

Gastrointestinal lymphoma: a spectrum of fluoroscopic and CT findings

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ABSTRACT

Gastrointestinal lymphomas can occur in nodular, polypoid, cavitory, ulcerative or diffuse infiltrating (submucosal) forms. Barium studies and computed tomography (CT) are the most popular imaging techniques used to diagnose these lymphomas. Barium studies are superior to CT in evaluating mild mucosal and submucosal changes. However, CT is the technique of choice because it provides a complete evaluation of the extent of disease dissemination, recent disease development, therapeutic response, and related complications.

Key words: • gastrointestinal tract • lymphoma • diagnostic imaging • tomography, spiral computed • fluoroscopy

Primarily gastrointestinal (GI) tract lymphomas account for approximately 0.9% of all GI tract tumors (1). The GI tract is more commonly involved secondarily in patients with generalized lymphomas because of the frequent origination of lymphomas in the mesenteric and retroperitoneal lymph nodes (2). Primary GI tract lymphoma has been defined by Dawson et al. (3) as follows: a) the GI tract is predominantly associated with lymph node involvement confined to the drainage area of the primary tumor site; b) there is no hepatic or splenic involvement or palpable lymph nodes; c) chest radiography findings are normal; and d) the peripheral white blood cell count is normal.

The GI tract is the most common extranodal location for non-Hodgkin's lymphoma (NHL) and accounts for up to 20% of cases of NHL (2). The primary sites of origin in decreasing order of frequency include the stomach (50–70%), small bowel (20–35%), colon (especially the cecum) (5–10%), and esophagus (<1%) (3, 4). Primary involvement of the gastrointestinal tract is extremely rare in Hodgkin's lymphoma (HL), with only isolated cases reported in the literature (5–11).

Although there is no characteristic appearance, familiarity with the radiological features of GI tract lymphoma can help to ensure a correct diagnosis and proper management. Barium studies and computed tomography (CT) are the most popular imaging techniques for gastrointestinal lymphoma (2). In this study, we reviewed the fluoroscopic and CT findings of GI tract HL and NHL and the advantages and limitations of imaging techniques, and we provided differential diagnostic criteria for gastrointestinal lymphomas.

Esophagus

Primary lymphoma of the esophagus is a rare condition, with only a few cases of HL or NHL reported in the literature (5, 6, 12–15). Primary esophageal lymphomas are predominantly of the B-cell type, whereas some recent reports have coined the diagnostic term “mucosa-associated lymphoid tissue” (MALT) lymphomas (1, 16). Esophageal lymphomas most frequently occur secondarily to cervical and mediastinal lymph node invasion or a contiguous spread from gastric lymphomas (1, 2).

NHL most commonly involves the distal esophagus, whereas upper and middle esophageal involvement is more common in HL (7, 17). Endoscopic and radiologic findings are not specific. The predominant appearance is a submucosal infiltration, but polypoid or ulcerated masses (Fig. 1) resembling carcinomas, diffuse thickening and varicoid submucosal folds that mimic varicose veins may be encountered (1, 2). Localized submucosal or diffuse nodules resembling leiomyomas and distal strictures simulating achalasia or tracheoesophageal fistulas may be seen (5, 13, 14). Aneurysmatic dilatations similar to those observed in the small bowel and colon are also among the reported findings (15).

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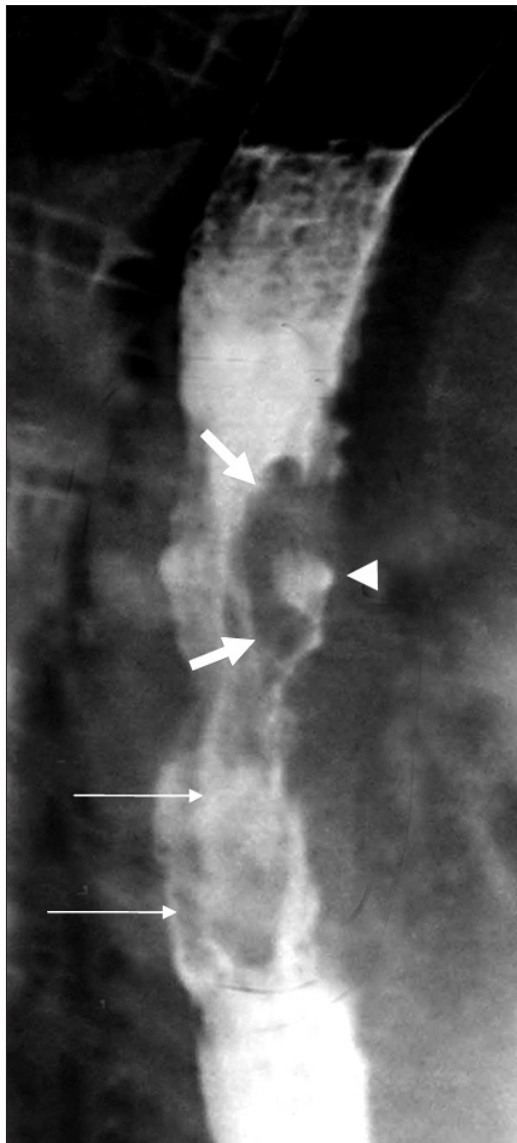


Figure 1. B-cell-type non-Hodgkin's lymphoma of the esophagus in a 67-year-old woman who presented with dysphagia that manifested with consuming solids. A magnified frontal view of the barium esophagogram shows a polypoid lesion (large arrows) with a central ulceration (arrowhead) and a nodular thickening of the folds (long arrows) in the middle esophagus.

cosal infiltration (1, 2). However, some HLs and NHLs cause a linitis plastica appearance that mimics primary sclerosing carcinoma (25, 26).

Ulcerative lymphomas are characterized by single or multiple ulcers of varying size. The contours of the ulcers are usually irregular, and they occasionally mimic benign ulcers (2). Polypoid gastric carcinomas are characterized by one or more lobulated intraluminal masses (2) that are hard to differentiate from polypoid carcinomas (Fig. 3).

Plenty of submucosal nodules or masses can be seen in the stomach. The masses range from a few millimeters to several centimeters in size. They are frequently ulcerated and form a bull's-eye or target appearance on barium studies (Fig. 4) (2). It is difficult to visualize these nodules on CT. Endoscopic ultrasonography (EUS), with an accuracy of 90%, is the best diagnostic method for these lesions (27). Gastric lymphoma may spread to the esophagus via the cardia and duodenum (10%) and pylorus (5–25%). The duodenum may be involved in conjunction with the stomach (Fig. 3) (2, 28). Primary duodenal lymphoma is very rare (29).

