Advances in Medicine and Engineering Interdisciplinary Research, 2025, Volume 3, Issue 4
DOI: 10.32629/ameir.v3i4.4742
ISSN Online: 2972-3825
ISSN Print: 2972-3833

Proven sepsis on Klebsiella oxytoca in a newborn

Lil Katia Rodríguez-Díaz[1,*], Yuleiny Pérez-Santana[1], Ismary Rodríguez-González[2]

1. Hospital University Gynecobstetric Mariana Grajales. Villa Clara, Cuba.
2. Hospital Materno Infantil 10 de Octubre. La Habana, Cuba.
*Corresponding author.
Email address: lilkatiarodriguez@gmail.com

Abstract: Neonatal sepsis is one of the main causes of neonatal deaths in developing countries, with data estimating more than one million deaths around the world every year. The aim is to present case a case, given the infrequency of late neonatal sepsis by Klebsiella oxytoca. This is the case of a pre-term female patient, with low weight at birth, who at 17 days of birth began with deterioration of her clinical status due to hypo-activity, skin paleness, morose suction and increase in abdominal circumference, accompanied by severe hematological dysfunction given by anemia, thrombocytopenia and neutropenia, which required several transfusions with blood products and combined antimicrobial therapeutic (first with meronem and amikacin, then with ciprofloxacin and vancomycin). She was also treated antifungals, diuretics, vasoactive drugs, mechanical ventilation and erythropoietin. She was consulted with Pediatric Cardiology and Infectious diseases. Finally she had a satisfactory evolution, with effective maternal breastfeeding. Sepsis increase in hospitalized neonates and bacterial resistance are public health problems. It is important to recognize the risk factors for sepsis in this group of patients, for their timely treatment.

Key words: Klebsiella oxytoca; newborn; sepsis

1 Introduction

Neonatal sepsis is one of the leading causes of neonatal mortality in developing countries, with estimates of more than one million deaths worldwide each year [1,2]. It is reported that there are about 7 cases of sepsis per 1,000 live births, while among neonates with extremely low birth weight (under 1,500 grams), the rate rises to 162 cases per 1,000 live births [2].

The presence of clinical disease distinguishes sepsis from isolated bacteremia. The microorganisms that cause sepsis in the neonatal period vary based on geographic region, gestational age, and factors related to local populations and the Neonatal Intensive Care Unit (NICU). Knowledge of the microorganisms most likely to cause infection in the local area is essential to ensure that appropriate antimicrobial treatment is provided while awaiting the results of cultures and other diagnostic tests [3].

Countries in poverty, with poor infrastructure and unequal healthcare provision, have a high incidence of neonatal sepsis [2]. In South Asia, the incidence of neonatal sepsis can be up to four times higher than that reported in England and the United States [4]. The etiology is characteristically different in developing countries, with Gram-negative bacilli

responsible for more than 60% of infections. Among the main agents are Klebsiella spp., Escherichia coli, and Acinetobacter spp [2].

There are various publications on the etiology of nosocomial infections in very low birth weight newborns, but to date only a few refer to atypical microorganisms such as Klebsiella oxytoca, Enterobacter asburiae, and Citrobacter freundii. All of these belong to the Enterobacteriaceae family. K. oxytoca belongs to the genus Klebsiella spp. and differs from K. pneumoniae in its ability to metabolize indole, producing a red or red-violet culture. One of the problems with these microorganisms is their ability to produce chromosomal beta-lactamases (K1 in K. oxytoca) or extended-spectrum beta-lactamases (ESBL), with multidrug-resistant strains frequently being isolated [5].

According to Rosete et al. [6], the genus Klebsiella was named in honor of microbiologist Edwin Klebs by Trevisan in 1885. K. oxytoca is known to be rather pathobiontic, capable of proliferating and causing disease when beneficial intestinal microbial communities lose their homeostasis due to changes in diet, inflammatory processes, or medication.

Klebsiella oxytoca can cause community-acquired and hospital-acquired infections, but in recent years it has become more prevalent, with high antimicrobial resistance never seen before [7].

We aim to present a case, given the infrequency of late neonatal sepsis caused by Klebsiella oxytoca.

2 Case presentation

Newborn, son of a 32-year-old mother, housewife, non-reactive serology, with two obstetric histories of pregnancies, two deliveries, and no abortions. Dystocic delivery by cesarean section occurred at 36.1 weeks of gestational age, with a 48- hour rupture of membranes, clear amniotic fluid, and cephalic presentation. He was given an Apgar score of 8/9 (normal), with a birth weight of 1750 grams.

She was admitted to the NICU due to her weight and prematurity, with placement of an epicutaneous catheter and parenteral feeding. At 17 days of life, her clinical condition began to deteriorate, with hypoactivity, skin pallor, slow sucking, and increased abdominal circumference. Blood tests (blood gas analysis and sepsis profile) were performed, revealing anemia and C-reactive protein; the diagnostic possibility of nosocomial sepsis was considered, so two samples were taken for blood culture and treatment was started with broad-spectrum antimicrobials for Gram-negative bacteria (meropenem and amikacin). In addition, red blood cell transfusions were administered.

