Case Report

**Vibrio cholerae** O1 (serovar *inaba*) as a cause of fatal bacteremia in a patient with relapsed acute lymphoblastic leukemia

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**A B S T R A C T**

*Vibrio cholerae* O1 is an uncommon cause of bacteremia with only a few cases reported in published literature. We report a rare and fatal case of dual *E. coli* and *V. cholerae* O1 serovar *inaba* bacteremia in a 29-year-old male patient on chemotherapy for relapsed and refractory B-cell acute lymphoblastic leukemia. He had no associated intestinal symptoms.

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1. **Introduction**

*Vibrio cholerae* are gram-negative bacteria that are differentiated into O1/O139 and non-O1/non-O139 serogroups depending on their ability to agglutinate with specific antiserum. *V. cholerae* O1 and O139, the causative agents of cholera, are morphologically and biochemically identical to the other non-O1 *V. cholerae*, but are antigenically, epidemiologically and clinically distinct. Non-O1 *V. cholerae* can cause small outbreaks of diarrheal illness related to contaminated seafood.1 While there are, numerous case reports of bacteremia caused by non-O1 *V. cholerae* in persons with predisposing conditions, most commonly cirrhosis but also nephrotic syndrome, diabetes, hematologic malignancy, gastrectomy, and AIDS/lymphoma there are only a handful of cases of bacteremia caused by *V. cholerae* O1.2,3 We report a rare case of *V. cholerae* O1 serovar *inaba* bacteremia from India in a patient with severe sepsis but no preceding or concomitant intestinal symptoms.

2. **Case History**

A 29-year-old male was admitted for chemotherapy for relapsed refractory B-cell Acute Lymphoblastic Leukemia (B-ALL) in August 2020. The primary diagnosis of B-ALL was established in January 2014 following which he relapsed in 2015 and since then was on multiple salvage chemotherapy regimens. The patient had history of recent admission to our hospital, for one month duration in April 2020, for intensive chemotherapy.

During the current admission, chemotherapy with bortezomib, rituximab, doxorubicin and dexamethasone was initiated after inserting a PICC (peripherally inserted central catheter) line. He had no urinary catheter. The patient was on a neutropenic diet, no uncooked fruits and vegetables were served to him and only bottled mineral water was used. The patient developed fever on day five of admission with no associated symptoms of diarrhea, dysuria or flank pain. Routine investigations were repeated along with paired...
Table 1: Reported cases of invasive disease caused by *V. cholerae* O1<sup>4–10</sup>

<table>
<thead>
<tr>
<th>No.</th>
<th>Age, sex</th>
<th>Known predisposing factor/s</th>
<th>Clinical presentation</th>
<th>Outcome</th>
<th>Year of publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6 years, Female</td>
<td>Autoimmune disease, achlorhydria</td>
<td>Diarrhea, severe sepsis syndrome</td>
<td>Survived</td>
<td>1977</td>
</tr>
<tr>
<td>2</td>
<td>6 days, Male</td>
<td>Neonate</td>
<td>Diarrhea, afebrile, neutrophilia, uremia</td>
<td>Died</td>
<td>1983</td>
</tr>
<tr>
<td>3</td>
<td>8 months, Female</td>
<td>None</td>
<td>Diarrhea, febrile, neutrophilia</td>
<td>Survived</td>
<td>1992</td>
</tr>
<tr>
<td>4</td>
<td>6 years, Female</td>
<td>Chemotherapy</td>
<td>Meningitis, blood culture negative</td>
<td>Died</td>
<td>1996</td>
</tr>
<tr>
<td>5</td>
<td>79 years, Male</td>
<td>Obese, alcoholic, portal hypertension without cirrhosis</td>
<td>No diarrhea, h/o travel Canary Islands, fever</td>
<td>Survived</td>
<td>2000</td>
</tr>
<tr>
<td>6</td>
<td>2 days, Male</td>
<td>Neonate</td>
<td>No diarrhea</td>
<td>Died</td>
<td>2001</td>
</tr>
<tr>
<td>7</td>
<td>45 years, Female</td>
<td>None</td>
<td>Diarrhea transiently bloody, afebrile</td>
<td>Died</td>
<td>2001</td>
</tr>
<tr>
<td>8</td>
<td>65 years, Female</td>
<td>None</td>
<td>Diarrhea, neutrophilia, renal failure secondary to dehydration</td>
<td>Died of renal failure after 2-3 weeks</td>
<td>2007</td>
</tr>
<tr>
<td>9</td>
<td>70 years, Male</td>
<td>None (past h/o myocardial infarct 40 days back)</td>
<td>Fever, diarrhea</td>
<td>Died</td>
<td>2007</td>
</tr>
<tr>
<td>10</td>
<td>47 years, Male</td>
<td>Primary peritonitis with liver cirrhosis</td>
<td>No diarrhea, hematemesis, dizziness, hypotension &amp; tachycardia</td>
<td>Survived</td>
<td>2009</td>
</tr>
<tr>
<td>11</td>
<td>1 day, Female</td>
<td>Prematurity (27 weeks), mother had premature rupture of membranes for over 36 h, no vomiting or diarrhea in mother</td>
<td>Severe respiratory distress and septic shock</td>
<td>Unknown, was moved to another hospital and lost to follow up</td>
<td>2010 Analysis of 8 cases (1 reported previously Ref Sr No.3 - 1992)</td>
</tr>
<tr>
<td>12</td>
<td>11 days, Male</td>
<td>None</td>
<td>Watery diarrhea, dehydration, septic shock, respiratory distress, leukocytosis, deranged coagulation</td>
<td>Died</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>3 months, female</td>
<td>Concurrent Campylobacter spp. enteritis</td>
<td>Diarrhea, vomiting, leukocytosis</td>
<td>Survived</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>7 months, Female</td>
<td>Concurrent Staphylococcus aureus, supraclavicular abscess</td>
<td>Vomiting, diarrhea, fever, leukocytosis</td>
<td>Survived</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>4 years, Female</td>
<td>None</td>
<td>Vomiting, diarrhea, 4/HPF pus cells in stool</td>
<td>Survived</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>39 years, Female</td>
<td>Hepatitis B virus-associated end-stage liver disease</td>
<td>Fever, ascites</td>
<td>Survived</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>75 years, Female</td>
<td>Malignancy</td>
<td>Diarrhea, vomiting, leukocytosis, deranged coagulation, elevated hepatic enzymes, 4/HPF pus cells in stool</td>
<td>Died</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>29 years, Male</td>
<td>Chemotherapy</td>
<td>No diarrhea</td>
<td>Died</td>
<td>This report</td>
</tr>
</tbody>
</table>
blood cultures and urine cultures. Automated blood culture system was used (BACTEC, BD-USA). The investigations revealed bicytopenia, with a white blood cells of 350/cmm and platelets of 13,000/cmm. He had elevated serum C Reactive Protein (47 mg/dl) and serum procalcitonin (98 ng/ml) levels. In view of febrile neutropenia, treatment with intravenous cefoperazone sulbactam, amikacin and caspofungin was initiated as per institutional protocol. The condition of the patient further deteriorated on the same day with hypotension (blood pressure 86/50 mm Hg), tachycardia (170 beats per minute) and hypoxia. He was shifted to the intensive care unit and supportive treatment initiated. The antimicrobials were escalated to meropenem, teicoplanin & polymyxin B. On day two of fever owing to further deterioration, relatives were explained the need for invasive ventilation, and hemodialysis but they were not willing for the same. Patient had asystole, apnoea and succumbed on the same day.

