



## 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% CO<sup>2</sup> 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.

### Article History

Received 25 January 2020  
Accepted 14 June 2020

### Keyword

Child,  
*Aggregatibacter paraphrophilus*,  
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%  $\text{CO}_2$  at  $37^\circ\text{C}$  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  $\beta$ -NAD. The isolates were susceptible to all antibiotics tested according to EUCAST breakpoint standards (Figure 2).

Normalization of WBC counts was obtained by the 10<sup>th</sup> 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

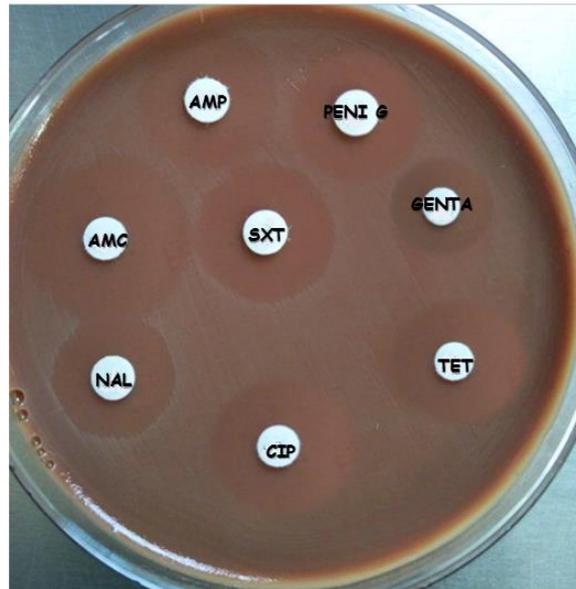


Figure 2: Antimicrobial susceptibility



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 <sub>2</sub>	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; CO<sub>2</sub>: 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 <sup>rd</sup> 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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