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Case Report

Microbiology Section

Cupriavidus gilardii Pneumonia in a Young Patient with Chronic Kidney Disease: A Case Report

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ABSTRACT

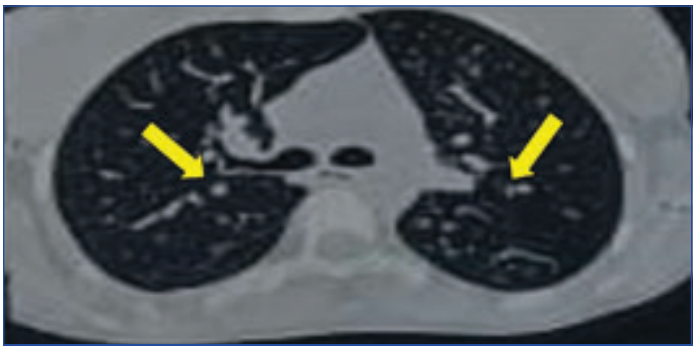
Cupriavidus gilardii (C. gilardii) is a Gram-negative, motile, non sporulating, non lactose fermenting bacterium. It was first identified by Coenye et al., and has a complex taxonomy, often being misidentified as *Wausteria gilardii, Ralstonia gilardii*. It is commonly found in ecosystems containing plants and heavy metal-contaminated soil and is rarely isolated from clinical samples with no clear evidence of its clinical significance. The pathogenic nature of *C. gilardii* in respiratory ailments, particularly in patients with cystic fibrosis, is still unclear. This case report presents a 19-year-old female with Chronic Kidney Disease (CKD) who developed pneumonia caused by *C. gilardii*. The report also includes the sensitivity pattern of the bacterium to guide physicians in treating these rare pathogens.

Keywords: Cystic fibrosis, Ecosystems, *Ralstonia gilardii*, Soil

CASE REPORT

A 19-year-old female, a known case of CKD with bilateral small kidneys, presented to the emergency outpatient department with chief complaints of progressively worsening cough with expectoration and occasional episodes of blood in vomit for the past one week, followed by low-grade fever for the past five days. She had been in contact with a positive case of tuberculosis within the family and was suspected to have pulmonary tuberculosis at a Community Healthcare Centre (CHC). She was administered oral tablet levofloxacin 400 mg BD for two weeks, but no improvement in her symptoms was observed. She was then referred to a tertiary care centre.

On examination, a consulting physician observed a pulse rate of 156 beats per minute and a blood pressure of 137/70 mmHg, with a respiratory rate of 28 breaths per minute. The partial pressure of oxygen was recorded as 89% on ambient air. A High Resolution Computed Tomography (HRCT) of the chest was performed, which revealed nodular lesions in both lungs [Table/Fig-1].

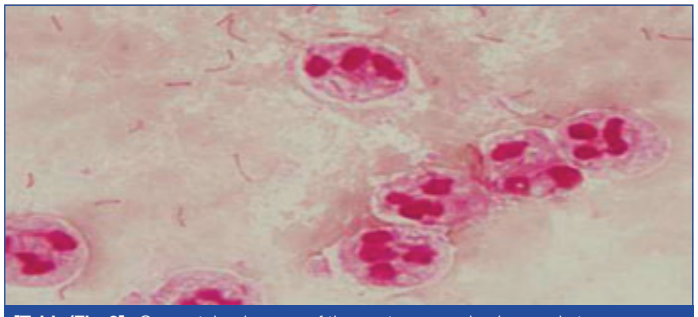


[Table/Fig-1]: High Resolution Computed Tomography (HRCT) Chest showing bilateral nodular opacities marked by yellow arrows.

All routine tests were performed on admission, and the results are represented in [Table/Fig-2]. The patient was admitted, and her procalcitonin assay was elevated (29.49 ng/mL), suggestive of an underlying infectious aetiology. A deeply expectorated sputum sample was sent to the bacteriology section of the Department of Microbiology. A Gram-stained smear and Ziehl-Neelsen (ZN) stain were prepared from the sample. On microscopy, the Gram-stained smear observed at 100X magnification showed a few epithelial cells, a few pus cells, and plenty of gram-negative bacilli [Table/Fig-3].