Segmental or diffuse wall thickening is the most frequent finding in lymphoma. Unlike carcinomas, lymphomas typically involve multiple segments of the stomach (Fig. 2). Lymphomas are accepted as soft tumors, and compared to gastric carcinomas, they rarely cause gastric outlet obstruction (Fig. 3). Perigastric adenopathy occurs with a frequency similar to that observed for gastric carcinoma. However, the existence of a lymphadenopathy beneath the renal hilum is suggestive of lymphoma. The preservation of perigastric fat planes is another CT finding that is indicative of lymphoma (Figs. 2 and 3) (1, 2).

It may be difficult to distinguish radiographically infiltrative gastric lymphoma from other pathologies that lead to thickening of the gastric folds. *Helicobacter pylori* gastritis, hypertrophic gastritis, Menetrier disease and gastric carcinoma are among such pathologies. The differential diagnosis of ulcerative gastric lymphoma from ulcerative gastric carcinoma may be impossible. In the presence of multiple ulcerative areas, Zollinger-Ellison syndrome, Crohn disease, tuberculosis,

Barium studies and CT can be used in the diagnosis of esophageal lymphomas, whereas barium studies are sensitive for the demonstration of subtle mucosal and submucosal abnormalities. However, CT should be the preferred method for determination of the extent of local disease and disease staging, as well as related complications such as perforation and fistulization (1).

Stomach

Primary gastric lymphoma represents only 2–5% of gastric malignancies, of which more than 90% are diffuse large B-cell NHLs and low-grade MALT lymphomas (18–20).

Primary NHL is usually unifocal, involving the antrum, corpus or fundus with decreasing frequencies. Second-

ary gastric lymphomas typically show multifocal involvement in the fundus and duodenum (18, 21).

Lesions can assume nodular, polypoid, cavitary, ulcerative or diffuse infiltrating (submucosal) forms (1, 2). High-grade lesions cause focal, large masses with a diameter of ≥ 5 cm (22, 23). Low-grade NHLs (MALT lymphomas) usually display a submucosal diffuse infiltration visualized as minimal wall thickening on CT. In this form, accompanying lymph nodes or extragastric involvement is very rare (23, 24).

Infiltrative gastric lymphoma is characterized by focal or diffuse thickening of the gastric folds (Figs. 2 and 3) (2). In the differential diagnosis, it is very important that the gastric luminal diameter is preserved despite diffuse submu-

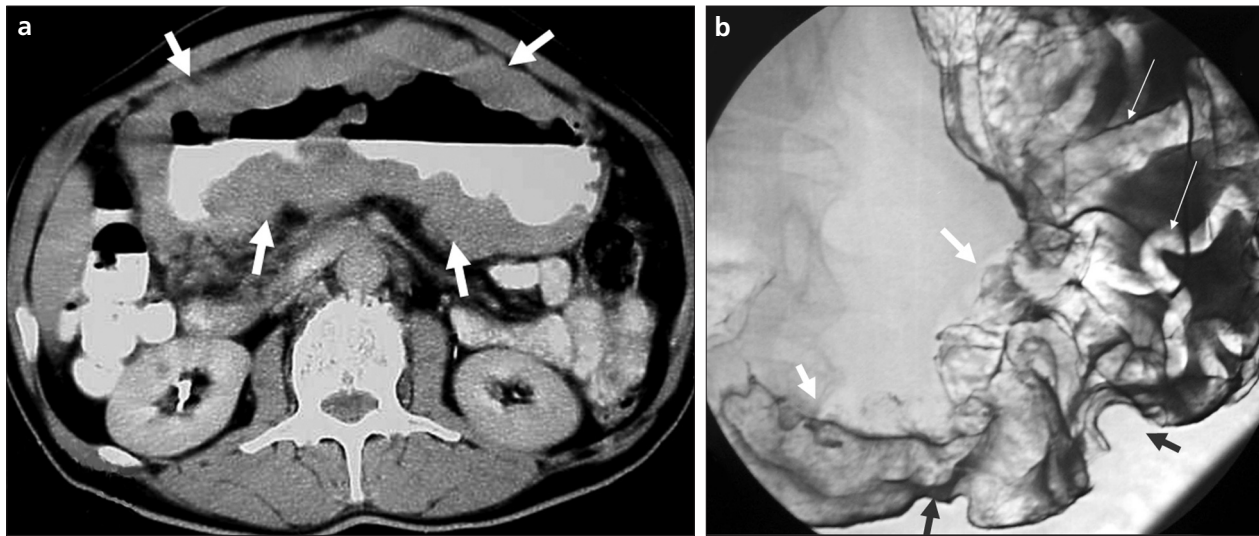


Figure 2. a, b. B-cell-type non-Hodgkin's lymphoma of the stomach in a 71-year-old man who presented with epigastric pain and dyspepsia. CT image (a) shows circumferential, nodular thickening of the distal gastric walls (arrows). Frontal view of the stomach from a double-contrast upper gastrointestinal study (b) shows a mass with nodular margins and luminal narrowing in the antrum (short arrows). Thickened nodular folds (long arrows) are observed more proximally in the stomach.

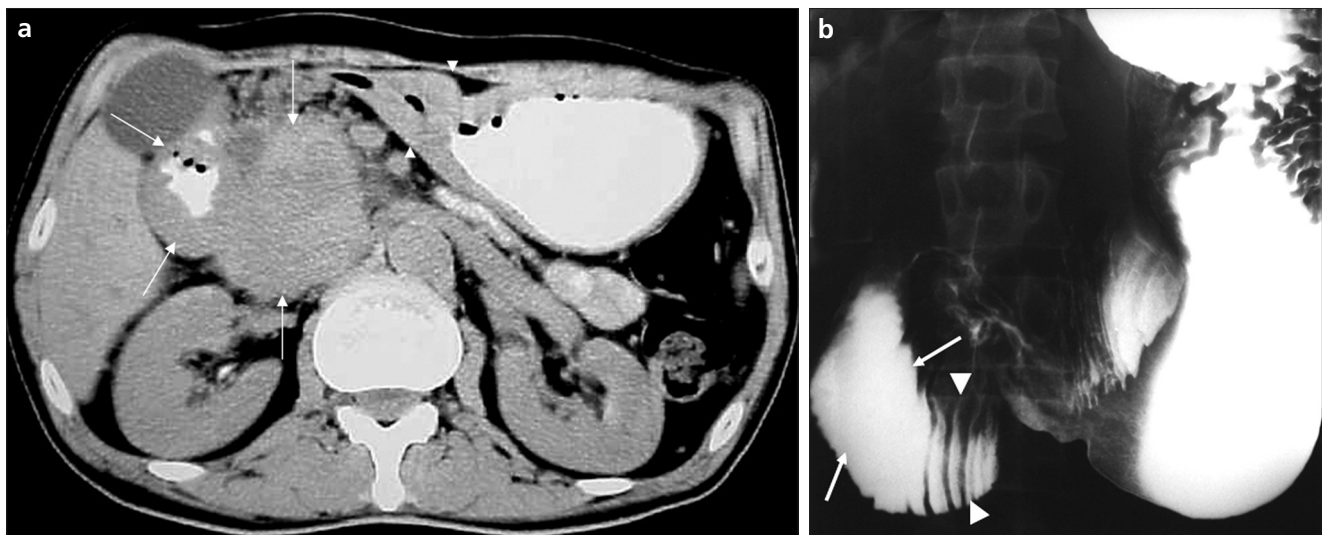


Figure 3. a, b. B-cell-type non-Hodgkin's lymphoma of the stomach and duodenum in a 57-year-old man with a gastric outlet obstruction. CT image (a) shows antral wall thickening (arrowheads) and an endoexoenteric mass with aneurysmal dilation in the duodenum (arrows). An image from an upper gastrointestinal study (b) shows duodenal dilation (arrows) and fold thickening (arrowheads).

