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CASE REPORT

# Pseudomonas aeruginosa meningitis after visiting a swimming pool: a complicated dive

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## Abstract

Community-acquired meningitis caused by *P. aeruginosa* is rare and has a very high mortality rate. Early recognition and treatment is of paramount importance. We describe a case of a 75-year-old male with a *P. aeruginosa* meningitis which was linked to a regional swimming pool. Physicians should be aware that treatment according to the Dutch meningitis guidelines does not include coverage of infection with *P. aeruginosa*, which can cause, as in our case, a significant treatment delay. The case was complicated by endocarditis of an aortic valve bio-prosthesis and illustrates the incremental value of a PET-CT scan in case of high clinical and microbiological suspicion for endocarditis, while having negative echocardiographic findings.

## Introduction

Meningitis caused by *Pseudomonas aeruginosa* is rare and potentially life-threatening. *P. aeruginosa*, a Gram-negative bacterium, can cause severe infections in immunocompromised and, rarely, in healthy patients, with extremely high mortality rates of up to 61%.[1,2] Because of its inherent antibiotic resistance, *P. aeruginosa* is a notorious pathogen residing in hospitals. Reservoirs of these bacteria are often found, for example, in respiratory equipment. Infections can also be community acquired, particularly after contact with water.

Dutch guidelines recommend treatment with ceftriaxone 2 x 2000 mg in combination with amoxicillin 6 x 2000 mg as empiric antimicrobial therapy for community-acquired meningitis in adults. This spectrum, however, does not include coverage of *P. aeruginosa.* We describe the pathogenesis and clinical aspects of severe *P. aeruginosa* meningitis and sepsis complicated by endocarditis.

## Case

A 75-year-old male was admitted to the emergency department (ED) with fever, vomiting and confusion for eight hours, starting several hours after a visit to a public swimming pool. He had a history of an aortic valve replacement (bio-prosthesis) for aortic stenosis and had no other underlying disease.

Physical examination revealed a lethargic patient with a Glasgow Coma Score of E3M6V3. His body temperature was 39 °C. There was clear nuchal rigidity with apositive Kernig's and Brudzinski's sign. Analysis of the cerebrospinal fluid (CSF) revealed a glucose concentration of 3.2 mmol/l (simultaneous plasma glucose concentration 7.4 mmol/l) and 126.7 x $10^6$ leucocytes/l (93% polymorphonuclear leukocytes).

After collecting blood and CSF cultures, treatment with ceftriaxone and amoxicillin was initiated according to the current Dutch guidelines for the treatment of acute bacterial meningitis in adults. In addition, since aseptic meningitis due to viral pathogens could not be excluded, acyclovir was administered.

CSF and blood cultures yielded growth of the Gram-negative bacterium *P. aeruginosa*, intrinsically resistant to ceftriaxone and amoxicillin. Acyclovir, amoxicillin and ceftriaxone were discontinued and treatment with ceftazidime 3 x 2000 mg was initiated.

The patient developed respiratory distress and a chest radiograph revealed a left lower lobe opacity. A pneumosepsis was diagnosed but sputum cultures and blood cultures remained negative. Transferral to the intensive care unit (ICU) was needed for haemodynamic and respiratory support. Since the clinical situation had worsened during treatment with ceftazidime, tobramycin, which has a synergistic effect with beta-lactam antibiotics, was added.

After six days the patient was detubated and transferred to the neurology department. Although there were no signs of endocarditis, we performed transthoracic echocardiography (TTE) because of the increased risk due to his aortic valve bio-prosthesis and the positive blood cultures. Transoesophageal

echocardiography (TEE) was considered but we decided to perform TTE because of the lack of clinical signs in combination with a lower diagnostic burden for the patient. No signs of endocarditis were detected. After two weeks the patient was transferred to a revalidation centre.
However, three days later, the patient was retransferred to the ED with sepsis and accordingly admitted to the ICU. Blood cultures again yielded *P. aeruginosa*, whereas CSF cultures remained negative. Treatment was started with ceftazidime 3 x 2000 mg and ciprofloxacin 2 x 600 mg.

