



## Appendix Diverticula - A Serious Diagnosis: Case Report and Literature Review

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### Abstract

This is a case report of a 59-year old gentleman presenting to the surgical emergency unit with symptoms and signs suggestive of acute appendicitis. An ultrasound scan revealed a mixed echogenic area measuring 5 cm × 2 cm within the right iliac fossa. At laparoscopic appendicectomy the appendix was enclosed in a matt of small bowel and omentum. Histology revealed Appendix Diverticulitis (AD). Postoperative recovery was uneventful and the patient discharged 4 days later. The association between AD and appendix neoplasm is strong. Colonoscopy is recommended in such patients if such a lesion is not found in the appendix remnant.

### Introduction

Appendix diverticula is uncommon and a strong marker for appendiceal neoplasm. Signs and symptoms are unlikely to be different from appendicitis and the diagnosis is usually made on histological analysis rather than at surgery. There is a greater incidence of perforation with appendix diverticula. We describe a case of appendix diverticula in a 54-year old gentleman. It highlights the difficulty in making the diagnosis and is in keeping with the literature which suggests a higher rate of perforation than in an appendix without AD. A literature review discusses the association between appendix diverticula and neoplasm. Recommendations regarding follow-up investigations are made.

### Case Presentation

A 54 year old gentleman presented to the Surgical Emergency Unit (SEU) with a 3 day history of cramping peri-umbilical abdominal pain worse with movement and coughing. It radiated to the right iliac fossa and the patient nauseated having lost his appetite. Over the last 2 days he had noticed loose stools without blood, mucous or melaena. He had no urinary symptoms to indicate a urinary tract infection. Past medical history comprised Chronic Obstructive Pulmonary Disease (COPD) for which he was taking Salbutamol and Duaklir inhalers. He had not undergone previous surgery.

On examination he had a temperature of 37.3°C, pulse 94 beats per minute and blood pressure 118/76. The abdomen was tender with guarding and rebound in the right iliac fossa. Admission leucocyte and neutrophil counts and C-reactive protein were 12.0, 10.0 × 10<sup>9</sup>/l and 325 mg/l respectively. Amylase was 25 U/l. An abdominal ultrasound revealed a mixed echogenic area measuring 5 cm × 2 cm within the right iliac fossa raising the possibility of a collection. Intravenous Amoxicillin, Gentamicin and Metronidazole were commenced. At diagnostic laparoscopy small bowel and omentum were adherent to a pus-filled inflamed appendix. A standard laparoscopic appendicectomy was performed and patient discharged 4 days later. Postoperative recovery was uneventful. Histological analysis revealed a perforated acutely inflamed diverticulum at the appendix tip (Figure 1). Malignancy or parasites were not found in the removed appendix.

### Discussion

Appendicular diverticulum (AD) is uncommon with a reported incidence of 0.004% to 2.1% and 0.2% to 1.89% in autopsy specimens [1,2]. It is an entity that is not indolent for it can be associated with significant pathology such as neoplasm, perforation and gastrointestinal bleeding. It is often regarded as pseudo-diverticula with pathogenesis explained by the muscular contraction hypothesis. Increased luminal pressure pushes mucosa through a weakening (at a point where blood vessels penetrate) in the mesenteric side of the appendix wall or by traction from an adhesion [2]. Edwards showed that most appendicular diverticula are around the appendiceal circumference at the meso-appendiceal border. The average age of patients in his study was 42 years (Edwards 1934 in) [3]. In 30 specimens, 59% came from males and the most frequent appendix pathology was acute

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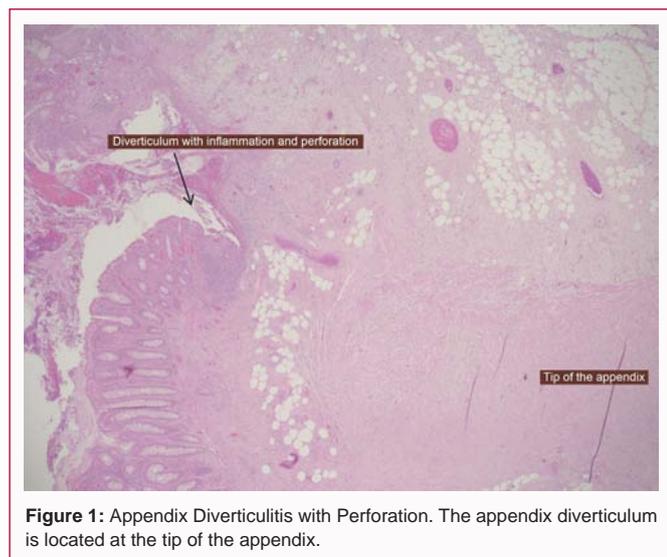
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**Figure 1:** Appendix Diverticulitis with Perforation. The appendix diverticulum is located at the tip of the appendix.

