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Case Report

Bladder-Adherent Primary Appendiceal Carcinoma Masquerading as a Carpeting Rectal Lesion Detected by a Fecal Immunochemical Test: A Case Report

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Keywords
Appendiceal carcinoma · Rectal invasion · Bladder adherent · Magnetic resonance imaging · Fecal immunochemical test

Abstract
Introduction: Primary appendiceal carcinoma is rare and comprises up to 1% of all colorectal malignancies. Its invasion into adjacent organs, such as the bladder and rectum, especially as a presenting characteristic, is even less common. ***Case Presentation:*** A 75-year-old asymptomatic male tested positive on a screening fecal immunochemical test (FIT). Colonoscopy showed a rectosigmoid tumor and normal appendiceal orifice. Staging MRI surprisingly showed that the cancer was, in fact, of appendiceal origin, coursed posteriorly to invade the rectosigmoid and form adhesions with the urinary bladder. Staging CT did not show metastatic disease. Low anterior resection, en bloc appendectomy, and right hemicolectomy were performed along with cystectomy and ileal conduit. Hematoxylin and eosin stains showed appendiceal adenocarcinoma invading through the appendiceal wall into the rectal muscularis and submucosa. Features of neuroendocrine carcinoma were not identified

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on immunohistochemistry. This was a colonic type of adenocarcinoma of the appendix. ***Conclusion:*** This is a rare case of appendiceal carcinoma invading the rectum and presenting as a positive screening fecal immunochemical test in an asymptomatic individual. We effectively demonstrate the use of preoperative MRI to identify the appendiceal origin of the tumor, as well as to demonstrate the extent of tumor spread, which assisted with operative management and treatment planning.

Introduction

Appendiceal carcinoma is rare and comprises 0.1–4% of all malignancies of the gastrointestinal tract [1] with an incidence of approximately 0.12 cases per 1000,000 individuals diagnosed per year [2]. Invasion into adjacent organs, such as the urinary bladder and rectum, is even rarer [1–3]. Although right lower quadrant abdominal pain mimicking acute appendicitis is more commonly seen as the primary presenting symptom [2], irritative urinary symptoms such as increased frequency, dysuria [1, 4], hematuria, and fecaluria can occur [5]. The prognosis depends on the extent of organ invasion and spread of the tumor in the peritoneal cavity, as well as the type of surgery performed [6]. The preoperative determination of the origin and extent of appendiceal carcinoma is challenging [1]. We report an unusual case of appendiceal carcinoma that presented as a positive result on the fecal immunochemical test (FIT) and describe the use of pretreatment rectal MRI to identify the appendiceal origin of the tumor and its invasion into the urinary bladder and rectum.

Case Report

A 75-year-old asymptomatic male tested positive for colon cancer on routine screening using the FIT. Screening for colon cancer is performed through a provincial colon cancer screening program, in which average risk individuals between the ages of 50 and 74 receive a fecal immunochemical test (FIT) every 2 years. Individuals with an abnormal FIT test have further workup with colonoscopy through the Diagnostic Assessment Program (DAP) at our hospital. A digital examination revealed no abnormalities in the rectum. A colonoscopy performed on March 25, 2020, showed multiple colonic polyps and a 4-cm carpeting lesion in the rectum and distal sigmoid colon with a firm center (shown in Fig. 1). The appendicular orifice was normal on colonoscopy (shown in Fig. 1). The biopsy result for the rectal lesion was conclusive of a malignant lesion. The patient had a previous clinical history of prostate carcinoma that was treated with radiation and hormone therapy.

Staging MRI using the rectal cancer protocol performed on June 8, 2020, revealed a distended, T1 hypointense and T2 hyperintense, heterogeneously enhancing the appendix measuring 1.6 cm in diameter and 6.7 cm in length. The appendix demonstrated a posterior course with its tip abutting the right lateral wall of the rectosigmoid (shown in Fig. 2). A plaque-like intraluminal T1 hypointense and T2 hyperintense mass was observed within the rectosigmoid contiguous with the appendix (shown in Fig. 2). This raised the possibility of an appendiceal tumor invading the rectosigmoid and forming a plaque-like intraluminal rectosigmoid mass.

