DOI: 10.7860/JCDR/2025/76010.20859

Case Report

Microbiology Section

Isolation of *Ochrobactrum anthropi* from Cerebrospinal Fluid: Insights from a Unique Case in an ICU Setting

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ABSTRACT

Ochrobactrum anthropi (*O. anthropi*), previously classified as *Achromobacter* and designated by the Centers for Disease Control and Prevention (CDC) as group Vd, is known to cause severe infections even in immunocompetent individuals without underlying conditions. In index case, the patient presented with persistent symptoms for 5-6 months, including headaches, vertigo while walking, blurred vision in her right eye, hearing loss in her right ear and balance issues. Following a thorough diagnostic work-up, the patient underwent a Ventriculoperitoneal (VP) shunt procedure, during which Cerebrospinal Fluid (CSF) was collected and sent to the microbiology laboratory for culture. Microbiological investigation showed the growth of lactose non fermenting bacteria on MacConkey Agar (MA). Subsequent biochemical testing identified the organism as *O. anthropi*. This is notable as this bacterium is rarely found in CSF, marking this as potentially the third reported case. Most instances of infection stem from nosocomial or hospital-acquired sources, attributed to the organism's ability to adhere to various surfaces. Recently, the pathogenicity of *O. anthropi* has increased due to its acquired resistance to multiple antibiotics. The patient was treated with a combination of fluoroquinolones, sulfonamides and beta-lactam antibiotics. Ensuring the appropriate use of antibiotics through susceptibility testing is essential for effective treatment and in preventing the development of resistance.

Keywords: Antimicrobial susceptibility test, Immunocompetent, Ventriculoperitoneal

CASE REPORT

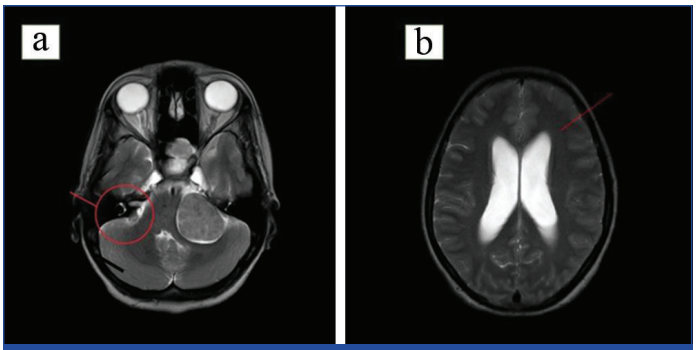
A 55-year-old female was admitted to the trauma Intensive Care Unit (ICU), presenting with complaints of a headache, vertigo while walking, blurred vision in her right eye, hearing loss in her right ear and imbalance while walking, all persisting for 5-6 months. She had also developed a tumour on the left-side of her face. The patient was conscious and oriented but reported facial deviation on the right-side. She had a 4-year history of hypertension, for which she was on medication, with no other co-morbidities. Additionally, she experienced dizziness and had 2-3 episodes of vomiting three days before admission.

Upon admission, her vital signs were as follows: Pulse-82 beats/min, Blood pressure-140/100 mmHg, Respiratory rate-20/min. Physical examination revealed normal findings in the Respiratory System (RS) and Cardiovascular (CVS) systems, and the abdomen (PA) was soft and non tender. Central nervous system examination showed a Glasgow Coma Score (GCS) of E4 V5 M6 (E-Eye opening, V-Verbal response, M-Motor response). Local examination showed no evidence of facial nerve palsy, reduced hearing in the left ear, or involvement of other cranial nerves.

Routine blood tests were performed on the day of admission, revealing haemoglobin (Hb)- 11.9 gm/dL, White Blood Cells (WBCs)- 15,800/mm^3, and Platelets- 1.2×10^3/µL. The patient had no history of unconsciousness, bleeding from the ear, nose, or throat, or seizures. However, on the first day, she experienced an episode of epilepsy, which was treated with intravenous Levetiracetam.

Magnetic Resonance Imaging (MRI) investigation revealed well defined intensively extra-axial mass in the left Cerebellopontine (CP) angle as well as obstructive hydrocephalus [Table/Fig-1]. On the 3rd day, a diagnosis of a left CP angle tumour was confirmed. On the 5th day, the patient underwent a VP Shunt procedure. She was administered ceftriaxone 1 gm intraoperatively and cefixime. A CSF sample was collected and sent to the pathology and microbiology laboratory for further analysis.

