

## Unusual gastric tumors and tumor-like lesions: Radiological with pathological correlation and literature review

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### Abstract

Although gastric tumors have overlapping radiologic appearances, some unusual tumors may present specific imaging features. Using multidetector computed tomography (MDCT), with water as a negative oral contrast agent and intravenous contrast medium, can provide critical information for the diagnosis of gastric diseases. In addition, MDCT can evaluate the involvement of the gastric wall and extragastric extent of the disease, as compared with gastroenteroscopy and double-contrast upper gastrointestinal study. Regarding lesion location and size, enhancing and growth patterns, presence of calcification or fat, and involvement of the gastric wall and adjacent structures, CT may provide useful information. In this review article, we review the relevant literature and discuss the CT features and the histopathologic findings of different types of gastric lesions. The lesions are divided into benign (glomus tumors, schwannomas, leiomyomas, and lipomas), malignant (gastrointestinal stromal tumors, mucinous carcinomas, lymphomas, and carcinoid tumors), and tumor-like lesions (ectopic pancreas and bezoar). Familiarity with imaging appearances and pathologic findings can help physicians make an accurate diagnosis.

**Key words:** Multidetector computed tomography; Stomach; Neoplasm; Adenocarcinoma; carcinoid; Lymphoma; Lipoma; Glomus tumor; Heterotopic pancreas; Schwannoma; Gastrointestinal submucosal tumor; Leiomyoma; Bezoar

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**Core tip:** Diagnostic imaging of gastric tumors remains a practical challenge. However, in some cases of uncommon gastric tumors and tumor-like lesions, there are some specific radiographic features. Using the multidetector computed tomography, with water as a negative oral contrast agent and intravenous contrast medium, can provide critical information for the diagnosis of gastric diseases. Familiarity with the computed tomography features of these diseases facilitates accurate diagnosis and further management.

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## INTRODUCTION

Diagnostic imaging of gastric tumors remains a practical challenge. The most common primary gastric tumors are gastric adenocarcinomas (> 90%)<sup>[1]</sup>.

Esophagogastroduodenoscopy (EGD) is the main test used to find stomach cancer and perform a biopsy, and multidetector computed tomography (MDCT) is used to locate the lesion and determine the extent of the disease. Using MDCT to characterize the disease always leads to a long list of differential diagnoses because many overlapping characteristics have been shown to exist among various gastric tumors (Table 1).

However, in some cases of unusual tumors and tumor-like lesions, familiarity with the most relevant radiologic features with clinical information allows adequate characterization and diagnosis. Using the MDCT, with water as the negative oral contrast agent, can provide useful information regarding lesion location and size, enhancing and growth patterns, presence of calcification or fat, and involvement of the gastric wall and adjacent structures.

In this review article, we review the relevant literature and discuss the CT features and histopathologic findings of different types of gastric lesions. The lesions are divided into benign (glomus tumors, schwannomas, leiomyomas, and lipomas), malignant (gastrointestinal stromal tumors, mucinous carcinomas, lymphomas, and carcinoid tumors), and tumor-like lesions (ectopic pancreas and bezoar).

### CT protocol of stomach studies

Dynamic MDCT with stomach distention is optimal for the study of stomach tumors. The stomach is distended with positive or negative oral contrast to avoid overlooking tumors<sup>[2]</sup>. The traditional positive oral contrast material may not mix uniformly with

gastric contents, and mimics pseudotumors. In addition, high-attenuation contrast may mask subtle disease on contrast-enhanced images of the gastric wall<sup>[3]</sup>. Water and low-concentration barium sulfate are used as a negative oral contrast agent. We preferred to use water as a negative oral contrast agent for optimal assessment. Water is free and well tolerated. Before the CT scan, our patient was fasted for 4 h. After intravenous injection of hyoscine N-butylbromide (Buscopan, Boehringer International, Ingelheim, Germany) for slowing down gastrointestinal movement, the water (500 mL) was administered in a routine procedure to obtain gastric distention before the patient was laid down on the CT table.

The dynamic CT imaging for the gastric lesions was performed in three phases (non-enhanced, arterial, and portovenous). Non-enhanced imaging was obtained to provide a baseline for the degree of lesion enhancement as well as detecting the hemorrhage, calcification, and fat component of the lesion. The arterial phase was obtained 30 seconds after the injection of a dose of 2 mg/kg of nonionic contrast material at a rate of 2.5 mL/s, using an automated power injector. The portovenous phase was obtained 50 s after the contrast injection. The contrast-enhanced phases help in assessing the extent of involvement of the stomach, differentiating mucosal and submucosal tumors, determining the enhancing and growth patterns, and detecting distant metastasis and lymphadenopathy<sup>[4,5]</sup>.

