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Case Series

Microbiology Section

Ochrobactrum anthropi as an Emerging Nosocomial Pathogen: A Case Series from the Neurosurgery ICU of a Tertiary Care Centre in Northern Kerala, India

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ABSTRACT

Ochrobactrum anthropi is a non lactose fermenting, Gram-negative bacillus increasingly recognised as a cause of healthcare-associated infections, particularly in critically-ill or immunocompromised patients. While traditionally considered of low virulence, recent reports revealed its potential for causing outbreaks, especially in intensive care settings. This case series reports an outbreak of *O. anthropi* bacteraemia in a neurosurgical Intensive Care Unit (ICU), emphasising its clinical impact, source identification, and infection control implications. In November 2022, four patients admitted to the neurosurgical ICU of a tertiary care centre in Northern Kerala were diagnosed with *O. anthropi* bacteraemia. Two were elderly individuals with co-morbidities (diabetes, chronic kidney disease), while the other two were young, immunocompetent patients. Presenting symptoms included fever, altered sensorium, seizures, and pneumonia. Blood cultures in all cases grew *O. anthropi*, confirmed via biochemical tests and VITEK-2 identification. All *O. anthropi* isolates showed resistance to ceftazidime but susceptibility to meropenem, piperacillin-tazobactam, ciprofloxacin, gentamicin, and amikacin. Environmental surveillance identified *O. anthropi* on ICU bed surfaces previously occupied by infected patients, suggesting dry surface contamination and possible contact transmission. No growth was observed from i.v. fluids, water sources, or other wet surfaces. After implementing enhanced infection control measures and terminal cleaning, no further cases were reported. This case series highlights *O. anthropi* as an emerging nosocomial pathogen capable of causing outbreaks even among immunocompetent individuals. Environmental contamination, particularly of dry surfaces, may act as a reservoir. Early recognition, appropriate antimicrobial therapy, and stringent infection control practices are critical to prevent future outbreaks in ICU settings.

Keywords: Infection control, Nosocomial pathogen, Outbreak investigation

INTRODUCTION

Gram negative non fermenters are major causes of hospital acquired infections in critically-ill and immunocompromised patients. Apart from *Pseudomonas* and *Acinetobacter,* several less common gram negative non lactose fermenters like *Stenotrophomonas*, *Burkholderia*, *Achromobacter* and *Ochrobactrum* can cause nosocomial infections especially in ICU environment. However, infectivity and clinical patterns of the latter group, especially the *Ochrobactrum* species, have not been fully studied yet. *Ochrobactrum anthropi* is a gram-negative, aerobic, oxidase-positive, motile bacillus that is non lactose fermenting and often found in environmental sources [1]. While its role as a human pathogen has been underappreciated, recent evidence suggests a rising incidence in hospital-acquired infections, particularly in immunocompromised patients or those with indwelling devices. In November 2022, two cases of *O. anthropi* bacteraemia were identified within a week in the NSICU of a tertiary care centre in Northern Kerala, prompting a retrospective review and environmental investigation which revealed a total of four cases from Neuroscience Intensive Care Unit (NSICU) in the same month. This case series highlights the clinical features, antimicrobial profile, source identification, and infection control implications of the outbreak.

