
Review Tool reports

UNDERSTANDING AND CONTEXTUALIZING THE REPORTS

Readers of these automated manuscript Review Tool reports are encouraged to use them to support them in performing their own assessment and 'health check' on a preprint prior to it completing peer review.

However, these should only be used as a guide, read within the overall context of the article itself, and should never replace full peer review. Please ensure you read the article fully alongside these and familiarize yourself with the tools and how they work, using the links provided below.

These reports are published under the terms of the [Creative Commons Attribution License](#)

ITHENTICATE® REPORT

iThenticate® (<https://www.ithenticate.com>) checks the submitted article against an extensive database of articles from the internet and scholarly publications and highlights where similar sentences or phrases have been used previously, including in the author's own published work. Each individual match is given a percentage score based on how much it overlaps with the previously existing work, and an overall similarity score is given. The report generated from this are included here for transparency and can be cited independently using the DOI below.

- FAQs: <https://www.ithenticate.com/products/faqs>
- Help pages: <https://help.turnitin.com/ithenticate/ithenticate-user/ithenticate-user.htm#TheSimilarityReport>

How to cite the iThenticate report for this article:

ADIL FZ, BENAÏSSA E, BEN LAHLOU Y, LAAMARA L, BSSAIBIS F, *et al.* iThenticate report for: *Haemophilus influenzae* in acute appendicitis. *Access Microbiology*. 2024. <https://doi.org/10.1099/acmi.0.000794.v1.1>

ACMI-D-24-00037.pdf

By Fatima Zahra ADIL

WORD COUNT

1733

TIME SUBMITTED

14-FEB-2024 10:15AM

PAPER ID

106891303

Access Microbiology
Haemophilus influenzae in acute appendicitis
--Manuscript Draft--

CONFIDENTIAL

Haemophilus influenzae in acute appendicitis

Fatima Zahra ADIL^{1*}, Elmostafa BENAÏSSA^{1,2}, Yassine BEN LAHLOU^{1,2}, Leila LAAMARA¹, Fatna BSSAIBIS¹, Adil MALEB², Mariama CHADLI^{1,2}, Mostafa ELOUENASS^{1,2}

¹ Bacteriology Department, Mohammed V Military Teaching Hospital, Rabat, Morocco

² Research Team of Epidemiology and Bacterial Resistance, Faculty of Medicine and Pharmacy, Mohammed V University, Rabat, Morocco

*Corresponding author: Fatima Zahra ADIL, Email: adilfatimazahra95@gmail.com

Abstract:

Appendicitis, typically caused by appendiceal lumen obstruction, is a prevalent abdominal surgical emergency worldwide. While most cases involve *Enterobacterales*, *Haemophilus influenzae*, primarily known for upper respiratory infections, is infrequently associated with gastrointestinal infection. This article presents a case of acute appendicitis caused by *Haemophilus influenzae* in a 15-year-old child, highlighting the significance of recognizing uncommon pathogens in appendicitis and emphasizing the necessity for thorough microbiological investigations to refine diagnostic approaches.

Keywords: acute appendicitis, *Haemophilus influenzae*, children

Data summary:

No data was generated during this research or is required for the work to be reproduced.

Introduction :

Appendicitis refers to the inflammation of the vermiform appendix; its primary cause is typically attributed to the obstruction of the appendiceal lumen [1]. Acute appendicitis stands as the most prevalent abdominal surgical emergency worldwide [2]. Most often, the bacteria associated with acute appendicitis include *Enterobacterales* such as *Escherichia coli*, *Bacteroides*, *Peptostreptococcus* and *Pseudomonas* [1].

Haemophilus influenzae is a part of the normal microbiota of the upper respiratory tract. It is responsible for various infections ranging from uncomplicated upper respiratory conditions such as conjunctivitis, sinusitis, and otitis media to severe ones such as endocarditis and meningitis [3]. However, little is known about the ability of *Haemophilus influenzae* to cause gastrointestinal infections [4].

We report a case of acute appendicitis due to *Haemophilus influenzae* in a 15-year-old child.

Case presentation:

A 15-year-old child was admitted to the emergency department of the Mohamed V Military Teaching Hospital (HMIMV) for intense pain in the right iliac fossa, where abdominal guarding was observed during the clinical examination. Notably, the patient was afebrile during the evaluation. Among the patient's medical history is a tonsillectomy performed at the age of 8.