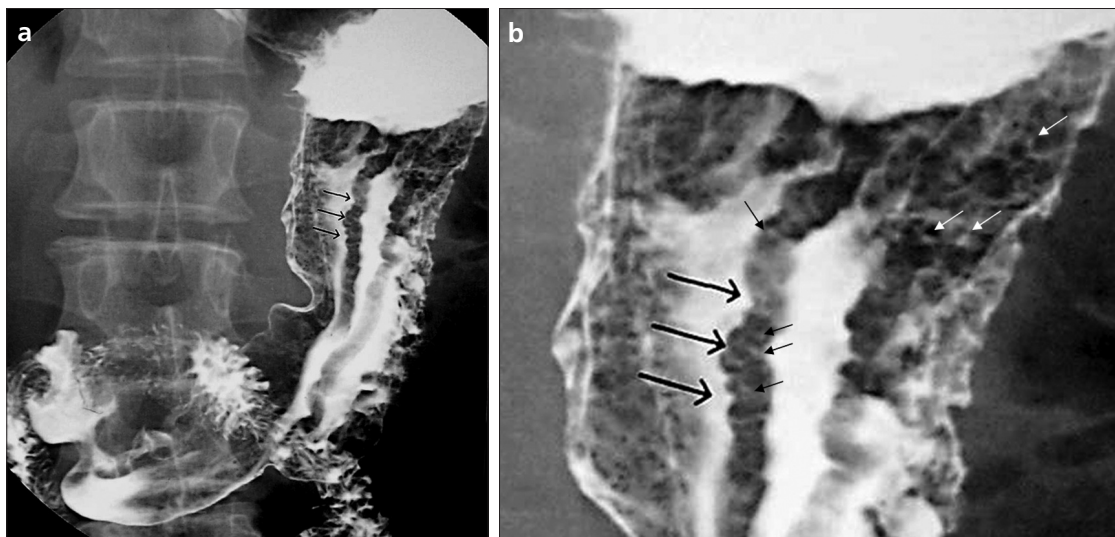


Figure 4. a, b. Low-grade MALT lymphoma of the stomach in a 55-year-old woman with dyspepsia. Frontal view of the stomach from a double-contrast upper gastrointestinal study (a) shows thickened nodular folds (arrows). A magnified image from the study (b) shows thickened nodular folds (long arrows) and numerous submucosal nodules with central ulcerations (target sign) (short arrows).

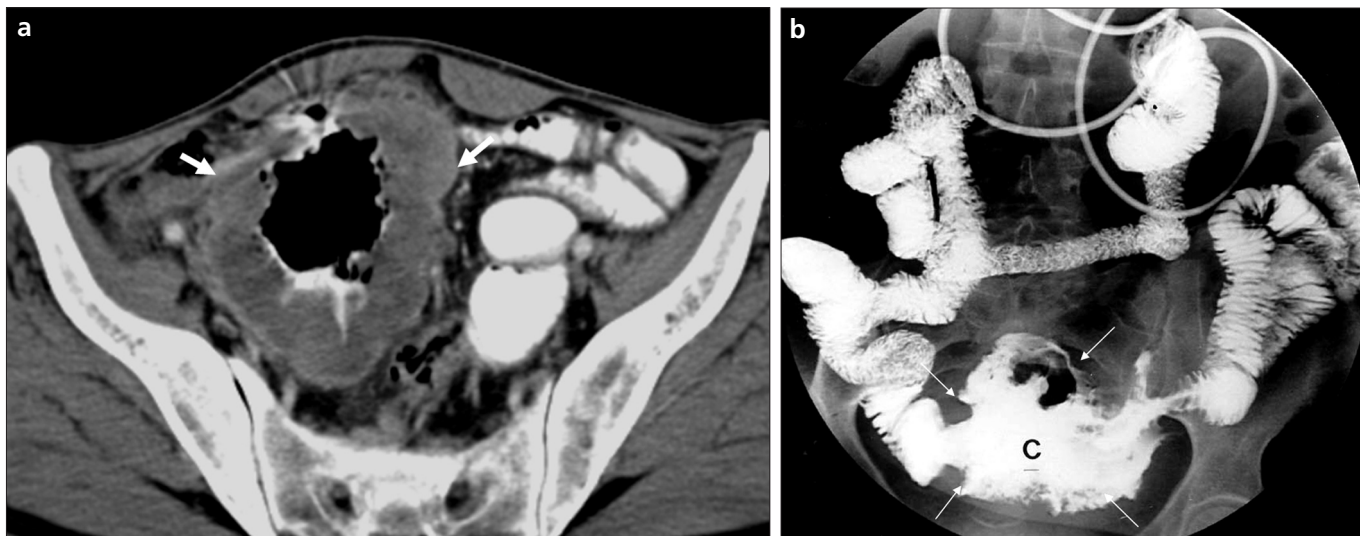


Figure 5. a, b. B-cell-type non-Hodgkin's lymphoma of the jejunum in a 59-year-old man who presented with rectal bleeding and anemia. A contrast-enhanced CT image (a) shows a markedly thickened small bowel wall (arrowheads) on the right side of the lower abdomen with aneurysmal dilatation (arrows). Note that the perijejunal fatty planes are well preserved despite a very bulky tumor. An image from a conventional barium enteroclysis study (b) shows an abnormal small bowel loop with aneurysmal dilatation, fold thickening, and ulceration (arrows). There is no evidence of obstruction. (C, cavitation.)

