A rare case of opportunistic Kluyvera bloodstream infection in a pediatric patient with supratentorial ependymoma

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Abstract

A 2.5-year-old girl with a history of surgically resected supratentorial ependymoma WHO grade 3 developed a central line-associated bloodstream infection (CLABSI) during hospitalization for intensity-modulated radiation therapy (IMRT). The patient had a peripherally inserted central catheter (PICC) line placed for management and developed fever five days post-insertion. Blood cultures from both PICC line and peripheral vein grew Kluyvera *species, a rare gram-negative opportunistic pathogen from the* Enterobacteriaceae *family. The organism was susceptible to several antibiotics including piperacillin-tazobactam, carbapenems and aminoglycosides. The infected PICC line was removed, and the patient received systemic antibiotic therapy with piperacillin-tazobactam. Clinical improvement was observed within three days, with complete recovery from the infection achieved after five days of treatment. This case highlights the potential for* Kluyvera *spp. to cause CLABSI in immunocompromised pediatric oncology patients. It underscores the importance of prompt recognition, appropriate antibiotic therapy, and heightened surveillance and infection prevention strategies in this vulnerable population.*

Keywords: *Kluyvera* species, Central line-associated bloodstream infection, Pediatric oncology, Ependymoma, PICC line, Opportunistic pathogen

Introduction

Kluyvera species are gram-negative, facultatively anaerobic bacteria belonging to the *Enterobacteriaceae* family that were first described in 1936.[1] These organisms are ubiquitous in the environment, particularly in water, soil, and sewage and have been identified as normal flora in the human digestive tract. While historically considered opportunistic pathogens with low virulence, *Kluyvera* spp. have emerged as causative agents of clinically significant infections, particularly in immunocompromised hosts.[2]

In the pediatric population, *Kluyvera* infections are rare but have been associated with a spectrum of clinical presentations ranging from urinary tract infections to life-threatening sepsis with multiorgan failure.[2] The organism exhibits intrinsic resistance to ampicillin and first- and second-generation cephalosporins; however, typically remains susceptible to third-generation cephalosporins, aminoglycosides, fluoroquinolones and carbapenems.[3,4]

Central line-associated bloodstream infections (CLABSIs) represent a significant complication in pediatric oncology patients, with incidence rates of approximately 1.51 per 1000 central venous catheter-days.[5] These infections not only necessitate antibiotic treatment but often require catheter removal and prolonged hospitalizations.[5,6] Pediatric oncology patients are particularly susceptible to CLABSI due to their immunocompromised state, frequent neutropenia and prolonged need for central venous access.[5,7]

Supratentorial ependymomas constitute approximately 30% of all pediatric ependymomas and are

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characterized by distinct molecular and clinical features.[8] WHO grade 3 (anaplastic) ependymomas are aggressive tumors with higher rates of recurrence and metastasis compared to lower-grade variants.[8] The standard treatment approach involves maximal surgical resection followed by adjuvant radiation therapy, with intensity-modulated radiation therapy (IMRT) being increasingly utilized to minimize dose to normal brain tissue.[8,9]

Herein, we report a rare case of *Kluyvera* spp. CLABSI in a pediatric patient with supratentorial ependymoma undergoing adjuvant radiation therapy, highlighting the clinical significance of this opportunistic pathogen in immunocompromised pediatric patients.

Case Presentation

A 2.5-year-old female patient with a known history of supratentorial ependymoma and surgical excision, presented for intensity-modulated radiation therapy (IMRT) management. The patient had initially presented six months prior with vomiting and seizures, and imaging studies revealed a supratentorial space-occupying lesion. Pre-operative Magnetic Resonance Imaging (MRI) on February 18, 2025, demonstrated a lesion in the fronto-parietal region measuring 2.9 × 5.1 × 5.5 cm with anterior cystic components and slight midline shift. The patient underwent craniotomy with excisional biopsy, and histopathological examination confirmed high-grade supratentorial ependymoma WHO grade 3. Post-operative MRI on April 26, 2025, showed a residual lesion in the left parietal region measuring 3.4 × 3.4 × 3.3 cm with surrounding enhancement and cystic areas.

