Journal of Cardiovascular Disease Research
ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 9, 2025

Ochrobactrum anthropi: An Emerging Opportunistic Pathogen - Case Reports and Literature Review

Case reports & Review of literature

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Email: drranu18@gmail.com, Ph no. 7837986941 **Word count:** 1389 [Excluding Abstract & References]

Abstract:

Ochrobactrum anthropi is increasingly recognized as an opportunistic pathogen implicated in various infections, particularly among immunocompromised individuals or those utilizing invasive medical devices. While this pathogen has been documented globally, its prevalence in India remains comparatively low. This is likely attributable to several factors, including challenges in accurate identification, the absence of automated detection systems, misidentification as a contaminant, and the existence of a distinct hospital environment. This study presents two cases of *Ochrobactrum anthropi*, emphasizing the necessity of recognizing it as a potential pathogen in both immunocompromised and immunocompetent patients. The environmental ubiquity of *Ochrobactrum anthropi* may lead to its erroneous classification as a contaminant. The second case highlights the necessity of recognizing *Ochrobactrum anthropi* as a potential pathogen, even when initial clinical manifestations may resemble other infections, such as tuberculosis.

The prompt identification and administration of appropriate antibiotic therapy were pivotal in achieving favorable outcomes in both patients. To address these challenges, microbiologists should maintain a heightened level of vigilance when *Ochrobactrum anthropi* is isolated from clinical specimens, particularly when there is a strong correlation with the patient's clinical presentation. Accurate identification and timely reporting are essential to prevent misdiagnosis and to ensure the appropriate management of infections caused by this pathogen.

Keywords*: Ochrobactrum anthropi*; emerging pathogen; immune-competent, localized infections, immunocompromised.

Manuscript text

Introduction:

Ochrobactrum anthropi is increasingly recognized as an opportunistic pathogen implicated in a range of infections, particularly among immunocompromised individuals or those utilizing invasive medical devices. [1,2] Despite the documentation of over 135 cases globally, the incidence of this condition in India remains relatively low. This can likely be attributed to several factors, including: a) Challenges in identification: *Ochrobactrum anthropi* is often difficult to identify using conventional microbiological methods.

Advanced identification techniques, such as MALDI-TOF MS or molecular methods (e.g., 16S rRNA sequencing), are required. [3] Additionally, the absence of automated systems poses a challenge; many laboratories, particularly those in resource-limited settings, may lack automated identification systems capable of accurately distinguishing *Ochrobactrum anthropi* from other closely related species.

c)Misidentification as a contaminant: Given that *Ochrobactrum anthropi* is an environmental bacterium, it is often present in hospital settings and may be erroneously

regarded as a contaminant when isolated from clinical specimens, resulting in underreporting.[4] d) The pathogen's presence in discrete hospital environments, such as water sources, sinks, or medical devices, [5] may be clinically significant, yet it is often underestimated or overlooked.

To effectively address these challenges, microbiologists must maintain a heightened level of vigilance when *Ochrobactrum anthropi* is isolated from clinical specimens, particularly when there is a strong correlation with the patient's clinical symptoms. Accurate identification and prompt reporting are essential to prevent misdiagnosis and to ensure the appropriate management of infections caused by this pathogen.

Case 1: A 40-year-old male presented with a fever of 102°C, accompanied by chills and rigors persisting for three days, which were alleviated by medication administered outside the hospital setting. The patient also reported experiencing swelling in the left lower limb for two days, with no antecedent history of trauma. Upon examination, there was noted erythema, warmth, and a blister containing yellowish fluid located over the shin bone of the left lower limb**.** [Figure 1]. Although the patient exhibited these symptoms, his routine diagnostic tests were within normal parameters. Nevertheless, his HbA1c level was elevated at 10.0%, suggesting inadequate glycaemic control and urinalysis indicated the presence of protein traces. Serological tests for hepatitis B, hepatitis C, and HIV were nonreactive. [Table 1] An ultrasound examination of the affected limb demonstrated substantial subcutaneous oedema accompanied by skin thickening and inflammation. These findings led to the diagnosis of lower limb cellulitis. [Figure 2] The patient underwent an incision and drainage procedure of the blister under local anesthesia, and the aspirated pus was submitted to the microbiology laboratory for culture analysis. Empirical antimicrobial therapy was initiated with piperacillin-tazobactam, clindamycin, and paracetamol. On the second day, the

