



Appendiceal Perforation by Fish Bones: Imaging-Surgical Correlation and Laparoscopic Management in a Three-Case Series

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ABSTRACT

Appendiceal perforation caused by ingested fish bones is rare but clinically significant. Although the presentation often mimics acute appendicitis, sharp foreign bodies may traverse the gastrointestinal tract and cause occult injury. In populations with high fish consumption, maintaining a high index of suspicion and performing careful intraoperative assessment are essential. We report three male patients aged 31-44 years with appendiceal perforation caused by fish bones, none of whom recalled foreign body ingestion. Computed tomography (CT) reports consistently described a linear radiopaque object, with complete imaging documentation available for one patient. All patients underwent emergency laparoscopic appendectomy, confirming isolated fish bone perforation without additional intra-abdominal injuries. Recovery was uneventful, and discharge occurred within 1-3 days. Because most patients are unaware of ingestion, CT plays a pivotal role in diagnosis, and careful laparoscopic exploration remains important to avoid missed injuries or retained foreign bodies. CT combined with thorough intraoperative inspection enables accurate diagnosis and safe, effective laparoscopic management with rapid postoperative recovery.

Keywords: Appendectomy, appendiceal diseases, appendicitis, foreign bodies, laparoscopy

Introduction

Appendiceal perforation caused by ingested fish bones is an uncommon but clinically important condition that may closely mimic routine acute appendicitis. Because most patients do not recall foreign body ingestion and clinical manifestations are often nonspecific, preoperative diagnosis remains challenging, and the underlying etiology may only be recognized intraoperatively.^{1,2} In regions with frequent dietary fish consumption, sharp fish bones represent a relevant source of occult gastrointestinal injury and perforation.³ The appendix, as a narrow, blind-ending structure with limited motility, may serve as a site of foreign body impaction and subsequent inflammation or perforation.⁴

With the increasing use of computed tomography (CT) in the evaluation of acute abdominal pain, preoperative identification of appendiceal foreign bodies has become more feasible.

Nevertheless, awareness of this entity remains limited due to its rarity and close resemblance to conventional acute appendicitis. In this study, we present three cases of appendiceal perforation caused by fish bones, focusing on CT-based diagnosis, imaging-surgical correlation, operative findings, and clinical outcomes. By highlighting reproducible diagnostic and intraoperative features, this report aims to provide practical insights for surgeons and radiologists encountering atypical presentations of acute appendicitis.

Case Report

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of the study hospital. Written informed consent was obtained from all patients specifically for the publication of this case series and any accompanying images. Three cases of appendiceal perforation caused by



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Received: 08.10.2025 **Accepted:** 26.06.2026 **Epub:** 25.09.2026 **Publication Date:** 28.09.2026

Cite this article as: Ngo DQ, Tran LH, Nguyen NT. Appendiceal perforation by fish bones: imaging-surgical correlation and laparoscopic management in a three-case series. Turk J Colorectal Dis. 2026;36(3):115-120



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ingested fish bone were identified between 2023 and 2025 (Table 1 and Figures 1-3). These cases shared several notable common features while demonstrating distinct individual characteristics (Table 2).

In all cases included in this study, gastrointestinal symptoms were carefully elicited and thoroughly examined by gastrointestinal surgeons. Particular attention was paid to dietary habits, especially frequent fish consumption, defined as eating fish three or more times per week. At our hospital, most patients underwent abdominal ultrasonography and were further evaluated with CT when clinical findings remained unclear and ultrasound was insufficient to establish a definitive diagnosis.

The standard surgical approach for appendectomy at our hospital is laparoscopic appendectomy, with the appendiceal stump routinely managed using a Roeder knot. Abdominal drainage is not routinely performed during laparoscopic appendectomy, even in cases with peritonitis. Although drainage is not routinely used in our practice, a drain was selectively placed in Case 2 according to the surgeon's intraoperative judgment. All resected appendiceal specimens were sent for histopathological examination. Routine postoperative follow-up was scheduled approximately 1 week after surgery, with selective use of ultrasonography and blood tests when clinically indicated.

