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Osteomyelitis Caused by *Enterobacter taylorae*, Formerly Enteric Group 19

T. ULF WESTBLOM[1]* AND MARK E. COGGINS[2]

Marshall University School of Medicine, Huntington, West Virginia 25701,[1] and SUNY Upstate Medical Center, Syracuse, New York 13210[2]

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The first case of osteomyelitis caused by *Enterobacter taylorae* is presented. The infection occurred as a complication to an open fracture in an otherwise healthy host. Despite antimicrobial therapy, based on in vitro susceptibilities, it was not possible to establish a microbiologic cure.

Enteric group 19 is a biochemically distinct group of gram-negative rods that differs from other known biogroups of members of the family *Enterobacteriaceae*. In 1985, its characteristics were described and the name *Enterobacter taylorae* was proposed (3). The number of human isolates of this organism is small, and clinical information on associated illnesses is limited. We present the first case of osteomyelitis caused by this newly recognized organism.

A previously healthy 18-year-old male was a party in a motor vehicle accident and suffered an open, comminuted, supracondylar-intracondylar fracture of his left femur. He was treated with open reduction and internal fixation, and a skin graft was applied to cover the wound. Cefazolin, 1 g every 8 h for 3 days, was given as prophylaxis during surgery. When discharged after 8 weeks of hospitalization, he was feeling well but had experienced unexplained low-grade fevers on and off for about 2 weeks. These worsened at home and were accompanied by minor chills and sweats. After an episode of bleeding through his cast, the patient was readmitted and a swab culture of his wound grew *E. taylorae* and *E. cloacae*. He was treated with cefotaxime, 2 g every 8 h, which after 2 days was changed to cefoperazone, 2 g every 12 h for another 10 days. He was then discharged with oral cefadroxil for 2 weeks and topical neomycin-polymyxin B bandages. The patient did not experience any more fevers at home but had pain from his leg and a continuous drainage from the wound. Outpatient swab cultures of this drainage repeatedly grew *E. taylorae*, and the patient was again admitted, 4 months after his first injury. A leukocyte count and erythrocyte sedimentation rate were within normal limits, but when intraoperative bone biopsy was performed it grew a pure growth of *E. taylorae*. The organism was resistant to cefalothin and cefadroxil (MIC, >16) but susceptible to cefotaxime (MIC, <2), cefoperazone (MIC, <4), piperacillin and ticarcillin (MIC, <8), tobramycin and gentamicin (MIC, <1), tetracycline (MIC, 2), and ampicillin (MIC, 4). The patient was treated with cefotaxime, 2 g every 6 h, and gradually improved with significant decrease in pain and drainage. Four weeks into his hospitalization, the patient developed a nosocomial superinfection of his wound with *Pseudomonas aeruginosa*. Extensive debridement was performed. At the time of surgery, gross pus was coming from the bone and there was nonhealing of the fracture. All purulent-appearing bone was resected, which included 90% of the bone from the condyle to the distal shaft. *P. aeruginosa* and *E. taylorae* were cultured from the bone. The resistance pattern for the *E. taylorae* was unchanged from that of the isolate examined 3 months earlier. Tobramycin was then added to the antibiotic regimen, but the infection was not eradicated, and a bone graft eventually had to be removed. Repeat bone cultures grew *P. aeruginosa* and *E. taylorae*, and the patient has subsequently gone on to develop chronic osteomyelitis, with both organisms growing from purulent exudate.

The biochemical characteristics of *E. taylorae* and methods of differentiation from other species of *Enterobacter* are well described (1–3) (Table 1). The most extensive of these reviews based their data on 94 human isolates, but these consisted primarily of strains submitted to the Centers for Disease Control for identification and the authors noted that little was known about the clinical significance of this new organism (3).

We believe our case to be the first report of osteomyelitis with *E. taylorae*. The organism was repeatedly cultured from drainage material and grew in pure growth from bone biopsy. The history of an open fracture suggests an environmental source of the organism. We are unaware of any soil cultures

TABLE 1. Biochemical characteristics of the isolated organism

Test	Result
Oxidase	−
Catalase	+
Urease	−
Hydrogen sulfide	−
Indole	−
Lysine	−
Arginine	−
Ornithine	+
Tryptophan	−
Esculin	+
Voges-Proskauer	+
Citrate	+
Malonate	+
ONPG[a]	+
Acid production from:	
Glucose	+
Sucrose	−
Sorbitol	−
Raffinose	−
Rhamnose	+
Arabinose	+
Inositol	−
Adonitol	−
Melibiose	−

[a] ONPG, *o*-Nitrophenyl-β-D-galactopyranoside.

* Corresponding author.

of *E. taylorae*, but the organism has previously been recovered from a water source at least once (3). The symptoms of the patient did not differ significantly from those of other patients with gram-negative osteomyelitis, and we observed that *E. taylorae* is capable of causing the same morbidity as other species of *Enterobacter*. Our strain showed an antimicrobial susceptibility pattern similar to those previously described (4). It was resistant to cefazolin, which was used for prophylaxis at the time of initial surgery; this resistance may have helped select for the organism. Despite adequate antimicrobial therapy, on the basis of in vitro susceptibilities, we were unable to eradicate the infection. The superinfection with *P. aeruginosa*, however, complicated the patient's course in the end. Extensive debridement of infected bone was performed, but in retrospect the single addition of tobramycin for this infection may have been suboptimal therapy. *E. taylorae*, however, was susceptible to both tobramycin and cefotaxime, but we were still unable to clear the infection. We hope that this does not represent an inherent therapeutical problem with this organism, but proof of this will have to await reports of other similar infections.

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