Over the course of several days, the patient's clinical deterioration increased: pallor persisted, more intense generalized edema appeared in areas of decline, accompanied by hepatosplenomegaly. Arterial blood gas analysis was performed again with no positive findings.

Liver profile: TGP: 24 units; TGO: 45 units; cholesterol: 1.9 mmol/L (no abnormalities), and total proteins: 49 g/L (hypoproteinemia); creatinine: 56 mmol/L (normal); severe anemia recurs, with marked thrombocytopenia of 22 x $(10)^9$ /L. A chest X-ray was performed, showing healthy lungs, and an abdominal ultrasound confirmed hepatosplenomegaly. Blood culture was positive for Klebsiella oxytoca, sensitive to meropenem (which was already indicated at 120 mg/kg/day and was continued for 14 days). He was again transfused with red blood cells and platelet concentrates by apheresis; the anterior deep venous access was removed and an epicutaneous catheter was placed.

In view of new gastrointestinal symptoms (abdominal circumference of 31 cm, with gastric residue in the nasogastric tube), oral administration was suspended and, once treatment with amikacin had been completed, ciprofloxacin was added. Support was provided with vasoactive drugs, albumin administration was initiated, furosemide was administered via infusion pump, and Pediatric Cardiology was consulted, who recommended a combination of furosemide and spironolactone.

After that, no clinical improvement was observed: there was a marked increase in edema, and it was significant that

platelets had a value of 5 x $(10)^9$/L, with macroscopic hematuria and easy bleeding from the puncture sites, as well as leukocytes at 3.3 x $(10)^9$/L. Ventilation was performed with low parameters and Pediatric Infectious Diseases was consulted due to the possibility of polymicrobial sepsis. Vancomycin was then added to cover Gram-positive bacteria, and anpholip was added as an antifungal agent. He was again transfused with blood products, and transfer factor, leukokine, and erythropoietin were indicated.

Gradually, mechanical ventilation was weaned, the edema resolved, and the abdomen returned to normal. Currently, he weighs 1995 grams, is receiving vitamin therapy, and is breastfeeding effectively.

3 Discussion

Neonatal sepsis is a major cause of morbidity and mortality in the first month of life. Up to 62% of extremely low birth weight preterm infants who survive more than 12 hours after birth have at least one positive blood culture during their hospitalization [8].

K. oxytoca is a human commensal, but it has been described as an opportunistic pathogen that causes various infections. It has also been documented as the cause of outbreaks, most often from environmental sources. On the other hand, neonates in the NICU are vulnerable to acquiring nosocomial infections, often in the form of outbreaks with facilitating factors [9].

Herruzo et al.[10] agreed, stating that this pathogen has been rarely isolated in newborns under epidemiological surveillance for two years in a tertiary hospital, with an incidence between 0.1 and 0.3%, with a high possibility of transmission of multidrug-resistant microorganisms.

Márquez et al.[11] also found K. pneumoniae to be the most common species in 16 cases (76%) in their microbiological analysis, followed by K. oxytoca in 4 (19%) and K. ornithinolytica in one (5%), with neutropenia in 27.3% of the patients studied. In empirical antibiotic treatment, before obtaining the isolation result, meropenem was used in 33% of patients and piperacillin/tazobactam in 28.5%. Once the germ was confirmed positive, combination therapy was administered to 52% of cases, lasting 14 days.

Unlike the case presented, Ulloa et al.[12] reported Staphylococcus epidermidis and Staphylococcus aureus as the most frequent pathogens in late neonatal sepsis. They also explained that resistance mechanisms such as the production of extended-spectrum beta-lactamases in Klebsiella species or methicillin resistance in Staphylococcus spp. can cause treatment failure.

García et al.[2] report that the most common pathogenic microorganisms in cases of neonatal sepsis are generally: Klebsiella spp., methicillin-resistant Staphylococcus aureus, Pseudomonas aeruginosa, Staphylococcus spp., Neisseria meningitidis, Streptococcus spp., and E. Coli (gram-negative bacilli account for almost half of all blood cultures in newborns). Mendoza et al.[8] described the presence of E. coli (31.3%) and Klebsiella pneumoniae (28.1%) in all newborns, related to healthcare-associated sepsis. Similar to the case presented here.

Given the potential negative outcomes associated with neonatal sepsis, antibiotics used to treat this condition usually include beta-lactams such as ampicillin, oxacillin, cefotaxime, piperacillin/tazobactam, and meropenem. In addition, glycopeptides such as vancomycin and aminoglycosides are also included. Empirical antibiotic therapy should be guided by local resistance patterns and the most common microorganisms present in each NICU. More than 95% of neonates in these units receive empirical antibiotics, but only 1% to 5% have positive initial blood cultures [2].

