CASE REPORT

# *Chryseobacterium indologenes*: an emerging infection in the USA

Ridhwi Mukerji, Radhika Kakarala, Susan Jane Smith, Halina G Kusz

Graduate Medical Education/Internal Medicine, McLaren-Flint Health Center/Michigan State University, Flint, Michigan, USA

**Correspondence to**
Dr Halina G Kusz,
Halina.Kusz@mclaren.org

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## SUMMARY

Nursing home-associated infections and antibiotic resistant pathogens constitute common and serious problems in the geriatric population. *Chryseobacterium indologenes*, a non-motile Gram-negative rod, though widely distributed in nature, is an uncommon human pathogen. Typically thought of as an organism of low virulence, it may cause serious infections, particularly among the immunocompromised. The majority of reported cases are nosocomial, often associated with immunosuppression or indwelling catheters. It has been reported as the causative agent in bacteraemia, peritonitis, pneumonia, empyema, pyelonephritis, cystitis, meningitis and central venous catheter-associated infections. We report a rare case of *C. indologenes* infection affecting a nursing home resident in the USA and we provide a review of similar cases. This report emphasises the importance of individualised treatment and promotes awareness about this organism as one of several emerging pathogens in immunocompromised adults and in the frail elderly who are often nursing home residents, in the Western Hemisphere.

## BACKGROUND

The elderly, including frail nursing home residents, adults with advanced or chronic illnesses regardless of age, immunocompromised patients whether due to systemic illness or medications and patients with indwelling devices or tubes, are especially prone to acquiring healthcare-associated infections. The emergence of new infections and antibiotic-resistant organisms increases this vulnerability even more. *Chryseobacterium indologenes* appears to be one of the new human pathogens all the more fearsome because of its exceptional antibiotic resistance.[1]

*C. indologenes* belongs to the *Chryseobacterium* genus, previously known as *Flavobacterium*. The genus is composed of six species where *Chryseobacterium meningosepticum*, in current taxonomy named *Elizabethkingia meningosepticum*, is reported as the most pathogenic, while *C. indologenes* was reported to have low virulence.[2] *C. indologenes* is a yellow-pigmented, non-motile, oxidase positive, glucose non-fermentative, Gram-negative rod-shaped bacterium widely distributed in nature. Other clinically significant Gram-negative rod-shaped micro-organisms commonly associated with urinary tract infections or sepsis are shown in the flow-diagram (figure 1).

Until 1996, *C. indologenes* had been only rarely implicated in bacteraemia in humans. Since then, the numbers of reported cases of *C. indologenes* infections are steadily increasing. The majority of reported infections have been from Taiwan[3] and only about 10% have been outside of Asia. A few reports have come from Australia, India, Europe and the USA[4 5] (table 1). There are many reported cases of *C. indologenes* in paediatric populations,[8 11] as well as in immunocompromised, hospitalised patients[12–14] with severe illness and or with indwelling devices.[7–9]

We report a *C. indologenes* infection in a diabetic nursing home adult with an indwelling Foley catheter, in the USA.

## CASE PRESENTATION

A 63-year-old Caucasian man, a resident of an extended care facility, was brought to the hospital, with acute confusion that was preceded by dysuria, fever and diffuse cramping lower abdominal pain. He had a history of spinal stenosis and urinary retention treated with an indwelling Foley catheter of 2 months' duration. Prior to admission, he had been treated empirically with nitrofurantoin 100 mg orally every 12 h for 5 days. Comorbid conditions included stable chronic obstructive pulmonary disease, coronary artery disease, diabetes mellitus, benign prostatic hypertrophy, atrial fibrillation, bipolar disorder and anaemia with haemoglobin of 7.7 g/dL. On physical examination, he was alert but oriented to neither time nor place; he had stable vital signs and some suprapubic tenderness.

