest incidence was among young adults between 15 and 24 years (26.8%), while children of school-age (23.2%) and those under 5 years of age (15.5%) together accounted for over one-third. There was little difference in the sex distribution, although males were significantly more common between five and 34 years of age ($P < 0.05$).

One-third of all cases (65) were imported from overseas. The other two-thirds (129) occurred in persons who had not been outside the United Kingdom, and of these 113 (58.2%) had not been outside the area of their home town (Table 3). A significantly greater proportion of typhoid (54.7%) was contracted abroad, in

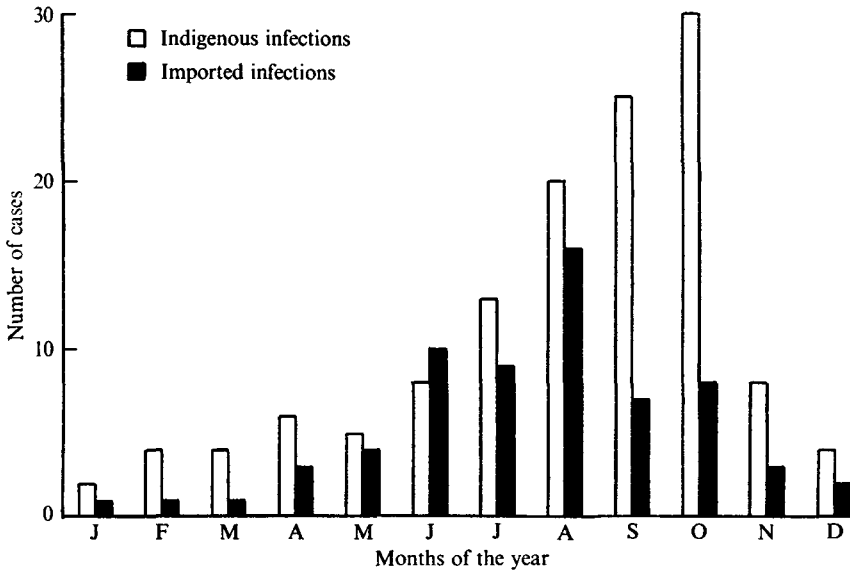


Fig. 1. Seasonal distribution of indigenous and imported infections, 1967-74.

Table 2. Age/sex distribution of cases of enteric infection, 1967-74

	Age-groups in years								Totals
	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65+	
Males	14	24	34	16	4	4	4	2	102
Females	16	21	18	14	8	5	3	7	92
Totals	30	45	52	30	12	9	7	9	194
%	15.5	23.2	26.8	15.5	6.2	4.6	3.6	4.6	100.0%

Table 3. Location of where infection acquired by organism, 1967-74

	Home town	Elsewhere in:		
		Scotland	U.K.	Overseas
<i>S. typhi</i>	22	7	—	35
<i>S. paratyphi A</i>	—	—	—	3
<i>S. paratyphi B</i>	91	8	1	27
Totals	113	15	1	65

contrast to paratyphoid B with only one-fifth (21.2%) being imported ($P < 0.001$). Importations were more common than home infections during 1973 only, when all seven typhoid and 10 out of 19 paratyphoid patients were overseas travellers. Of the 65 imported cases (Table 4), 18 were persons who had been in India or Pakistan, 15 came from Europe and in particular from countries adjoining the Mediterranean Sea, 11 were from North Africa, and 10 had visited various lands in the Middle East; nine others had been in tropical Africa and the Far East, and of the remaining two patients, one had been in Mauritius and the other was a crew member of a cruise ship on which an outbreak of typhoid had occurred (Davies *et al.* 1972). Typhoid occurred predominantly among travellers from Asia or tropical Africa,

Table 4. *Imported cases: geographical origin of infection, 1967-74*

	<i>S. typhi</i>	<i>S. paratyphi A</i>	<i>S. paratyphi B</i>	Total no. of cases
India/Pakistan	14	3	1	18
Middle East	1	—	9	10
Far East	2	—	1	3
West Africa	2	—	1	3
East Africa	2	—	1	3
North Africa	5	—	6	11
Europe	7	—	8	15
'Other'	2	—	—	2
Totals	35	3	27	65

whereas most paratyphoid B patients had been in the Mediterranean littoral or the Middle East. The three patients with paratyphoid A, one of whom also had two other salmonella serotypes (*S. cambridge* and *S. oranienburg*) isolated from his faeces, were from India or Pakistan.

