GIST and Other Subepithelial Tumors

9

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Contents

Most subepithelial tumors of the stomach are found incidentally at upper endoscopy and may arise from any of the layers of the stomach. Subepithelial tumors are evaluated for size, consistency, color, and shape by conventional endoscopy. The most common of these is the gastrointestinal stromal tumor (GIST), which is potentially malignant. GISTs are usually firm and immobile. Carcinoid tumor appears as slightly yellow, sessile, or semipedunculated lesions with normal-appearing overlying mucosa. Lipomas are often yellowish and compress like a pillow with a forceps. Pancreatic rests are often antral and may have a central umbilication. If the cause of the lesion is not evident at conventional endoscopy, it should be evaluated with endoscopic ultrasonography (EUS), which can determine the size and the layer of origin. Histology is the confirmative method to differentiate between the different types of subepithelial lesions.

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9.1 Subepithelial Tumor or Submucosal Tumor

9.1.1 Definition

A subepithelial tumor or submucosal tumor is defined as any intramural growth underneath the mucosa, where etiology cannot readily be determined by luminal diagnostic endoscopy or barium radiography. However, the term "submucosal tumor" is inappropriate because many of these lesions do not arise from the submucosa and many of them are not tumors. Thus, "subepithelial" is a more appropriate term than "submucosal." It can be classified into benign and malignant (potentially) (Table 9.1).

Table 9.1 Classification of subepithelial tumors

Benign	Malignant (potentially)
GIST – benign	GIST – malignant
Leiomyoma	Carcinoid
Lipoma	Lymphoma
Varix	Metastasis
Neural origin – schwannoma	Glomus tumor
Granular cell tumor	–
Inflammatory fibrinoid polyp	–
Duplication cyst	–
Lymphangioma	–
Pancreatic rest	–

9.1.2 Clinical Manifestations

Subepithelial tumors are usually asymptomatic and therefore most often discovered as accidental findings during surgery, autopsy, or diagnostic procedures. If symptoms do occur, they are unspecific such as abdominal pain, obstruction, hemorrhage, and intussusception. Like other malignancies, malignant subepithelial tumors may present with systemic symptoms, especially weight loss.

9.1.3 Diagnostic Procedures in Subepithelial Tumors

9.1.3.1 Standard Endoscopy

Due to their lack of overt symptoms, subepithelial tumors are generally discovered accidentally during standard endoscopic examination. Standard endoscopy can assess the location, mucosal appearance, and consistency of the lesion [1]. However, endoscopy cannot provide enough information to definitively determine its nature.

9.1.3.2 Endoscopic Ultrasonography (EUS)

EUS is the most reliable method to evaluate subepithelial tumors. Importantly, it is very accurate in determining if the mucosal "bump" is the result of extrinsic compression. EUS can also clearly distinguish solid from cystic structure within the submucosa. EUS accurately differentiates the layers of the gut wall and can define the layer of origin of the subepithelial tumors [2, 3].

9.1.3.3 Histologic Evaluation

Histology is the confirmative method to differentiate between the different types of subepithelial lesions. Tissues for histologic evaluation can be obtained only through techniques such as endoscopic biopsy, EUS–fine-needle aspiration (FNA), endoscopic mucosal resection (EMR), or surgical resection [4, 5].

9.2 Gastrointestinal Stromal Tumor (GIST)

9.2.1 Definition

GISTs arise from the interstitial cells of Cajal and can be identified using immunohistochemistry staining for expression of CD117, which is also known as the c-kit protein (a cell membrane receptor with tyrosine kinase activity). GISTs are the most commonly identified intramural subepithelial mass in the upper gastrointestinal tract. GISTs are most frequently diagnosed in older individuals, in whom they are most common in the stomach (60–70 %).

9.2.2 Endoscopic Appearance

A GIST commonly appears as a bulge located in the GI tract with normal overlying mucosa and can vary in size from several millimeters to over 30 cm. It usually has a smooth and regular appearance without major mucosal irregularities (Figs. 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, and 9.7). GIST can also be a fast-growing tumor and can quickly outgrow its blood supply. As a result, they can develop a central necrosis or inflammatory lesion. The necrotic areas can fistulize to the gastrointestinal lumen and result in gastrointestinal bleeding [6, 7].

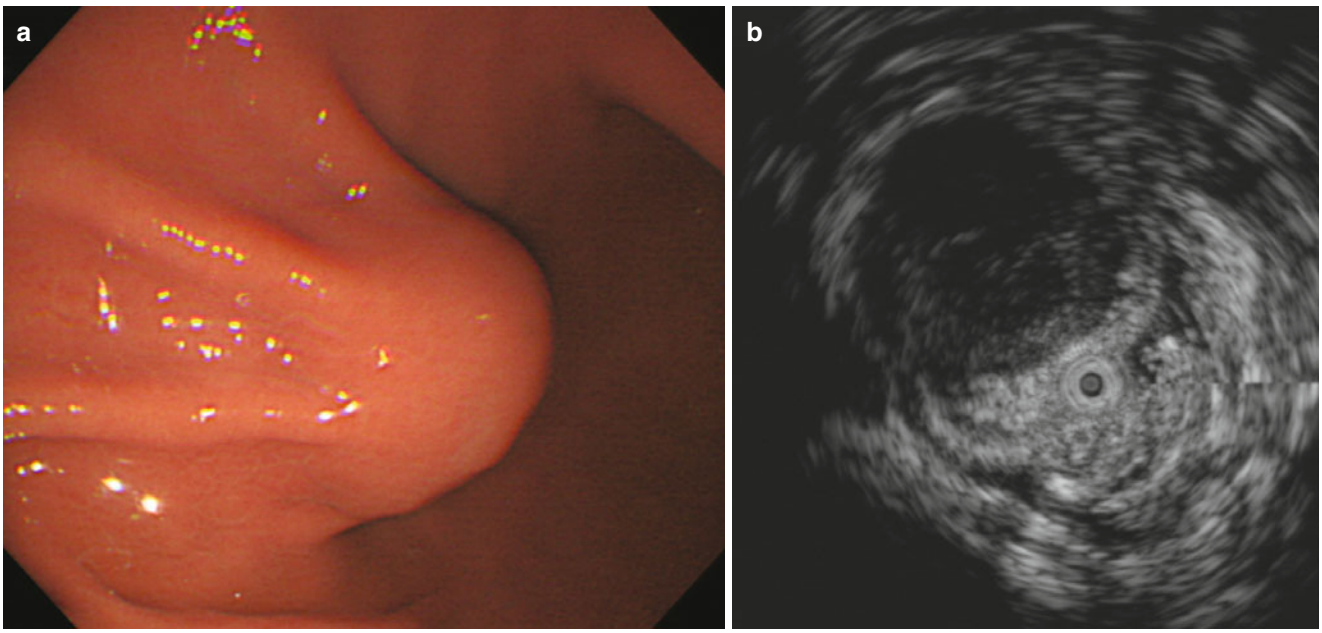

Fig. 9.1 Gastric GIST. (**a**) Subepithelial tumor with bridging fold in the antrum, (**b**) heterogeneous hypoechoic mass, 14 mm in diameter, arising from the proper muscle layer

