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Case Report

A New Case of Meningitis Caused by *Psychrobacter sanguinis* in a Child and Literature Review

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Abstract

As per our knowledge, this is the first case of meningitis of a pediatric patient associated with *Psychrobacter sanguinis* to be reported. Further, the role of *Psychrobacter* spp. in relation to severe infections have been described in this report.

The present case-report concerns a 2-and-a-half-year-old patient, who developed meningitis after undergoing brain surgery. A few days later she develops hyperthermia (40°C) and neck pain. The surgical scar was red and swollen. A lumbar puncture was performed, where CSF analysis was cloudy and showed hyperleukocytosis. Incubation of the blood culture was positive for *Psychrobacter* spp. The patient recovered after treatment.

Ten cases of *Psychrobacter* spp. were recorded, where four cases were recorded from Rigshospitalet and six cultures were sent from other hospitals.

Psychrobacter spp. has been reported in different cases and different environments. They have been seen related to severe infections, where most cases were caused by *P. sanguinis* and *P. immobilis*. However, *Psychrobacter* spp. has also been found in the intestinal microbiome and in other common environments. These different features of *Psychrobacter* spp. make it difficult to determine the clinical importance of the bacteria.

Keywords: *Psychrobacter sanguinis; Meningitis; Child*

Introduction

Psychrobacter spp. are nonmotile, aerobic, gram-negative coccobacilli and belongs to the family *Moraxellaceae* [1,2]. *Psychrobacter* spp. are psychrotolerant (cold tolerant) and halotolerant (high salt concentration tolerant) and have been isolated from deep sea or sea ice [3,4] and a variety of different food products including marine species [5]. *Psychrobacter* spp. are considered as rare opportunistic human pathogens and have been reported in a limited number of case reports including specimens obtained from human blood, cerebrospinal fluid, wounds, and eyes [6]. *P. sanguinis* was first reported in 2012 as a new species as detected in human blood in 4 cases [7]. The pathogenicity of *Psychrobacter sanguinis,* including meningitis, is relatively unknown due to recent discovery and limited cases. Post neurosurgical meningitis has been reported in one case from France in 2014 [8]. One pediatric meningitis case associated with *P. sanguinis* has been reported, identified by metagenomic next-generation sequencing in cerebrospinal fluid in 2016 [9].

In this case report *P. sanguinis* was identified in a blood culture. Gram negative bacteria were identified by microscopy. The isolate, direct from the blood culture, was identified with MALDI-TOF as *Psychrobacter sanguinis*. The bacteria had the best condition to grow on 5% blood agar in 30°C. There was no grow on the specific medium 7%Vitek NaCl.

CSF analysis showed hyperleukocytosis with high number of neutrophilic leukocytes. CSF was not transparent and had an elevated level of mononuclear leukocytes. No microorganisms were seen in the microscope. Furthermore, there was no growth of bacteria and the result of 16S rRNA showed no result.

Materials and Methods

Case selection: A child with clinical meningitis and a positive blood culture with *P. sanguinis* is described below.

Spinal fluid and blood culture: The spinal fluid was clouded with some mononuclear leucocytes and no bacteria seen by microscopy. There was no growth of bacteria or molds on 5% blood agar plates aerobic or anaerobic at 37°C and no bacterial DNA could be detected by 16s RNA. Gram negative rods were seen by microscopy in a blood culture in the Bactec system. Gram negative rods were cultured on 5% blood agar plates aerobically at 30°C.

Identification of culture: The Gram-negative rods were identified as *P. sanguinis* by (MALDI-TOF).

Search in microbiologic database: A search in the Microbiological data base which contain all microorganisms cultured or detected by molecular biological methods are recorded since 2001. A search on *Psychrobacter* spp. was done and all cases are shown in table 1.

Literature search: As shown in table 1 the microbiological database revealed that *Psychrobacter* spp. were found in blood samples or from superficial sites of the body. The importance of the latter is difficult to establish, but bacteria in blood samples are most often of clinical importance. Therefore, the literature search includes invasive *Psychrobacter* spp. with the two search strings "*Psychrobacter* spp. and meningitis" and "*Psychrobacter* spp. and sepsis".

Different databases were used for both search strings. These included Embase, Pubmed and PMC. The search string used was "*Psychrobacter* and meningitis". This string was chosen to find studies, which illuminates a possibly association between *Psychrobacter* spp. and meningitis. 107 hits were found in PMC, 5 hits were found in PubMed and 4 hits were found in Embase. In 3 studies relevant material were found, where 2 of the studies are found in PMC [8,10], all 3 of the studies are found in both PMC and Embase [8-10].

The next search string used was "*Psychrobacter* and sepsis". This string was chosen to find studies, which illuminates a possibly association between *Psychrobacter* spp. and sepsis. 107 hits were found in PMC, 6 hits were found in PubMed and 1 hit was found in Embase. In 3 studies relevant material were found, where 2 of the studies are found in Pubmed [11,12], one of these studies [11] was also found in Embase and one of these was also found in PMC [12] and the third relevant study was only found in PMC [13].

