In rare cases, *Kluyvera* spp. can cause opportunistic infections in immunosuppressed and healthy individuals. The disease spectrum of *Kluyvera* spp. in the pediatric population was found to be similar to that in adults. Clinical significance of *Kluyvera* infections in the pediatric population has been recently reviewed by Carter et al. (1). Of the 15 pediatric *Kluyvera* infections only two were seen in newborns. In both cases *Kluyvera ascorbata* was the microorganism detected, in the first case from stool and in the second case from cerebrospinal fluid (CSF) (2,3).

Newborn infants are susceptible to infections, particularly if they are born prematurely. However, *Kluyvera* spp. are rarely reported as a cause of infection in preterm infants. The reluctance to recognize these microorganisms as serious pathogens may be attributable to our former knowledge of them as benign saprophytes. This reluctance may cause the underestimation of clinical significance of *Kluyvera* infections in the newborn period. In this report we present a preterm newborn with *Kluyvera cryocrescens* sepsis that was successfully treated.

A 1,200-g male infant was delivered at 30 weeks of gestation by emergency C-section to a para 1 pre-eclamptic mother due to fetal compromise. Apgar scores were 8 and 10 at 1 and 5 min, respectively. Because of deteriorating respiratory function, the patient was intubated following admission to the neonatal intensive care unit. Chest X-ray findings were suggestive of respiratory distress syndrome. Umbilical vein and umbilical artery catheters were placed and mechanical ventilation was initiated. Synthetic surfactant was administered. The patient was given empirical antibiotic therapy with ampicillin and netilmicin. On admission complete blood count and routine biochemical tests including C-reactive protein (CRP) were within normal limits. Initial blood and tracheal aspirate cultures were negative. The patient was successfully extubated in the 1st day of life, repeated laboratory investigations were within normal limits. Minimal enteral nutrition with breast milk was initiated on the 3rd day of life. However, because of gastric residuals, feedings were conducted. On the 7th day of life distention and color change occurred in the abdominal wall and necrotizing enterocolitis (NEC) was suspected. There were dilated intestinal loops on plain abdominal X rays, and occult blood testing was positive in the stools. There was no thrombocytopenia or increase in CRP. Antibiotic therapy was changed to meropenem and metronidazole. After 7 days of antibiotic therapy and total parenteral nutrition, antibiotics were stopped and minimal enteral nutrition with breast milk was restarted and was well tolerated. The umbilical artery catheter was removed on the 5th day of life and umbilical vein catheter was removed on the 10th day of life.

On the 17th day of life the clinical condition of the patient deteriorated dramatically with poor peripheral perfusion, hypotension, apnea, and abdominal distension. A sepsis workup revealed thrombocytopenia and increased CRP. Ciprofloxacin, teicoplanin, and fluconazole were commenced after obtaining blood, CSF, and urine cultures. Supportive immunotherapy with intravenous immunoglobulin was administered. *K. cryocrescens* which was susceptible to cefotaxime, amikacin, and ciprofloxacin grew on three consecutive blood cultures taken from the infant. CSF and urine cultures were found to be sterile. Teicoplanin was discontinued; ciprofloxacin was continued for 10 days. Blood cultures became sterile after 3 days of therapy, and clinical condition and laboratory findings improved. The patient was discharged on the 47th day of life without any further complication. Throughout the follow-up period after discharge the patient had no other infection and is growing well without any disabilities.

During the past several decades, progress in perinatal medicine has improved the survival rates of preterm infants including those with extreme prematurity. Preterm infants are at higher risk of nosocomial infections due to their underdeveloped immune systems, prolonged...
hospital stays, vascular catheterization, and administration of broad-spectrum antimicrobial agents.

Many microorganisms that were previously regarded as nonpathogenic for humans are now being reported with increasing frequency as the cause of a multitude of diseases. *Kluyvera* spp. are rarely encountered as the cause of infections in clinical practice. However, they can cause a wide spectrum of infections, ranging from soft tissue infections to fatal disseminated disease (4–6). *K. ascorbata* accounts for most of the pediatric infections (1).

In the review of Carter et al. (1), *K. cryocrescens* was the causative agent in only one of the 15 clinically significant *Kluyvera* infections in the pediatric age group. The first report of *K. cryocrescens* infection was related to a central venous catheter in a 17-month-old infant with congenital heart disease (7). The second report on *K. cryocrescens* infection in the pediatric age group was a case of catheter related sepsis in a 2-year-old child with neuroectodermal tumor and febrile neutropenia (8). There was no indwelling central catheter in our patient at the time of bacteremia and former blood cultures from umbilical artery and vein catheters (which had been removed on day 5 and 10, respectively) were all sterile.

In the literature, we found only two cases of neonatal *Kluyvera* infections. Aevaliotis et al. reported isolation of *K. ascorbata* from the stool specimen of a 3-week-old girl who recovered without the need of any antimicrobial treatment (2). The second case occurring during the neonatal period was a case of *K. ascorbata* meningitis reported by Rosso et al. in a male newborn with a ventriculoperitoneal shunt (3). In our patient CSF culture was sterile.

There is only limited data about the antibiotic susceptibility of *Kluyvera* spp. Data show that by production of beta-lactamases, resistance to ampicillin and 1st- and 2nd-generation cephalosporins can be expected. In *Kluyvera* infections 3rd-generation cephalosporins, fluoroquinolones, aminoglycosides, tetracycline, aztreonam, and imipenem are recommended as treatment options. *K. cryocrescens* isolated in our patient was resistant to ampicillin, 1st- and 2nd-generation cephalosporins, and also to aztreonam and piperacillin/tazobactam. Because of the previous antibiotic usage (ampicillin and netilmicin for 7 days, meropenem for 7 days), we decided to continue ciprofloxacin, which was started empirically with the high suspicion of a nosocomial infection with resistant Gram-negative bacteria. Blood cultures became sterile on the 3rd day of treatment with ciprofloxacin.

The outcome of infection with *K. cryocrescens* is usually favorable, but it may cause severe and disseminated disease. Early identification of the pathogen is crucial for improving outcomes. In conclusion, the potential of *K. cryocrescens* as an opportunistic pathogen should be recognized, since the prognosis in immunocompromised patients such as preterm infants may be poor without appropriate treatment.

**REFERENCES**