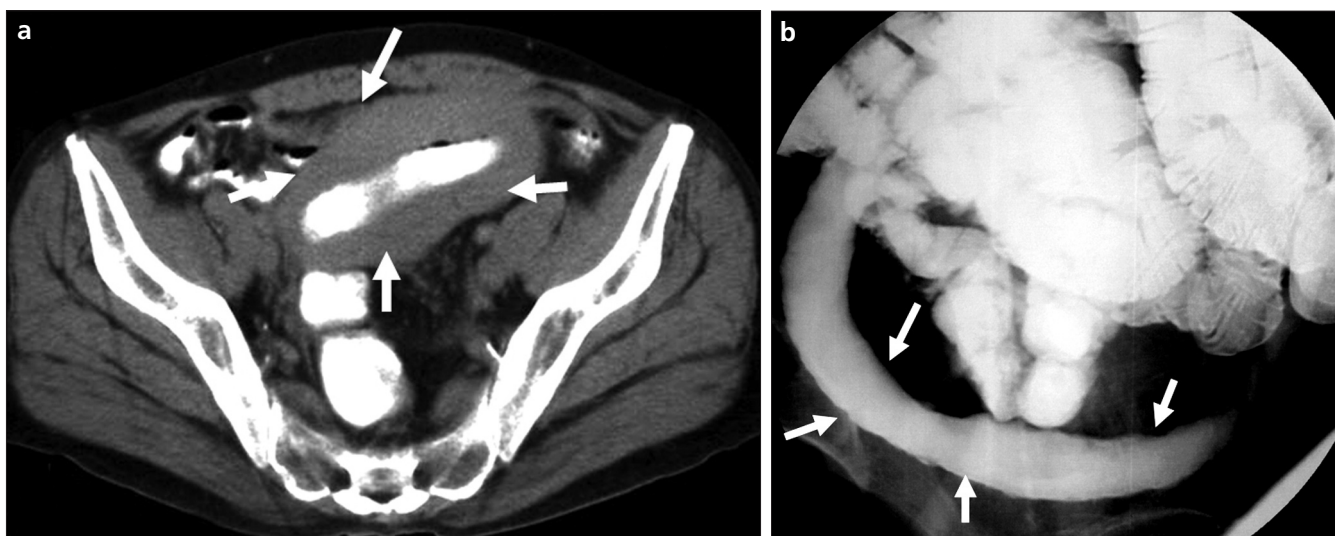


Figure 6. a, b. B-cell-type non-Hodgkin's lymphoma of the ileum in a 47-year-old man who presented with abdominal pain. A pelvic CT image (a) shows a markedly thickened ileal wall with smooth inner and outer margins (arrows). A magnified image from a conventional barium enteroclysis study (b) shows an ileal loop with abnormal rigidity and effaced folds due to diffuse infiltration (arrows).

syphilis and cytomegalovirus infection should also be considered in the differential diagnosis. Differentiation between leiomyosarcoma and malignant melanoma should be made via histological examination of submucosal masses, whereas Kaposi sarcoma, carcinoid tumors and metastases (especially malignant melanoma) can be endoscopically or radiologically discriminated by examining the target appearance. However, lymphomatous lesions tend to have a relatively uniform size, whereas metastases often exhibit a variable size (30).

Small bowel

Lymphoma is the most frequent malignancy of the small bowel (31). Histologically, MALT lymphoma, diffuse large B-cell lymphoma, enteropathy-associated T cell lymphoma, Burkitt's lymphoma, mantle cell lymphoma (MCL), follicular lymphoma, immunoproliferative small intestinal disease (IPSID), and rarely HL are detected in the small bowel (32).

Small bowel B-cell lymphoma is mostly located in the distal ileum due to its abundant lymphoid tissue content. B-cell lymphoma constitutes a

huge, circumferential mass in the intestinal wall and frequently spreads to the small bowel mesentery and regional lymph nodes (Figs. 5–7). Unlike B-cell lymphoma, T-cell lymphoma mostly involves the jejunum (Fig. 8). Multifocal involvement and bowel perforation are very frequent in cases of peripheral T-cell lymphoma (1, 28). Enteropathy-associated T-cell lymphoma typically displays nodules, ulcers, or strictures (Figs. 8 and 9) (2). However, in our series, a huge mass resembling a B-cell lymphoma with circumferential invasion into the ileal loop has been ob-

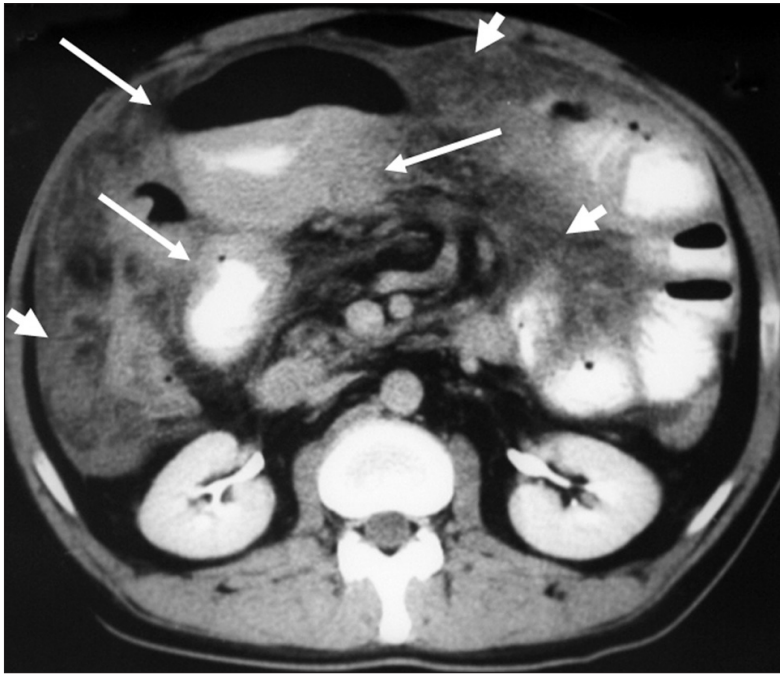


Figure 7. High-grade diffuse large B-cell-type non-Hodgkin's lymphoma of the ileum and peritoneal lymphomatosis in a 72-year-old man who presented with abdominal pain. CT image shows diffuse omental and peritoneal lymphomatosis (*short arrows*) and a markedly thickened ileal wall with aneurysmal dilatation (*long arrows*).



Figure 8. Enteropathy-type T-cell jejunal non-Hodgkin's lymphoma in a 20-year-old man with a history of celiac disease who presented with abdominal pain, weight loss, and diarrhea. Magnified image from a barium meal follow-through study shows polypoid lesions (*arrowheads*) with thickened folds (*thin arrows*) and aneurysmal luminal dilatation (*thick arrows*) in the jejunum.