Due to the large residual lesion,which was not amenable to further surgical resection, the patient was referred for adjuvant IMRT. Physical examination revealed a well-oriented and alert child with right-sided motor weakness with power of 4/5 in both upper and lower limbs. The patient was admitted for further management and underwent insertion of a peripherally inserted central catheter (PICC) line for medication administration and supportive care.

Five days following PICC line insertion, the patient developed a fever of 102°F. Physical examination revealed stable vital signs with clear chest examination and soft abdomen. Two sets of blood cultures were obtained, one from the PICC line and one from a peripheral vein. Both sets of blood cultures became positive after 48 hours of incubation, with Gram stain revealing gram-negative rods (Figure 1). Subculture on chocolate agar, 5% sheep blood agar and MacConkey agar demonstrated growth of round, convex, yellow-colored, non-lactose fermenting and oxidase-negative colonies after 48 hours of aerobic incubation (Figure 2).

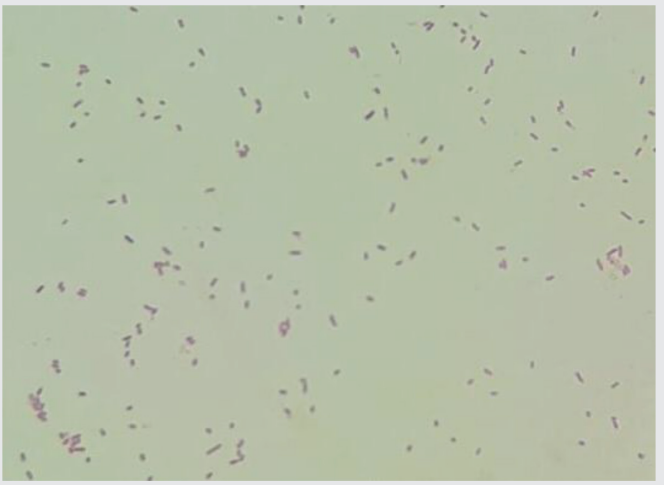

Figure 1. Gram stain morphology of *Kluyvera* species.

The organism was identified as a *Kluyvera* species using API® ID strips and APIWEB™ database. Antimicrobial susceptibility testing was performed using Kirby-Bauer disk diffusion method, with interpretation according to Clinical and Laboratory Standards Institute (CLSI) M100 guidelines.[10] The isolate demonstrated sensitivity to amikacin, gentamicin, ceftriaxone, cefixime, ciprofloxacin, co-trimoxazole, piperacillin-tazobactam, imipenem and meropenem.

A diagnosis of CLABSI was established after ruling out other sources of bacteremia. The patient was initiated on intravenous piperacillin-tazobactam. The infected PICC line was removed and systemic antibiotic therapy was continued. Clinical improvement was noted within three days of treatment initiation, with resolution of fever and improvement in general condition. The patient achieved complete recovery from the infection after 5 days of treatment.

