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Brief Report

# Intravenous fluid contaminated with *Klebsiella oxytoca* as a source of sepsis in a preterm newborn: Case report

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Advances in neonatal care have led to the increasing survival of smaller and sicker infants, but nosocomial infections continue to be a serious problem, associated with increased mortality rates, immediate and long-term morbidity, prolonged hospital stay, and increased cost of care. We report a case of hospital-acquired sepsis in a preterm baby secondary to *Klebsiella oxytoca*, resulting from contaminated intravenous fluid.



Nosocomial infections (NI) in neonates generally manifest 48 hours after admission to the neonatal unit and contribute significantly to neonatal morbidity and mortality, prolonged hospitalization, and increased cost of treatment.[1,2] Outbreaks with multidrug-resistant organisms continue to occur in neonatal intensive care units (NICUs) worldwide. NI rates in NICUs have increased over the past several years.[3,4] The most common organisms causing NIs in NICUs are *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Escherichia coli*, *Acinetobacter*, *Pseudomonas, Staphylococcus aureus*, and coagulase-negative staphylococci.[1,3,5,6] This case is reported from the NICU of Jimma University Medical Center in southwest Ethiopia, which admits an average of 110 newborns per month.

## METHODS

The newborn was born to a para 5 mother, who claimed amenorrhea of 8 months, and admitted at a postnatal age of 20 minutes with diagnoses of prematurity (34-36 weeks), very low birth weight (1,300 g), and respiratory distress syndrome after presenting with difficulty breathing since birth. Maternal hepatitis B surface antigen and HIV tests were negative. Mother was admitted to the maternity ward with a diagnosis of preeclampsia, for which labor was induced and delivered after 4 hours of labor. After admission, the newborn was put on intravenous (IV) ampicillin and gentamicin, IV maintenance fluid, radiant heater, and continuous positive airway pressure (CPAP) ventilation. He also received trophic feeding (breast milk) through a nasogastric tube. Until the fourth day of admission, he did not show any improvement or worsening and was still on CPAP and IV fluid (IVF).

On the fifth day, he developed feeding intolerance, coffee-ground emesis, jaundice, fever, and puncture site bleeding, with ecchymosis of the hands and continued to require oxygen. With diagnoses of hospital-acquired sepsis, disseminated intravascular coagulopathy, and stress ulcer, a complete blood count was done (white blood cells 20,110/μL, platelets 11,000/μL, hemoglobin 12 g/dL). Total serum bilirubin was 15.7 mg/dL, chest radiograph was normal, and blood was sent for culture and sensitivity. Lumbar puncture was deferred because the patient was having respiratory distress. Urinalysis was

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Ethics approval and consent to participate: Ethical approval was obtained from the Jimma University institutional review board (reference number RPGE/451/2076). Written informed consent to publish the case was obtained from the parents of the infant.

Author contributions: B.E., M.B., and M.G. generated the idea and drafted the manuscript. M.G. and A.A. performed the microbiologic tests. A.A., L.M., E.M., and R.L. reviewed the manuscript and gave feedback. All authors reviewed and agreed on the final version of the manuscript.

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**Table 1**
Results of laboratory investigations for isolated bacteria from blood and IV fluid samples

| Source of isolates | Gram's stain | Colony morphology | Biochemical tests | | | | | | | | Identified organism |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lactose | Indole | Urea | $H_2S$ | Gas/glucose | Citrate | Motility | Lysine | |
| Blood | Gram-negative rods | Mucoid, large | + | + | + | - | + | + | - | + | *K oxytoca* |
| IV fluid | Gram-negative rods | Mucoid, large | + | + | + | - | + | + | - | + | *K oxytoca* |

*$H_2S$*, hydrogen sulfide; *IV*, intravenous; *K oxytoca*, *Klebsiella oxytoca*.