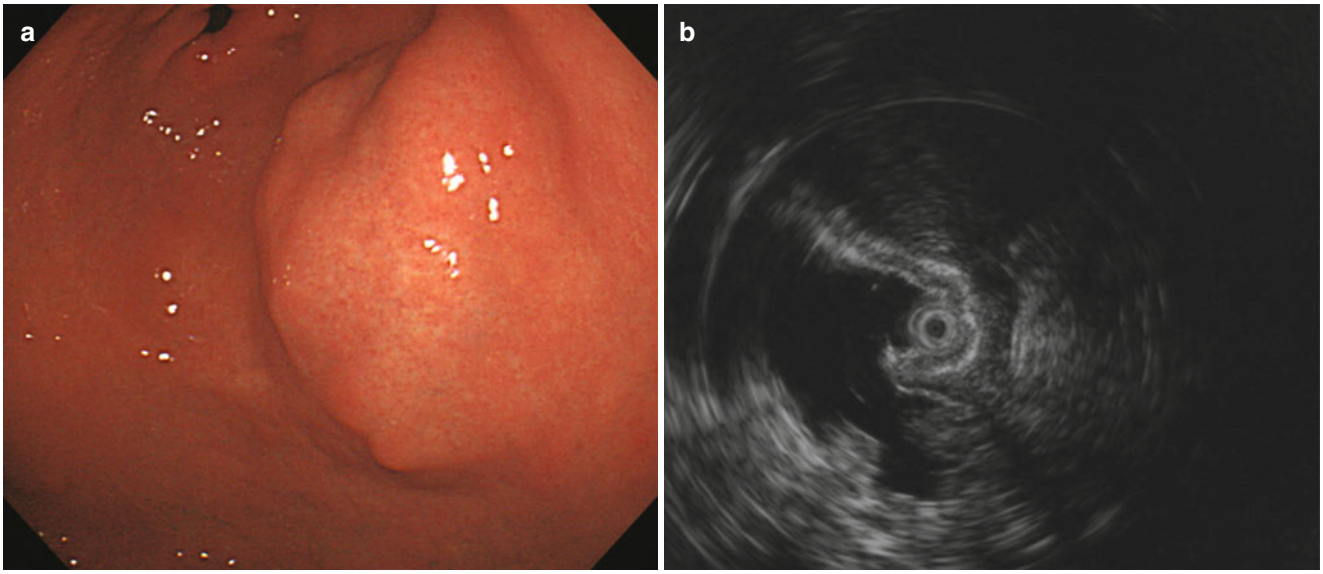

Fig. 9.2 Gastric GIST. (**a**) A subepithelial mass with a normal gastric mucosa was noticed on the antrum. (**b**) EUS showed a 30×25 mm sized homogenous hypoechoic tumor and lesion was originated from the proper muscle layer

