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Case Report

Microbiology Section

Atypical Presentation of *Pseudomonas aeruginosa* Meningitis as a Sequel of Mastoiditis: A Case Report

ANKITA PODDAR[1], SAMPURNA BORBORA[2], YUGESHWARI TIWADE[3], NANDKISHOR JAGESHWAR BANKAR[4]

ABSTRACT

Bacterial meningitis is associated with significant morbidity and mortality. One of the causative agents, *Pseudomonas aeruginosa* is a less commonly encountered pathogen, predominantly associated with post-neurosurgical infections. Here, in this case report, the patient presented with persistent headache, otalgia, vomiting, and cough. The Computed Tomography (CT) scan suggested the possibility of Central Venous Sinus Thrombosis (CVST). Diagnostic work-up revealed right-sided mastoiditis. Microbiological analysis of Cerebrospinal Fluid (CSF) showed growth of *Pseudomonas aeruginosa*. The patient received intravenous antibiotics as per sensitivity report, which showed clinical improvement and resolution of the infection. This case highlights the importance of early diagnosis, culture and antimicrobial susceptibility testing, and appropriate antimicrobial therapy in managing *Pseudomonas aeruginosa* meningitis secondary to mastoiditis. An integrated, multidisciplinary approach involving neurologists and otolaryngologists is important to ensure favourable clinical outcomes.

Keywords: Antimicrobial agents, Central venous sinus thrombosis, Cerebrospinal fluid, Gram-negative bacilli

CASE REPORT

A 52-year-old male presented with chief complaints of pain in the right ear, persistent headache for 15 days, along with vomiting and cough for seven days. He was taken to a private hospital at first where he was evaluated for the similar complaints by Magnetic Resonance Imaging (MRI) brain that was suggestive of CVST involving superior sagittal sinus, where initial treatment included Injection of low molecular weight Heparin and Tablet Dabigatran 110 mg twice daily for four days along with other symptomatic treatment Injection. Emset 4 mg i.v. TDS for nausea/vomiting, Tab Sibellium 10 mg HS for headache. However, there was no improvement in the patient's condition; still, he was complaining of headaches and pain in the ear, and then he was referred to our facility for further evaluation and management. The patient had no history of hypertension, diabetes, tuberculosis, asthma, seizures or similar complaints in the past or in the family. On admission to the medicine department, the general condition was moderate, pulse of 69/min, and BP-130/80 mm Hg. On examination, the patient was fully conscious and oriented to time, place and people. The patient was also evaluated with complete blood count, coagulation profile, biochemistry panel, along with inflammatory markers [Table/Fig-1] and anticoagulant treatment was maintained as previously prescribed.

Due to persistent pain in the right ear, the patient was evaluated by an otorhinolaryngologist, where clinical examination revealed tenderness and swelling in the mastoid region, with otoscopic findings suggesting middle ear pathology along with a moderate degree of sensorineural hearing loss in the right ear. Due to cough, High-Resolution Computed Tomography (HRCT) thorax was also performed [Table/Fig-2], however, no significant finding was observed. CT paranasal sinus [Table/Fig-3] was also conducted to rule out any underlying pathology.

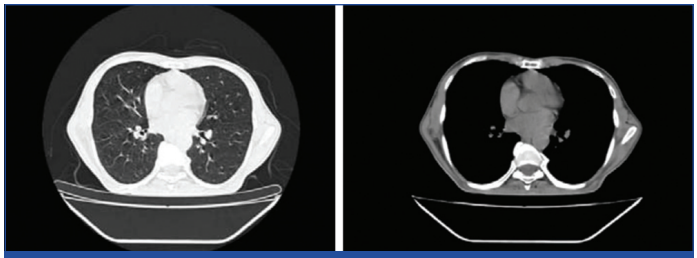
The provisional diagnosis was CVST with headache and ataxia under evaluation, along with mastoiditis. Taking into account prolonged headache and concerns regarding intracranial complications, the patient underwent a detailed neurological investigation. A temporal bone CT scan confirmed the diagnosis of mastoiditis, showing opacification of right-sided mastoid ear cells [Table/Fig-4].

