

Pseudomonas plecoglossicida meningitis: A potential evolving human pathogen and a threat to public health

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Abstract

Pseudomonas plecoglossicida, a well-known fish pathogen, seems to have evolved into a human pathogen, inciting a public health concern. We present a rare case of community-acquired *Pseudomonas plecoglossicida* meningitis in a healthy adult. A 49-year-old male, a “Galamsey” (water-based, small-scale gold mining) operator, presented with one week’s history of headache, neck and whole-body stiffness. On further questioning, he revealed that he was unable to open his mouth and could not walk due to severe back pain and body stiffness. There was a preceding history of sore throat of four days duration. Examination revealed nuchal rigidity, and positive Kernig’s and Brudzinski’s signs. Cerebrospinal fluid (CSF) analysis showed high protein and glucose levels, with normal cell counts. A culture of CSF isolated gram-negative bacilli, found to be *Pseudomonas plecoglossicida*, was sensitive to Ceftazidime, Cefepime and Meropenem. Clinical features were completely resolved without any clinical evidence of complications after a full course of tailored treatment. We report, to the best of our knowledge, the first case of *Pseudomonas plecoglossicida* meningitis with some diagnostic challenges. This underscores the urgent need for establishment of public health surveillance systems to identify similar cases especially in “Galamsey” zones in Ghana and similar settings, in order to mitigate their pathogenic burden.

Keywords: *Pseudomonas plecoglossicida*, *Pseudomonas*, meningitis, human pathogen, threat, public health

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Informed Consent

The authors stated that the written consent was obtained from the patient presented with images in the study.

Conflict of Interest

No conflict of interest was declared by the authors.

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Introduction

Pseudomonas plecoglossicida is a gram-negative rod-shaped, flagellated bacterium in the pseudomonas putida group. It is a well-established pathogenic organism in fish. It has a number of virulence factors which enable it colonize the host fishes and produce diseases including visceral white spot disease, and hemorrhagic ascites in ayu fish (*plecoglossus altivelis*), giving it its name [1,2]. This organism is a culprit in disease outbreaks in aquaculture [3]. Nonetheless, the organism has not been well-documented as a cause of human disease. Few case reports, however, described pseudomonas putida, the “species typica” of the group, as a rare cause of pneumonia and meningitis in humans [4-6]. This draws attention to a potential paradigm shift of gradual transition of this organism from a fish pathogen to a human pathogen. Probably, the organism might have acquired special environmental and genetic adaptations. This is, however, subject to further exploration in future studies. Generally, *Pseudomonas* infections are most often hospital-acquired or encountered in immunocompromised patients [7,8]. Moreover, *Pseudomonas* infections are known for their treatment challenges, due to their resistance to the common antibiotics used in clinical practice [9-13]. Thus, this case posed a threat to human life and public health. No study had yet reported the organism as a causative agent for bacterial meningitis in humans, to the best of our knowledge. We report a rare case of community-acquired *Pseudomonas plecoglossicida* meningitis in a healthy adult, recorded in a district hospital in Ghana. Additionally, we share our experiences with the management and some diagnostic challenges.

Case presentation

Clinical History

A 49-year-old African male and small-scale miner (*Galamsey* operator) presented to the emergency department with a one-week history of headache, generalized body stiffness and severe back pain worsened by walking. On further questioning, he had difficulty opening the jaw, and an inability to walk due to stiffness of the lower limbs and back. These symptoms were preceded four days earlier by a low-grade fever, sore throat, and difficulty swallowing. He denied any photophobia, phonophobia, altered mental state, or personality changes.

Physical Examination

A middle-aged male wheeled into the emergency room. He was not in respiratory distress, nor warm to the touch. Vital signs checked were within normal ranges (T-37.0 °C, BP-118/81 mmHg, PR-84 bpm, RR-20 cpm, SPO2-99% on room air). A neurological exam revealed a conscious and alert patient, with a Glasgow Coma Score (GCS) of 15/15. He was oriented to time, place, and person. His pupils were equal in size (about 2 mm) and equally reactive to light directly and consensually. There was nuchal rigidity with positive Kernig and Brudzinski signs. Power was 5/5 in all limbs and deep tendon reflexes were normal. There was no lateralizing sign or focal neurological deficits. Examination of other systems was unremarkable.

Differential Diagnoses

An initial impression of meningitis was made based on clinical findings. However, this was closely seconded by a differential diagnosis of tetanus. However, this was less likely, given the absence of previous injury, and clinical features pointing more to meningism than skeletal muscle spasm of tetanus.

Lumbar Puncture (LP) Procedure

Under aseptic conditions in the operating theater, the patient was positioned in a lateral decubitus, knee-chest position. He was exposed from upper trunk to the infra-gluteal folds. The site was cleaned with povidone iodine, Savlon, and methylated spirit and draped with a sterile drape. A sterile spinal needle was introduced into the L3-L4 interspace. About 5 mls of clear CSF was obtained into a plain universal CSF bottle, covered, and transported air-tight to the laboratory for analysis.

Results of Laboratory Investigations

A full blood count showed moderate anemia and severe thrombocytopenia (Table 1). CSF analysis revealed clear CSF with high protein, low glucose and normal cell counts (Table 2).

CSF culture showed gram-negative bacilli, *Pseudomonas plecoglossicida* isolated. Antimicrobial sensitivity testing showed the organism was sensitive to Ceftazidime, Cefepime and Meropenem.

Treatment/Treatment Response

The patient was started on intravenous (IV) Ceftriaxone (Rocephin) 2g 12 hourly from day 1-7 of admission, while awaiting CSF analysis/culture and sensitivity results. LP was done on Day 2 of admission, but results were obtained on Day 8 of admission. The antibiotic was then immediately switched to IV Ceftazidime 2g 8 hourly for an additional 14 days, making a total of 21 days of IV antibiotic therapy. Symptomatic treatment was also given, including analgesia for headache and generalized body pains, and skeletal muscle relaxants for neck and body stiffness.

