



Case report

A rare case of appendiceal tip complete attachment to a sigmoid diverticulum: An appendiceal phlegmon case report[☆]Farzad Vaghef Davari^a, Arezou Hashem Zadeh^{b,*}^a Surgery Fellowship of Surgical Oncology, Tehran University of Medical Sciences, Iran^b Student's Scientific Research Center, Tehran University of Medical Sciences, Tehran, Iran

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ABSTRACT

Introduction: Appendiceal phlegmon is defined as an inflammatory mass, consisting of the inflamed appendix, enclosed by adjacent viscera and the greater omentum in 2 % to 10 % of patients with acute appendicitis.

Case presentation: A 24-year-old female presented to the hospital with chief complaints of fever, nausea, vomiting, and pain over the right lower quadrant of the abdomen for two days. In the local examination, tenderness and rebound tenderness were detected. Ultrasonography and abdominal CT scan indicated appendiceal phlegmon. After seven weeks of receiving a course of antibiotics with complete resolution of her symptoms, she underwent elective laparoscopic appendectomy. During surgery, the appendiceal tip was completely attached and fused to a sigmoid diverticulum, which has not been reported elsewhere. The appendix was completely removed, and the patient was discharged from the hospital in a good general condition after two days.

Discussion: Acute appendicitis can cause serious complications, such as ruptured appendix, abscess, or phlegmon. In most cases, inflammation and infection resolve by antibiotic administration. In some cases perforation of the inflamed appendix and local abscess or diffuse peritonitis formation, which requires immediate percutaneous drainage or surgery as indicated. Theoretically, the inflamed appendix can cause adhesive damage to the adjacent organs; however, there is no particular report on this type of damage.

Conclusion: This rare case suggests that during phlegmon formation and related inflammation, other complications such as fistula formation, are theoretically expected.

1. Introduction

Acute appendicitis, with an incidence rate of 7–8 %, is still considered as one of the most common causes of acute abdomen, mostly in the second decade of life [1–3]. It can be divided into two major categories of complicated and uncomplicated. Complicated appendicitis is often defined as peritonitis, localized abscess, or appendiceal phlegmon [2,4]. Phlegmon describes an inflammatory mass, containing the inflamed appendix, enclosed by the adjacent viscera and the greater omentum [5,6]. It is mainly diagnosed by ultrasound (US) and computed topography (CT); however, evidence suggests that CT scan has a higher diagnostic accuracy [7,8].

So far, definitive diagnosis has been established by surgical exploration of the abdomen [6,9]. The treatment of choice for these patients is still controversial [10]. Although immediate surgical management is

considered to be an efficient approach for acute appendicitis, in case of appendiceal phlegmon, inflamed tissues and distorted anatomy of adjacent structures may increase the difficulty of separating the inflamed appendix from the adjacent tissue and closing the appendiceal stump [5,11,12]. Moreover, non-surgical management, followed by elective appendectomy, is still the traditional management, with a relatively low risk of recurrence following surgery [13,14].

Here, we present a case of appendiceal phlegmon in a 24-year-old female with no history of colon disease, who was managed with interval appendectomy.

2. Case presentation

A 24-year-old female presented to the hospital with chief complaints of pain over the right lower quadrant (RLQ) of the abdomen for two

[☆] The authors declare that they had full access to all of the data in this study and the authors take complete responsibility for the integrity of the data and the accuracy of the data analysis.

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days. She experienced vomiting, nausea, anorexia, and low-grade fever. She reported no urinary tract symptoms or diarrhea, and did not pass motion for the last two days. She also had no history of irregular or delayed menstruation, no family history of any colon disease, no history of psychosocial disorder and was not taking any medications. In her first admission to the hospital, on initial physical examination, tenderness was also observed without a suspicious mass in the RLQ of the abdomen. Her vital signs were within normal. Her body mass index (BMI) was 22.6. Other examinations were not significant. Laboratory tests showed leukocytosis of 11,500 with 82.8 % neutrophils and CRP 15 mg/L. The beta-human chorionic gonadotropin (β HCG) test was also negative, and the result of urinary analysis was within the normal range. She underwent an abdominal ultrasonographic evaluation, which revealed no abnormalities. Following pain relief and stable vital signs, she was discharged from the hospital.