CASE SERIES

Case 1

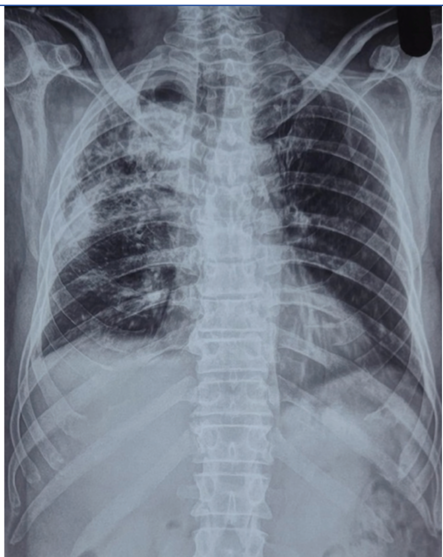
An 80-year-old female admitted in the NSICU with a history of type 2 diabetes mellitus and chronic kidney disease presented with fever and altered sensorium on day 2. The patient was febrile (101.6°F), disoriented, and drowsy, with a Glasgow Coma Scale (GCS) score of 10/15. Computed Tomography (CT) scan taken did not have any evidence of acute intracranial pathology. Vital signs revealed a blood pressure of 130/80 mmHg, heart rate of 96 bpm, and oxygen saturation of 96% on room air. Initial blood investigations showed leukocytosis with a neutrophilic predominance, elevated blood urea and creatinine levels consistent with her baseline renal function, and mild hyperglycaemia. Two sets of blood cultures were sent prior to starting empirical antibiotic therapy. Blood cultures revealed the presence of *Ochrobactrum anthropi* [Table/Fig-1], identified by gram stain morphology, catalase test, oxidase test, urease test, and other biochemical tests and confirmed using VITEK-2 automated identification system. Antimicrobial susceptibility testing according

[Table/Fig-1]: Blood agar (Left) showing non haemolytic mucoid colonies of *Ochrobactrum anthropi* MacKonkey agar (Right) showing non lactose fermenting colonies.

to Clinical and Laboratory Standard Institutes (CLSI M100) for other non enterobacterales showed that the isolate was resistant to ceftazidime >32 μg/mL but susceptible to piperacillin-tazobactam ≤4 μg/mL, meropenem ≤0.25 μg/mL, amikacin 2 μg/mL, gentamicin ≤2 μg/mL, ciprofloxacin 1 μg/mL and cefepime ≤4 μg/mL [2]. She was started on meropenem, following which she showed clinical improvement, and repeat blood cultures were sterile.

Case 2

A 30-year-old male admitted in the NSICU presented with fever, cough, and breathlessness. On arrival, the patient was febrile (102.2°F), tachypneic with a respiratory rate of 28 breaths per minute, and hypoxic with an oxygen saturation of 88% on room air. Auscultation revealed bilateral coarse crepitations. He was haemodynamically stable but appeared in moderate respiratory distress. A chest X-ray revealed bilateral patchy infiltrates suggestive of pneumonia [Table/Fig-2]. Initial laboratory investigations revealed leukocytosis (TLC: 15,000/μL) with neutrophilic predominance, elevated C-Reactive Protein (CRP), and normal renal and liver function tests. As part of the sepsis workup, two sets of blood cultures and a Bronchoalveolar Lavage (BAL) sample were sent before initiating empirical antibiotic therapy. Blood cultures grew *O. anthropi*, and BAL also showed the presence of *Pseudomonas aeruginosa*, indicating a co-infection. Identification was performed using conventional biochemical methods which showed a non fermenter gram negative bacilli with catalase and oxidase positive, indole negative, citrate utilised and urease negative. Identification was further confirmed with the VITEK-2 system. Antimicrobial susceptibility testing showed that *O. anthropi* was resistant to ceftazidime >32 μg/mL but susceptible to piperacillin-tazobactam ≤4 μg/mL, meropenem ≤0.25 μg/mL, Gentamicin ≤2 μg/mL, ciprofloxacin 1 μg/mL. He was treated with piperacillin-tazobactam and subsequently had complete resolution of symptoms with negative follow-up cultures.



[Table/Fig-2]: Chest X-ray suggestive of bilateral patchy infiltrates suggestive of pneumonia (Case 2).

