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The importance of appendiceal diverticulum as an incidental finding on routine histopathology: Case report with literature review

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Abstract

Appendiceal diverticulum is an uncommon but clinically significant finding, most often identified incidentally on routine histopathological examination. Its importance lies in the increased risk of perforation, its association with neoplasia, and its potential to complicate acute appendicitis presentations. We present the case of a 48-year-old female with phlegmonous appendicitis and an incidental diverticulum, managed surgically with appendectomy. Histopathology confirmed a pseudodiverticulum in the appendiceal tip. This case underscores the relevance of diverticula in shifting otherwise uncomplicated appendicitis toward complicated disease pathways. A literature review highlights the divergent and hybrid concepts of appendicitis pathogenesis, the relationship between diverticula and neoplasms, and the clinical implications for follow-up and surveillance. Awareness among surgeons and pathologists can improve recognition and guide management of this rare but consequential entity.

Keywords: Appendiceal diverticulum, phlegmonous appendicitis, perforation risk, collision tumors, hybrid concept of appendicitis pathogenesis

Introduction

Incidence and Epidemiology: Appendiceal diverticulum is a rare entity, reported in 0.004-2.1% of appendectomy specimens and up to 1.4% in autopsy studies ^[1, 2]. It is most often an incidental finding during histopathological evaluation, since the majority of cases remain clinically silent. Male predominance and presentation in the fourth to sixth decade of life are typical features ^[3].

Pathogenesis and Classification: Most appendiceal diverticula are acquired pseudodiverticula, characterized by mucosal and submucosal herniation through the muscular wall, usually at points of vascular penetration ^[4]. True congenital diverticula, involving all wall layers, are exceedingly rare. Lipton *et al.* proposed a classification system dividing diverticula into four types:

1. Diverticulitis without appendicitis
2. Appendicitis with diverticulitis
3. Appendicitis with incidental diverticulum
4. Incidental diverticulum without inflammation ^[5].

Clinical Significance: Although frequently asymptomatic, appendiceal diverticulum has several important clinical implications:

- **Increased risk of perforation:** When diverticulitis occurs, perforation rates are significantly higher than in conventional acute appendicitis, reported in 33-66% vs. 10-20% of cases ^[6, 7]. This is attributed to the thin wall of pseudodiverticula and delayed clinical recognition due to atypical presentations.
- **Mimicry of appendicitis:** Some cases present with right lower quadrant pain, but clinical and radiological differentiation from acute appendicitis is challenging, leading to delayed surgical intervention ^[8].

Case report

A 48-year-old female patient was admitted as an emergency with clinical and laboratory signs of acute appendiceal disease.

She reported abdominal pain that began 24 hours prior to admission and migrated to the ileocecal region. Notably, there was no fever or loss of appetite. Laboratory findings on admission showed: WBC $6.0 \times 10^9/L$, neutrophil-to-lymphocyte ratio 1.29, CRP 35.58 mg/L, CRP-to-albumin ratio 1.09, sodium 140 mmol/L, total bilirubin 14.1 $\mu\text{mol/L}$,

procalcitonin 0.05 ng/mL, and IL-6 20 pg/mL.

Contrast-enhanced abdominal CT revealed a dilated terminal ileum with a single hydroaeric level and pronounced inflammatory infiltration of the mesocecum [Fig.1].

