Review

CT evaluation of benign gastric lesions

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SUMMARY

This pictorial review demonstrates CT features of benign gastric lesions. CT features are non-specific and frequently overlap. Familiarity with the most specific findings on CT may be useful for diagnosis.

Key words: Computed tomography, benign gastric lesions.

INTRODUCTION

Barium contrast studies and endoscopy have been used for detection of gastric abnormalities. Computed tomography (CT) is also a valuable adjunct to these modalities. It allows evaluation of the lumen and the stomach wall and adjacent structures.[1,2] Frequently CT is requested to further evaluate a gastric lesion suggested by barium studies or endoscopy, in order to demonstrate its extent.[1]

A prerequisite for technically good studies is optimal distension and contrast opacification of the gastric lumen with positive or negative contrast medium.

Recently the use of water as an oral contrast medium has been recommended, particularly together with intravenous contrast enhancement. The enhancing gastric wall and adjacent low-attenuation water emphasize any abnormality.[3,4] The use of air as a contrast medium is necessary for evaluation of gastric tumours using 3 D reconstruction.[5]

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Three-dimensional CT and virtual endoscopy are helpful imaging tools in identifying the intraluminal component of the gastric lesion, although accurate evaluation requires conventional endoscopy.[6] The radiology images of many gastric tumours overlap and their differentiation is difficult; some of them have characteristic CT features that may suggest the diagnosis, but generally, most have no specific CT features.[7,8]

In this article we discuss and illustrate the CT appearance of benign gastric lesions and demonstrate signs that could help to distinguish between some of them.

CT TECHNIQUE

To obtain two-dimentional images of the stomach, oral ingestion of 500-800 ml of pure tap water is sufficient to optimally distend the stomach.[3,4] Intravenous administration of 1 mg glucagon or 5 mg butyl scopolamine before scanning induces gastric wall hypotonia. A total of 100-150 ml contrast agent intravenously administered at a rate 2,5 - 3 ml/sec and scanning 35 sec after the start of infusion optimally enhances the gastric wall and any lesion.[3,4]

Scanning is usually performed with 120 KV p, 230 m A, 5 mm collimation , and 7 mm / sec table feed from the diaphragmatic dome to the lower abdomen with a single breath-hold of 25-30 sec. The patient is usually prone.

Additional images can be obtained in specific positions if required.

GASTRIC STROMAL TUMOURS

Gastrointestinal stromal tumours are a group of tumours of mesechymal origin, characterized by various biological patterns. They are most common in the stomach (60-70%) and have a wide clinical spectrum, from benign to malignant.[9] This group include tumours with differentiation toward

smooth muscle cells (eg, leiomyoma, leiomyosarcoma), tumours with differentiation toward neural elements (eg, schwannoma, neurofibroma), lipocytic tumours (eg, lipoma, liposarcoma), tumours originating from vascular tissue (eg, glomus tumour, hemangioma, lymphangioma), and others.[10] Tumours of low mitotic rate and small size (smaller than 5 cm) usually have a benign behavior.[9]

Imaging these tumours is important since their biologic behavior is more critical to determine the prognosis than their histopathologic criteria.[11] CT patterns of gastric stroma tumours are nonspecific. Benign tumours are usually intramural, have a regular shape, homogeneous structure, and homogeneous contrast enhancement. Malignant tumours are usually have exophytic, diffuse involvement and heterogeneous morphology and enhancement. Enlarged lymph nodes and mıtastases may be present.[11,12]

LEIOMYOMA

Gastric leiomyoma is the most common benign tumour of the stomach, accounting for 2,5% of all gastric tumours.[1] The lesion most frequently develops in the antrum and body but may also be found in the fundus. Leiomyomas are usually submucosal lesions originating from the muscularis propria or muscularis mucosa and presenting as endogastric lesions; exogastric leiomyomas originate from the serosa. The size of the tumour is usually smaller than 5 cm and is asymptomatic, but ulcıration may cause bleeding.[1,5,8]

Figure 1. Benign leiomyoma of the stomach in a 73 - year old man with symptoms of bleeding. CT scan obtained with water as contrast agent shows a soft-tissue mass in the wall of the antrum with endogastric growth (arrow). This is smoothly marginated with slightly inhomogeneous enhancement due to hemorrhage. A central ulcıration was found in gastroscopy.