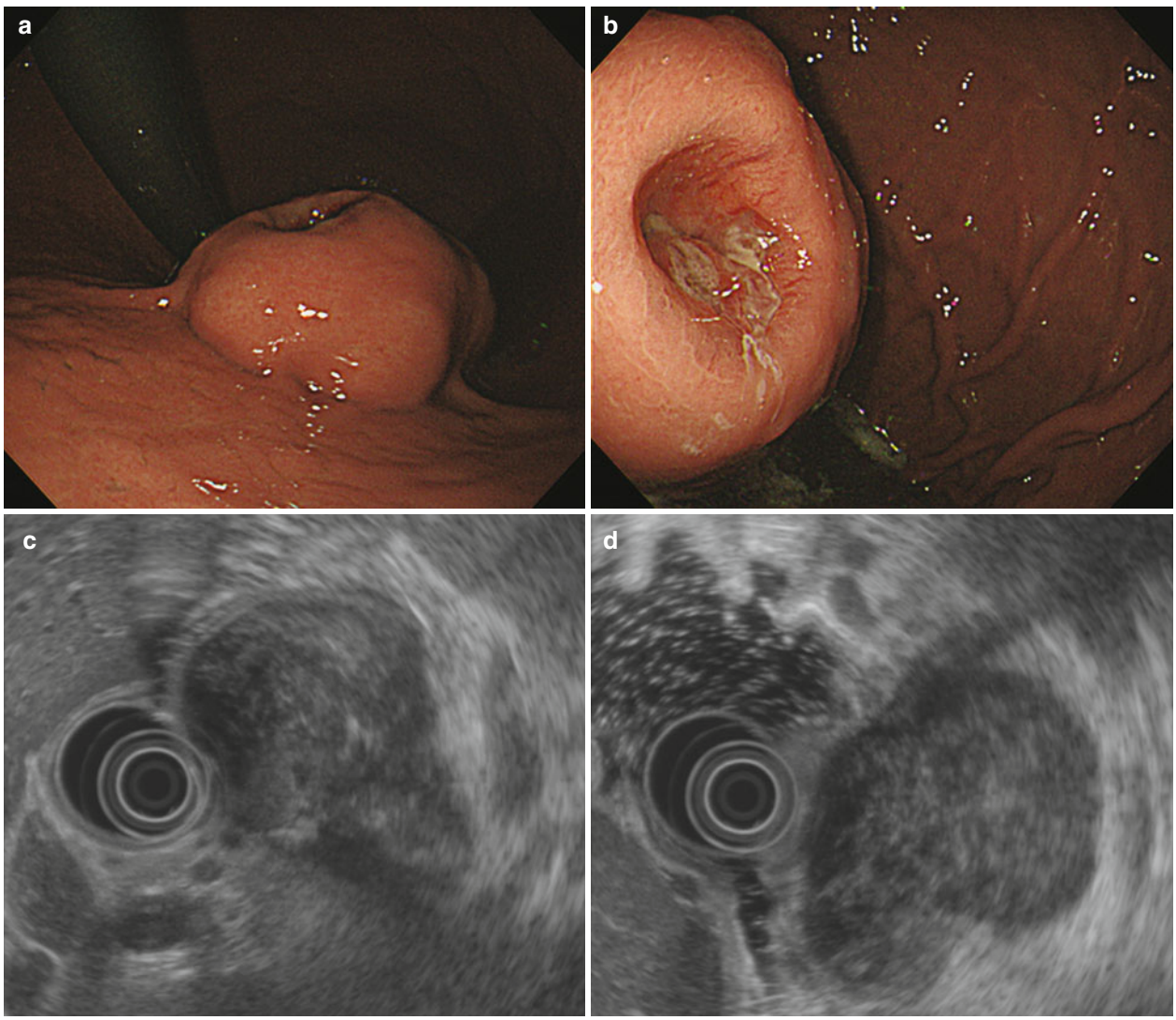

Fig. 9.3 GIST, high risk. (**a**, **b**) Subepithelial tumor with central umbilication and ulcer on the posterior wall of the upper body. (**c**, **d**) Heterogeneous hypoechoic mass, 6 cm in diameter, arising from the proper muscle layer. It shows internal hyperechoic foci and cystic degeneration

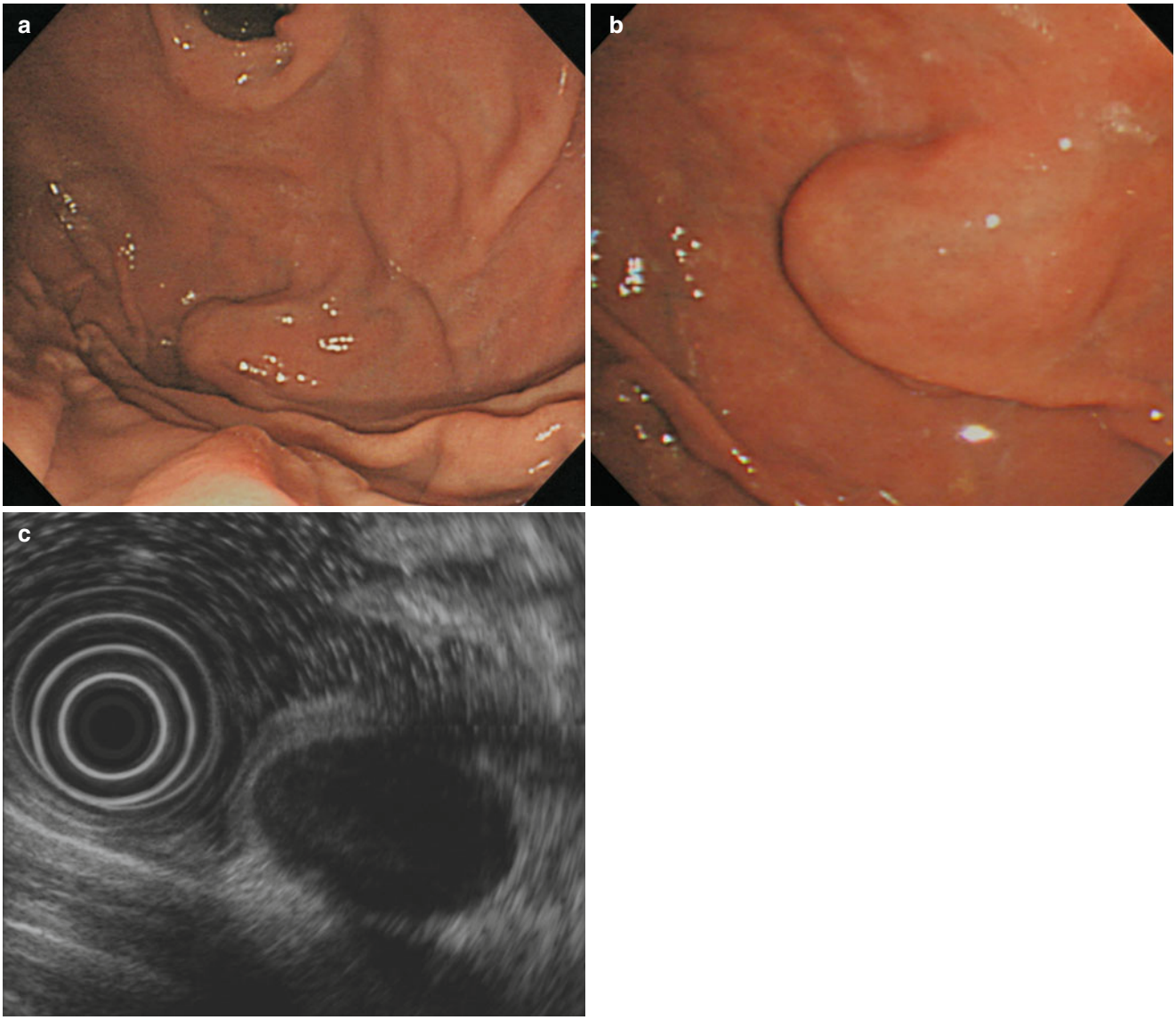

Fig. 9.4 Gastric GIST, intermediate risk. (**a**, **b**) About 2.5-cm subepithelial tumor was noticed on the fundus. (**c**) EUS showed a homogenous hypoechoic mass arising from the proper muscle layer. Wedge resection was performed for treatment and mitotic figures were seen in 3/50 high-power fields

