Imaging and Screening of Cancer of the Small Bowel

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KEYWORDS

• Small bowel • Cancer • Screening • Surveillance • CT • MR

KEY POINTS

- Although population-based screening of asymptomatic patients for small bowel cancers is ineffective, targeted screening/surveillance strategies can be used in specific at-risk and symptomatic patient groups.
- Computed tomography (CT) and magnetic resonance (MR) enterography are currently the dominant radiologic techniques to detect small bowel cancers and are used in conjunction with push enteroscopy, capsule endoscopy, and balloon-assisted endoscopy.
- Radiologic screening/surveillance of small bowel adenocarcinoma can be applied to at-risk hereditary conditions as supplementary tools to endoscopy (upper, lower, push, capsule), tailored to the individual patient, and is relatively well established for Peutz-Jeghers syndrome.
- CT and MR enterography are often performed in patients with celiac disease after a gluten-free diet fails to evaluate for refractory celiac and to exclude enteropathy-associated T-cell lymphoma.
- Suspicion of small bowel bleeding in patients at increased risk for small bowel gastrointestinal stromal tumors (GISTs), such as familial GIST and neurofibromatosis type 1, should prompt referral to CT or MR enterography.

INTRODUCTION

Small bowel cancers are very rare despite the length and large mucosal surface of the small bowel and account for 3% to 6% of all gastrointestinal (GI) tract malignancies.[1] Adenocarcinoma, neuroendocrine neoplasms, lymphoma, and GI stromal tumors (GISTs) are the most prevalent primary small bowel cancers, with adenocarcinoma and neuroendocrine neoplasms accounting for nearly two-thirds of small bowel cancers.[1–7] According to the most recent US statistics, small bowel cancer is 24th in terms of incidence with an estimated 10,000 new patients a year.[7] Small bowel cancers are known to have bad prognosis and most patients already have advanced stages of disease at the time of initial diagnosis.[4,8,9] Delayed diagnosis of small bowel cancers is a real concern and is one of the main reasons for the lack of meaningful improvements in the oncologic outcomes of patients with small bowel cancer despite the overall advances in medicine.[4,8,9] Delayed diagnoses of small bowel cancer are associated with various factors,

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including the low incidence of the disease, difficult endoscopic access, lack of mucosal mass or abnormality, subtle radiologic features, and low index of clinical suspicion. As small bowel cancers are rare and their causes are largely unknown, routine population-based screening of asymptomatic patients to find precursor lesions or early cancers is ineffective and does not exist. However, targeted screening/surveillance strategies are used in specific at-risk and symptomatic patient populations using a wide variety of radiologic and endoscopic modalities. This article reviews issues regarding early diagnosis of small bowel cancers, with focus on state-of-the-art cross-sectional imaging techniques and their role in diagnosis and staging in the era of capsule endoscopy and balloon-assisted endoscopy, the primary endoscopic methods of small bowel visualization.

POTENTIAL IMAGING TESTS FOR SMALL BOWEL CANCERS

Barium fluoroscopy, including small bowel follow-through and barium enteroclysis, and cross-sectional imaging techniques, including computed tomography (CT) and magnetic resonance (MR) enterography (single or multiphase) and CT and MR enteroclysis, can be used to radiologically diagnose small bowel neoplasms; their performance and acquisition has been extensively described. Of these, CT and MR enterography are currently the dominant techniques. Barium fluoroscopy has a limited role in small bowel surveillance. Compared with barium fluoroscopy, CT and MR also have an advantage of multi-planar imaging with lack of superimposition and ability to evaluate the mesentery. Enteroclysis may cause substantial patient discomfort as it requires small bowel intubation, although it permits improved fluid distention of the bowel compared with per-oral administration of luminal contrast. Scan techniques for CT and MR enterography are well established and described elsewhere.[10–14] Regarding CT enterography, unlike the examination for inflammatory bowel diseases for which a single enteric-phase imaging to limit radiation exposure after an oral administration of neutral enteric contrast is the general standard,[13] CT enterography for small bowel cancers must be adjusted more to the specific individual indications, for example, multiphase (arterial, enteric, portal, or delayed phases) scans for a better characterization of the tumors or in case of suspected small bowel bleeding[10,11]; an omission of enteric contrast in case of overt bleeding for a speedy diagnosis[12]; and use of positive contrast in lieu of neutral contrast, when polyps and mucosal masses are the imaging target, to display filling defects similar to small bowel follow-through. MR enterography scan techniques are more homogeneous across different indications as they consist of similarly comprehensive sets of all potentially useful sequences,[14] which is because, unlike CT, multiple image acquisitions are not worrisome because MR does not incur radiation exposure.

A recent prospective study investigated the accuracy of MR enterography for detecting various small bowel neoplasms and reported fairly high per-patient sensitivity and specificity of 96%,[15] which were comparable with the published results obtained with MR enteroclysis[16,17] and CT enteroclysis[18] in the same clinical setting. There is a paucity of data regarding the direct comparison between CT enterography and MR enterography for the diagnosis of small bowel neoplasms. According to a recent prospective study comparing CT enterography and MR enterography for the detection of small bowel neoplasms, MR enterography demonstrated a higher accuracy compared with CT enterography.[19]

Push enteroscopy or extended upper endoscopy examines the entire duodenum and very proximal jejunum (depth of 80–120 cm).[20] This procedure is limited mainly by the extent of the examination; it is tolerated well by patients and can be performed with a pediatric colonoscope. Capsule endoscopy has been shown to be superior in detecting small bowel lesions in human and animal studies.[21,22] However, if a lesion is known to be in the reach of push enteroscopy, it can be used to obtain tissue.

Capsule endoscopy is a safe and minimally invasive modality for visualizing the entire small bowel. It is typically well tolerated by patients. The limitations of the procedure include diagnostic procedure (no therapeutic ability), potential of missing a lesion, decreased visualization if fluid or bubbles are retained in the lumen, false-positive findings, and capsule retention if stricture or significant inflammation present. Capsule endoscopy is well established as a procedure to assess for the cause of small bowel bleeding and is considered a first-line procedure for suspected small bowel bleeding.[23] There are mixed results for capsule endoscopy in the detection of small bowel tumors. In small retrospective and prospective single-center studies, CT enterography was shown to be superior to capsule endoscopy in the detection of small bowel tumors.[10,24] However,