On microscopic examination of CSF, approximately 2 mL of clear, transparent fluid was received. Pathological findings revealed 0-1 RBCs/HPF, and 1-2 WBCs/HPF, with a Total Leukocyte Count (TLC) of approximately 25 cells/cumm, predominantly mononuclear cells (lymphocytes). The glucose level was 70 mg/dL, protein was 45 mg/dL, pH was 7.2, Lactate Dehydrogenase (LDH)- 40 u/L. Continuous monitoring of the patient's calcium levels showed fluctuations, ranging from 8.1 mg/dL on day 3 to a low of 6.7 mg/dL on day 6, before stabilising at 7.2 mg/dL on day 7.

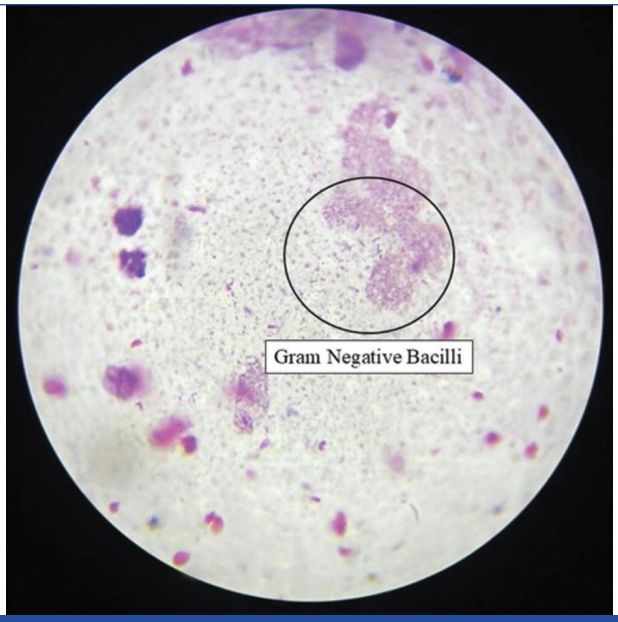


[Table/Fig-1]: a) The arrow shows a well-defined intensely enhancing extra axial mass in the left cerebellopontine angle; b) The arrow shows obstructive hydrocephalus.

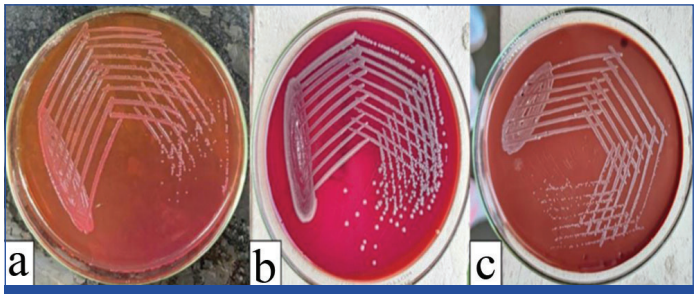
A CSF sample was collected for microbiological analysis. Direct microscopy showed 5-6 pus cells/HPF, 2-4 RBCs/HPF, and viable organisms. Gram staining at 100x oil immersion revealed gram-negative bacilli [Table/Fig-2].

The sample was cultured on MA, Blood Agar (BA), and Chocolate Agar (CA) and incubated at 37°C for 24-48 hours. On MA, non lactose fermenting colonies, approximately 1 mm in diameter, were noted, displaying a circular, low convex, smooth, shiny and mucoid appearance. BA exhibited large, circular, greyish, non haemolytic colonies, while CA showed non bleaching colonies [Table/Fig-3].

A series of biochemical tests [Table/Fig-4,5] and automatic system Vitek 2 was performed for identification of *O. anthropi.*



[Table/Fig-2]: Gram staining of CSF sample showing gram-negative bacilli (100x).



[Table/Fig-3]: Colony morphology of *Ochrobactrum anthropi*: a) MaConkey Agar (MA); b) Blood Agar (BA); c) Chocolate Agar (CA).

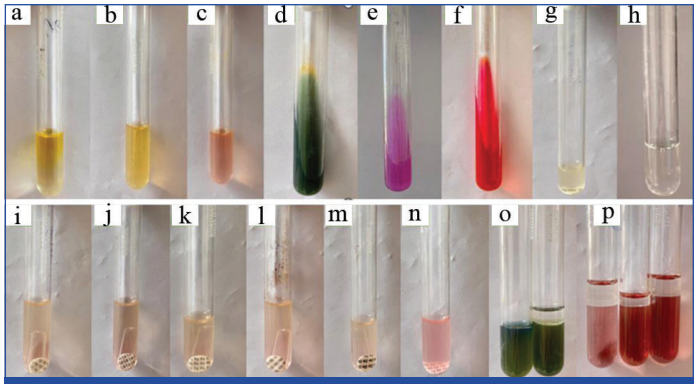
Biochemical test	Result
Oxidase	Positive
Indole	Negative
Motility test medium	Motile
Methyl red	Negative
Citrate	Negative
Urease	Positive
Triple sugar iron agar	Alkaline/No change
Ortho-nitrophenyl-beta –D galactopyranoside (ONPG) test	Negative
6.5% NaCl test	Growth
Sucrose	Not fermented
Lactose	Not fermented
Fructose	Not fermented
Mannitol	Not fermented
Dextrose	Not fermented
Arabinose	Fermented
Oxidative-Fermentative test	Oxidative
Lysine	Decarboxylase negative
Ornithine	Decarboxylase negative
Arginine	Decarboxylase negative