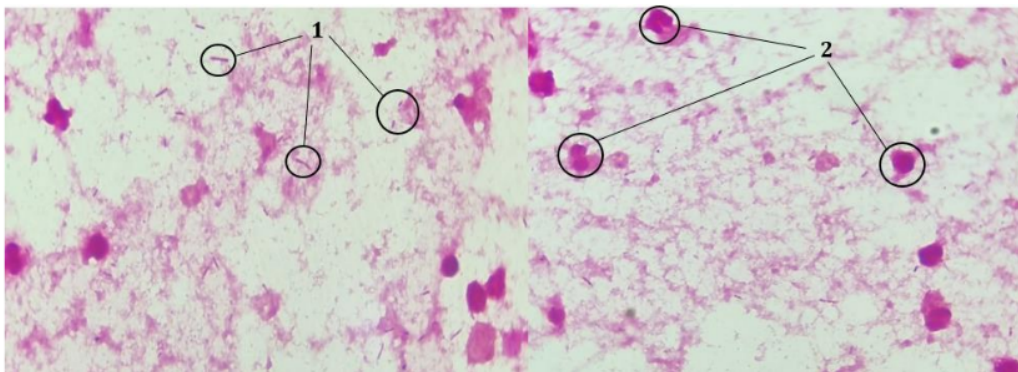
The biological assessment revealed a white blood cell count of 13,100/ μ l and a C-reactive protein of 16mg/l. Abdominal ultrasound showed a swollen aperistaltic and non-compressible appendix with an outer diameter measuring 8 mm associated with hyperechoic periappendiceal fat stranding and reactive lymphadenopathy.

The diagnosis made was acute non-perforated appendicitis. The patient subsequently underwent an appendectomy using the McBurney incision. Swabbing of the appendiceal base was performed, and the sample was sent to the microbiology laboratory of HMIMV.

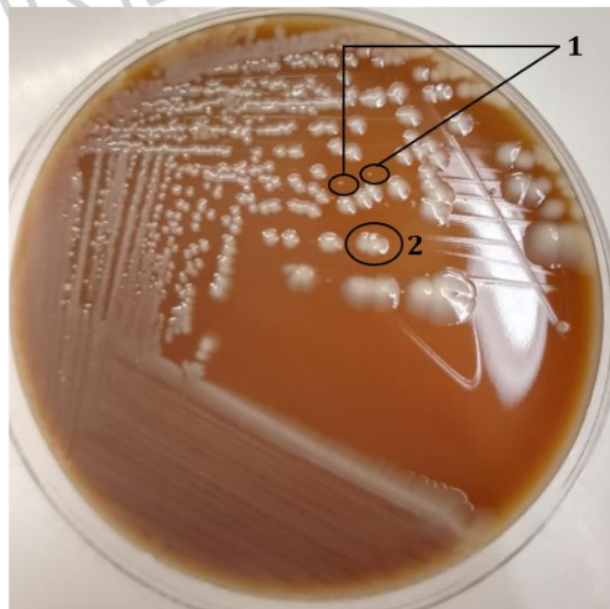
The sample was inoculated on blood agar and enriched chocolate agar, then incubated at 37°C in aerobic conditions with CO₂. A smear for Gram staining was performed, revealing a cellular

50 reaction composed of neutrophilic polymorphonuclear cells and numerous Gram-negative bacilli
51 (Figure 1). After 24 hours of incubation, the culture showed positive results with two types of
52 colonies of Gram-negative bacilli (Figure 2). Species identification was based on morphological
53 and biochemical characteristics using API® identification galleries. The results indicated
54 *Haemophilus influenzae* and *Enterobacter cloacae* with probabilities of 99,9% and 98,7%,
55 respectively. Antimicrobial susceptibility testing was performed using the agar diffusion
56 technique following the recommendations of the Antibiotic Susceptibility Committee of the
57 French Society of Microbiology (CA-SFM) and the European Committee on Antimicrobial
58 Susceptibility Testing (EUCAST) [5]. The antibiograms demonstrated that both *Haemophilus*
59 *influenzae* and *Enterobacter cloacae* were susceptible (wild).

60 The patient was hospitalized for 48 hours postoperatively and was prescribed Amoxicillin-
61 Clavulanic Acid 1g/8h. A positive clinical progress was observed, and the patient was discharged
62 from the hospital.



63 **Figure 1:** Gram negative bacilli (1) and neutrophilic polymorphonuclear cells (2) on a Gram-
64 stained smear
65



66 **Figure 2:** Colonies of *Haemophilus influenzae* (1) and *Enterobacter cloacae* (2) on enriched
67 chocolate agar
68

69 **Discussion:**

70 In 2019, the global prevalence of acute appendicitis was estimated at approximately 17.7 million
71 cases, equating to an incidence rate of 228 cases per 100,000 population. The associated mortality
72 reached a rate of 0.43 deaths per 100,000 population. The highest incidence occurred in the age
73 range of 15 to 19 [6]. Acute appendicitis has a male-to-female ratio of 1.4 [7].

