



## Case Report

# Rare case of resistant *Achromobacter xylosoxidans*-associated meningitis due to intrathecal catheter

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## ABSTRACT

**Background:** *Achromobacter xylosoxidans* (AX) is an aerobic Gram-negative opportunistic bacteria known to inhabit various environments and is most commonly associated with nosocomial infections in immune-compromised patients. Although rare, AX can cause a variety of neurological infections, such as meningitis, ventriculitis, and osteomyelitis. Intravascular catheters, intrathecal pumps, and contaminated surgical instruments are potential vectors for such patients.

**Case Description:** Here, we present a unique case of multidrug-resistant AX-positive meningitis secondary to infection of a nonfunctional intrathecal narcotic pump. The patient has a complex past medical history leading up to infection, and care was significantly compromised by homelessness and inflammatory bowel disease (IBD). Treatment included catheter removal and antibiotics.

**Conclusion:** Patients who suffer from homelessness or IBD show a possible increased risk of this infection. This case emphasizes the need for increased care regarding these patients, along with describing the complications and timeline when treating this rare type of meningitis.

**Keywords:** *Achromobacter xylosoxidans*, Homeless, Inflammatory bowel disease, Intrathecal, Meningitis

## INTRODUCTION

Intrathecal pump systems have been used to treat a variety of pain syndromes. While often effective, they require consistent maintenance, and their use carries risks, including overdose, withdrawal, malfunction, and infection.<sup>[3]</sup> Homeless individuals are at increased risk for infection for a variety of reasons, including poor follow-up, lack of transportation, unsanitary living conditions, and insufficient access to medications.<sup>[6,10,11]</sup> Both inflammatory bowel disease (IBD) and its immunomodulatory treatments also pose an increased risk of infection to affected individuals. These observations are exemplified in this report of only the second documented case of *Achromobacter xylosoxidans* (AX)-associated meningitis from an intrathecal catheter and the only reported case in an adult patient.

## CASE PRESENTATION

A 36-year-old homeless man with a history of small bowel resection, inferior vena cava thrombosis, left common iliac vein thrombosis, and Crohn's disease treated with adalimumab

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presented to an outside facility with severe abdominal pain where he was diagnosed with toxic megacolon. Following a total abdominal colectomy with end ileostomy, he had severe malnutrition requiring total parenteral nutrition. Computed tomography scan imaging for persistent postoperative abdominal pain demonstrated a perirectal stump abscess not amenable to surgical drainage. The patient was subsequently transferred to a long-term acute care (LTAC) facility for extended antibiotic treatment with vancomycin and piperacillin-tazobactam for 4 weeks. His stay at the LTAC was further complicated by a *Candida esophagitis* infection treated with Protonix and Diflucan. While at the LTAC, the exposed catheter from an intrathecal pump was discovered, resulting in the transfer of the patient to our institution.

Investigation revealed that he had undergone prior placement of an intrathecal narcotic pump system for chronic abdominal pain. However, the presence of the intrathecal pump system was not noted during the recent abdominal surgery. Intrathecal hydromorphone therapy had been maintained through the intrathecal pump until a positive urine drug screen resulted in cessation 3 years before this encounter. Twelve months before admission, the pump had eroded through the skin and had been held in place by the abdominal segment of the catheter. He had not sought care for this problem. The device and catheter were still attached to the patient when he presented with a toxic megacolon. During hospitalization for treatment of his abdominal pathology, the catheter had fractured, and the pump had been lost, resulting in a catheter emerging from the patient's flank. The catheter had no active cerebrospinal fluid (CSF) leak.

He was taken to the operating theater, where the entire catheter was removed. The intrathecal portion was patent, and CSF was harvested. CSF grew multidrug-resistant AX bacteria. The infection was treated by surgical removal of the catheter along with a 3-week combined antibiotic course of 2 g of meropenem every 8 h and 240 mg of trimethoprim-sulfamethoxazole (TMP-SMX) every 12 h.

