Original Article

Chryseobacterium indologenes: An Emerging Hospital Infection

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ABSTRACT

Aim: The study reports of *Chryseobacterium indologenes* are limited in India. Hence, we retrospectively investigated the underlying diseases in patients in whom we isolated this organism and studied the antimicrobial resistance pattern. **Background:** *C. indologenes* is a rare pathogen in humans and is not normally present in the human microflora although it is widely distributed in nature. It shows a multidrug resistance pattern which makes the treatment challenging for the clinicians. **Description:** Patients with *C. indologenes* were identified in our hospital between January 2016 and August 2017. Clinical features and antimicrobial susceptibilities of these patients were analyzed. Five isolates of *C. indologenes* were identified, with all the patients having underlying diseases. *C. indologenes* were isolated from endotracheal secretions, blood, pleural fluid and hemodialysis catheter tip. Majority patients had other co-morbidities. Out of 5 isolates, 3 isolates were pandrug resistant for our selected panel of drugs. **Conclusion:** *C. indologenes* are shown to be resistant isolates to multiple antibiotics, making the treatment challenging for the clinicians. However, the outcomes of the patients remain favorable. Although resistance was high, virulence is not very high.

Key words: *Chryseobacterium indologenes*, hospital infection, multidrug resistance

INTRODUCTION

Chryseobacterium indologenes, formerly known as flavobacterium indologenes or *Flavobacterium aureum*, belongs to CDC Group II b. *C. indologenes* is a rare pathogen in humans and is not normally present in the human microflora although it is widely distributed in nature.[1] It is non-motile, catalase positive, oxidase positive, indole positive, non-glucose-fermenting Gram-negative bacilli. *C. indologenes* has been seen to cause various types of infections such as bacteremia, septicemia, pneumonia, meningitis, artificial shunt infection, and catheter-associated urinary tract infection,[2-8] especially in those with indwelling devices and those with underlying diseases. *Chryseobacterium meningosepticum* and *C. indologenes* are two species most commonly isolated from clinical specimen.[2] *C. indologenes* is also intrinsically resistant to carbapenems and cephalosporins.[9,10] In this study, we retrospectively analyzed a case series of four patients with *C. indologenes* in our hospital for a period of 1½ years.

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METHODS

Patient Identification

We isolated and identified five isolates of *C. indologenes* from various clinical samples such as blood, endotracheal tube secretions, hemodialysis catheter tip, and pleural fluid. Detailed data of the patient's

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age, gender, underlying diseases, initial admission diagnosis, period of stay, use of indwelling catheters, ventilator, hemodialysis, and clinical outcomes were recorded.

Bacterial Identification

These samples were inoculated on blood agar and MacConkey agar. Yellow-pigmented colonies were seen on blood agar. No growth was seen on MacConkey agar. It was oxidase positive, catalase positive Gram-negative bacilli. It does not ferment glucose.

Antibiotic Sensitivity

VITEK 2 system (bioMerieux) with VITEK 2 GN card was used to confirm bacterial identification. All the microorganisms were identified as *C. indologenes*. Antibiotic sensitivity was performed using VITEK 2 AST N281 GNB card.

CASE REPORTS

Five isolates of *C. indologenes* were identified from four patients in our hospital. Detailed clinical characteristics of these patients are summarized in Table 1. Underlying diseases were present in all our patients. Male patients predominated (75%) in our study and patients of different age group were affected with age varying from 1 year to 67 years.

Three of the four patients had comorbid conditions such as diabetes and hypertension. Majority patients (75%) had indwelling devices such as endotracheal tube and catheters. All strains were isolated after 48 h of admission to the hospital making it a nosocomial infection. Of four patients, survival was recorded in three patients. One patient who was admitted after road traffic accident died of intracranial bleed. The remaining three patients were treated with antibiotics appropriate to the minimum inhibitory concentrations (MIC) test results. In two patients, we have also isolated *Enterobacter cloacae* and *Enterococcus faecalis* from blood and urine sample simultaneously in addition to *C. indologenes*.

The results of antimicrobial susceptibility testing are shown in Table 2. Of five isolates, three were pandrug resistant. Our isolates were sensitive to co-trimoxazole (40%), ciprofloxacin (40%), cefoperazone-sulbactam (40%), ceftriaxone (40%), amoxicillin-clavulanate (20%), and colistin (20%). 100% resistance was seen to piperacillin-tazobactam, cefepime, and carbapenems.