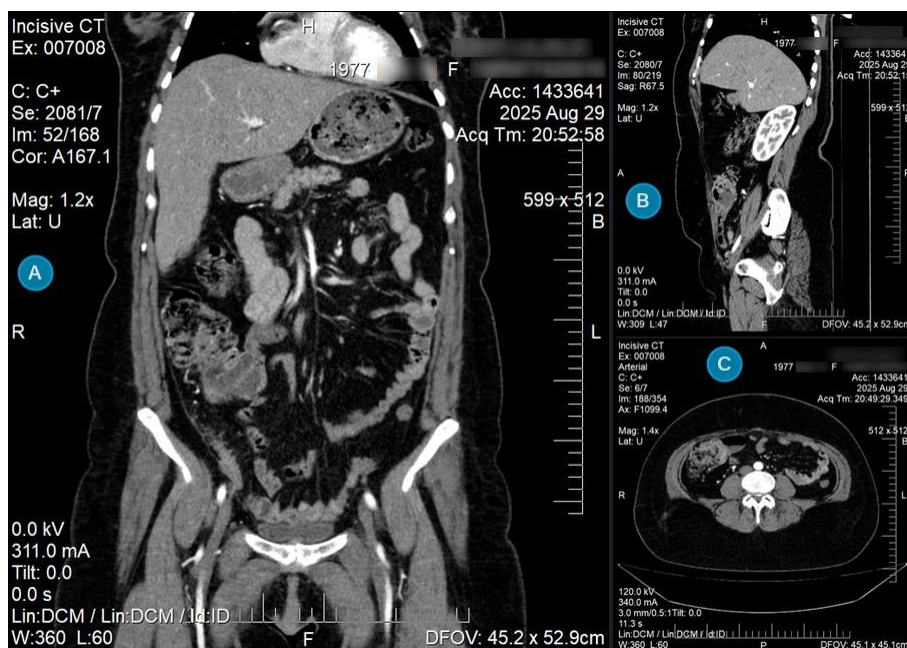


Fig 1: Contrast-enhanced abdominal CT (A) Coronal view, (B) Sagittal view, (C) Horizontal view

Based on clinical and radiological findings, an indication for surgical treatment was established

Intraoperatively, the appendix was found to be phlegmonously inflamed, measuring 7.5×1 cm, with a turbid serosa and focal hemorrhagic areas. Histopathological analysis demonstrated a focally eroded mucosa with hemorrhagic luminal content, accompanied by transmural

acute inflammatory infiltrates of polymorphonuclear leukocytes spreading through all layers of the wall. Dilated and congested blood vessels were also observed. Sections from the tip of the appendix revealed mucosal and submucosal prolapse through the muscular layer, consistent with an appendiceal diverticulum [Fig.2].

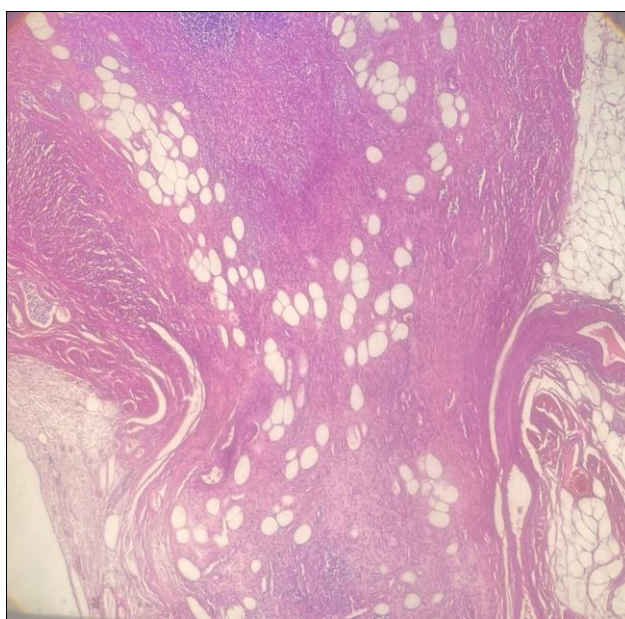


Fig 2: HE x40 Mucosal prolapse through muscularis propria at the tip of the appendix

Microbiological analysis of a luminal swab and mucosal fragment yielded *Escherichia coli*, *Klebsiella pneumoniae* ssp. *pneumoniae*, *Bacillus subtilis*, and *Candida albicans*. A

standard appendectomy was performed with appropriate ligation of the appendiceal base. The postoperative course was uneventful, and the patient was discharged home on the

second postoperative day. Following histopathological confirmation of the diverticulum, the patient was referred for lower gastrointestinal endoscopy to exclude synchronous pathology.

