

## Misleading low-grade appendiceal mucinous neoplasm (LAMN) of the appendiceal orifice: a case report

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### Summary

*Introduction:* A case of a 74-year-old woman who was planned for endoscopic full-thickness resection (eFTR) of a recently colonoscopy-detected polyp of the appendiceal orifice.

*Important clinical findings:* During the colonoscopy, a polyp prolapsed through the appendix orifice into the cecum. A full-thickness resection device (FTRD) was used to perform a resection, which removed most of the polyp. The histopathology report described dysplastic epithelium extending to the resection margin. The finding corresponded to a sessile serrated lesion (SSL) with low-grade dysplasia.

*Main intervention and outcome:* The medical team advised appendicectomy, which was performed using the linear stapler while preserving the ileocecal valve. Twelve days postoperatively, the histopathology analysis was finalized. The neoplasm of the appendiceal orifice was described as a solid, low-grade mucinous appendiceal neoplasm (LAMN) that had invaded the submucosa of the appendiceal wall.

*Conclusion:* The histopathological characteristics of the LAMN cannot be described by analyzing the eFTR-gathered tissue alone. Furthermore, due to the possible risk of dissemination, for appendiceal neoplasms, an appendectomy should be a diagnostic and therapeutic method of choice, coupled with a histopathology analysis.

**KEYWORDS:** *appendiceal neoplasm; appendectomy; digestive system endoscopy*

### INTRODUCTION

Appendiceal neoplasms, though relatively rare, present a significant challenge in clinical management due to their diverse histopathological characteristics and potential for malignancy. The standard approach for localized, non-complicated appendiceal neoplasms has traditionally been appendectomy, a procedure that involves the removal of the appendix(1). However, the advent of full-thickness resection techniques, which aim to achieve more extensive excision of affected tissues, has raised questions regarding their superiority over appendectomy. This case report aims to highlight the importance of appendectomy as the preferred surgical intervention for appendi-

ceal neoplasms, especially in cases where the tumor is confined to the appendix. Through a detailed analysis of a case, we will demonstrate that appendectomy not only provides adequate oncological outcomes but also minimizes the risk of histopathology diagnostic error, which may later lead to unnecessary complications. By reviewing the current evidence and comparing both approaches, we underscore the continued relevance of appendectomy in the management of appendiceal neoplasms.

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## CASE PRESENTATION (SIGNIFICANT CLINICAL FINDINGS AND CASE TIMELINE)

A 74-year-old woman was diagnosed with a polyp of the appendiceal orifice during the colonoscopy. Another colonoscopy was planned for an endoscopic full-thickness resection (eFTR) of the polyp. There was no significant prior medical history except Hashimoto's disease, which required no therapy except active surveillance of the disease. So far, she has been under antibiotic treatment for H. Pylori infection.

The patient did not have any prescribed therapy or active medical therapy and had no other comorbidities. Occasionally consumed dietary supplements of Zinc and Selenium. She had a confirmed allergy to seafood and iodine contrast.

The patient stated no complaints of dysphagia, nausea, vomiting, stool pattern, consistency, or color. During physical examination, there were no complaints of abdominal pain, guarding, or rebound pain. During the colonoscopy, the previously described polyp was shown in the cecum, and this time prolapsed through the orifice of the appendix (Paris class Is, KUDO type IV, JNET 2A). Marking was made around the polyp and the appendix orifice. The polyp was entirely located within the appendix. The traction of the polyp was challenging with a grasper, and even impossible to pull out.

Then, using a full-thickness resection device (FTRD), the polyp was resected, removing most of it.

During an endoscopic check-up, it was unclear if the polyp had been completely removed. It was planned to perform a colonoscopy within 2 months, with an insight into the histopathology report. The patient was observed after eFTR of the appendiceal polyp. During hospitalization, mild deep palpation tenderness in the right lower quadrant of the abdomen was observed, without progression and with an increase in inflammatory parameters (CRP 88 mg/L). Prophylactic preprocedural antibiotic (ciprofloxacin) was continued therapeutically.

Three days post-colonoscopy, the histopathology report has been reviewed. An analyzed tissue was colonic mucosa (2 cm x 1 cm) with a polypoid structure (0.8 cm x 0.5 cm) at the border of the resected tissue. The tissue consisted of crypts with basal distortion, lined by hyperplastic mucinous epithelium with low-grade dysplasia. The dysplastic epithelium was reaching the resection margin. The finding corresponded to a sessile serrated lesion (SSL) with low-grade dysplasia (Figure 1). The affiliated pathologist has recommended removal of the neoplasm in its entirety and referral for histopathological analysis.