The posterosuperior wall of the urinary bladder was adherent to the rectosigmoid at the site of tumor infiltration with resultant tenting of the urinary bladder (shown in Fig. 2). There

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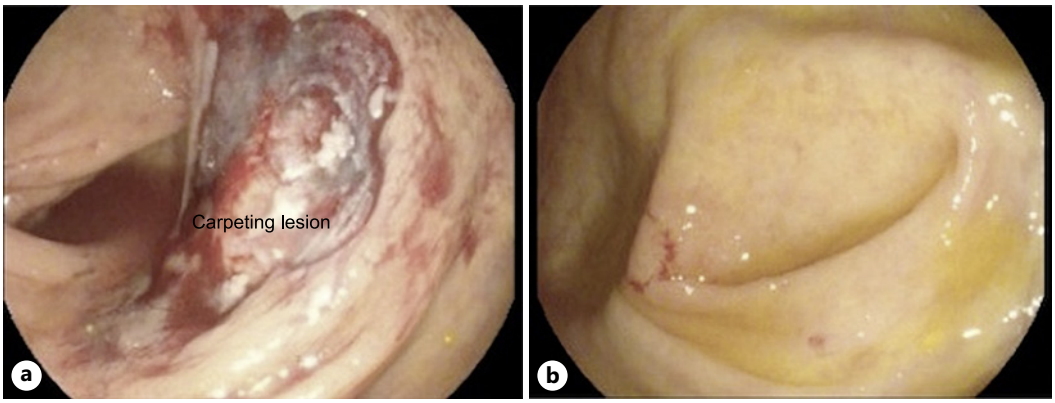

Fig. 1. Colonoscopy images show a 4-cm carpeting lesion within the rectum and sigmoid colon (**a**) and a normal appendiceal orifice (**b**).

was no evidence of extraluminal tumor extension or suspicious locoregional lymphadenopathy in the MRI.

Staging CT of the chest, abdomen, and pelvis performed on June 12, 2020, showed an enlarged appendix measuring up to 1.5 cm in width with irregular thickening of the appendicular wall which was highly concerning for malignancy (shown in Fig. 2). The tip of the appendix was adherent to the rectosigmoid colon on the right side. There were no suspicious lymph nodes and no CT evidence of metastatic disease.

A low anterior resection with appendectomy and en bloc right hemicolectomy was performed on June 25, 2020. Intraoperative observations revealed significant tumor invasion of the trigone of the urinary bladder. An unsuccessful attempt to dissect the tumor adherent to the urinary bladder required a radical cystectomy with an ileal conduit. Although the patient had a slightly prolonged ileus postoperatively, he was discharged in stable condition after a satisfactory recovery.

Pathological reports confirmed a well-differentiated grade 1 adenocarcinoma, with a maximum dimension of 4.2 cm, arising from the appendix on a background of villous adenoma with high-grade dysplasia. Hematoxylin and eosin stains showed appendiceal adenocarcinoma invading through the appendiceal wall into the rectal muscularis and submucosa. Sectioning showed that the tumor emerged from the appendix, further forming a fistulous tract and invading the muscularis propria and submucosa of the rectosigmoid (shown in Fig. 3). The overlying rectal mucosa contained a large villous adenoma with high-grade dysplasia. Examination of numerous sections confirmed that the rectal mucosal lesion was, in fact, an incidental villous adenoma located on the underlying appendiceal tumor that invaded the rectal muscularis and submucosa. Surgical resection margins were negative. Tumor invasion into the urinary bladder was not conclusive. The perivesical fat was clear of tumor involvement. No lymphovascular or perineural invasion was observed. Sixteen resected lymph nodes were tested negative for metastatic disease. The tumor corresponded to pT4b N0 disease.