The blood profile and inflammatory markers were indicative of an underlying infective pathology and with a suspicion of meningitis a lumbar puncture was performed, yielding slightly turbid CSF, which was subsequently sent for biochemical analysis and bacterial culture. Gram staining of the sample revealed that occasional pus cells and few Gram-negative bacilli were seen [Table/Fig-5]; Acid-fast bacilli were not detected on Ziehl-Neelsen (ZN) staining.

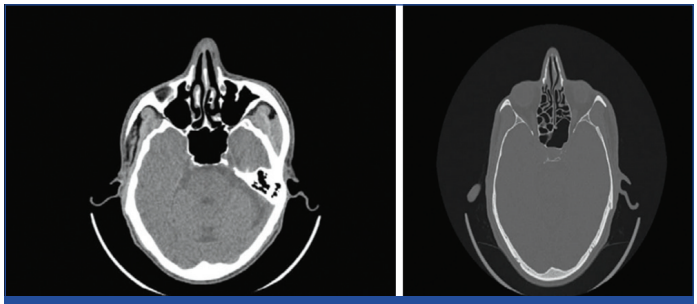
The CSF culture was performed on blood agar, MacConkey agar, chocolate agar along with inoculated in Brain Heart Infusion (BHI broth) and incubated at 37°C for 18-24 hours. The next day, on blood

Test category	Parameter	Value	Reference range
CBC	Haemoglobin (Hb) (g/dL)	13.0	M: 13.5-17.5, F: 12-16
	MCHC (g/dL)	34.5	32-36
	MCV (fL)	86.9	80-100
	MCH (pg)	30	27-33
	Total RBC count (millions/µL)	4.35	M: 4.7-6.1, F: 4.2-5.4
	Total WBC count (/µL)	8090	4,000-11,000
	Platelet count (lac/µL)	3.27	1.5-4.5
Coagulation	PT (sec)	20.2	11-15
	INR	1.55	0.8-1.2
Inflammatory	ESR (mm/hr)	90	M: <15, F: <20
	HS-CRP (mg/L)	11.6	<3
CSF	CSF glucose (mg/dL)	29	40-70
	CSF protein (mg/dL)	104.4	15-45
	CSF cell count (/µL)	2–3	0-5
	CSF differential	65% lymphocytes, 35% mononuclear	Predominantly lymphocytes

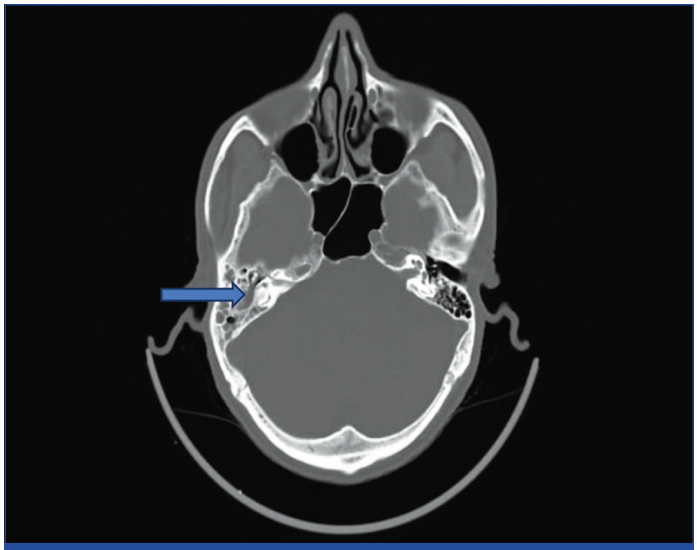
[Table/Fig-1]: Laboratory profile parameters on admission.
*Abbreviations: Hb: Haemoglobin; MCHC: Mean corpuscular haemoglobin concentration; MCH: Mean corpuscular haemoglobin; MCV: Mean corpuscular volume; PT: Prothrombin time; INR: International normalised ratio; HS-CRP: High sensitive C-reactive protein ;ESR:Erythrocyte sedimentation rate;CSF:Cerebrospinal fluid