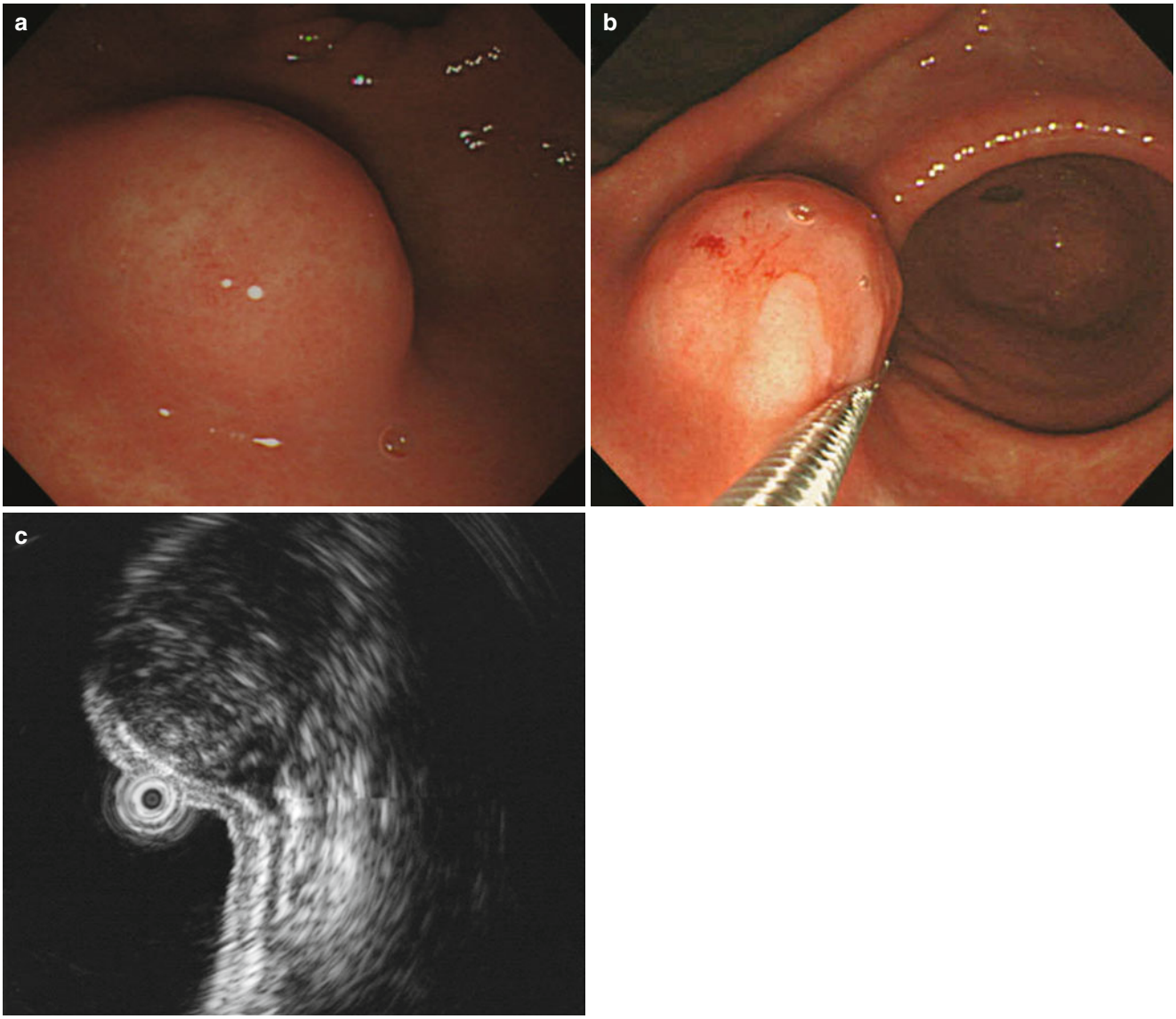

Fig. 9.5 Gastric GIST, low risk. (**a**, **b**) About 2.5-cm subepithelial tumor was noticed on the antrum. This lesion had a firm consistency. (**c**) On EUS examination, a homogenous hypoechoic tumor was noticed and lesion was originated from the proper muscle layer

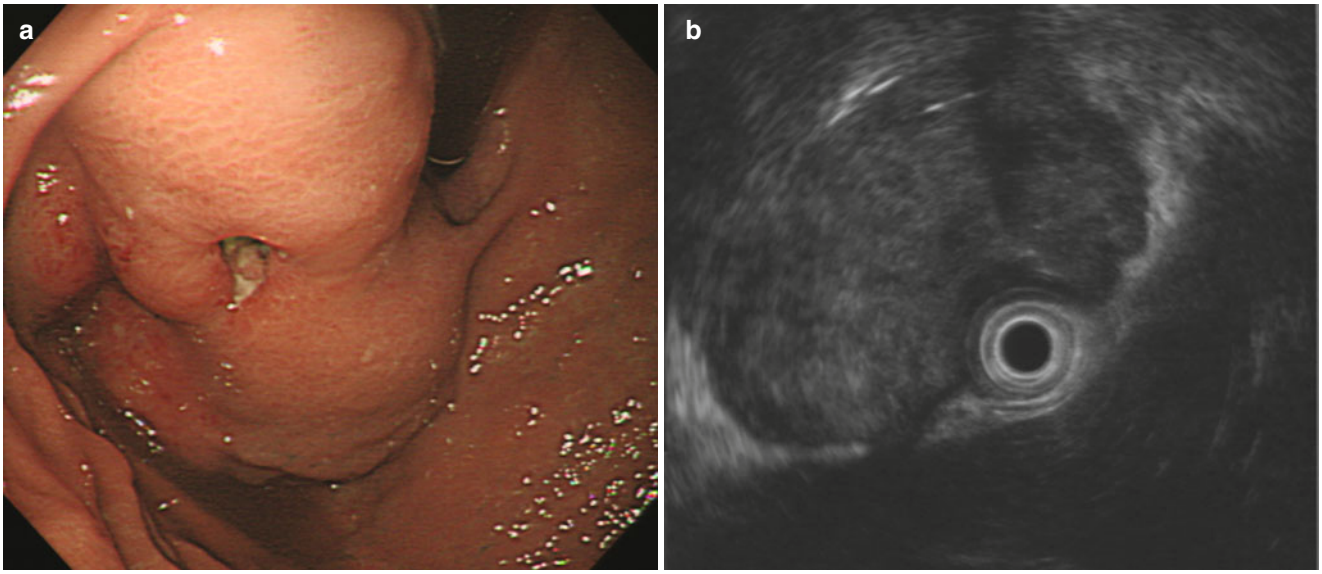

Fig. 9.6 Gastric GIST, high risk. (**a**) Large subepithelial tumor with central ulceration in the fundus. (**b**) On EUS examination, about 12-cm heterogeneous hypoechoic lesion originates from the proper muscle layer was noticed. This lesion has multiple echogenic foci and streak