A medical team, including a surgeon, a gastroenterologist, and a pathologist, concluded that

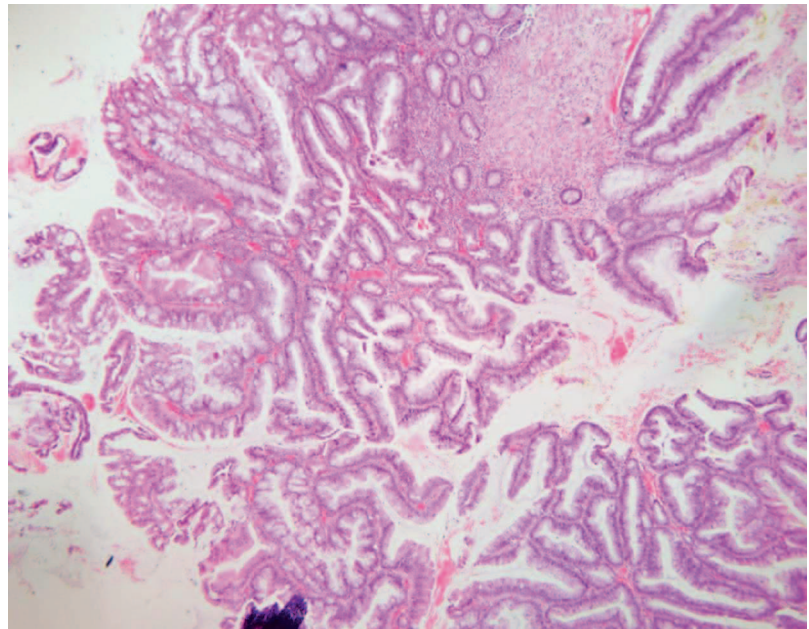


Figure 1: Serrated architecture of the LAMN (left-middle), mimicking a serrated lesion (partially eFTR harvested polyp, magnification 4x)

a partial resection of the caecum with appendix vermiformis should be performed and that the newly obtained tissue should be sent for histopathological analysis according to the Chicago Consensus on Peritoneal Surface Malignancies.

The patient was admitted to the surgery department 4 days post-colonoscopy for a surgical procedure. Under general anesthesia, the laparoscopic approach was used with two additional working trocars. The appendix was shown lying iliacally, slightly enlarged. The cecum and the appendix were mobilized using a harmonic cutter. Appendicectomy was performed by transecting the large bowel using the endoscopic linear stapler (Echelon Flex 60) while preserving the ileocaecal valve. The specimen was extracted in an endobag and referred to the pathology department for histopathological analysis. The patient was released the day after surgery and had an uneventful recovery.

12 days post-operatively, the histopathology analysis was finalized. The neoplasm of the appendiceal orifice was described as a low-grade mucinous appendiceal neoplasm (LAMN) that had invaded the submucosa of the appendiceal wall. The initial tissue was preserved in 15 paraffin-embedded cubes, and multiple slices were analyzed in detail. The mucosa of the appendix vermiformis is circularly altered along its entire length (100%). The neoplasm was made of filiform and partly serrated villi lined with low dysplastic cylindrical epithelium with apically located cytoplasmic vacuoles. In most villi, multiple ectopic crypts were positioned laterally, similar to those in sessile serrated lesions. No residual lymphatic apparatus could be seen in the submucosa, and the wall was slightly fibrously altered. No extra-appendiceal mucin or epithelium was found. The finding corresponded to LAMN (pTis). TP53 immunohistochemistry staining of the neoplasm showed wild-type staining, with a few cytoplasm heavily stained but most likely not aberrant.

## FOLLOW-UP DIAGNOSTIC

The patient was referred to an oncology multidisciplinary team for tumors of the digestive tract. The MSCT scan was unremarkable and showed no signs of LAMN spread. No pathologically enlarged lymph nodes were visible, nor was

there free abdominal fluid. 6 months post-surgery, the ultrasound showed no abnormalities or a spread of the disease. Tumor marker values were within the reference interval after 8 months (CEA < 0.30 µg/L, CA 19-9 6.38 kIU/L, CA 15-3 14.1 kIU/L, CA 125 10.9 kIU/L, NSE 8.9 µg/L) and after 12 months of the surgical procedure. An MSCT scan performed 1 year post-surgery showed no signs of malignancy. The patient remains under active oncological surveillance.

## PROGNOSIS

Patients who were appendectomized because of pTis LAMN do not need additional monitoring or treatment after surgery since the spread of the primary disease is very rare but possible. Appendectomy for these patients can be considered curative.

## ADVERSE AND UNANTICIPATED EVENTS

Preformed interventions caused no detectable adverse events.

## DISCUSSION

Serrated architecture in LAMN might resemble a serrated lesion. However, LAMN can be distinguished from serrated lesions by the absence of extensive serrations and lateralization or dilatation at the base of the crypt. Focal obliteration or loss of the muscularis mucosa and lamina propria is the bare minimum needed for diagnosing the LAMN. Typical findings include submucosal fibrosis and the absence of lymphoid tissue. When the lamina propria/muscularis mucosa is not obliterated, low-grade mucinous epithelial growth is categorized as an adenoma, and staging is unnecessary. It is better to favor LAMN in questionable situations, even though the loss of lamina propria or muscularis mucosa might occasionally be minor(2).