Discussion

Diverticulum and Phlegmonous Appendicitis: The coexistence of appendiceal diverticulum and phlegmonous appendicitis (diffuse transmural neutrophilic inflammation without frank perforation) is of particular clinical interest. While diverticula are often incidental, the inflamed appendix with phlegmonous changes may obscure their presence, making the diagnosis purely histological. In such cases, the diverticulum itself may not be inflamed, but the overall weakened appendiceal wall increases the risk of rapid progression to perforation compared with typical phlegmonous appendicitis [1, 6]. Moreover, the inflammatory milieu of phlegmonous appendicitis can make radiologic differentiation impossible, reinforcing the importance of careful pathological examination. Recognition of diverticula in this context highlights their potential role as a predisposing factor for complicated disease, and supports their significance even when discovered incidentally.

From a pathophysiological perspective, this relationship can be framed within the divergent and hybrid models of acute appendicitis. The divergent concept proposes that uncomplicated and complicated appendicitis represent

distinct biological entities rather than sequential stages of the same process. In this model, appendiceal diverticulum may act as a structural anomaly that predisposes to the “complicated” pathway by creating a locus of weakness, thereby favoring transmural bacterial invasion and rapid wall disruption, even in the absence of classical luminal obstruction. Conversely, the hybrid concept incorporates elements of both the divergent and progressive theories, suggesting that appendicitis may initially evolve along different biological tracks, but that crossover between pathways is possible.

The crossover model becomes especially relevant in the setting of diverticulum with phlegmonous inflammation. A patient may initially present with an inflammatory profile resembling uncomplicated appendicitis; however, once the inflammatory cascade involves a diverticulum, the inherent wall weakness facilitates a transition or crossover toward the complicated disease phenotype. Thus, diverticulum-associated phlegmonous appendicitis can be interpreted as an example of structural pathology driving a shift from one pathophysiological track to another. This framework helps explain why diverticula, although sometimes histologically silent, carry disproportionate clinical significance: they transform a potentially self-limiting inflammatory process into one with a markedly higher risk of perforation, abscess, or peritonitis [Fig.3].

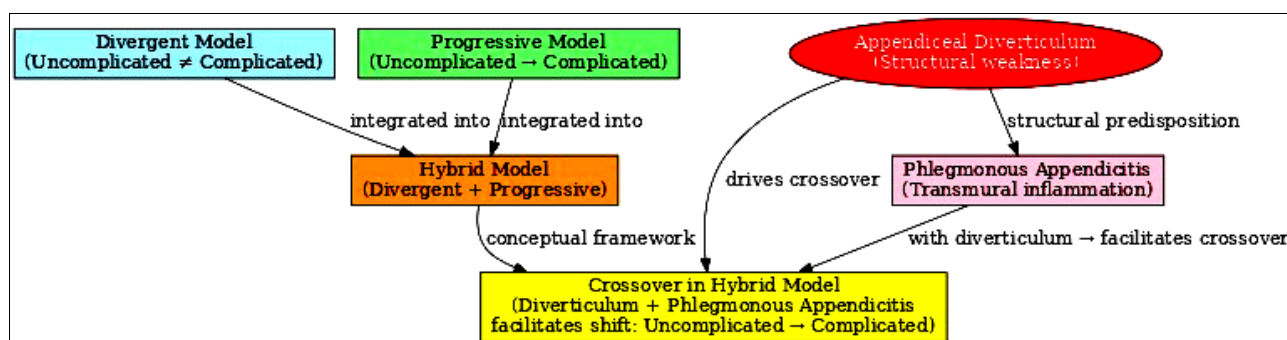


Fig 3: Conceptual integration of appendicitis pathogenesis models with appendiceal diverticulum

In summary, when analyzed through the lens of the divergent and hybrid concepts, appendiceal diverticulum serves as both a biological modifier and a mechanical risk factor, positioning it as a crucial determinant in the transition from phlegmonous but non-perforated disease to the complicated spectrum of acute appendicitis.