The morning after in the patient's second hospitalization, her symptoms had deteriorated. She had stable vital signs, except for a temperature of 39.4 °C. In the physical examination, tenderness and suspicious rebound tenderness over the RLQ of the abdomen were detected. The repeated laboratory test showed leukocytosis of 12,200 ($\times 10^9/L$) with 86.4 % neutrophils, while other tests showed no significant change compared to the previous day. Abdominal ultrasonography showed features in accordance with acute appendicitis and phlegmon, besides normal ovaries and uterus. Abdominal CT scans with IV and oral contrast agents also confirmed the US findings and indicated peri-appendiceal fat stranding, wall thickening, accumulation of neighboring bowel loops, and small collection of free fluid without abscess, consistent with appendiceal phlegmon (Fig. 1).

The patient was referred to the surgical ward with a diagnosis of acute appendicitis for further management. She was placed on nil per os (NPO). Fluid resuscitation and antibiotics were then administered, and the patient became hemodynamically stable. Ceftriaxone and metronidazole were used as the primary antibiotics; however, the patient showed cephalosporin allergy, and it was replaced with imipenem. During hospitalization, the patient experienced non-bloody and watery diarrhea, which resolved spontaneously. The stool analysis showed no white cells or blood cells. Fever and leukocytosis resolved after the onset of antibiotic treatment within two days. The patient's vital signs became stable, and she was discharged after six days following the complete resolution of fever, leukocytosis, abdominal pain, and tenderness; she was advised a regular diet. She underwent elective laparoscopic appendectomy after seven weeks.

3. Surgical technique

The study has been reported in line with the SCARE 2020 criteria [15]. Written informed consent was obtained from the patient for publication of this 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. The procedure was performed by a board-certified general surgeon. During the procedure, she received general anesthesia. The laparoscopic appendectomy technique using a 5 mm, a 10 mm and a 12 mm trocar as camera port and working ports were used.

First, the cecum was explored, and any surrounding adhesions were released. Next, the appendix was explored. The appendiceal base was clearly identified at the tip of the cecum over the medial side and at the taeniae coli converge. The appendiceal tip was deviated to the left and was completely attached and fused to the sigmoid. After more careful exploration we noticed the tip of the appendix appeared to be fully attached to a sigmoid diverticulum (Fig. 2). As it was not feasible to separate the appendix from the sigmoid, the basal part of the sigmoid diverticulum was stapled and cut using a linear-cutter stapler (Edo Tri-Staple) (Fig. 3). The mesoappendix vessels were ligated and cut with Hem-o-Lok clips. The appendiceal base was also double-clipped and cut using plastic Hem-o-Lok clips. The appendix was completely removed through the 12-mm trocar.

The patient was monitored overnight, and her vital signs were found to be stable. Simple fluids were initiated one day after the procedure. The patient was satisfied with the result and was discharged from the hospital in a good general condition after two days. The patient was advised to try to walk short distance each day, avoid lifting and straining for two weeks and avoid strenuous activities. No further symptoms were reported by the patient in the subsequent visits. The pathology report of the removed appendix indicated acute appendicitis.

4. Discussion

Acute appendicitis is one of the most common causes of lower abdominal pain and the most common cause of acute abdomen in young individuals [1]. It can cause serious complications, such as ruptured appendix, abscess, or phlegmon [10]. A ruptured appendix is associated with generalized peritonitis, localized abscess, higher morbidity and mortality rates, and increased in-hospital stay [16]. In the first 12 h after the emergence of acute appendicitis symptoms, the risk of perforation is scarce and often negligible; however, over time, it shows an increasing



Fig. 1. Axial abdominal IV and oral contrast computed tomography view of the Phlegmon.