Table 1. Patient timeline

	Symptom onset duration	Hospital admission (MM/DD/YYYY)	Abdominal and pelvic CT-scan	Surgery	Discharge	Follow-up duration
Case 1	1 day	08/10/2023	Same day	Same day	Day 1	2 years
Case 2	2 days	09/28/2023	Same day	Day 1	Day 4	2 years
Case 3	2 hours	09/04/2025	Same day	Same day	Day 1	4 months

CT: Computed tomography

Table 2. Clinical characteristics, radiologic and intraoperative findings, and outcomes of appendiceal perforation caused by fish bones

	Case 1	Case 2	Case 3
Patient information			
Age (years)	31	44	32
Sex	Male	Male	Male
Symptom duration	1 day	2 days	2 hours
Symptoms			
- Abdominal pain	Right iliac fossa	Right iliac fossa	Right iliac fossa
- Other symptoms (such as fever, vomiting, diarrhea, distension)	No	No	No
Past medical history	Unremarkable	Well-controlled hypertension	Unremarkable
Past surgery	No	No	No
Frequent fish consumption	Yes	Yes	Yes
Ingesting a fish bone	No	No	No
Clinical findings			
Heart rate (bpm)	86	54	80
Blood pressure (mmHg)	110/60	130/80	130/80
Temperature (°C)	37	37	37
Abdominal tenderness	Right iliac fossa	Right iliac fossa	Right iliac fossa
Guarding	(+)	(-)	(-)
Diagnostic assessment			
White blood cell count (1,000/ μ L)	10.9	9.8	11.2
C-reactive protein (mg/L)	4	4.3	4

Table 2. Continued

	Case 1	Case 2	Case 3
Ultrasound	Appendiceal diameter: 5 mm (base) and 7 mm (tip); wall thickness 2.5 mm; gas-filled and compressible	Not performed	Appendix poorly visualized
Contrast-enhanced computed tomography of the abdomen			
- Diameter of appendix	9 mm	7-8 mm (body) and 10-11 mm (tip)	6 mm
- Appendiceal wall thickness	3 mm	2.5 mm	2 mm
- Free air	No	No	No
- Free fluid	No	No	No
- Abscess	No	No	No
- Foreign body size	19 mm in length (slender)	24 mm in length (slender)	14 mm in length (slender)
- Foreign body location	Appendiceal body	Near the appendiceal tip	Near the appendiceal tip
Therapeutic intervention			
Antibiotic	Ceftriaxone and metronidazole	Ceftriaxone and metronidazole	Cefazolin
Surgery			
- Surgical approach	Laparoscopic	Laparoscopic	Laparoscopic
- Number of trocar	3	3	3
- Foreign body	Fish bone (~20 mm)	Fish bone (~30 mm)	Fish bone (~20 mm)
- Location perforation	Appendiceal body	Near the appendiceal tip	Near the appendiceal tip
- Enteric leakage	No	No	No
- Additional perforations	No	No	No
- Surgical method	Appendectomy	Appendectomy	Appendectomy
- Appendiceal stump closure	Roeder knot	Roeder knot	Roeder knot
- Irrigation	No	Yes	No
- Drain	No	1	No
- Operative time (min)	60	35	85
Follow-up and outcomes			
Histopathology	Perforated acute appendicitis	Perforated acute appendicitis	Perforated acute appendicitis
Length of stay (days)	1	3	1
Outcomes	Complete resolution of symptoms at 1-week follow-up, with no postoperative complications during 2 years of follow-up	Complete resolution of symptoms at 1-week follow-up, with no postoperative complications during 2 years of follow-up	Complete resolution of symptoms at 1-week follow-up, with no postoperative complications during 4 months of follow-up
White blood cell count (1,000/ μ L)	Not performed	7.7 (1 week postoperatively)	Not performed
C-reactive protein (mg/L)	Not performed	4 (1 week postoperatively)	Not performed
Ultrasound	Not performed	No abnormalities detected (1 week postoperatively)	No abnormalities detected (1 week postoperatively)
Adverse events	No	No	No