Table 1: Demographic profile of patients

Case	Age (years)/ sex	Underlying condition	Comorbid disease	Day of isolation (after admission)	Samples from which *Chryseobacterium* indologenes isolated	Other bacteria isolated	Antimicrobials agents	Clinical outcomes
1	67/M	Congestive cardiac failure, pleural effusion, lymphoma	Hypertension	14	Pleural fluid	–	Ciprofloxacin	Survival
2	53/M	Road traffic accident	Diabetes	18	blood Endotracheal tube	Enterococcus faecalis from urine	Colistin	Died
3	1/F	Respiratory failure	–	5	Endotrcheal tube	Enterobacter cloacae from Blood	Ciprofloxacin+cotrimoxazole	Survival
4	17/M	Chronic kidney disease	Hypertension	5	Hemodialysis catheter tip	–	–	Survival

Table 2: Antimicrobial spectrum of selected antimicrobial agents against *Chryseobacterium indologenes*

Antimicrobial agents	MIC range	Number of isolates susceptible (*n*−5)
Piperacillin+tazobactam	>128	0
Ciprofloxacin	1−>4	2
Cefepime	4−>64	0
Imipenem	>16	0
Meropenem	>16	0
Amoxicillin+clavulanic acid	16−>32	1
Cefoperazone+sulbactam	<8−>64	2
Ceftriaxone	4−>64	1
Tigecycline	1−>8	2
Cotrimoxazole	<20−160	2
Colistin	<0.5−>16	1

MIC: Minimum inhibitory concentrations

DISCUSSION

C. indologenes is widely distributed in nature but is a rare human pathogen. In 1993, Bonten *et al*. first isolated it from tracheal aspirate in a patient with ventilator-associated pneumonia.[11] The six species of the genus *Chryseobacterium* which are commonly isolated from clinical specimen are *C. meningosepticum*, *Chromolaena odoratum*, *Chryseobacterium multivorum*, *Chryseobacterium breve,* and Group IIb *Chryseobacterium* spp., which includes *C. indologenes* and *Chryseobacterium gleum*. Of six species, *C. indologenes* and *C. meningosepticum* are most pathogenic.[12] In the literature, most cases of *C. indologenes* bacteremia were detected in hospitalized patients with a severe underlying disease, such as malignancies or diabetes mellitus, or indwelling devices.[2-8] The world literature cites different indwelling devices such as respirators, endotracheal tubes, tracheostomy rubes, and humidifiers responsible for colonization of this pathogen. The organism survives in chlorinated water supplies and can form biofilms, thereby easily colonizing hospital environment or patients through contaminated medical equipment.[8] In the hospital environment, these organisms exist in water systems and on wet surfaces of medical tools and equipment. *Chryseobacteria* are of low pathogenicity. The production of biofilm and protease activity plays an important role in the virulence of invasive infections due to *C. indologenes*.[4]

The choice of an effective drug for the empirical treatment of infections due to *C. indologenes* is difficult due to the limited data in the literature. *C. indologenes* is also intrinsically resistant to carbapenems and cephalosporins due to its production of molecular class A β-lactamase[10] and Class B carbapenem-hydrolyzing β-lactamase (IND1-IND7).[13,14] In addition, the results of susceptibility testing vary when different methods are used. However, *in vitro* susceptibilities determined by the disk diffusion method showed poor correlation compared with the broth microdilution method, which is the preferred methodology.[15-17] The MIC breakpoints for these organisms have not been established by the CLSI, therefore making the treatment challenging.

In our study, we could not find the source of infection since we followed the patients retrospectively.

CONCLUSION

C. indologenes infections are mostly nosocomial. No case of community-acquired *C. indologenes* infection has yet been reported. Although resistance is high, virulence is not very high. Due to automated techniques, identification of this organism has become easier. Disk diffusion method criteria are yet to be more standardized for the antimicrobial susceptibility testing.

