CORYNEBACTERIUM XEROSIS
VENTRICULOOPERITONEAL SHUNT INFECTION IN AN INFANT: REPORT OF A CASE AND REVIEW OF THE LITERATURE

The genus Corynebacterium is composed of a wide variety of Gram-positive, non-acid-fast, nonmotile, rod-shaped, catalase-positive bacteria. The bulk of the species is considered to be normal cutaneous, pharyngeal and gastrointestinal flora of humans. Corynebacterium diphtheriae is recognized as an obligate human pathogen but several normally avirulent diphtheroids such as Corynebacterium jeikeium, striatum, xerosis, minutissimum and pseudodiphtheritcicum have been shown to cause a variety of infectious diseases in humans. Corynebacterium xerosis has been reported as a rare but serious cause of bacteremia, septicemia, pneumonia, septic arthritis, vertebral osteomyelitis, meningitis and, most commonly, endocarditis in adults. It has also been isolated from wounds including amputation sites, from an arterio-venous shunt and from an implanted vascular catheter. To our knowledge we describe the first case of ventriculooperitoneal shunt infection caused by C. xerosis. In addition we provide a review of the current literature concerning invasive disease produced by this organism.

Case report. A 5-month-old black female was admitted to Texas Children’s Hospital in October, 1992, with a 48-hour history of irritability, lethargy, anorexia, vomiting and a fever to 38.8°C. At birth she was a 1,100-g, 27-week pre-
mature infant with a Grade IV intraventricular hemorrhage who required placement of a right parietal ventriculoperitoneal (VP) shunt for increasing frontal occipital circumference caused by hydrocephalus.

Physical examination upon admission revealed an alert but irritable infant with a temperature of 37.2°C. Other vital signs were within normal limits. The anterior fontanelle was soft and not bulging. The sagittal suture remained somewhat split but the lambdoid and coronal sutures were overlapping. The VP shunt was functioning appropriately. The remainder of her examination was unremarkable.

Initial laboratory studies included a white blood cell count of 12,300/mm³ with 62% neutrophils, 12% band forms, 23% lymphocytes and 3% monocytes. Urinalysis and blood chemistries were normal. A cerebrospinal fluid sample was aseptically collected from the shunt bubble. The fluid was clear and colorless with 57 white blood cells/mm³ (1% neutrophils, 97% lymphocytes and 2% eosinophils), 10 red blood cells/mm³, protein of 117 mg/dl and glucose of 43 mg/dl. The serum glucose was 118 mg/dl. No organisms were seen on Gram stained smear or an India ink preparation. Acid-fast smears were also negative. The shunt fluid was submitted for bacterial, mycobacterial and fungal cultures. Cultures of blood, urine and stool were obtained at the same time and revealed no pathogens.

On the basis of analyses of the shunt fluid, the child was hospitalized with a diagnosis of VP shunt infection. Intravenous vancomycin in a dosage of 60 mg/kg/day and amikacin 30 mg/kg/day were administered. On the second hospital day a repeat shunt tap was performed. An examination of the shunt fluid showed findings similar to those of the first sample but a Gram-stained smear revealed few Gram-positive rods.

Approximately 48 hours after admission the VP shunt was removed and a ventriculostomy tube was placed. Ventricular fluid obtained at that time showed 34 white blood cells/mm³ (3% neutrophils, 95% lymphocytes and 2% eosinophils, 35 red blood cells/mm³, a protein of 104 mg/dl and a glucose of 42 mg/dl. The serum glucose was 80 mg/dl. No organisms were seen on a Gram-stained smear of the fluid. At that time cultures of the cerebrospinal fluid (CSF) obtained upon admission were reported positive for C. acnes. C. acnes was eventually isolated from all shunt and ventricular fluid specimens collected over the first 3 days of observation. All isolates were gram-positive, catalase-positive and nonmotile. Biochemical identification of the isolates was accomplished with the Vitek Identification System (Vitek Systems bioMerieux USA, Hazelwood, MO). All isolates were susceptible to chloramphenicol, erythromycin, clindamycin, gentamicin, vancomycin and penicillin and resistant to cephalothin, oxacillin by disk diffusion testing. Susceptibility to penicillin minimal inhibitory concentration (MIC) = minimal bactericidal concentration (MBC = 0.125 μg/ml) and erythromycin (MIC = MBC = 0.25 μg/ml) was confirmed by tube dilution studies. The organism also was susceptible to amikacin (MIC = MBC = 0.25 μg/ml) and cefotaxime (MIC = MBC = 0.125 μg/ml).

After a 5-day course of vancomycin and amikacin, the patient's antimicrobial therapy was changed to intravenous penicillin G in a dosage of 25,000 units/kg/day and erythromycin lactobionate in a dosage of 30 mg/kg/day. The child's symptoms gradually resolved. After serial CSF samples were reported sterile, the right parietal ventriculostomy tube was removed and a left parietal VP shunt was placed on the 9th hospital day. The patient eventually received a 5-day course of erythromycin and a 14-day course of parenteral penicillin G. She was discharged on the 17th hospital day with no medication. Mycobacterial and fungal cultures of ventricular and shunt fluid specimens were subsequently reported as negative.

