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Sucrose-Positive *Edwardsiella tarda* Mimicking a Biogroup 1 Strain Isolated from a Patient with Cholelithiasis

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An unusual strain of *Edwardsiella tarda* mimicking a biogroup 1 isolate was recovered in a mixed infection from a woman suffering from cholelithiasis. Rare biochemical characteristics (e.g., H_2S negativity) originally detected were related to an unusual biochemical property in this species, sucrose fermentation; other points of interest regarding this strain included the site of isolation (bile) and the failure of this isolate to produce many of the in vitro virulence markers associated with *E. tarda*.

Edwardsiella tarda is a less frequently encountered member of the family *Enterobacteriaceae* that is occasionally associated with gastroenteritis, bacteremia, and soft-tissue infections in humans. The species is phenotypically tight and displays little biochemical variability. Under most circumstances *E. tarda* is easy to identify in the clinical laboratory since it is indole and lysine and ornithine decarboxylase positive, produces hydrogen sulfide gas, and lacks the capability to ferment most sugars. In 1980, Grimont and colleagues (3) described a new biogroup of *Edwardsiella tarda* (designated biogroup 1), the members of which were chiefly distinguished from classic strains by their acid production from L-arabinose, D-mannitol, and sucrose (negative for wild-type isolates) and their failure to reduce tetrathionate and produce H_2S (positive for classic strains). In this report, we describe an unusual strain of *E. tarda* mimicking a biogroup 1 strain because of its unusual ability to ferment sucrose.

In July 1992, a 72-year-old female from Southeast Asia was admitted to a local hospital with a 2-day history of epigastric and right upper quadrant pain. No vomiting or nausea had been noted. Ultrasound revealed cholelithiasis, and she was taken to surgery where a cholecystectomy was performed. Biliary fluid was submitted to the laboratory for culture. Pathology of the gall bladder revealed carcinoma.

E. tarda was isolated in mixed culture (with *Escherichia coli*) on blood, chocolate, and MacConkey plates that had been inoculated with the biliary fluid. Upon initial biochemical workup the isolate was tentatively identified as a possible biogroup 1 *E. tarda* strain on the basis of its positive sucrose reaction and its inability to produce H_2S; the strain was subsequently forwarded to the Microbial Diseases Laboratory for definitive identification.

Table 1 lists the pertinent biochemical and phenotypic characteristics of this strain. Although it was sucrose positive (one day), it did not belong to biogroup 1 *E. tarda* as it was both L-arabinose and D-mannitol negative. This strain also failed to produce H_2S on TSI agar; its lack of hydrogen sulfide production was attributed to the copious amount of acid produced from sucrose metabolism on TSI Agar which dissolved the ferrous sulfide precipitate. This was supported by the fact that this strain of *E. tarda* was strongly H_2S positive on a cysteine-thiosulfate based agar (7). In virulence-related assays, only a cell-associated hemolysin was detected by using 3% sheep erythrocytes. Invasion of HEp-2 cells under a variety of conditions could not be demonstrated (5). By broth microdilution (MicroScan, West Sacramento, Calif.), our strain was found to be susceptible to all agents tested, including ampicillin, ticarcillin, piperacillin, cefoxitin, cefazolin, cefuroxime, cefotaxime, ceftriaxone, ceftazidime, gentamicin, tobramycin, and amikacin.

On the basis of an analysis of 494 strains of *E. tarda* by Ewing (2) only one sucrose-positive strain (0.2%) was identified, making this an extremely rare biochemical characteristic. Since these seminal studies, positive sucrose reactions have been linked to biogroup 1 strains by Grimont et al. (3); all of the strains reported in this study originated from snakes (3). Our strain significantly deviated from the ideal phenotype of biogroup 1 strains in several key tests (notably arabinose and mannitol). Failure to produce a characteristic ferrous sulfide precipitate on TSI agar slants was linked to the copious acid produced from sucrose metabolism. This phenomenon had previously been investigated by Veron and Gasser (7) in members of the *Enterobacteriaceae*, for which high acid production in certain sugar-containing media caused solubilization of iron sulfur formation when the pH dropped during fermentation. The phenotypic result detected on TSI agar indicated an H_2S-negative variant and, coupled with a positive sucrose reaction, suggested a biogroup 1 strain; additional workup indicated both atypical reactions to be due to the rare ability of this strain to ferment sucrose.

Besides unusual biochemical properties, several other aspects of this case report are noteworthy. Of particular interest is the anatomic site of isolation. In only one other instance could we find a case of *E. tarda* associated with bile and a cholecystectomy, that occurring in a female with fever and jaundice (1); no other information was included in that study. Also of interest is the failure of our strain to exhibit several recognized virulence markers associated with *E. tarda*. These include invasion of HEp-2 cells, production of a mannose-resistant hemagglutinin, and failure to elaborate siderophores. These traits, which are usually present in most wild-type strains isolated from humans, may be related to the unusual biochemical characteristics of this strain (4). Since biogroup 1 strains have not been isolated from human infections to date to our knowledge, it is tempting to speculate that lack of infectivity may be related to the absence of

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TABLE 1. Relevant characteristics of sucrose-positive *E. tarda*

Test or characteristic	Reaction	Expected reaction[a]
Oxidase	−	−
Catalase	+	+
Indole	+	+
Motility	+	+
Lysine decarboxylase	+	+
Ornithine decarboxylase	+	+
Arginine dihydrolase	−	−
Voges-Proskauer	−	−
H_2S production		
On TSI agar	−	+
On cysteine-thiosulfate	+	+
Acid from:		
L-Arabinose	−	−
D-Glucose	+	+
D-Rhamnose	−	−
Cellobiose	−	−
Lactose	−	−
Maltose	+	+
Sucrose	+	−
Mannitol	−	−
Sorbitol	−	−
m-Inositol	−	−
Virulence-associated factors		
HEp-2 invasion	−	+
Cell-associated hemolysin	+	+
Mannose-resistant hemagglutination[b]	−	+
Siderophores[c]	−	+

[a] For wild-type strains.
[b] Against group A human erythrocytes.
[c] On chrome azurol S agar.

such these factors. A similar situation apparently exists with *Vibrio vulnificus*, biogroup 1 strains of which are almost invariably recovered from eels and not humans (6). When further analyses of potential pathogenic mechanisms operative in edwardsiellae are undertaken, a clearer picture of the relationship between human infectivity and virulence factors may be forthcoming.

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