(13.32%), chronic (19.98%) and obliterative (19.98%) appendicitis [3]. Perforation is more likely with risk around 27% compared to 6.6 % for appendicitis [4,5]. In Collins' study perforation was seen in approximately 17% of appendiceal diverticula specimens [3]. His assessment of the literature revealed similarities in that appendiceal perforation was seen in 28.3% and acute appendicitis in 59.9%. The same literature review identified the average age for males to be 31.1 years, about 30 years younger than our patient. There was consistency within the literature review for the location (28.3 at the tip) and number of diverticula (59.9% for one): the tip and one respectively in our patient [3]. AD may be associated with an increased risk of appendix neoplasm with one study reporting a 10-fold risk in comparison to patients without this abnormality. Neoplasm included adenoma, carcinoid, lymphoma, carcinoma, mucinous neoplasm and neurofibroma in patients with Neurofibromatosis type I the mean age of this cohort (n=2711) was 34 years and AD was found in 57 patients (2.1%) [6,7]. AD has also been described as a potential indicator for Primary Appendiceal Adenocarcinoma (0.5% of all gastrointestinal malignancies) [8], carcinoid and Low Grade Mucinous Neoplasm (LGMN) with perforation possibly resulting in Pseudomyxoma peritonei [9]. A study looking at the association/link between AD and LGMN identified 38 LGMN and 96 AD in 1922 appendix specimens between 2011 and 2015. The mean age of the cohort was 51 years. After having set criteria for LGMN and AD the authors categorized specimens into LGMN, LGMN with AD and AD only. Non-parametric statistics were used for significance analysis. LGMN was found in 1% of the specimens indicating its relative rarity and equal in sex distribution (51% males, 49% females). Appendix diverticula were more common in males (63%) and exhibited an incidence 2 to 4 times (4.8 %) that of other studies mentioned. When the two were compared AD was seen in 23 out of the 38 identified LGMN specimens (61%) and in only 96 out of 1902 appendices without LGMN (5%). It suggested a significant association between the presence of an AD and LGMN (P=0.000). The presence of an AD had no significant bearing on the site of the tumour-pan, distal or middle. Further in patients with a LGMN, the AD was more likely to be located distally than anywhere else [10]. A postoperative colonoscopy may be important to ensure lesions located more proximal to the resection margin or appendix orifice are not missed. Acute lower Gastrointestinal (GI) tract bleeding can also result from an AD but the pathogenesis is unclear [5]. It should

be considered in the differential diagnosis of GI bleed particularly in the young age group. Treatment in the form of appendicectomy will produce a good outcome.

A CT diagnosis can be made with authors highlighting the following features peri-appendiceal loculated fluid and/or fat stranding [11], fluid-filled structures with contrast enhanced walls or solid enhanced masses protruding from the appendix [12]. In our patient, ultrasound had revealed a mixed echogenic area in the right iliac fossa representative of peri-appendiceal loculated fluid. Ultrasound can help in the diagnosis of AD in 33% of cases but it is likely to be linked with clinicians who have a high index of suspicion based upon past experience an assessment of clinical symptoms and a sign between AD and appendicitis reveals no distinct differences [13]. AD is frequent in the older age group and men are older than their counterparts with acute appendicitis. In one study over 3 years, AD was found in 12 cases and acute appendicitis in 378. Mean age was  $42.7 \pm 15.4$  vs.  $29.1 \pm 17.7$  (P=0.009) and in men  $57 \pm 18.02$  vs.  $33.33$  years  $\pm 15.89$  years, P<0.001 [13,14]. There may be a degree of selection bias as 54 out of 4300 patients with acute appendicitis were selected for comparison to 27 cases of AD over 12 years. Patients with AD are less likely to have a leucocytosis and C-Reactive Protein can be lower or higher than acute appendicitis [13,14]. It is not possible to know if like-for-like severity was being compared in these studies. Some studies have shown no difference in the inflammatory markers but in one the duration of symptoms with AD was longer:  $3.6$  days  $\pm 3.8$  days vs.  $1.8 \pm 3.2$  days, P<0.05 [15]. None of these are hard diagnostic features of AD and more than likely these patients undergo surgery for acute appendicitis and AD is discovered incidentally on histological analysis. Appendicectomy in patients with AD took longer ( $85$  minutes  $\pm 40$  minutes fronts to  $60$  minutes  $\pm 21$  minutes, P=0.001) and the appendix was covered in phlegmon [14]. Pseudomyxoma peritonei following iatrogenic rupture of an AD with spread of malignant cells in an appendix containing a LGMN could be high and therefore requiring careful handling of the appendix tip where the majority of diverticula reside.

## Conclusion

Diverticulum of the appendix is uncommon and is likely to be associated with an appendix neoplasm. Appendix diverticulitis and acute appendicitis cannot be clearly differentiated on clinical symptoms and signs. Features such as prolonged illness, older age group and male gender may lend weight to the diagnosis. CT scanning could be useful in diagnosis. Perforation of AD is more likely in the acute scenario. The accepted treatment is appendicectomy but it is important to handle the distal third carefully. The majority of AD resides in the distal third. The condition is found in the older population and it may be wise to consider postoperative colonoscopy if the appendix is clear of tumour/growths on histology.

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