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Haemophilus paraphrophilus brain abscess in a 9-year-old boy: Case report and literature review

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Abstract

Human diseases due to *A. paraphrophilus* aren't usual. The following case report describes the first isolated case of *A. paraphrophilus* brain abscess in our laboratory. A 9-year-old boy presented to pediatric emergencies for frontal headache, vomiting, blurred vision and left hemiparesis. Radiological diagnosis consists with a frontal abscess. Gram staining of purulent samples showed abundant neutrophils with gram negative bacilli. Culture was made on blood agar, chocolate agar, Chapman's agar and incubated in 5% CO₂ at 37°C for 24 hours. Positive culture was detected only on chocolate agar. It was monomicrobial with small yellowish non-hemolytic colonies. Gram stain of colonies showed pleomorphic gram-negative coccobacilli. The strain required V factor for growth. The isolated strain was sensitive to all antibiotics tested. The interest of this case is that it shows the emergence of *A. paraphrophilus* as a causative agent of brain abscesses on pediatric population without associated congenital heart disease. It may also help identifying risk factors of these infections and how to prevent them.

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Keyword

Child,
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Sinusitis,
Brain abscess.

Introduction

H. aphrophilus and *H. paraphrophilus* are now combined as the same species: *Aggregatibacter aphrophilus*, with the V-factor dependence of *H. paraphrophilus* being considered as a variable phenotypic characteristic [1]. *A. aphrophilus* belongs to the HACEK group, fastidious gram-negative bacilli that are found in the human upper respiratory and genitourinary tracts [1]. *A. aphrophilus* may cause brain abscess and infective endocarditis and has been isolated from various other body sites including peritoneum, pleura, wound and bone [2].

Case Report

A 9-year-old boy was admitted to pediatric emergencies for frontal headache not relieved with painkillers, vomiting and blurred vision. He had no obvious associated conditions except a sinusitis that took place two weeks ago. On admission, he was afebrile with a stable hemodynamic state. Neurological examination showed a Glasgow coma scale

score of 13, a supple neck and left hemiparesis. The remaining physical examination was normal. CT with contrast demonstrates a ring-enhancing lesion along with midline shift to the left. Drainage of the abscess was achieved and empiric parenteral antibiotic therapy was initiated with metronidazole (10mg/kg/8h), and ceftriaxone (100mg/kg/j). Other investigations were carried out: ultrasound of liver, chest X-ray and dental examination. These were all negative. Blood tests showed leukocytes $14 \times 10^3/\text{uL}$ with $9,8 \times 10^3/\text{uL}$ neutrophils, hemoglobin 12g/dL and C-reactive protein 2,8 mg/L. Gram staining of purulent samples showed abundant neutrophils with gram negative bacilli. A small volume of pus was inoculated onto blood agar, chocolate agar, Chapman's agar and incubated in 5% CO_2 at 37°C for 24 hours. Positive culture was detected only on chocolate agar. It was monomicrobial with small yellowish non-hemolytic colonies (figure 1). Gram stain of colonies showed pleomorphic gram-negative coccobacilli. The strain required V, but not X factor for growth, it was oxidase positive and catalase negative. Late identification by API NH system revealed *Haemophilus paraphrophilus* (Figure 3).

Antimicrobial susceptibility was detected by the disk diffusion test using an inoculum of 0,5 McFarland on M-H base agar supplemented by 5% horse blood and 20mg/L β -NAD. The isolates were susceptible to all antibiotics tested according to EUCAST breakpoint standards (Figure 2).

Normalization of WBC counts was obtained by the 10th postoperative day. After six weeks of intravenous antibiotic therapy, CT scan control showed diminished lesion and neurological manifestations disappeared.



Figure 1: Culture on chocolate agar

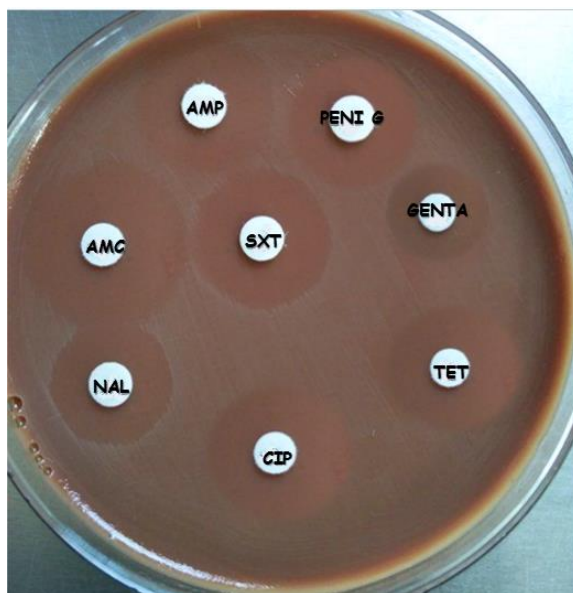


Figure 2: Antimicrobial susceptibility



Figure 3: API NH identification of *H. paraphrophilus*

Discussion

Brain abscess is a rare disease in childhood requiring prompt medical and/or surgical treatment [3]. To our knowledge this is the third case report of *A. paraphrophilus* brain abscess in a child without underlying heart disease.

