Title: *Dermacoccus* sp. isolated from a brain abscess in a 4-year-old child

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ABSTRACT

Dermacoccus spp. have rarely been reported as human pathogens. We describe a case of a 4-year-old boy with congenital heart disease who was diagnosed with a brain abscess. The abscess was drained and the sample grew *Streptococcus intermedius*, *Aggregatibacter aphrophilus* and *Dermacoccus* sp.. *Dermacoccus* grew after 5 days of incubation and the patient was treated with meropenem.

Keywords: *Dermacoccus*, brain abscess, case report, children

Introduction

Brain abscesses are rare but severe infections associated with significant morbidity and mortality. Known predisposing factors for brain abscesses in children include preceding respiratory infections such as sinusitis or otitis media and underlying clinical conditions such as congenital heart disease or immunodeficiency. Both gram positive and gram negative bacteria, typically from the upper respiratory tract and oral mucosa, can be found in brain abscesses [1].

The genus *Dermacoccus* is one form of actinomycetes bacteria that has more recently been described as a member of the human skin flora as well as respiratory flora [2,3]. To our knowledge, only two earlier case reports, both on central line associated *Dermacoccus* spp. bloodstream infections, have been published in humans [4,5]. There is also a recent report from Ethiopia where a significant number of patients were found to have *Dermacoccus nishinomiyaensis* as urinary isolates although the clinical significance was not clear [6].

We describe a case of a 4-year-old child with congenital heart disease and a polymicrobial brain abscess including *Dermacoccus* sp..

Case report

A 4-year-old boy presented to the emergency room of a children's hospital with 6 to 10 days of poor feeding, increasing sleepiness, tactile fevers and intermittent vomiting and 3 days of increasing headache, vomiting and vague abdominal pain. He was seen twice by a physician in the week leading to his admission and was thought to have a viral infection. He was born at 35 weeks of gestation with a complex cyanotic congenital heart disease, including atrioventricular and ventriculoarterial discordance, hypoplastic left-sided right ventricle,

ventricular septal defect, hypoplastic aortic arch, bicuspid aortic valve and pulmonary arteriovenous malformations. He had undergone Norwood/Sano procedure and bidirectional Glenn shunting operation following muscular obstruction of the Sano shunt 4 years ago. His infection history was unremarkable and his immunizations were up to date. He had no recent travel history nor significant animal or water exposures, and no sick contacts. He had undergone routine dental examination 9 weeks ago, and cardiac catheterization 4 weeks before his presentation.

In the emergency room, his vital signs were normal except fever of 38.0 °C and oxygen saturation of 75%, which was his baseline. The remaining clinical examination showed mild dehydration, central cyanosis, good capillary refill time, and Glasgow coma scale of 15. There were no localizing physical signs. His echocardiogram showed no evidence of vegetation and chest X-ray was unchanged from before. Laboratory examination showed elevated neutrophils of 12.1 $x10^9$/L and C-reactive protein of 12 mg/L. He had a known polycythemia, and a normal platelet count. He had normal electrolytes, random glucose, renal and liver function tests. Three sets of aerobic blood cultures and a urine culture showed no growth. He was hospitalized for dehydration and prolonged fever of unknown etiology. No antimicrobials were started.

Three days later he deteriorated. His level of consciousness worsened with Glasgow coma scale 8-10, and he developed new focal neurological signs with partial left-sided hemiplegia. Computed tomography (CT) of the head with contrast was done urgently and showed a large, superior right-sided thalamic brain mass with hyperattenuating wall, measuring 6.5 x 5 x 3.2 cm in diameters, and a mass effect with signs of increased intracranial pressure (ICP) (Fig. 1, panel A). Blood cultures were drawn and antibiotic treatment with vancomycin, cefotaxime

and metronidazole were initiated pre-operatively. The neurosurgery team performed an urgent ultrasound guided needle aspiration of the abscess through a right partial mini-craniotomy and aspirated 30 mL of pus that was sent for bacterial, mycobacterial, nocardial and fungal cultures.

Blood cultures remained negative and repeated trans-thoracic echocardiogram examinations suggested no endocardial involvement. Bacterial culture from the abscess grew *Streptococcus intermedius* (4+) and *Aggregatibacter aphrophilus* (4+), identified by matrix assisted laser desorption/ionization-time of flight mass spectrometry (MALDI-TOF MS; Bruker Biotyper), within 48 hours of incubation on 5% sheep blood agar plate. Both isolates were susceptible to third generation cephalosporin. Patient was continued on cefotaxime and metronidazole. *Dermacoccus* sp. (1+) grew from abscess sample after 5 days of incubation. The isolate was identified as *Dermacoccus nishinomiyaensis* by MALDI-TOF MS with a similarity score [log(score)] of > 2.0 and was confirmed to be *Dermacoccus sp.* by 16S ribosomal ribonucleic acid polymerase chain reaction followed by Sanger sequencing analysis by British Columbia Centre for Disease Control. Antimicrobial susceptibility testing was performed using gradient strip minimum inhibitory concentration (MIC) determination (Etest® strip (bioMérieux SA, Marcy l'Etoile, France and Liofilchem®, Roseto degli Abruzzi, Italy). MIC values of cefotaxime, ceftriaxone, meropenem and penicillin against *Dermacoccus* sp. are shown in Table 1. Post-operative head CT without contrast enhancement showed remaining moderate abscess and improved ICP (Fig. 1, panel B), and treatment with cefotaxime and metronidazole was switched to meropenem to cover all the identified isolates, including *Dermacoccus* sp..