Association with Neoplasia, Pseudomyxoma Peritonei, and Colliding Tumors:

One of the most critical aspects of appendiceal diverticulum is its strong association with appendiceal neoplasms. Several studies demonstrate that diverticula coexist with neoplasia in up to 25-48% of cases [8, 9]. The most commonly associated tumors include:

- Low-grade appendiceal mucinous neoplasms (LAMN)
- Mucinous adenocarcinomas
- Neuroendocrine tumors

This association is hypothesized to result from increased intraluminal pressure caused by mucinous tumors, predisposing to diverticulum formation [8]. Importantly, the presence of a diverticulum may facilitate the extrusion of

mucin through the weakened appendiceal wall, which can contribute to the development of pseudomyxoma peritonei (PMP) in cases associated with mucinous neoplasia [8, 9]. Perforation of a diverticulum in this setting therefore represents a critical step in disease progression.

Another rare but noteworthy phenomenon is the occurrence of colliding tumors within the appendix, where two histologically distinct neoplasms coexist in close proximity or abut each other in the same specimen. Reported examples include:

- Neuroendocrine tumor colliding with a LAMN, where the neuroendocrine component is located at the tip of the appendix while the mucinous tumor involves the body and base [8, 9].
- Carcinoid tumor combined with adenocarcinoma, a phenomenon sometimes termed “composite carcinoma,” which can complicate both diagnosis and staging [9].
- Goblet cell adenocarcinoma colliding with a mucinous neoplasm, illustrating the capacity of the appendix to harbor multiple distinct epithelial proliferations [8].

In some of these cases, the presence of diverticula was thought to play a role by altering local wall architecture and intraluminal dynamics, potentially facilitating the simultaneous development of multiple neoplastic clones. While exceedingly rare, the recognition of colliding tumors is clinically important because it influences treatment planning, prognosis, and follow-up. These cases underscore the necessity of comprehensive sampling and careful histopathological evaluation of appendectomy specimens, especially when diverticula are identified.

Implications for Histopathology and Management

Given its rarity but significant associations, the detection of appendiceal diverticulum on histopathology should always be reported, even if incidental. Pathologists must carefully examine the entire appendix for synchronous or colliding neoplasms. From a clinical perspective, incidental diverticulum should raise awareness for possible underlying or future neoplastic transformation, and some authors recommend close clinical follow-up when diverticulum is identified, even in the absence of tumor.

Follow-Up Strategy After Incidental Finding of Appendiceal Diverticulum: There are no formal international guidelines specifically addressing follow-up after incidental discovery of appendiceal diverticulum. However, several evidence-based considerations emerge from the literature:

1. Risk of Synchronous and Metachronous Neoplasia

- Studies report that diverticula coexist with neoplasia in up to 48% of cases^[9].
- This risk justifies thorough histopathological sampling of the entire appendix at the time of appendectomy.
- If a neoplasm is identified, management follows disease-specific guidelines (e.g., ENETS/NCCN for NETs, consensus for LAMN/adenocarcinoma).

2. Surveillance When No Neoplasm Is Found

Even in the absence of neoplasia, the incidental finding of diverticulum may warrant heightened vigilance, given the structural weakness of the wall and its hypothesized role as a precursor or facilitator for tumor spread.

3. Recommended strategies in the literature include

- Baseline colonoscopy (particularly in patients >40 years or with family history of colorectal cancer) to rule out synchronous colonic lesions.
- Cross-sectional imaging (CT or MRI) only if there were intraoperative findings of mucin, perforation, or peritoneal deposits.