## DISCUSSION

AX is an aerobic, nonlactose fermenting, Gram-negative opportunistic pathogen prevalent in various environments, particularly health-care settings.<sup>[5,7,15,16]</sup> It is observed in immunocompromised individuals or those with underlying malignancies and cardiac conditions but rarely in healthy cohorts.<sup>[15]</sup> Up to 70% of AX infections are nosocomial.<sup>[12]</sup> Although AX primarily manifests as bacteremia and pneumonia, its clinical spectrum extends to skin infections, surgical site infections, and otitis media.<sup>[7]</sup> Additional manifestations encompass urinary tract infections, abscesses, corneal ulcers, prosthetic valve endocarditis, and peritonitis.<sup>[15]</sup> There is a rising prominence

of AX as an infection for peripherally inserted central catheters among immunocompromised patients.<sup>[12]</sup> In the spine and central nervous system (CNS), AX has been described as meningitis, ventriculitis, osteomyelitis, and discitis, usually from bacteremia or a direct insult or entry to the specific affected system.<sup>[5,15,17]</sup> These insults include catheters (insulin pumps, central venous, etc.) or intrathecal pumps, as well as surgical interventions.<sup>[2,5,7,14,15,17,18]</sup>

This bacterium is difficult to treat due to an array of resistance mechanisms and its propensity to form biofilms, often resulting in a multidrug-resistant infection.<sup>[7]</sup> The bacteria are intrinsically resistant to aminoglycosides, cephalosporins, aztreonam, and other antibiotics through drug efflux pumps and B-lactamases.<sup>[8]</sup> Two known efflux pump genes are AxyABM and AxyXY-OprZ, while the class D beta-lactamase is OXA-114.<sup>[8]</sup> The beta-lactamases found in the bacteria are extended-spectrum, AmpC, and metallo-B-lactamases.<sup>[9]</sup> These, in combination with the aminoglycoside acetyltransferase/phosphotransferases and dihydrofolate reductases, provide significant difficulty in the treatment. Standard treatment protocols involve beta-lactams or carbapenems supplemented by the removal of indwelling devices.<sup>[3]</sup> However, the escalating resistance to carbapenems and other antibiotics has narrowed the treatments available.<sup>[6]</sup> Meropenem and tazobactam have been shown to have poor CNS penetration, while piperacillin can reach therapeutic levels but requires more specific monitoring in cases with meningitis.<sup>[1,13]</sup> In select cases, TMP-SMX has shown promise as an alternative treatment with excellent CNS penetration.

The case discussed can be compared with another similar case in a 13-year-old female who was receiving intrathecal baclofen for cerebral palsy.<sup>[14]</sup> The pump was found to be infected when external breakdown was visualized, prompting empiric therapy and CSF cultures to be taken. The CSF grew Gram-negative rods with further cultures showing AX-associated meningitis. The catheters and pump were removed, and antibiotics were switched to meropenem, which the patient recovered from until 5 months later when the patient had another recurrence of meningitis, demanding further treatment with gentamicin and then meropenem once susceptibility was reassured. This case differs from ours as the patient was not severely immunocompromised and was much younger, nor did she have the risk associated with homelessness, IBD, and immunotherapy.

People affected by homelessness suffer from discontinuity of care and limited treatment access due to transportation and insurance barriers. Studies reveal that approximately one-third of deaths among homeless individuals stem from treatable conditions due to insufficient health-care access.<sup>[9]</sup> Homeless patients are more likely to have frequent emergency department visits compared to the general population.<sup>[6,10,11]</sup> Discharge complexities arise due to the absence of insurance

and postdischarge care options, prolonging hospital stays, and complicating treatment protocols.<sup>[4]</sup> Due to this, homeless individuals appear particularly susceptible. IBD is also a risk factor, both in itself and in its treatment. IBD is associated with increased AX presence in the blood, with it dominating the microbiota for both Crohn's disease and ulcerative colitis, although the reason is unknown.<sup>[19]</sup> Furthermore, treatment for IBD often includes agents such as anti-inflammatories, steroids, and immunomodulators such as azathioprine and adalimumab, which are also a risk factor for AX bacteria entry.<sup>[19]</sup> The patient in this case not only had Crohn's disease but was being treated with adalimumab as well, both providing independent risk factors for an AX-associated infection.

## CONCLUSION

Our case represents the only adult patient known to have an infection of a nonfunctional intrathecal pump by AX. Patients who suffer from homelessness or IBD may be at elevated risk for this unusual infection. This suggests that more emphasis is needed when managing patients with these comorbidities to make sure all their health risks are properly addressed to reduce infection and morbidity wherever possible.

## Ethical approval

Institutional Review Board approval is not required.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI.

