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Casi clinici

Case reports

Is *Chryseobacterium indologenes* a shunt-lover bacterium? A case report and review of the literature

Chryseobacterium indologenes predilige gli shunt? Descrizione di un caso clinico e rassegna della letteratura

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INTRODUCTION

Chryseobacterium genus was first described by Vandamme et al. in 1994 [1]. A study of SENTRY Antimicrobial Surveillance Program reported that *Chryseobacterium* species were only 0.03% of all isolated bacteria and 0.27% of non-fermentative bacteria collected during the five-year period from 1997 to 2001 [2]. *Chryseobacterium* infections are observed most frequently in the elderly (>65-year-old) however it is relatively rare (the lowest frequency) among children of five-year-old [2]. More commonly isolated *Chryseobacterium* species are *C. meningosepticum*, *C. odoratum*, *C. multivorum*, *C. breve* and group IIb *Chryseobacterium* species including *C. indologenes* and *C. gleum* [3, 4]. The most common species that causes human disease is *C. meningosepticum* followed by *C. indologenes* [4]. There are a few reported cases of *C. indologenes* infections in pediatric age group. These case reports are presented in Table 1 [5-12].

Chryseobacterium indologenes is a non-fermentative, oxidase positive, Gram-negative rod shaped bacterium. It is widely found in nature; soil and water but rarely causes infections in human [3]. It is an uncommon human pathogen. Contamination of the medical devices in hospital settings may lead to serious infections in immunocompromised patients, newborns, and having serious medical illnesses [13]. Biofilm production on foreign materials and protease activity may play an important role of *Chryseobacterium* virulence especially in patients with indwelling devices [11]. Reported infections due to *C. indologenes* include bacteremia, ventilator associated pneumonia, pyonephritis, biliary tract infections, peritonitis, lumboperitoneal shunt infections, ocular infections, surgical, burn wound infections, endocarditis, and keratitis [8-17]. Altered immune status, underlying medical illnesses and presence of indwelling medical devices are the risk factors for *C. indologenes* infections. A 13-year-old boy with a lumboperitoneal shunt (LP) from USA and a two-month-old male infant with an external shunt from Turkey have been reported previously [5, 8]. We present a ventriculoperitoneal (VP) shunt infection caused by *C. indologenes* in a hydrocephalic premature infant. This is the third case to our knowledge, of central nervous system (CNS) infection due to *C. indologenes*.

CASE REPORT

A six-month-old male infant with congenital hydrocephalus and VP shunt was applied with complaints of fever and irritability to another

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Table 1 - Case reports of C. indologenes infections of pediatric age in the literature.

Study name	*Year*	*Age/Gender (m-y/M-F)*	*Underlying condition*	*Infection site*	*Treatment*	*Associated condition*	*Course of disease*
Our case	2012	6 m/M	Prematurity+ hydrocephaly	Meningitis (VP shunt infection)	TMP-SMX+ SCP+shunt removal	VP shunt	Recovered
Ceylan et al. (5)	2011	2 m/M	Hydrocephaly	Meningitis+ sepsis	Ampicillin-sulbactam+ Levofloxacin	External shunt, hydrocephaly	died
Calderon et al. (6)	2011	0 m/M	Congenital heart disease	Pneumonia	Piperacillin-tazobactam	Ventilator	Recovered
Sudharani et al. (7)	2011	36 w/?	Prematurity	Bacteremia	Cefoperazone-sulbactam	Ventilator	Recovered
Douvoyiannis et al. (2)	2009	1 m/F	None	Bacteremia	Cefepim	None	Recovered
Al-Tatari et al. (8)	2007	13 y/M	?	CNS infection	TMP-SMX+ Rifampin	Lumbo-peritoneal shunt	Recovered
Bayraktar et al. (9)	2007	5 m/M	?	Bacteremia	?	?	?
Cascio et al. (10)	2005	2 y/M	DM	Bacteremia	Ceftriaxone	Peripheral catheter	Recovered
Hsueh et al. (11)	1996	1 y/F	Hepatoblastoma	Bacteremia	?	Port-A-Catheter	Recovered
Hsueh et al. (11)	1996	5 y/F	Neuroblastoma	Bacteremia	?	Hickman catheter	Recovered
Hsueh et al. (12)	1996	1 y/M	Burn	Nasocomial pneumonia	Ciprofloxacin+ Cefoxitin+ amikacin	Ventilator	Died

VP: ventriculoperitoneal, TMP-SMX: trimethoprim-sulfamethoxazole, SCP: sulbactam-cefoperazone.