Case 3

A 20-year-old male with no known co-morbidities presented with two day history of high-grade fever followed by two episodes of generalised tonic-clonic seizures within 12 hours. CT Scan taken did not have any evidence of acute intracranial pathology. On examination, the patient was febrile (temperature 101.4°F), drowsy but arousable (GCS 13/15), and haemodynamically stable. Neurological examination revealed postictal confusion but no focal deficits. Initial investigations showed leukocytosis (TLC: 13,800/μL), elevated CRP, and normal renal and liver function. Electrolytes and blood glucose levels were within normal limits. Magnetic Resonance Imaging (MRI) brain was unremarkable for any acute structural abnormality. A lumbar puncture was deferred due to initial concerns about raised intracranial pressure, pending imaging. As part of the fever work-up, two sets of blood cultures were drawn. Within 48 hours, both sets of blood cultures grew *Ochrobactrum anthropi*, confirmed using conventional biochemical methods and validated with the VITEK-2 automated identification system. Antimicrobial susceptibility testing revealed resistance to ceftazidime >32 μg/mL, and susceptible to meropenem ≤0.5 μg/mL, piperacillin-tazobactam ≤4 μg/mL, ciprofloxacin 1 μg/mL, gentamicin <4μg/mL and amikacin 4 μg/mL. CSF analysis, performed after clinical improvement and imaging clearance, was normal, making meningitis less likely. He was managed with meropenem. Fever subsided by the third day of therapy, and there were no further seizure episodes. Repeat blood cultures performed on day 4 of antibiotic therapy were negative.

Case 4

A 75-year-old male with a history of type 2 diabetes mellitus presented with complaints of high-grade fever and progressive alteration in mental status. The patient was febrile (temperature 102°F), disoriented (GCS: 12/15), and mildly tachycardic (HR: 104 bpm). His blood pressure was 140/86 mmHg, and oxygen saturation was 96% on room air. Neurological examination revealed no focal deficits, but signs of generalised encephalopathy were noted. CT findings were suggestive of diffuse cerebral dysfunction, likely metabolic or septic encephalopathy. No evidence of acute haemorrhage, infarction, or structural lesion [Table/Fig-3]. Initial laboratory investigations showed leukocytosis (TLC: 14,500/μL), elevated CRP, and mildly deranged renal parameters. As part of the sepsis workup protocol in NSICU, two sets of blood cultures were drawn prior to initiation of empirical antibiotics. The patient was started on intravenous piperacillin-tazobactam, along with supportive care for glycaemic control and hydration. Blood cultures flagged positive after 48 hours and grew *Ochrobactrum anthropi*, identified using standard biochemical methods and confirmed via the VITEK-2 system. Antimicrobial susceptibility testing showed resistance to ceftazidime >32 μg/mL and susceptible to piperacillin-tazobactam ≤4 μg/mL, meropenem ≤0.5 μg/mL, ciprofloxacin 1 μg/mL, gentamicin <4 μg/mL and amikacin 4 μg/mL. He was started on piperacillin-tazobactam, responded well to treatment, and repeat blood cultures turned negative.

[Table/Fig-3]: CT findings suggestive of diffuse cerebral dysfunction, likely metabolic or septic encephalopathy. No evidence of acute haemorrhage, infarction, or structural lesion (Case 4).

The isolation of *Ochrobactrum anthropi* from multiple patients within the same NSICU setting, all demonstrating an identical antimicrobial susceptibility pattern, prompted an outbreak investigation to identify potential sources of infection. Environmental sampling was done from room furniture (beds, side table, i.v. stand), sinks, tap water and other equipment of NSICU. Fluids were inoculated into brain heart infusion broth in the ratio 1:20 for enrichment [3]. Swabs were inoculated onto Blood agar, MacConkey agar, and brain heart infusion broth. All the samples were incubated overnight at 37°C. The isolates obtained were confirmed using routine biochemical tests including catalase, oxidase and citrate (positive) and indole and urease test (negative). Final identification using the VITEK-2 system.

O. anthropi was isolated from beds of two patients who were admitted in the same time span in the NSICU. This was done as part of surveillance sampling using swab following notification on increased number of cases. Review of bed occupancy logs indicated that the same beds had previously been used by patients who were earlier found to be blood culture-positive for *O. anthropi*, suggesting a possible link to environmental contamination. All the isolates were found to be resistant to ceftazidime but susceptible to piperacillin-tazobactam, meropenem, amikacin, gentamicin, ciprofloxacin and cefepime. The concerned department was immediately informed and thorough wiping and cleaning of ward with 0.5% sodium hypochorite and detergents were done along with reinforcing the infection control practices. No growth was observed from samples taken from intravenous fluids, water sources, sinks, or other wet surfaces. Following thorough cleaning and disinfection of the area, repeat environmental sampling yielded no growth. No further cases of *O. anthropi* bacteraemia was reported from NSICU till date.