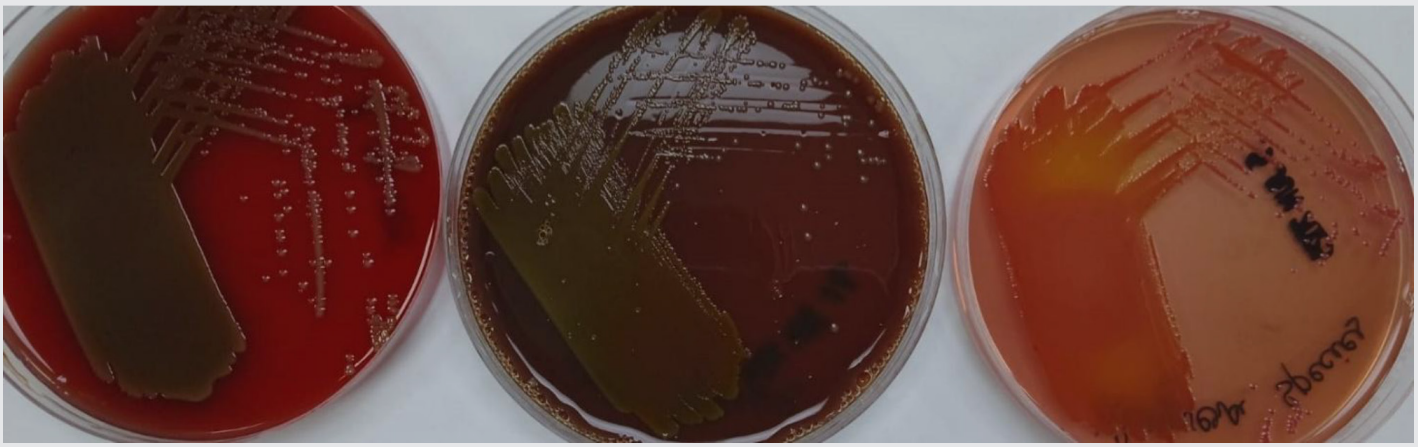

Figure 2. Colony morphology of *Kluyvera* species on Chocolate agar, 5% Sheep blood agar and MacConkey agar.

Discussion

This case represents a rare occurrence of *Kluyvera* spp. causing CLABSI in a pediatric patient with supratentorial ependymoma. While *Kluyvera* infections have been reported in the pediatric population, they remain uncommon, particularly in the context of central line-associated infections.[1,2] The clinical significance of this case lies in several important aspects.

Firstly, the patient population represents a particularly vulnerable group. Pediatric oncology patients, especially those with brain tumors undergoing active treatment, are at increased risk for healthcare-associated infections due to immunosuppression, frequent hospitalizations and need for invasive procedures.[5,7] Furthermore, the identification of *Kluyvera* spp. in this case required careful microbiological evaluation. These organisms can be challenging to identify due to their phylogenetic similarity to other *Enterobacteriaceae*, including *Enterobacter*, *Klebsiella* and *Citrobacter*.[11] Recent studies have highlighted potential misidentification by molecular diagnostic panels, emphasizing the importance of conventional culture methods and standardized antimicrobial susceptibility testing.[11]

The antimicrobial susceptibility profile demonstrated in this case is consistent with previously reported patterns for *Kluyvera* spp. The organism showed sensitivity to broad-spectrum antibiotics including piperacillin-tazobactam, carbapenems and aminoglycosides, while typically demonstrating intrinsic resistance to ampicillin and first-generation cephalosporins.[3,4] This susceptibility pattern is crucial for clinicians managing *Kluyvera* infections, as an inappropriate initial antimicrobial therapy can lead to treatment failure and complications.

The clinical course in this case was favorable, with prompt clinical improvement following appropriate antimicrobial therapy and catheter removal. This outcome aligns with previous pediatric case series reporting good clinical responses to third-generation cephalosporins, aminoglycosides and beta-lactam/beta-lactamase inhibitor combinations.[1,4]

Risk factors for CLABSI in pediatric oncology patients include prolonged catheter duration, neutropenia, malnutrition and underlying malignancy.[12] In this case, the patient had recently undergone neurosurgical procedures and was receiving treatment for a high-grade brain tumor, both factors that could contribute to immunosuppression and increased infection risk.[7]

The emergence of *Kluyvera* spp. as opportunistic pathogens in immunocompromised patients have important implications for infection prevention and antimicrobial stewardship. These organisms serve as reservoirs for extended-spectrum beta-lactamase

(ESBL) genes, particularly CTX-M variants, which can be transferred to other *Enterobacteriaceae*.[13] While the isolate in this case remained susceptible to multiple antimicrobials, clinicians should be aware of the potential for resistance development and the importance of appropriate antimicrobial selection. The successful management of this case highlights the importance of prompt recognition of CLABSI, appropriate microbiological evaluation and timely intervention with catheter removal and antimicrobial therapy.

Conclusion

We reported a rare case of *Kluyvera* species CLABSI in a pediatric patient with supratentorial ependymoma. The successful management of this infection demonstrates the importance of maintaining high clinical suspicion for opportunistic pathogens in immunocompromised pediatric oncology patients. Prompt recognition, appropriate microbiological evaluation and timely intervention with catheter removal and antimicrobial therapy are crucial for favorable outcomes.

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