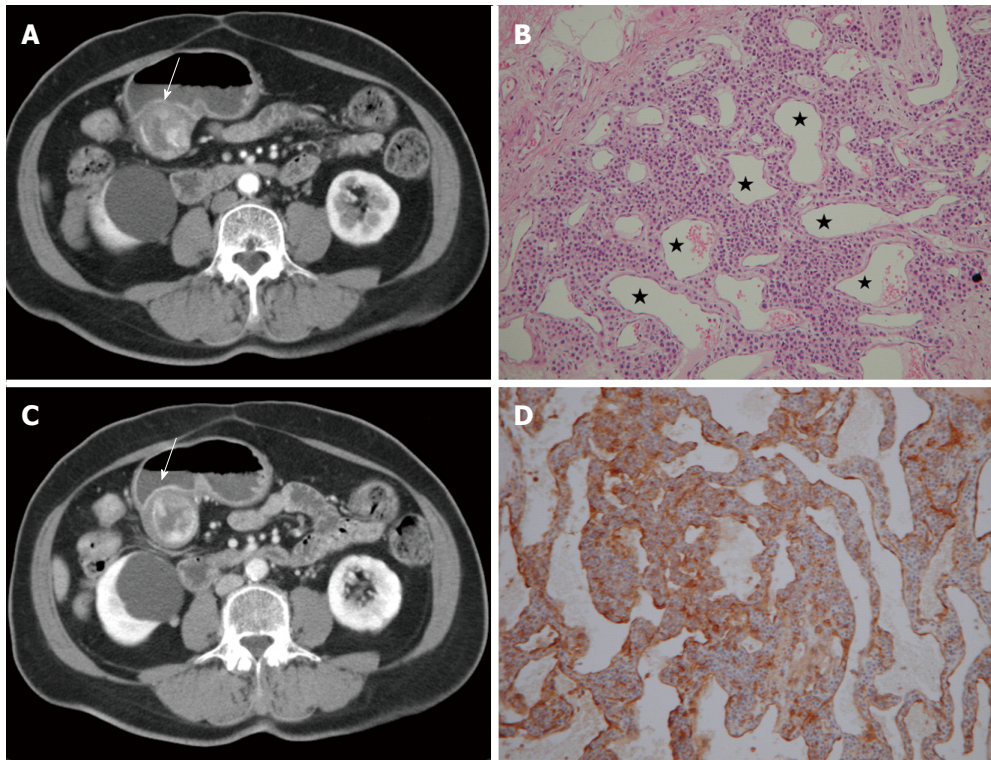
## BENIGN TUMORS

### Glomus tumors

Glomus tumors are modified smooth muscle cells that recapitulate perivascular glomus body cells. They are typically found in peripheral soft tissues, but can occur anywhere in the body<sup>[6]</sup>. In the gastrointestinal tract, glomus tumors are more common in the stomach as benign vascular submucosal tumors. The clinical symptoms are nonspecific. However, larger lesions are likely to be ulcerated, causing upper gastrointestinal bleeding. Surgical resection is typically curative.

On gastroenteroscopy, the glomus tumors appear as nonspecific submucosal lesions with a smooth surface<sup>[7]</sup>. Glomus tumors are typically small and solitary, and are commonly located in the gastric antrum. In pre-contrast CT, they are iso-dense to the stomach wall and manifest as solitary hypervascular lesions in the arterial phase, which persist in the portovenous phase in dynamic CT (Figure 1)<sup>[8]</sup>. Sometimes, they may exhibit a hemangioma-like "central fill-in" enhancement pattern in the delayed phase<sup>[9]</sup>. By contrast, adenocarcinoma is a relatively poor-enhancing mucosal tumor manifesting as a polypoid lesion with generalized mural thickening or focal mural thickening, with or without ulceration.

In histologic analysis, glomus tumors are composed



**Figure 1** Glomus tumor. A 66-year-old woman presented with epigastric pain for 1 mo. A: Arterial phase showing a submucosal mass at the gastric antrum (arrow) with an exophytic growth pattern. Peripheral nodular enhancement is evident; B: Portovenous phase showing central fill-in enhancement compared with the arterial phase; C: High power photomicrography (original magnification, × 200, HE stain) showing many vessels (star) filled with red blood cells and lined within the tumor cells. The tumor cells were positive for smooth muscle actin (D).

**Table 1** Characteristics of uncommon gastric tumors and tumor-like lesions

		CT features
Benign tumors		
Glomus Tumor	Small, solitary, and hypervascular tumor at gastric antrum	
Schwannoma	Homogeneous attenuated gastric tumor	
Leiomyoma	Small, endoluminal growth, hypoenhanced tumor at gastric cardia	
Lipoma	Fat contained tumor	
Malignant tumors		
Adenocarcinoma	Polypoid, or generalized mural thickening, or focal mural thickening with/without ulceration tumor The mucinous type has punctate or miliary calcification within the tumor	
GIST	Exophytic hypervascular GI mass arising from submucosa with central ulceration, amorphous calcification	
Lymphoma	Regional or diffuse wall thickening preserved perigastric fat plane and lymphadenopathy extending below the renal hila	
Carcinoid	Type I and II, small, polypoid lesion, with marked enhancement. Type III, larger, sporadic, solitary tumor with distant metastasis	
Tumor-like lesion		
Ectopic pancreas	Small solitary lesion at greater curvature of distal antrum with enhancement similar to pancreas	
Bezoar	Intraluminal gastric filling defect with mottled appearance	

GIST: Gastrointestinal stromal tumor; CT: Computed tomography.

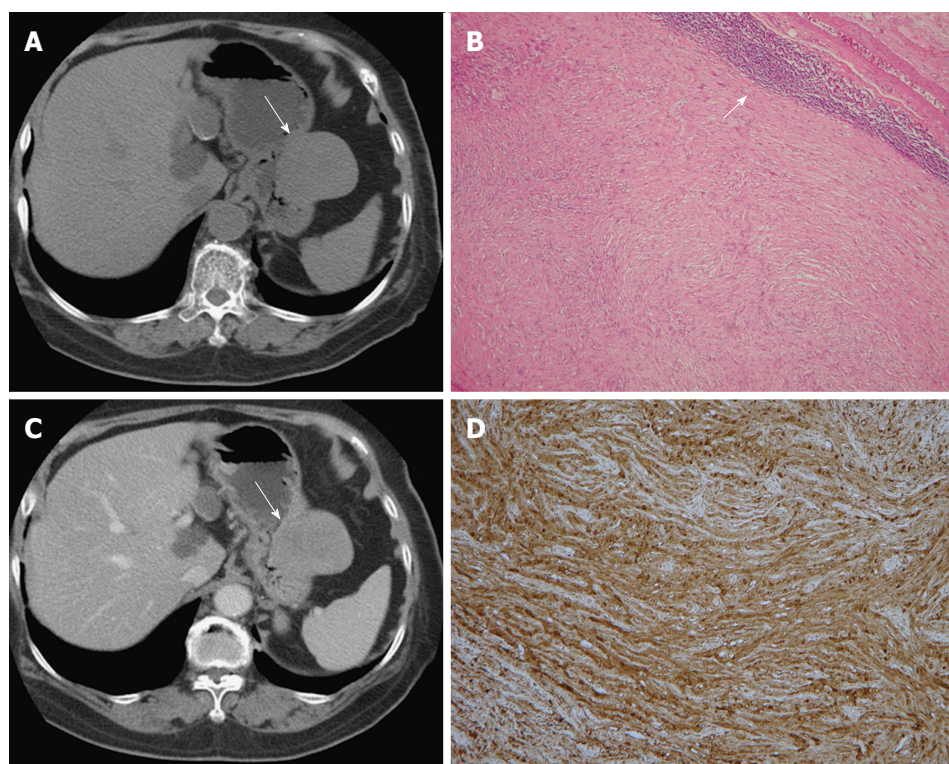
of numerous dilated, irregular shaped vessels, covered by numerous, monotonous round cells. The tumor cells are positive for smooth muscle actin (Figure 1)<sup>[6]</sup>. The prominent vascular structures are responsible for dense contrast enhancement in CT.