hospital. No antibiotic was given and projectile vomiting was developed on the second day, and he was transferred to our hospital. He was born as a twin brother with 1,600 g birth weight at 32th week of pregnancy. A VP shunt had been inserted when he was one month of age because of congenital hydrocephalus. Then it had been revised three months later due to malfunction. He was 3,200 g in weight (<3 percentile), 60 cm tall (<3 percentile), and his head circumference was 48 cm (>97 percentile). His laboratory findings showed leukocytosis (WBC: 19,300 mm^3) and hypochromic microcytic anemia (red blood cell [RBC]: 3,810,000 mm^3, hemoglobin: 9.5 g/dL, hematocrit [HCT]: 27%, mean corpuscular volume [MCV]: 71.2 fL, mean corpuscular hemoglobin [MCH]: 25.1 pg). Investigation with cranial computerized tomography (CT) showed hydrocephalic enlargement of third ventricle and lateral ventricle, and a hypodense area was observed between cortex and sub-cortical zone adjacent to the right lateral ventricle.

The VP shunt was externalized and analysis of CSF revealed pleocytosis, a white blood cell count (WBC) of 1,300 mm^3 (60% polymorphonuclear leukocytes), a protein level of 380 mg/mL and a glucose level of 4 mg/100 ml. Polymorphonuclear leukocytes were observed in Gram staining of CSF.

Based on these findings, vancomycin and meropenem were started empirically, and CSF sample was sent to microbiology laboratory for bacterial culture. Yellow-colored colonies were

grown after 18-24 hours incubation onto 5% sheep blood agar plates. The microorganism was isolated as a non-lactose fermenting, oxidase positive and Gram-negative bacillus. The biochemical reactions of the isolate were positive for tryptophane, urease, gelatin, citrate, esculin hydrolysis and acid in maltose. The isolated bacterium was identified as *C. indologenes* by BD Phoenix™ 100 (Becton Dickinson, MD, USA) fully automated microbiology system.

Antimicrobial susceptibility testing was performed by both determining the minimal inhibitory concentration (MIC) value using microdilution method and measuring the inhibition zone diameter onto Mueller-Hinton agar (Oxoid Ltd., Basingstoke, K) medium aerobically at 35±2°C for 18-24 hours using Kirby-Bauer's disk diffusion method according to Clinical and Laboratory Standards Institute (CLSI) guidelines for non-fermentative microorganisms.

The isolate was found susceptible to ciprofloxacin (MIC: 0.5 µg/mL), levofloxacin (1 µg/mL), cefoperazone (4 µg/mL) and trimethoprim-sulfamethoxazole (1/19 µg/mL), while it was resistant to amikacin (64 µg/mL), aztreonam (32 µg/mL), cefepime (32 µg/mL), ceftazidime (32 µg/mL), gentamicin (16 µg/mL), ticarcillin-clavulanate (128/2 µg/mL) and piperacillin-tazobactam (128/4 µg/mL). Based on the susceptibility report, vancomycin and imipenem were discontinued, and trimethoprim-sulfamethoxazole and cefoperazone-sulbactam treatment was started. Then, the department of neurosurgery was consulted for removing the shunt.

After the removal of VP shunt, the patient's clinical and laboratory findings improved, and the CSF culture, obtained on the third day after the procedure, was sterile. Trimethoprim-sulfamethoxazole and cefoperazone-sulbactam treatment continued for 14 days. Subsequent CSF cultures remained sterile and a new VP shunt was placed. The patient was fully healed after two weeks and discharged.

DISCUSSION

C. indologenes is most likely acquired (nosocomial) by lumboperitoneal and external shunts [5, 8]. Al-Tatari et al. reported a case of LP shunt infection in a 13-year-old boy with congenital hydrocephalus treated with trimethoprim-sulfamethoxazole and rifampin [8]. Ceylan et al. reported a case of fatal *C. indologenes* septicemia (*C. indologenes* were isolated both from CSF and blood) developed in a newborn with hydrocephalus [5]. Our case was also an infant with VP shunt. These data have been showed that *C. indologenes* infections should be considered in infections due to VP shunt.

C. indologenes is often resistant to aminoglycosides, penicillin, aztreonam, first-, second- and third-generation cephalosporin (except for ceftazidime), chloramphenicol and erythromycin. It also shows resistance to imipenem and meropenem due to a class B carbapenem-hydrolyzing enzyme.

The newer quinolones (garenoxacin, gatifloxacin and levofloxacin), trimethoprim-sulfamethoxazole, rifampin, piperacillin, piperacillin-tazobactam, cefoperazone-sulbactam and cefepime are the most active agents among the β-lactams [8, 13].

Sudharani *et al*. reported on a bacteremia in a preterm baby who was treated successfully with cefoperazone-sulbactam [7]. Although *Chryseobacterium* is known as the only Gram-negative bacillus for which vancomycin has been effective, it can have variable sensitivity to vancomycin, trimethoprim-sulfamethoxazole and rifampin [12, 17].

