A Case of Trauma Wound Related Infection Caused by Enterobacter cancerogenus and Aeromonas hydrophila

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Abstract:
We herein describe a case of trauma-related wound infection with a subcutaneous abscess caused by both Enterobacter cancerogenus and Aeromonas hydrophila. An 89-year-old Japanese man was admitted to our hospital because of an injury that he had suffered in a car accident. The right dorsal region of the foot around the wound was reddish and swelling. The pus culture on his right foot grew E. cancerogenus and A. hydrophila. The patient was successfully treated with a 10-day course of meropenem and a 25-day course of levofloxacin. E. cancerogenus can therefore be a causative pathogen in skin and soft tissue infections among trauma patients.

Key words: Enterobacter cancerogenus, trauma, skin and soft tissue infection


Introduction

Enterobacter cancerogenus, previously known as Enterobacter taylorae, is a facultative anaerobic gram-negative bacteria, which can be isolated from the environment (1). Although this organism can cause bone and joint infections after environmental exposure, such as either a crash injury or laceration, human infections caused by E. cancerogenus are rare (2-4). No cases of a wound infection associated with E. cancerogenus have yet been reported in Japan. In this article, we report a case of trauma wound-related infection with a subcutaneous abscess caused by both E. cancerogenus and Aeromonas hydrophila.

Case Report

An 89-year-old Japanese man with chronic kidney disease and polymyalgia rheumatica was admitted to our hospital because of an injury that he had suffered in a car accident. He was hit by a light truck while he was walking a street running through a rice field. He fell into a dirty adjacent waterway next to a rice field after the car accident. He was initially taken to one hospital by ambulance, and later transferred to our hospital about 3 hours after the injury because of multiple wounds. His medications included prednisolone 2 mg/day and lansoprazole 15 mg/day.

On physical examination, the patient was 163 centimeters tall and his weight was 48 kilograms. His blood pressure was 181/89 mm Hg, pulse rate was 94 beats per minute, temperature was 35.9°C, respiratory rate was 24 breaths per minute, and his peripheral arterial oxygen saturation was 95%. His Glasgow Coma Scale score was evaluated as E4, V5, and M6. His physical examination was unremarkable, except for multiple superficial abrasions and a wound in the interdigital area between third and fourth toes, as well as between the fourth and fifth toes of the right foot. The wounds were superficial and measured 2.0 cm in diameter each.

Laboratory data obtained on admission revealed a white blood cell (WBC) count of 25,090/μL with 91% neutrophils, 4% lymphocytes, and 4% monocytes. The hemoglobin level was 10.3 mg/dL, and the platelet count was 214,000/μL. A serum chemistry analysis revealed the following results: sodium 139 mEq/L, potassium 5.5 mEq/L, chloride 104 mEq/L, blood urea nitrogen 35.6 mg/dL, creatinine 1.3 mg/dL, glucose 111 mg/dL, albumin 3.4 g/dL, total protein 6.4 g/dL, AST 45 IU/L, ALT 26 IU/L, lactate dehydrogenase 353 IU/L, alkaline phosphatase 218 U/L, total bilirubin 0.5 mg/dL.
The bacterial strain was identified using a GenBank BLAST search and EzTaxon (http://www.ezbiocloud.net/eztaxon/). The interdigital region of the right foot was closed after wound debridement and irrigation, and his clinical course seemed to go well. However, on day 3, he developed a fever. On physical examination, the right dorsal region of the foot around the wound was reddish and swelling (Figure). The wound was therefore re-opened, and a moderate amount of pus was drained. Osteomyelitis was clinically ruled out. The patient was then started on intravenous cefazolin with 1 g administered every 12 hours.

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In addition, we performed molecular identification by PCR amplification and a sequencing analysis of the 16S rRNA gene using DNA extracted from the isolates. The universal primers 8UA (5’-AGAGTTTGATCMTGGCTCAG-3’) and 1485B (5’-ACGGGCCGTGTGTRC-3’) were used as described previously (5). A sequencing analysis was performed using a GenBank BLAST search and EzTaxon (http://www.ezbiocloud.net/eztaxon/). The bacterial strain was identified as E. cancerogenus according to sequencing analysis of the 16S rRNA gene using DNA extracted from the isolates. The sequence of the 16S rRNA gene was 99.86 % identical (1,408 bp over the entire 1,411 bp fragment) with that of the type strain E. cancerogenus (LMG2693, accession number Z96078). The isolates of E. cancerogenus exhibited susceptibility to piperacillin, piperacillin/tazobactam, cefazidime, cefepime, meropenem, gentamicin, levofloxacin, minocycline, and trimethoprim/sulfamethoxazole. However, the isolate from our patient was resistant to ceftriaxone.