24 hr clinical chemistry	Result	Reference range
S.Creatinine (mg/dL)	3.77	0.6-1.5
S.Bilirubin, Total (mg/dL)	1.54	0.2-1.2
S.AST (SGOT) (U/L)	19	8.0-40.0
S.ALT (SGPT) (U/L)	07	8.0-40.0
S.Amylase (U/L)	416	11.0-90.0
S.Lipase (U/L)	469	6.0-38.0
S.Urea (mg/dL)	140.52	12.8-42.8
CRP (mg/L)	41.7	Up to 5.0
Hb (gm/dL)	9.2	11-14
TLC (/µL)	10.0×1000	4.4-11.0×1000
DLC (%)	Monocytes 03	M-2 to 8
	Lymphocytes 15	L-20 to 40
	Eosinophils 02	E-1 to 4
	Neutrophils 80	N-40 to 60
	Basophils 00	B-0.5 to 1
ESR (mm/h)	106	Male <15 and Female <20
PLT (/cubic mm)	178×1000	150,000 to 450,000

[Table/Fig-2]: All routine tests were performed on admission of the patient to the emergency ward at institute.
AST: Aspartate transaminase; SGOT: Serum glutamic-oxaloacetic transaminase; ALT: Alanine transaminase; SGPT: Serum glutamic-pyruvic transaminase; CRP: C-reactive protein; Hb: Haemoglobin; TLC: Total leukocyte count; DLC: Differential leukocyte count; ESR: Erythrocyte sedimentation rate; PLT: Platelet count



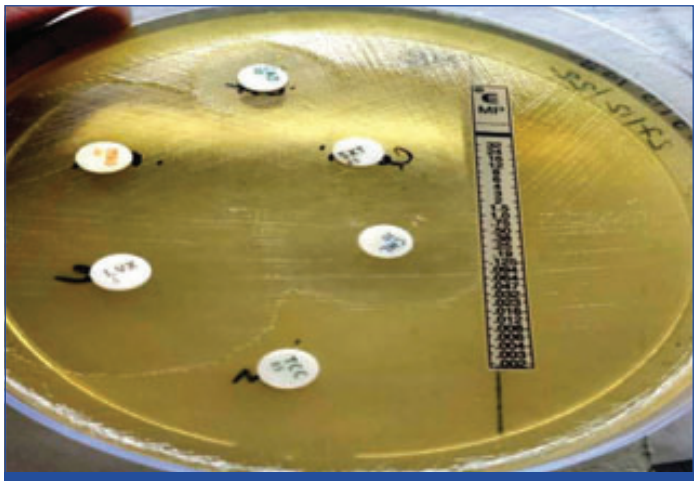
[Table/Fig-3]: Gram stained smear of the sputum sample observed at a magnification of 100X shows few epithelial cells, moderate pus cells and plenty gram negative bacilli.

No acid-fast bacilli were observed on the ZN-stained smear. The sample was inoculated on MacConkey's and Blood agar and

incubated overnight in an aerobic incubator at 37ºC. After 16-18 hours of incubation, late-lactose fermenting colonies were observed on MacConkey agar [Table/Fig-4].

[Table/Fig-4]: Late-lactose fermenting colonies of *Cupriavidus gilardii* were observed on MacConkey agar.

Chocolate agar was not used in this laboratory. The identification of the bacteria was confirmed by Matrix-Assisted Laser Desorption/Ionisation-Time of Flight-Mass Spectrometry (MALDI-TOF-MS) with a confidence percentage of 99%. To confirm the isolation of this microorganism from respiratory secretions, a repeat sample was advised, and growth of the same microorganism was observed. Antibiotic sensitivity testing was performed using the Kirby Bauer disc diffusion method on cation-adjusted Muller-Hinton Agar (MHA) and interpreted according to CLSI guidelines 2023 [1]. The isolate was found to be susceptible to ceftazidime, chloramphenicol, trimethoprim-sulfamethoxazole, and levofloxacin [Table/Fig-5].