DISCUSSION

The genus *Ochrobactrum* comprises 18 species out of which five species- *O. anthropi, O. intermedium*, *O. pseudointermedium*, *O. haematophilum,* and *O. pseudogrignonense* have been isolated from clinical samples [4,5]. Among the five, *O. anthropi* is increasingly being recognised as a nosocomial pathogen. Conventional microbiological methods can cause misidentification of this pathogen due to its phenotypic similarities with other microorganisms. There have been case reports on the misidentification of *O. anthropi* as *Brucella* genus, one of the closest relatives based on molecular markers and genomic comparison [6]. The organism is found in soil, environmental and water sources, including antiseptic solutions and dialysis fluid. It has also been identified as part of the normal human flora of the large intestine [7]. The first human infection of *O. anthropi* was reported in 1980 from the pancreatic abscess of 75-year-old debilitated patient. Since then cases have been reported around the world including catheter related bacteraemias, puncture wound osteochondritis, endophthalmitis, urinary tract infection, meningitis, osteomyelitis and pelvic abscess [5]. Out breaks of bacteraemia and meningitis have also been reported were contaminated pharmaceutical preparation was proved to be the source [5].

Although most cases of *O. anthropi* bacteraemia are seen in immunocompromised patients this pathogen is known to cause bacteraemia in patients with normal immune function. Two cases out of the four patients included in the current study were having Type 2 Diabetes mellitus. One of them had chronic kidney disease and was on steroids. The other two patients were immunocompetent with no known co-morbidities. Previous studies have reported rare occurrences of *O. anthropi* bacteraemia in immunocompetent individuals [8]. Hence*, O. anthropi* bacteraemia cases should not be neglected in hospitalised patients as it can be suggestive of a possible nosocomial infection or outbreak. Also, two of the patients included in the current study were within 30 years of age with no known immune dysfunctions. This was in line with the fact that bacteraemia cases due to *O. anthropi* have been reported irrespective of the age of the patients, ranging from as young as seven months [8].

The clinical presentation in all four patients was significantly different apart from fever, as all four were admitted for different complaints. After sending blood culture samples and other investigations, all patients were started on antibiotics. *Pseudomonas aeruginosa* was isolated from the BAL sample of a patient with pneumonia who was started on piperacillin-tazobactam. There were no significant findings in other culture results. Subsequent blood cultures were negative in these patients which could be due to antibiotic therapy initiated to which the organism was found susceptible

Catheter line infection is the most common way by which *O. anthropi* causes infections in humans [5]. The ability of *O. anthropi* to adhere to foreign bodies (biofilm formation) is another mechanism of causing nosocomial infections. But in the present series, none of the patients were on the central line. Intravenous catheterisation was done in two patients but culture of i.v. fluids and catheter hub yielded no growth. Contaminated pharmaceutical preparation has been responsible for outbreaks in the past [4]. Another important source of the organism described in literature is hospital water sources. So the water from the taps in both sinks and bathrooms were tested along with wet surfaces like sink and floor, but none of them tested positive. Since most of the cases reported in the past are bacteraemia cases in catheterised or implant related immunocompromised patients, the isolation of this pathogen from the beds of two patients with bacteraemia is a rare scenario [9-11]. The presence of bedsore in these patients indicates the likelihood of contact transmission through broken skin. The identity of the isolates and similar antimicrobial susceptibility pattern was further confirmed using VITEK-2. When the log was reviewed, it was found that the previous two culture positive patients were also admitted in the same day. This pointed out a breach in infection control practices in the NSICU. Subsequently, infection control measures including proper cleaning and disinfection of the ward and training sessions on standard precautions were conducted in order to strengthen the infection control practices and prevent further spread of such organisms.