74 The most common trigger for appendicitis is typically an obstruction within the appendiceal
75 lumen, often caused by an appendicolith or other mechanical factors like appendiceal tumors.
76 When the appendiceal lumen gets obstructed, bacteria accumulate, leading to acute inflammation
77 and, in some cases, perforation and the formation of abscesses.
78 In the initial stages of appendicitis, aerobic organisms tend to dominate, while as the condition
79 progresses, a combination of both aerobes and anaerobes becomes prevalent [1]. Acute
80 appendicitis is a polymicrobial infection [8]. The most frequently isolated bacteria in many
81 reported cases are gram-negative bacilli, specifically *Escherichia coli*, *Bacteroides fragilis* and
82 *Pseudomonas aeruginosa*. Additionally, gram-positive bacteria such as *Streptococcus spp.* and
83 *Clostridium perfringens* have also been found in the appendix [8,9].

84 *Haemophilus influenzae* is a small Gram negative-bacilli [3], commonly associated with
85 respiratory infections, but infrequently responsible for infections in other anatomical sites [10].

86 The involvement of *Haemophilus influenzae* in appendicitis has been documented in the
87 literature. In 1991, Astagneau et al. reported a case of appendicitis involving both *Haemophilus*
88 *influenzae* and *Streptococcus pneumoniae* in a 4-year-old child [11]. Furthermore, in 1996, another
89 noteworthy case involving an appendiceal mass attributed to *Haemophilus influenzae* was
90 documented in a 3-year-old child [10]. Shedding light on the prevalence of *Haemophilus spp.* in
91 appendicitis cases among children, Mégraud et al.'s study revealed the isolation of *Haemophilus*
92 *spp.* in 7.8% of operative specimens [12].

93 The pathophysiological mechanism underlying *Haemophilus influenzae*-induced appendicitis
94 remains elusive. Nevertheless, several hypotheses have been proposed to elucidate its migration
95 to the gastrointestinal tract. One plausible scenario involves a hematogenous route, particularly
96 following prior respiratory tract surgery [11], or an alternative pathway through the descent from
97 the oropharyngeal sphere to the digestive system [13].

98 **Conclusion:**

99 This case of acute appendicitis due to *Haemophilus influenzae* underscores the importance of
100 considering unconventional pathogens in appendicular pathology. Despite unclear
101 pathophysiological mechanisms, the case underscores the need for heightened clinical awareness
102 and comprehensive microbiological investigations. These findings contribute to refining
103 diagnostic approaches and highlight the evolving spectrum of infectious etiologies in appendicitis.

104 **Funding Statement:**

105 This research received no specific grant from any funding agency in the public, commercial, or
106 not-for-profit sectors.

107 **Author contributions:**

108 F.Z.A. contributed to the preliminary drafting of the manuscript, E.B., Y.B.L., L.L., F.B., A.M., M.C.
109 revised it, and M.E. conferred final approval for the version intended for publication.

110 **Conflicts of interest:**

111 The authors declare that there are no conflicts of interest.

112 **Consent to publish:**

113 The patient's father provided written informed consent for the publication of this report,
114 adhering to the patient policy of the journal.