Special Considerations: Pseudomyxoma Peritonei (PMP)

- If mucinous material was observed intraoperatively, or if histology shows diverticulum adjacent to a mucinous neoplasm, close postoperative surveillance is recommended.

3. Suggested approaches include

- Abdominal MRI or CT at 6-12 months.
- Tumor markers (CEA, CA 19-9, CA-125) may provide additional information in mucinous cases.
- Referral to a peritoneal surface malignancy center if any suspicion of PMP arises.

4. Colliding and Composite Tumors

- In rare cases of colliding tumors, follow-up must be individualized and multidisciplinary, as outcomes and recurrence risk depend on the most aggressive histologic component.
- Oncological consultation is strongly recommended.

5. Practical Clinical Recommendations [Fig.4]

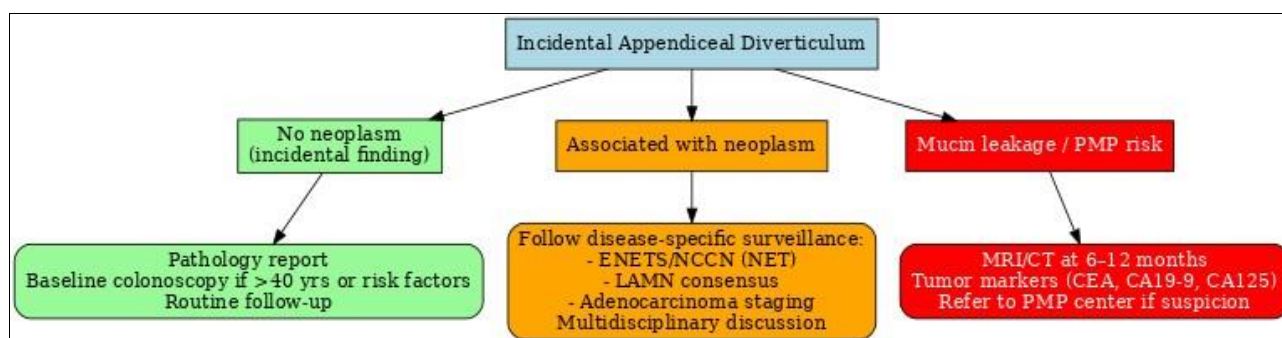


Fig 4: Follow-up strategy for incidental appendiceal diverticulum

- If diverticulum only: document clearly in the pathology report; no immediate oncologic work-up required in young patients without risk factors, but consider baseline colonoscopy in older patients.
- If diverticulum with neoplasia: follow disease-specific surveillance guidelines (NET, LAMN, adenocarcinoma).
- If diverticulum with mucin leakage or perforation: initiate PMP-oriented surveillance (imaging + tumor markers).
- If colliding tumors: multidisciplinary follow-up, tailored to tumor type and stage.

In summary: The incidental finding of an appendiceal diverticulum should not be dismissed as trivial. Instead, it should trigger a stepwise evaluation strategy, starting with complete histopathological examination, baseline colon evaluation, and risk-adapted surveillance. While guidelines are lacking, literature supports a conservative but vigilant follow-up to detect synchronous neoplasia and prevent delayed diagnosis of PMP or composite tumors.

Conclusion

Although uncommon, appendiceal diverticulum is an important incidental finding on routine histopathology. Its significance lies in the increased risk of perforation, its

potential to complicate presentations such as phlegmonous appendicitis, and its strong correlation with appendiceal neoplasms, particularly mucinous tumors. Furthermore, diverticula may act as a pathway for mucin spillage into the peritoneum, playing a role in the pathogenesis of pseudomyxoma peritonei. The rare occurrence of colliding tumors such as neuroendocrine tumors with LAMN or carcinoid with adenocarcinoma further emphasizes the need for thorough histological examination and reporting. Awareness among surgeons and pathologists can improve patient outcomes through early recognition and appropriate oncological evaluation.

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