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Title page

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Avoiding unnecessary bowel resection in adult intussusception: A case report in a patient with multiple prior surgeries utilizing intraoperative enteroscopy

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Abstract

Intussusception is a rare condition in adults, accounting for approximately 5% of all cases. Unlike pediatric intussusception, which is typically idiopathic, adult cases are usually associated with an underlying pathology, most commonly malignancies. Surgical intervention is often required, but in small bowel cases, where malignancy is less frequent than in colonic intussusception, the decision regarding resection requires careful consideration. There are no prior reports on the use of intraoperative enteroscopy for small bowel intussusception evaluation. We report the case of a 78-year-old woman who presented with acute abdominal pain, nausea, and bilious vomiting. She had a history of distal gastrectomy with gastroduodenostomy (Billroth-I) and total gastrectomy with Roux-en-Y for gastric ulcer and residual stomach cancer, respectively. Abdominal computed tomography (CT) revealed small bowel intussusception without clear evidence of a lead point lesion. Emergency laparotomy confirmed intussusception 15 cm distal to the Roux-en-Y anastomosis, which was manually reduced. Intraoperative enteroscopy revealed inflammatory changes but no malignancy or structural abnormalities. Given the absence of a lead point lesion and the viability of the bowel, resection was avoided. The patient had an uneventful postoperative course and was discharged without complications. Adult intussusception is frequently associated with malignancy, yet cases without a lead point lesion pose a diagnostic and therapeutic challenge. Surgical history, including prior anastomotic procedures, may contribute to the pathogenesis through disrupted intestinal pacemaker activity and retrograde contractions. While second-look surgery can aid in bowel viability assessment, it carries a high complication rate. This case highlights the potential role of intraoperative enteroscopy in evaluating small

47 bowel viability, minimizing unnecessary resection, and improving surgical decision-making. Although
48 further studies are needed to assess its role in optimizing surgical outcomes, intraoperative enteroscopy may
49 be a valuable adjunct in cases of adult small bowel intussusception without an apparent lead point.

50

51 **Key words:**

52 Idiopathic intussusception, adult, small bowel, intraoperative enteroscopy

53

54 **Abbreviations:**

55 CT, computed tomography; POD, postoperative day; WBC, white blood cell; CRP, C-reactive protein; bpm,

56 beats per minute.

57

Text

Introduction:

Only approximately 5% of intussusception cases occur in adults, making it significantly rarer in this population compared to children ¹. Unlike pediatric intussusception, which is often idiopathic, adult intussusception is frequently associated with a malignant lesion ². Other reported causes include benign polyps, Meckel's diverticulum, and inflammatory diseases ³. However, the exact cause of intussusception in adults without a lead point lesion remains unclear. Surgical resection is considered the most effective treatment for adult intussusception. However, in cases involving the small intestine, where malignancy is less common than in the large bowel, careful consideration is necessary to preserve bowel length. Surgeons often face challenges in deciding whether small bowel resection is warranted. Notably, there are no previous reports on the use of intraoperative enteroscopy to assess small bowel conditions.

Case report:

A 78-year-old woman was referred to our department by her primary care physician due to worsening upper abdominal pain. The pain had started eight hours before her arrival at our hospital, accompanied by nausea and multiple episodes of bilious vomiting. Her medical history included a gastric ulcer, for which she had undergone distal gastrectomy with gastroduodenostomy (Billroth-I) at the age of 29. Two years ago, she was diagnosed with residual stomach cancer and underwent residual gastrectomy and Roux-en-Y reconstruction.

77 She had also been taking 4 mg/day of steroids for four years due to polymyalgia rheumatica. The patient was
78 fully independent in her daily activities. On examination, tenderness was most pronounced in the upper
79 abdomen, with a palpable bulge in the right lower quadrant. There was a midline abdominal incision, but no
80 hernias or stomas. Her vital signs were stable, with the saturation of 100% on room air, the blood pressure
81 of 133/73 mmHg, the temperature of 36.6°C, and the heart rate of 73 bpm. The blood tests showed no
82 elevated inflammatory markers, with the WBC count of $7.3 \times 10^4/\mu\text{L}$ and the CRP level of 0.02 mg/dL (Table
83 1). Given her history of distal gastrectomy and Roux-en-Y reconstruction, we suspected strangulated or
84 adhesive intestinal obstruction. An urgent abdominal and pelvic computed tomography (CT) scan was
85 performed, revealing a double-lumen appearance of the small bowel in the pelvis, suggestive of small bowel
86 intussusception (Fig. 1). There was upstream bowel dilatation and the small amount of free fluid, but no free
87 air, and the intestinal blood flow appeared preserved. The patient was scheduled for emergency laparotomy.
88 The laparotomy was performed using the previous midline incision. Small amount of serous ascites was
89 noted, along with small bowel dilatation from the jejunal limb to the Roux-en-Y reconstruction. The segment
90 of small bowel, 15 cm distal to the Roux-en-Y anastomosis, was intussuscepted (Fig. 2a). The distal bowel
91 segment had telescoped approximately 10 cm into the proximal segment (Fig. 2b). The intussusception was
92 manually reduced using the Hutchinson procedure, and no masses were identified as the cause. The bowel
93 appeared viable, with normal coloration and peristalsis (Fig. 2c). To further evaluate the condition of the
94 bowel, we consulted a gastroenterologist and performed intraoperative enteroscopy. Enteroscopic
95 examination revealed only inflammatory changes without evidence of a mass or malignancy. In addition, we