On CT, leiomyomas appear as solid round or ovoid mass lesions of uniform density, well-delineated with smooth borders, producing a focal thickening of the gastric wall.[13] When they are exogastric, the fat plan between the tumour and the adjacent organs is preserved. The inner margin may be irregular because of its ulcération. Calcification may also be detected and the tumour occasionally enhances after IV contrast administration[8] (Fig. 1,2,3). Moreover, on 3D CT and virtual

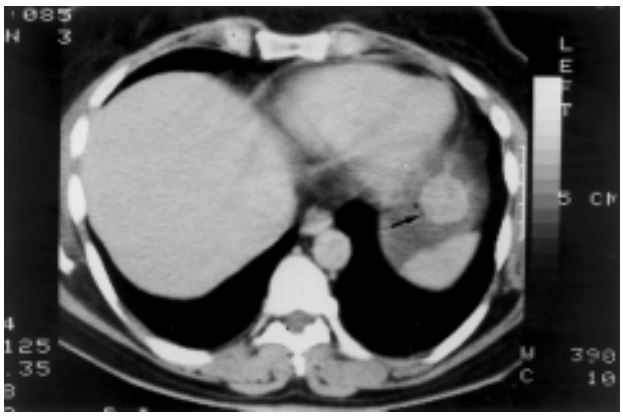

Figure 2. Benign leiomyoma of the stomach in a 55 year old woman with symptoms of bleeding. CT scan obtained with water as contrast agent shows a soft-tissue mass arising from the fundus (arrow). It's margins are smooth and it has a slightly inhomogeneous enhancement.

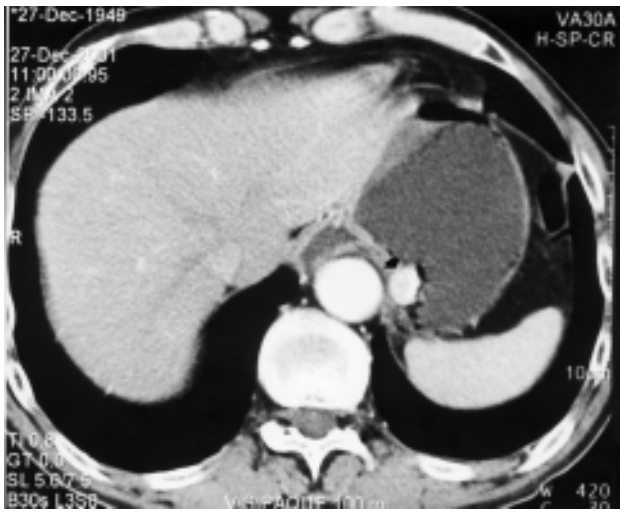

Figure 3. Benign leiomyoma of the stomach in a 52 year old woman with a recent history of vomiting. CT scan obtained with water as contrast agent shows a small soft-tissue mass in the wall of the fundus that is partially calcified and enhanced, (arrow).

gastroscopy, bridging folds over the tumour may be detected, surrounding the endoluminal mass.[14]

A large exogastric leiomyoma could be difficult to distiguish from a leiomyosarcoma.[15] CT features of size, contour enhancing pattern, mesenteric fat infiltration, and regional lymphadenopathy are significantly reliable in differential diagnosis[11] (Fig. 4).

Figure 4. Leiomyosarcoma of the stomach in a 74-year old man with clinical findings of pain and fever. CT scan obtained with air as contrast agent (severely ill patient) shows a large soft-tissue mass in the wall of the fundus, having endogastric and exogastric growth (arrow). The lesion is heterogeneous in enhancement and it has a low density area, due to central necrosis.

LEIOMYOBLASTOMA

Leiomyoblastoma is a rare benign neoplasm variant of leiomyoma, arising from muscle cells and predominantly composed of round or polygonal cells.[13] Leiomyoblastomas are more common in men than in women and tend to occur more often in the antrum. They are considered to have a malignant potential and metastasis occurs in 10% of cases.[13] The common symptoms are epigastric pain and upper Gl bleeding.

CT features are not different from leiomyoma and a definitive diagnosis is made only with histology after laparotomy (Fig. 5).