The strains of *S. typhi* most commonly reported were those belonging to Vi-phage types K1 and C1 (9 cases of each), followed by type E1 (8); degraded Vi strains were also isolated from eight patients. Of *S. paratyphi B* organisms, phage type 1 was most common (34 cases) with type 1 var 1 being reported from six others, followed by type 3a (31), type Taunton (20) and type 3b (11).

Ninety-three of the cases (47.9%) occurred as single sporadic infections, 39 (20.1%) were in 13 family episodes of two or more cases, and the remaining 62 (32.0%) were part of 13 community or hospital outbreaks. Twenty-six cases (13.4%) were infected by secondary spread from 14 other patients, 38 (19.6%) were infected by 13 chronic carriers, and in five cases specific foods such as shellfish were incriminated; the source of infection of the remaining 125 patients (64.4%) remained unknown.

Two of the typhoid and 18 of the paratyphoid B patients were temporary symptomless excretors, who were discovered on routine screening following the notification of an index case. Of the 174 patients who were ill, clinical details were not fully available for many of those reported during the earlier years of the review. Most patients, however, appeared to have had illnesses characteristic of enteric fever, although many of the paratyphoid cases had symptoms of gastroenteritis.

Two patients died, both of whom had paratyphoid. In 1968 a 36-year-old Glasgow woman was infected by her mother-in-law, a known chronic carrier of *S. paratyphi B* phage type 1, and developed a perforation of the transverse colon during her illness; she died the day after a colostomy was performed. The second death occurred in 1973 in Fife, when a 61-year-old woman with acute gastroenteritis died the day after her admission to hospital; as she also had atherosclerosis, it is not known to what extent paratyphoid contributed to her death.

All of the other patients responded well to antibiotic treatment, usually chloramphenicol, ampicillin or, in a few cases, co-trimoxazole, although many continued to excrete organisms for several weeks during convalescence. With two exceptions, all became bacteriologically clear; a 68-year-old man from Ross and

Cromarty and a 52-year-old woman from Glasgow, continued to excrete *S. paratyphi B* and became chronic carriers.

Several episodes of particular epidemiological interest occurred during the eight years; some examples are given.

(1) Seven patients who developed typhoid resided in Edinburgh and were part of a series of eight cases between 1963 and 1970; all were infected with *S. typhi* Vi-phage type K1. The source of infection was eventually traced to a small river which was shown, by the use of Moore's swabs, to be contaminated by the excreta of a hitherto unknown carrier (Conn *et al.* 1972).

(2) A similar episode occurred in a small town in Ayrshire, in which a chronic carrier of *S. paratyphi B* type 3a was discovered by the same method following a smouldering outbreak with 19 cases of paratyphoid between 1972 and 1974 (to be published elsewhere).

(3) In 1972 typhoid fever was diagnosed in a 4-year-old boy in Kincardineshire whose grandmother was discovered to have been a missed case and subsequent chronic carrier of *S. typhi* type 34, following the Aberdeen outbreak in 1964.

(4) Three episodes of hospital cross-infection occurred. In 1970 a ward sister in a general hospital contracted paratyphoid fever from a child patient who was later discovered to have been infected with *S. paratyphi B* type Taunton. In 1971 a nurse in another hospital developed typhoid from a child who was later discovered to have been infected by her grandmother, a previously unknown carrier of *S. typhi* type D1-N (Macleod, Young, Lawson & Pinkerton, 1971). Three years later, in the same hospital, a small outbreak of typhoid caused by *S. typhi* type E1 affected four persons in a mother-and-child unit; the source was found to be the grandmother of one of the patients.