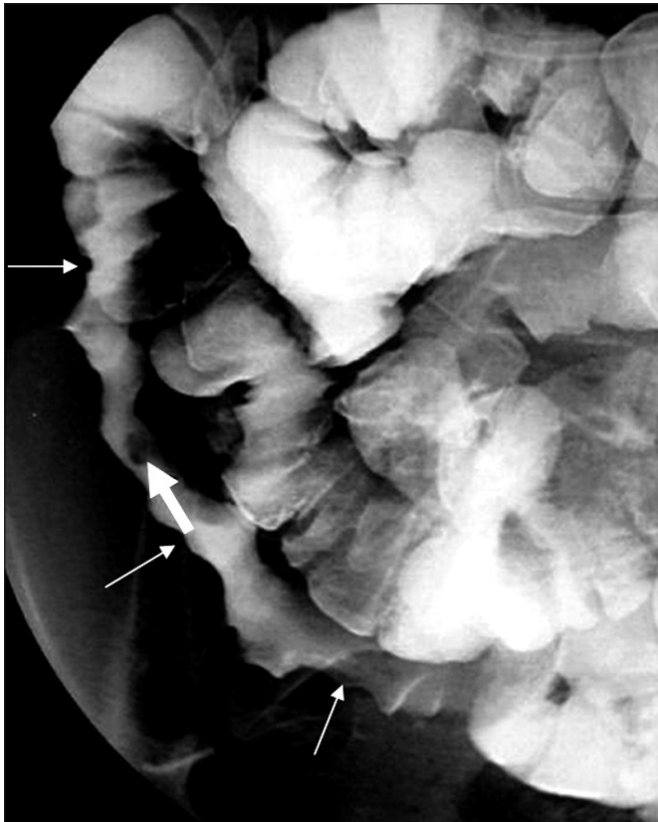


Figure 9. Enteropathy-type T-cell ileal non-Hodgkin's lymphoma in a 36-year-old man with a history of celiac disease who presented with abdominal pain, weight loss, and diarrhea. This magnified image from a conventional barium enteroclysis study shows polypoid lesions (*thick arrow*) with abnormal rigidity and effaced folds due to diffuse infiltration (*thin arrows*).

served in a case with T-cell lymphoma (Fig. 10). MCL arises most commonly in the terminal ileum and jejunum; however, any portion of the GI tract can be affected, including the colon. MCL, follicular cell lymphoma and rarely MALT lymphoma may produce a distinctive pattern of multiple polyps (multiple lymphomatous polyposis). IPSID tends to be proximal with a disseminated nodular pattern that leads to mucosal fold thickening, irregularity, and spiculation (2).

Small bowel lymphoma can exhibit infiltrative, polypoid, endoexoenteric or mesenteric invasive forms. The infiltrative form of small bowel lymphoma is the most common and causes bowel wall thickening, separation of the bowel loops, distortion or loss of the fold pattern, nodularity, and either luminal narrowing or aneurysmal dilatation (Figs. 5, 6 and 11) (2). An-

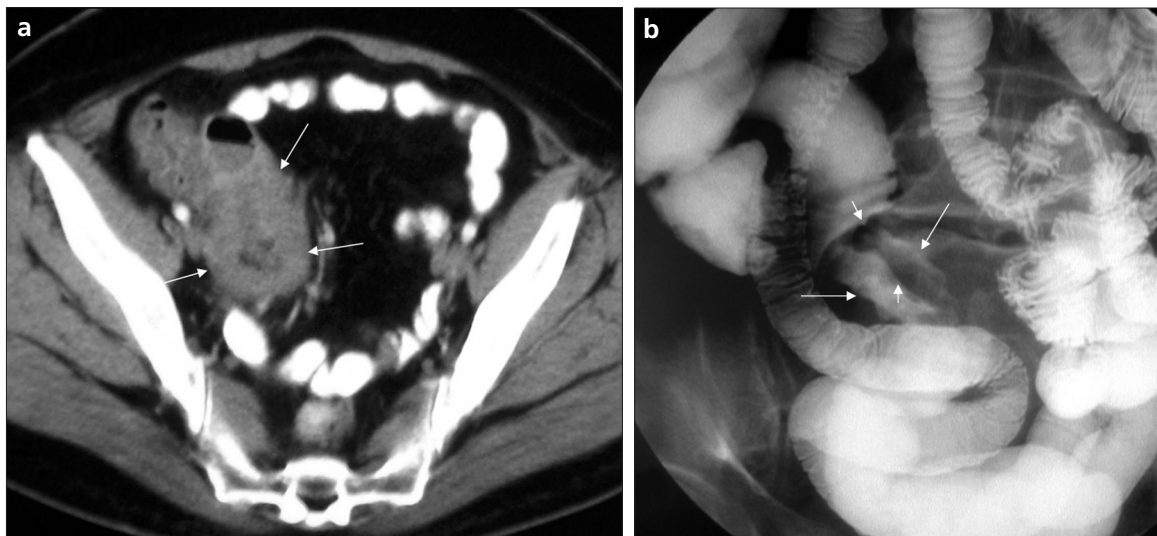


Figure 10. a, b. T-cell-type non-Hodgkin's lymphoma of the ileum in a 62-year-old man who presented with abdominal pain and weight loss. CT image (a) shows circumferential thickening of the ileum (arrows). An image from a conventional barium enteroclysis study (b) shows luminal narrowing and rigidity (long arrows) with intrinsic ileal masses without mucosal destruction (short arrows).

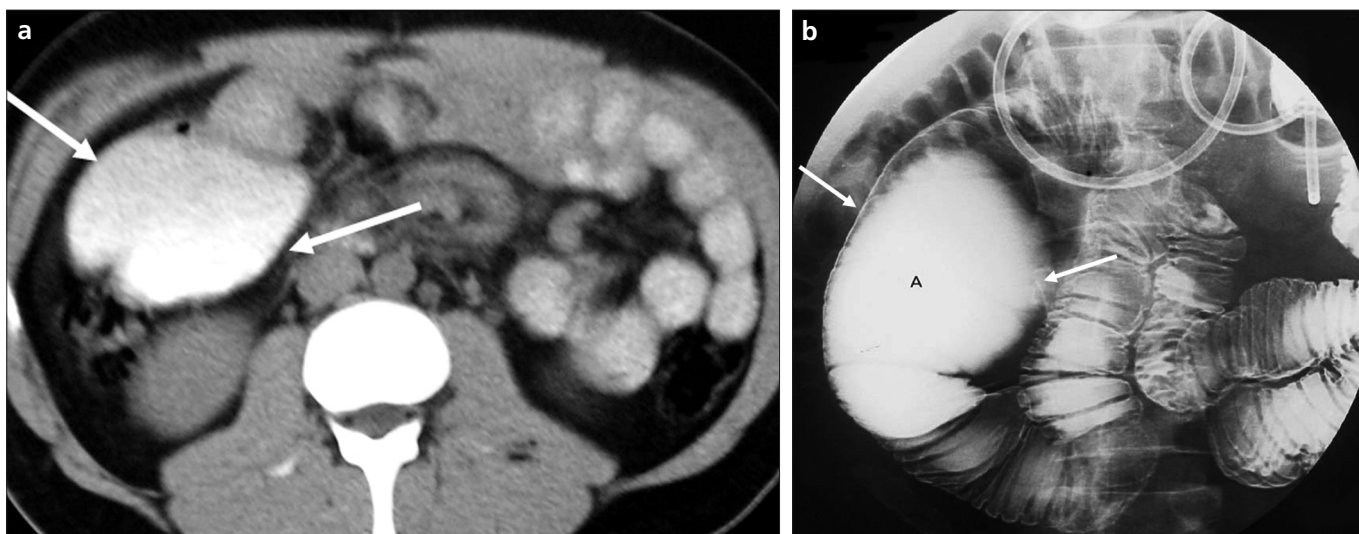


Figure 11. a, b. B-cell-type non-Hodgkin's lymphoma of the ileum in a 44-year-old woman who presented with abdominal pain and intermittent diarrhea. CT image (a) shows aneurysmal dilatation without wall thickening of the ileum (arrows). Image from a conventional barium enteroclysis study (b) shows aneurysmal luminal dilatation of the jejunum (arrows) (A, aneurysmal dilatation).