**Schwannomas**

Gastrointestinal schwannomas are considered to be different from conventional schwannomas because of unique different histologic features<sup>[10]</sup>. Conventional

schwannomas are benign neurogenic tumors composed of over-proliferated Schwann cells in the soft tissue or central nervous system. In the gastrointestinal tract, such lesions often display prominent lymphoid cuffing (Figure 2). Gastrointestinal schwannomas are rare in the gastrointestinal tract, with the stomach being the most common site, followed by the colon and rectum. They are believed to arise from the gastrointestinal autonomic nervous system<sup>[11]</sup>. Gastrointestinal schwannomas account for 4% of all benign gastric





**Figure 2 Schwannoma.** A 75-year-old woman presented with coffee ground vomitus. A: Pre-contrast transverse computed tomography (CT) showing a homogeneous iso-density tumor in the greater curvature of the stomach (arrow); B: Post-contrast-enhanced CT showing homogeneously moderate enhancement with a mixed (endoluminal and exophytic) growth pattern; C: Low-power photomicrograph (original magnification,  $\times 20$ ; HE stain) showing that the tumor retains its circumscription with lymphoid aggregate cuffing (arrow); D: The vaguely bundled spindle tumor cells were positive for S-100.

neoplasms and the peak incidence occurs is in fourth and fifth decades of life<sup>[12]</sup>. They are typically asymptomatic, but can present with gastrointestinal bleeding or palpable mass.

Gastric schwannomas are submucosal lesions with endoluminal or exophytic growth patterns and their common CT appearance is homogeneous attenuation in pre-contrast and post-contrast images with moderate enhancement (Figure 2)<sup>[10]</sup>. Calcification, cystic change, hemorrhage, and necrosis are rarely seen in gastric schwannoma. By contrast, adenocarcinomas typically exhibit ulceration, necrosis, and involvement of the gastric mucosa.

In histologic analysis, gastrointestinal schwannomas consist of focally atypical spindle cells in a microtrabecular-microfascicular pattern with evidence of nerve sheath differentiation (S-100 protein-positive), peripheral lymphoid cuffing, and occasional germinal centers (Figure 2)<sup>[11,13]</sup>.

### Leiomyomas

True leiomyomas were not well distinguished from gastrointestinal stromal tumors (GISTs) until the development of immunohistochemical staining techniques. It is clinically important to distinguish GISTs from leiomyomas, because GISTs have a risk of progression and metastasis. True leiomyomas are

benign neoplasms and never metastasize; surgery is not required unless obstruction or compression occur.

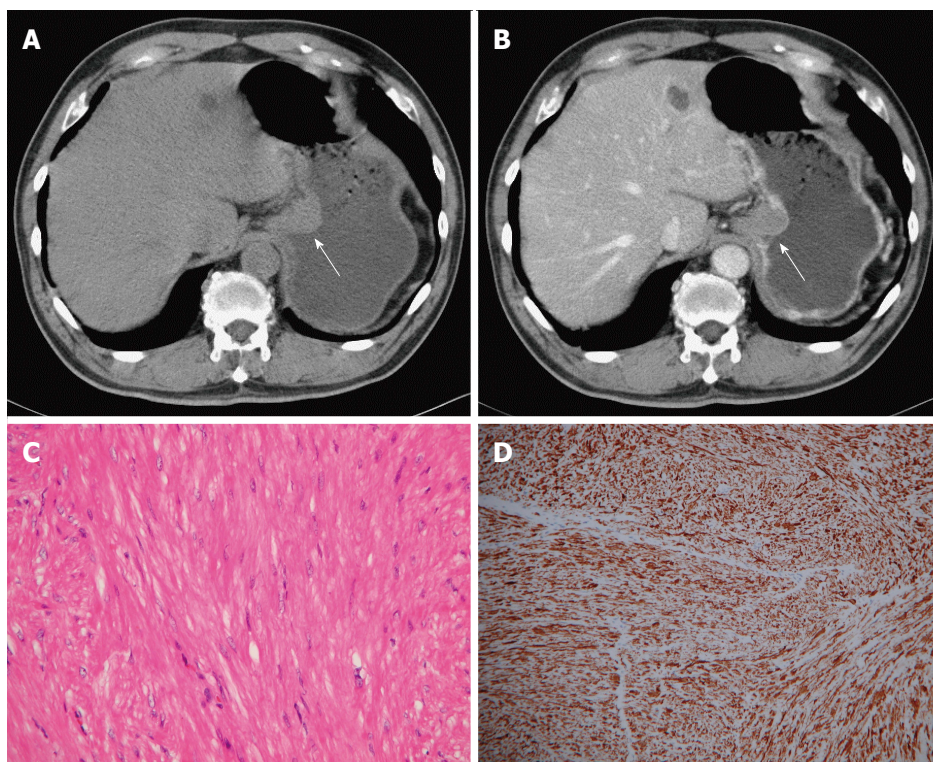
Gastrointestinal leiomyomas are the most frequent mesenchymal tumor of the esophagus<sup>[14]</sup>. They are relatively rare in the stomach, and are typically located in the gastric cardia. Leiomyomas typically manifest as homogeneous, low attenuation, poorly to moderately enhanced small masses in the gastric cardia (Figure 3). They typically exhibit an endoluminal growth pattern and are relatively small compared with GISTs<sup>[15]</sup>.

Histologically, leiomyomas resemble to normal smooth muscle cells. They exhibit hypocellular spindle cells with eosinophilic cytoplasm, arranged in perpendicularly oriented fascicles. The tumor cells are positive for desmin and SMA, and negative for CD34 and CD117 (c-kit) (Figure 3)<sup>[16]</sup>. In contrast to true leiomyomas, GISTs show higher cellularity, and are positive for CD34 and CD117.