## INVESTIGATIONS

On the second hospital day, urine culture showed more than 100 000 colony-forming units of *C. indologenes*, which was resistant to almost all antimicrobials except imipenem-cilastatin. The patient had no leucocytosis and blood cultures were negative.

## TREATMENT

Ceftriaxone 1 g was administered intravenously, which was later switched to vancomycin 1 g intravenously daily and piperacillin/tazobactam 3.375 g intravenously every 8 h, to provide broader empiric coverage. The source of infection was felt to be the indwelling Foley catheter, which was replaced and antibiotic therapy was changed to imipenem-cilastatin after consulting infectious disease.

## OUTCOME AND FOLLOW-UP

Repeat urine culture was negative and the patient was discharged with resolution of symptoms after 7 days of hospitalisation.

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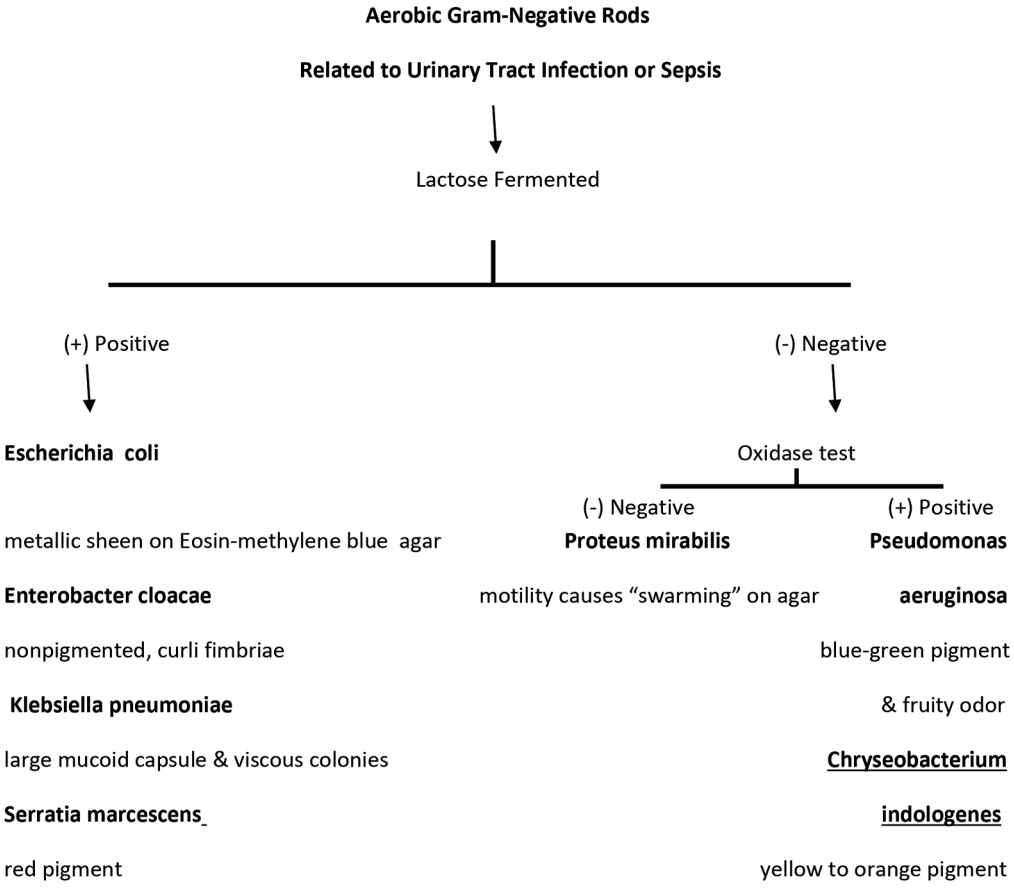