microbiology laboratory reported the isolation of a non-lactose fermenting, catalasepositive, oxidase-positive, urease-positive gram-negative bacillus. This organism was identified as *Ochrobactrum anthropi* using the VITEK 2 Compact System (BioMérieux, Marcy-l'Étoile, France). Antimicrobial susceptibility testing conducted using the Kirby–Bauer disk diffusion method indicated that the organism was susceptible to cefepime, meropenem, imipenem, ciprofloxacin, levofloxacin, and cotrimoxazole. Conversely, it exhibited resistance to ceftazidime, cefoperazonesulbactam, aztreonam, tigecycline, and piperacillin-tazobactam.

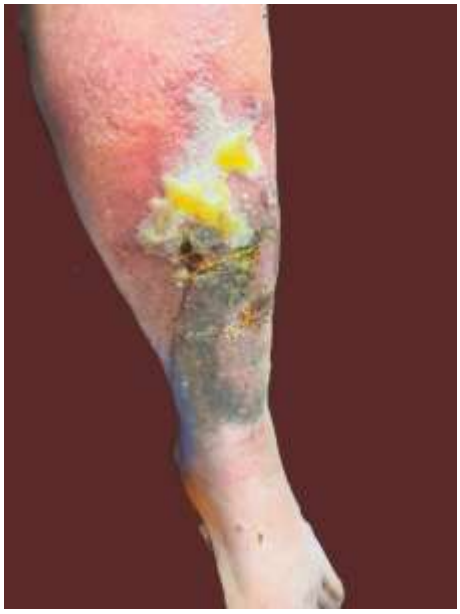

Figure 1: Clinical image (patient-1) showing a yellowish fluid filled wound over the shin area caused by *Ochrobactrum anthropi*

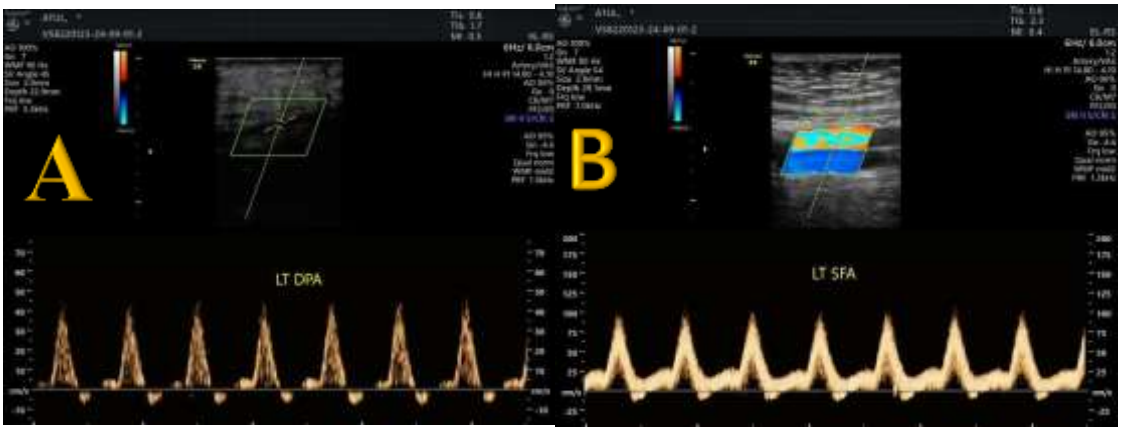

Figure 2 : Ultrasound of Venous Doppler of the left lower limb, showing no significant abnormalities in left Sapheno-femoral artery(A) and Sapheno-popliteal artery (B)junctions.

Following the susceptibility profile, the patient was transitioned to intravenous meropenem (1 g three times daily) for a period of one week. Upon observing clinical improvement, the patient was discharged with a prescription for oral cotrimoxazole (160 mg/800 mg) to be administered twice daily for four weeks, alongside pantoprazole (40 mg) once daily for five days and metformin SR (1000 mg) once daily for glycaemic management. The patient achieved a successful recovery and was discharged in a stable condition.