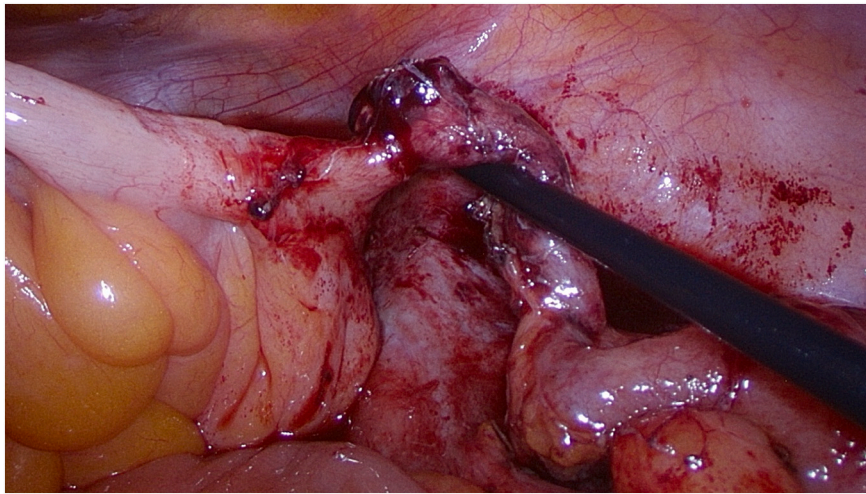


Fig. 2. Intraoperative view showing the appendiceal base at the tip of the cecum and appendiceal tip attached to a sigmoid diverticulum.

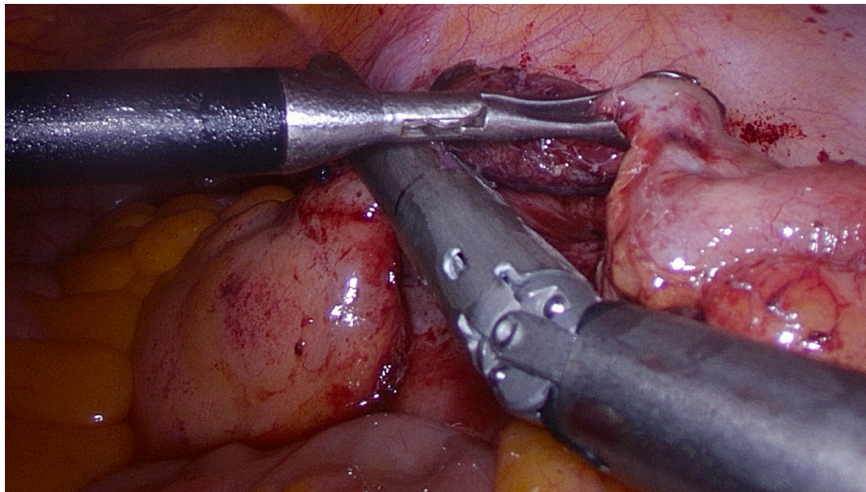


Fig. 3. Dividing the appendiceal tip with a linear-cutting endo-stapler.

trend [17]. Moreover, early risk of perforation within the first 36 h from the onset of symptoms was slightly higher in male patients [18]. Phlegmon is defined as an inflammatory mass, containing the inflamed appendix, enclosed by the adjacent viscera and the greater omentum, which can occur in 2 % to 10 % of acute appendicitis cases [5,6]. The diagnosis of phlegmon must be suspected in patients with symptoms for more than three days and a palpable mass, especially in children younger than five years (nearly 8.8 %) [9,13]. In patients with delayed presentation of appendiceal phlegmon, children, and the elderly, higher morbidity rates have been reported [19].

There is an ongoing debate regarding the importance of preoperative imaging in the diagnosis of acute appendicitis. However, with advances in CT and US technologies, studies have reported the higher diagnostic accuracy and significant benefits of preoperative CT in excluding other pathologies, especially in the presence of an appendiceal mass or abscess [7,8,20]. Although ultrasonography has lower sensitivity, especially in the presence of perforation, it needs to be still considered as the imaging modality of choice in children [9,20].

Appendiceal malignancies represent up to 1 % of all large intestinal malignancies, with an elevated incidence rate up to 12 % in recent years [21]. Although it is relatively rare, acute appendicitis is the primary presentation in more than 50 % of all appendiceal malignancies [22].

Immediate surgical management is considered to be an efficient

management approach for acute appendicitis. However, in the presence of appendiceal phlegmon, inflamed tissues and distorted anatomy of adjacent structures increase the difficulty of accessing and closing the appendiceal stump [5,11,12].