**Figure 1** Aerobic Gram-negative rods associated with urinary tract infection.

## DISCUSSION

*C. indologenes* is ubiquitous in nature, mainly found in soil and water and may be perceived as a coloniser. However, in some patients, it may cause significant morbidity and mortality. It resists chlorination and can survive in municipal water supplies.[2] It is prevalent on wet or humid surfaces in hospitals and also in catheters containing fluids, such as feeding tubes, central venous catheters and tracheostomy tubes.[15] The presence of contaminated medical devices in institutionalised and or immunocompromised patients, such as patients with diabetes mellitus, malignancies and neutropaenia and prolonged treatment with antibiotics, may result in serious infections.[4 7 16–18] More than half of the reported cases have been among hospitalised, immunocompromised patients with mechanical ventilation or indwelling catheters.[5 7 10 15] Although *C. indologenes* infections are nosocomial, device-related infections and, recently, non-catheter-related community-acquired *C. indologenes* bacteraemia in immunocompetent patients, have been reported.[12 19 20]

**Table 1** *Chryseobacterium indologenes*-related infections reported in the USA

| Author | Year | Place | Age/gender | Predisposing factor | Clinical presentation | Treatment | Outcome |
|---|---|---|---|---|---|---|---|
| Green *et al*[6] | 2001 | Texas | 77-year-old man | Treatment for squamous cell carcinoma of leg, swam in his pool | Cellulitis and bacteraemia | Levofloxacin | Recovered |
| Cone *et al*[7] | 2007 | California | 57-year-old woman | Breast cancer central catheter | Sepsis due to an infected central catheter | Ciprofloxacin catheter was removed | Recovered |
| Al-Tatari *et al*[8] | 2007 | Michigan | 13-year-old boy | Congenital hydrocephalus and LP shunt | LP shunt infection | Trimethoprim-sulfamethoxazole and rifampin LP shunt was removed | Recovered |
| Shah *et al*[9] | 2012 | New York | 26-year-old woman | Liver transplant on immunosuppressive treatment; subcutaneous port | Worsening ascites, abdominal pain | Levofloxacin and trimethoprim-sulfamethoxazole port was removed | Recovered |
| Yasmin *et al*[5] | 2013 | Georgia | 32-year-old woman | Metastatic breast cancer; on mechanical ventilation | Ventilator-associated pneumonia | Levofloxacin | Patient Died |
| Afshar *et al*[4] | 2013 | District Columbia | 51-year-old man | End stage renal disease; on peritoneal dialysis | Peritonitis | Ceftazidime *without* catheter removal | Recovered |
| Monteen *et al*[10] | 2013 | Tennessee | 66-year-old man | Critical accident; trapped under water and later intubated | Ventilator-associated pneumonia | Moxifloxacin and cefepime | Recovered |
| This study | 2015 | Michigan | 63-year-old man | Indwelling Foley catheter; nursing home patient | UTI | Imipenem | Recovered |

LP, lumboperitoneal; UTI, urinary tract infection.

**Table 2** Urinary tract infections associated with *Chryseobacterium indologenes*: case reports

| | Patient 1 | Patient 2 | Patient 3 | Patient 4 |
|---|---|---|---|---|
| Age (years) | 19 | 86 | 42 | 21 |
| Gender | Female | Female | Female | Female |
| Predisposing factor | Urinary catheter for 7 days after pyelolithotomy | Insulin-dependent type 2 diabetes | Chronic myeloid leukaemia | Urinary catheter for 24 h after induced labour for intrauterine fetal death |
| Clinical presentation | High-grade fever, burning micturition on fifth postoperative day | Hospitalised for decompensated congestive heart failure | High-grade fever | Fever spike |
| Treatment | Piperacillin-tazobactam | Levofloxacin | Ceftriaxone | Tigecycline |
| Outcome | Recovered | Recovered | Died with severe sepsis | Recovered |
| Year | 2012 | 2013 | 2014 | 2015 |
| Place | India | Spain | Senegal | India |
| Author | Bhuyar *et al*[26] | Acosta *et al*[21] | Omar *et al*[27] | Solanke *et al*[28] |

It has also been reported that *C. indologenes* infection is more prevalent in the elderly.[20–23] However, there are only a few reports in octogenarians and/or nursing home patients. In addition to device-related risk in the elderly, other predisposing factors include immunocompromising conditions such as diabetes and long-term treatment with systemic steroids. Infections such as healthcare-associated pneumonia in an immunocompetent patient and polymicrobial urinary tract infections have been reported in this age group.[20 21 24] Outcomes of the hospitalised elderly have been favourable.