(5) During the summer of 1973 a women's soccer team toured Morocco, after which four members of the party developed paratyphoid fever (*S. paratyphi B* type Taunton).

DISCUSSION

The annual incidence of 15–31 cases of enteric infection in Scotland since 1967 is similar to the experience in recent years in England and Wales, where 150–200 cases have been reported annually (E. S. Anderson, personal communication) in a population nearly tenfold greater.

A considerable proportion of patients (38·7%) were children under 15 years of age, including 10 who had been overseas. Thirty-two of the 65 indigenous cases were infected by a carrier or by another patient. The source of infection of the other 33 children remained unknown, although almost all of these had been infected within the area of the home town.

Two previously recognized features of enteric fever observed in the present study were the low incidence (13·4%) of secondary infections arising from index cases and the infrequency of the development of chronic carriage (1·0%). Secondary spread of infection from primary cases is uncommon in enteric fever, but does occur from time to time. The only two episodes showing a high incidence of secondary spread were outbreaks of paratyphoid in Glasgow and in Ayrshire

affecting households in which low standards of hygiene prevailed. Conversely, none of the 65 imported cases resulted in further spread of infection. Nevertheless many doctors and others continue to over-emphasize the communicability of enteric infection, and in consequence impose unnecessarily severe restrictions on contacts of patients when implementing control measures. Convalescent excretion of organisms may continue for several weeks in some patients, although the proportion who became chronic carriers is usually only about 3% after typhoid, and is thought to be less after paratyphoid (Wilson & Miles, 1964).

Paratyphoid fever is not uncommonly encountered as an indigenous infection in the United Kingdom, whereas typhoid is more often imported from abroad. The experience in Scotland since 1967 is in keeping with this. Only in 1973 was there a higher proportion than usual of imported cases of paratyphoid, in contrast to all other years when home-acquired infections predominated. A high incidence of imported typhoid and paratyphoid infection, however, was observed among young adults in particular – a reflexion of the facility of international travel which has become available in recent years to students and other young persons. As might be expected, most imported cases (76.9%) were reported between the months of June and October, although there was no significant difference between this finding and the seasonal distribution of home infections.

The high incidence of *S. typhi* organisms belonging to Vi-phage types C1 and E1, and of *S. paratyphi B* organisms belonging to types 1, 3a and Taunton, was consistent with the experience throughout the United Kingdom in recent years (Report, 1973). With the small numbers available for analysis in the present study, it was not possible to observe any marked geographic association with particular areas of the world. Vi-phage types C1 and E1 are cosmopolitan in their distribution; four of the nine cases of type C1 were imported from Europe (3) and West Africa (1) and six of the type E1 infections were from India (3), Southern Europe (2) and North Africa (1).

Of the four most commonly reported phage types of *S. paratyphi B*, only type 3b had not figured prominently in the United Kingdom (Report, 1973). The predominance of type 1 as an indigenous organism in the British Isles was further emphasized in the present study by its isolation from 34 patients, only one of whom had been abroad (in France); in addition all six cases of infection with type 1 var 1 were acquired locally. Similarly 29 of the 31 cases of type 3a and all 11 cases of type 3b were indigenous infections. Phage type Taunton featured more prominently among imported cases with eight out of 20 coming from overseas – North Africa (4), Middle East (2) and one each from India and Vietnam; and all nine cases of type Dundee were imported – the Middle East (7) and Europe (2).

A continued increase in the proportion of imported cases of typhoid and paratyphoid fever is to be expected in future years in Scotland and elsewhere in the United Kingdom as more persons travel overseas and visit lands where infection is still endemic, concurrent with the continuing decline in the number of chronic carriers resident in the British Isles.

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