

Infection Control Challenge: *Kocuria rhizophila* Bacteremia from A Peripherally Inserted Central Venous Catheter in A Pediatric Oncology Patient

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ABSTRACT

Kocuria rhizophila is a widespread gram-positive bacterium from the family *Micrococcaceae*, within the order *Actinomycetales*. Among several species, *Rhizophila* is known for causing infections, particularly in immunocompromised individuals, typically leading to bloodstream infections. The patient in question had been diagnosed with B cell acute lymphoblastic leukemia (B-ALL) and was hospitalized in the hematology ward to undergo induction chemotherapy. During a prolonged hospital stay, following chemotherapy, the patient experienced severe complications, including grade IV febrile neutropenia, sepsis, and septic shock. A blood culture taken from the patient's PICC line revealed the presence of *Kocuria rhizophila*. The patient was treated conservatively, completed the induction chemotherapy, and was eventually discharged in hemodynamically stable condition.

KEYWORDS: B Cell Acute Lymphoblastic Leukemia (B cell ALL), Infection Control, *Kocuria rhizophila*, Pediatric Oncology, PICC (Peripherally Inserted Central Catheter), Septic Shock.

INTRODUCTION

Catheter-related bloodstream infections are a significant concern, particularly among patients with haematological malignancies who require prolonged use of PICC (Peripherally Inserted Central Catheter) lines for administering chemotherapeutic drugs [1,2]. This extended use often leads to such complications. Infections caused by *Kocuria rhizophila*, a gram-positive coccus are not as common as catheter-related bloodstream infections [3]. Typically, it exists as a commensal organism on the skin and mucous membranes. Recently, this organism has been identified as a cause of opportunistic infections in immunocompromised individuals, particularly those with haematological malignancies, including patients who have undergone hematopoietic stem cell transplants and have indwelling catheters like PICC lines or dialysis catheters [1,4]. Treatment typically involves removing the source of infection, such as the indwelling devices, and administering parenteral antibiotics guided by antimicrobial susceptibility patterns. In situations

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where device removal is not feasible, such as in resource-limited settings like in our case, antimicrobial lock therapy for the indwelling devices may be used.

CASE SUMMARY

A 14-year-old male patient with no known co-morbidities was admitted to the haematology department with intermittent episodes of fever and bilateral flank pain for the last 2 months associated with nausea and loss of appetite. There were no bleeding manifestations or burning micturition. After sanitising the area with 70% isopropyl alcohol, about 5-10 mL of blood from adults and 1-5 mL from paediatric patients were drawn into blood culture bottles at the patient's bedside while aseptic procedures were followed. Bottles were promptly sent for culture to the microbiology lab. Blood cultures were processed automatically (BD Phoenix BACTEC) [5]. As soon as the blood culture bottle arrived at the lab, it was put straight into the BD Phoenix, a completely automated blood culture system that looks for blood growth. Conventionally, the isolate was identified microbiologically using a Gram stain and culture by aerobic incubation at 37 °C for 18-24 hours, followed by subculturing on chocolate agar, 5% sheep blood agar, and MacConkey agar plates [6,7].

Automated next-gen identification of isolates was done with the VITEK 2 system and simultaneously using MALDI-TOF MS (Matrix Assisted Laser Desorption-Time of flight Mass Spectrometry). Mass spectra were collected using a linear positive MALDI-TOF MS spectrometer (Microflex, Bruker Daltonics) [5,7].

MR (Magnetic Resonance) urography was done and revealed

bilateral moderate hydronephrosis with intra-abdominal lymphadenopathy with a large lesion in the left kidney. The patient underwent bilateral D-J stenting. A hemogram showed bi-cytopenia with leucocytosis. Peripheral blood showed blasts and later immunophenotyping by flow cytometry established the diagnosis of acute lymphoblastic leukaemia (ALL). The Patient was started on chemotherapy as per ALL-BFM (modified Berlin-Frankfurt-Muenster 2009 protocol).

The patient underwent bone marrow aspiration, conventional karyotyping and multiplex PCR (Polymerase Chain Reaction). The patient was diagnosed with B cell acute lymphoblastic leukaemia and all relevant routine investigations were done (Table 1-5). During the induction chemotherapy, the patient experienced Grade-IV febrile neutropenia and septic shock. The PICC line was removed, and a right-sided central venous catheter was placed in the internal jugular vein. Parenteral antimicrobials and blood products were administered. After the patient's blood count recovered and further chemotherapy was needed, another PICC line was inserted. Once again, the patient developed febrile neutropenia, which responded to parenteral antibiotics (Piperacillin-Tazobactam and Teicoplanin) along with antibiotic lock therapy for the PICC line. Blood cultures indicated the presence of *Kocuria rhizophila* (Figures 1-3).

The patient was discharged with the PICC line in place for ongoing chemotherapy. There were no further episodes of febrile illness up to the last follow-up, and the patient continued chemotherapy through the same PICC line.