Post-operatively, neurological findings improved significantly over the following 10 days. He continued to have weekly head CT which showed residual anterior component of the abscess and reduced posterior component, evolution of post-operative changes and secondary mild increase in midline shift (Fig. 1, panels C and D, 7 and 13 days after the initial drainage, respectively), and the patient continued to have low-grade fever. However, 22 days after initial drainage, patient's level of consciousness worsened and he started vomiting again. Repeated head CT scans showed loculation and partial enlargement of the abscess as a sign of inadequate source control and therefore it was re-drained with ultrasound guidance. This second aspirated pus sample of 10 ml volume did not grow any bacteria and patient became finally afebrile in 2 days. Patient remained well and repeated head CT scan showed substantial improvement in the size of the abscess. However, 8 days after the second drainage the patient had recurrent vomiting and a CT scan showed trapping of the left temporal horn of the lateral ventricle despite further improving abscess size, and he underwent Ommaya reservoir placement to relieve his ICP. Patient received another 6 weeks of intravenous meropenem after the second surgery. He required frequent bedside tapping of the Ommaya reservoir for relive of ICP and finally had a right- temporal ventriculo-peritoneal shunt placed 3 months after initial presentation for more definitive relief of his obstructive hydrocephalus as an out-patient. At this point, all his neurological symptoms had fully resolved. The chain of events is summarized in Fig. 2.

Discussion

We report a 4-year-old patient with underlying bi-directionally shunting congenital heart disease and a polymicrobial brain abscess. One of the three bacteria that were isolated from the brain abscess was *Dermacoccus* sp.. MIC of cephalosporins against *Dermacoccus* sp. was

4 mg/L and the empiric antibiotic therapy was changed to meropenem. We also note that it took a total of 5 days of incubation before the growth was visible on the primary plate.

In our patient, multiple pathogens were detected from the abscess. This is not uncommon. An earlier pediatric study reported one fourth of brain abscesses to have polymicrobial etiology [1]. Oral source of infection seems possible because *S. intermedius* and *A. aphrophilus* are both known colonizers/pathogens of the oral mucosa. Our patient's bi-directionally shunting heart condition and preceding dental treatment make oral source plausible. For *Dermacoccus* sp. source of potential bacteremia prior to abscess formation is unclear. In humans, the bacteria has been detected at least from skin and from nasopharynx [2,3]. Based on detection of the other bacteria, it can be speculated that there was likely an oral source for the *Dermacoccus* sp. isolate in this case as well.

Only recently, *Dermacoccus* spp. have been identified as potential human pathogens. The only two earlier reports on invasive infections by *Dermacoccus* spp. documented *Dermacoccus barathri* and *Dermacoccus nishinomiyaensis* as the causative agents in central venous access device related bloodstream infections in children [4,5]. In the first paper, *Dermacoccus* isolate grew only after 10 days of incubation and it was non-susceptible to cefepime and cefixime [4]. A more recent report, describes a 1-year-old child with repeated catheter-related bacteremia [5]. Another recent report suggested that depletion of *Dermacoccus* spp. in the skin was associated with atopic dermatitis prone skin type [2].

Ceftriaxone/Cefotaxime and metronidazole are recommended as empiric treatment for brain abscesses in children [1]. It is worth a notion, that *Dermacoccus* sp. had MICs of 4 mg/L against cephalosporins suggestive of resistance and our empiric antibiotic therapy had to be

changed after antimicrobial susceptibility results of *Dermacoccus* sp. were reported. The role of *Dermacoccus* sp. as human pathogen remains uncertain but when identified in clinically relevant samples it should be considered.

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Conflicts of interest

All authors: No reported conflicts of interest.

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TABLES

Table 1. Antibiotic susceptibility results of *Dermacoccus* sp. isolate from brain abscess of a 4-year-old child. Susceptibilities were determined using gradient strip minimum inhibitory concentration (MIC) determination (mg/L).

Antibiotic\Pathogen	*Streptococcus intermedius*	*Aggregatibacter aphrophilus*	*Dermacoccus* sp.
Ampicillin	ND	0.25	ND
Cefotaxime	ND	ND	4
Ceftriaxone	0.125	0.06	4
Meropenem	0.004	ND	0.008
Penicillin	0.032	ND	0.032
Vancomycin	0.5	ND	0.5

ND, not done

FIGURE CAPTIONS

Fig. 1. Computed tomography of the head before (panel A) and 1 (panel B), 7 (panel C), and 13 (panel D) days after the first drainage.

Fig. 2. Timeline of the clinical course of events. CT, computer tomography; US, ultrasound; ED, emergency department.