[Table/Fig-5]: Antibiotic susceptibility to the antimicrobial agents were determined by disk diffusion using Mueller-Hinton agar (MHA) in ambient air, incubation 16-18 h in 35°C ±2°C and the results were interpreted according to CLSI guidelines.

The patient was started on ceftriaxone empirically before the antibiotic sensitivity report was acknowledged, and thereafter, she was managed with trimethoprim-sulfamethoxazole 80 mg/400 mg BD for five days. After three days of treatment, she was relieved of fever and expectoration. Due to financial constraints, she was unable to afford further treatment but returned to the pulmonary outpatient department with all organ systems, especially the respiratory system, within normal physiological limits.

DISCUSSION

C. gilardii is a Gram-negative, motile, non sporulating, non lactose fermenting bacterium [2]. It was first identified by Coenye T et al., and has a complex taxonomy. It has been misidentified as *Wausteria gilardii, Ralstonia gilardii* [3,4]. It is commonly found in the environment, specifically in plants and heavy metal-contaminated soil. It is rarely isolated from clinical samples, and its clinical significance is not well-established [2,5,6]. The pathogenic nature of *C. gilardii* in respiratory ailments, particularly in patients with cystic fibrosis, is still not clear [5].

Due to its rarity in clinical isolates, there is limited literature available on infections caused by *C. gilardii*. This case report presents a review of all reported cases of *C. gilardii* infection in humans [Table/Fig-6] [7-11]. Previous cases of infection with *C. gilardii* involved immunocompromised patients with underlying conditions such as renal transplant [7], acute lymphocytic leukaemia [8], idiopathic aplastic anaemia [9], patients with pacemaker support [10], and Chronic Obstructive Pulmonary Disease (COPD) [11]. Advancements in diagnostic modalities like MALDI-TOF-MS have improved the accuracy of identifying *C. gilardii* from clinical samples compared to earlier cases where biochemical tests played a significant role [10].

Authors, year of publication	Age (years)/Sex	Site involved	Underlying condition
Wauters G et al., [8], 2001	7/F	Catheter related sepsis	Acute lymphoblastic leukaemia
Karafin M et al., [9], 2010	12/F	Isolated from blood throat and stool	Severe idiopathic aplastic anaemia
Tena D et al., [7], 2014	36/M	Thigh abscess	Renal transplant recipient
Kobayashi T et al., [10], 2016	90/F	Pacemaker-associated bloodstream infection	Pacemaker implanted for sick sinus syndrome
Zhang Z et al., [11], 2017	87/M	Blood	COPD and hypertension
Jamwal A et al., 2023	19/F	Sputum	Chronic kidney disease

[Table/Fig-6]: A review of all the cases of infection with *C. gilardii* reported in humans [7-11].
COPD: Chronic obstructive pulmonary disease

In the literature, all studies have identified *C. gilardii* as an opportunistic pathogen causing infections in immunocompromised patients. In this case, the patient was immunocompromised due to CKD with elevated urea levels and sepsis, indicated by high procalcitonin levels. The age of the patient in this case aligns with the age range of previously reported cases (36, 7, and 12 years old) [7-9]. The patient had no history of contact with soil and plants, so the source of the pathogen could not be identified.

C. gilardii is intrinsically resistant to a spectrum of antibiotics [10]. This case report mentions that the microorganism showed susceptibility to trimethoprim-sulfamethoxazole, consistent with previous reports [7-9]. The isolate in this case was also found to be susceptible to levofloxacin in-vitro, but it was not used due to the microorganism's ability to easily develop resistance, limiting the effectiveness of most drugs [9,10].

CONCLUSION(S)

This case report describes the sixth reported case of infection caused by *C. gilardii*. Although the source of infection could not be identified in this case report, the isolation of the microorganism from two consecutive sputum samples and the clinical symptoms of the patient were indicative of its pathogenic nature. A larger study cohort is needed to further investigate the characteristics and pathogenicity of *C. gilardii*.

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