aneurysmal dilatation is more common than narrowing due to infiltration of the submucosal myenteric plexus and the muscularis propria with a loss of bowel wall tonicity (Figs. 5, 8 and 11). The tumor may invade a long (>2 cm) segment of the bowel circumferentially (1, 2). In this form of lymphoma, the length of involvement, the degree of narrowing, and the absence of obstruction are distinctive from those observed in carcinoma (2). Crohn disease and tuberculosis should also be considered in the differential diagnosis. Thickening of the valvula conniventes can be an early finding in lymphoma and Crohn disease (33). The hypertrophic form of

tuberculosis may also mimic lymphoma. Nodular GI tract lymphoma may present as multiple submucosal nodules that sometimes exhibit ulceration to form a bull's-eye appearance. Malignant melanoma metastases, Kaposi sarcoma, and Crohn disease (usually in its inactive stage) should be considered in the differential diagnosis for this finding (2). The nodular form of lymphoma is usually widely disseminated, unlike malignant melanoma metastases and Kaposi sarcoma (34).

In its polypoid form, single or multiple filling defects can be seen (Figs. 8, 9 and 12). MCL may produce a distinctive pattern of multiple polyps

(multiple lymphomatous polyposis), which is less commonly observed in follicular cell lymphoma and is rarely observed in MALT lymphoma (2). In the differential diagnosis, nodular lymphoid hyperplasia, intestinal polyposis syndromes, gastrointestinal stromal tumors (GIST), lipomas, adenomas, and metastases should be considered. Diagnosis via CT may be difficult in the nodular form of lymphoma. Conventional enteroclysis is the imaging technique of choice for this purpose (35).

The endoenteric form of small bowel lymphoma initially constitutes an intraluminal mass that progresses,

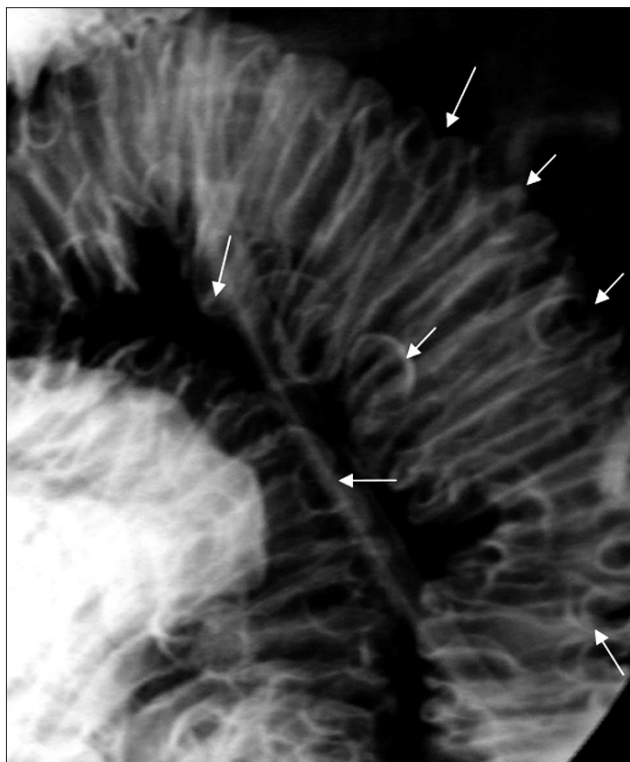


Figure 12. B-cell-type non-Hodgkin's lymphoma of the ileum in a 59-year-old man who presented with weight loss and abdominal pain. This magnified image from a conventional barium enteroclysis study shows numerous polypoid lesions (*arrows*).



Figure 13. B-cell-type non-Hodgkin's lymphoma of the colon in a 63-year-old man who presented with rectal bleeding. This magnified image of the descending colon from a double-contrast enema study shows multiple millimeter-sized nodules (*circle*) with larger polypoid lesions (*arrows*) concordant with polypoid lymphoma.

ulcerates, and perforates into the adjacent mesentery, resulting in a sterile abscess (35). Barium studies can demonstrate a large cavity along the mesenteric border of the affected bowel. CT may reveal extraluminal contrast material that extends into the bowel cavity, which often contains fluid, debris, or air (Fig. 5). Similar findings can be caused by GIST and metastasis, especially metastatic melanoma (32).

The mesenteric invasive form of small bowel lymphoma is characterized as a mesenteric mass that spreads to the mesenteric border of the small intestine. It can be seen associated with tethered folds and angulation, narrowing or obstruction of the adjacent small bowel (36). CT may help reveal the degree and extent of the tumor (Fig. 7). Mesenteric, omental and peritoneal findings cannot be distinguished from peritoneal carcinomatosis or tuberculosis peritonitis (37, 38).

Large bowel and rectum

Primary colonic lymphomas constitute only 0.4% of all malignant tumors that arise in the colon (2). Primary

rectal lymphoma (PRL) is the rarest form of all GI tract lymphomas and accounts for 0.1–0.6% of colonic malignancies and 0.05% of primary rectal tumors (38). Primary colorectal lymphomas include conventional large B-cell lymphoma, MALT lymphoma, MCL and T-cell lymphoma (1). Almost all colon lymphomas arise from NHL, and most of them have a B-cell origin (39–41). HL is very rare. Isolated rectal HL, which we detected in one case, has only been reported in four cases to date (42).

Low grade B-cell lymphoma progresses slowly, whereas MCL is an aggressive disease. Multiple polypoid lesions (lymphomatous polyposis) can be seen in both types of lymphoma (Fig. 13). Although peripheral T-cell lymphomas usually prefer the small bowel, cases exhibiting colon involvement have been reported (1). Widespread mucosal ulcers have been observed in double-contrast barium enema studies and resemble inflammatory bowel disease. Diffuse or focal segmental lesions generally accompany this lesion (43). Peripheral T-cell lymphoma can cause

colon perforation, as observed in other regions of the GI tract (1).

Primary large bowel lymphoma mostly involves the cecum, ileocecal valve or rectum, whereas systemic lymphoma usually involves the entire colon or a long segment of the bowel (33, 44, 45). Double-contrast barium studies and CT may reveal polypoid (Figs. 13 and 14), infiltrative (Fig. 15), endoexoenteric cavitary masses opening to the mesentery (Fig. 16), mucosal nodules (Fig. 13) and fold thickening (Fig. 17) (1, 2). Focal luminal narrowing (Fig. 17), aneurysmal dilatation (Fig. 16), or fistula formation in the ulcerative form are occasionally observed (4, 43).