REFERENCES

1. Hsueh PR, Hsiue TR, Wu JJ, Teng LJ, Ho SW, Hsieh WC, *et al*. *Flavobacterium indologenes* bacteremia: Clinical and microbiological characteristics. Clin Infect Dis 1996;23:550-5.
2. Lin YT, Jeng YY, Lin ML, Yu KW, Wang FD, Liu CY, *et al.* Clinical and microbiological characteristics of *Chryseobacterium indologenes* bacteremia. J Microbiol Immunol Infect 2010;43:498-505.
3. Aydin Teke T, Oz FN, Metin O, Bayhan GI, Gayretli Aydin ZG, Oguz M, *et al*. Chryseobacterium indologenes septicemia in an infant. Case Rep Infect Dis 2014;2014:270521.
4. Christakis GB, Perlorentzou SP, Chalkiopoulou I, Athanasiou A, Legakis NJ. Chryseobacterium indologenes non-catheter-related bacteremia in a patient with a solid tumor. J Clin Microbiol 2005;43:2021-3.
5. Atıcı S, Ünkar ZA, Erdem K, Kadayifci EK, Karaaslan A, Memişoğlu AÇ, *et al.* Ventilator-associated pneumonia caused by *Chryseobacterium indologenes*: A rare infant case and review of the literature. Springerplus 2016;5:1741.
6. Hendaus MA, Zahraldin K. *Chryseobacterium indologenes* meningitis in a healthy newborn: A case report. Oman Med J 2013;28:133-4.
7. Ozcan N, Dal T, Tekin A, Kelekci S, Can S, Ezin O, *et al.* Is *Chryseobacterium indologenes* a shunt-lover bacterium? A case report and review of the literature. Infez Med 2013;21:312-6.
8. Bhalla GS, Gupta S. *Chryseobacterium indologenes*: Case report of an emerging pathogen. J Med Mar Soc

2018;20:70-2.
9. Matsumoto T, Nagata M, Ishimine N, Kawasaki K, Yamauchi K, Hidaka E, *et al.* Characterization of CIA-1, an ambler class A extended-spectrum β-lactamase from *Chryseobacterium indologenes*. Antimicrob Agents Chemother 2012;56:588-90.
10. Bellais S, Poirel L, Leotard S, Naas T, Nordmann P. Genetic diversity of carbapenem-hydrolyzing metallo-beta-lactamases from *Chryseobacterium* (*Flavobacterium*) *indologenes*. Antimicrob Agents Chemother 2000;44:3028-34.
11. Bonten MJ, van Tiel FH, van der Geest S, Smeets HG, Stobberingh EE, Gaillard CA, *et al.* Topical antimicrobial prophylaxis of nosocomial pneumonia in mechanically ventilated patients. Microbiological observations. Infection 1993;21:137-9.
12. Nulens E, Bussels B, Bols A, Gordts B, Van Landuyt HW. Recurrent bacteremia by *Chryseobacterium indologenes* in an oncology patient with a totally implanted intravascular device. Clin Microbiol Infect 2001;7:391-3.
13. Zeba B, De Luca F, Dubus A, Delmarcelle M, Simporé J, Nacoulma OG, *et al.* IND-6, a highly divergent IND-type metallo-beta-lactamase from *Chryseobacterium indologenes* strain 597 isolated in Burkina Faso. Antimicrob Agents Chemother 2009;53:4320-6.
14. Yamaguchi Y, Takashio N, Wachino J, Yamagata Y, Arakawa Y, Matsuda K, *et al.* Structure of metallo-beta-lactamase IND-7 from a *Chryseobacterium indologenes* clinical isolate at 1.65-A resolution. J Biochem 2010;147:905-15.
15. Chang JC, Hsueh PR, Wu JJ, Ho SW, Hsieh WC, Luh KT, *et al.* Antimicrobial susceptibility of flavobacteria as determined by agar dilution and disk diffusion methods. Antimicrob Agents Chemother 1997;41:1301-6.
16. Fraser SL, Jorgensen JH. Reappraisal of the antimicrobial susceptibilities of *Chryseobacterium* and *Flavobacterium* species and methods for reliable susceptibility testing. Antimicrob Agents Chemother 1997;41:2738-41.
17. Kirby JT, Sader HS, Walsh TR, Jones RN. Antimicrobial susceptibility and epidemiology of a worldwide collection of *Chryseobacterium* Spp: Report from the SENTRY antimicrobial surveillance program (1997-2001). J Clin Microbiol 2004;42:445-8.

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