The most common clinical presentations of *C. indologenes* infection are pneumonia, bacteraemia, cellulitis, surgical wound infections, urinary tract infections, ocular infections, meningitis due to central nervous system shunt, peritonitis due to peritoneal catheter dialysis, intra-abdominal and other catheter-related infections.[4 6–8 25]

*C. indologenes* associated urinary tract infections have been recently reported worldwide[26–28] (table 2).

The mortality rate of *C. indologenes* varies with different studies, however, in a 2011 study from Taiwan, which included 10 patients with *C. indologenes* with sepsis (mean age of 71.1 years), the mortality rate at 14 days was 40%.[17] The analysis of 215 other *C. indologenes* cases, also from Taiwan, revealed that in-hospital mortality rates from bacteraemia were as high as 63.6% and from pneumonia, 35.25%.[3]

Although *C. indologenes* exhibits characteristics of low virulence, it may cause life-threatening infections due to its multidrug resistance.[22 29 30] Its ability to produce biofilm on foreign materials and produce proteases, can cause several forms of infections and is responsible for its virulent character.[31] One study mentioned the production of a metallo-β-lactamase, which allows the bacteria to hydrolyse the β lactam part of some drugs.[32] It was sensitive to a limited number of antibiotics that include newer quinolones, in particular, garenoxacin, gatifloxacin and levofloxacin, rifampin, trimethoprim-sulfamethoxazole and piperacillin-tazobactam.[22] The antibiotics commonly used to treat Gram-negative organisms, such as cephalosporins, aminoglycosides and imipenem, have—in an in vitro study—been reported to be ineffective against *C. indologenes*.[3] In addition, it is now shown in this study that its resistance is rapidly evolving, with drastically limited antibiotics to which it is susceptible, namely, trimethoprim-sulfamethoxazole and cefoperazone-sulbactam.[3]

There is controversy regarding whether indwelling catheters should be removed when there is an associated *C. indologenes* infection. Reports vary on the effectiveness of antibiotic treatment with or without removal of the indwelling device.[9 15 18 33–35] In general, when there is failure to respond to appropriate antibiotic treatment, indwelling catheters should be removed.[15] If the indwelling catheter-related infection caused by *C. indologenes* does not cause rapid clinical deterioration, then the device does not require removal.[15 18 36] However, in some immunocompromised patients, removal of a port or central catheter may hasten recovery.[37]

Because of varying susceptibilities, it has been suggested that the treatment of the organism should be based on its sensitivity pattern. In our case, results of susceptibility testing differed from what has been previously reported. Our isolated pathogen was sensitive only to imipenem-cilastatin.

In summary, infection from *C. indologenes* was initially rarely reported outside Taiwan. It is important to keep *C. indologenes* in mind as a possible source of infection in patients with the appropriate risk factors. Because of varying susceptibilities to antimicrobials, empiric antibiotic treatment of the patient with possible *C. indologenes* infection needs to be tailored to its local susceptibilities until a confirmatory culture report is obtained. This may avoid delay in the recovery of the patient. In addition, removing the probable source of infection may also be an important consideration. Moreover, the multidrug resistance makes this organism an ominous emerging pathogen.

## Learning points

- In the elderly and people with advanced illness or indwelling catheters and institutionalised or frail nursing home residents, even an organism with low virulence, such as *C. indologenes*, may become a life-threatening pathogen.
- Nosocomial spread is possible, therefore in hospitals and nursing homes, universal precautions need to be observed to avoid spread of the infection.
- Because of varying susceptibilities to antimicrobials, empiric antibiotic treatment of the patient with possible *C. indologenes* infection needs to be tailored to its local susceptibilities until a confirmatory culture report is obtained.