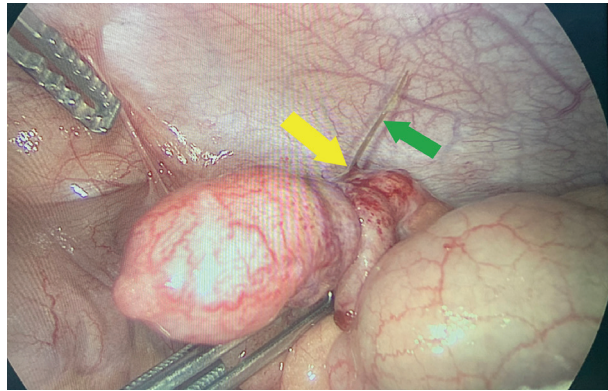


Figure 1. Laparoscopic intraoperative view in Case 1, a 31-year-old male patient, showing the appendix in the right iliac fossa, with a fish bone (green arrow) penetrating the appendiceal wall and causing perforation of the appendiceal body (yellow arrow)

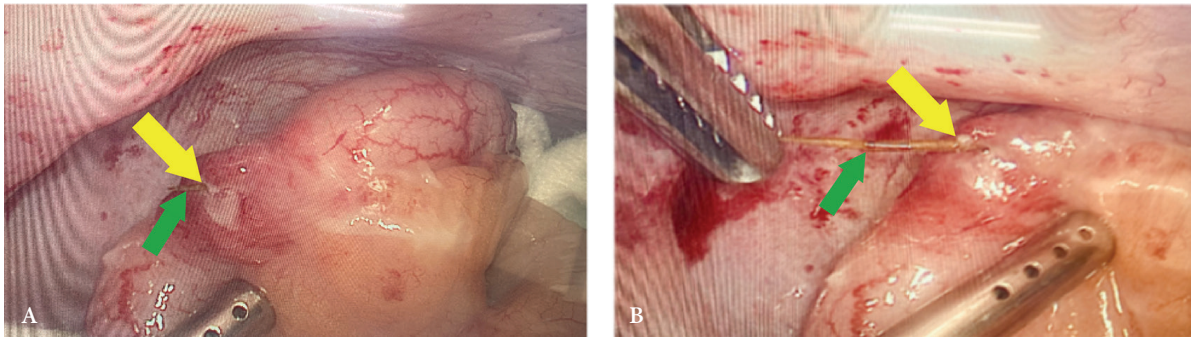


Figure 2. (A) Laparoscopic intraoperative view in Case 2, a 44-year-old male patient, showing the appendix in the right iliac fossa, with a fish bone (green arrow) penetrating the appendiceal wall and causing perforation near the appendiceal tip (yellow arrow). (B) The fish bone (green arrow) after removal from the appendix

