

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

journal homepage: [www.elsevier.com/locate/radcr](http://www.elsevier.com/locate/radcr)

## Case Report

# Radiological diagnosis of severe appendicitis in 4 months infant with possible microperforation: A rare case report <sup>☆,☆☆</sup>

Mohammad G. Ibdah<sup>a,\*</sup>, Omar Abu-Qare'e<sup>b</sup>, Firas Abdallah<sup>a</sup>,  
Leen Ibrahim Ahamd Masalmeh<sup>a</sup>, Nataly Joma<sup>a</sup>, Layth Al-Karaja<sup>a</sup>, Asala M. Awaysa<sup>a</sup>,  
Mohammad I. Smerat<sup>c</sup>

<sup>a</sup> Al-Quds University, College of Medicine, Palestine

<sup>b</sup> Misr University For Science And Technology, Giza, Egypt

<sup>c</sup> Radiology Department, Al-Ahli Hospital, West Bank, Palestine

### ARTICLE INFO

#### Article history:

Received 30 December 2023

Revised 25 April 2024

Accepted 1 May 2024

#### Keywords:

Case report

Acute appendicitis

Pediatric appendicitis

Ultrasonography

Microperforation

### ABSTRACT

Appendicitis is the most common cause of acute abdominal pain requiring surgical intervention; however, it is extremely rare in infants. Its diagnosis and treatment are challenging due to nonspecific clinical signs and symptoms. As a result, delayed or missed diagnosis is common in young children and is associated with an increased risk of perforation and peritonitis. We reported a case of a 4-month-old healthy male child. The patient presented with abdominal distention and fever. After ruling out other possible causes, he was diagnosed with acute appendicitis, which was confirmed by a CT scan. A gangrenous appendix, dilated bowel loops, and free fluid in the abdomen were discovered during surgery. An appendectomy was performed. The appendix in infants has an average length of 4.5 cm compared with 9.5 cm in adults. Infantile appendicitis is considered rare but cases have been documented also in neonates, misdiagnosis rates are high due to rarity in this age group in addition to nonspecific signs and symptoms, which led to a high perforation rate. Ultrasonography can diagnose appendicitis in children with a sensitivity and specificity of 90%–95% without subjecting the child to radiation. A physician should always keep the diagnosis of appendicitis in mind in the infant age group, even though it is rare, as a delay in diagnosis and treatment has been associated with an increased risk of complications including appendicular perforation and peritonitis.

© 2024 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

<sup>☆</sup> Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

<sup>☆☆</sup> Acknowledgments: The authors thank the patient and his family.

\* Corresponding author.

E-mail address: [mrirdah@gmail.com](mailto:mrirdah@gmail.com) (M.G. Ibdah).

<https://doi.org/10.1016/j.radcr.2024.05.008>

1930-0433/© 2024 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

## Introduction

The most frequent condition in children requiring urgent abdominal surgery is appendicitis [1]. The incidence of appendicitis has its peak in the teens and early 20s, becoming quite uncommon in children <6 months [2]. Even though the classic presentation of diffuse central abdominal pain followed by vomiting, localization of the pain to the right iliac fossa, and pyrexia affects up to one-third of children, these are typically older kids.

Diagnosis tends to be delayed, due to failure to consider this disease in the infant age group, as it is unusual to find right lower quadrant tenderness with peritonitis on physical examination [3]. Therefore, appendicitis in infancy is difficult to diagnose, and easily perforated with a high morbidity and mortality rate [4].

In this manuscript, we represent a very rare case worldwide of severe appendicitis with suspected micro-perforation, of a 4-month-old male patient presented with a fever of 4 days duration, distended abdomen, distended gangrenous appendix, dilated bowel loops, and free fluid in the abdomen. It was diagnosed using clinical findings and ultrasound imaging. In the end, it was successfully removed via appendectomy.

## Case presentation

A 4-month-old male patient was presented to the emergency department with fever measured as 39 C for 4 days duration, not in respiratory distress his respiratory rate was 35 bpm, regular heart rate. It is worth mentioning that the patient has a free past medical and surgical history, and has no history of vomiting, loss of consciousness, or convulsions. Later on, he developed abdominal distension and his abdomen was rigid on examination. Also, the patient looked ill and hypoactive on examination with no signs of respiratory distress.

A septic workup was done and the patient was initially diagnosed with meningitis as CSF analysis showed, and treated with antibiotics for meningitis for 7 days duration (ampicillin with gentamicin).

The patient's laboratory findings showed leukocytosis and moderate anemia as shown in Table 1, cerebrospinal fluid analysis showed bacterial meningitis as showed in Table 2. The patient has also done an abdominal ultrasound which showed a distended appendix, 8 mm, with surrounding fat stranding as shown in Fig. 1. CT scan with contrast was done which showed a mural enhanced sub-hepatic inflamed appendix with inflamed mesenteric fats and surrounding fluid as demonstrated in Fig. 2.

