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Salmonella bacteraemia in England and Wales, 1981–1990

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Abstract

Aims: **To report the incidence of non-typhoidal salmonellas in England and Wales and identified in the Division of Enteric Pathogens, London between 1981 and 1990.**

Methods: **Strains were serotyped and phage typed for *Salmonella typhimurium, S enteritidis,* and *S virchow,* using established methods.**

Results: **Overall, less than 2% of non-typhoidal salmonellas isolated from humans were from blood culture. The highest numbers of bloodstream isolates were from infections caused by *S enteritidis* and *S typhimurium,* but the highest incidence of septicaemias was attributable to infections with *S cholerae-suis, S dublin,* and *S virchow.* 2·2% of *S typhimurium* isolates phage type 204C were from blood culture; likewise, 5·5% of *S virchow* phage type 19. This could be a cause for concern as most isolates of both these phage types are multiresistant to antimicrobial drugs.**

Conclusions: **Salmonella septicaemia is rare in England and Wales in other than a few serotypes of limited epidemiological importance.**

Salmonella septicaemia can be a life-threatening disease and while it is commonly associated with *Salmonella typhi, S paratyphi A,* and *S paratyphi B,* it is uncommon for other serotypes. The Division of Enteric Pathogens (DEP) provides a reference service for salmonellas isolated from humans in England and Wales, and from 1981 to 1990, 186 244 non-typhoidal isolates belonging to 305 serotypes were identified. Although the most common symptomology was gastro-intestinal, bloodstream invasion occurred in isolates from over 100 of these serotypes.

Methods

Strains were serotyped by the methods of Kauffman[1] and phage typed by the methods of Callow[2] for *S typhimurium,* by those of Ward *et al*[3] for *S enteritidis,* and by those of Chambers *et al*[4] for *S virchow.*

Results

Of the 186 244 isolates identified during the 10 year period 1981–1990, 2842 were from blood culture, an overall incidence of 1·5% (table 1). For the three most common serotypes, the incidence of blood infections was between 1% and 2% for *S enteritidis* and *S typhimurium* and 4% for *S virchow.* In terms of the number of bloodstream isolates/isolates received, the highest incidence of blood infection was in *S cholerae-suis* (74%) followed by *S dublin* (25%). Only 27 isolates of *S cholerae-suis* however, were identified and *S dublin* was also an uncommon serotype, with only 430 isolates from humans over the study period. Other serotypes in which the incidence of blood infection was greater than 2% included *S bovis-morbificans, S ealing, S heidelberg, S kedougou* and *S panama.*

For *S enteritidis* the highest incidence of septicaemia (4·5%) was associated with isolates which did not conform to recognisable phage type patterns (NC) (table 2). The epidemiological importance of this is difficult to interpret, however, as these isolates comprised strains with several different phage reaction patterns. In phage types of epidemiological importance the highest incidence of septicaemia ranged from 1·0% (phage type 6) to 3·4% (phage type 13a).

For *S typhimurium* phage types the incidence of septicaemia ranged from 0·5% (phage type 49) to 2·2% (phage type 204c). Previous studies have shown that all strains of phage type 204c are resistant to at least four antimicrobial drugs, including ampicillin, chloramphenicol, and trimethoprim.[5]

The *S virchow* phage typing scheme has been in use since 1985. Over the six years 1985–1990 the incidence of bloodstream invasion for phage types of this serotype

Table 1 Salmonellas from blood, England and Wales, 1981–90

Serotype	*Total No of isolates*	*Blood isolates No (%)**
S enteritidis	70498	981 (1·4)
S typhimurium	64563	729 (1·1)
S virchow	10554	406 (3·8)
S dublin	430	109 (25·3)
S heidelberg	1898	63 (3·3)
S panama	1756	48 (2·7)
S kedougou	945	21 (2·2)
S cholerae-suis	27	20 (74·1)
S bovis-morbificans	321	7 (2·2)
S ealing	261	6 (2·3)
Others (295 serotypes)	34991	452 (1·3)
Totals	186244	2842 (1·5)

*Percentage of each serotype.

