cephalosporins (8, 9). Positive cultures were detected in three of the 85 patients after 24 h of antibiotic therapy, although the count had decreased at least 100-fold compared to pretreatment levels. All positive cultures after the start of therapy were from the CSF of neonates who had initial concentrations equal to or greater than $10^7$ CFU/ml.

Children aged from 1 to 6 months had significantly higher CSF bacterial counts than the other age groups ($p < 0.05$). This could be explained by a delay in the diagnosis which is more difficult to establish in younger infants. The other groups showed no significant differences in the mean levels of bacteria.

Results from the present study corroborate those of Feldman and Richmond (2), who found no relationship between the concentration of bacteria in CSF and CSF leukocytes counts.

In conclusion, determination of bacterial colony counts in CSF of children with meningitis is a simple procedure that could be used to predict a decrease of antibiotic activity and an unfavorable prognosis. Since colony counts over $10^7$ CFU/ml are critical for the outcome, the search for means to increase antibiotic efficacy is warranted. Further clinical studies are indicated to evaluate antibiotics which produce no inoculum effect, antibiotic combinations, higher dosages and supportive therapy.

References

Acute Pyelonephritis Due to a Kluyvera Species in a Child

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A Kluyvera sp. was recovered from the urine of a previously healthy 5-year-old child with clinical and laboratory evidence of acute pyelonephritis. This pathogen is usually a saprophyte and even when recovered in humans it is ordinarily considered an opportunistic pathogen. Only two other cases of Kluyvera infection have been described in immunocompetent individuals. The case presented further supports the finding that this bacterium can cause severe disease even in previously healthy, immunocompetent children.

Kluyvera spp., recently characterized gram-negative rods of the family Enterobacteriaceae, are found in water, soil, sewage and hospital environments and are known pathogens in animals (1). They have been isolated from throat swabs and clinical specimens of sputum, stool, urine, soft tissues and blood (1-4), but their role in the pathogenicity of clinical disease has not been clearly established. We report the case of a 5-year-old girl with acute pyelonephritis caused by a Kluyvera sp.

Case Report. The 5-year-old girl presented at the emergency room with a four-day history of fever of up to 39 °C, vomiting, dysuria and right flank pain. She had been seen with the same complaints three days earlier by her family physician, who had prescribed amoxicillin 40 mg/kg/day after obtaining a urine sample for urinalysis and culture. The patient had no history of urinary tract infections.

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On physical examination the patient was pale, appeared ill and had a rectal temperature of 39°C. Right flank tenderness was easily elicited. The physical examination was otherwise normal. Urinalysis revealed a pH of 7. Traces of protein were detected by use of a Labstick (Miles, USA). Over 50 leukocytes and 5 to 7 erythrocytes per high power field were found. The peripheral leukocyte count was 6,800 cells/mm³, with 6% band forms and 72% neutrophils. The erythrocyte sedimentation rate was 110 mm in the first hour. The C-reactive protein value, which is normally negative, was +3, as determined by a capillary tube serum technique, (Difco, USA). The serum urea and creatinine were within normal limits.

The child was hospitalized with a diagnosis of pyelonephritis and was treated with intravenous cefazoline 75 mg/kg/day. Within two days the fever remitted, dysuria disappeared and she stopped vomiting. Ultrasonography of the abdomen showed normal-sized kidneys with no dilatation of the collecting system. The urine specimen obtained by the family physician was plated on 5% sheep blood agar and grew over 100,000 colonies of a Kluyvera sp. as identified by routine biochemical assay according to the recommendations of the Centers for Disease Control and the Roche method (Cobas Rotor, Hoffmann-La-Roche, Switzerland). The bacterium was shown to be oxidase-negative. Other reactions included hydrolysis of ONPG; oxidation of lactose, glucose, maltose, mannitol and xylose; fermentation of raffinose, rhamnose, L-arabinose and glucose; decarboxylation of ornithine; utilization of malonate and citrate; and negative urease, arginine dihydrolase, DNase and tryptophan deaminase tests. The Kluyvera strain was sensitive to furadantin, nalidixic acid and trimethoprim-sulfamethoxazole but resistant to ampicillin. Tests for sensitivity to the cephalosporins were not performed. The second urine culture obtained upon hospitalization was sterile.

Treatment of the child with intravenous cefazoline for five days and subsequently with oral cephalxin for five days resulted in complete clinical recovery. Urine culture performed after completion of therapy was sterile.

Discussion. In 1964 Farmer et al. (1) isolated a previously unknown species of the family Enterobacteriaceae, which he called "Enteric group 8" or "API group 1." In 1978 one of Farmer's group noticed that this strain was similar to an organism described by Assai in 1956 (5). He named it Kluyvera after A.J. Kluyver, in acknowledgement of Kluyver's research on the physiology of the Enterobacteriaceae family. These previously reported names "Enteric group 8" and "API group 1" are not in use today. The new genus Kluyvera has three species: Kluyvera ascorbata, Kluyvera cryocrescens and Kluyvera spp. group 3, which includes other Kluyvera spp. that do not meet the criteria for the first two species.

The literature contains only sparse data on Kluyvera as a human pathogen. Several reports described immunocompromised hosts. Feinstein et al. (6) isolated Kluyvera ascorbata from stool samples of five cancer patients and one healthy individual who had diarrhea, as well as from five cancer patients without diarrhea. Most of these elderly cancer patients were neutropenic and febrile, and were receiving chemotherapy and antibiotics. Braunstein (7) isolated Kluyvera ascorbata from the sputum of a 6-year-old child with pulmonary tuberculosis, but questioned the significance of this bacterium as a pathogen. Kluyvera ascorbata and Kluyvera cryocrescens have been reported as a cause of acute pancreatitis (8). Wong (2) isolated Kluyvera cryocrescens from the blood of a patient with a Broviac catheter-related infection.

A recent report (3) describes an 11-month-old girl with bilateral vesicourethral reflex who developed Kluyvera urosepsis while receiving trimethoprim-sulfamethoxazole as prophylactic therapy. There is only one report of infection in a previously immunocompetent host (4). It describes a healthy young woman who suffered a wound infection from which a Kluyvera sp. was cultured.

Our pediatric patient with Kluyvera pyelonephritis provides further evidence that, although Kluyvera is generally considered a saprophyte, this bacterium can cause severe disease in susceptible as well as in previously healthy patients. The host-pathogen interactions that favor Kluyvera infection remain to be elucidated.