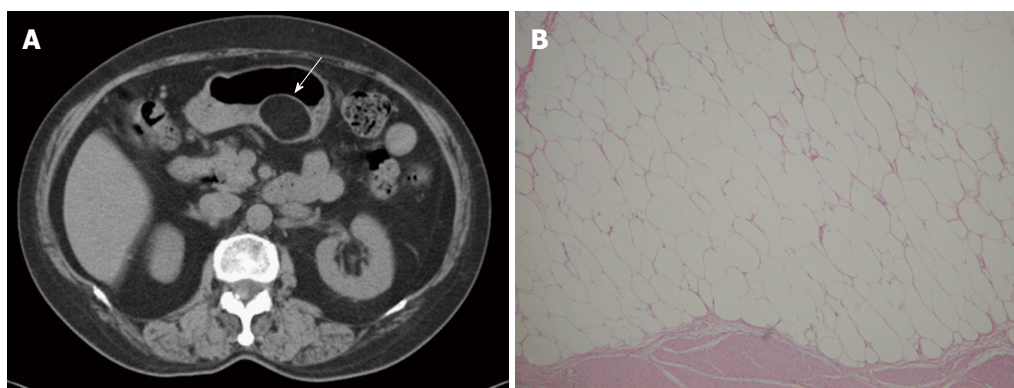
### Lipomas

Gastrointestinal lipomas are benign submucosal tumors composed of adipose tissue covered with a fibrous capsule. They are solitary slow-growing tumors and can occur anywhere in the gastrointestinal tract. Approximately 90% to 95% of lipomas are located in the submucosa and the remaining 5% to 10% are subserosal<sup>[17]</sup>. They are rare in the stomach, and most





**Figure 3 Leiomyoma.** A 70-year-old man had no symptoms. A and B: Pre- and post-contrast-enhanced axial computed tomography scans showing the leiomyoma at the gastric cardia (arrow), with an intraluminal growth pattern and homogeneous, poor enhancement. Note the intact enhancing mucosa, indicating the submucosal lesion; C: High-power photomicrograph (original magnification,  $\times 200$ ; HE stain) showing paucicellular spindle cells with low or moderate cellularity, arranged in perpendicularly oriented fascicles; The tumor cells were positive for smooth muscle actin (D) and negative for CD34 and CD117 (not shown).



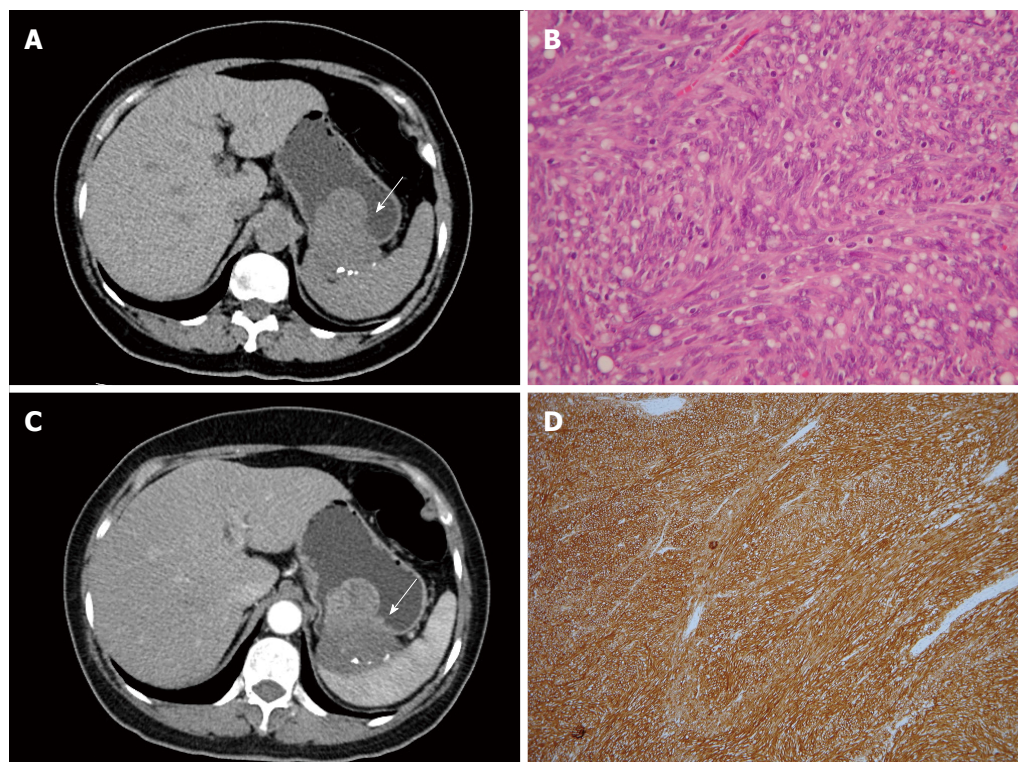
**Figure 4 Lipoma.** A 69-year-old man presented with abdominal fullness. A: Non-contrast-enhanced computed tomography (CT) showing a round, sharply margined, uniform fatty mass (arrow) with negative CT numbers (-90 HU) in the greater curvature of the stomach; B: High-power photomicrograph (original magnification,  $\times 200$ ; HE stain) showing that the tumor consists of mature adipocytes.

are located in the gastric antrum with an endoluminal growth pattern<sup>[18]</sup>. Because lipomas are soft, they may prolapse through the pylorus into the duodenum without gastric outlet obstruction. If the tumor is large enough, it may cause intussusception. CT is the imaging modality of choice for diagnosing of lipoma. A definitive diagnosis is based on a well-circumscribed mass with uniform fat density (-70 to -120 HU) (Figure 4). Soft tissue attenuation may be present in the tumor because of inflammation and ulceration<sup>[19]</sup>.

## MALIGNANT TUMORS

### *Gastrointestinal stromal tumors*

GISTs are the most common mesenchymal tumors of the gastrointestinal tract. GISTs can occur anywhere along the gastrointestinal tract, with approximately 60% to 70% occurring in the stomach, and 30% occurring in the small bowel. They arise from the intestinal cell of Cajal in muscularis propria of the gastrointestinal wall. Because they are mesenchymal



**Figure 5** Gastrointestinal stromal tumor. A 58-year-old woman presented with melena and abdominal cramping pain for a year. A: Pre-contrast computed tomography (CT) scan showing amorphous calcifications in a gastric tumor with endoluminal and exophytic growth patterns (arrow); B: Post-contrast-enhanced CT scan showing the intact enhancing mucosa and central necrosis; C: High-power photomicrograph (original magnification,  $\times 100$ ; HE stain) showing spindle cells arranged in lobules; D: The tumor cells were positive for CD117.

tumors, they may exhibit exophytic, intraluminal or mixed growth pattern.