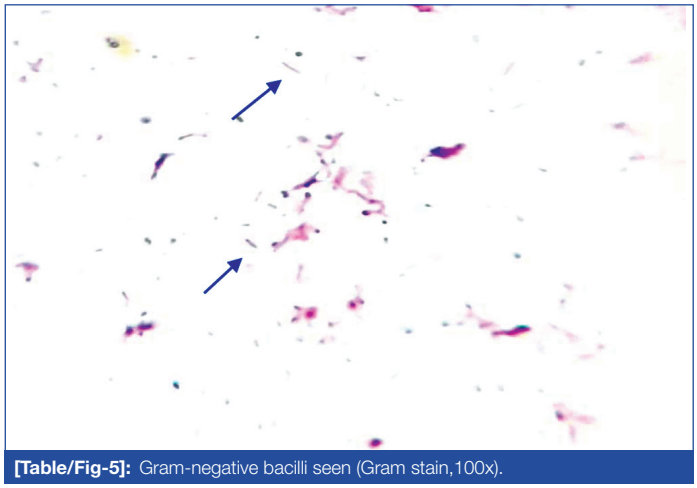
[Table/Fig-2]: HRCT Thorax images with no significant finding.



[Table/Fig-3]: CT paranasal sinus images with no significant findings.



[Table/Fig-4]: (Bone window CT) shows opacification in the right middle ear with mastoid sclerosis and loss of pneumatisation of mastoid air cells, suggestive of right mastoiditis.

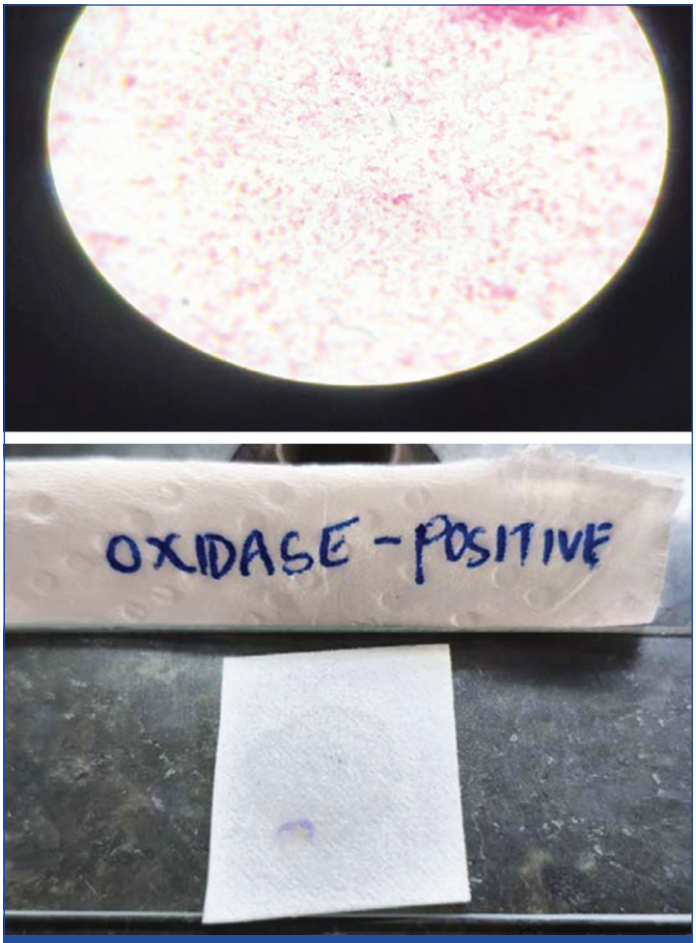


[Table/Fig-5]: Gram-negative bacilli seen (Gram stain,100x).

agar, non haemolytic colonies were observed, while MacConkey agar showed non lactose fermenting colonies with a metallic sheen [Table/Fig-6]. The BHI broth appeared to be turbid.

