Isolation of *Enterobacter intermedium* from the Gallbladder of a Patient with Cholecystitis

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We describe the isolation and identification of *Enterobacter intermedium* from the gallbladder of a patient with cholecystitis. There have been only four documented isolations of this organism from humans; it normally occurs in surface water and unpolluted soils. The identification was initially made by a MicroScan Walk/Away system with a Neg Combo 18 conventional identification-susceptibility panel. The organism is susceptible to the aminoglycosides and imipenem but resistant to the cephalosporins and ciprofloxacin.

*Enterobacter intermedium* is a member of the family *Enterobacteriaceae* and is usually isolated from surface water and unpolluted soil. It was originally characterized by Izard et al. (4) in 1980 and had previously been referred to as “Group H1” (5), a group phenotypically related to *E. cloacae*. It had not been known to occur in humans until 1987, when Prats et al. (8) reported four strains of *E. intermedium* that had been isolated from a foot wound, blood, stool, and bile, respectively. No clinical history was available for any of the patients from whom these specimens were taken. We report here the isolation and identification of *E. intermedium* from the gallbladder of a patient with cholecystitis.

**Case report.** The patient was a 94-year-old white male who was a resident of a personal care home. He had mild senile dementia and hypertension. His medical history included cerebrovascular disease, cardiomegaly secondary to hypertensive cardiomyopathy, vitamin B12 deficiency, prostatism, chronic vertigo, and transient ischemic attacks. He presented to Jefferson Hospital, Pittsburgh, Pa., with a 1-day history of nausea, vomiting, high-grade fever (101.1°F), and epigastric pain. His abdomen was tenderness in the right upper and lower quadrants of his abdomen and a computerized axial tomography scan revealed inflammation in the pancreas. An ultrasound of the gallbladder revealed numerous gallstones in the lumen. His respiratory rate was 20 breaths/min. On examination, the patient had tenderness in the right upper and lower quadrants of his abdomen and a computerized axial tomography scan revealed inflammation in the pancreas. An ultrasound of the gallbladder revealed numerous gallstones in the lumen. His leukocyte count was 20,200, with a left shift in the differential. Chemistry tests revealed an immensely elevated lipase level of 1,218, an amylase level of 421, and a creatinine level of 1,4, all of which are consistent with pancreatitis. With an empirical diagnosis of pancreatitis but needing to rule out gallbladder disease, the patient was given ampicillin-sulbactam (Unasyn) and taken to surgery, where a cholecystectomy was performed. The patient recovered with no complications.

Cultures of the blood and gallbladder were sent to the microbiology laboratory at Jefferson Hospital. The blood culture was negative, but the gallbladder culture yielded a polymicrobial mixture containing group D *Streptococcus*, coagulase-negative *Staphylococcus*, and a gram-negative bacillus identified as *E. intermedium*. The enteric organism was identified by using a MicroScan Walk/Away system (Dade Behring, Inc., West Sacramento, Calif.) with a Neg Combo 18 conventional identification-susceptibility panel. The organism was identified by using a MicroScan Walk/Away system (Dade Behring, Inc., West Sacramento, Calif.) with a Neg Combo 18 conventional identification-susceptibility panel. The profile number was 77101372. Because of the unusual identification, the identification test was repeated by using an API20E strip (bioMérieux Vitek, Inc., Hazelwood, Mo.). This yielded the profile number 1105573 for an identification of *Enterobacter* species at the very good probability level, requiring additional tests of dulcitol fermentation and methyl red production for a definitive identification of *E. intermedium*. The laboratory, however, reported the organism as *Enterobacter* sp.

Confirmatory identification was performed at the Centers for Disease Control and Prevention (CDC) by methods previously cited (1–3). A computer-based program at CDC aids in the identification of isolates that are submitted from hospital laboratories. When the conventional biochemical reactions of a given isolate are entered into the program, the program searches the database and returns a listing of the 50 most closely related isolates that it contains. When the reactions of this organism were entered, 10 of the first 12 strains on the listing were *E. intermedium*, including the type strain and 9 of Izard’s original isolates (4). Our single strain from Prats’ collection (528-V) did not appear on the listing.

When we inoculated this isolate into other commercially available identification systems, we obtained the following answers. The Vitek GNI+ card (bioMérieux Vitek, Inc.) gave a profile number of 6664771632 with an identification of *E. cloacae* (88%) and *E. intermedium* (sic) (5%). The BBL Crystal E/NF system (Becton Dickinson Microbiology Systems, Sparks, Md.) gave a profile number of 5764457156, which was “Unacceptable.” *E. intermedium* is in the Vitek GNI+ database, but it is not in the Crystal database.

Broth microdilution susceptibility testing of the isolate was performed at the Centers for Disease Control and Prevention (CDC) by methods previously cited (1–3). A computer-based program at CDC aids in the identification of isolates that are submitted from hospital laboratories. When the conventional biochemical reactions of a given isolate are entered into the program, the program searches the database and returns a listing of the 50 most closely related isolates that it contains. When the reactions of this organism were entered, 10 of the first 12 strains on the listing were *E. intermedium*, including the type strain and 9 of Izard’s original isolates (4). Our single strain from Prats’ collection (528-V) did not appear on the listing.

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**TABLE 1. Differentiation of *E. intermedium* and *E. cloacae***

<table>
<thead>
<tr>
<th>Test</th>
<th>% Positive strains by species*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>E. intermedium</em></td>
</tr>
<tr>
<td>Acetate utilization</td>
<td>0</td>
</tr>
<tr>
<td>Arginine dihydrolase</td>
<td>0</td>
</tr>
<tr>
<td>Dulcitol, acid</td>
<td>100</td>
</tr>
<tr>
<td>Methyl red</td>
<td>100</td>
</tr>
<tr>
<td>Urease</td>
<td>0</td>
</tr>
</tbody>
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performed (6) by using in-house microdilution plates prepared with cation-adjusted Mueller-Hinton broth (Difco Laboratories, Detroit, Mich.). The organism was susceptible to amikacin, gentamicin, imipenem, meropenem, tobramycin, and trimethoprim-sulfamethoxazole. It was intermediate to piperacillin and tetracycline. It demonstrated resistance to amoxicillin-clavulanic acid, ampicillin, aztreonam, cefazolin, cefotaxime, cefotetan, cefoxitin, ceftazidime, ceftriaxone, cefuroxime, chloramphenicol, ciprofloxacin, ofloxacin, and ticarcillin. Susceptibility results obtained with the MicroScan panel were identical to the CDC reference results for the antibiotics listed above except for one minor error. The organism was determined to be aztreonam intermediate by the MicroScan system (MIC = 16 μg/ml) and aztreonam resistant by broth microdilution (MIC = 64 μg/ml). The MicroScan system also reported resistance to ampicillin-sulbactam and piperacillin-tazobactam.

This organism remains a rare isolate from human specimens. A differential table which may assist in separating the species of Enterobacter has been published previously (7). Table 1 lists biochemical tests that are useful in differentiating E. intermedium from E. cloacae.

We acknowledge the staff of the Microbiology Laboratory at Jefferson Hospital for their contributions to this study.

REFERENCES