Escherichia hermannii Infection of a Cephalohematoma: Case Report, Review of the Literature, and Description of a Novel Invasive Pathogen

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We describe a neonate with bacterial infection of a cephalohematoma by Escherichia hermannii and with meningitis. We review the literature on infected cephalohematomas and E. hermannii and document the first case of invasive disease due to this pathogen.

Case report. A five-day-old infant was admitted to the neonatal intensive care unit with fever, seizures, and lethargy. Caretakers reported a 12-h history of intermittent stiffening of the extremities, accompanied by pallor and labored respiration. Prenatal history included vaginal delivery at 38 weeks gestation, labor complicated by prolonged rupture of membranes (18 h), and maternal fever. Ampicillin and gentamicin were administered 2 h prior to delivery. A fetal scalp electrode was used for intrapartum monitoring. At birth, a right parietal cephalohematoma was noted, and the hospital stay was complicated by hyperbilirubinemia, which was treated with phototherapy. The infant was discharged on the third day of life and was healthy until 12 h prior to hospital admission.

On admission, the patient was febrile, tachycardic, and tachypneic and had a widened pulse pressure. Findings of a physical examination were remarkable for lethargy, hypotonia, and a large right parietal cephalohematoma. After 2 generalized seizures, a loading dose of phenobarbital was administered. Complete blood cell count, electrolyte levels, blood culture, urinalysis, and urine culture were done, and CSF samples were obtained. A single dose of ceftriaxone was given prior to obtaining samples for culture. CSF samples were sent to the laboratory for bacterial culture, cell count, and chemical analysis, as well as for detection of herpes simplex virus and enterovirus by PCR. Analysis of the CSF revealed 12 WBCs/mm³, with a differential of 79% neutrophils and 15% lymphocytes; 757 RBCs/mm³; a glucose level of <1 mg/dL; and a protein level of 583 mg/dL. Gram stain demonstrated gram-negative rods. The peripheral WBC count was 1200 cells/mm³, with a differential of 4% neutrophils, 28% bands, 60% lymphocytes, and 2% monocytes. The hematocrit was 35%, and the platelet count was 252,000 cells/mm³. Electrolyte levels were normal, except for a calcium level of 3.6 mg/dL and a bicarbonate level of 15 mEq/L. Results of urinalysis were unremarkable. Intravenous cefotaxime, ampicillin, gentamicin, and acyclovir were administered. During the first 48 h, the patient required crystalloid, inotropic support, supplemental oxygen, calcium chloride, and phenobarbital.

CSF cultures grew Escherichia hermannii. Blood and urine cultures were negative for E. hermannii, as was the herpes simplex virus and enterovirus analysis of CSF by PCR. After 48 h of antimicrobial therapy, a second lumbar puncture was performed (table 1). CSF gram stain was negative for E. hermannii, but CSF culture again grew E. hermannii. On the basis of antimicrobial susceptibility patterns, antibiotic coverage was narrowed to include only cefotaxime and gentamicin.

The patient demonstrated neurologic improvement by the third day of hospitalization but had persistent fevers, with increasing size and tenderness of the cephalohematoma. CT of the head revealed parenchymal hematomas (consistent with birth trauma) and a large extracranial soft-tissue density with fluid adjacent to the right parietal calvarium, which is consistent with a cephalohematoma. The cephalohematoma was suspected to be a nidus of infection and was aspirated, and a culture of this fluid grew E. hermannii.

Despite appropriate antimicrobial therapy and multiple aspirations of the cephalohematoma, the patient continued to have seizures and persistent fever. A repeat CT demonstrated a decrease in the size of the cephalohematoma. Because of the lack of clinical improvement, a surgical debridement of the cephalohematoma was performed on the tenth day after hospital admission. After debridement, the patient’s condition gradually improved, and CSF and cephalohematoma aspirates were negative for E. hermannii. An evaluation of the patient’s
Table 1. Culture and CSF-analysis results for an infant with infection of a cephalohematoma.

<table>
<thead>
<tr>
<th>Test</th>
<th>Result, by day of hospitalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cephalohematoma aspirate culture</td>
<td>ND ND + + − ND +</td>
</tr>
<tr>
<td>CSF analysis</td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td>+ + + ND ND − ND</td>
</tr>
<tr>
<td>WBC count, cells/mm³</td>
<td>13 1000 237 ND ND 587 ND</td>
</tr>
<tr>
<td>Protein level, mg/dL</td>
<td>583 272 152 ND ND 341 ND</td>
</tr>
<tr>
<td>Glucose level, mg/dL</td>
<td>0 0 0 ND ND 3 ND</td>
</tr>
</tbody>
</table>

**NOTE.** ND, not done; +, positive for Escherichia hermannii; −, negative for E. hermannii.

immune status revealed no abnormalities. After 4.5 weeks, the patient was discharged from the hospital to complete a 6-week course of intravenous ceftriaxone at home for treatment of presumed osteomyelitis of the calvarium.

**Review of the literature.** We report here the first documented case of invasive E. hermannii infection of a cephalohematoma and the CSF of a neonate. A cephalohematoma is noted in ~1%–2% of spontaneous vaginal deliveries and ~3%–4% of forceps or vacuum-assisted deliveries [1]. Anatomically, a cephalohematoma is defined as a subperiosteal accumulation of blood beneath ≥1 of the bones in the skull. The most common location is under the right parietal bone and may be associated with an underlying skull fracture. Resolution typically occurs without treatment by 3–4 months of age. Anemia and hyperbilirubinemia are common sequelae, but cephalohematomas rarely become spontaneously infected. Surgical drainage of uncomplicated cephalohematomas is contraindicated because of the usually benign course, the propensity for reaccumulation with resultant hemodynamic instability, and the possibility of introducing microorganisms into a sterile space.

