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Sepsis Due to *Chryseobacterium gleum* in a Diabetic Patient with Chronic Obstructive Pulmonary Disease: a Case Report and Mini Review

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Chryseobacterium species are ubiquitous in nature. Many fomites and medical devices in the hospital may serve as potential reservoirs of infection, especially for immunocompromised patients (1). *Chryseobacterium gleum* (2) was previously known as *Flavobacterium gleum* (3). Vancanneyt et al. proposed the novel genus *Chryseobacterium* in 1994 (4), and *C. gleum* is considered as the type species. It is a lactose non-fermenting Gram-negative bacillus (NFGNB), which was first described in detail by Yabuuchi et al. in 1983 (5).

Patients at both extremes of age and immunocompromised individuals are more susceptible to this infection (6,7). Very limited clinical data are available for this newly identified pathogen, and it has been rarely reported as a cause of sepsis anywhere in the world (Table 1) (8). The correct identification of this pathogen is essential due to its contrasting susceptibility pattern to other NFGNBs. It is highly resistant to third generation cephalosporins and carbapenems, which are often used as empirical therapy in intensive care units (ICUs). Here we describe a case of sepsis due to *C. gleum*. To the best of our knowledge, this is the first case of sepsis due to *C. gleum* in India and the second case world-wide.

In this case study, a 64-year-old diabetic and hypertensive man (on treatment), who was a known case of chronic obstructive pulmonary disease (COPD) since the last 10 years presented to our tertiary care hospital with severe respiratory distress. He had required hospitalization twice in the past year for exacerbation of respiratory symptoms, which was managed empirically with steroids, antibiotics (details could not be obtained), and bilevel positive airway pressure (BiPAP) support. In our hospital, the patient was intubated and placed on a ventilator as above. Culture of tracheal secretions revealed growth of *Pseudomonas aeruginosa* after 48 h of incubation, while the blood culture was sterile. The patient was started on intravenous imipenem (1 g; t, d, s). On the sixth day of treatment, after initial improvement the patient developed fever and signs of sepsis. The complete blood count showed leukocytosis (19,300/ μ L) with raised neutrophils (82%) and decreased lymphocytes

(15%). The blood was sent for culture. On MacConkey agar, lactose non-fermenting colonies were seen with non-diffusible orange-yellow pigment, which were better discernable on nutrient agar. On blood agar, colonies were non-hemolytic. The organism was non-motile, catalase and oxidase positive. In Triple Sugar Iron agar, no sugars were fermented, and neither gas nor hydrogen sulfide was produced. Indole production was detected, and the organism hydrolyzed urea. Further, it was negative for citrate utilization. It was nitrate non-reducing, and amino acids were not decarboxylated. None of the sugars were fermented. The NFGNB was conventionally identified as *C. gleum* due to indole production, hydrolysis of urea, and absence of growth at 42°C (2). To exclude contamination, a repeat sample was obtained 34–36 h after the first one from a site different to that selected for the first blood culture, before changing the antibiotic. It revealed a morphologically identical, cytochrome oxidase-positive, and pigmented pathogen. The identification was confirmed by the Matrix-Assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS; Bruker Daltonics, Bremen, Germany) using the MALDI Biotyper 3, and the isolate was identified as *C. gleum* from the high score (≥ 2 ; 2.1).

To trace the source of infection, environmental surveillance was conducted by the ICU. Various samples were taken from the ventilator, patient's bed, intubation tubes, humidifiers, and disinfectants; nonetheless, growth of *C. gleum* was not observed in any of the samples.

Antimicrobial susceptibility testing was performed by the Kirby-Bauer disk diffusion method according to the Clinical and Laboratory Standards Institute (CLSI) 2016 guidelines. The organism was susceptible to amikacin, cotrimoxazole, ciprofloxacin, levofloxacin, piperacillin-tazobactam, and tetracycline. It was resistant to imipenem, ceftazidime, cefepime, ceftriaxone, and amoxicillin-clavulanic acid. Based on the antibiogram pattern, the patient was successfully treated with the administration of levofloxacin 750 mg o.d. in 100 mL normal saline for 7 days. Blood culture obtained on seventh day was sterile, and patient made an uneventful recovery.