Table 1. Hematological parameters on admission

| COMPLETE BLOOD COUNT | VALUES |
|-----------------------------------|--------------------------------|
| Hemoglobin | 8.8 g/dL |
| Total leucocyte counts | 7040/ μ L |
| | Neutrophil (61.1) |
| | lymphocyte (20.6) |
| Differential leucocyte counts (%) | eosinophil (0) |
| | basophil (0.3) |
| | monocyte (18) |
| Differential leucocyte count | Blast / atypical cells - 15 %, |
| Platelet counts | 269000/ μ L |

Table 2. Hematological parameters on admission

| PERIPHERAL BLOOD SMEAR | FINDINGS |
|------------------------|---|
| RBCs | Mild anisocytosis with normocytic normochromic to microcytic hypochromic RBCs. |
| WBCs | <ul style="list-style-type: none"> • Normal counts with presence of 15 % blasts / atypical cells. • There are medium to large in size with high nuclear cytoplasmic ratio. round to irregular nuclear membrane, coarse chromatin, 1-3 prominent nucleoli and scant to moderate cytoplasm. |

Table 3. Biochemical parameters on admission

| LIVER FUNCTION TEST | VALUES |
|---------------------|------------------------|
| Total Bilirubin | 0.49 mg/dL (0.3 - 1.2) |
| Direct Bilirubin | 0.13 mg/dL (0 - 0.2) |
| SGPT | 19 U/L (0 - 35) |
| SGOT | 40 U/L (0 - 35) |
| ALP | 228 U/L (30 - 120) |
| GGT | 86 U/L (0 - 38) |
| Serum Total Protein | 6.2 g/dL (6.6 - 8.3) |
| Serum Albumin | 2.5 g/dL (3.5 - 5.2) |
| Serum Globulin | 3.7 g/dL (2.5 - 3.2) |

Table 4. Biochemical parameters on admission

| KIDNEY FUNCTION TEST | VALUES |
|----------------------|--------------------------|
| Blood Urea | 74 mg/dL (17 - 43) |
| Serum Creatinine | 2.49 mg/dL (0.55 - 1.02) |
| Serum Na+ | 135 mmol/L (136 - 146) |
| Serum K+ | 4.30 mmol/L (3.5 - 5.1) |
| Serum Cl- | 104 mmol/L (101 - 109) |
| Serum Total Calcium | 7.8 mg/dL (8.8 - 10.6) |
| Serum Uric Acid | 5.9 mg/dL (2.6 - 6) |
| Phosphorus | 2.5 mg/dL (2.5 - 4.5) |

Table 5. Microbiological investigations

| | |
|---|---|
| Viral markers | HBsAg: negative Anti-HCV antibodies: non-reactive Anti-HIV antibodies: non-reactive |
| Baseline blood and urine culture | Sterile |
| Blood culture during febrile neutropenia (peripheral blood) | <i>Escherichia coli</i> (sensitive to Piperacillin- Tazobactam and meropenem) (Resistant to colistin) |
| Throat swab culture during febrile neutropenia | <i>Klebsiella pneumoniae</i> (Resistant to Piperacillin- Tazobactam and meropenem) (Intermediate resistant to colistin) |
| Blood culture during febrile neutropenia (2 consecutive blood samples) | <i>Kocuria rhizophila</i> |

HIV: Human Immunodeficiency Virus

HCV: Hepatitis C Virus

HBsAg: Hepatitis B surface antigen

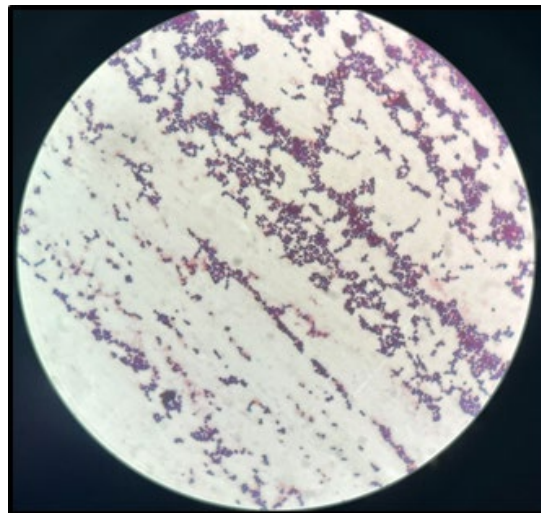


Figure 1. Kocuria is a Gram-positive cocci arranged in pairs, short chains, tetrads, cubical packets of eight and irregular clusters as seen on gram stain in 100x oil immersion lens.