confirmed adequate intestinal blood flow (Fig. 3). Based on these findings, enterotomy was deemed unnecessary, and only a jejunal biopsy was performed. It is well established that even in healthy individuals, the intestine periodically generates retrograde peristalsis to slow the transit of luminal contents. In patients who have undergone total gastrectomy, rapid entry of ingested food into the jejunum may occur, potentially contributing to abnormal intestinal motility. Experimental studies in canine models have demonstrated that, over time following surgery, electrical activity in the afferent and Roux limbs occurs independently, without coordinated propagation across the jejunojejunostomy. In the present case, it is plausible that impaired coordination of peristalsis near the anastomotic site contributed to the development of intussusception.

Furthermore, idiopathic small bowel intussusception in adults has been associated with *Anisakis* infection. In this context, intraoperative enteroscopy was effective in ruling out parasitic involvement. This case was classified as idiopathic intussusception without a discernible lead point. Although bowel resection was considered for recurrence prevention, the location of the lesion near the anastomosis rendered surgical intervention technically challenging. To establish optimal strategies for preventing recurrence in idiopathic intussusception, particularly in cases without lead points, further accumulation of clinical cases is warranted. The patient's postoperative course was uneventful. She tolerated clear fluids on postoperative day (POD) 1, advanced to a low-residue diet by POD 4, and resumed a normal diet shortly thereafter. She was discharged on POD 12 without complications. At a follow-up visit two weeks later, she reported normal bowel function, and no postoperative recurrence was observed. Pathological examination of the biopsy specimen revealed inflamed mucosa without evidence of malignancy. Stool and peritoneal fluid cultures showed no significant

findings.

Discussion

Intussusception occurs when a proximal segment of the gastrointestinal tract telescopes into a distal segment ⁴. While intussusception can occur at any age, the sex distribution in adults is equal ⁵. In pediatric cases, approximately 90% of intussusceptions are idiopathic ⁶. In contrast, in adults, approximately 90% of cases have an identifiable underlying cause, with tumors—both benign and malignant—being the most common etiology, with malignancy being more common in colonic intussusception ⁷. In cases of small bowel intussusception, both benign conditions (e.g., Meckel's diverticulum, lipomas, hemangiomas, Crohn's disease) and malignant conditions (e.g., adenocarcinomas, melanoma, malignant fibrous histiocytoma, malignant lymphoma) can serve as lead points ⁸. Additionally, previous studies have suggested that surgical history, including anastomotic sites and adhesions, may contribute to the development of intussusception. Tu et al. proposed that jejunal transection during limb construction disrupts the natural pacemaker activity of the small intestine, which originates in the duodenum, leading to ectopic pacemakers in the limb and retrograde contractions ⁹. In the present case, the patient's history of Billroth-I and Roux-en-Y surgeries likely contributed to retrograde contractions, which may have played a role in the development of intussusception.

The decision of whether to perform bowel resection for intussusception or incarcerated hernia poses a significant challenge for surgeons. The bowel resection is associated with increased post-operative

complications and longer hospital stays compared to manual reduction ¹⁰. The need of bowel resection is high, with one study reporting 77% of cases requiring resection due to gangrene ¹¹. Since idiopathic intussusception in adults is rare, determining precise risk factors for bowel resection remains challenging, however, in pediatric cases, the reported predictors of resection include anemia, palpable abdominal mass, and bilious vomiting ¹²⁻¹⁴. This case met all three risk factors and, additionally, had a history of long-term steroid use and multiple abdominal surgeries, warranting careful consideration of the necessity for bowel resection. In cases where the necessity of intestinal resection is uncertain, a second-look surgery may be performed. This procedure involves re-evaluating the intestine 24 to 72 hours after the initial operation to assess its viability ¹⁵, and it has been shown to improve outcomes in acute mesenteric ischemia ¹⁶. However, the optimal timing for a second-look procedure remains unclear, particularly in patients with anastomotic sites. Moreover, the procedure has been associated with high complication (42.8%) and mortality (57.1%) rates in some studies ¹⁵. Furthermore, reports exist of cases in which the gastrointestinal tract appeared normal during surgery, yet mucosal necrosis was present ¹⁷. Consequently, enteroscopic examination is recommended for a more accurate assessment of intestinal viability.