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## REFERENCES


1 Asaad AM, Al-Ayed MSZ, Qureshi MA. Emergence of unusual non-fermenting gram-negative nosocomial pathogens in a Saudi hospital. *Jpn J Infect Dis* 2013;66:507–11.
2 Steinberg J. Other Gram-Negative and Gram-variable Bacilli. In: Bennett JE, Dolin R, Blaser MJ *et al* eds. *Anonymous. Mandell, Douglas and Bennett's principles and practice of infectious diseases*. Saunders, 2015:2667–83.
3 Chen FL, Wang GC, Teng SO, *et al*. Clinical and epidemiological features of *Chryseobacterium indologenes* infections: analysis of 215 cases. *J Microbiol Immunol Infect* 2013;46:425–32.
4 Afshar M, Nobakht E, Lew SQ. *Chryseobacterium indologenes* peritonitis in peritoneal dialysis. *BMJ Case Rep* 2013;2013:pii: bcr2013009410.
5 Yasmin S, Garcia G, Sylvester T, *et al*. *Chryseobacterium indologenes* in a woman with metastatic breast cancer in the United States of America: a case report. *J Med Case Rep* 2013;7:190.
6 Green BT, Nolan PE. Cellulitis and bacteraemia due to *Chryseobacterium indologenes*. *J Infect* 2001;42:219–20.
7 Cone LA, Morrow AA, Benson M, *et al*. *Chryseobacterium indologenes* sepsis due to an infected central catheter in a patient with metastatic breast cancer to the skin. *Infect Dis Clin Pract* 2007;15:403–5.
8 Al-Tatari H, Asmar BI, Ang JY. Lumboperitonial shunt infection due to *Chryseobacterium indologenes*. *Pediatr Infect Dis J* 2007;26:657–9.
9 Shah S, Sarwar U, King EA, *et al*. *Chryseobacterium indologenes* subcutaneous port-related bacteremia in a liver transplant patient. *Transpl Infect Dis* 2012;14:398–402.
10 Monteen MR, Ponnapula S, Wood GC, *et al*. Treatment of *Chryseobacterium indologenes* ventilator-associated pneumonia in a critically ill trauma patient. *Ann Pharmacother* 2013;47:1736–9.
11 Douvoyiannis M, Kalyoussef S, Philip G, *et al*. *Chryseobacterium indologenes* bacteremia in an infant. *Int J Infect Dis* 2010;14:e531–2.
12 Christakis GB, Perlorentzou SP, Chalkiopoulou I, *et al*. *Chryseobacterium indologenes* non-catheter-related bacteremia in a patient with a solid tumor. *J Clin Microbiol* 2005;43:2021–3.
13 Bayraktar MR, Aktas E, Ersoy Y, *et al*. Postoperative *Chryseobacterium indologenes* bloodstream infection caused by contamination of distillate water. *Infect Control Hosp Epidemiol* 2007;28:368–9.
14 Ferreira Rde S, Brandão FFB, Lobo SM. *Chryseobacterium indologenes* infection: a case report. *Rev Bras Ter Intensiva* 2010;22:96–8.
15 Hsueh PR, Teng LJ, Ho SW, *et al*. Clinical and microbiological characteristics of Flavobacterium indologenes infections associated with indwelling devices. *J Clin Microbiol* 1996;34:1908–13.
16 Lin YT, Jeng YY, Lin ML, *et al*. Clinical and microbiological characteristics of *Chryseobacterium indologenes* bacteremia. *J Microbiol Immunol Infect* 2010;43:498–505.
17 Chou DW, Wu SL, Lee CT, *et al*. Clinical characteristics, antimicrobial susceptibilities, and outcomes of patients with *Chryseobacterium indologenes* bacteremia in an intensive care unit. *Jpn J Infect Dis* 2011;64:520–4.
18 Wang YC, Yeh KM, Chiu SK, *et al*. *Chryseobacterium indologenes* peritonitis in a patient with malignant ascites. *Int Med Case Rep J* 2011;4:13–15.