**Discussion.** The genus *Corynebacterium* was originally created for the diphtheria bacillus and a few other animal pathogens. Subsequently, and over the course of many years, several bacterial species of human, animal and plant origin were included in the genus on morphologic grounds creating a burgeoning collection of Gram-positive, club-shaped or curved, nonmotile, nonspore-forming, non-acid-fast, aerobic or facultatively anaerobic rods. This includes

<table>
<thead>
<tr>
<th>Case</th>
<th>Reference</th>
<th>Sex/Age</th>
<th>Illness</th>
<th>Source</th>
<th>Predisposition</th>
<th>Therapy</th>
<th>Outcome</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>M, 41 years</td>
<td>Endocarditis</td>
<td>Blood</td>
<td>Pneuritic valve</td>
<td>Cephalothin</td>
<td>Died</td>
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<tr>
<td>2</td>
<td>3</td>
<td>M, 44 years</td>
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<td>Blood</td>
<td>Blood, wound, sputum</td>
<td>Penicillin G</td>
<td>Recovered</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>M, 83 years</td>
<td>Endocarditis</td>
<td>Blood, wound, sputum</td>
<td>Perforation of aortic colon</td>
<td>Gentamicin</td>
<td>Died</td>
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<td>4</td>
<td>4</td>
<td>M, 49 years</td>
<td>Sepsis</td>
<td>Blood, sputum</td>
<td>Hemolytic</td>
<td>Chloramphenicol</td>
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<td>5</td>
<td>4</td>
<td>M, 63 years</td>
<td>Pneumonia with empyema</td>
<td>Sputum, pleural fluid</td>
<td>Penicillin, flucloxacillin</td>
<td>Carcinoma of lung</td>
<td>?</td>
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<td>Gentamicin</td>
<td>?</td>
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<td>7</td>
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<td>M, 92 years</td>
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</tr>
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<td>7</td>
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<td>Blood</td>
<td>Diabetes, fever</td>
<td>Penicillin G</td>
<td>Recovered</td>
</tr>
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<td>10</td>
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<td>Blood, sputum</td>
<td>Prosthetic valve</td>
<td>Cloxacillin</td>
<td>Recovered</td>
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<td>10</td>
<td>11</td>
<td>M, 61 years</td>
<td>Ventricular endocarditis</td>
<td>Blood</td>
<td>Shy-Draize syndrome</td>
<td>Penicillin G</td>
<td>Recovered</td>
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<td>11</td>
<td>12</td>
<td>M, 85 years</td>
<td>Endocarditis</td>
<td>Blood</td>
<td>Aspiration of nasogastric tube</td>
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<td>Recovered</td>
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<td>Recovered</td>
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<td>15</td>
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<td>M, 29 years</td>
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<td>CSF</td>
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<td>Penicillin G</td>
<td>Recovered</td>
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<td>24</td>
<td>F, 28 years</td>
<td>Meningitis</td>
<td>CSF</td>
<td>VP shunt</td>
<td>Vancomycin, Penicillin G</td>
<td>Recovered</td>
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<tr>
<td>17</td>
<td>Present</td>
<td>F, 5 months</td>
<td>Meningitis</td>
<td>CSF</td>
<td>VP shunt</td>
<td>Penicillin G</td>
<td>Recovered</td>
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</table>
both obligate and opportunistic human pathogens. Nondiphtheria Corynebacteria (diphtheroids) are considered normal inhabitants of mucosa and skin but the incidence of opportunistic infections caused by these organisms has steadily increased.

Although C. xerosis is a common inhabitant of the nasopharynx, skin and conjunctiva, a review of the literature has shown it to be a rare cause of invasive disease in adults (Table 1). However, of the 16 previously reported cases 15 involved patients with prosthetic devices and/or predisposing conditions. Three patients had prosthetic valves, 1 patient had a central venous access catheter and 3 other patients were on hemodialysis presumably had vascular catheters. One patient with endocarditis was a previously healthy individual. Of the total cases 3 had fulminant courses ending in the death of the patient. One represented the first description of C. xerosis meningitis to appear in the literature. This case involved a previously healthy 76-year-old woman who developed meningitis with coma and seizures after spinal anesthesia. The administration of penicillin, ampicillin, dexa-methasone and maminol led to a complete resolution of symptoms.

To our knowledge the patient described here is the first reported case of invasive disease caused by C. xerosis in a child and the second case of central nervous system infection caused by this organism. It is possible that the isolation of C. xerosis from the VP shunt in this case represents colonization or contamination. However, the patient's clinical condition, laboratory findings, and repeated absence of the organism from CSF was consistent with shunt infection, meningitis and ventriculitis. It is possible that infection occurred during surgical placement of the VP shunt because of the normal cutaneous habitat of C. xerosis.

In most instances the isolation of corynebacteria from clinical specimens such as blood or CSF is considered as an indication of cutaneous contamination. As a result the identification of Corynebacterium to the species level (other than ruling out C. diphtheriae) is not often attempted. However, under certain circumstances a full identification and antimicrobial susceptibility testing of the isolate is warranted. The clinical significance of a single positive culture for Corynebacterium is questionable, but repeated isolation of the same organism especially from an immunocompromised patient or a patient with an indwelling or transcutaneous catheter, prosthesis or previous instrumentation should be evaluated.

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