TEE showed no signs of endocarditis nor prosthetic valve dysfunction. However, a subsequent 18-fluoro-2-deoxyglucose positron emission tomography-computed tomography ((18) F-FDG-PET-CT) scan showed clear signs of endocarditis of the aortic valve bio-prosthesis (figure 1). Antibiotic treatment was changed into meropenem 3 x 2000 mg for six weeks and tobramycin 5 mg/kg (350 mg/day) for two weeks.
At this stage, optimal treatment would include valve replacement. However, the patient's overall clinical condition did not allow these surgical interventions. A palliative treatment plan was initiated, and accordingly, our patient was discharged home.

## Discussion

*P. aeruginosa*, a Gram-negative non-fermenting rod, is ubiquitous in the environment. It is able to survive in nutrient-poor environments. Because of its inherent antibiotic resistance, *P. aeruginosa* is a notorious pathogen in hospitals. Reservoirs for infection are often found, for example in respiratory equipment.[1,2]
P. aeruginosa is a very uncommon cause of bacterial meningitis in adults. In the Netherlands, the incidence for meningitis is 1.6 cases per 100,000 adults per year.[3] Most cases of *P. aeruginosa* meningitis are nosocomial and occur in patients with underlying disease, such as cancer or diabetes.[4]
There has been increasing recognition of *P. aeruginosa* being an important cause of community-acquired infections. It has been linked to warm and moist environments such as hot tubs and swimming pools.[5] A case of community-acquired pneumonia due to *P. aeruginosa* was directly linked to a swimming pool.[6]
Our case was linked to a regional swimming pool. A recent Dutch investigation showed that *P. aeruginosa* was detectable in 10 out of 14 swimming pools (71%) mainly on play accessories.[7] When used, temporarily high concentrations of *P. aeruginosa* could be detected in swimming water.[7] Since our patient became ill several hours after swimming in a public pool and other potential foci for P. aeruginosa infection were absent (contact lenses, contact with soil, contact with other natural surface water), we hypothesise that this particular infection was acquired in the swimming pool, even though cultures (unfortunately not taken from the play accessories) one week later did not yield *P. aeruginosa.*
The presence of heart valve bio-prosthesis implied a higher risk for bacterial endocarditis. Theoretically the whole disease process could have been started with the endocarditis leading to a secondary meningitis. In a Dutch study, a coexisting endocarditis was found in 2% with patients presenting with bacterial meningitis.[7] Because of frequent complications and inability to sterilise valves with antibiotics, early surgery is recommended for left-sided *Pseudomonas* endocarditis.[8]

TEE is often indicated for assessing (or excluding) bacterial endocarditis but turned out to be negative in our case. In contrast, the PET-CT scan did show signs of endocarditis. This advanced imaging modality is advocated for its high diagnostic yield for the (modified) Duke criteria of endocarditis and secondary septic embolisms.[9] The latter increase morbidity and mortality in patients with infective endocarditis. A study using 18F-FDG PET/CT in diagnosing septic embolisms in a group of 47 patients with infectious endocarditis found a sensitivity, specificity, positive predictive value and negative predictive value of 100%, 80%, 90%, and 100%, respectively.[10] Particularly in cases of high clinical and microbiological suspicions of endocarditis and negative echocardiographic findings, PET-CT scan may be of incremental value for the diagnostic process.
Community-acquired spontaneous meningitis caused by *P. aeruginosa* has a very high morbidity and mortality rate.[1] Swift recognition and adequate treatment is of paramount importance. Physicians should be aware that treatment according to the Dutch guidelines for the treatment of acute bacterial meningitis in adults does not cover *P. aeruginosa* as a potential causative agent, thereby causing a significant delay in the initiation of appropriate antibiotic therapy. Furthermore, this case illustrates why a PET-CT scan should be strongly advised in case of high clinical and microbiological suspicion for endocarditis and negative echocardiographic findings.

## Disclosures

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