Immunohistochemistry showed that the tumor was negative for synaptophysin and chromogranin. CD56 showed focal area staining. Features of neuroendocrine carcinoma were not identified. Immunostains for CDX-2 and CK 20 were positive in keeping with colonic-type adenocarcinoma of the appendix. Pathology and immunohistochemistry confirmed that this was a typical adenocarcinoma arising from the appendix with dirty necrosis in the lumen and desmoplastic response around the tumor. The tumor was positive for the KRAS and PIK3CA gene mutations. The patient received adjuvant capecitabine; however, he tolerated only one

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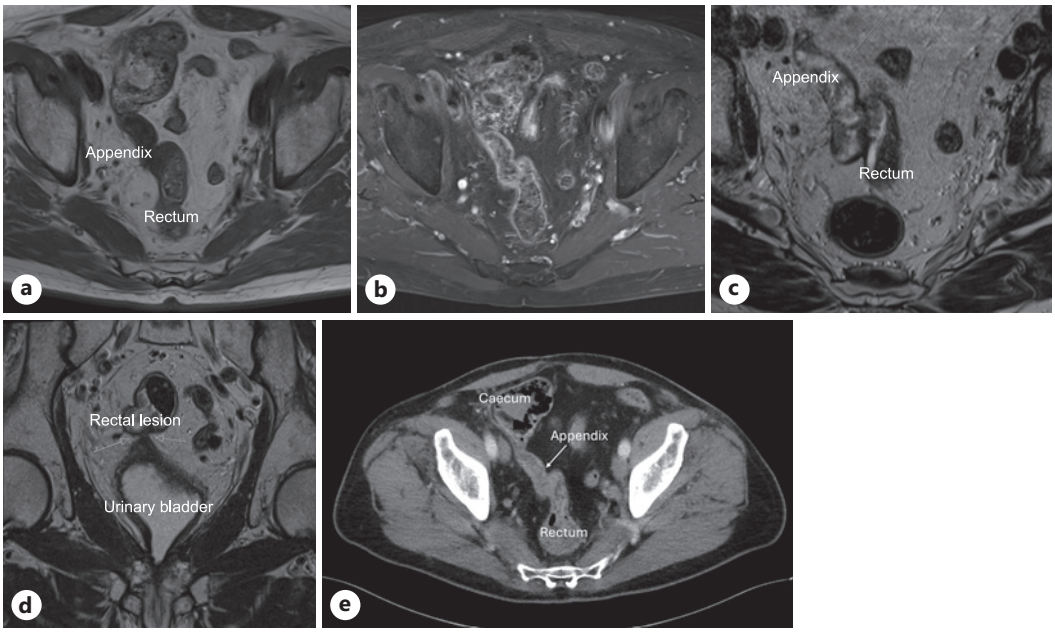

Fig. 2. **a** Axial T1-weighted image shows a thickened appendix arising from the cecum, coursing posteriorly and abutting the right lateral wall of the rectum. There is a T1 hypointense appendiceal tumor invading the rectosigmoid, with loss of the intervening fat plane. **b** Axial fat-suppressed post-contrast T1-weighted image demonstrates heterogeneous enhancement within the appendiceal and rectal components of the tumor. **c** High-resolution axial T2-weighted images without fat suppression show heterogeneous T2 hyperintense tumor involving the appendix. The distal end of the appendix abuts the right lateral wall of the rectum. Tumor invades the right lateral wall of the rectum, forming an intraluminal carpeting lesion within the rectum. **d** High-resolution coronal oblique T2-weighted images demonstrate tumor adherent to the wall of the urinary bladder, resulting in tenting of the bladder wall. **e** Axial contrast enhances CT image through the pelvis shows an enlarged appendix with irregular thickening of its walls. The appendix courses posteriorly and the tip of the appendix is adherent to the rectosigmoid on the right side.

cycle and decided not to proceed with the chemotherapy. He did not continue with chemotherapy and is now under observation.

The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see https://doi.org/10.1159/000535273). The timeline for this case report has been described (shown in Fig. 4).

Discussion

Primary appendiceal carcinoma is rare, accounting for approximately 1% of colorectal malignancies [1] and 0.2–0.5% of malignancies of gastrointestinal origin [7]. The presentation secondary to locoregional spread with the invasion of adjacent organs such as the sigmoid colon [2] and the urinary bladder is even more rare [1, 3]. A study by Berger [8] first described appendiceal carcinoma in 1882. Appendiceal carcinoma can be classified into three subtypes: (a) mucinous adenocarcinoma, (b) intestinal-type adenocarcinoma, and (c) signet ring cell carcinoma [9, 10]. Men are affected more frequently than women with the peak incidence being between 50 and 70 years of age [11].