Large polypoid masses are the most common type of primary large bowel lymphoma. Lesions appear as solitary large masses with a smooth surface. The diameter of these lesions varies between 4 and 20 cm (2, 40), and they are mostly located near the ileocecal valve (Fig. 14) (46). Distinctive features of primary large bowel lymphoma from adenocarcinoma are as follows: spread to the terminal ileum, preservation of

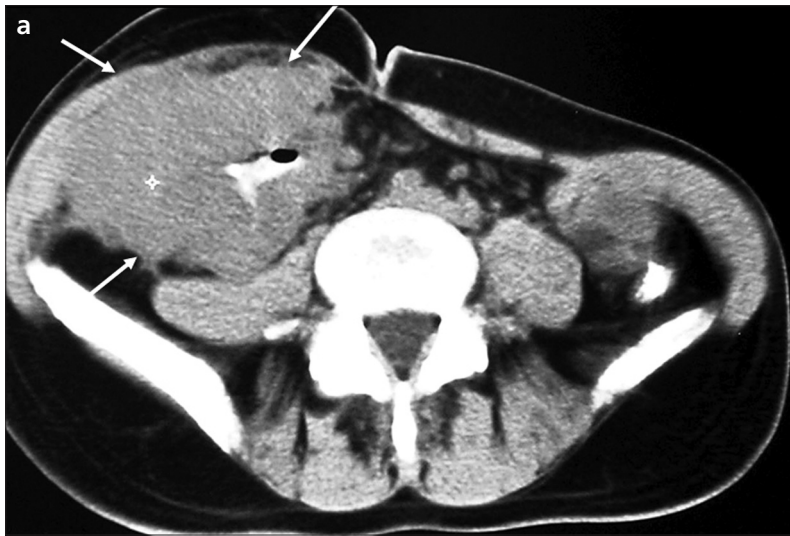


Figure 14. a, b. B-cell-type non-Hodgkin's lymphoma of the colon in a 57-year-old man who presented with pain and a mass in the right iliac fossa. CT scan (a) shows significant wall thickening of the cecum that measures more than 4 cm (arrows). This magnified image from a conventional barium enteroclysis study (b) shows polypoid filling defects (arrows) with ulceration (arrowhead) of the cecum and an ascending colon without bowel obstruction.

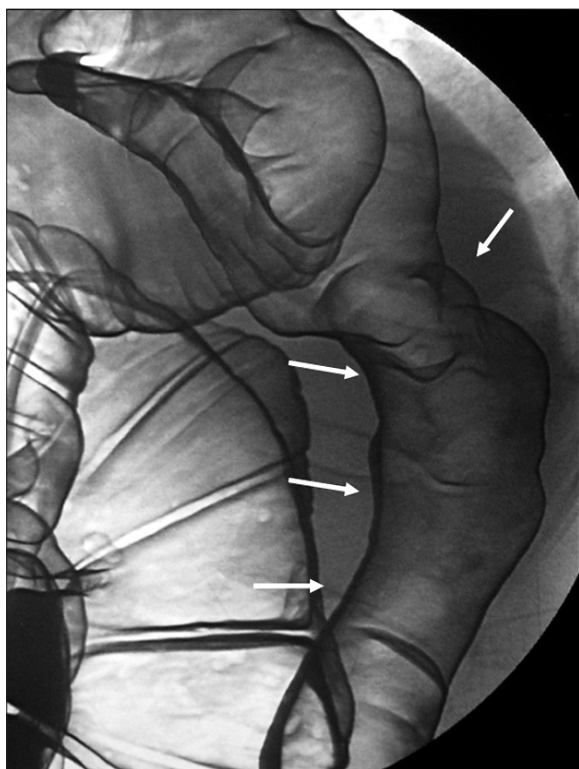


Figure 15. B-cell-type non-Hodgkin's lymphoma of the colon in a 73-year-old man who presented with rectal bleeding. This magnified image from a double-contrast enema study shows haustral effacement and rigidity with luminal narrowing in the descending colon (arrows).

The annular infiltrating form of large bowel lymphoma involves the long segment of the colon. It is visible as a circular narrowing of the lumen or a cavitary mass. Although the narrowing is significant, luminal obstruction is rare due to the lack of desmoplastic response and weakening of the muscularis propria due to lymphoid infiltration (Fig. 15) (2). The external contours of the masses are sometimes irregular, but the internal contours are regular, which is suggestive of submucosal infiltration. Submucosal edema, ischemia, and hemorrhage should be considered in the differential diagnosis for haustral fold thickening (2). Large and infiltrative masses may spread to the mesentery and cause central cavitation (Fig. 16). Perforated colon carcinoma, leiomyosarcoma, and GIST provide imaging findings similar to those obtained for lymphoma (47).

The diffuse form of colon lymphoma (lymphomatous polyposis) can occur in a primary or a secondary form of lymphoma and may involve the entire colon or the long segment. Multiple nodules with diameters of 2 to 25 mm are present on the surface of the colon (Fig. 13) (47, 48). Conglomerate masses in the cecum accompany 50% of these lesions (Fig. 14). Lymphomatous polyposis is highly progressive, and multiple organ involvement occurs during the early period of disease (46–48).

fat planes, an absence of adjacent organ invasion, and a high incidence of perforation due to the lack of a desmoplastic reaction (47). On the other hand, other diseases with cecum involvement and

Kaposi sarcoma in immunocompromised patients may demonstrate similar findings (29). However, the growth pattern of Kaposi sarcoma is more focal and nodular (1).