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Table 2 Blood isolations in phage types of S enteritidis, S typhimurium, and S virchow 1981–1990

S enteritidis			*S typhimurium*			*S virchow**		
Phage type	*Total*	*Blood No (%)†*	*Phage type*	*Total*	*Blood No (%)*	*Phage type*	*Total*	*Blood No (%)*
4	54307	720 (1·3)	12	7699	123 (1·6)	8	1087	91 (8·4)
8	6275	104 (1·7)	193	4224	61 (1·4)	19	475	26 (5·5)
1	1412	27 (1·9)	49	8325	44 (0·5)	31	921	22 (2·4)
6	2693	26 (1·0)	204c	1786	40 (2·2)	26	866	19 (2·2)
13a	679	23 (3·4)	204	3049	39 (1·3)	21	504	15 (3·0)
NC	470	21 (4·5)	104	4092	34 (0·8)	2	295	6 (2·1)
11	671	12 (1·8)	141	3275	33 (1·0)	Others	2079	47 (2·3)
2	246	9 (3·6)	NC	1669	27 (1·6)			
Others	3745	39 (1·0)	49a	2866	25 (1·6)			
			170	3416	21 (0·6)			
			Others	24170	282 (1·2)			
Totals	70498	981 (1·4)		64571	729 (1·1)		6227	226 (3·6)

†Percentage of each phage type.
NC: do not conform to designated phage types.
*Isolates of *S virchow* from 1985–1990.

ranged from 8·4% for phage type 8, the most common phage type identified, to 2·1% for phage type 2. For phage type 19, 5·5% of isolates were from blood culture. Previous studies have shown that multiple resistance, including resistance to ampicillin, chloramphenicol, and trimethoprim is common in this phage type.[5]

Discussion

In England and Wales the overall incidence of bloodstream invasion in non-typhoidal salmonellas isolated from humans and identified in the DEP in the 10 years 1981 to 1990 was less than 2%. For bloodstream isolates, strains of *S enteritidis* and *S typhimurium* were the most numerous, but this reflected the overall preponderance of these two serotypes over the study period. In terms of the number of bloodstream isolates/isolates received, however, the highest incidence of septicaemias (74%) was in infections caused by *S cholerae-suis*. This serotype has been associated with extra-intestinal infections in both the United States of America and Britain.[6 7] Fortunately, *S cholerae-suis* is extremely uncommon in England and Wales, with strains each year accounting for less than 0·01 of isolations referred to the DEP. The second most invasive serotype was *S dublin*, 25% of isolates of this serotype were from blood culture. Although *S dublin* is not an important cause of food poisoning in England and Wales, the high incidence of septicaemia is of particular concern, and infections with this serotype need careful clinical supervision.

S dublin was the second most common serotype in cattle for the 12 year period 1978–89, and *S cholerae-suis* ranked in the top 10 of serotypes in pigs.[8] It is interesting to note that although *S dublin* and *S cholerae-suis* are rarely isolated from humans, a particular feature of human infections with these "species-specific" serotypes is the high incidence of bloodstream invasion.

Other salmonellas with septicaemia rates greater than 2% included *S virchow*, *S heidelberg*, *S panama*, *S kedougou*, *S bovis-morbificans* and *S ealing*. *S virchow* was the third most common serotype in humans over the 10 year period. A high incidence of blood stream isolations of *S virchow* has been observed in outbreaks in Liverpool,[9] Manchester,[10] and Scotland.[11] *S heidelberg* and *S panama* have ranked in the top 10 of serotypes identified in the DEP each year from 1981 through to 1990 and have each comprised about 1% of the total isolates. Since 1989 *S kedougou* has become an increasingly important cause of food poisoning in England and Wales[12] and in 1989 was responsible for a series of outbreaks associated with cooked turkey meat. *S ealing* and *S bovis-morbificans* have only been rarely isolated from cases of food poisoning in England and Wales. In late 1985, however, *S ealing* associated with a contaminated dried milk product caused an outbreak among infants.[13] Two of 54 isolates from infants infected in this outbreak were from blood culture. In a study of strains isolated in Liverpool from 1969–1984, *S london* was reported to cause a higher than average number of extra-intestinal infections,[7] but in this investigation only one of 95 isolates of this serotype was from blood culture.

For *S typhimurium* phage types there was little overall difference in the incidence of blood stream isolations. It is noteworthy, however, that 2·4% of phage type 204c isolates were from blood culture, and because strains of this phage type are invariably resistant to at least four antimicrobial drugs,[5] the choice of treatment may be restricted in cases of sepicaemia. Likewise, 5·5% of isolates of *S virchow* phage type 19 were from the bloodstream, and like *S typhimurium* phage type 204c, most isolates of this phage type have been reported to be multiresistant.[5]

These results show that in England and Wales most salmonella serotypes seldom cause septicaemia. It is particularly reassuring that the incidence of bloodstream invasion in the two most common serotypes, *S enteritidis* and *S typhimurium*, is less than 2·0%.

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