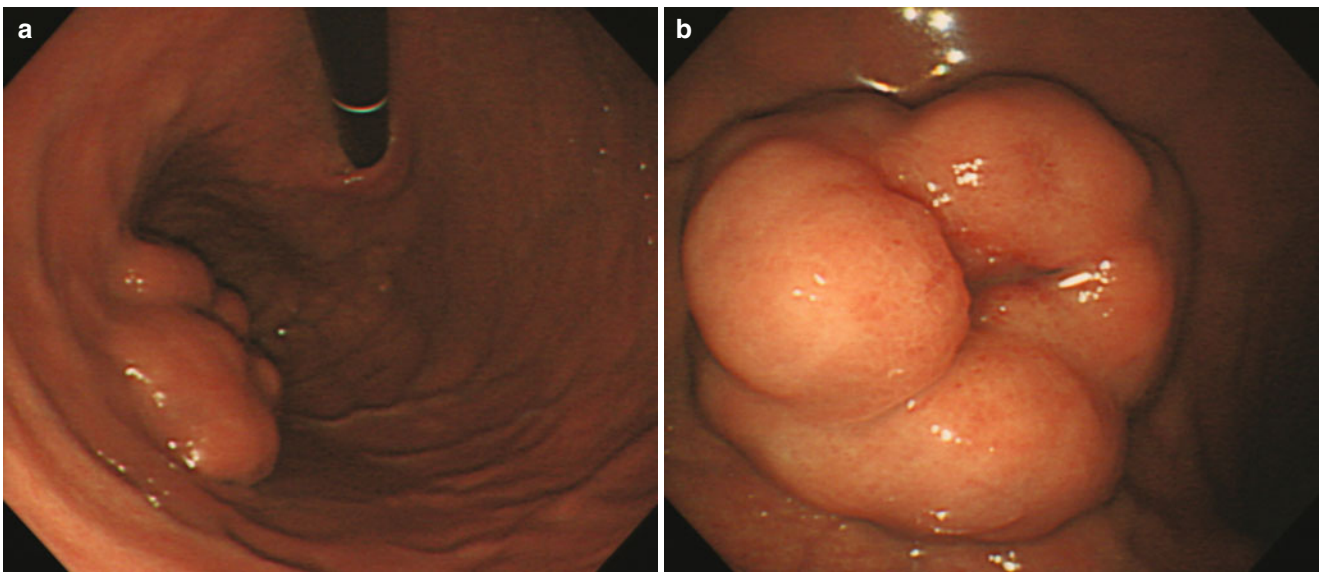

Fig. 9.7 Gastric GIST, high risk. (**a**) About 5-cm lobulated subepithelial tumor was noted on the fundus. (**b**) Closer view shows central ulceration

9.2.3 EUS Appearance

EUS examination of the GIST shows a hypoechoic mass with a homogenous echotexture that is usually contiguous with the muscularis propria (fourth EUS layer) (Figs. 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, and 9.7). EUS can differentiate benign from malignant GISTs by examining for the following criteria: diameter greater than 3 cm, irregular outer borders, cystic spaces, echogenic foci (heterogeneous echotexture), and adjacent malignant-appearing lymph nodes.

Table 9.2 Risk of aggressive behavior in gastrointestinal stromal tumors

–	Size	Mitotic count
Very low risk	<2 cm	<5/50HPF
Low risk	2–5 cm	<5/50HPF
Intermediate risk	<5 cm	6–10/50HPF
–	5–10 cm	<5/50HPF
High risk	>5 cm	>5/50HPF
–	>10 cm	Any mitotic rate
–	Any size	>10/50HPF

9.2.4 Prognosis

About 10–30 % of all GISTs display malignant behavior. All GISTs are potentially malignant and thus cannot be classified as benign or malignant. Tumor size and mitotic rate formed the foundation for the NIH 2002 consensus approach to GIST risk stratification, as illustrated in the Table 9.2.

9.3 Other Subepithelial Tumors

9.3.1 Carcinoid Tumor

Carcinoid tumors are neuroendocrine tumors that originate from enterochromaffin-like cells located in the deep mucosa. Gastric carcinoid tumors are subdivided into three categories (Table 9.3). Gastric carcinoids usually have the endoscopic appearance of slightly yellow, sessile, or semipedunculated lesions with normal-appearing overlying mucosa (Figs. 9.8, 9.9, 9.10, 9.11, 9.12, and 9.13). Type I tumors are usually smaller than 1 cm, often multiple, and may appear as polypoid lesions with a small central ulceration. Type III lesions are usually solitary. The surrounding mucosa may be macroscopically normal, especially in type II lesions, or there may be evidence of atrophy (type I) or associated peptic ulcer (type II). Carcinoids appear at EUS as small (most often less than 2 cm in diameter), hypoechoic, well-circumscribed, homogenous lesions developed in the second and third layers.

Table 9.3 Characteristics of gastric carcinoid tumors

	Type I	Type II	Type III
Proportion	70–80 %	Less than 5 %	15–20 %
Associations	Atrophic gastritis, pernicious anemia	MEN-1, Zollinger–Ellison syndrome	Sporadic carcinoid syndrome
Epidemiology	Typically women 50–70 years old	Family history of MEN-1 syndrome	Increased in African Americans
Plasma gastrin	High	High	Normal
Gastric acid	Low	High	Normal
Number of tumors	Multiple	Multiple	Single
Size of tumors	<1 cm	<1 cm	2–5 cm
Site of tumors	Fundus	Fundus	Fundus or antrum
Metastasis	2–5 %	<10 %	>50 %
Mean age	63	50	55
Prognosis	Good	Usually good	Poor