On day 13, the patient was switched to treatment with levofloxacin based on the findings of the susceptibility test. The patient was successfully treated with a 10-day course of meropenem and a 25-day course of levofloxacin. No evidence of any infection relapse was noted at the 2-month follow-up.

**Discussion**

We herein describe a case of trauma wound-related cellulitis with a subcutaneous abscess caused by both E. cancerogenus and A. hydrophila. To date, nineteen species in this genus have been identified, including Enterobacter cloacae and Enterobacter aerogenes, which are common organisms isolated from humans (6). In contrast, the other species are mostly isolated from environmental sources (1). E. cancerogenus has a DNA sequence homology of 61% to that of E. cloacae and it differs from it mostly by being ornithine decarboxylase negative and D-arabinose positive (3). E. cancerogenus is rarely recognized, but it is associated with human infections. Approximately 1 % of Enterobacter infections are due to E. cancerogenus (4), and these infections seem to occur mostly in the setting of contaminated wounds, as in the present case. A previous case series from the United States showed 59 percent of all published cases of E. cancerogenus have been secondary to trauma, and the mortality rate was 11% (4). It is possible that the actual mortality rate caused by E. cancerogenus infection is lower because the mortality rate may be more closely related to the trauma itself rather than to the resulting E. cancerogenus infection. In addition, there have been case reports of E. cancerogenus causing osteomyelitis (3) bacteremia (7), urinary tract infection (8), and pneumonia (9). The pathogenicity of this organism remains unknown, therefore, further studies are needed to clarify the clinical characteristics of infections due to E. cancerogenus. Based on a previous study, E. cancerogenus is naturally resistant to amoxicillin, amoxicillin/clavulanic acid, cefaclor, cefazoline, and cefoxitin (10). In general, the β-lactam sensitivity of E. cancerogenus seems to be similar to that of other common Enterobacter spcies, such as E. cloacae and E. aerogenes (10). In the present case, the pattern of antibiotic susceptibility was similar to that described in previous reports.

The Aeromonads are Gram-negative, non-acid-fast facultative anaerobes that are widely distributed in the soil and in aquatic environments (11). Aeromonas infection is also associated with both skin and soft tissue infections, especially wound infections (12). In the present case, the patient had a history of contact after falling into a dirty waterway after a car crush injury. Major traumatic events, such as car or motorcycle accidents, also can lead to severe infections (13). Although the typical presentation is cellulitis, the disease pattern can vary from an uncomplicated wound infection to severe soft tissue infections, including myonecrosis and necrotizing fasciitis. In addition, fatal Aeromonas infections are often seen in patients with either liver diseases or malig-
In conclusion, we herein reported a case of *E. cancerogenus* and *A. hydrophila* infection associated with trauma wound-related cellulitis and the development of a subcutaneous abscess. This is the first case report of a skin and soft tissue infection caused by *E. cancerogenus* in Japan. In addition to *A. hydrophila*, *E. cancerogenus* can be a causative pathogen in skin and soft tissue infections among trauma patients. *E. cancerogenus* may therefore be a more important human pathogen than previously thought. Further studies are needed to elucidate the typical characteristics of this infection.

The authors state that they have no Conflict of Interest (COI).

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pressuralis comb. nov. and Lelliottia annigena comb. nov., respectively, *E. gergoviae* and *E. pyrini* into *Pluralibacter* gen. nov. as *Pluralibacter gergoviae* comb. nov. and *Pluralibacter pyrini* comb. nov., respectively, *E. cownii*, *E. radicincitans*, *E. oryzae* and *E. arachidis* into *Kosakonia* gen. nov. as *Kosakonia cownii* comb. nov., *Kosakonia radicincitans* comb. nov., *Kosakonia oryzae* comb. nov. and *Kosakonia arachidis* comb. nov., respectively, and *E. tu-
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