Although right lower quadrant abdominal pain that mimics acute appendicitis is more commonly seen as the primary presenting symptom [2], irritative urinary symptoms such as

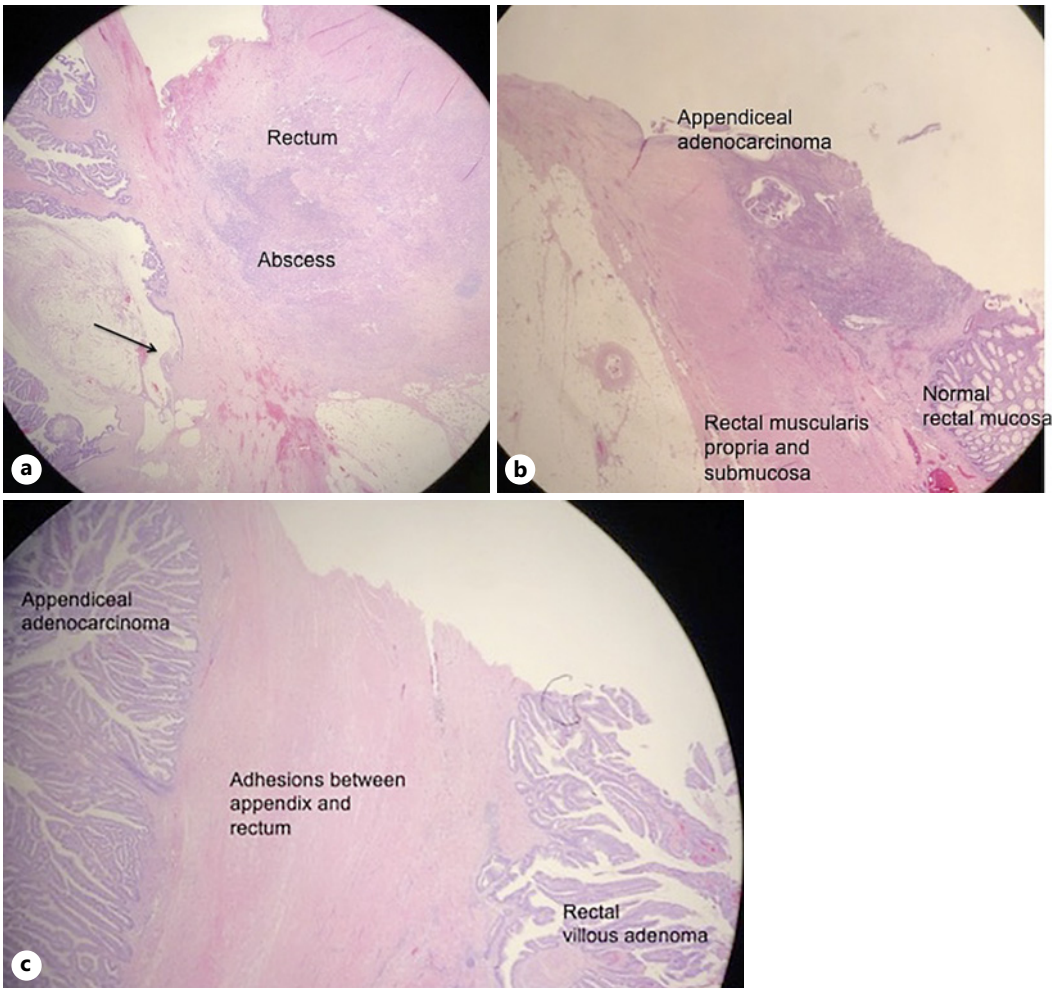

Fig. 3. a Hematoxylin and eosin (H&E)-stained section shows adenocarcinoma arising from the appendix on the bottom, infiltrating through appendiceal wall into adhesions with the rectum (arrows), abscess between appendiceal adenocarcinoma, and muscularis propria of rectum (rectum on top). **b** H&E-stained section shows appendiceal adenocarcinoma infiltrating into the rectal muscularis propria and submucosa (middle), with normal rectal mucosa on the bottom right. **c** H&E-stained section shows appendiceal adenocarcinoma on the left infiltrating into adhesions between appendix and rectum; a rectal villous adenoma is seen on the right of the image.

increased frequency, dysuria [1, 4], and hematuria [1] can also be observed. Occasionally, fecaluria may occur, which would indicate an enterovesical fistula [5]. In cases where the symptoms of appendicitis and urinary symptoms have been persistent for a long time and where appendicitis has been ruled out, an appendiceal carcinoma should be considered a differential diagnosis and should be investigated in a timely manner [1].