Case 2 A 42-year-old female patient presented to the surgery outpatient department with a swelling and purulent discharge located below the right breast, persisting for one week [Figure 3].

Figure 3: Clinical images of patient-2, with localized sinus below the right breast caused by *Ochrobactram anthropi*

The patient reported no significant medical history, including the absence of diabetes, hypertension, or cardiac illness. Serological tests for hepatitis B, hepatitis C, and HIV were nonreactive, and additional investigations, such as hemogram and blood glucose levels, were within normal limits. [Table 1]. An incision and drainage procedure was conducted under local anaesthesia, and the discharge was submitted for bacterial culture and sensitivity analysis. Acid-fast staining was requested following a preliminary diagnosis of a tubercular sinus.

Acid-fast staining did not reveal the presence of tubercular bacilli. However, the bacterial culture produced a gram-negative bacillus that was non-lactose fermenting, catalase-positive, and oxidase-positive. Further analysis using the VITEK 2 Compact System (BioMérieux, Marcy-l'Étoile, France) identified the organism as *Ochrobactrum anthropi.* Antimicrobial susceptibility testing, performed using the Kirby–Bauer disk diffusion method, demonstrated that the organism was susceptible to meropenem, imipenem, amikacin, cotrimoxazole, and ciprofloxacin. However, it exhibited resistance to cefepime, piperacillin-tazobactam, ceftazidime, and cefoperazone–sulbactam.

Following the collection of a culture specimen, the patient was administered empirical antibiotic therapy, specifically ciprofloxacin and metronidazole. Based on the results of antimicrobial susceptibility testing, ciprofloxacin was continued for a duration of 10 days. The patient subsequently achieved complete recovery without any complications. This case (Second) highlights the necessity of recognizing *Ochrobactrum anthropi* as a potential pathogen, even when initial clinical presentations may indicate alternative infections, such as tuberculosis. Prompt identification and the administration of appropriate antibiotic therapy resulted in a favourable outcome for this patient.

Discussion: *Ochrobactrum anthropi* is an emerging pathogen within the genus *Ochrobactrum*, known to inhabit a variety of environments, including water, soil, and hospital settings. It functions as an opportunistic pathogen, particularly affecting immunocompromised individuals [1,2]. The nomenclature "*Ochrobactrum anthropi*" is derived from the Greek terms "*Ochros*," meaning yellow, and "anthropic," reflecting its association with contaminated biological products in hospital environments, such as intravenous cannulas, indwelling catheters, and biological specimens (e.g., blood, urine, cerebrospinal fluid, pus, and throat swabs) [5].

Table 1: Lab investigations of Case1 and Case 2

Investigations	Case 1	Case 2	Reference range
Hemoglobin	13.1 g/dL	10.4 g/dL	Male-13-17g/dL Female- 12-15 g/dL
TLC	6.5× 10^3/cumm	11.6× 10^3/cumm	4-11× 10^3/ cumm
Platelet count	139× 10^3/ cumm	150× 10^3/ cumm	150-400×10^3/ cumm

HHH Serology (Rapid card)	Non-reactive	Non-reactive	NA
Malaria (Rapid card)	Negative	Negative	NA
Typhi Dot IgM, IgG	Negative	Negative	NA
Dengue NS1 & IgM	Negative	Negative	NA
Scrub typhus IgM	Negative	Negative	NA
HbA1c	10.0%	4.2 %	Normal 2.00-5.97% Prediabetes 5.97%-6.81% Diabetes ≥6.81%
Urine routine sugar	+ve	-ve	Negative
Pus culture & sensitivity	*Ochrobactrum anthropi*	*Ochrobactrum anthropi*	Sterile
Acid-fast staining for tubercular bacilli	Not requested	Negative	NA