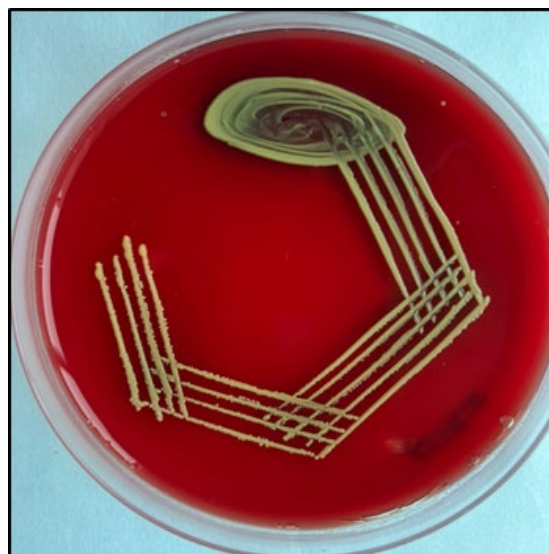


Figure 2. Kocuria spp form 2-3 mm whitish, small, round, raised, convex colonies on initial isolation after 48 hours of aerobic incubation at 37 degrees Celsius, and might develop non-diffusible yellowish pigmentation after prolonged incubation.

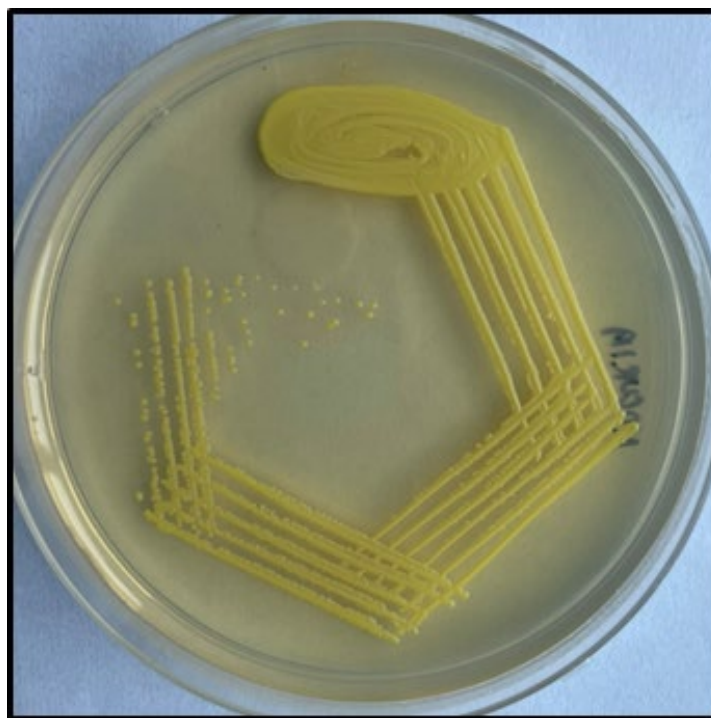


Figure 3. *Kocuria* spp displaying non-diffusible yellowish pigmentation on nutrient agar after 48 hours of aerobic incubation at 37 degrees Celsius.

DISCUSSION

Kocuria rhizophila is often mistaken for coagulase-negative *staphylococcus* or deemed as a laboratory contaminant [6,7]. Notably, it poses a significant risk to immunocompromised individuals, paediatric patients, and those with implanted medical devices, although rarely affecting those with a robust immune system [8,9]. This bacterium is accountable for a range of infections, including catheter-related bloodstream infections, peritoneal catheter-associated peritonitis, dacryocystitis, endophthalmitis, brain abscess, septic arthritis, and infective endocarditis [10-14]. Given the limited data on antibiotic susceptibility and treatment duration, the recommended approach involves using antibiotics typically employed for *staphylococcus* infections. [15-18]. The patient received treatment according to our institutional policy, which involved administering parenteral antibiotics and antibiotics lock therapy using Gentamicin and Vancomycin. The child responded well to the treatment and was discharged home later. Due to the limited prevalence and awareness of this organism, there is insufficient data on the optimal duration of antimicrobial therapy. It is worth noting that different cases have been managed with device removal or with intravenous antimicrobial therapy, and antimicrobial lock therapy of the catheter, based on clinician preferences and resource availability in the case of *staphylococcus* infection. This infection requires immediate treatment as it

can rarely lead to life-threatening infections and metastatic abscesses, particularly in immunocompromised hosts.

CONCLUSION

The case emphasizes the importance of recognizing and treating *Kocuria rhizophila* infection, particularly in vulnerable patient populations. The successful treatment of the patient with parenteral antibiotics and antibiotic lock therapy using Gentamicin and Vancomycin serves as a testament to the importance of swift and appropriate intervention. However, the limited understanding of this organism underscores the need for further research into optimal antimicrobial therapy duration and management approaches. It is crucial for healthcare providers to remain vigilant and consider *Kocuria rhizophila* as a potential pathogen in susceptible patient populations to ensure timely and effective treatment.

STANDARD OF REPORTING

CARE guidelines and methodology were followed to conduct the study. ("How Much Vitamin D is Too Much? A Case Report and Review of the Literature")

CONSENT FOR PUBLICATION

Written informed consent has been taken from the patient.

FUNDING

None.

COMPETING INTEREST

The authors declare no conflicts of interest, financial or otherwise.

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Declared none.

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