19 Cunha V, Ferreira M, Fonseca A, *et al*. community-acquired *chryseobacterium indologenes* in an immunocompetent patient. *JMM Case Reports* 2014:1.
20 Degandt S, Van Hoecke F, Colaert J, *et al*. Bacteremia due to *Chryseobacterium indologenes*, a naturally carbapenem-resistant Gram-negative pathogen, in a geriatric patient. *Eur Geriatr Med* 2013;4:345.
21 Acosta-Ochoa MI, Rodrigo-Parra A, Rodriguez-Martin F, *et al*. Urinary infection due to *Chryseobacterium indologenes*. *Nefrologia* 2013;33:620.
22 Kirby JT, Sader HS, Walsh TR, *et al*. 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.
23 Wang X, Hu Z, Fan Y, *et al*. *Chryseobacterium indologenes* catheter-related meningitis in an elderly patient after intracranial aneurysm clipping surgery. *Neurol Sci* 2014;35:113–15.
24 Nemli SA, Demirdal T, Ural S. A case of healthcare associated pneumonia caused by *Chryseobacterium indologenes* in an immunocompetent patient. *Case Rep Infect Dis* 2015;2015:483923.
25 Kilvington S, Shovlin J, Nikolic M. Identification and susceptibility to multipurpose disinfectant solutions of bacteria isolated from contact lens storage cases of patients with corneal infiltrative events. *Cont Lens Anterior Eye* 2013;36:294–8.
26 Bhuyar G, Jain S, Shah H, *et al*. Urinary tract infection by *Chryseobacterium indologenes*. *Indian J Med Microbiol* 2012;30:370–2.
27 Omar A, Camara M, Fall S, *et al*. *Chryseobacterium indologenes* in a woman with acute leukemia in Senegal: a case report. *J Med Case Rep* 2014;8:138.
28 Solanke V, Verma S, Nataraj G, *et al*. *Chryseobacterium indologenes* associated urinary tract infection- a case report. *Br Biomed Bull* 2015;3:75–80.
29 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.
30 Maravic A, Skocibusic M, Samanic I, *et al*. Profile and multidrug resistance determinants of *Chryseobacterium indologenes* from seawater and marine fauna. *World J Microbiol Biotechnol* 2013;29:515–22.
31 Chang YC, Lo HH, Hsieh HY, *et al*. Identification, epidemiological relatedness, and biofilm formation of clinical *Chryseobacterium indologenes* isolates from central Taiwan. *J Microbiol Immunol Infect* 2015;48:559–64.
32 Zeba B, De Luca F, Dubus A, *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.
33 Nulens E, Bussels B, Bols A, *et al*. Recurrent bacteremia by *Chryseobacterium indologenes* in an oncology patient with a totally implanted intravascular device. *Clin Microbiol Infect* 2001;7:391–3.
34 Hsueh PR, Hsiue TR, Wu JJ, *et al*. Flavobacterium indologenes bacteremia: clinical and microbiological characteristics. *Clin Infect Dis* 1996;23:550–5.
35 Ozcan N, Dal T, Tekin A, *et al*. Is *Chryseobacterium indologenes* a shunt-lover bacterium? A case report and review of the literature. *Infez Med* 2013;21:312–16.
36 Lin JT, Wang WS, Yen CC, *et al*. *Chryseobacterium indologenes* bacteremia in a bone marrow transplant recipient with chronic graft-versus-host disease. *Scand J Infect Dis* 2003;35:882–3.
37 Mutcali SI, Yemisen M, Soylu H, *et al*. Recurrent port infection due to *chryseobacterium indologenes*. *Eurasian J Med* 2013;45:60–1.