115

116 **References:**

- 117 [1]. Jones MW, Lopez RA, Deppen JG. Appendicitis. [Updated 2023 Apr 24]. In: StatPearls
118 [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from:
119 <https://www.ncbi.nlm.nih.gov/books/NBK493193/>
- 120 [2]. Moris, Dimitrios, Erik Karl Paulson, and Theodore N. Pappas. "Diagnosis and management of
121 acute appendicitis in adults: a review." *Jama* 326.22 (2021): 2299-2311. DOI:
122 10.1001/jama.2021.20502
- 123 [3]. De la Maza, L. M., Pezzlo, M. T., Bittencourt, C. E., & Peterson, E. M. (2020). *Color atlas of medical*
124 *bacteriology*. John Wiley & Sons.
- 125 [4]. Mégraud, F., et al. "Haemophilus species in the human gastrointestinal tract." *European*
126 *Journal of Clinical Microbiology and Infectious Diseases* 7 (1988): 437-438. DOI:
127 10.1007/BF01962361
- 128 [5]. CA-SFM-EUCAST. *Recommandations. Comité de l'Antibiogramme-Société Française de*
129 *Microbiologie and European Committee on Antimicrobial Susceptibility Testing standards, V 1.0,*
130 *Mai; 2022.*
- 131 [6]. Wickramasinghe, Dakshitha P., Chrisjit Xavier, and Dharmabandhu N. Samarasekera. "The
132 worldwide epidemiology of acute appendicitis: an analysis of the global health data exchange
133 dataset." *World Journal of Surgery* 45 (2021): 1999-2008. DOI: 10.1007/s00268-021-06077-5
- 134 [7]. Krzyzak, Michael, and Stephen M. Mulrooney. "Acute appendicitis review: background,
135 epidemiology, diagnosis, and treatment." *Cureus* 12.6 (2020). DOI: 10.7759/cureus.8562
- 136 [8]. Abdurrazzaq, Abdusseme, et al. "Bacterial pattern in acute appendicitis." *Annals of African*
137 *Surgery* 15.1 (2018). DOI: 10.4314/aas.v15i1.3
- 138 [9]. Zachos, Konstantinos, et al. "Association of the Bacteria of the Vermiform Appendix and the
139 Peritoneal Cavity with Complicated Acute Appendicitis in Children." *Diagnostics* 13.11 (2023):
140 1839. DOI: <https://doi.org/10.3390/diagnostics13111839>
- 141 [10]. Cousin, G. C., and R. Burman. "Haemophilus influenzae and appendix mass." *The Journal of*
142 *infection* 34.2 (1997): 157-157. DOI: 10.1016/s0163-4453(97)92585-8
- 143 [11]. Astagneau, P., et al. "Appendicitis due to both Streptococcus pneumoniae and Haemophilus
144 influenzae." *European Journal of Clinical Microbiology and Infectious Diseases* 11 (1992): 559-
145 560. DOI: 10.1007/BF01960816
- 146 [12]. Mégraud, F., et al. "Haemophilus species in the human gastrointestinal tract." *European*
147 *Journal of Clinical Microbiology and Infectious Diseases* 7 (1988): 437-438. DOI:
148 10.1007/BF01962361
- 149 [13]. Christensen, J J et al. "Haemophilus isolated from unusual anatomical sites." *Scandinavian*
150 *journal of infectious diseases* vol. 22,4 (1990): 437-44. DOI: 10.3109/00365549009027075

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

CONFIDENTIAL

Figure (only used for published Version of Record)

[Click here to access/download](#)

Figure (only used for published Version of Record)

Figure 1.pptx

CONFIDENTIAL

Figure (only used for published Version of Record)

[Click here to access/download](#)

Figure (only used for published Version of Record)

Figure 2.pptx

CONFIDENTIAL

19%

SIMILARITY INDEX

PRIMARY SOURCES

1 Leila Laamara, Elmostafa Benaissa, Amine Achemlal, Amal Bounakhla et al. "Peritoneal Tuberculosis: An Underestimated Diagnosis", Microbiology Society, 2023 66 words — 5%

Crossref Posted Content

2 Loubna Yacoubi, Soumia Farih, Noussaiba Benhamza, Abderazzak Seddari, Adil maleb. "Health vigilance concerning Acinetobacter baumannii bacteremia at the mohammed VI university hospital of oujda (morocco): epidemiological profile and antibiotic resistance", E3S Web of Conferences, 2021 26 words — 2%

Crossref

3 Muqdad Fuad, Ahmed Modher, Mohammed Habash. "Is Routine Intra-operative Gram Stain, Culture, and Sensitivity during an Appendectomy is Effective in Decreasing the Rate of Post-operative Infective Complications?", Open Access Macedonian Journal of Medical Sciences, 2022 22 words — 2%

Crossref

4 "13th European Congress of Clinical Microbiology and Infectious Diseases", Clinical Microbiology and Infection, 2003 20 words — 2%

Crossref

5 SAMIA BAZHAR, Yassine ElBenaissi, Elmostafa Benaissa, Yassine Ben Lahlou, Mariama Chadli. "`<xhtml:span xmlns:xhtml="http://www.w3.org/1999/xhtml"`" 20 words — 2%

xml:lang="en">Invasive *Streptococcus pyogenes*
Infection: A case report </xhtml:span>", Microbiology
Society, 2024

Crossref Posted Content

6	worldwidescience.org Internet	17 words — 1%
7	www.pubfacts.com Internet	15 words — 1%
8	bmcneurol.biomedcentral.com Internet	14 words — 1%
9	academicworks.medicine.hofstra.edu Internet	10 words — 1%
10	akjournals.com Internet	10 words — 1%
11	link.springer.com Internet	10 words — 1%
12	Marwa AlTarayra, Khalil N.M. Abuzaina, Ammar W.M. Hassouneh, Osama Y.A. Aljabarein. "Spondylodiscitis following perforated acute appendicitis in a 14-year-old female: A case report", International Journal of Surgery Case Reports, 2023 Crossref	9 words — 1%
13	dadun.unav.edu Internet	8 words — 1%
14	ddd.uab.cat Internet	8 words — 1%

EXCLUDE QUOTES OFF

EXCLUDE BIBLIOGRAPHY ON

EXCLUDE SOURCES OFF

EXCLUDE MATCHES OFF