[Table/Fig-4]: Biochemical test result.

For therapeutic management, the patient was administered ceftriaxone and cefixime antibiotics and after therapy the patient was fully recovered and discharged and advice for follow-up.

DISCUSSION

Ochrobactrum anthropi, previously known as *Achromobacter*, derives its name from the Greek word "ochros," meaning pale yellow [1]. *Ochrobactrum* spp. belongs to the Brucellaceae family.



[Table/Fig-5]: (a) Indole; (b) Motility medium; (c) Methyl red; (d) Citrate; (e) Urease; (f) Triple sugar iron agar; (g) Ortho-nitrophenyl-beta -D-galactopyranoside (ONPG) test; (h) 6.5% NaCl test; (i) Sucrose; (j) Lactose; (k) Fructose; (l) Mannitol; (m) Dextrose; (n) Arabinose; (o) Oxidative-Fermentative test; (p) Lysine, Ornithine, Arginine.

This organism can thrive in a wide range of environments and has been classified by the CDC in group Vd. It can be distinguished from *Ochrobactrum intermedium* by its sensitivity to colistin and netilmycin [1-3]. Of the nine species within the *Ochrobactrum* genus, only *O. anthropi*, *O. intermedium*, and *O. pseudo-intermedium* have been identified in clinical samples. Molecular (DNA, rRNA) and protein studies indicate that *O. anthropi* is closely related to the *Brucella* genus [2,3]. Historically, *O. anthropi* and *O. intermedium* were regarded as opportunistic pathogens, primarily affecting immunocompromised individuals with underlying health conditions [4]. Reported cases include brain empyema, spontaneous bacterial peritonitis, infective endocarditis in a prosthetic mitral valve, bloodstream infections complicating haemodialysis, left distal clavicular osteomyelitis in an immunocompetent patient, septic arthritis in orthopaedic infections, Postoperative Endophthalmitis (POE), bilateral endogenous endophthalmitis, catheter-associated sepsis and the rare occurrence of pneumonia. Additionally, catheter-related infections have been linked to superior vena cava syndrome [5,6].

Over the past decade, *O. anthropi* has emerged as an opportunistic pathogen and shares environmental and biochemical traits with *Pseudomonas* (both are oxidase-positive and motile), which can result in frequent misidentification and underdiagnosis [7].

O. anthropi is a nosocomial infection that can cause various infections in patients. Case reports indicate that *O. anthropi*-induced endophthalmitis often occurs following cataract intraocular lens implantation, with a case also reported after artificial corneal implantation. The organism's ability to adhere to artificial surfaces may account for these implant-related infections. Additionally, contamination of intraocular irrigation fluids and surgical equipment, such as cannula kits, has been linked to outbreaks, highlighting the role of equipment contamination in these infections [8]. In most instances, the aetiology is associated with infections in immunocompromised individuals. However, Loganathan S et al., documented a rare case of purulent skeletal muscle infection caused by *O. anthropi* in an immunocompetent patient. Notably, the patient had no history of indwelling catheters, foreign body presence, or exposure to contaminated solutions, and the infection displayed atypical antibiotic susceptibility [Table/Fig-6] [5,9-13].

In a study by Daxboeck F et al., two cases of *O. anthropi* infection were initially treated with ciprofloxacin, resulting in successful cures. However, both patients experienced recurrences after discontinuing ciprofloxacin. During the recurrence, the first patient was treated with gentamicin, while the second patient continued ciprofloxacin therapy [10]. Another case reported by Gigi R et al., demonstrated the effective use of a combination of ciprofloxacin and cephradine to alleviate the patient's symptoms [11]. Additionally, a study by Steinberg JP and Burd EM, indicated that fourth-generation Cephalosporins (CPM) and Antipseudomonal Penicillins (PIT) are ineffective against *Ochrobactrum* species [14]. Further, research