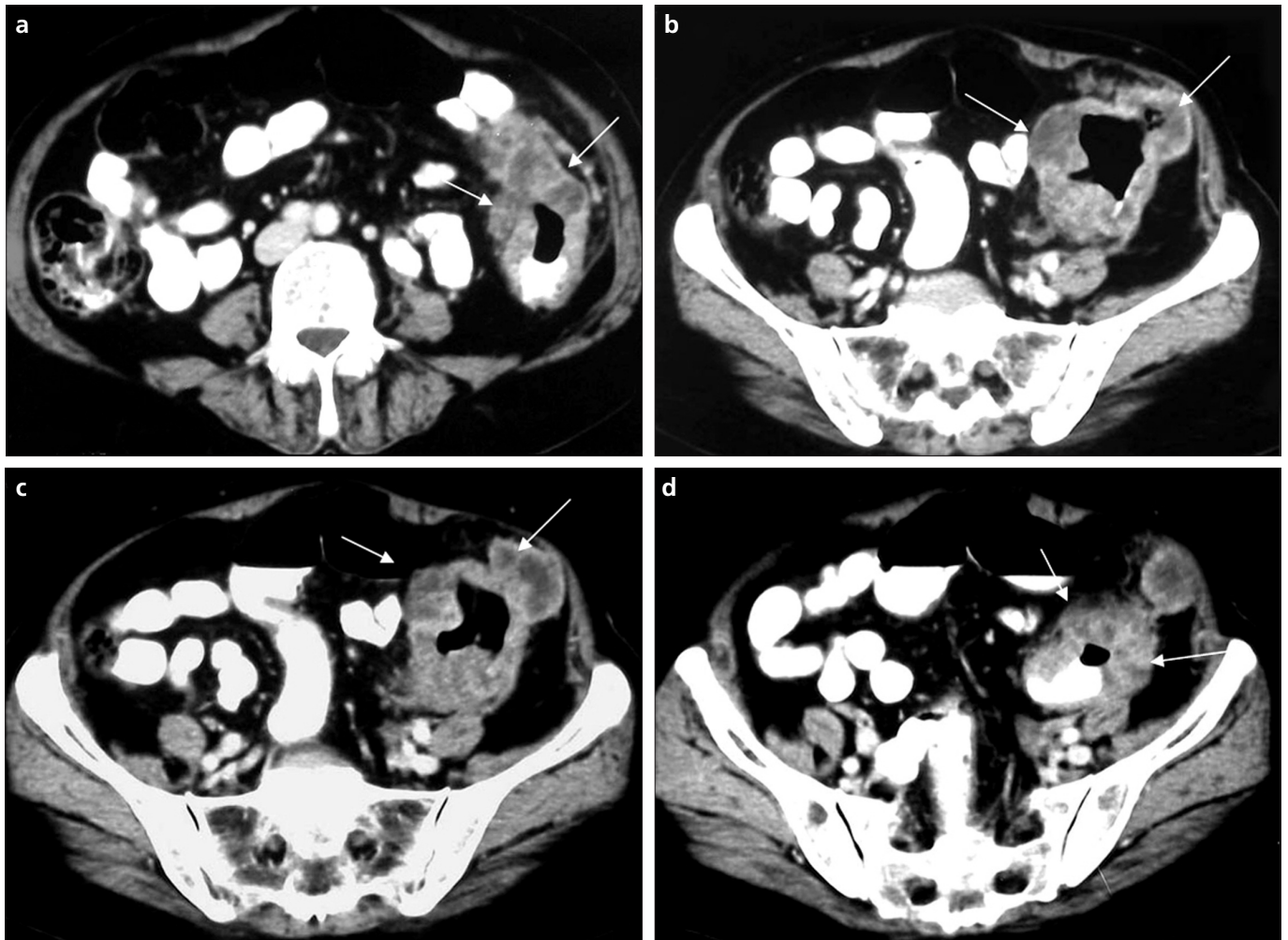


Figure 16. a–d. B-cell-type non-Hodgkin’s lymphoma of the colon in a 74-year-old woman who presented with weight loss, abdominal pain and an abdominal mass. Contrast-enhanced serial CT images (a–d) show marked thickening of the descending colon wall with aneurysmal dilatation (arrows).

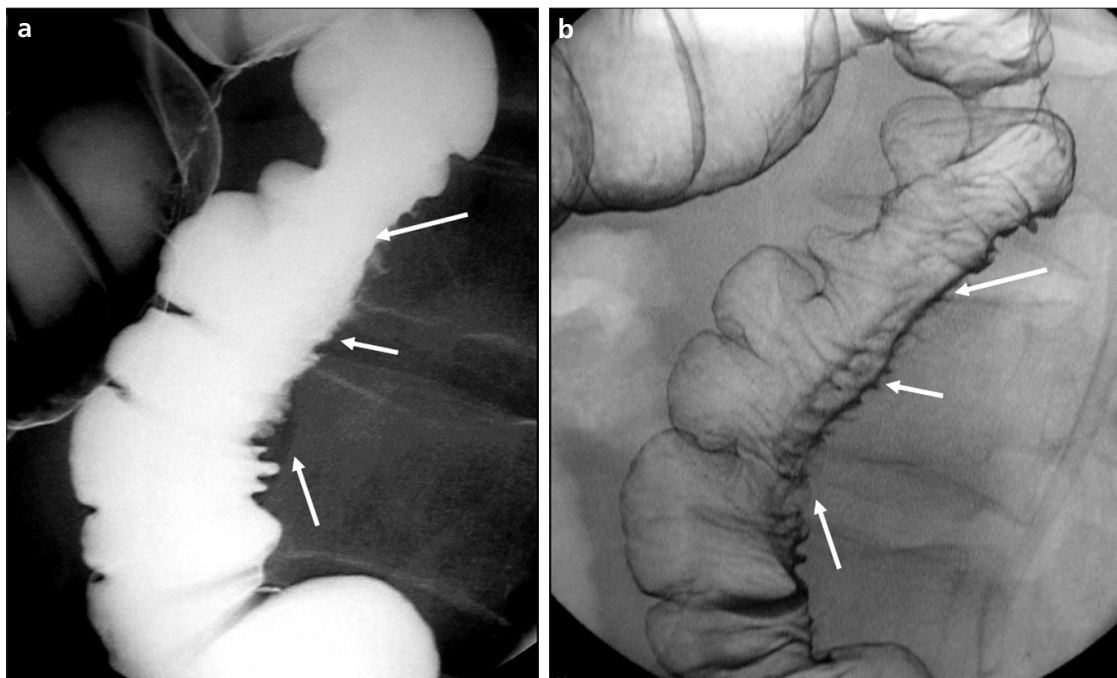


Figure 17. a, b. B-cell-type non-Hodgkin’s lymphoma of the colon in a 73-year-old man who presented with rectal bleeding. Magnified images from single- (a) and double-contrast (b) enema studies show haustral effacement and rigidity with superficial ulceration and mucosal nodularity in the descending colon (arrows).



Figure 18. a, b. Primary rectal Hodgkin's lymphoma. Contrast-enhanced serial CT images (a, b) show a markedly thickened rectal wall (arrows) without perirectal invasion.

Primary rectal lymphoma displays long segment involvement unlike rectal carcinoma. In addition, aneurysmal dilatation may occur. A lack of mesorectal fatty tissue or adjacent organ invasion despite significant wall thickening differentiates this condition from carcinomas (Fig. 18).

In conclusion, primary GI tract lymphoma may present a large variety of imaging findings that are similar to many other pathologies, including adenocarcinoma, mesenteric sarcoma, and various inflammatory diseases. Although characteristic findings are lacking, the existence of aneurysmal dilatation of the intestinal lumen, absence of luminal obstruction despite circular involvement, involvement of a long segment or multifocal disease, diffuse infiltration with preservation of fat planes, and the presence of bulky, ulcerated masses are distinctive features that differentiate GI tract lymphoma from carcinoma. Barium studies and CT are complementary in the diagnosis of GI lymphoma. Barium studies are superior to CT in the evaluation of mild mucosal and submucosal changes; however, CT is the technique of choice when evaluating the extent of disease, the associated extraluminal findings, the therapeutic response, and related complications.

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