Primary GISTs are typically large masses with irregular lobulated margins, mucosal ulceration, central necrosis, hemorrhage, and heterogeneous enhancement (Figure 5). Occasionally, calcifications are observable and are amorphous. Sometimes it is difficult to identify the origin of a mass because of the large size and extraluminal growth pattern<sup>[20]</sup>. Nearly 50% of patients with GISTs exhibit metastasis, and the liver and peritoneum are the most involved organs<sup>[21]</sup>. GISTs smaller than 3 cm can be endoluminal and polypoid in appearance. They are typically well-defined, homogeneous, soft-tissue attenuation masses. Sometimes it is difficult to distinguish small GISTs from other benign intramural gastric tumors. Unlike adenocarcinoma, they are submucosal tumors with intact mucosa, prone to exhibiting mixed exophytic and endoluminal growth patterns and amorphous calcification.

Histologically, GISTs exhibit uniform spindle cells or epithelioid cells arranged in lobules. Malignant GISTs are larger, more highly cellular, and more mitotically active than benign GISTs. Most GISTs (90%) are characterized by expression of CD117 (c-kit), which is a tyrosine kinase receptor in the intestinal cells of Cajal (Figure 5). The immunoreactivity of CD117 (c-kit) distinguishes GISTs from true

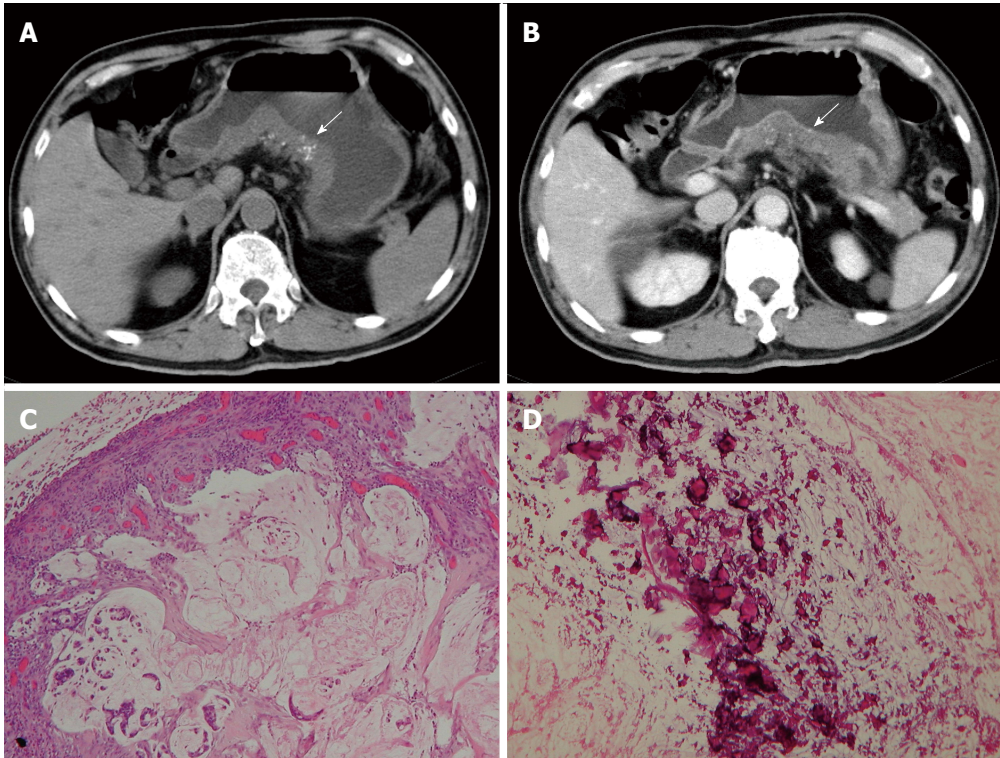
leiomyomas, leiomyosarcomas, schwannomas, and neurofibromas<sup>[22]</sup>.

#### **Mucinous adenocarcinomas**

The gastric adenocarcinomas are classified into mucinous, papillary, tubular, signet-ring cell, and undifferentiated types. The prognosis of mucinous carcinoma is poorer than non-mucinous carcinoma. Mucinous carcinoma is characterized by prominent glandular formation and abundant extracellular mucin deposition<sup>[23]</sup>. Miliary and punctate calcifications are present in the mucin pool, which is a diagnostic clue for mucinous carcinoma (Figure 6)<sup>[24]</sup>. It is proposed that the alkaline mucin promotes calcium salt deposition<sup>[25]</sup>, but the actual pathogenesis is not entirely clear.

Mucinous adenocarcinomas exhibit a diffuse thickened gastric wall with relatively low attenuation on pre-contrast-enhanced CT images and poor enhancement after contrast enhancement because of the accumulation of mucin (Figure 6)<sup>[26]</sup>. Calcifications within the tumor are rarely larger than 3 mm in diameter and are located within the thickened gastric wall. Calcifications in primary untreated gastric cancer are rare, but can sometimes be observed in GISTs and hemangiomas<sup>[27]</sup>. Calcification is amorphous in GISTs (Figure 5) and manifests as a cluster of phleboliths in hemangiomas, which differs from mucinous adenocarcinomas.





**Figure 6 Mucinous adenocarcinoma.** A 65-year-old man presented with vomiting and diarrhea for 2 mo. A and B: Pre- and post-contrast-enhanced computed tomography scans showing a segmental thickening at the posterior wall of the gastric antrum, with poor enhancement and punctate calcification (arrow). Low-power photomicrograph (original magnification,  $\times 20$ ; HE stain) showing abundant extracellular mucin pools (C) with floating tumor cells and calcifications (D).

### Lymphomas

Primary gastrointestinal lymphomas are the most frequently occurring extranodal lymphomas and are almost exclusively of non-Hodgkin type. The stomach constitutes 50% of all gastrointestinal tract lymphomas and 25% of extranodal lymphomas. Gastric lymphomas are predominantly non-Hodgkin lymphomas of B-cell origin<sup>[28,29]</sup>. It is believed that primary gastric lymphomas originate from low-grade mucosa-associated lymphoid tissue (MALT), and transform into intermediate or high-grade large cell lymphomas<sup>[30]</sup>.