## REFERENCES

1. Blassmann U, Roehr AC, Frey OR, Vetter-Kerkhoff C, Thon N, Hope W, et al. Cerebrospinal fluid penetration of meropenem

- in neurocritical care patients with proven or suspected ventriculitis: A prospective observational study. *Crit Care* 2016;20:343.
2. Crosby MD, Petropolis AA, Mackey VT, Culpepper KS. An unusual skin infection with *Achromobacter xylosoxidans*. *Cutis* 2020;106:2110-212.
3. Delhaas EM, Huygen FJ. Complications associated with intrathecal drug delivery systems. *BJA Educ* 2020;20:51-7.
4. Franco A, Meldrum J, Ngaruiya C. Identifying homeless population needs in the Emergency Department using Community-Based Participatory Research. *BMC Health Serv Res* 2021;21:428.
5. Fort NM, Aichmair A, Miller AO, Girardi FP. L5-S1 *Achromobacter xylosoxidans* infection secondary to oxygen-ozone therapy for the treatment of lumbosacral disc herniation: A case report and review of the literature. *Spine (Phila Pa 1976)* 2014;39:E413-6.
6. Hadenfeldt C, Todd MJ, Hamzhe C. Medical respite post-hospitalization for adults experiencing homelessness. *Nursing* 2023;53:47-52.
7. Houlihan E, Lucey M, Pandian A, Hanahoe B, Higgins F, DeLappe N, et al. Case of recurrent *Achromobacter xylosoxidans* bacteraemia and PICC (peripherally-inserted central catheter) line infection in an immunocompromised patient. *Infect Prev Pract* 2022;4:100202.
8. Hu Y, Zhu Y, Ma Y, Liu F, Lu N, Yang X, et al. Genomic insights into intrinsic and acquired drug resistance mechanisms in *Achromobacter xylosoxidans*. *Antimicrob Agents Chemother* 2015;59:1152-61.
9. Isler B, Kidd TJ, Stewart AG, Harris P, Paterson DL. *Achromobacter* infections and treatment options. *Antimicrob Agents Chemother* 2020;64:e01025-20.
10. Jacobsen SM, Stickler DJ, Mobley HL, Shirliff ME. Complicated catheter-associated urinary tract infections due to *Escherichia coli* and *Proteus mirabilis*. *Clin Microbiol Rev* 2008;21:26-59.
11. Jenkinson J, Wheeler A, Wong C, Pires LM. Hospital discharge planning for people experiencing homelessness leaving acute care: A neglected issue. *Health Policy* 2020;16:14-21.
12. Mitchell E, Waring T, Ahern E, O'Donovan D, O'Reilly D, Bradley DT. Predictors and consequences of homelessness in whole-population observational studies that used administrative data: A systematic review. *BMC Public Health* 2023;23:1610.
13. Nau R, Kinzig-Schippers M, Sörgel F, Schinschke S, Rössing R, Müller C, et al. Kinetics of piperacillin and tazobactam in ventricular cerebrospinal fluid of hydrocephalic patients. *Antimicrob Agents Chemother* 1997;41:987-91.
14. Nichols KR, Knoderer CA, Jackson NG, Manaloor JJ, Christenson JC. Success with extended-infusion meropenem after recurrence of baclofen pump-related *Achromobacter xylosoxidans* meningitis in an adolescent. *J Pharm Pract* 2015;28:430-3.
15. Pérez Barragán E, Sandino Pérez J, Corbella L, Orellana MA, Fernández-Ruiz M. *Achromobacter xylosoxidans* bacteremia: Clinical and microbiological features in a 10-year case series. *Rev Esp Quimioter* 2018;31:268-73.
16. Rotter J, Graffeo CS, Perry A, Gilder HE, Wilson JW, Link MJ.

Polymicrobial intracerebral abscess growing *Mycobacterium avium* complex and *Achromobacter xylosoxidans*: Case report and literature review. *World Neurosurg* 2020;141:441-7.e1.

17. Shigeta S, Yasunaga Y, Honzumi K, Okamura H, Kumata R, Endo S. Cerebral ventriculitis associated with *Achromobacter xylosoxidans*. *J Clin Pathol* 1978;31:156-61.
18. Tena D, Carranza R, Barberá JR, Valdezate S, Garrancho JM, Arranz M, *et al.* Outbreak of long-term intravascular catheter-related bacteremia due to *Achromobacter xylosoxidans*

subspecies *xylosoxidans* in a hemodialysis unit. *Eur J Clin Microbiol Infect Dis* 2005;24:727-32.

19. Xu J, Molin G, Davidson S, Roth B, Sjöberg K, Håkansson Å. CRP in outpatients with inflammatory bowel disease is linked to the blood microbiota. *Int J Mol Sci* 2023;24:10899.

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