Acronyms: HHH- Hepatitis B, Hepatitis C and HIV Serology, NA- Not applicable The evolving patterns in the aetiology of infectious diseases, shaped by diverse environmental factors, have broadened the scope of *Ochrobactrum anthropi* infections to include patients beyond those who are immunocompromised. [2,3] Historically, the majority of cases have been associated with immunocompromised individuals, manifesting as endocarditis, bacteraemia, and localized infections. [6,7] Nonetheless, recent studies indicate a rising incidence of this infection in immunocompetent individuals or those with indwelling medical devices. [8] This study reports on two instances of *Ochrobactrum anthropi* infection in individuals who were previously healthy. One individual was newly diagnosed with diabetes upon hospital admission, while the other exhibited no identifiable immunocompromising factors. The existing literature corroborates these findings. Bratschi C. et al. documented a case of a localized

hand infection in a healthy elderly patient, with no association with indwelling devices. [6] Another case, reported by Theodore J., involved a patient who developed a pyogenic infection following cholecystectomy, amidst comorbidities such as hypertension, hypothyroidism, renal insufficiency, and chronic congestive heart failure. [8] In this instance, a bile culture from a draining T-tube on the 22nd day of hospitalization yielded *Ochrobactrum anthropi.*[8] Similarly, Madhan J. et al. presented a case involving a young male with a localized musculoskeletal infection, characterized by fever, pain, restricted movement in the left shoulder, and generalized body pain for 20 days. X-ray findings revealed osteolysis, and the causative organism was identified as *Ochrobactrum anthropi* on pus culture following incision and drainage. [7]

The resistance profile of *Ochrobactrum anthropi* has undergone significant evolution. Historically, this pathogen exhibited resistance to β-lactam antibiotics, including penicillin, cephalosporins, and carbapenems. However, recent observations, including those from the present study, indicate a shift in this pattern. Both cases examined demonstrated susceptibility to cephalosporins and carbapenems, yet resistance to βlactam and β-lactam inhibitor combinations, likely attributable to the extensive use of these combinations.

Table 2; Review of *Ochrobactrum anthropi* Infections Reported in India

AUTHORS/ YEAR/REFERENCE	CLINICAL DIAGNOSIS	RISK FACTOR	AGE/ SEX	ANTIBIOTIC SUSCEPTIBILITY	OUTCOME
U Arora et al./ 2008. [9]	Blood/ CAD with LVD	DM, HTN, LVD, CAD	68/F	Susceptible to ciprofloxacin, sulbactamcefoperazone, imipenem. Tobramycin Resistant to piperacillin, ticarcillin, cefotaxime, cefoperazone, amikacin, gentamicin, and aztreonam	Died
Kumar S. et al./ 2013 [10]	Blood/ Sepsis with Pneumonia	SGA, Preterm, RD, VLBW	45 day/ M	Susceptible to ciprofloxacin, gentamicin, imipenem, meropenem, piperacillintazobactam Resistant to aztreonam, and amikacin	Recovered
Khan et al. /2014 [11]	Bacteremia	CKD, ESRD	53/F	Susceptible to imipenem and Sulphamethoxazole-trimethoprim Resistance to β-lactams, aminoglycosides, quinolones, and colistin	Died
Rastogi N. et al. /2017 [12]	Meningitis with Sepsis	Immunocompetent pt	58/M	Susceptible to Amikacin Cefepime-Tazobactam, Cotrimoxazole, Tigecycline & Colistin	Recovered
Radha R. et al. / 2019 [13]	Meningitis in & COVID-19 positive patient	Breast Carcinoma, COVID-19-positive patient	31/F	Susceptible to Amikacin, Gentamicin. Cotrimoxazole, Ciprofloxacin, Levofloxacin, Meropenem Resistance to Gentamicin, Ciprofloxacin, Levofloxacin	Recovered
Nag, A. Et al ./ 2021 [14]	Aqueous aspirate/ Endophthalmitis	NAD	54/M	Susceptible to Amikacin, Ciprofloxacin, Resistant to Ceftazidime, Cefotaxime, Vancomycin	Recovered
Anjana A. et al. / 2022 [15]	Bacteremia	**Case 1**; Acute Lymphoblastic Leukemia	18/F	Sensitive to Imipenem, Meropenem, Amikacin, Cotrimoxazole, PiperacillinTazobactam, Cefoperazone-Sulbactam, Minocycline Resistant to- Gentamicin, Ciprofloxacin, Levofloxacin	Recovered
	Bacteremia	**Case2;** Hodgkin Lymphoma	28/F	Sensitive to Ciprofloxacin, Levofloxacin, Cotrimoxazole, Minocycline, Imipenem Resistant – Gentamicin, Amikacin, Piperacillin-Tazobactam	Recovered
Vaidhyswaran R., et al. /2022 [16]	Bacteremia	Systemic Lupus Erythematosus	18/F	Sensitive to imipenem, meropenem, and trimethoprim-sulfamethoxazole Resistant to amikacin. Gentamycin, cefepime, cefuroxime, ceftazidime,	Recovered