Emergency appendectomy is associated with a mortality rate of 0.5–2.4 % and 0.07–0.7 % in cases with and without perforation, respectively [12]. Compared to non-surgical management, immediate appendectomy for patients with phlegmon seems to be associated with more than a three-fold increase in morbidity [5]. In a recent review study, immediate appendectomy was also associated with unnecessary ileocecal resection or right-sided hemicolectomy for suspicion of malignancy or technical reasons in 3 % of cases [5].

Non-surgical treatment is the traditional approach, which can be followed by interval appendectomy to minimize the risk of recurrence [5,23]. Particular attention has been paid to the significance and necessity of interval appendectomy in recent studies. As evidence suggests, interval appendectomy has lost its importance, as the risk of recurrence has been reported to be relatively small in cases with successful non-surgical treatment [5,24]. Recurrence after a successful non-surgical treatment is defined as an attack with a milder course compared to the primary one, and the risk of recurrence is estimated to be less than 10 % [5,25].

In the interval between the diagnosis of phlegmon and

appendectomy, some scenarios are expected. In most cases, inflammation and infection resolve by antibiotic administration. Another possibility is perforation of the inflamed appendix and local abscess or diffuse peritonitis formation, which requires immediate percutaneous drainage or surgery as indicated. Theoretically, the inflamed appendix can cause adhesive damage to the adjacent organs; however, there is no particular report on this type of damage.

In the present case, management of phlegmon was successful; however, in the final surgery, an unexpected complication was found, which had been caused by prolonged local inflammation. Also two simultaneous pathology assumption is unlikely, but there may be a sigmoid diverticulitis that had attract the appendiceal tip toward itself and made the observed fusion.

5. Conclusion

We found no report on this type of complication. Nevertheless, we assume that it may be associated with other problems, such as enter-enteric, entero-vaginal, and entero-vesical fistulas in the inflammation phase of phlegmon, especially when there is also inflammation in the second adjacent organ. To the best of our knowledge, this is the first report of this complication; nevertheless, further studies are warranted to investigate the abovementioned concepts and long-term complications.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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Ethical approval

Written informed consent was obtained from the patient prior to the procedure. Tehran university of medical sciences hospital ethical board committee has approved the present study and, it was performed in compliance with the 1996 Health Insurance Portability and Accountability Act (HIPAA).

Informed consent

The patient filled the written consent form for his information to be published in the International journal of surgery case reports.

Author contribution

FD was major contributor in study design, definition of intellectual content, clinical studies, manuscript preparation, data acquisition, manuscript editing and review. AH was major contributor in literature search, data and statistical analysis, design, data acquisition, manuscript preparation editing and review.

Research registration

Was not added due to no new surgical technique or new equipment/technology.