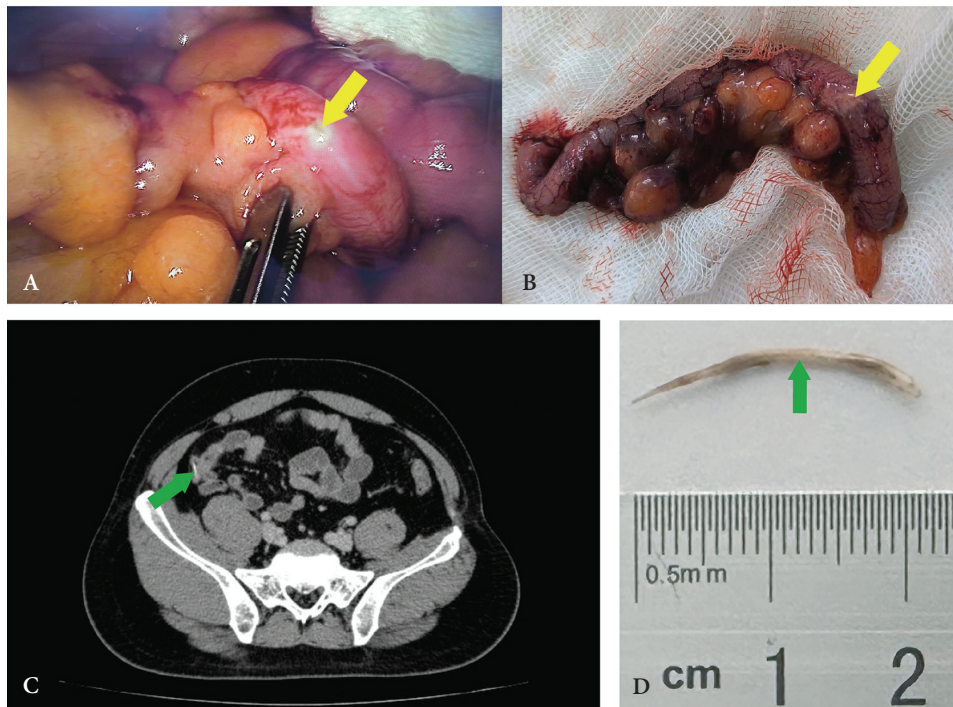


Figure 3. (A) Laparoscopic intraoperative view in Case 3, a 32-year-old male patient, showing perforation near the appendiceal tip (yellow arrow) with surrounding fibrinous exudate. (B) Gross appearance of the resected appendix following appendectomy. (C) Preoperative contrast-enhanced computed tomography demonstrating a linear, slender foreign body (green arrow) penetrating the appendiceal wall. (D) The retrieved fish bone (green arrow) after longitudinal incision of the appendix, measuring approximately 20 mm in length

In all cases, the foreign bodies measured longer after surgical removal than on CT. This discrepancy may be related to differences in the measurement method. The foreign bodies were slightly curved; after removal, their entire length could be measured directly from one end to the other. In contrast, measurements on CT imaging planes may capture only part of a curved foreign body rather than its entire length, potentially resulting in an underestimation of its actual length.

Discussion

Analysis of these three cases revealed several clinically relevant features of appendiceal perforation caused by ingested fish bones. All patients were men and aged 31-44 years, consistent with previous reports by Hoang et al.¹ and Kim et al.⁵ Nevertheless, this apparent male predominance should be interpreted cautiously because prior studies have also documented cases in older and female patients.² Clinically, all patients presented with right lower quadrant pain mimicking typical acute appendicitis, yet none had fever or marked inflammatory responses. These findings correlated with intraoperative observations demonstrating localized appendiceal perforation without diffuse peritoneal contamination. Notably, none of the patients recalled ingesting a foreign body despite frequent fish consumption, in agreement with previous studies indicating that foreign body ingestion is often unrecognized before presentation.³

A notable finding in our series was that CT successfully identified the perforating foreign body in all three cases, enabling definitive preoperative diagnosis despite inconclusive initial clinical assessment and ultrasonography. Previous imaging studies have demonstrated that CT has high diagnostic accuracy for sharp gastrointestinal foreign bodies, with a reported specificity around 93%.⁶ These findings highlight the important role of CT in patients with atypical presentations that do not fulfill classic criteria for acute appendicitis. In addition to direct visualization of the foreign body, CT also allows evaluation of associated complications such as mural injury, inflammation, abscess formation, and perforation.⁶ Once the perforating object is identified, laparoscopic appendectomy can generally be performed similarly to standard appendicitis. Nevertheless, careful history taking and thorough intraoperative exploration remain important because multiple ingested foreign bodies may occasionally occur, although no such cases were observed in our series.