**Table 2**
Drug resistance patterns of *Klebsiella oxytoca* isolated from blood and IV fluid

| Source of isolates | AMC | CN | CAZ | CRO | FEP | FOX | STX | AMP | CHL | CIP | MRP | TE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blood | 6 | 9 | 6 | 6 | 10 | 10 | 12 | 6 | 11 | 27 | 22 | 6 |
| IV fluid | 6 | 8 | 6 | 6 | 10 | 10 | 12 | 6 | 11 | 27 | 22 | 6 |

*AMC*, amoxicillin/clavulanic acid; *AMP*, ampicillin; *CAZ*, ceftazidime; *CHL*, chloramphenicol; *CIP*, ciprofloxacin; *CN*, gentamicin; *CRO*, ceftriaxone; *FEP*, cefepime; *FOX*, cefoxitin; *IV*, intravenous; *MRP*, meropenem; *STX*, trimethoprim/sulfamethoxazole; *TE*, tetracycline.

not done, and procalcitonin was not available. Subsequently, the patient was kept nothing by mouth, on maintenance fluid, given a therapeutic dose of vitamin K and IV cimetidine, transfused with whole blood, and continued on the same antibiotics until the culture result was obtained.

Two milliliters of blood was collected, added aseptically to the BD BACTEC Peds Plus/F bottle (Becton Dickinson, Franklin Lakes, NJ), and incubated in the BD BACTEC FX40 machine. After overnight incubation, the machine showed a red flag, which was an indicator of a positive culture. The bottle was then subcultured on MacConkey and blood agar (Oxoid, Basingstoke, United Kingdom) and incubated aerobically at 36°C for 18 hours.

During that time, the number of gram-negative rods increased, and we wanted to investigate the source of the infection. The IVF was suspected because of a likely breach in the fluid preparation process. Therefore, 4 mL of IVF was taken aseptically for 2 samples; directly inoculated onto nutrient, MacConkey, and blood agar (Oxoid, Basingstoke, United Kingdom); and incubated at 36°C. After 18 hours of aerobic incubation, the inoculated plates from both samples showed growth. Colony morphology, Gram's stain, and different biochemical tests were done for isolates from both samples to identify the organisms based on their phenotypic characteristics (Table 1).

The isolates from both samples showed identical phenotypic characteristics, and the organisms were identified as *K oxytoca*. In addition, the organisms from both specimens showed similar antibiotic susceptibility patterns and exhibited the same zone of inhibition for multiple antibiotics (Table 2). ATCC 25922 *E coli* (ATCC, Manassas, VA) were used as control strains, and the test results were only accepted when the inhibition zone diameters of the control strains were within performance ranges as described by the Clinical and Laboratory Standards Institute. Based on the culture and sensitivity result, ampicillin and gentamicin were changed to IV ciprofloxacin, after which the infant started to show improvement. He was reinitiated on feeding after 4 days and discharged with an appointment after 15 days of treatment.

## DISCUSSION

We have identified contaminated IVF as a source of nosocomial *K oxytoca* infection in a preterm newborn. Although we were not able to do genotyping of the isolated organisms from both samples, considering their phenotypic characteristics and drug resistance patterns, we suspect the isolates were identical and the source of the infection was the IVF.

Outbreaks of NIs caused by *K oxytoca* have most often been associated with contamination of environmental reservoirs, such as disinfectants, multidose vials, IVF bags, humidifiers, ventilators, and artificial nails of health workers.[7-10] One of the limitations of this case report is that other potential sources of infection were not investigated, including breast milk that was expressed into a cup and kept at room temperature until feeding and CPAP that used tap water that was not regularly changed unless the patient was weaned off or the water ran out.

The most important factors contributing to IVF contamination during preparation and administration are lack of handwashing facilities, hand disinfectants, and good hand hygiene practices in the NICU. In addition to this, a single bag of IVF is usually used for multiple patients, and hence could be punctured several times since the IVF in our setting is always supplied in volumes of 1,000 mL and smaller volumes are unavailable. Additionally, because we do not have ready-made 10% dextrose, we reconstitute it from other available fluids, which at times can remain for hours and be used by other patients. These fluids, particularly if containing glucose, create good culture media for growth and proliferation of bacteria. Even with adequate infection prevention and control practices, NIs remain a great threat to quality of health care delivery worldwide, especially in low-income settings.

## CONCLUSIONS

Contaminated IVF was found to be a source of *K oxytoca*–associated hospital-acquired sepsis in a premature neonate. The absence of appropriate volumes and concentrations of IVF, coupled with poor infection prevention and control practices, could lead to contamination of IVF, which could be a potential source of NIs in the NICU. Attempts to minimize unhygienic preparations of IVF and maintain appropriate volumes and concentrations should be made to reduce morbidity and mortality from NIs.

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