Concurrent neonatal *Proteus mirabilis* infection in dizygotic twins

Lillian Sung MD FRCPC¹, Noni E MacDonald MD FRCPC², James S Hutchison MD FRCPC²

L Sung, NE MacDonald, JS Hutchison. Concurrent neonatal *Proteus mirabilis* infection in dizygotic twins. Can J Infect Dis 1999;10(2):156-158.

A case of concomitant infection with *Proteus mirabilis* in dizygotic twin neonates is presented. The first twin presented with meningitis and septic shock at eight days of age and subsequently died. An investigation of the asymptomatic second twin revealed a urinary tract infection that resolved with antimicrobial therapy. It is recommended that when infection with this virulent organism is diagnosed in one twin, the second twin should be fully evaluated for sepsis and empirical antimicrobial therapy should be considered.

Key Words: Neonate, *Proteus mirabilis*, Sepsis, Twin gestation, Urinary tract infection

Infection néonatale concomitante par *Proteus mirabilis* chez des jumeaux dizygotes

On présente ici un cas d'infection concomitante par *Proteus mirabilis* chez des jumeaux dizygotes nouveau-nés. Le premier jumeau a été emporté par une méningite et un choc septique à huit jours de vie et l'examen du second jumeau asymptomatique a révélé la présence d'une infection urinaire qui est rentrée dans l'ordre avec l'antibiothérapie. En présence d'une infection par un organisme virulent chez un jumeau, on recommande, pour le deuxième jumeau, de procéder à un examen complet pour dépister une infection et d'administrer un traitement antibiotique empirique.

Proteus species is a well known cause of neonatal sepsis and is particularly associated with meningitis and brain abscess. In contrast with the frequent reports of concurrent neonatal infection in twins with group B streptococcus (GBS) infection, there are few reports of simultaneous infection with other organisms, with no reports of concurrent infection with *Proteus* species. We report concurrent *Proteus mirabilis* infection in eight-day-old twins.

CASE PRESENTATIONS

Twin A: An eight-day-old female presented to the emergency department of a tertiary care paediatric centre with a one-day history of irritability and poor feeding. The pregnancy was a

diamniotic, dichorionic twin gestation but was otherwise uncomplicated. The mother was asymptomatic during pregnancy, and a swab for GBS and urine cultures were not obtained. Labour was induced at 37 weeks' gestation for non-medical indications; fetal distress was absent, and intrapartum antibiotics were not given. There was spontaneous vaginal delivery after 5 h of ruptured membranes, and the birth weight was 2.76 kg. The infant was breastfed, and, other than for the 24 h before presentation, she had been completely asymptomatic.

On presentation, the baby was in shock and was resuscitated using fluid boluses, inotropic support, intubation with rapid sequence induction of anaesthesia and ventila-

¹Department of Pediatrics, Divisions of Infectious Disease and ²Intensive Care, University of Ottawa, Ottawa, Ontario

Correspondence: Dr NE MacDonald, Division of Infectious Disease, Department of Pediatrics, Children's Hospital of Eastern Ontario, Ottawa, Ontario K1H 8L1. Telephone 613-737-2651, fax 613-738-4832, e-mail macdonald_n@cheo.on.ca

Received for publication May 22, 1998. Accepted July 21, 1998

tion. She was treated with intravenous ampicillin, cefotaxime and acyclovir, and transferred to the paediatric intensive care unit. She subsequently developed focal left-sided hemispheric seizures, and a computerized tomography scan showed marked cerebral edema with obliteration of the right lateral ventricle and shift of the midline to the left. Cerebrospinal fluid examination was deferred because of the patient's instability, but a blood culture grew *P mirabilis* that was susceptible to ampicillin, gentamicin and cefotaxime. Twenty-one hours after presentation, severe cerebral edema was evidenced by marked head swelling accompanied by bulging of the fontanelles and separation of the cranial sutures. Only minimal evidence of brainstem function was present on neurological examination, and life support was withdrawn with full consent of both parents. Autopsy revealed severe acute purulent meningitis involving the cerebral hemispheres, the brainstem, the cerebellum and the spinal cord associated with acute cerebritis in the cerebral hemispheres and brainstem, acute ventriculitis in the fourth and lateral ventricles, and infarction of both cerebral hemispheres, cerebellum and brainstem. Moderate to severe cerebral edema was seen associated with herniation of the cerebellar tonsils and uncus of the temporal lobes. The postmortem meningeal swab also grew *P mirabilis*.

Twin B: The asymptomatic twin sister was brought to the emergency department for assessment after the diagnosis of sepsis was made in Twin A. Complete blood count revealed a normal white blood cell count of 13.2×10^9 cells/L with a normal neutrophil count but an elevated monocyte count of 1.23×10^9 cells/L and an elevated platelet count of 531×10^9 cells/L. Blood culture, lumbar puncture and bladder catheter specimens were obtained, and the infant was given ceftriaxone empirically pending cultures. Cerebrospinal fluid and blood cultures were negative and the urinalysis showed no pyuria; however, urine culture grew 10^6 organisms/L of *P mirabilis* with the same susceptibilities as the isolate from Twin A. An abdominal ultrasound was normal, and the baby remained well clinically. She was treated with 14 days of intravenous ampicillin and subsequently discharged home.