Consequently, he was referred to the surgical team and was taken to the operating room where a right upper transverse incision was done, dilated bowel loops and free abdominal fluid were found, the appendix was gangrenous, the base of the appendix was crushed and double ligation was done, and closure by layer was carried out. The post-operative course was uneventful with no post-operative complications, then patient discharged home well.

**Table 1 – Laboratory tests findings and relevant normal values.**

	Finding	Normal value
White blood cell count	15.8	6-14
Neutrophil	56%	54%-62%
Platelets	250	150-450
Hemoglobin	9.6	10.5-14

**Table 2 – CSF analysis.**

	Finding	Normal value
appearance	turbid	clear
WBC	1200	Less than 8
glucose	40	50-80
protein	210	15-45

## Discussion

The appendix is a thin, long diverticulum that arises from the lower end of the cecum. The appendix in infants has an average length of 4.5 cm compared with 9.5 cm in adults. It is funnel-shaped in infants and young children, which helps to limit its tendency to swell. At the age of 1 to 2 years, the appendix has a normal cone shape, similar to that in adults [5].

Even though infantile appendicitis is rare, instances in infants and neonates have been documented [6].

In pediatric-centered single research conducted over 28 years, appendicitis was diagnosed in 0.34 percent of infants under one year old and 2.33 percent of patients under three. In a cohort of Danish children, Andersen et al. observed a yearly incidence of 2.22/10,000 for males under the age of 4 and 1.82/10,000 for girls under the age of 4, with perforation rates of 0.64 and 0.62, respectively [1].

The overall misdiagnosis rates in children 3 years or less range from 70% to 100%. This is due to nonspecific signs and symptoms as well as the rarity of this condition in infancy. Misdiagnosis rates in young infants range from 19% to 57%, in school-aged children from 12% to 28%, and in teenagers from up to 15%. Misdiagnosis rates for acute appendicitis are significant despite the wide range of diagnostic techniques employed, such as CT scans, ultrasounds, and other radiographic tests [7].

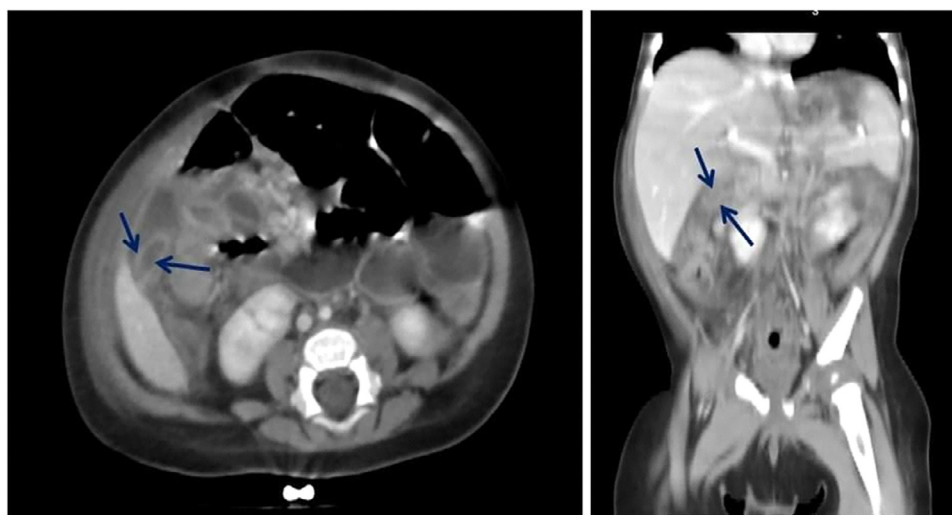
Delay in diagnosis in infants leads to a high perforation rate, ranging from 37% to 94% [8].

The presenting nonspecific symptoms contribute the most to missed diagnoses in neonates. The most common signs and symptoms are vomiting, diarrhea, and abdominal pain. Other less common features include feeding refusal, fever, abdominal distention, malaise, cough or rhinitis, and grunting breathing. Malaise, gasping, and diarrhea may be present in younger infants, making appendicitis difficult to distinguish from a primary respiratory disease process, intussusception, or gastroenteritis; those are the most common diagnoses in this age group [2,8].

In our case, the infant first presented to the hospital with nonspecific symptoms and signs. He appeared ill, hypoactive,



**Fig. 1 – Axial section of the distal appendix shows inflamed sub-hepatic appendix (Blue arrow) with surrounding inflamed fats.**



**Fig. 2 – Post contrast –(A) Axial and-(B) Coronal images show mural enhanced sub hepatic inflamed appendix (Blue arrow), with surrounding fluid and inflamed mesenteric fats.**

and had a fever of 4 days duration. He was primarily diagnosed with Meningitis and was prescribed antibiotics.

Appendicitis is classified as complicated when there is evidence of a perforated or gangrenous appendix, an intra-abdominal abscess, or fecal peritonitis often resulting in a longer length of stay and greater rates of morbidity and mortality [9].