The blood culture (flagged after patient succumbed) and urine culture reports were available after the patient’s death. Patient’s paired blood culture sent on day one of fever (Left Brachial & Right PICC), grew E. coli & V. cholerae with a differential time to positivity (DTP) of one hour. Identification was done by MALDI-TOF (Vitek MS, Biomerieux- France) and susceptibility testing by automated system (VITEK 2). Identification of V. cholerae was confirmed by serotyping – V. cholerae serovar Inaba at a reference lab (Antiserum Kit Denka Seiken – Central Research Institute Kasauli). The V. cholerae isolate was sensitive to ampicillin, cephalosporins, ciprofloxacin and trimethoprim/sulfamethoxazole. The urine culture grew E. coli (10^5 cfu/ml). Antimicrobial susceptibility pattern of E. coli isolated from blood and urine was identical. The isolate was sensitive only to amikacin, and carbapenems, and resistant to beta lactam- beta lactamase inhibitor (BL-BLI) combinations, ciprofloxacin and third generation cephalosporins.

3. Discussion

The patient died with dual infection with E. coli and V. cholerae and the relative contribution of each of these cannot be delineated. The initial empiric therapy, partially covered E. coli (amikacin) but was appropriate for the V. cholerae isolate. The rapid deterioration despite escalation of antibiotics to meropenem (active against E. coli) was probably due to lack of host defenses, very low neutrophil count, damaged mucosal barriers and dual infection. While the E. coli sepsis possibly originated from the patient’s own endogenous flora of the gut/urine, the source of V. cholerae bacteremia (community acquired or hospital acquired infection) cannot be ascertained. The differential time to positivity of one hour rules out contamination of the central line as a cause of the V. cholerae bacteremia. While we did not culture the stool of the patient as the patient did not have diarrhea, it is reasonable to assume that colonization of the gut from contaminated water/food followed by translocation to the blood stream was the pathogenetic mechanism. We also initiated an investigation wherein food, water/environmental surfaces were cultured and practices in the kitchen audited. No source could be identified and there was no other case of V. cholerae infection in the hospital.

V. cholerae serogroup O1 is generally regarded as a non-invasive enterotoxigenic organism causing gastroenteritis of various severities. This contrasts with non-O1/non-O139 V. cholerae, which can invade the bloodstream causing bacteremia and septicemia. V. cholerae O1 rarely causes bacteremia or invasive extraintestinal disease. The limited reported cases of invasive disease caused by V. cholerae O1 are summarized in Table 1.4-10

Pathogenic mechanisms causing invasion in V. cholerae infections are not well recognized. Possible reasons could be pre-existing disruption of mucosal barrier, achlorhydria, simultaneous infection with an invasive pathogen, translocation of viable V. cholerae via M cells and hemolysin production. Immunocompromised status and prematurity have also been addressed as risk factors.4-10 In our case, the patient had leukemia, chemotherapy, damaged mucosal barriers and associated infection with E. coli as predisposing factors. The patient did not have any history of travel or any episode of diarrhea prior to current admission.

4. Conclusion

Our case shows that serotype 01 can also cause bacteremia similar to V. cholera serotypes non-01/non-139. We recommend clinicians to remember this, as early diagnosis and treatment can be curative in certain patients.

5. Conflicts of Interest

The authors declare no conflicts of interest.

Acknowledgements

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