After 10 days of IV antibiotic therapy, the patient began to demonstrate significant improvement, and symptoms resolved gradually over this period. He took his first step unaided on Day 10 of treatment, though with an unsteady gait. He continued with a Zimmer frame, and then later, without the Zimmer frame by day 18 of antibiotic treatment. At this time, all stiffness and pain associated with walking had resolved. He was discharged after marked clinical improvement on Day 22 of admission.

Follow-up

The patient was reviewed at the medical outpatient department two weeks after discharge. He was completely free of symptoms and signs, and he was walking with a normal gait at this time.

Ethical and Privacy Statement

A written and signed informed consent (from the hospital) was obtained from the patient under no duress to publish the details of his case. He was made aware that this case report would only be published for improvement of the scientific knowledge base, clinical practice, and the health of the public, but not for commercial purposes. Additionally, all efforts were made to anonymize our patient, and all confidential patient information attached were de-identified.

Table 1: Patient's full blood count (FBC) results before treatment

Findings	Ref range	Unit	Interpretation
Hb-10.7	13.0-17	g/dl	Low
WBC-5.0	3.5-10.5	x 10 ³ /μL	Normal
PLT-35	150-450	x 10 ³ /μL	Low (Severe Thrombocytopenia)

Hb: Hemoglobin, PLT: Platelet count, WBC: White Blood Cell count

Table 2: Patient's CSF analysis (macroscopy, biochemistry and microscopy) results

CSF Analysis	Findings	Ref Range	Unit	Interpretations
Appearance	Clear and colorless			
Total Protein	0.54	0.15-0.45	g/L	High*
Glucose	1.7	2.2-3.89	mmol/L	Low*
Chloride	127	120-130	mmol/L	Normal
Polymorphs	0	0-2	/μL	Normal
Lymphocytes	0	0-5	/μL	Normal
Erythrocytes	1	0	/μL	-
Random Blood Sugar (Just before LP)	7.1	3.5-7.8	Mmol/L	Normal

* remarkable finding, CSF: Cerebrospinal Fluid, LP: Lumbar Puncture

Table 3: Patient's full blood count (FBC) results after treatment

Findings	Ref range	Unit	Interpretation
Hb-13.0	13.0-17	g/dl	Normal
WBC-4.20	3.5-10.5	x 10 ³ /μL	Normal
PLT-157	150-450	x 10 ³ /μL	Normal

Hb: Hemoglobin, PLT: Platelet count, WBC: White Blood Cell count

Discussion

We present a case of *Pseudomonas plecoglossicida* meningitis in a healthy adult male, with an upper respiratory tract infection as the possible focus. We also share our experiences with management and some diagnostic challenges. Of the classic triad of fever, neck stiffness, and altered mental status mostly seen in cases of bacterial meningitis in adults [14], our patient exhibited only neck stiffness at presentation.

The cerebrospinal fluid (CSF) biochemistry revealed low glucose and elevated protein, consistent with bacterial meningitis, as per findings established by other studies [15,16]. However, a notable deviation detected was the absence of white cells (polymorphs or lymphocytes) in the CSF. This may be due to a low antigenicity or virulence of the organism, resulting in a reduced inflammation response, though this hypothesis warrants further exploration in future studies. There was also a finding of severe thrombocytopenia, typically associated with cases of bacterial meningitis and an indicator of poor prognosis [17].

Interestingly, the patient had no bleeding complications, and platelet counts normalized with treatment (Table 1 and Table 3) without any hemorrhagic sequelae.

Pseudomonas aeruginosa is more commonly implicated in adult bacterial meningitis as compared to other *Pseudomonas* species. Sadly, it is usually associated with a worse prognosis [18]. In contrast, our patient responded well to tailored antibiotic therapy, which may indicate a less virulent disease course. Nonetheless, this is just a single case whose report does not provide conclusive evidence for scientific inferences. Further studies are, therefore, necessary to evaluate this organism's pathogenic process in humans.

Generally, *Pseudomonas species* are known to be largely environmental, dwelling in soils, natural water bodies on land, and fomites or instruments in health facilities [19,20]. Thus, most infections in humans are opportunistic and nosocomial in nature. Our patient's occupation as a Galamsey miner, involving digging and washing gold frequently in rivers, underpins a probable environmental exposure to these organisms as the source of infection. As such, it provides a significant potential causal link between the prior exposure to source (water) and the disease (meningitis) emergence. Therefore, this case brings on board more scientific evidence to fuel the ongoing fight against Galamsey in Ghana.

Limitations

We encountered a few challenges in management of the case. Due to the low socioeconomic status of our client, we were unable to do concurrent cultures of throat, blood, and urine samples. However, combining the clinical presentation/context, we believed that the primary focus of infection was the prior upper respiratory tract. In addition, we could not do a repeat CSF analysis/culture to ascertain complete clearance of the infection and resolution of CSF biochemical parameters post-treatment. However, after the full (21 days) course of parenteral antibiotic treatment, the patient improved with almost complete resolution of clinical signs and symptoms before he was discharged.

Conclusion

We report, to the best of our knowledge, the first case of *Pseudomonas plecoglossicida* meningitis in humans, per the current state of published reports. Hence, clinicians should be mindful of this with a high index of suspicion, considering the atypical clinical features of this type of meningitis. Public health surveillance systems should, therefore, be instituted to look out for such cases, especially in mining areas, as well as communities along the banks of rivers used for Galamsey activities in Ghana. Well-organized studies are needed in the future to support our findings and explore factors contributing to the evolution of the organism into a human pathogen.

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