Urinalysis, a complete blood count, and a full metabolic panel are frequently requested laboratory tests, particularly when the cause of the abdominal pain is unknown and the use of clinical scoring system/ Alvarado score is being explored. WBC count only has a small amount of prognostic value. A 79% overall sensitivity and 80% overall specificity were found in an observational survey of 772 individuals between the ages of 1 and 19 who presented with abdominal discomfort and had an increased WBC count or an absolute neutrophil count >80%. With small, observational studies reporting that when both C-reactive protein and white blood cells

are elevated, specificity for appendicitis is about 90%, although sensitivity is still low at about 40%, C-reactive protein also has limited predictive value in confirming the diagnosis of appendicitis.

Numerous studies have examined the role of abdominal imaging in appendicitis, and it has been found that if the appendix can be seen clearly by a radiologist, ultrasonography can diagnose appendicitis in children with a sensitivity and specificity of 90%-95% without subjecting the child to radiation. However, this percentage may vary depending on the operator. Many individuals may have normal early imaging findings. A radiologist's failure to see the appendix does not rule out appendicitis, and repeated ultrasound tests make the diagnosis more likely. Less than 10% of patients have an appendiceal fecalith, which indicates the diagnosis of appendicitis. Our patient was diagnosed with an abdominal ultrasound which showed a distended appendix of 8 mm, with fatty stranding around it [2].

---

## Conclusion

In conclusion, our case highlights the importance of raising the index of suspicion toward acute appendicitis in infants. Although it is regarded as a rare condition and is challenging to diagnose due to nonspecific clinical signs and symptoms, delays in diagnosis and treatment have been associated with an increased risk of complications including appendicular perforation and peritonitis [10]. So, including it in the differential diagnosis of abdominal distention in the newborn allows for early and appropriate management, leading to a better prognosis.

---

## Ethical approval

Informed consent was signed by the patient's parents for publication.

---

## Authors' contributions

Study concept or design: Mohammad Ibdah.

Writing the manuscript: Mohammad G. Ibdah, Omar Abu-Qare'e, Firas Abdallah, Leen Ibrahim Ahamd Masalmeh Nataly Joma, Layth al\_karaja, Asala M Awaysa.

Review and editing the manuscript: Mohammad G. Ibdah, Mohammad I. Smerat.

---

## Provenance and peer review

Not commissioned, externally peer-reviewed.

---

## Patient consent

A written informed consent was obtained from the patient's parents for publication of this case report (Radiological Diag-

nosis of Severe Appendicitis in 4 Months Infant With Possible Microperforation: A Rare Case Report) and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

---

## REFERENCES

- [1] Alloo J, Gerstle T, Shilyansky J, Ein SH. Appendicitis in children less than 3 years of age: a 28-year review. *Pediatr Surg Int* 2004;19(12):777–9 Epub January 16, 2004. doi:10.1007/s00383-002-0775-6.
- [2] Goldberg LC, Prior J, Woolridge D. Appendicitis in the infant population: a case report and review of a four-month old with appendicitis. *J Emerg Med* 2016;50(5):765–8 Epub February 15, 2016. doi:10.1016/j.jemermed.2016.01.021.
- [3] Perger L, Muensterer OJ. Laparoscopic appendectomy for torsed appendix presenting as an acute abdomen in an infant female. *JSL* 2011;15(4):565–7. doi:10.4293/108680811x13176785204634.
- [4] Lin YL, Lee CH. Appendicitis in infancy. *Pediatr Surg Int* 2003;19(1-2):1–3 Epub November 14, 2002. doi:10.1007/s00383-002-0898-9.
- [5] Rothrock SG, Pagane J. Acute appendicitis in children: emergency department diagnosis and management. *Ann Emerg Med* 2000;36(1):39–51 ISSN 0196-0644. doi:10.1067/mem.2000.105658.
- [6] Howell EC, Dubina ED, Lee SL. Perforation risk in pediatric appendicitis: assessment and management. *Pediatric Health Med Ther* 2018;9:135–45. doi:10.2147/PHMT.S155302.
- [7] Kwan Karen Y, Nager Alan L. Diagnosing pediatric appendicitis: usefulness of laboratory markers. *Am J Emerg Med* 2010;28(9):1009–15 ISSN 0735-6757. doi:10.1016/j.ajem.2009.06.004.
- [8] Koehler RL, Phillips R, Diaz-Miron J. Acute appendicitis and rotavirus infection in an infant. *J Pediatr Surg Case Rep* 2020;57:101453 ISSN 22135766. doi:10.1016/j.epsc.2020.101453.
- [9] Pham X-BD, Sullins VF, Kim DY, Range B, Kaji AH, Virgilio CM, et al. Factors predictive of complicated appendicitis in children. *J Surg Res* 2016;206(1):62–6 ISSN 00224804. doi:10.1016/j.jss.2016.07.023.
- [10] Rothrock SG, Pagane J. Acute appendicitis in children: emergency department diagnosis and management. *Ann Emerg Med* 2000;36(1):39–51 PMID:10874234. doi:10.1067/mem.2000.105658.