LIPOMA

Lipomas are benign tumours composed of adipose tissue and represent about 2-3 % of all benign gastric tumours.[16] The lesions are usually small in size, solitary and sessile, and the antrum is the commonest site of their location. When small, lipomas are usually asymptomatic

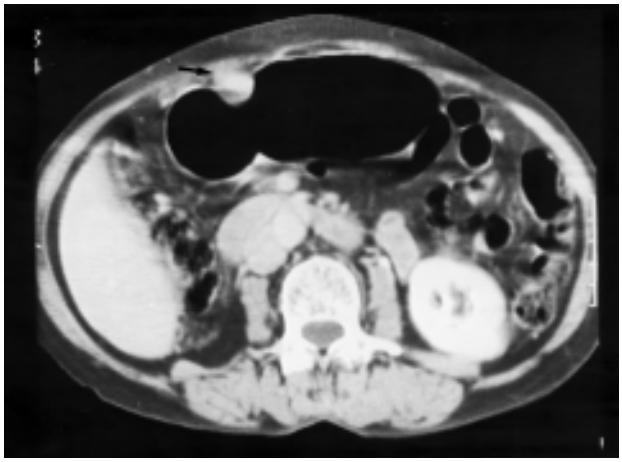

Figure 5. Benign leiomyoblastoma of the stomach in a 80- year old woman with symptoms of bleeding. CT scan obtained with air as contrast agent (because of her age) shows a soft-tissue mass in the wall of the antrum with endogasrtic growth (arrow). The tumour is smoothly marginated and has homogeneous enhancement.

and detected incidentally. When larger, the main clinical manifestation is bleeding due to ulcération of the tumour.[16,17] Gastric lipomas are localized, encapsulated tumours and have a submucosal or, less frequently, subserosal origin.[18]

At CT lipoma appears as a well-circumscribed tumour with homogeneous negative attenuation values and no infiltrative growth[1,7,16] (Fig. 6,7). Therefore, the CT pattern of lipoma is specific, based on the fat density of the tumour and unnecessary endoscopy or surgery can

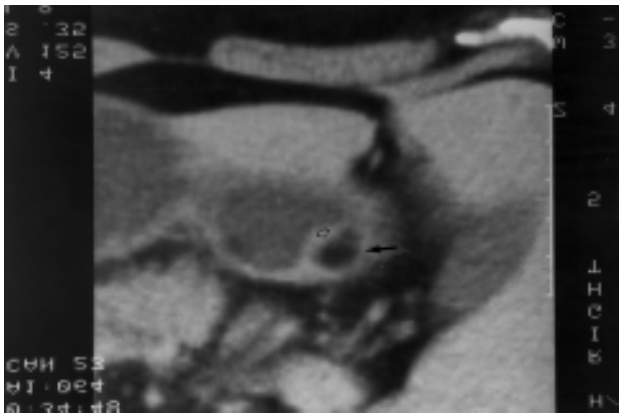

Figure 6. Lipoma of the stomach in a 53-year old man with epigastric pain due to gastritis. CT scan obtained with water as contrast agen shows a small well-circumscribed, submucosal fatty mass in the pre-pyloric wall (arrow). The overlying mucosa is clearly visible (open arrow).

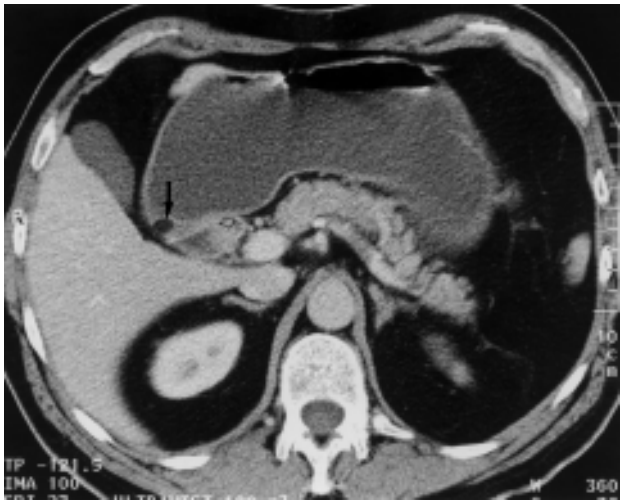

Figure 7. Lipoma of the stomach in a 54-year old man with clinical symptoms of intermittent gastric obstruction. CT scan obtained with water as contrast agent shows a small, fatty mass in the wall pylorus (arrow). The mass in the duodenum (open arrow) represents a small component of a 4 cm Brunner gland hamartoma causing the obstruction.

be avoided.[7]

INFLAMMATORY LESIONS

Gastritis

Gastritis is an inflammatory process of the gastric mucosa and has many causes, including infection, inflammatory conditions, irradiation, ingestion of alcohol and medications. On CT it appears, in most cases, as thickening of gastric folds and the gastric wall (Fig. 8). The thickened wall attenuation is similar to that of soft tissue and it could have a bright enhancement in the arterial phase.[1,3,8]

Low density areas in the thickened wall due to edema have been described.[1] Gastritis is considered a pathological rather than radiological diagnosis; CT findings of the wall are similar to those of tumour infiltration[1] (Fig 9,10). But unlike carcinoma there are no adenopathy or extension to adjacent structures.