Guarantor

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References

- [1] G. Cervellin, R. Mora, A. Ticinesi, T. Meschi, I. Comelli, F. Catena, et al., Epidemiology and outcomes of acute abdominal pain in a large urban emergency department: retrospective analysis of 5,340 cases, *Ann. Transl. Med.* 4 (19) (2016) 362.
- [2] I. Ilves, A. Fagerström, K.H. Herzig, P. Juvonen, P. Miettinen, H. Paajanen, Seasonal variations of acute appendicitis and nonspecific abdominal pain in Finland, *World J. Gastroenterol.* 20 (14) (2014) 4037–4042.
- [3] A. Viniol, C. Keunecke, T. Biroga, R. Stadje, K. Dornieden, S. Bösner, et al., Studies of the symptom abdominal pain—a systematic review and meta-analysis, *Fam. Pract.* 31 (5) (2014) 517–529.
- [4] D.R. Flum, Clinical practice. Acute appendicitis—appendectomy or the "antibiotics first" strategy, *N. Engl. J. Med.* 372 (20) (2015) 1937–1943.
- [5] R.E. Andersson, M.G. Petzold, Nonsurgical treatment of appendiceal abscess or phlegmon: a systematic review and meta-analysis, *Ann. Surg.* 246 (5) (2007) 741–748.
- [6] G.J. Fitzmaurice, B. McWilliams, H. Hurreiz, E. Epanomeritakis, Antibiotics versus appendectomy in the management of acute appendicitis: a review of the current evidence, *Can. J. Surg.* 54 (5) (2011) 307–314.
- [7] S. Musunuru, H. Chen, L.F. Rikkers, S.M. Weber, Computed tomography in the diagnosis of acute appendicitis: definitive or detrimental? *J. Gastrointest. Surg.* 11 (11) (2007) 1417–1421, discussion 21–2.
- [8] S. Sippola, J. Virtanen, V. Tammilehto, J. Grönroos, S. Hurme, H. Niiniviita, et al., The accuracy of low-dose computed tomography protocol in patients with suspected acute appendicitis: the OPTICAP study, *Ann. Surg.* 271 (2) (2020) 332–338.
- [9] J. Tannoury, B. Abboud, Treatment options of inflammatory appendiceal masses in adults, *World J. Gastroenterol.* 19 (25) (2013) 3942–3950.
- [10] I. Ahmed, D. Deakin, S.L. Parsons, Appendix mass: do we know how to treat it? *Ann. R. Coll. Surg. Engl.* 87 (3) (2005) 191–195.
- [11] M. Samuel, G. Hosie, K. Holmes, Prospective evaluation of nonsurgical versus surgical management of appendiceal mass, *J. Pediatr. Surg.* 37 (6) (2002) 882–886.
- [12] L. Ansaloni, F. Catena, F. Coccolini, G. Ercolani, F. Gazzotti, E. Pasqualini, et al., Surgery versus conservative antibiotic treatment in acute appendicitis: a systematic review and meta-analysis of randomized controlled trials, *Dig. Surg.* 28 (3) (2011) 210–221.
- [13] D. Oliak, D. Yamini, V.M. Udani, R.J. Lewis, T. Arnell, H. Vargas, et al., Initial nonoperative management for periappendiceal abscess, *Dis. Colon Rectum* 44 (7) (2001) 936–941.
- [14] D. Oliak, D. Yamini, V.M. Udani, R.J. Lewis, H. Vargas, T. Arnell, et al., Nonoperative management of perforated appendicitis without periappendiceal mass, *Am. J. Surg.* 179 (3) (2000) 177–181.
- [15] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, *Int. J. Surg.* 84 (2020) 226–230.
- [16] S. Sirikurnpiboon, S. Amornpornchareon, Factors associated with perforated appendicitis in elderly patients in a tertiary care hospital, *Surg Res Pract.* 2015 (2015), 847681.
- [17] T. Augustin, B. Gagir, T.J. Vandermeer, Characteristics of perforated appendicitis: effect of delay is confounded by age and gender, *J. Gastrointest. Surg.* 15 (7) (2011) 1223–1231.
- [18] B. Papazios, P. Tsiaousis, I. Koutelidakis, A. Giakoustidis, S. Atmatzidis, K. Atmatzidis, Effect of time on risk of perforation in acute appendicitis, *Acta Chir. Belg.* 109 (1) (2009) 75–80.
- [19] Y. Cheng, X. Xiong, J. Lu, S. Wu, R. Zhou, N. Cheng, Early versus delayed appendectomy for appendiceal phlegmon or abscess, *Cochrane Database Syst. Rev.* 6 (6) (2017), Cd011670.
- [20] N.A. Parks, T.J. Schroepel, Update on imaging for acute appendicitis, *Surg. Clin. North Am.* 91 (1) (2011) 141–154.
- [21] J. Misdrjaji, Appendiceal mucinous neoplasms: controversial issues, *Arch. Pathol. Lab. Med.* 134 (6) (2010) 864–870.
- [22] F.J.R. Teixeira Jr., S.D.D. Couto Netto, E.H. Akaishi, E.M. Utiyama, C.A. M. Menegozzo, M.C. Rocha, Acute appendicitis, inflammatory appendiceal mass and the risk of a hidden malignant tumor: a systematic review of the literature, *World J. Emerg. Surg.* 12 (2017) 12.
- [23] P.J. Willemsen, L.E. Hoorntje, E.H. Eddes, R.J. Ploeg, The need for interval appendectomy after resolution of an appendiceal mass questioned, *Dig. Surg.* 19 (3) (2002) 216–220, discussion 21.
- [24] B. Tingstedt, E. Bex-Lindskog, M. Ekelund, R. Andersson, Management of appendiceal masses, *Eur. J. Surg.* 168 (11) (2002) 579–582.
- [25] S.A. Adalla, Appendiceal mass: interval appendectomy should not be the rule, *Br. J. Clin. Pract.* 50 (3) (1996) 168–169.