Bacteria reach the brain through contiguous spread, hematogenous dissemination from a distant focus or through a head trauma (penetrating injury, post-neurosurgery) [4]. Congenital heart disease is the most common underlying condition, and the most common preceding infection is sinusitis [3]. We assume that in the case of our patient, the brain abscess was due to a contiguous spread from the sinusitis that took place 2 weeks earlier.

The most frequently isolated microorganisms from brain abscesses in pediatric population are *Viridans streptococci*, *Staphylococcus aureus* and Enterobacteriaceae [5]. *A. paraphrophilus* has emerged as an important cause of brain abscesses [6].

A. paraphrophilus is a small, pleomorphic Gram-negative coccobacilli, it's slow growing requires enriched culture media and increased carbon dioxide tension [7]. Non motile, facultatively anaerobic with no dependence to X factor but V factor is required for growth [2]. Colonies on chocolate agar are granular, yellowish and opaque [2]. Glucose is fermented, ONPG is hydrolyzed and oxidase is positive [2]. Phenotypic characteristics differentiating *A. paraphrophilus* from other HACEK group species are shown in Table 1. Fortunately, *A. paraphrophilus* is sensitive to a wide range of antibiotics [8]. Production of

beta-lactamase should be tested, while third-generation cephalosporins should be considered drug of choice [9]. Ciprofloxacin and the newer fluoroquinolones have potent activity against *A. paraphrophilus*, and can be used as alternatives for penicillin allergic individuals, and for those infected with strains resistant to cephalosporins [10]. Our isolated strain was susceptible to all antibiotics tested according to the EUCAST breakpoint standards [11].

Table 1. Phenotypic characteristics differentiating *A. paraphrophilus* from other HACEK group species [2][6]

	X	V	CO ₂	CAT	OX	NIT	ODC	LDC	ONPG	IND	GLU	LAC	SAC
<i>A. aphrophilus</i>	-	+	+	-	+	+	-	-	+	-	+	+	+
<i>A. paraphrophilus</i>	-	-	+	-	-	+	-	-	+	-	+	+	+
<i>A. actinomycetemcomitans</i>	-	-	+	+	-	+	-	-	-	-	+	-	-
<i>Eikenella corrodens</i>	-	-	+	-	+	+	+	+	-	-	-	-	-
<i>Cardiobacterium hominis</i>	-	-	+	-	+	-	-	-	-	+	+	-	+
<i>Kingella kingae</i>	-	-	+	-	+	-	-	-	-	-	+	-	-
<i>Haemophilus influenza</i>	+	+	-	+	+	+	v	v	-	v	+	-	-
<i>Haemophilus parainfluenzae</i>	-	+	-	v	+	+	v	-	v	v	+	-	+

X: V-factor-dependence; V: V-factor-dependence; CO₂: capnophile; CAT: catalase; OX: oxidase; NIT: nitrate; ODC: ornithine decarboxylase; LDC: Lysine decarboxylase; IND: Indole; GLU: Glucose; LAC: Lactose; SAC: saccharose; v: variable

The literature review since 1984 showed only 10 previously reported cases of *A. paraphrophilus* brain abscess (Table 2). Two of the 10 cases are children (20%) and six are males (60%). 30% have underlying congenital heart disease while no predisposing factor was identified in two cases. Therapy is based on antibiotics combined with surgical drainage in 80% of cases. The mortality rate is 20%.

Table 2. Reported cases of *A. paraphrophilus* brain abscesses

Case no. date [R]	Age (y) / gender	Predisposing factors	Therapy	Outcome
1. 1984 [12]	49 / F	None	Antibiotics (cefotaxime, metronidazole)	Death
2. 1985 [13]	26 / F	Congenital heart disease	Antibiotics (Ampicillin, Gentamicin)	Death
3. 1987 [14]	47 / M	Poor dentition	Surgical + antibiotics (ampicillin, metronidazole)	Recovery
4. 1988 [15]	51 / M	Dental manipulation	Surgical + antibiotics (Ampicillin, ceftriaxone)	Recovery
5. 1990 [16]	43 / M	Congenital heart disease Tooth extraction	Surgical + antibiotics (ciprofloxacin, metronidazole)	Recovery
6. 1996 [17]	66 / F	Toothache	Surgical + antibiotics (Penicillin G, metronidazole)	Recovery
7. 1998 [18]	42 / M	none	Surgical + antibiotics (cefotaxime, ciprofloxacin)	Recovery
8. 2008 [8]	3 / M	Otitis media	Surgical + antibiotics (3 rd generation cephalosporins, metronidazole)	Recovery

9. 2010 [19]	53 / M	Congenital heart disease Dental filling ingestion	Surgical + antibiotics (meropenem, metronidazole)	Recovery
10. 2013 [20]	6 / F	Dental extraction	Surgical + antibiotics (ceftriaxone, metronidazole)	Recovery
11. 2019 (Present case)	9 / M	Sinusitis	Surgical + antibiotics (ceftriaxone, metronidazole)	Recovery

R = Reference; M= male; F= female

Conclusions

A. paraphrophilus is emerging as a causative agent of brain abscesses in pediatric population. Prevention is therefore crucial and involves good dental hygiene and the treatment of any ENT infection.

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