Gastric ulcer disease

Benign peptic ulcer can appear on CT in sizable or subtle areas of thickening of the gastric wall. Local findings as contrast enhancement of the lesion, focal wall thickening > 5 mm, and perigastric tissue abnormalities could assist in distinguishing the malignancy.[19] The ulcer crater can be identified when its base is perpendicular to the plane of the CT section (Fig. 11,12). Computed

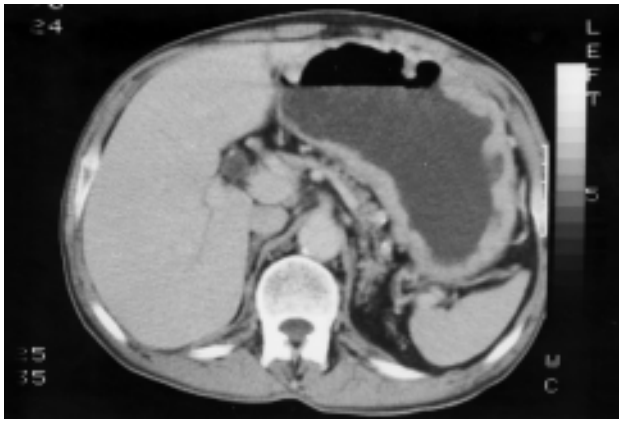

Figure 8. Chronic gastritis in a 68-year old man with epigastric pain. CT scan obtained with water as contrast agent shows diffuse thickening of the gastric wall and thickened gastric folds.

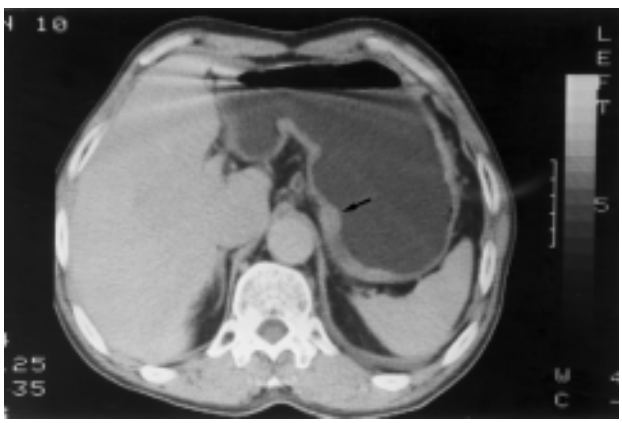

Figure 9. MALT lymphoma of the stomach in a 58-year old woman. CT scan obtained with water as contrast agent shows a segmental thickening of the gastric wall with smooth inner surface and transition to the normal wall (arrow).

tomography is sensitive in demonstrating gastric or duodenal ulcer perforation as extraluminal air or contrast medium.[20]

VASCULAR PATHOLOGY

Varices

Gastric varices are usually the result of portal hypertension, secondary to cirrhosis. They are dilated venous collaterals of the short gastric and left gastric veins, usually seen in the fundus of the stomach. On unenhanced CT, a multilobulated mass can easily be mistaken for a neoplasm. On enhanced CT, rounded or tubular structures can be seen within the gastric wall, enchancing

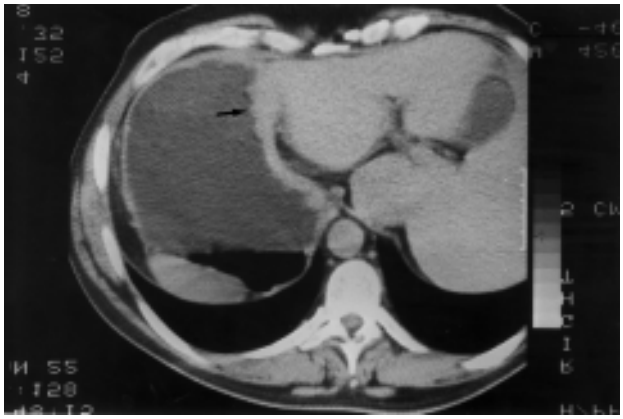

Figure 10. Adenocarcinoma of the stomach in a 52-year old man. CT scan obtained with water as contrast agent shows a segmental thickening of the gastric wall with irregular inner surface (arrow).