Gastric lymphomas typically show regional or diffuse gastric wall thickening on CT images (Figure 7). The enhancement is typically homogeneous, with preservation of the underlying gastric rugae, but low-attenuation areas of necrosis may be observed in some cases<sup>[31]</sup>. The stomach typically remains pliable and distensible, and transpyloric spread of the tumor may occur in 30% of cases<sup>[32]</sup>. In high-grade gastric lymphomas, involvement of adjacent organs is usually observed, with some perigastric lymph nodes. Low-grade MALT lymphomas frequently result in non-specific findings, such as mucosal nodularity, depressed lesions, and thickened folds. Compared to gastric adenocarcinomas, the perigastric fat plane is more likely to be preserved<sup>[33]</sup> and lymphadenopathy can typically be observed extending below the renal

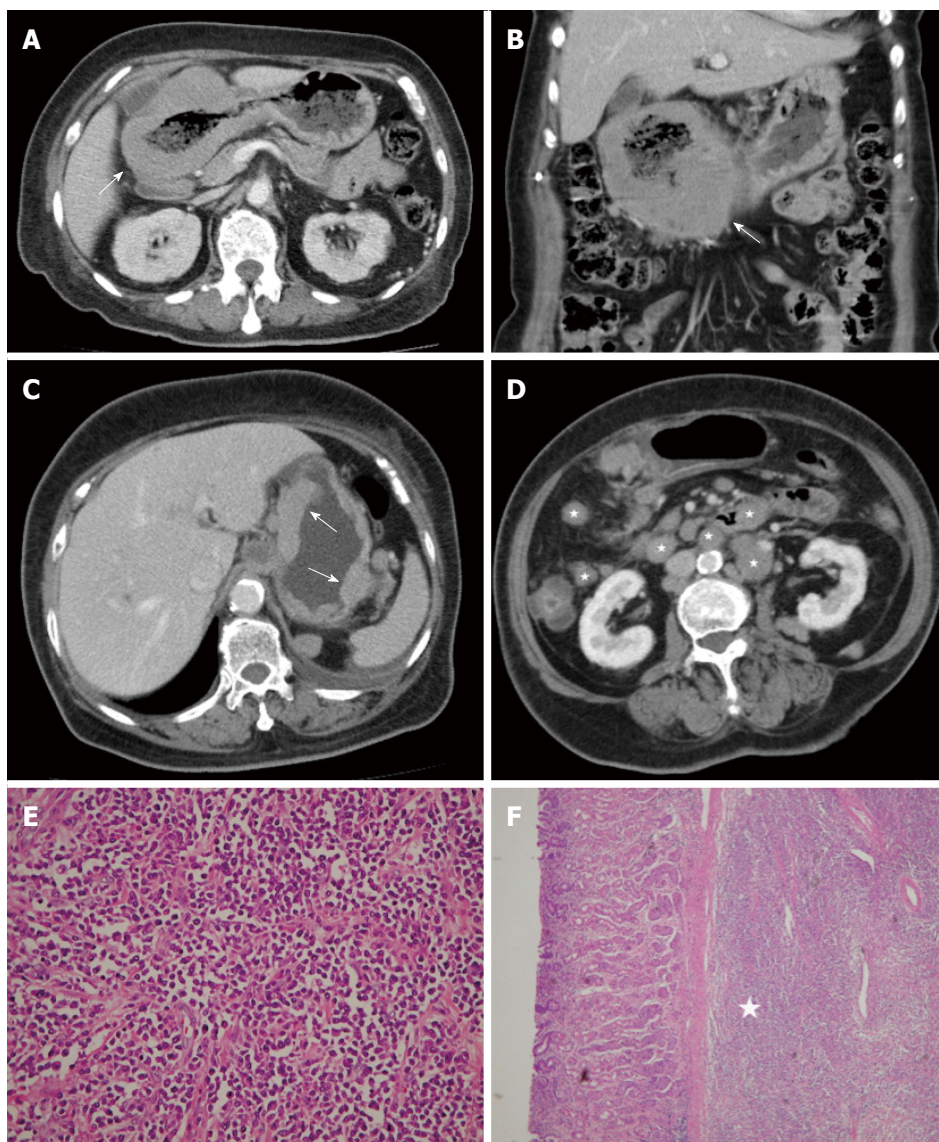
hilum (Figure 7)<sup>[31]</sup>.

### Carcinoids

Gastric carcinoids are well-differentiated endocrine neoplasms that originate from enterochromaffin-like cells in the gastric mucosa and are therefore epithelial in origin. Although the stomach is the least common site of gastrointestinal carcinoids, they are clinically important because of the associated carcinoid syndromes. Gastric carcinoids can be divided into three subtypes, each with a distinct pathophysiologic mechanism, resulting in different clinical outcomes and management<sup>[34,35]</sup>.

Type 1 gastric carcinoids are the most common (75%-80% of gastric carcinoids), and are associated with hypergastrinemia and chronic atrophic gastritis. Patients with type 1 gastric carcinoid are typically asymptomatic; tumors are typically encountered during endoscopy for nonspecific symptoms. Type 2 gastric carcinoids are less common (5%-10% of gastric carcinoids) and are associated with Zollinger-Ellison syndrome, with multiple endocrine neoplasms. Approximately 30% of patients with multiple endocrine neoplasia type 1 have gastric carcinoid tumors<sup>[36]</sup>. In type 2 gastric carcinoids, elevated gastrin levels produce signs and symptoms of hypertrophic, hypersecretory gastritis. Type 1 and type 2 carcinoids are small, circumscribed, mucosal and/or submucosal





**Figure 7 Diffuse large B-cell lymphoma.** A 63-year-old woman presented with epigastralgia. A and B: Contrast-enhanced computed tomography (CT) scan showing diffuse, homogeneous gastric wall thickening with a smooth well-defined outer wall (arrow). An 83-year-old woman presented with tarry stool and constipation for a week; C and D: Post-contrast-enhanced CT revealing wall thickness (arrow) at the gastric body and several enlarged lymph nodes in the mesentery and para-aortic retroperitoneum (stars); E: Low-power photomicrograph (original magnification,  $\times 20$ ; HE stain) showing diffuse proliferation of large monomorphic neoplastic cells with abundant cytoplasm; F: The neoplastic cells occupy the full thickness of the submucosa (star).

polypoid tumors in the gastric body and fundus<sup>[37,38]</sup>. On CT, polypoid lesions appear iso-dense in the pre-contrast phase, with marked enhancement in the arterial phase (Figure 8)<sup>[39]</sup>. Type 3 gastric carcinoids, which are larger, sporadic, solitary tumors, are not associated with atrophic gastritis or hypergastrinemia; however, they may exhibit ulceration and distant metastases, and the prognosis is poor compared with type 1 and 2 carcinoids<sup>[40]</sup>.

