Rare central nervous system infection by *Chryseobacterium indologenes* diagnosed using metagenomic next-generation sequencing

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Learning points for clinicians

Neurosurgical central nervous system (CNS) infection associated with indwelling medical devices involving *Chryseobacterium indologenes* in adults identified using metagenomic next-generation sequencing (mNGS) is novel in the literature. The decision to remove or retain indwelling devices remains controversial. mNGS is particularly valuable for identifying causative pathogens when traditional cultures are negative.

Case representation

A 65-year-old Chinese female patient presented after experiencing a sudden headache lasting one day, altered consciousness, and vomiting. She had no history of systemic disease. Upon admission, her pupils were non-reactive to light. Cranial computed tomography revealed subarachnoid and intraventricular hemorrhage (Figure A). Computed tomography angiography showed a ruptured cerebral aneurysm. Immediate interventional embolisation of the cerebral aneurysm and lumbar cistern drainage were performed (Figure B). Her symptoms improved gradually. Intravenous ceftriaxone was initiated. However, four days later, she developed fever and headache. Cerebrospinal fluid (CSF) leucocyte counts were $910 \times 10^6$/L (reference, 0 to $8 \times 10^6$/L), and her C-reactive protein level was 80.5 mg/L (reference, 0.5 to 10 mg/L). These clinical characteristics and laboratory findings led to a diagnosis of CNS infection. Two days later, her condition worsened, with CSF leucocyte counts rising to $1188 \times 10^6$/L. CSF cultures were negative.

On day 3 after fever, CSF mNGS confirmed the presence of *Chryseobacterium indologenes* (Genome coverage position, 2864000 and 2864400 bp) (Figure C). Consequently, due to cephalosporin resistance, the antibiotic regimen was adjusted to oral trimethoprim-sulfamethoxazole (0.8 g/day) and intravenous levofloxacin (0.75 g/day) for one week. Her symptoms resolved completely, with CSF leucocyte counts
decreasing to $12 \times 10^6$/L and CSF microbial cultures remaining negative. Post-treatment CSF mNGS results were normal.

The lumbar cistern drainage catheter was removed as scheduled, and the patient was discharged in good condition, continuing antibiotic therapy for an additional two weeks. At the one-month follow-up appointment, no recurrence of *C. indologenes* CNS infection had occurred, nor was evidence of drug-related side effects present.

**Discussion**

*C. indologenes* is an uncommon gram-negative pathogen in humans.\(^1\) Infections caused by *C. indologenes* are closely associated with indwelling medical devices, immunocompromised status, and prolonged antibiotic use.\(^1,2\) Hospital-acquired infections due to *C. indologenes* encompass ventilator-associated pneumonia, urinary tract infections, endophthalmitis, cellulitis, and dermatitis.\(^3,4\) Untreated or delayed treatment of these infections can lead to life-threatening complications, including meningitis, bacteraemia, sepsis, and death.\(^1,4\)

CNS infection is an urgent medical condition with a high mortality rate.\(^1,5\) Clinical features and laboratory results aid in diagnosis, but identifying the etiology in patients with CNS infection remains challenging. Traditional techniques, such as CSF cultures and polymerase chain reaction, have limitations, including a low detection rate and a narrow range of detectable pathogens.\(^5\) Compared to traditional techniques, mNGS detects a wider array of pathogens, including bacteria, fungi, viruses, parasites, and other organisms, facilitating early diagnosis and precise treatment. The use of mNGS is particularly valuable for identifying causative pathogens in patients with CNS infection when traditional sample cultures are negative.\(^5\)

In this case, the patient developed an intracranial infection four days after the placement of a lumbar cistern drainage catheter. Although the CSF cultures were
negative, the identification of *C. indologenes* using mNGS confirmed the diagnosis. This was highly suggestive of a catheter-related infection. However, standard guidelines for the management of *C. indologenes* infection are lacking. Early diagnosis and the treatment of sensitive antibiotics are crucial.1,5

The decision to remove or retain an indwelling catheter in patients with catheter-related *C. indologenes* infection remains controversial. For patients with severe systemic diseases, the prompt removal of the catheter is recommended.6 We decided to maintain lumbar cistern drainage for this patient, believing that the benefits outweighed the risks. First, the patient was immunocompetent, and the current infection was not severe. Second, *C. indologenes* was identified using mNGS, and treatment with sensitive antibiotics (trimethoprim-sulfamethoxazole and levofloxacin) was administered. Our results indicated a favorable outcome with the appropriate antibiotics, as determined by minimal inhibitory concentration testing. Finally, replacing the indwelling medical catheter could increase the risk of intracranial infection.

DECLARATIONS

Ethics approval
The study was approved by the Institutional Review Board of The Affiliated Nanjing Drum Tower Hospital of Nanjing University Medical School.

Consent to participate and consent to publish statements
Informed written consent had been obtained from the patient.

Data availability statement
The datasets presented in this study are included in the article, further inquiries can be directed to the corresponding author/s.

Competing interests
The authors declare that they have no competing interests.

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Authors’ contributions

BTY wrote the manuscript; SYL edited the manuscript; PLZ established the diagnosis and reviewed the manuscript. All authors read and approved the final manuscript.

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References


Figure legends

Figure. (A) Cranial computed tomography revealed subarachnoid and intraventricular hemorrhage; (B) Photograph showed lumbar cistern drainage catheter was placed
after surgery; (C) On day 3 after fever, cerebrospinal fluid mNGS confirmed the presence of *C. indologenes* (Genome coverage position, 2864000 and 2864400 bp).