MOTILITY OF ENTEROCOCCI ISOLATED FROM THE URINARY TRACT AND FROM OTHER SOURCES

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SUMMARY. The identity and motility of enterococci isolated as urinary pathogens were compared with those of strains from other sources. The majority of isolates from all sources proved to be *Streptococcus faecalis* or *S. faecium* but eight of 117 urinary strains and seven of 127 non-urinary strains belonged to a group intermediate between *S. faecalis* and *S. faecium*. Of the seven “intermediate” strains from non-urinary sources, four were motile. None of the urinary enterococci was motile. The results do not indicate that urinary enterococci are more likely to be motile than are non-urinary strains.

INTRODUCTION

Urinary-tract pathogens are generally derived from the aerobic microbial flora of the intestine. The large majority of organisms causing urinary-tract infection are gram-negative rods, and most of them are motile. Enterococci are responsible for 2–4% of urinary-tract infections in general practice and 3–5% in hospital (Grüneberg, 1980).

This study had two aims: to identify the enterococci isolated from patients with urinary-tract infection and from other sources, because motile strains investigated by other authors (Shattock, 1955; Graudal, 1957; Langston, Gutierrez and Bouma, 1960; Lund, 1967) have shown characteristics intermediate between *Streptococcus faecalis* and *S. faecium*; and to compare the proportion of motile isolates obtained from the urinary tract and from other sources.

MATERIALS AND METHODS

From urinary-tract infections, 117 strains were isolated in pure culture; from other sources such as faeces, wound swabs, high-vaginal swabs and cervical swabs, 127 isolates were also investigated. All isolates were categorised as gram-positive cocci, catalase negative and aesculin positive, and were subcultured on nutrient-agar slopes for storage at room temperature.

TABLE I
Expected biochemical reactions of group-D streptococci

Species	Survival at 60°C 30 min	Growth in NaCl	Production of acid from			Reduction of tellurite	Utilisation of citrate
			inulin	mannitol	sucrose		
<i>Streptococcus faecalis</i>	+	+	—	+	+	+	+
<i>S. faecium</i>	+	+	—	V	V	—	—
<i>S. avium</i>	+	+	V	+	+	...	...
<i>S. faecium</i> var. <i>casseliflavus</i>	V	+	V	+	+	...	...
<i>S. bovis</i>	—	—	+	V	+	...	...
<i>S. equinus</i>	—	—	V	—	+	...	...

+ = Most strains positive; — = most strains negative; V = some strains positive, some strains negative;
 ... = test not done.

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Further characterisations included tests of growth in 6.5% NaCl, resistance to heat at 60°C for 30 min, fermentation of inulin, mannitol and sucrose, reduction of tellurite, and utilisation of citrate. The expected biochemical reactions are shown in table I.

All of the isolates were tested for motility, which was demonstrated by inoculation of Brain Heart Infusion Broth (Oxoid) with 0.025 ml of an overnight broth culture and incubation at room temperature for 15–20 h; Graudal and Birch-Andersen (1958) found these conditions to be optimal for the development of motility. Growth was vigorous and motility was observed by

FIGURE.—Motile streptococci showing chains with flagella.

direct microscopy of living cells. Mutation to non-motile variants has not been recorded and so it was expected that motility would be a stable and reproducible characteristic.

RESULTS

Urinary-tract isolates

Of 117 strains investigated, 96 were *S. faecalis*, 13 were *S. faecium* and eight were intermediate; in that they reduced tellurite but did not utilise citrate (table II). Motile strains were not isolated from the urinary tract.

Isolates from other sources

Of 127 isolates, 90 were *S. faecalis*, 23 were *S. faecium*, seven were not enterococci and seven were of the intermediate type (table II). Four motile strains were isolated (see the figure); according to our classification these were all of the intermediate type in that they reduced tellurite but did not utilise citrate as a source of energy. Colonies of two of these isolates were α haemolytic and non-pigmented and two produced non-haemolytic yellow colonies.

TABLE II
Comparison of isolates from different sources

Species	Number (and percentage) of isolates from	
	urinary tract	other sources
<i>S. faecalis</i>	96 (82)	90 (75)
<i>S. faecium</i>	13 (11)	23 (19)
Intermediate types	8 (7)	7* (6)
All	117	120
Not enterococci (excluded)	0	7

* Four strains were motile.

DISCUSSION

The occurrence of motile streptococci was recognised by Billroth (1874). From the 1950s various studies of motile streptococci have led to their being classified as culturally and biochemically intermediate between *S. faecalis* and *S. faecium* or bearing a closer similarity to the latter than the former. In our study, the majority (82%) of 117 strains isolated from the urinary tract were *S. faecalis*. Of the remainder, 13 (11% of the total) were *S. faecium* and only 8 (7%) could be classified as intermediate. None of the enterococci causing urinary-tract infection was motile.

The isolates from other sources can all be considered as being primarily of faecal origin, but the proportions of the species that we encountered cannot be considered as indicative of their proportion in faeces or, indeed, in the population at large. In our selection of these strains, no attempt was made either to count the numbers present or to ensure that all of the enterococci in a specimen were selected. Strains were merely picked at random from a range of specimens to provide a sample of enterococci from which we could determine the proportion of motile strains. Of the 120 enterococci isolated from non-urinary sources, *S. faecalis* was again the most numerous (75%), but *S. faecium* was isolated more often (19%) than from the urinary tract (11%). Seven isolates (6%) were considered to be intermediate between *S. faecalis* and *S. faecium*; four of these were motile.

Thus, of the 120 isolates from other sources four (3.3%), all of intermediate type, were motile, whereas none of the 117 urinary isolates was motile. This does not suggest that urinary enterococci are more likely to be motile than are non-urinary strains.

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