Previous studies have reported that preoperative imaging techniques are ineffective in accurately exhibiting the origin and extent of appendiceal adenocarcinoma [1], often necessitating surgical intervention for diagnostic and therapeutic purposes [1, 2, 6]. Here, we demonstrate that preoperative staging MRI was, in fact, crucial in identifying the appendiceal origin of this carcinoma and its invasion to the urinary bladder and rectum.

The workup, staging, and treatment of colonic-type adenocarcinomas arising in the appendix mimic colon cancer [12]. Open exploratory laparotomy is usually required in the treatment of appendicular adenocarcinoma [1, 2], with aggressive surgical management as

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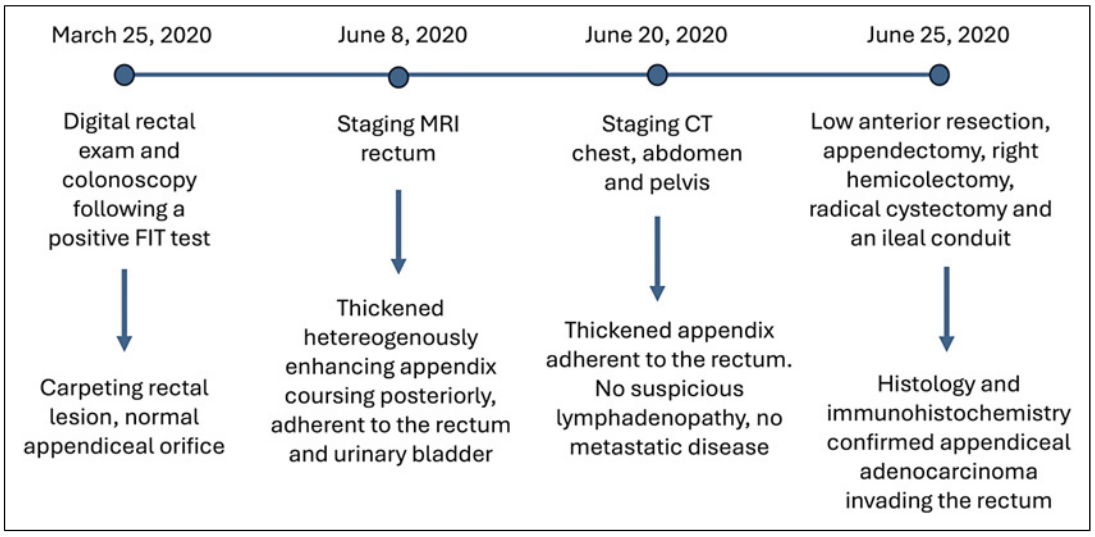

Fig. 4. Timeline of events showing interventions and outcomes.

the preferred treatment [2]. An en bloc cystectomy is performed when there is bladder involvement [3, 4, 9]. A comparatively longer survival rate of 5 years has been reported with a right hemicolectomy (73%) over appendectomy alone (44%) [2, 3, 13]. Treatment for metastatic disease includes chemotherapy, hyperthermic intraoperative intraperitoneal chemotherapy, radical surgery with peritonectomy, and a combination of these treatments [14].

Conclusion

Appendiceal adenocarcinoma is rare and can have unusual presentations that make diagnosis challenging. We describe a unique scenario of appendiceal carcinoma detected on a routine fecal immunochemical screening test in an asymptomatic individual. Pre-treatment MRI was instrumental in identifying the origin and extent of the tumor and invasion of surrounding organs such as the bladder and rectum, thus aiding treatment planning.

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Statement of Ethics

Ethics approval is not required for this study in accordance with local guidelines. Written informed consent was obtained from the patient for publication of the details of their medical case and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Conceptualization and methodology: N.B. and R.R.; writing: N.B., E.A.-I., and F.H.; colonoscopy images: E.A.-I. and W.H.; pathology images: F.H.; and review and editing: N.B., F.H., O.A., A.K., W.S., and W.H., R.R.

Data Availability Statement

All data generated or analyzed during this study are included in this article and its online supplementary material. Further inquiries can be directed to the corresponding author.

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