REVIEW ARTICLE

Evaluation and management of small-bowel tumors in the era of deep enteroscopy

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Tumors of the small bowel are a rare entity within the GI tract and can be difficult to diagnose and treat. They account for approximately 3% to 6% of all GI neoplasms and 1% to 3% of all GI malignancies. There are 5300 new cases annually, with an estimated 1100 deaths in the United States per year.[1] Carcinoid tumors and adenocarcinoma are the most common primary tumors of the small bowel, with an annual incidence of 3.8 and 3.7 cases per million people, respectively, in the United States.[2] These numbers, however, most likely underestimate the actual incidence because most of the literature was written before the introduction of small-bowel enteroscopy.

Previously, gastroenterologists were stymied in their ability to identify small-bowel tumors because of the limited tools available. Push enteroscopy and barium radiologic imaging were of limited value in evaluating the entire small bowel. Now, with the development of video capsule endoscopy, as well as deep enteroscopy, that is, balloon-assisted enteroscopy and spiral enteroscopy (SE), the reported incidence of small-bowel tumors has increased. This was reflected in a 2012 Korean study[3] in which the incidence of small-bowel tumors evaluated by capsule endoscopy (CE) had risen to 4.3%; another study[4] identified small-bowel tumors in 8.9% of patients. These studies suggest that the incidence of small-bowel tumors may be higher than previously thought.

In this review, we discuss the evaluation and management of small-bowel tumors after the advent of CE and deep enteroscopy in evaluation of these disorders.

Abbreviations: CE, capsule endoscopy; DBE, double-balloon enteroscopy; MR, magnetic resonance; SBE, single-balloon enteroscopy; SE, spiral enteroscopy; SPICE, smooth protruding index on capsule endoscopy.

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See CME section: p. 821.

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CLINICAL PRESENTATION OF PATIENTS WITH SMALL-BOWEL TUMORS

The clinical manifestation of small-bowel tumors, unfortunately, tends to be very nonspecific; patients may present with abdominal pain, nausea, and/or distension. Neuroendocrine tumors can present with diarrhea, flushing, and wheezing. This can delay the diagnosis, especially in the early stages, because symptoms may be attributed to other benign GI diseases (ie, functional GI disorders).[5-8] Because the clinical symptoms are nonspecific, a high index of suspicion is needed to diagnose the underlying tumor. In late stages, patients commonly present with iron deficiency anemia, GI bleeding, or obstructive symptoms. Small-bowel tumors have been discovered in 6% of patients with obscure GI bleeding.[9-13] Unfortunately, when overt symptoms are present, there may be local invasion or metastases of the tumor, portending a poor prognosis.[3]

EVALUATION OF SMALL-BOWEL TUMORS BEFORE DEEP ENTEROSCOPY

Before the advent of deep enteroscopy, there was a significant lag time from the initial symptoms until the final diagnosis, with a mean delay of 3 years for benign tumors and 18 months for malignant tumors.[14,15] The diagnosis often was made with a combination of findings from imaging studies, laboratory and endoscopic tests, and surgery. The diagnostic tools included barium small-bowel follow-through, abdominal-pelvic CT scans, push enteroscopy, ileocolonoscopy, and intraoperative enteroscopy.

TABLE 1. Summary of methods for evaluation of small-bowel tumors

Endoscopic evaluations of small-bowel tumors	Advantages	Disadvantages
Push enteroscopy	Commonly available No additional training necessary	Not able to reach or detect lesions beyond proximal jejunum
Intraoperative enteroscopy	High diagnostic yield for obscure GI bleeding	Invasive with adverse events Less-invasive modalities available
Video capsule endoscopy	Safe, noninvasive evaluation Determine extent of tumor involvement	Capsule retention in subset of patients (Crohn's disease) Can miss lesions Quality of examination determined by adequacy of small-bowel preparation False-positive findings
CT enterography	Detection of hypervascular small-bowel masses Allows extraluminal visualization Identifying metastatic lesions for staging purposes	Incomplete bowel distension can limit the study Ionizing radiation exposure
MR enterography	Same as CT enterography Limited radiation exposure	Costs Not widely available Claustrophobic patients may not comply Contraindicated in patients with metal devices such as pacemakers
CT enteroclysis	Same as CT enterography Allows distension of small bowel due to nasojejunal tube	Ionizing radiation exposure Patient discomfort due to placement of nasojejunal tube
MR enteroclysis	Same as CT enteroclysis Limited radiation exposure	Costs Not widely available Claustrophobic patients may not comply Patient discomfort due to placement of nasojejunal tube Contraindicated in patients with metal devices such as pacemakers
DBE	Both diagnostic and therapeutic Higher rate of total enteroscopy than other deep-enteroscopy modalities	Invasive and time consuming Not widely available at all centers Therapeutic interventions with adverse events (10%) Additional training may be necessary Unable to perform in patients with latex allergy (currently)
SBE	Same as double-balloon enteroscopy Able to perform in patients with latex allergy (currently)	Same as double-balloon enteroscopy Total enteroscopy rate not as high as with DBE Additional training may be necessary
Spiral enteroscopy	Same as double-balloon and single-balloon enteroscopy Early studies suggest lower adverse event rate	Same as single-balloon enteroscopy, including lower rate of total enteroscopy Additional training may be necessary

MR, Magnetic resonance; *DBE,* double-balloon enteroscopy; *SBE,* single-balloon enteroscopy.

Push enteroscopy

One of the older methods gastroenterologists use to evaluate for small-bowel tumors is push enteroscopy. Push enteroscopy can reach and detect lesions located in the proximal jejunum but typically not beyond an average depth of 80 to 120 cm.[16-19] The diagnostic yield of push enteroscopy for small-bowel tumors is 5% to 6% in patients presenting with obscure GI bleeding and positive radiologic findings.[20] This technique is limited by the inability to advance the enteroscope beyond the proximal small bowel because of looping and the enteroscope extent (Table 1).

Both human and animal studies comparing push enteroscopy to capsule endoscopy have shown that CE is superior in diagnosing small-bowel lesions.[21-27] A meta-analysis of 14 studies found that CE had an incremental yield of 35% over