DISCUSSION

To our knowledge, this is the first report of concurrent infection with *P mirabilis* in twin infants. *P mirabilis* is a highly motile Gram-negative bacteria that is the second most frequent Enterobacteriaceae isolated in clinical microbiology laboratories (1). Clinical syndromes related to this pathogen include urinary tract infection in immunocompetent hosts and systemic infection in immunocompromised hosts such as neonates (2). Specifically, *Proteus* species are a well established cause of neonatal meningitis (3) and brain abscesses (4,5).

The outcome of *P mirabilis* central nervous system infection is usually poor. Renier and colleagues (6) reviewed 30 newborn infants treated for brain abscess and found *P mirabilis* was the most commonly found organism, with isolation in 27 (90%) cases. Four (13%) died, and 14 (47%) had hydrocephalus requiring shunting. In the 22 children in whom

cognitive outcome was assessed, eight (36%) had an intelligence quotient (IQ) or a developmental quotient (DQ) less than 60 and six (27%) had an IQ or DQ between 60 and 80. Interestingly, *proteus* was also recovered from the maternal urine in four of these cases. Reports of *proteus* infection in various clinical scenarios have not included any twins (2-6), and without prospective studies, the actual risk of concurrent *proteus* infection in twins will remain unknown.

In contrast with the lack of reports of *proteus* infection in twins, simultaneous GBS infection in twins, both in early (7-9) and late onset disease (10) is well described. Edwards et al (10) reviewed 11 sets of twins and one set of triplets in which one or more of the infants had proven infection with GBS. In three of the 12 sets, the second twin was also diagnosed with invasive infection, with two of the cases being late in onset. In one of the sets of late onset infection, the second twin was asymptomatic on history; however, on evaluation the twin was found to be febrile and subsequently had a positive blood culture. Recovery was uneventful after appropriate intervention. In contrast, in the second set of late onset infection in both twins, no empirical examination was performed for the second twin, and the patient presented four days later with septic shock and had neurological abnormalities on discharge from hospital. In both of these cases of late onset infection in both twins, the infections occurred in close proximity in time, occurring on days 19 and 20 in one set and on days 28 and 32 in the other set. Based on these findings, the authors suggested that the twin of an affected infant with GBS disease should receive empirical penicillin G therapy pending blood and cerebrospinal fluid culture results.

There are a few case reports of simultaneous infection in twins with other organisms including a case report of group A beta-hemolytic streptococcus in a mother and her twins (11), and *Salmonella agona* infection in malnourished twins (12).

In our case, it is likely that twin B had an early infection of *P mirabilis* because the organism grew on a specimen obtained by bladder catheterization. We presume that infection in these twins was acquired by vertical transmission. Given the devastating effect of Gram-negative sepsis in a neonate, we suggest that, when one twin has this diagnosis, the second twin should be assessed by a physician and should undergo laboratory evaluation consisting of a complete blood count with differential, blood culture, urinalysis with urine culture, cerebrospinal fluid evaluation and initiation of empirical antimicrobial therapy pending cultures. Alternatively, the second twin may have specimens obtained after clinical assessment followed by observation in hospital pending cultures. We hope that these interventions may prevent the devastating sequelae of *proteus* sepsis in the second twin.

CONCLUSIONS

We report a case of concurrent *P mirabilis* infection in eight-day-old twins. We suggest that a thorough evaluation and close observation in hospital are necessary for any twin of an infant infected with this virulent Gram-negative bacteria.

REFERENCES

1. Farmer JJ III. Enterobacteriaceae. In: Murray PR, Baron EJ, Pfaller MA, Tenover FC, Tenover RH, eds. *Manual of Clinical Microbiology*, 6th edn. Washington: American Society for Microbiology, 1995:438.
2. Khan AJ, Ubriani RS, Bombach E, Agbayani MM, Ratner H, Evans HE. Initial urinary tract infection caused by *Proteus mirabilis* in infancy and childhood. *J Pediatr* 1978;93:791-3.
3. Unhanand M, Mustafa MM, McCracken GH Jr, Nelson JD. Gram-negative enteric bacillary meningitis: a twenty-one-year experience. *J Pediatr* 1993;122:15-21.
4. Krajewski R, Stelmasiak Z. Brain abscess in infants. *Childs Nerv Syst* 1992;8:279-80.
5. Ersahin Y, Mutluer S, Guzelbag E. Brain abscess in infants and children. *Childs Nerv Syst* 1994;10:185-9.
6. Renier D, Flandin C, Hirsch E, Hirsch J-F. Brain abscesses in neonates. *J Neurosurg* 1988;69:877-82.
7. Pass MA, Khare S, Dillon HC Jr. Twin pregnancies: incidence of group B streptococcal colonization and disease. *J Pediatr* 1980;97:635-7.
8. Christensen KK, Christensen P, Groggaard J, Hjalt C-A. Fatal streptococcus group B meningitis in newborn twins. *Scand J Infect Dis* 1974;6:361-3.
9. Moore DH, Schreiner RL. Fatal group B streptococcal septicemia in newborn twins. *J Indiana State Med Assoc* 1976;69:630-1.
10. Edwards MS, Jackson CV, Backer CJ. Increased risk of group B streptococcal disease in twins. *JAMA* 1981;245:2044-6.
11. Nieburg PI, Williams ML. Group A beta hemolytic streptococcal sepsis in mother and infant twins. *J Pediatr* 1975;87:453.
12. Larsen JG, Hanna BA, Bottone EJ, Kurtz WM, Kasen L, Uretsky SC. Multiple antibiotic resistant *Salmonella agona* infection in malnourished neonatal twins. *Mount Sinai J Med* 1979;46:541-5.