Chryseobacterium spp. are emerging opportunistic pathogens that can survive in a hospital environment. In this report, we have presented on a highly immunocompromised diabetic patient with severe COPD, who had 2 recent episodes of prolonged hospitalization. He had been treated with multiple antibiotics during each admission. Diabetes has been identified as a risk factor in

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Table 1. Review of literature regarding *Chryseobacterium gleum*

Publication (ref no.)	Age (yr)	Sex	Country	Sample	Underlying medical condition	Treatment	Outcome
2014 (6)	3 neonates		Croatia	stomach content aspirate	early onset neonatal sepsis	ciprofloxacin	survived
2015 (7)	62	M	<u>India</u>	urine pus	chronic kidney disease, diabetes mellitus, hypertension	ofloxacin/piperacillin-tazobactam	survived
2015 (9)	48	M	<u>India</u>	USG-PCN fluid	surgery (double J-stent)	tetracycline	survived
2015 (8)	35	W	Croatia	tracheal aspirate blood	extreme malnutrition	piperacillin-tazobactam	survived
2016 (1)	6 mon	M	Saudi Arabia	respiratory sample	infantile nephrotic syndrome	levofloxacin	survived
2016 (10)	58	M	<u>India</u>	urine	chronic kidney disease, diabetes mellitus	ciprofloxacin	survived

M, man; W, woman; USG-PCN, ultrasound-guided direct percutaneous nephrostomy.

other reported cases as well (7). The patient in our study was on ventilator, had indwelling devices, and required prolonged ICU stay. He was also given imipenem for treating pseudomonal infection, which could have led to selective infection by *C. gleum*, as it is resistant to imipenem. These factors could have contributed to sepsis by *C. gleum*, and sepsis cases due to this uncommon organism are very rarely reported in the literature. To the best of our knowledge, the present case is the second reported case of sepsis due to *C. gleum* in the world. In 2015, Brkic et al. reported a case of a 35-year-old female patient with extreme malnutrition and a hepatic lesion, whose blood and tracheal aspirate cultures showed growth of *C. gleum* (8).

According to the SENTRY Antimicrobial Surveillance Program, *Chryseobacterium* spp. represented about 0.27% (50 of 18,569) of the processed NFGNBs from 33 medical centers in 16 countries, among which only 2 isolates (4%) were identified as *C. gleum* (11). Nonetheless, in the Indian subcontinent, this pathogen is being increasingly reported in the last few years. Various cases of *C. gleum* along with the underlying comorbidity are described in Table 1.

According to Chang et al., *Chryseobacterium* species are susceptible to agents like vancomycin, erythromycin, and clindamycin (12); however, the majority of other studies have reported resistance to all of these antibiotics. Most of the cases of *C. gleum* infections have been treated successfully with a fluoroquinolone (ciprofloxacin and levofloxacin) or piperacillin-tazobactam (1,6,7). In contrast, Garg et al. reported resistance to fluoroquinolones and susceptibility to only tetracycline and minocycline (9). Abdalhamid et al. have reported successful treatment of an infected infant with levofloxacin (1). Likewise, in our case, the patient was successfully treated with levofloxacin.

It is imperative to identify *C. gleum* because the therapy for frequently isolated NFGNBs, such as *P. aeruginosa*, is ineffective against this organism. In addition, due to the production of class A beta-lactamase, it is resistant to carbapenems and cephalosporins, and this may contribute to its rise as a notorious nosocomial pathogen (13).

Here we re-emphasize the importance of accurate identification of NFGNBs due to their contrasting susceptibility patterns. Furthermore, increased awareness

amongst microbiologists and clinicians about *C. gleum* is required, especially with regard to diabetic patients, who are treated with broad-spectrum antibiotics.

Conflict of interest None to declare.

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