In most adult cases of intussusception, an underlying pathological cause is identified, necessitating surgical intervention ². The surgical approach and the decision regarding resection should be guided by the patient's clinical condition and the viability of the bowel. However, unnecessary resection should be avoided whenever possible. Wang et al. suggested that intraoperative colonoscopy may help differentiate benign from malignant lesions before attempting reduction in cases of colonic intussusception ¹⁸. To our knowledge, no

prior reports have described the use of intraoperative enteroscopy for surgical decision-making in cases of idiopathic small bowel intussusception in adults. In this case, the patient previously underwent total gastrectomy, and the intussusception occurred near the Roux-en-Y anastomosis, necessitating a strategy to avoid bowel resection whenever possible. Intraoperative enteroscopy allowed direct visualization of the mucosa, confirming its viability and enabling a confident decision to preserve the bowel. Given the complexity of managing complications near the Roux-en-Y reconstruction in post-gastrectomy patients, collaboration with gastroenterologists for intraoperative enteroscopic assessment may enhance surgical outcomes and optimize patient care. This technique may provide valuable intraoperative information and warrants further investigation. We present a rare case of adult idiopathic intussusception successfully managed without bowel resection using intraoperative enteroscopy. This case highlights the importance of thorough intraoperative evaluation, including enteroscopy, to minimize unnecessary bowel resection and optimize patient outcomes. However, it should be noted that intraoperative enteroscopy is feasible only in patients who have undergone total gastrectomy and in whom the intussusception is located in the upper small intestine. In standard cases, such as those involving the distal small bowel, this approach may not be applicable. This limitation should be taken into account when considering the generalizability of this technique.

Disclosures

172 **Conflict of interest:** The authors declare that they have no conflicts of interest.

173

174 **Ethics approval and consent to participate:** Written informed consent was obtained from the patient for
175 the publication of this case report and the accompanying images. Ethical approval was not required for this
176 study as per local or national guidelines. All procedures performed in studies involving human participants
177 were in accordance with the ethical standards of the institutional and national research committee and with
178 the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

179

180 **Informed consent:** Informed consent was obtained from the patient.

181

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Figure legends:

Fig. 1 Contrast-enhanced CT findings

Axial abdominal CT with contrast showing small bowel intussusception with a characteristic ‘target sign’ (yellow arrowhead), situated just distal to the Roux-en-Y anastomosis.