Antibiotic resistance has become a problem because the speed at which new antibiotics are developed is outpaced by the speed at which resistance appears, as it is conditioned by the emergence of enzymatic mechanisms that are easily shared between bacteria through plasmids. Resistance mechanisms are the result of selective pressure exerted by antibiotics,

so greater exposure will lead to greater resistance. The constant growth of antimicrobial resistance will lead to ten million deaths per year by 2050, at a global cost of one hundred trillion dollars. It is estimated that Latin America will contribute 392,000 deaths per year by 2050 due to antimicrobial resistance. Sepsis is a condition of increasing concern to the World Health Organization, as it is a priority for health care due to its contribution to mortality and morbidity [2].

The success of empirical treatment requires early recognition of the infection, appropriate antimicrobial therapy, and dynamic respiratory, surgical, and cardiovascular support [3].

In the present case, risk factors consistent with those described in the literature [8-10] were recognized,such as prematurity, low birth weight, stay in the NICU for more than fifteen days, prolonged use of deep venous catheters, and parenteral nutrition, primarily. It was treated with a multidisciplinary approach, as polymicrobial sepsis with triple therapy, and the possibility of antimicrobial resistance was not ruled out.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Khaliq A, Rahman SU, Gul S, et al. Emerging antimicrobial resistance causing therapeutic failure in neonatal sepsis. Biocatal Agric Biotechnol. 2019;20:101233. DOI: 10.1016/j.bcab.2019.101233.

[2] García Henao JP, García Ríos JM, Naranjo Arango YA, et al. Uso de antibióticos y resistencia antimicrobiana en la unidad de cuidado intensivo neonatal. Rev Méd Risaralda. 2021;27(2). DOI: 10.22517/25395203.24631.

[3] Ostia Garza PJ, Salzar Espino B. Frecuencia de factores relacionados con sepsis neonatal. Perinatol Reprod Hum [Internet]. 2022 [citado 23/09/2022];35(1):3-9. Disponible en: https://www.perinatologia.mx/frame_esp.php?id=21.

[4] Chaurasia S, Sivanandan S, Agarwal R, et al. Neonatal sepsis in South Asia: Huge burden and spiralling antimicrobial resistance. BMJ [Internet]. 2019 [citado 10/02/2023];364:k5314. Disponible en: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6340339/.

[5] Sánchez Códez MI, Alonso Ojembarrena A, Arca Suárez J. Gramnegativos infrecuentes como agentes etiológicos de infecciones nosocomiales en una Unidad de Cuidados Intensivos Neonatales. Rev Esp Quimioter [Internet]. 2018 [citado 11/02/2023];31(3):288-90. Disponible en: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6166260/.

[6] Rosete Enríquez M, Quintero Hernández V, Morales García Y, et al. La personalidad multifacética del género Klebsiella: El bueno, el malo y el feo. AyTBUAP [Internet]. 2019 [citado 11/02/2023];4(15):16-35. Disponible en: https://repositorioinstitucional.buap.mx/items/5064e120-8890-4195-9e16- 8f3270b841a3.

[7] Yang J, Long H, Hu Y, et al. Klebsiella oxytoca Complex: Update on Taxonomy, Antimicrobial Resistance, and Virulence. Clin Microbiol Rev. 2022;35(1). DOI: 10.1128/CMR.00006-21.

[8] Mendoza A, Osorio M, Fernández M, et al. Tiempo de crecimiento bacteriano en hemocultivos en neonatos. Rev Chil Pediatr [Internet] 2015 [citado 12/02/2023];86(5):337-44. Disponible en: https://www.scielo.cl/pdf/rcp/v86n5/art06.pdf.

[9] Liébana Rodríguez M, Recacha Villamor E, Díaz Molina C, et al. Outbreaks by Klebsiella oxytoca in neonatal intensive care units: Analysis of an outbreak in a tertiary hospital and systematic review. Enferm Infecc Microbiol Clin. 2023. DOI: 10.1016/j.eimce.2023.04.018.

[10] Herruzo R, Ruiz G, Gallego S, et al. VIM-Klebsiella oxytoca outbreak in a Neonatal Intensive Care Unit. This time it wasn't the drain. J Prev Med Hyg. 2017;58(4):302-7. Citado en PubMed; PMID: 29707661.

[11] Márquez Herrera K, Rojas Vega A, Camacho Moreno G. Caracterización de pacientes con aislamiento de Klebsiella productora de carbapenemasa en un hospital pediátrico de tercer nivel de Bogotá, Colombia. Infectio [Internet].

2016 [citado 12/02/2023];20(4):231-7. Disponible en: https://www.sciencedirect.com/science/article/pii/S0123939216000060/pdfft?md5=16d57e7ca37410ef7743b46f744fb192&pid=1-s2.0-S0123939216000060-main.pdf.

[12] Ulloa-Ricárdez A, Salazar-Espino B. Epidemiología de infección neonatal temprana y tardía en una Unidad de Cuidados Intensivos Neonatales. Rev Hosp Jua Mex [Internet]. 2019 [citado 12/02/2023];86(3):110-5. Disponible en: https://www.medigraphic.com/pdfs/juarez/ju-2019/ju193b.pdf.