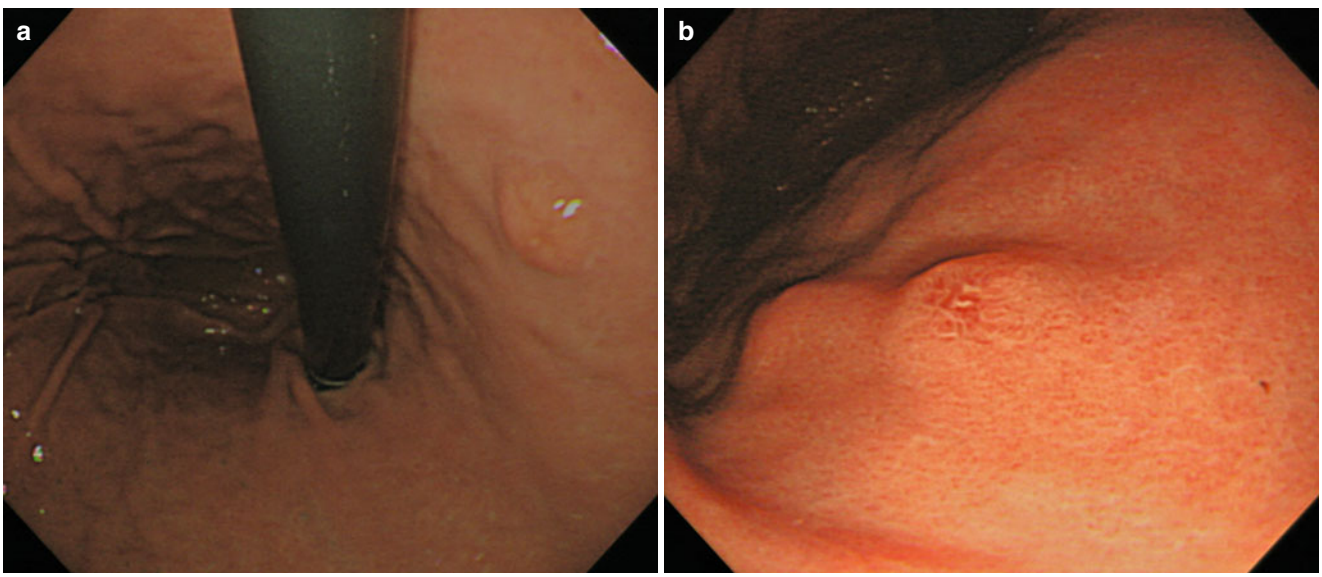

Fig. 9.8 Gastric carcinoid tumor. (**a**) Solitary polyp with central depression is noticed on posterior wall of the mid-body. This tumor is sessile and yellowish. (**b**) A polypoid lesion with slight erosive change on its surface was noticed on anterior wall of the mid-body

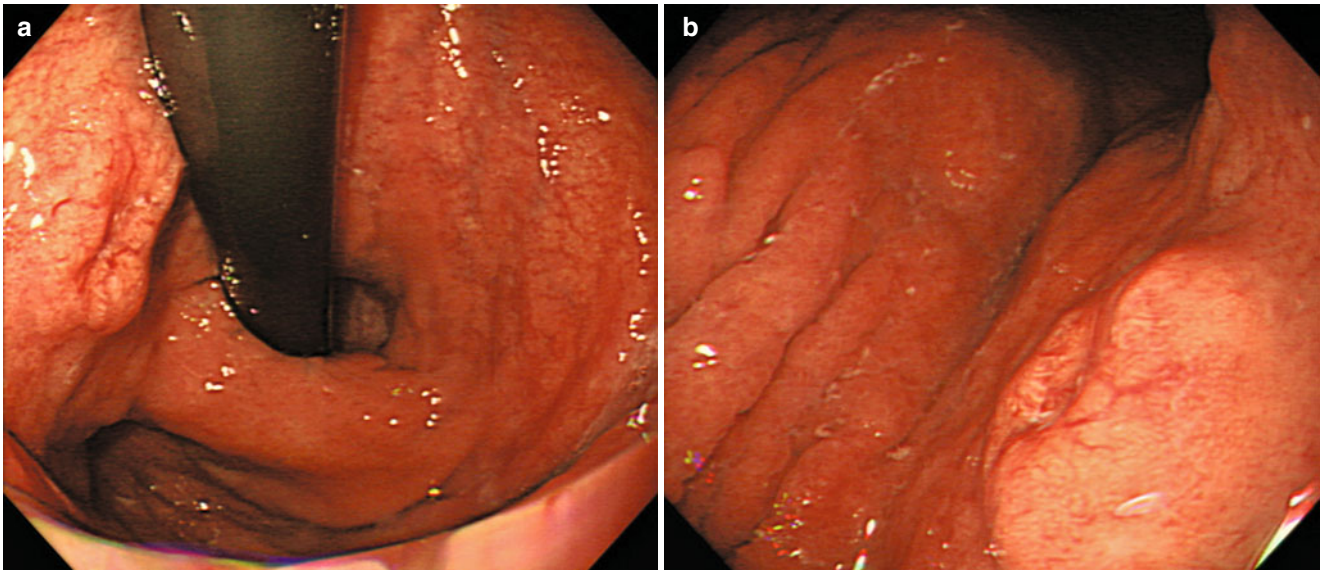

Fig. 9.9 Gastric carcinoid tumor. (**a**) About 1.5-cm gastric subepithelial tumor with central depression was noticed on posterior wall of the upper body. (**b**) Closer view shows central ulceration and hyperemic change. The patient underwent endoscopic resection using ligation. The resected specimen showed a well-differentiated neuroendocrine tumor with clear resection margin