Figure 12. Gastric ulcer disease in a 70-year old man with severe epigastric pain. CT scan obtained with water as contrast agent shows the huge crater of an ulcer in the lesser curvature (arrow) and the smooth thickening of the adjacent gastric wall (open arrow).

to the same degree as vessels. They have distinctive appearance that confirms the diagnosis[21,22] (Fig. 13). Dilated venous collaterals are usually seen in the region of gastrohepatic ligament and near the lesser omentum. 3D CT has similar results to that of a conventional barium study or endoscopy,[6] and 3D CT portography seems to be useful for the treatment of patients with gastric fundic varices.[23]

CONCLUSION

CT remains a complementary tool to gastroscopy, despite the development of 3D CT and virtual reality

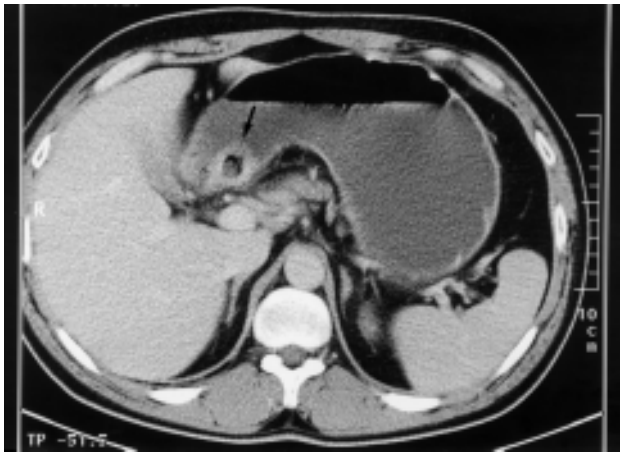

Figure 11. Gastric ulcer disease in a 36-year old man with epigastric pain. CT scan obtained with water as contrast agent shows the ring of the smooth wall and the crater of an ulcer in the antrum filled with water and entraped air (arrow).

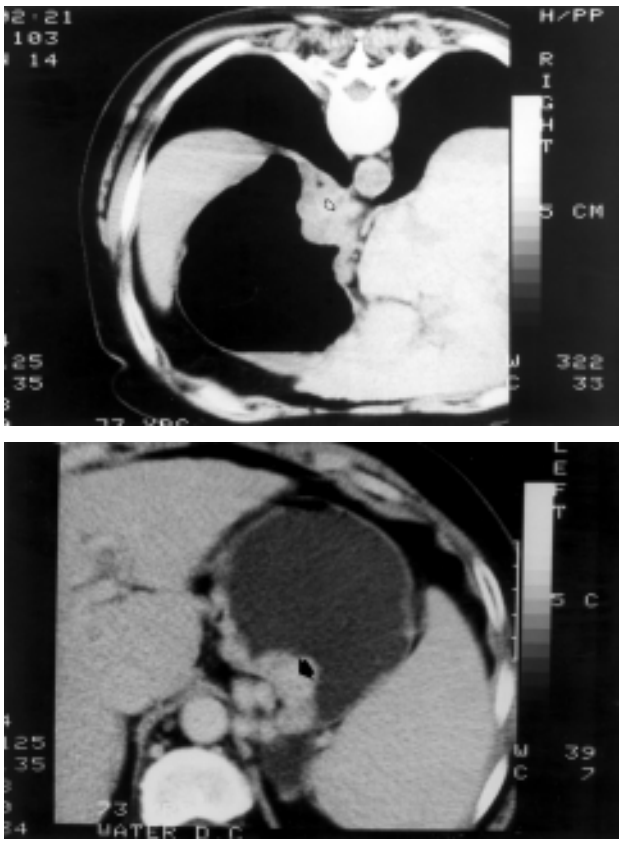

Figure 13. Gastric varices in a 73-year old woman. (a) CT scan obtained with air as contrast agent shows focal thickening with irregular inner surface of the proximal gastric body, suspicious of a neoplasm (open arrow). (b) CT scan obtained using water orally and bolus intravenous injection of contrast agent revealed well defined, lobulated structures consistent with varices (open arrow).

technology. It allows the view and measurement of the exact size of the abnormality. Among the described benign gastric lesions, lipoma and varices have typical CT features.

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