				aztreonam, amoxicillin-clavulanate, piperacillin-tazobactam	
Sardana V. et al. /2022 [17]	Bacteremia	DM-II with CKD on Hemodialysis	70/F	Susceptible to Ciprofloxacin, Cotrimoxazole, Imipenem, Meropenem, Gentamicin, Amikacin Resistant to Penicillin, Ampicillin, Cefepime, Chloramphenicol, Cefotaxime, Amoxiclav, Tetracycline, Colistin	Recovered

Jeyaraman M. et al/ 2022 [18]	**Musculoskeletal disorder**	**No risk factors**	37/M	Susceptibility to cotrimoxazole, imipenem, meropenem, piperacillintazobactam, Resistance to aminoglycosides, cephalosporins, fluoroquinolones.	Recovered
Ray D., et al. / 2024 [19]	**Bacteremia** **2 case reports:**	**Case1;** Post-Op Craniotomy (Extra-axial Space occupying lesions)	53/M	Susceptible to ciprofloxacin, levofloxacin, meropenem, imipenem, ertapenem, amikacin, gentamicin, and tetracycline. Resistance to ampicillinsulbactam, amoxicillin-clavulanate, cefotaxime, ceftazidime, cefuroxime, ceftriaxone, cefepime, aztreonam, and piperacillin-tazobactam.	Recovered
			85/M		Recovered
		Case 2; Urinary retention with COPD		Susceptible to ciprofloxacin, levofloxacin, meropenem, imipenem, ertapenem, amikacin, gentamicin, tetracycline Resistance to ampicillinsulbactam, amoxicillin-clavulanate, cefotaxime, ceftazidime, cefuroxime, ceftriaxone, cefepime, aztreonam, and piperacillin-tazobactam	

Acronyms: DM- Diabetes Melitus, HTN- Hypertension, CAD- Coronary artery disease, LVD-Left ventricular dysfunction, SGA-Small for gestational age, RDRespiratory distress, VLBW-Very low birth weight, ESRD-End stage renal disease, CKD- Chronic kidney disease, NAD-Nothing abnormal discovered, COPD- Chronic obstructive pulmonary disease.

These findings highlight the necessity of acknowledging *Ochrobactrum anthropi* as a potential pathogen, not only in immunocompromised individuals but also in healthy or immunocompetent patients, particularly in light of its evolving resistance patterns. We have depicted the literature of all the reported cases from India, highlighting the risk factors associated with infections caused by *Ochrobactrum anthropi*, its resistance patterns, and outcomes in table 2. Among the eleven reported cases from India, involving diverse clinical specimens and multiple risk factors, nine patients recovered, while two cases resulted in mortality.

Conclusions: In conclusion, infections attributable to rare or low-virulence pathogens, such as *Ochrobactrum anthropi*, should not be underestimated, even in immunocompetent individuals. Although this nonfermenting gram-negative bacillus is generally regarded as an opportunistic pathogen with low virulence, it has been implicated in over 135 cases worldwide, affecting both immunocompromised and immunocompetent individuals, often in discrete outbreaks. Healthcare professionals must maintain a heightened awareness of such pathogens, recognizing their potential to cause significant infections regardless of the patient's immune status

Declarations

Consent to participate: Informed written consent was obtained from both participants.

Consent to publish declaration: It is certified that Informed written consent was obtained from the patients regarding the use and publishing of their non-identifiable data.

Conflict of interest: "The authors declare that they have no competing interests" in this section.

Funding: Not applicable

Data availability: No datasets were generated or analyzed during the current study **Credit**

Author's contribution Statement:

1. **RS**: Conceptualization, Methodology, Software, Writing- Original draft preparation, Investigation, Validation
2. **AKS**: Visualization, Supervision, Reviewing and Editing
3. **NG**: Data curation, Visualization, Software.
4. **GD**: Data curation, Literature search, Validation
5. **AKV:** Visualization, Supervision, Reviewing and Editing

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