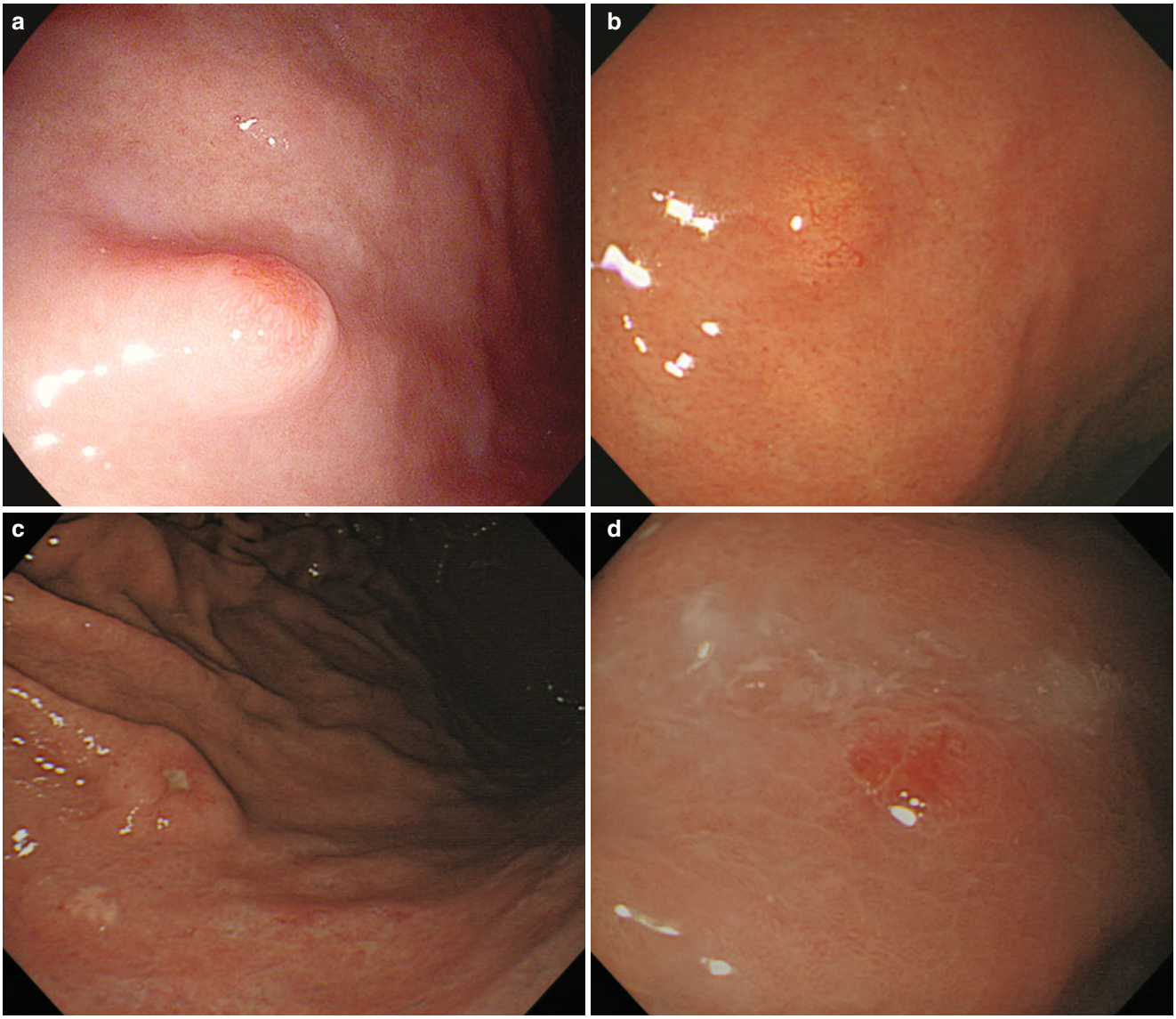

Fig. 9.10 Variable appearance of a gastric carcinoid tumor. (**a**) About 0.5-cm polypoid lesion with hyperemia was noticed and the lesion looks like raised erosion. (**b**) A 5-mm gastric carcinoid tumor. This tumor is sessile, round, and yellow. (**c**) Single subepithelial tumor with central erosion was noticed on the greater curvature of the body. (**d**) A tiny gastric carcinoid tumor with mucosa erythema was noticed

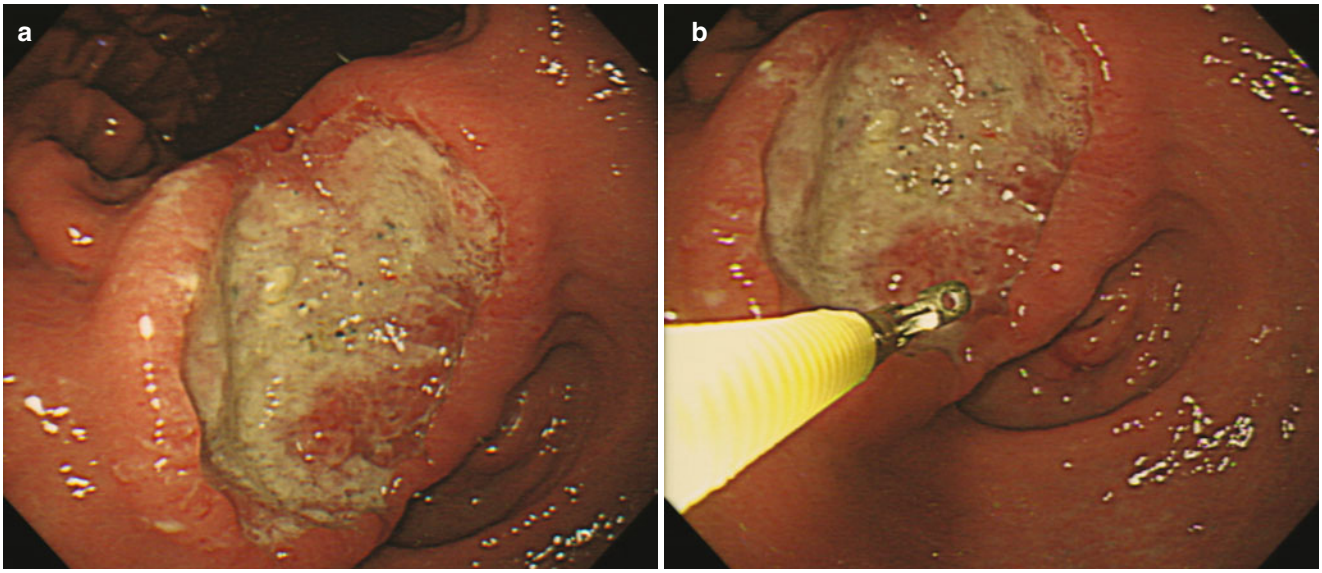

Fig. 9.11 A gastric neuroendocrine carcinoma that presented with huge gastric ulcer. (**a**) Huge gastric ulcer was noticed on the antrum. (**b**) Biopsy specimen demonstrated a well-differentiated neuroendocrine carcinoma