In the present case our isolate was found susceptible to ciprofloxacin, levofloxacin, cefoperazone and trimethoprim-sulfamethoxazole, while it was resistant to amikacin, aztreonam, cefepime, ceftazidime, gentamicin, ticarcillin-clavulanic acid, and piperacillin-tazobactam. Our case received trimethoprim-sulfamethoxazole and cefoperazone-sulbactam. He showed clinical improvement but his CSF cultures remained sterile only after VP shunt removal in addition to antibiotic treatment.

This result has been revealed that antimicrobial susceptibility testing should be performed in patient with *C. indolegenes* infections and the shunt must be unconditionally removed for effective treatment of patient with shunt.

In conclusion, appropriate antimicrobial therapy is the foremost part of treatment but may not be enough in some cases.

In patients with *C. indologenes* infection occurred in the presence of ventriculoperitoneal shunt, the treatment may require removal of the shunt.

Keywords: Chryseobacterium indologenes, ventriculoperitoneal shunt, hydrocephalus.

SUMMARY

Chryseobacterium indologenes is a non-fermentative Gram-negative bacillus formerly belonging to the *Flavobacterium* genus. It is widely found in water and soil, also on wet surfaces of the hospital environment. It rarely causes infections and is usually associated with altered immune status or indwelling devices. We present a case of ventriculoperitoneal shunt infection caused by *C. indologenes* in a premature pediatric patient. A six-month-old male infant with congenital hydrocephalus and ventriculoperitoneal shunt was admitted with complaints of irritability, high fever and projectile vomiting. He was diagnosed as suffering from meningitis based on the clinical symptoms and laboratory findings of cerebrospinal fluid. The ventriculoperitoneal shunt was externalized and cerebrospinal fluid samples were sent for bacterial cultures. The isolated bacterium was identified as *C. indologenes* by conventional methods and the BD Phoenix™ 100 (Becton Dickinson, MD, USA) fully automated microbiology system. Antimicrobial susceptibility testing was performed by the microdilution method and Kirby-Bauer's disk diffusion method according to the Clinical and Laboratory Standards Institute guidelines. The isolate was found susceptible to ciprofloxacin, levofloxacin, cefoperazone and trimethoprim-sulfamethoxazole, while it was resistant to amikacin, aztreonam, cefepime, ceftazidime, gentamicin, imipenem and ticarcillin-clavulanic acid. The treatment was started with trimethoprim-sulfamethoxazole and cefoperazone-sulbactam The ventriculoperitoneal shunt was then removed. The patient was fully healed after two weeks and discharged. Central nervous system infection is a rare form of *C. indologenes* infections. The case presented herein may make a useful contribution to the existing literature.

RIASSUNTO

Chryseobacterium indologenes *è un bacillo Gram negativo, non fermentante, appartenente in passato al genere* Flavobacterium. *É ampiamente presente nell'acqua e nel suolo ma anche sulle superfici umide degli ambienti ospedalieri. Raramente è causa di infezioni ed è generalmente associato a un'alterazione dello stato immunitario o alla presenza di cateteri. In questo articolo presentiamo un caso di infezione di uno shunt ventricolo-peritoneale causato da* C. indologenes *in un neonato prematuro.*

Un neonato di sei mesi con idrocefalo congenito e shunt ventricolo-peritoneale è ricoverato per irritabilità, febbre alta e vomito a getto. Sulla base della sintomatologia e dei dati di laboratorio sul liquido cerebro-spinale (LCS), viene posta diagnosi di meningite. Lo shunt *ventricolo-peritoneale è esternalizzato e i campioni di LCS vengono inviati in laboratorio per l'esame colturale. Il microrganismo isolato viene identificato come* C. indologenes *con i metodi convenzionali e con BD Phoenix™ 100 (Becton Dickinson, MD, USA), un sistema di identificazione microbiologica completamente automatico. I test di sensibilità agli antibiotici sono stati eseguiti mediante il metodo di microdiluizione e con il metodo di diffusione da dischetto di Kirby-Bauer, in accordo alle linee guida del* Clinical and Laboratory Standards Institute. *Il microrganismo isolato risulta sensibile a ciprofloxacina, levofloxacina, cefoperazone e trimetoprim-sulfametossazolo, e resistente ad amikacina, aztreonam, cefepime, ceftazidime, gentamicina, imipenem e ticarcillina-acido clavulanico. Viene iniziata terapia con trimetoprim-sulfametossazolo e cefoperazone-sulbactam. Quindi, lo* shunt *ventricolo-peritoneale viene rimosso. Dopo due settimane, il paziente risulta completamente guarito e viene pertanto dimesso.*

La localizzazione al sistema nervoso centrale è una forma rara di infezione da C. indologenes. *Riteniamo che il caso qui descritto potrà fornire un utile contributo alla letteratura scientifica.*

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