In the literature, there have been sporadic reports of infected cephalohematomas. In 1993, Blom and Vreede [2] reviewed 27 cases that occurred between 1818 and 1993. The first 2 reported cases (in 1818 and 1907) followed incision of the cephalohematoma. Other reported risk factors have included aspiration of the cephalohematoma, scalp infection, forceps delivery, and sepsis. Six of the 12 cases reported after 1975 have been associated with fetal scalp electrode use. An additional case was reported in 1999 [1].

Infected cephalohematomas present as either early onset (during the first or second week of life) or late onset (≥3 weeks after birth). In the first 2 weeks of life, cephalohematoma infection may follow bacterial sepsis (with or without meningitis), secondary to bacteremic seeding [2–6]. Although a rare occurrence, this insertion should be suspected if a cephalohematoma enlarges during treatment of primary sepsis. In addition, if the health of an infant who has received adequate treatment deteriorates after antibiotic therapy is stopped, the cephalohematoma should be suspected as a nidus of infection and should be aspirated for diagnostic purposes. If the cephalohematoma is found to harbor the pathogenic organism, incision and drainage should be undertaken promptly. The result of a delay in diagnosis or drainage can be fatal, as described in the case report by Blom in 1993 [2]: A neonate treated appropriately for Escherichia coli sepsis developed recurrent symptoms 48 h after discontinuation of antimicrobials. Gram-negative rods were identified from fluid aspirated from the cephalohematoma. Despite reinstitution of appropriate antibiotics, the neonate died of E. coli sepsis before the planned debridement could be undertaken.

Late presentation occurs when an older infant with cephalohematoma develops cellulitis over the involved area of the skull [1, 2, 7–9]. At the time of diagnosis, osteomyelitis often is obvious by radiographic studies. Again, incision and drainage is mandatory. In both early and late presentations, long-term antibiotic treatment is indicated, since osteomyelitis is likely to complicate subperiosteal infection.

With either early or late onset of infection, the potential for cephalohematomas to harbor microorganisms must be recognized. Warning signs include enlarging cephalohematomas, overlying erythema and tenderness, increasing head circumference with a CT scan negative for other focal lesions, and continuing signs of uncontrolled infection.

The infecting organism most commonly reported in both early onset and late onset cases is E. coli (12/27 cases) [2]. Other reported organisms include Staphylococcus aureus; Staphylococcus epidermidis; Pseudomonas, Proteus, Bacteroides, Salmonella, and Gardnerella species; and group B Streptococcus (GBS), each of which has been reported once as the infecting organism. In 7 of 27 cases reported between 1818 and 1952, no pathogen was isolated. No polymicrobial infections have been reported.

**E. hermannii.** First described in 1982, E. hermannii is a member of the family Enterobacteriaceae [10]. Formerly classified as enteric group 11 of E. coli, it was reclassified as a distinct species within the Escherichia genus after unique genomic features were identified. Biochemically, E. hermannii is distinguished from E. coli because it is cellulbiose positive and produces a yellow pigment. E. hermannii has been isolated from environmental sources and rarely from polymicrobial human infections, but it is not considered to be pathogenic. Most isolates have been identified from wound, respiratory, and stool specimens. In contrast with E. coli, this organism has not been recovered from the genitourinary tract. E. hermannii has been found to be nonpathogenic when investigated in a murine...
model of intraperitoneal infection, whereas *E. coli* was lethal in the same model.

In vitro susceptibility studies have been conducted on clinical and laboratory isolates of *E. hermannii* [10, 11]. The organism produces β-lactamase and exhibits a distinctive antibiotic resistance pattern, with resistance to penicillin, ampicillin, and carbenicillin. Resistance to amoxicillin is reversible if amoxicillin is administered in combination with the β-lactamase inhibitor clavulanate. No cephalosporin resistance has been detected in limited studies. *E. hermannii* is also susceptible to trimethoprim-sulfamethoxazole.

To date, only 1 case of human infection in which *E. hermannii* was a potential invasive pathogen has been reported [12]. *E. hermannii* was cultured from the blood of a septic neonate with a bowel perforation, along with *Serratia liquefaciens* and *Candida albicans*. *E. hermannii* was the only organism identified in the CSF and peritoneal fluid, but its pathogenic role in this patient was uncertain.

Our report is the first to document *E. hermannii* as the sole invasive pathogen. The organism was isolated by culture from multiple CSF specimens, as well as from fluid aspirated from an enlarging cephalohematoma, and showed an antibiotic resistance pattern typical for the organism. A potentially confounding factor was the single dose of antibiotic given prior to obtaining either blood or CSF specimens for culture. Another pathogen may have been inhibited by this dose and was never identified; however, this possibility is unlikely, since the growth of *E. hermannii* was rapid and persisted over a period of 9 days, and no other organisms was detected on Gram stain of clinical specimens. As further evidence of the pathogenic role of *E. hermannii* in the infection in this infant, the waxing and waning of symptoms and signs closely paralleled the isolation and clearance of *E. hermannii*, as determined by culture.

Recently, use of ampicillin as prophylaxis against GBS infection in pregnant women has increased, and the incidence of early onset GBS disease has decreased. Many experts have speculated that this practice could select for neonatal disease due to other bacterial pathogens, especially gram-negative organisms. Ampicillin also is commonly used for the treatment of perinatal maternal fever. Because of the resistance of *E. hermannii* to ampicillin, selective pressure could favor the emergence of *E. hermannii* as a pathogen, and clinicians should be aware of this organism’s pathogenic potential.

References