


Duodenal perforation due to multiple foreign bodies: consideration for operative approach and surgical repair

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CASE DESCRIPTION

A young patient with developmental delay and recurrent foreign body ingestion presented to the emergency department with abdominal pain, nausea, and vomiting after reportedly ingesting unidentified foreign objects 2 days previously. The patient was afebrile and slightly tachycardic, but hemodynamically stable. Labs were notable for white blood cell count of $19 \times 10^9/L$. CT of the abdomen showed multiple foreign bodies in the duodenum and small bowel including a screw (figure 1). The patient was taken to the operating room for foreign body removal, endoscopy, and repair of any bowel injuries.

We made an upper midline laparotomy incision. In D1, there were several large palpable objects. These were milked back through the pylorus and removed via a gastrotomy on the anterior stomach wall. They were too large to safely remove by upper endoscopy. One was a plastic object with a screw inside of it. Others were folded up plastic and unidentifiable inorganic material.

We then evaluated the small bowel and remainder of the duodenum. The mid small bowel was adherent to D3/D4. We finger fractured the bowel free and identified one 2 cm hole in the outer wall of D4 (<50% of the bowel circumference). Protruding from the perforation was a full-sized toothbrush (figure 2). A second toothbrush was also extracted from this hole. The edges were ragged, but the surrounding tissue appeared healthy. After taking down the ligament of Treitz and mobilizing D3, a second subcentimeter perforation was noted on the anterior wall of D3. No additional foreign bodies or areas of perforation were noted.

WHAT WOULD YOU DO?

- Primary repair of each duodenal perforation.
- Resection of affected duodenal segment with primary duodenoduodenal anastomosis.
- Bypass of the defects via Roux-en-Y duodenojejunostomy.
- Duodenal diversion via pyloric exclusion with gastrojejunostomy.

WHAT WE DID AND WHY?

A. Primary repair of duodenal perforations. The patient had two duodenal perforations that were each <50% bowel circumference, allowing for tension-free repair without significant narrowing of the bowel lumen. Though the bowel edges were a bit edematous and hyperemic, the bowel overall appeared healthy and well perfused, and the patient

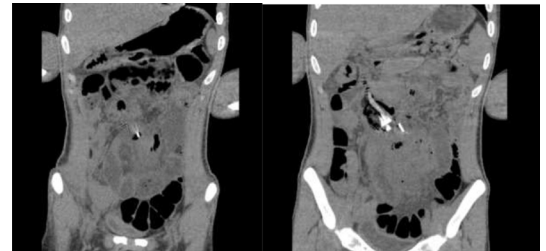


Figure 1 CT of the abdomen demonstrating multiple foreign bodies in the duodenum and proximal small bowel, with evidence of perforation.

was young and well nourished. An additional consideration was his propensity for foreign body ingestion. With future episodes of foreign body ingestion, any anastomotic connection would have been at risk of trauma, and a complex anatomic reconstruction may complicate endoscopic removal of the foreign bodies. We therefore proceeded with primary repair.

Duodenal injuries, particularly those secondary to foreign body ingestion, are rare and historically

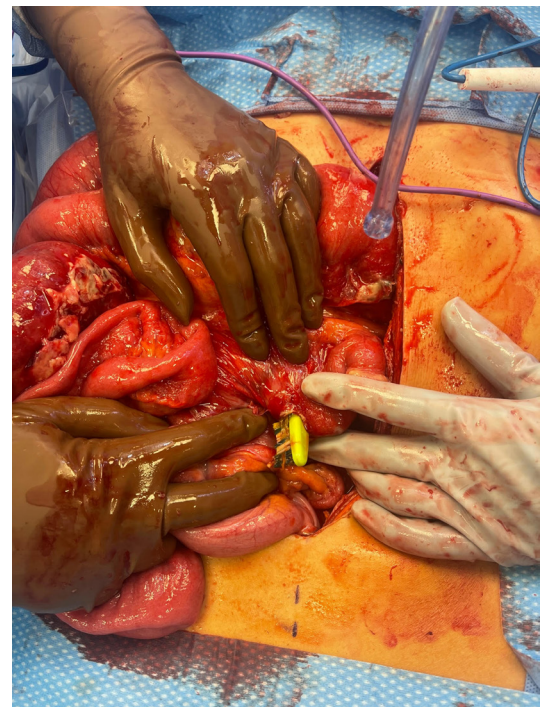


Figure 2 Intraoperative evidence of perforated D4 segment of the duodenum due to foreign body (toothbrush).