The isolated organism was tested positive for the oxidase test, and on the secondary gram stain, it showed gram-negative bacilli [Table/Fig-7]. Further evaluations showed that Indole was negative, Methyl red was negative, Citrate was utilised, and Urease was hydrolysed, Triple sugar iron K/no change with no gas, no H2S [Table/Fig-8].

[Table/Fig-6]: Non lactose fermenting colonies with metallic sheen on MacConkey Agar and non haemolytic colonies on blood agar.



[Table/Fig-7]: Secondary gram stain (100x) showing gram negative bacilli (above) and Oxidase test positive (below).

[Table/Fig-8]: Biochemical test of the isolate (1: Indole negative; negative; 2: Citrate utilised; 3: Urea hydrolysed; 4: Triple sugar iron K/no change with no gas no Hydrogen sulphide; 5: Methy red: Negative.

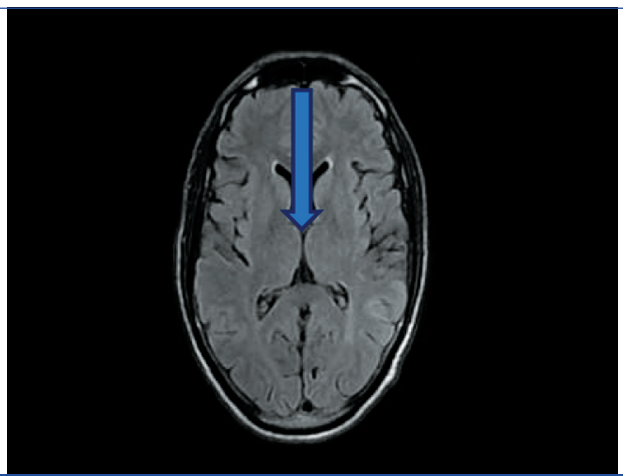
Antimicrobial sensitivity tests were conducted using the Kirby-Bauer disc diffusion method, in accordance with the guidelines [1]. Commercially available Hi- media discs and Mueller Hinton agar was used. The isolate was sensitive to ceftazidime (30 µg), cefepime (30 µg), piperacillin tazobactam (100/10 µg), tobramycin (10 µg), meropenem (10 µg) [Table/Fig-9]. In biochemical analysis of CSF protein level was increased (104 mg/dL), decreased glucose level (29 mg/dL) with normal white blood cell count, suggestive of bacterial meningitis. The tests that confirmed the isolation of *Pseudomonas aeruginosa* by conventional methods are summarised in [Table/Fig-10].

[Table/Fig-9]: Antimicrobial susceptibility testing of the isolate.

Investigations	Findings
Gram staining	Few pus cells and Gram-negative bacilli present
CSF culture	Growth on blood agar (non haemolytic colonies), MacConkey agar (non lactose fermenting colonies with metallic sheen), and BHI broth (turbid)
Biochemicals	Oxidase positive, indole negative, Methyl-Red was negative, Citrate was utilised and urease was hydrolysed, Triple sugar iron K/no change with no gas no H2S

[Table/Fig-10]: Investigation findings line in the case report.

Upon confirmation of mastoiditis followed by meningitis caused by *Pseudomonas aeruginosa* as the causative organism, the patient was started on high-dose intravenous antibiotics; injection Piperacillin-Tazobactam 4.5 gm iv TDS and injection Ceftriaxone 1 gm BD for seven days, specifically targeting this organism based on sensitivity testing. A contrast enhanced MRI of brain was conducted after two weeks of anticoagulant therapy which showed significant resolution of CVST [Table/Fig-11].



[Table/Fig-11]: Contrast-enhanced MRI images showed significant resolution of CVST.

The patient showed improvement after two to three days of the same above-mentioned antibiotic treatment. On eighth day after treatment, CSF analysis showed normal biochemical parameters and no bacterial growth. The patient was discharged after 20 days in stable condition with advice for follow-up and monitoring for any recurrence of symptoms. The patient visited Medicine outpatient department after 15 days and had no new complaints.

