Distribution of *Serratia* Species in Clinical Specimens

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Eighty-five strains of *Serratia* were speciated. The majority were *Serratia marcescens* and were recovered from a variety of clinical specimens. *S. liquefaciens* and *S. rubidaea* were recovered only from sputum.

A proposal has been made (1) that *Enterobacter liquefaciens* and *Bacterium rubidaea* be transferred to the genus *Serratia*, and that three species should be recognized in this genus: *S. marcescens*, *S. liquefaciens*, and *S. rubidaea*. Ewing et al. (1) reported on 22 extra-intestinal human isolates of *S. liquefaciens*. Eighty-two percent of these came from respiratory sources, 9% from blood, and 7% from urine. Ewing also reported on 17 extra-intestinal isolates of *S. rubidaea*. Fifty-nine percent of these came from respiratory sources, 24% from blood, and 18% from wounds and similar sources. *S. rubidaea* was not recovered from urine specimens.

We considered that it would be of interest to determine what differences may exist in the distribution of these species among various clinical specimens within a single institution.

All aerobic gram-negative rods from primary plating media (Eosin-methylene blue agar) were routinely tested for a variety of biochemical reactions. *Serratia* species were initially detected by a positive deoxyribonuclease reaction on plates containing this substrate. Deoxyribonuclease-positive isolates were further tested for H₂S production (to distinguish *Arizona* species [2], phenylalanine deaminase (to rule out the occasional deoxyribonuclease-positive *Proteus* species), and oxidase (to eliminate *Aeromonas* species).

Speciation of *Serratia* was accomplished by noting lysine and ornithine decarboxylation and the fermentation of arabinose (Table 1). With the exception of a single isolate of *S. rubidaea*, all strains were nonpigmented after 24 h on Mueller-Hinton agar.

Eighty-five strains of *Serratia* were recovered over a 6-month period. Seventy-four (87%) were *S. marcescens*, eight (9%) were *S. liquefaciens*, and three (3.5%) were *S. rubidaea*. The average age of the patients was 61 years, and 61% of them were males. The majority of the isolates were recovered from in-patients.

Forty-five percent of the *S. marcescens* strains were recovered from respiratory specimens (sputum and tracheal aspirates), 43% from urine specimens (voided and catheterized), and 10% from wounds. Two additional isolates were recovered from specimens of urethral exude and skin.

Strains of *S. liquefaciens* and *S. rubidaea* were recovered only from sputum.

All *Serratia* isolates were resistant to cephalothin as determined by the Kirby-Bauer technique. All isolates of *S. liquefaciens* and *S. rubidaea* were susceptible to chloramphenicol and kanamycin. Two of the *S. rubidaea* isolates were also resistant to tetracycline; the third strain was resistant to ampicillin. Three of the *S. liquefaciens* strains were susceptible to all antibiotics other than cephalothin; of the remaining five strains, all were resistant to ampicillin, three of these were additionally resistant to tetracycline, three were resistant to polymyxins, and a single isolate was resistant to carbenicillin.

The *S. marcescens* varied markedly in their susceptibility to ampicillin, tetracycline, and polymyxins. Sixteen percent were resistant to chloramphenicol, 10% to kanamycin, and 22% to chloramphenicol and kanamycin. It is of interest that 77% of the *S. marcescens* isolates resistant to chloramphenicol and/or kanamycin were urinary isolates.

| Organisms    | Ornithine decarboxylase | Lysine decarboxylase | Arabinose |
|--------------|-------------------------|----------------------|-----------|
| *S. marcescens* | +                       | +                    |          |
| *S. liquefaciens* | +                       | V*                   | +        |
| *S. rubidaea*     | -                       | V*                   | +        |

* V, variable.
It would appear that significant differences exist in the clinical sources of *Serratia* species. These studies suggest that most urinary isolates are *S. marcescens* with a high probability of multiple drug resistance. Additional studies are needed to determine whether any correlation exists between the species of *Serratia* and clinical factors such as the pathogenesis, management, and outcome of infections.

LITERATURE CITED

1. Ewing, W. H., B. R. Davis, and M. A. Fife. 1972. Biochemical characterization of *Serratia liquefaciens* and *Serratia rubidaea*. DHEW publication no. (HSM) 73-8209. Department of Health, Education, and Welfare, Washington, D.C.

2. von Graevenitz, A. 1973. Deoxyribonuclease-indole medium and its use in an identification system for non-lactose fermenting gram-negative rods. Ann. Clin. Lab. Sci. 3:284-296.