Both low-grade appendiceal mucinous neoplasm (LAMN) and appendiceal adenomas show circumferential involvement(3). If acellular mucin or mucinous epithelium is identified beyond the muscularis propria in the subserosa or mesoappendix, it should be classified as pT3 if the mucin does not involve the visceral serosal surface(4).

Since it is theoretically impossible for the operator to harvest the whole circumference of the appendix by FTRD, and all the histopathological characteristics of the LAMN cannot be described by the analysis of the eFTR-gathered tissue only (mesoappendix), appendectomy should be a method of choice coupled with a histopathology analysis.

Endoscopic full-thickness resection (eFTR) is a minimally invasive procedure to remove (resect) benign or cancerous tumors from the gastrointestinal tract. According to W.Zwager et al., perforations occurred in 2.5% of cases of eFTR. In 6.9% of cases, the lesions involved the appendiceal orifice, in whom the overall rate of appendicitis was 9.9% (13/131) diagnosed after a median time of 3 days (IQR, 2-4) after eFTR of the appendiceal orifice(5). Due to the pushing nature of the mucinous neoplasm, fibrosly altered appendiceal wall, relatively high post-interventional perforation/appendicitis occurrence, and possible spread of mucinous neoplasm (since the operator cannot macroscopically differentiate types of sessile lesions)(6), eFTR may not be a method of choice for appendiceal neoplasms and neoplasms of the appendiceal orifice.

## NOTES

Informed consent was not requested since the patient-specific information was de-identified.

This case was written step by step in accordance with the CARE (Case Report) guidelines.

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## REFERENCES

1. Kelly KJ. Management of appendix cancer. Clin Colon Rectal Surg. 2015;28(4):247-255. doi:10.1055/s-0035-1564433
2. Umetsu SE, Kakar S. Staging of appendiceal mucinous neoplasms: challenges and recent updates. Hum Pathol. 2023;132:65-76. doi:10.1016/j.humpath.2022.07.004
3. Pai RK, Beck AH, Norton JA, Longacre TA. Appendiceal mucinous neoplasms: clinicopathologic study of 116 cases with analysis of factors predicting recurrence. Am J Surg Pathol. 2009;33(10):1425-1439. doi:10.1097/PAS.0b013e3181af6067
4. Edge SB, Compton CC. The American Joint Committee on Cancer: the 7th edition of the AJCC cancer staging manual and the future of TNM. Ann Surg Oncol. 2010;17(6):1471-1474. doi:10.1245/s10434-010-0985-4
5. Zwager LW, Mueller J, Stritzke B, et al. Adverse events of endoscopic full-thickness resection: results from the German and Dutch nationwide colorectal FTRD registry. Gastrointest Endosc. 2023;97(4):780-789.e4. doi:10.1016/j.gie.2022.11.005
6. Cai MY, Martin Carreras-Presas F, Zhou PH. Endoscopic full-thickness resection for gastrointestinal submucosal tumors. Dig Endosc. 2018;30(Suppl.1):17-24. doi:10.1111/den.13003

## Sažetak

### Mucinozna neoplazma niskog gradusa (LAMN) orificija crvuljka: prikaz slučaja

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**Uvod:** Prikazan je slučaj 74-godišnje pacijentice kod koje je planirana endoskopska resekcija pune debljine (eFTR) nedavno otkrivenog polipa na otvoru crvuljka.

**Važni klinički nalazi:** Tijekom kolonoskopije uočen je polip koji prolabira kroz otvor crvuljka u cekum. Resekcija je izvedena pomoću uređaja za resekciju pune debljine (FTRD), čime je uklonjen veći dio polipa. Patohistološkim nalazom utvrđeno je da displastični epitel doseže do resekcijskog ruba. Lezija je odgovarala sesilnoj serratnoj leziji (SSL) s displazijom niskog stupnja.

**Glavna intervencija i ishod:** Medicinski tim preporučio je apendikocektomiju, koja je izvedena linearnim staplerom uz očuvanje ileocekalne valvule. Dvanaest dana nakon intervencije dovršena je patohistološka analiza, kojom je neoplazma na otvoru apendiksa okarakterizirana kao solidna mucinozna neoplazma apendiksa niskog stupnja (LAMN) s invazijom u submukozu apendiksa.

**Zaključak:** Patohistološke značajke LAMN-a nije moguće pouzdano utvrditi samo analizom tkiva dobivenog eFTR-om. S obzirom na potencijalni rizik diseminacije, apendektomija bi trebala biti dijagnostička i terapijska metoda izbora za novotvorine koje su ograničene na sam crvuljak, uz obveznu patohistološku analizu.

**KLJUČNE RIJEČI:** *novotvorine crvuljka; apendektomija; endoskopija probavnog trakta*