DISCUSSION

Bacterial meningitis is a life-threatening medical emergency characterised by inflammation of the meninges, associated with significant mortality and a high-risk of permanent neurological sequelae, necessitating early diagnosis and prompt initiation of appropriate antimicrobial therapy to improve outcomes [2]. The predominant bacterial pathogens responsible for meningitis differ across age groups. In neonates younger than two months, Group-B *Streptococcus* is most frequently isolated agent. *Streptococcus pneumoniae* is the leading causative agent in most other age categories, with the exception of individuals aged 11 to 17 years, wherein *Neisseria meningitidis* is more commonly observed [3]. Further explanations are provided in [Table/Fig-12] [2-13].

Findings of the present case	Comparison with published reports
CSF culture revealed *Pseudomonas aeruginosa* as a rare organism causing meningitis in an adult without neurosurgical intervention	Reported as a rare cause of bacterial meningitis in adults, with similar cases described by Gallaher C et al., Pomar V et al., and Cotran-Lenrow A et al., [4-6].
CT of the temporal bone confirmed its association with right-sided mastoiditis as the source of infection	Previous studies (Cassano P et al., van Zuijlen DA et al., Migirov L et al.,) reportefd mastoiditis as a recognised source of meningitis via direct extension or venous drainage [7-9].
The patient also had superior sagittal sinus thrombosis in association with CVST	Infection-related mastoiditis/meningitis leading to CVST has been documented by Cassano P et al., and Coutinho JM et al., [7,10].
In laboratory findings: Low CSF glucose (29 mg/dL), high protein (104.4 mg/dL), and Gram-negative bacilli on Gram stain	It matches the findings described in bacterial meningitis literature by van de Beek D et al., and Runde TJ et al., [2,3].
By conventional identification, the organism identified by biochemical methods and sensitivity testing	CLSI guidelines and Hasbun R et al., also emphasise conventional diagnostic methods for CSF pathogens [1,11].
Patient improved within 2-3 days of IV antibiotics	Similar rapid recovery noted in timely treated *P. aeruginosa* meningitis cases (Pomar V et al., Tamma PD et al.,) [5,12].
The treatment was multidisciplinary, where ENT department managed mastoiditis, neurology department managed CVST, and the infectious disease team guided antibiotics	Importance of multidisciplinary management highlighted by van de Beek D et al., Cassano P et al., Arlotti M et al., [2,7,13].
The patient was asymptomatic on follow-up, with no recurrence	Literature (van de Beek D et al., Pomar V et al., Hasbun R et al.,) emphasises follow-up for recurrence/ late complications [2,5,11].

[Table/Fig-12]: Comparison of findings from the present case with published reports [2-13].

The prognosis of *Pseudomonas aeruginosa* meningitis is generally poor if timely antibiotics are not administered, which is influenced by factors such as timely initiation of antibiotic therapy, the presence of predisposing factors, and the development of complications [6]. The patient, in this case, showed improvement in his clinical condition. However, follow-up care is essential for such cases.

CONCLUSION(S)

This case showed the critical role of early diagnosis, importance of microbiological culture and sensitivity report, and targeted antibiotic therapy in the treatment of *Pseudomonas aeruginosa* meningitis secondary to mastoiditis. Early diagnosis of *Pseudomonas aeruginosa* meningitis is of paramount importance because of its high

resistance and difficult to treat in deep infections. A multidisciplinary approach involving ENT and neurology specialists can lead to better outcomes in such cases.

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PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Microbiology, Datta Meghe Medical College, Nagpur, Maharashtra, India.
2. Assistant Professor, Department of Microbiology, Datta Meghe Medical College, Nagpur, Maharashtra, India.
3. PhD Scholar, Department of Microbiology, Datta Meghe Medical College, Nagpur, Maharashtra, India.
4. Professor, Department of Microbiology, Datta Meghe Medical College, Nagpur, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Ankita Poddar,
Assistant Professor, Department of Microbiology, Datta Meghe Medical College, Wanadongri Hingna, Nagpur-441110, Maharashtra, India.
E-mail: ankitapoddare30@gmail.com

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