More recent hospital-based outbreaks have implicated contaminated irrigation fluids, dialysis equipment, or water sources, demonstrating the organism's persistence in moist environments and its capacity for biofilm formation on medical devices [12-14]. In contrast, the present NSICU cluster was notable for identifying *O. anthropi* on patient beds- dry environmental surfaces rarely implicated in previous reports with no contamination detected in intravenous fluids, water sources, or invasive devices. Similar susceptibility patterns across all clinical and environmental isolates in present study further support a common environmental source. This finding emphasises the need for rigorous cleaning protocols, environmental surveillance, and strict adherence to infection-control practices to prevent transmission of such opportunistic environmental pathogens in high-risk settings like neurosurgical ICUs.

Although *O. anthropi* can be pathogenic in critically-ill or immunocompromised patients the organism is considered to be of relatively low virulence. In the current study, all the patients were discharged uneventfully after antibiotic treatment. *O. anthropi* isolates are resistant to chloramphenicol and all beta lactams. Generally the organism is susceptible to gentamicin, fluroquinolones, cotrimoxazole and colistin. In the current study, all the patients were on antibiotic treatment which might have led to the resolution of bacteraemia although there are cases where the *O. anthropi* bacteraemia has resolved without antibiotic administration probably owing to the low virulence of the organism. Hence, the cases of bacteraemia caused by *O. anthropi* should be carefully considered in conjunction with clinical information before establishing its direct pathogenic role and strict hospital infection control measures should be undertaken to prevent any outbreaks. Comparison of reported *Ochrobactrum anthropi* outbreaks with the current NSICU outbreak is given in the table [Table/Fig-4] [1,8,9,11-13].

CONCLUSION(S)

Although *O. anthropi* is considered to be of relatively low virulence, it is increasingly being reported as a nosocomial pathogen with unpredictable antibiotic resistance. The infection control programmes should consider investigation of possible *Ochrobactrum* species

Study / Reference	Hospital setting	Number of cases	Patient population	Source of infection	Environmental reservoir	Antimicrobial susceptibility pattern	Key distinguishing features
Kern WV et al., 1993 [9]	ICU/medical wards	4	Immunocompromised	Central venous catheters	Catheter-related	Susceptible to aminoglycosides and fluoroquinolones	Catheter-associated bacteraemia
Delière E et al., 2000 [1]	Haematology unit	Cluster	Immunocompromised (haematologic malignancy)	Suspected ward source	Environmental contamination (not localised)	Variable susceptibility	Early report of nosocomial clustering
Galanakis E et al., 2002 [8]	Paediatric ward	Cluster	Immunocompetent children	Unclear	Not identified	Broad susceptibility	Rare infections in immunocompetent hosts
Hernández-Torres A et al., 2014 [11]	Tertiary-care hospital	6	Mostly immunocompromised	Invasive devices	Not clearly identified	Resistance to β-lactams common	Device-associated infections
Zhu M et al., 2018 [13]	ICU	Case series	Critically-ill ICU patients	Intravascular devices	Moist hospital environment	Susceptible to carbapenems and fluoroquinolones	Biofilm-forming ability emphasised
Cipolla L et al., 2018 [12]	ICU	Outbreak	Critically-ill ICU patients	Common environmental source	Moist surfaces/ equipment	Similar susceptibility across isolates	Molecular confirmation of outbreak
Current study (NSICU, Kerala)	Neurosurgical ICU	4	Both immunocompetent and immunocompromised	Environmental contamination	Dry surfaces (ICU beds)	Resistant to ceftazidime; susceptible to meropenem, piperacillin-tazobactam, fluoroquinolones, aminoglycosides	Dry-surface reservoir; no catheter involvement; bed-occupancy link

[Table/Fig-4]: Comparison of reported *Ochrobactrum anthropi* outbreaks with the current NSICU outbreak [1,8,9,11-13].

outbreak if these bacteria are clinically isolated in more than one patient. Environmental sampling should include both dry and wet surfaces considering the ubiquitous nature of this organism. Hospital infection control practices need to be strengthened to reduce the impact of such environmental pathogens, especially on immunocompromised patients.

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