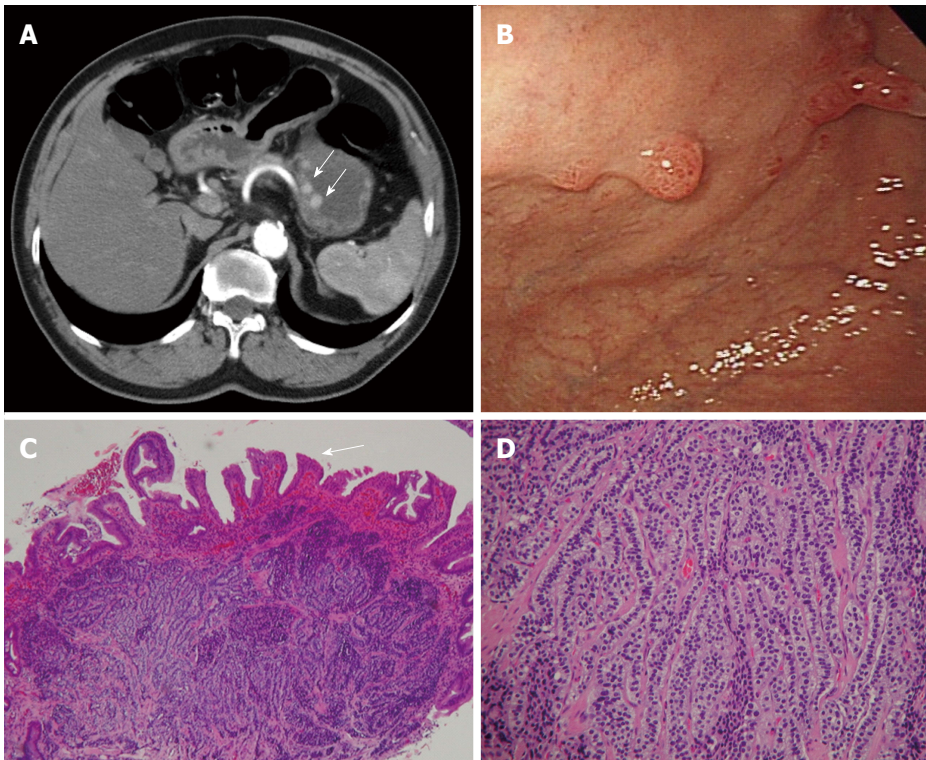
In histologic analysis, carcinoids are composed of small uniform cells arranged in trabecular or nest patterns. The nuclei are round or oval with finely stippled chromatin, infrequent mitoses, and minimal nuclear polymorphism (Figure 8). High-grade sporadic carcinoid tumors may resemble

small cell carcinomas, with nuclear pleomorphism, hyperchromasia and higher mitotic activity. These tumors are immunoreactive to chromogranin A and synaptophysin, which are general neuroendocrine markers<sup>[38]</sup>.

## TUMOR-LIKE LESIONS

### **Ectopic pancreas**

Ectopic pancreas is a condition whereby pancreatic tissues lack anatomic and vascular connections to the pancreas<sup>[41]</sup>. The pathogenesis is not clear, but some believe that during normal pancreatic development from evaginations, one or more evaginations may remain in the bowel wall. Others suggest that pancreatic



**Figure 8 Carcinoid.** A 66-year-old man presented with epigastralgia and elevated levels of serum gastrin. A: Contrast-enhanced transverse and coronal computed tomography (CT) scans showing multiple enhancing polypoid lesions (arrows) at the gastric body; B: Endoscopy showing multiple polypoid lesions; C: Low-power photomicrograph (original magnification,  $\times 10$ ; HE stain) showing atrophic gastritis (atrophy in glandular structures, arrow); D: High-power photomicrograph (original magnification,  $\times 100$ ; HE stain) showing uniform cells bearing round nuclei and growing in a festoon or ribbon-like arrangement in the submucosa.

metaplasia of the gastric submucosa may occur during the embryogenesis of endodermal tissues<sup>[42]</sup>. These lesions typically have a peak incidence in fourth to sixth decades of life, most commonly among men. They are typically discovered incidentally during surgery or autopsy, with an incidence during laparotomy of 0.2%<sup>[43]</sup>. Although most patients with ectopic pancreas are asymptomatic, some may present with nonspecific abdominal pain, bleeding, and mechanical obstruction<sup>[44-46]</sup>. Lesions are typically located in the stomach, duodenum, or jejunum. Because they are typically small, slow-growing, and asymptomatic, they might be overlooked in daily practice.

Ectopic pancreas typically manifests as an ill-defined, submucosal mass with endoluminal growth in the stomach, generally located in the greater curvature of the distal antrum<sup>[47]</sup>. On CT, the enhancement is typically similar to that of the normal pancreas. It has been reported that the enhancement degree depends heavily on the histopathologic composition of the ectopic pancreas<sup>[48]</sup>. There are three subtypes of ectopic pancreas. The acini-dominant type is more homogeneous and exhibits stronger enhancement than the normal pancreas (Figure 9), the duct-dominant type exhibits lower enhancement than the normal pancreas, and the mixed type exhibits variable CT attenuation values compared with the normal pancreas. Histologically, ectopic pancreas is not a

diagnostic problem when pancreatic acini, ducts, islets of Langerhans, and intervening connective tissue are present.