Case Report

A 2-and-a-half-year-old child was admitted to an emergency department after suddenly experiencing severe headaches, vomiting, and altered consciousness. The girl had been experiencing chronic headaches and neck pain for several months up to the incident. Clinical examination revealed no focal neurological signs. CT of the cerebrum showed signs highly suggestive of a tumor with hemorrhage. The patient was immediately transferred to a primary hospital, where she received high doses of steroids (dexamethasone 10 mg/m^2) to reduce the elevated intracranial pressure. MRi confirmed the presence of a tumor and a hemorrhage, correlating with the sudden aggravation of the patient's symptoms. Partial resection of the tumor was performed in general anesthesia a few days later. On day 3 after surgery, leakage from the surgical scar in the neck was observed, there was no local signs of inflammation or infection. The same day, de-escalation of the steroid therapy was debuted, with complete stop planned 8 days later. On day 11 after surgery, the patient develops hyperthermia

(40°C) and expresses discomfort around her neck. Redness and swelling of the scar were observed. A bacterial culture from the central venous catheter was performed and empirical antimicrobial therapy was initiated immediately using a combination of meropenem and vancomycin.

Direct examination of the blood culture revealed gram-negative rods. A lumbar puncture was performed, and CSF analysis was cloudy and showed hyperleukocytosis. Incubation of the blood culture was positive for *Psychrobacter* spp. found in the blood culture was susceptible to ampicillin. Based on the CSF parameters, the empirical antimicrobial therapy was continued, in case the CSF would be positive for another agent.

As no bacterial growth was observed in the CSF after a week of incubation, meropenem and vancomycin were switched to amoxicillin (50 mg/kg distributed in 3 times per day), for a total treatment of 8 days. The patient experienced a rapid recovery and was discharged from the hospital after receiving her last dose of antibiotics.

Microbiological data base

Ten cases of *Psychrobacter* spp. were recorded in the microbiological data base (Table 1). Four cases were recorded from Rigshospitalet: blood culture from a child with meningitis, from the outer part of the ear, a burn wound and a biopsy from a breast nipple. Six cultures were sent from other hospitals for identification by 16s RNA in our department.

Sex	Age	Year	Sample	Identification	
F	2	2021	Blood	Culture	RH
M	52	2019	Outer ear	Culture	RH
F	51	2020	Burn wound	Culture	RH
F	39	2016	Breast nipple	16s RNA	RH
F	72	2018	Blood	16s RNA	OH
F	54	2016	Blood	16s RNA	OH
F	54	2016	Blood	16sRNA	OH
M	79	2018	Blood	16s RNA	OH
M	23	2019	Cornea	16s RNA	OH
M	51	2014	Blood	16s RNA	OH

Table 1: *RH = Rigshospitalet, OH = Other hospitals.*

Literature search: The search strings and the different number of hits in the different databases illustrate that these 3 databases separate from each other at some point. These 3 different databases were chosen for a wider selection in a specified search (cf. Low number of hits in the search string).

From the result schedule, table 2, it can be summarized that the chosen studies for the search string "*Psychrobacter* and meningitis" have investigated meningitis by examining cerebrospinal fluid. It appears that *Psychrobacter sanguinis* is found in two of the studies, while *Psychrobacter immobilis* is found in one of them. Further, it can be summarized that the chosen studies for the search string "*Psychrobacter* and sepsis" have investigated cases related to sepsis by examining blood and cells. It appears that three different spp. of *Psychrobacter* have been found in these studies. Further a relevant study was found in making the introduction [7].

Reference	Study design	Tissue/secrete/organ	Studied illness	Identified organism
Guern., *et al*. [8]	Case report	Cerebrospinal fluid	Postneurosurgical meningitis	*Psychrobacter sanguinis*
Lloyd-Puryear., *et al*. [10]	Case report	Cerebrospinal fluid	Meningitis	*Psychrobacter immobilis*
Ortiz-Alcántara., *et al*. [9]	Case report	Cerebrospinal fluid	Meningitis	*Psychrobacter sanguinis*
Sriaroon., *et al*. [11]	Case report	Blood	Sepsis	*Psychrobacter immobilis*
Caspar., *et al*. [12]	Case report	Blood (transfusion-related)	Bacteremia	*Psychrobacter arenosus*
Michael., *et al*. [13]	Case-control	Tissue	Septic arthritis, cellulitis and vasculitis	*Psychrobacter sanguinis*
Wirth., *et al*. [7]	Case report	Human blood	Not mentioned	*Psychrobacter sanguinis*

Table 2

Discussion and Conclusion

Different species of *Psychrobacter* have been identified [1]. Most species have been found in environmental samples mainly from sea-water and sea animals [3-5]. *Psychrobacter* spp. have also been found as part of the intestinal microbiome in many animals and humans [14-16]. Thus, exposure to *Psychrobacter* spp. may be very common but despite of this human infection with these bacteria are rather uncommon. Some wound infections associated with surgery or exposure to marine environment have been described [6,17]. At Rigshospitalet *Psychrobacter* spp. have been identified in superficial infections in burn wound, cornea, breast nipple and outer ear (Table 1). As *Psychrobacter* spp. are common in environment and intestinal microbiome the clinical importance of the bacteria in superficial infections is difficult to determine.

Invasive infections such as sepsis and meningitis *Psychrobacter* spp. would more likely be regarded as a true cause of the infection. The literature search showed 7 papers describing invasive *Psychrobacter* infection (Table 2). In our hospital we receive samples from other hospitals for 16S RNA analyses and 5 of 6 of these samples were from blood samples (Table 1). In this case report the patient had clinical meningitis but with a negative culture and 16S RNA analyses of spinal fluid. 11 days prior to the debut of meningitis, the patient had undergone brain surgery with resection of a tumor and the surgical scar in the neck had been leaking. This could be the cause for an unusual infection with *Psychrobacter* spp. *P. sanguinis* was cultured from the blood samples but could not be confirmed by analyzing spinal fluid. No other agent was found to be causing the infection; thus, no other explanation could be found.

Psychrobacter spp. may in rare cases cause severe infections in humans. Most of which are caused by *P. sanguinis* and *P. immobilis*.

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