All retrieved foreign bodies were fish bones, consistent with previous reports identifying bony structures as the most common perforating agents.^{7,8} A proposed mechanism involves gravitational migration of the foreign body into the appendiceal lumen combined with limited appendiceal motility, resulting in impaction, mucosal injury, inflammation, and eventual perforation.⁴ Although uncommon, other sharp foreign

bodies such as chicken bones and toothpicks have also been reported to cause appendiceal perforation.² Hu et al.³ further noted that sharp objects accounted for 55% of ingested foreign bodies associated with gastrointestinal perforation. Compared with perforations at other gastrointestinal sites, appendiceal perforation is relatively favorable because treatment can usually be limited to laparoscopic appendectomy without bowel resection or stoma formation. In our series, histopathological examination showed only acute inflammatory changes without malignancy. All patients recovered uneventfully and were discharged within 1-3 postoperative days, consistent with previous reports demonstrating favorable outcomes after laparoscopic management of foreign body-related appendiceal perforation.¹

Although appendiceal perforation caused by fish bones has previously been described in isolated case reports, this three-case series demonstrates reproducible clinical, radiologic, and intraoperative patterns across multiple patients.^{2,4} This imaging-surgical correlation reinforces the practical value of CT in identifying atypical appendiceal perforation and facilitating appropriate surgical planning.⁶ Rather than representing isolated observations, this series highlights clinically reproducible features that may improve diagnostic awareness among surgeons and radiologists evaluating atypical presentations of acute appendicitis.

Several limitations of this study should be considered when interpreting the results. The small sample size and single-center design may limit the generalizability of the findings and restrict the extent to which the results can be extrapolated to broader populations. In addition, the retrospective study design carries an inherent risk of selection and information bias due to reliance on previously recorded data. Moreover, the lack of a comparison group prevents definitive assessment of associations and limits causal inference. In addition, although CT imaging represents a central diagnostic aspect of this study, CT images were available for only one case because imaging data from the earlier cases could not be fully retrieved from the institutional archive. This limited radiologic documentation should therefore be acknowledged as a study limitation. Further large-scale, multicenter prospective studies incorporating appropriate control groups are needed to confirm the present findings.

Conclusion

Appendiceal perforation caused by ingested fish bones is an uncommon but clinically important condition. Careful history taking, particularly regarding dietary habits in populations with frequent fish consumption, remains essential, although most patients do not recall ingesting a foreign body. CT plays a pivotal role in establishing the preoperative diagnosis and should be considered when foreign body-related perforation

is suspected. Thorough intraoperative exploration is also important to exclude additional injuries or retained foreign bodies. Laparoscopic appendectomy provides a safe and effective treatment, with favorable outcomes and rapid postoperative recovery, as demonstrated in our series.

Ethics

Informed Consent: Written informed consent was obtained from all patients specifically for the publication of this case series and any accompanying images.

Footnotes

Authorship Contributions

Surgical and Medical Practices: D.Q.N., L.H.T., N.T.N., Concept: D.Q.N., L.H.T., N.T.N., Design: D.Q.N., L.H.T., N.T.N., Data Collection or Processing: D.Q.N., L.H.T., N.T.N., Analysis or Interpretation: D.Q.N., L.H.T., N.T.N., Literature Search: D.Q.N., L.H.T., N.T.N., Writing: D.Q.N., L.H.T., N.T.N.

Conflict of Interest: The authors declare that they have no conflicts of interest relevant to the content of this article.

Financial Disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or notfor-profit sectors.

Declaration Regarding the Use of AI and AI-Assisted Technologies: During manuscript preparation, ChatGPT (OpenAI) was used solely at the final proofreading stage, after the manuscript had been fully written by the authors, to identify and correct errors in English grammar, spelling,

and punctuation. The AI tool was not involved in generating, developing, or writing any part of the manuscript or its scientific content. All corrections were reviewed and approved by the authors, who take full responsibility for the final content.

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