### Bezoar

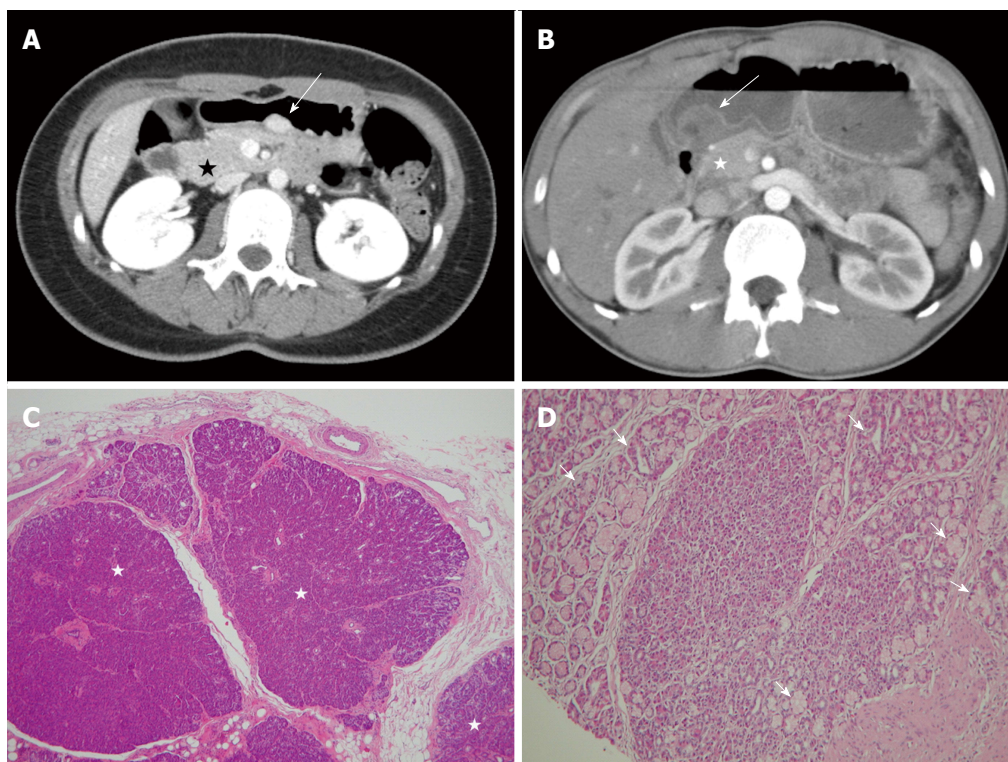
Bezoars, mimicking gastric neoplasms, consist of ingested foreign materials that accumulate within the gastrointestinal tract. They include trichobezoars, which are composed of hair; phytobezoars, which are composed of fruit or vegetable matter; lactobezoars, which are undigested milk concretions; and pharmacobezoars, which are composed of medications<sup>[49]</sup>. They are typically confined to the stomach but can extend through the pylorus into the jejunum, ileum and even up to the colon (known as Rapunzel syndrome).

Most bezoar cases are diagnosed using plain films or a barium meal, but CT may be requested for patients who present with abdominal masses. A bezoar in the stomach presents as a mobile intraluminal gastric filling defect, with a mottled appearance caused by air bubbles retained in interstices of the mass. (Figure 10)<sup>[50]</sup>. Clinical history is crucial for accurate diagnosis.

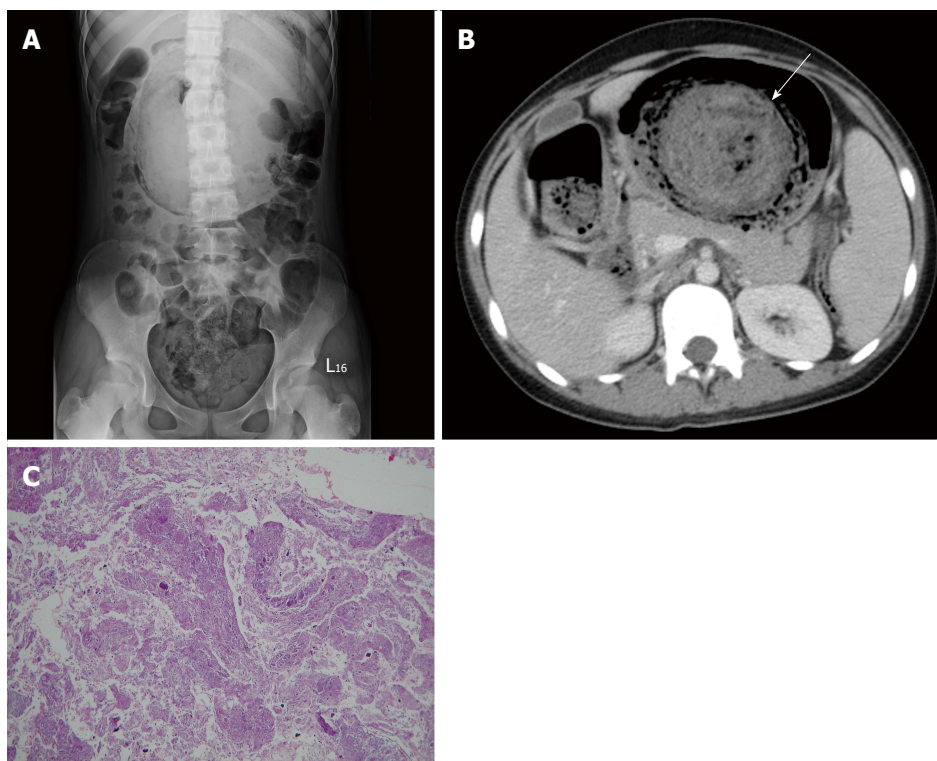
## CONCLUSION

It is often difficult to determine the etiology of gastric lesions based on the basis of clinical findings. Using





**Figure 9 Ectopic pancreas.** A 26-year-old woman presented with postprandial epigastric pain for 2 years. A: Transverse computed tomography (CT) scan showing a small round submucosal lesion with well-defined margins in the wall of the antrum (arrow). Note the contrast material enhancement is higher than that of the normal pancreas (star); B: Low-power photomicrograph (original magnification,  $\times 20$ ; HE stain) showing that pancreas tissue (star) is predominant in the acinar tissue. A 20-year-old man presented with intermittent epigastralgia for 2 mo; C: Transverse CT scan showing a submucosal round mass (arrow) with necrosis at the gastric antrum. Note the poorly enhancing nodular mass, as compared with the markedly enhancing adjacent normal pancreas (star); D: Low-power photomicrograph (original magnification,  $\times 200$ ; HE stain) showing ectopic pancreatic tissue, composed primarily of pancreatic ducts (arrow) in the gastric mucosal layer.



**Figure 10 Trichobezoar.** A 13-year-old girl presented with intermittent fever. She exhibited obsessive and compulsive hair pulling. A: Plain film revealing a bezoar outlined by air in the stomach; B: Transverse computed tomography image showing an inhomogeneous mass with a mottled gas pattern in the distended stomach (arrow); C: Low-power photomicrograph (original magnification,  $\times 10$ ; HE stain) showing hair tissue with inflammatory exudate.



MDCT with water as a negative oral contrast can provide useful information for the diagnosis of unusual gastric tumors or tumor-like lesions. Familiarity with imaging appearances and pathologic findings can help physicians make an accurate diagnosis.

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