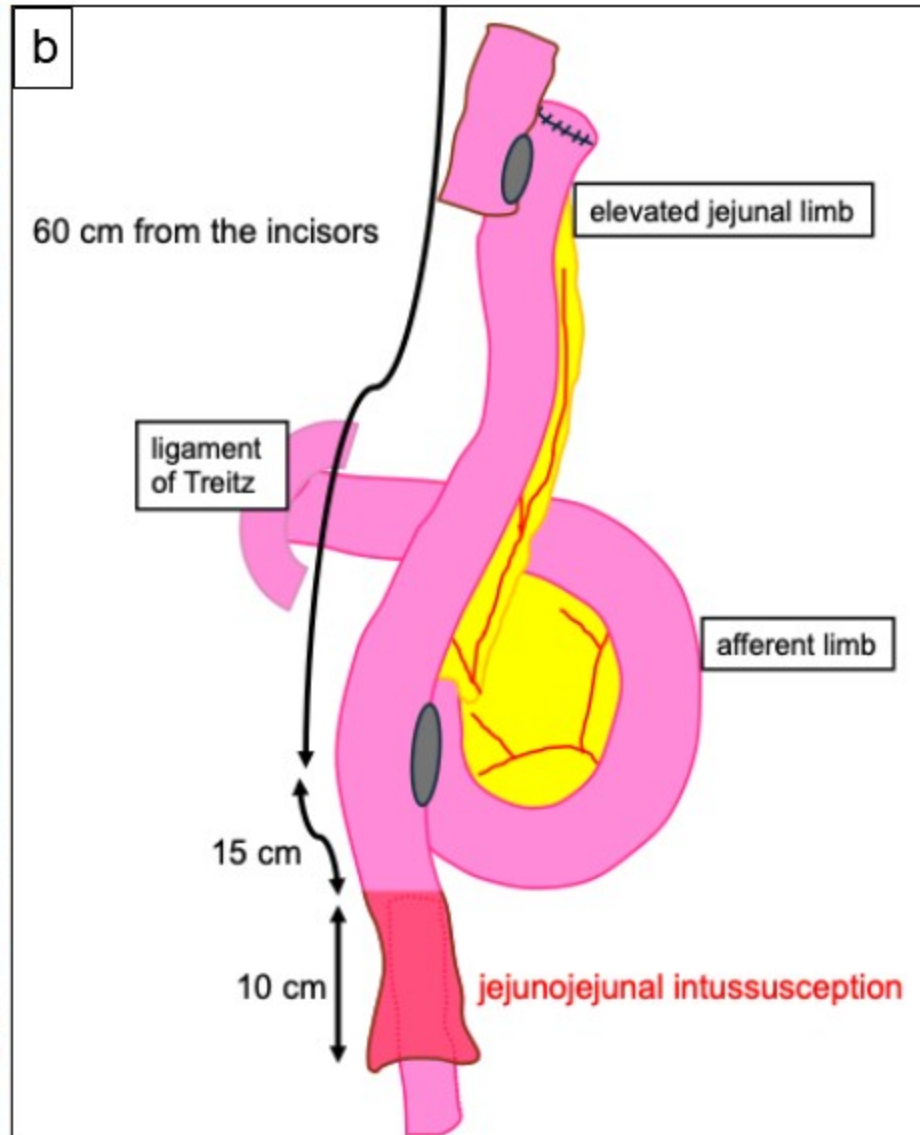
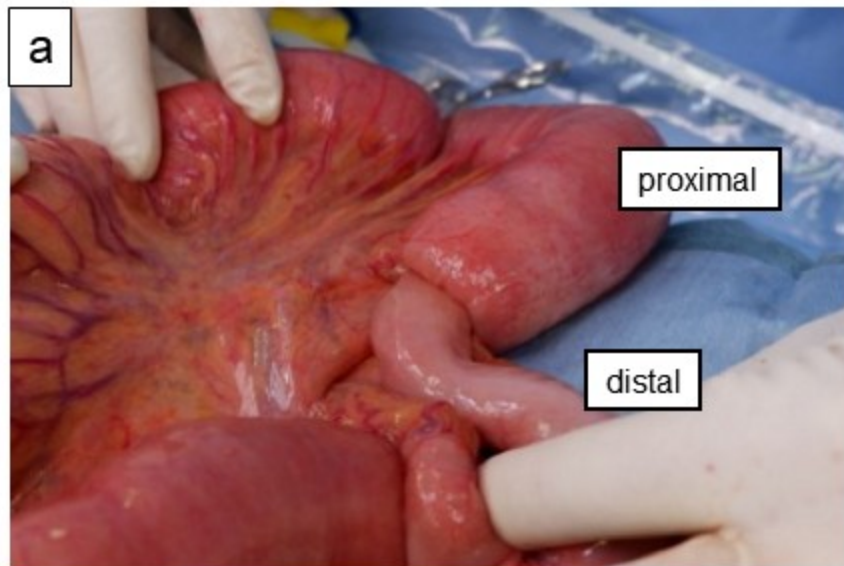
Fig. 2 Intraoperative external appearance of the incarcerated small intestine

- (a) The distal bowel segment had telescoped into the proximal segment.
 - (b) Schematic representation of the previously performed surgery and the anatomical location of the current small bowel intussusception.
 - (c) After releasing intussusception. Adequate blood perfusion and intestinal peristalsis were maintained.
- The segment between the yellow arrowheads corresponds to the previously incarcerated small bowel, which was later confirmed by enteroscopy.

Fig. 3 Intraoperative enteroscopic findings.

Multiple circumferential erosions with bleeding and superficial ulcers were observed over approximately 10 cm of the jejunum. The correspondence between the ulcerated area and the previously incarcerated segment of small bowel was confirmed by the transmission of enteroscopic light. It was also confirmed that the jejunal segment distal to the ulcerated area remained intact.







Complete blood count		Biochemical blood test	
WBC	7.3×10^4 / μ L	Total protein	6.2 g/dL
Hemoglobin	11.3 g/dL	Albumin	3.6 g/dL
Platelet	22.8×10^4 / μ L	Total bilirubin	0.6 mg/dL
Prothormbin time	12.8 second	Direct bilirubin	0.2 mg/dL
Activated partial thromboplastin time	30.3 second	Asparatate aminotransferase	20 U/L
		Alanine aminotransferase	15 U/L
		Alkaline phosphatase	69 U/L
		Amylase	80 U/L
		Blood urea nitrogen	17.1 mg/dL
		Creatinine	0.6 mg/dL
		Sodium	141 mEq/L
		Potassium	4.2 mEq/L
		C-reactive protein	0.02 mg/dL