Author	Case	Findings
Loganathan S et al., [9]	*Onchycobacter anthropi* pyomyositis in immunocompetent patient: Case report	A rare case of purulent skeletal muscle infection caused by *O. anthropi* in an immunocompetent patient. The patient had no history of indwelling catheters, foreign body presence, or exposure to contaminated solutions and the infection displayed atypical antibiotic susceptibility.
Daxboeck F et al., [10]	*Ochrobactrum anthropi* bloodstream infection complicating haemodialysis	Two cases of *O. anthropi* infection were initially treated with ciprofloxacin, resulting in successful cures. However, both patients experienced recurrences after discontinuing ciprofloxacin. During the recurrence, the first patient was treated with gentamicin, while the second patient continued ciprofloxacin therapy.
Gigi R et al., [11]	*Ochrobactrum anthropi*-caused osteomyelitis in the foot mimicking a bone tumour: Case report and review of the literature	Demonstrated the effective use of a combination of ciprofloxacin and cephradine to alleviate the patient's symptoms.
Zhu M et al., [12]	Clinical characteristics of patients with *Ochrobactrum anthropi* bloodstream infection in a Chinese tertiary-care hospital: A 7-year study	Conducted a seven-year study on *O. anthropi* blood stream infections recommended using quinolones, carbapenems, or both as monotherapy for severe cases.
Kish MA et al., [13]	Bacteremia caused by *Achromobacter* species in an immunocompromised host	Patient resistant to ticarcillin and tobramycin was successfully treated with gentamicin (270 mg/day) and intravenous trimethoprim-sulfamethoxazole (8 ampoules/day).
Hagiya H et al., [5]	Clinical characteristics of *Ochrobactrum anthropi* bacteremia	*O. anthropi* except ciprofloxacin, gentamicin, carbapenems, levofloxacin and sulfamethoxazole- trimethoprim, the pathogen exhibited resistance to many β-lactams. Notwithstanding the pathogen's resistance to the oral cephalosporin used for the first therapy, the patient made a full recovery.

[Table/Fig-6]: Literature review on *O. anthropi* [5,9-13].

indicated that ciprofloxacin is an effective first-line antibiotic for *O. anthropi*. A survey conducted by Thoma B et al., examined 103 isolates of *O. anthropi* and found that all were susceptible to ciprofloxacin, with 97.1% also sensitive to trimethoprim/sulfamethoxazole [15]. Zhu M et al., studied 11 isolates and revealed that 85.7% were susceptible to ciprofloxacin which was also a seven-year study on *O. anthropi* bloodstream infections and recommended using quinolones, carbapenems, or both as monotherapy for severe cases [12]. In a study by Kish MA et al., a patient resistant to ticarcillin and tobramycin was successfully treated with gentamicin (270 mg/day) and intravenous trimethoprim-sulfamethoxazole (8 ampoules/day) [13]. Finally, in a case reported by Hagiya H et al., the *O. anthropi* except ciprofloxacin, gentamicin, carbapenems, levofloxacin and sulfamethoxazole-trimethoprim, the pathogen exhibited resistance to many β-lactams [5]. Notwithstanding the pathogen's resistance to the oral CPM used for the first therapy, the patient made a full recovery. Present study was a unique case of *O. anthropi* isolated from CSF in a patient who had undergone surgery. This finding parallels the observations made by Alnor D et al., who highlighted *O. anthropi* capacity to adhere to foreign materials, such as silicates, and its ability to form biofilms, similar to *Staphylococcus* species [16].

As there are no Clinical and Laboratory Standards Institute (CLSI) guidelines for this organism, Minimum Inhibitory Concentration (MIC) values should have been used for interpretation. However, laboratory at that time used disc diffusion method to determine the antibiotic sensitivity. The complete details of disc diffusion test have not been provided here, to avoid misleading the reader. In future, it is recommended to use MIC values for interpretation.

CONCLUSION(S)

This case highlights *O. anthropi*, a rare pathogen isolated from CSF, emphasising its clinical relevance even in immunocompetent individuals. Identified through culture, biochemical tests and Vitek 2. The patient responded well to targeted therapy with ceftriaxone and cefixime. This case underscores the importance of prompt diagnosis, antimicrobial susceptibility testing and tailored treatment to manage such infections effectively and prevent resistance.

Acknowledgement

Authors would like to acknowledge the efforts and cooperation of Miss Rufejanaj Saiyyad (Technician) during the case study.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Oct 05, 2024
- Manual Googling: Mar 06, 2025
- iThenticate Software: Mar 08, 2025 (6%)

ETYMOLOGY: Author Origin

EMENDATIONS: 8

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Oct 03, 2024**
Date of Peer Review: **Dec 17, 2024**
Date of Acceptance: **Mar 11, 2025**
Date of Publishing: **Apr 01, 2025**