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Table 1 Summary of AAST Organ Injury Scale for the duodenum and associated WTA management recommendations

AAST organ injury scale for duodenum		
Grade	Description	WTA recommended management
I	Hematoma involving a single portion of the duodenum	▶ Initial non-operative management. ▶ If non-resolving, drainage and simple repair.
	Partial thickness laceration without perforation	▶ Simple repair.
II	Hematoma involving >1 portion of the duodenum	▶ Same as grade I hematoma.
	Laceration <50% of circumference	▶ Simple, tension-free repair, preferably transverse. ▶ If A not possible, see grade III.
III	Laceration 50–75% of circumference of D2 or 75–100% of circumference of D1/D3/D4	A. Simple, tension-free repair, preferably transverse B. If A is not possible or significant, contamination/delayed management: duodenoduodenostomy. C. If neither A nor B is possible and injury is distal to ampulla: perform Roux-en-Y duodenojejunostomy over injury. D. If neither A nor B is possible and injury is proximal to ampulla: close distal duodenum and perform Roux-en-Y duodenojejunostomy to the proximal end or antrectomy with gastrojejunostomy (Billroth II).
IV	Laceration >75% of circumference	▶ Same as grade III.
	Laceration >75% of circumference, involving ampulla or distal CBD	▶ Complex reconstruction with Roux-en-Y limb or pancreaticoduodenectomy.
V	Massive destruction of duodenopancreatic complex or duodenal devascularization	▶ Complex reconstruction with Roux-en-Y limb or pancreaticoduodenectomy.

Adapted from Malhotra *et al.*²
AAST, American Association for the Surgery of Trauma; CBD, common bile duct; WTA, Western Trauma Association.

associated with high mortality. A plethora of surgical procedures with varying complexities have been described for the management of duodenal injury, and in general, the severity of injury, mechanism, timing of presentation, and presence of any associated injury dictate the operative technique. However, the optimal surgical management of duodenal injury remains controversial.¹

Diversion-based techniques such as duodenal diverticulization, pyloric exclusion with gastrojejunostomy, and tube duodenostomies have been historically described as effective approaches to high-grade duodenal injury. These techniques are based on concern that the enzymatic fluid within the duodenal lumen may predispose to the breakdown of duodenal repairs and increase rates of fistula formation. However, the need for diversion has been questioned in recent literature and there are no definitive data that support the use of diversion.²

Instead, clinical practice has shifted toward simpler surgical approaches for the repair of duodenal injury. Some reports claim that 70% to 85% of all duodenal injuries can safely undergo primary repair³ and that less invasive procedures for duodenal injury may be associated with comparable or improved mortality and duodenal-related morbidity when compared with more complex reconstructions.¹ Accordingly, current guidelines recommend simple, tension-free repair as optimal management of even higher-grade duodenal lacerations (table 1).^{2,4}

When tension-free primary repair is not possible, segmental resection and primary duodenoduodenostomy may be performed. Duodenal diversion techniques such as pyloric exclusion with and without gastrojejunostomy may be considered in high-grade injuries; however, definitive indications remain controversial as these procedures are associated with increased operative time, length of stay, and complications without an improvement in morbidity or mortality. Rarely, severe duodenal injuries may require complex reconstruction such as antrectomy and gastrojejunostomy with closure of the duodenum, Roux-en-Y duodenojejunostomy, or pancreaticoduodenectomy.

In conclusion, duodenal injuries secondary to foreign body ingestion are rare, but principles of repair are similar to those employed in the management of duodenal trauma. When feasible, primary repair of duodenal injuries is favored over more complex repair techniques.

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