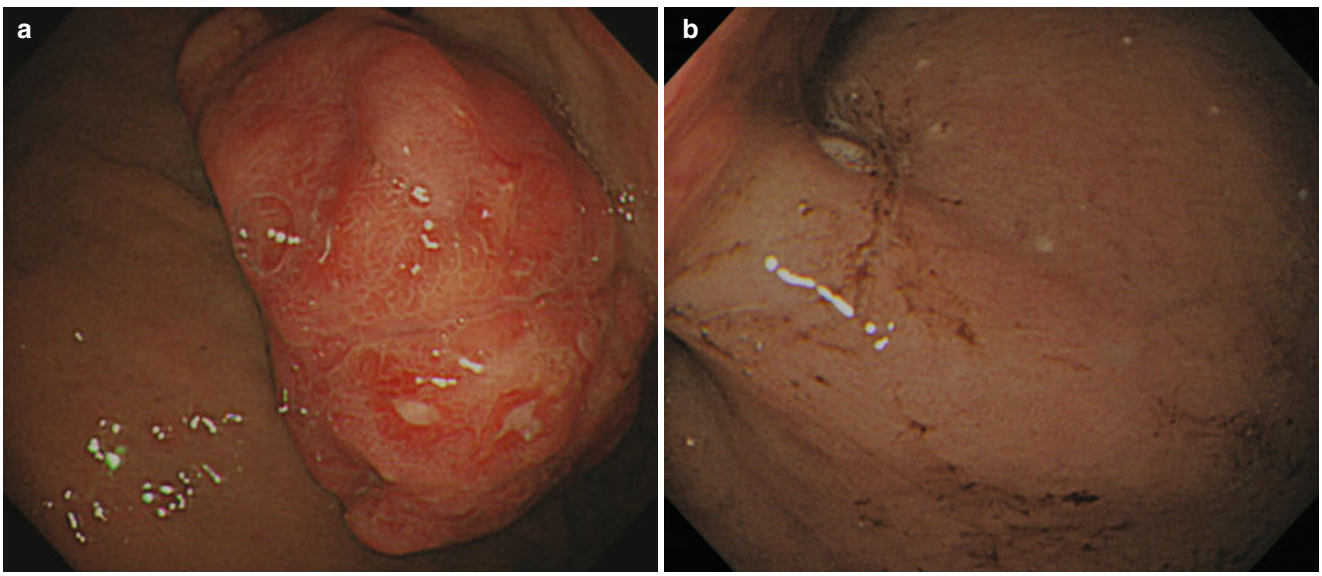

Fig. 9.12 Gastric neuroendocrine carcinoma. (**a**, **b**) About 4.0-cm huge polypoid mass with short and broad pedicle was noted at the anterior wall of the mid-body. This lesion was resected by standard snare polypectomy. Resected specimen demonstrates a malignant carcinoid tumor and clear resection margin

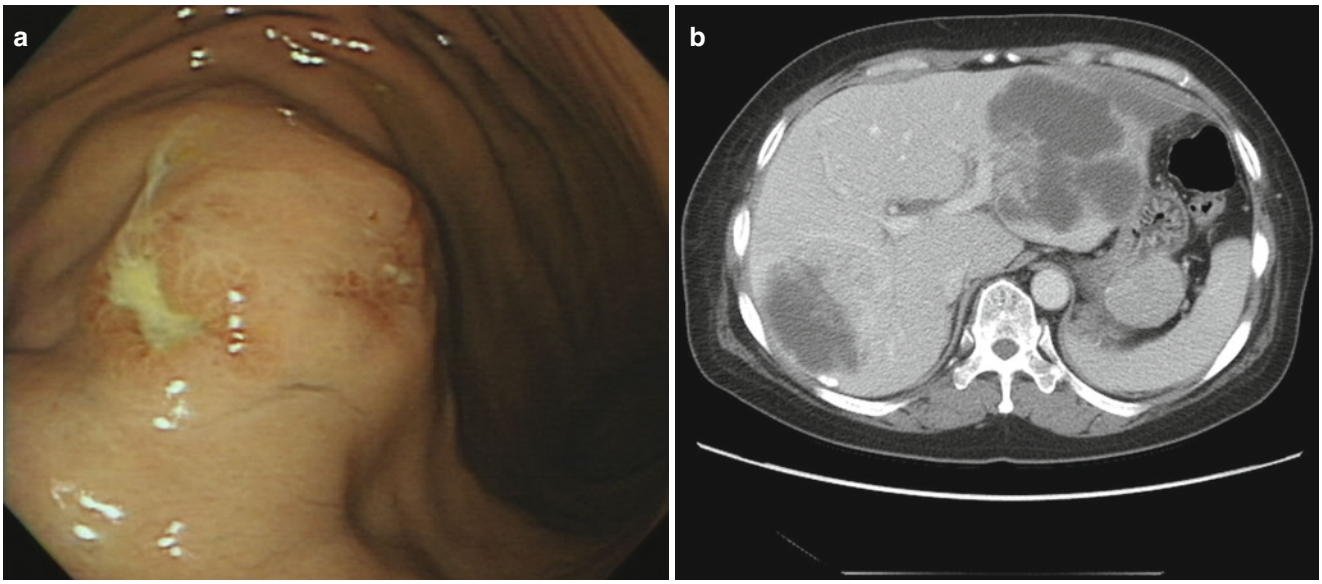

Fig. 9.13 A neuroendocrine carcinoma with liver metastasis. (**a**) A 5-cm, round protruding subepithelial tumor with multiple ulcerations was on the greater curvature of the body. (**b**) Abdominal pelvic CT showed enhanced exophytic gastric mass with multiple liver metastases

9.3.2 Glomus Tumor

Glomus tumors are very rare tumors that originate from modified vascular smooth muscle cells. In the gastrointestinal tract, glomus tumors are most commonly found in the stomach (antrum or prepylorus) and present as subepithelial masses that project into the lumen (Fig. 9.14) or out onto the serosa. These tumors are usually small, with median size ranging from 2 to 3 cm, but the tumors that metastasized were 6.5–8.5 cm. These lesions are usually benign, but they have the potential for malignant behavior and may also present with ulceration and hemorrhage. EUS will show a hypoechoic, well-circumscribed mass located in the 3rd and/or 4th EUS layer. Hypoechoic and hyperechoic spots may be seen within the lesion when hemorrhage occurs.

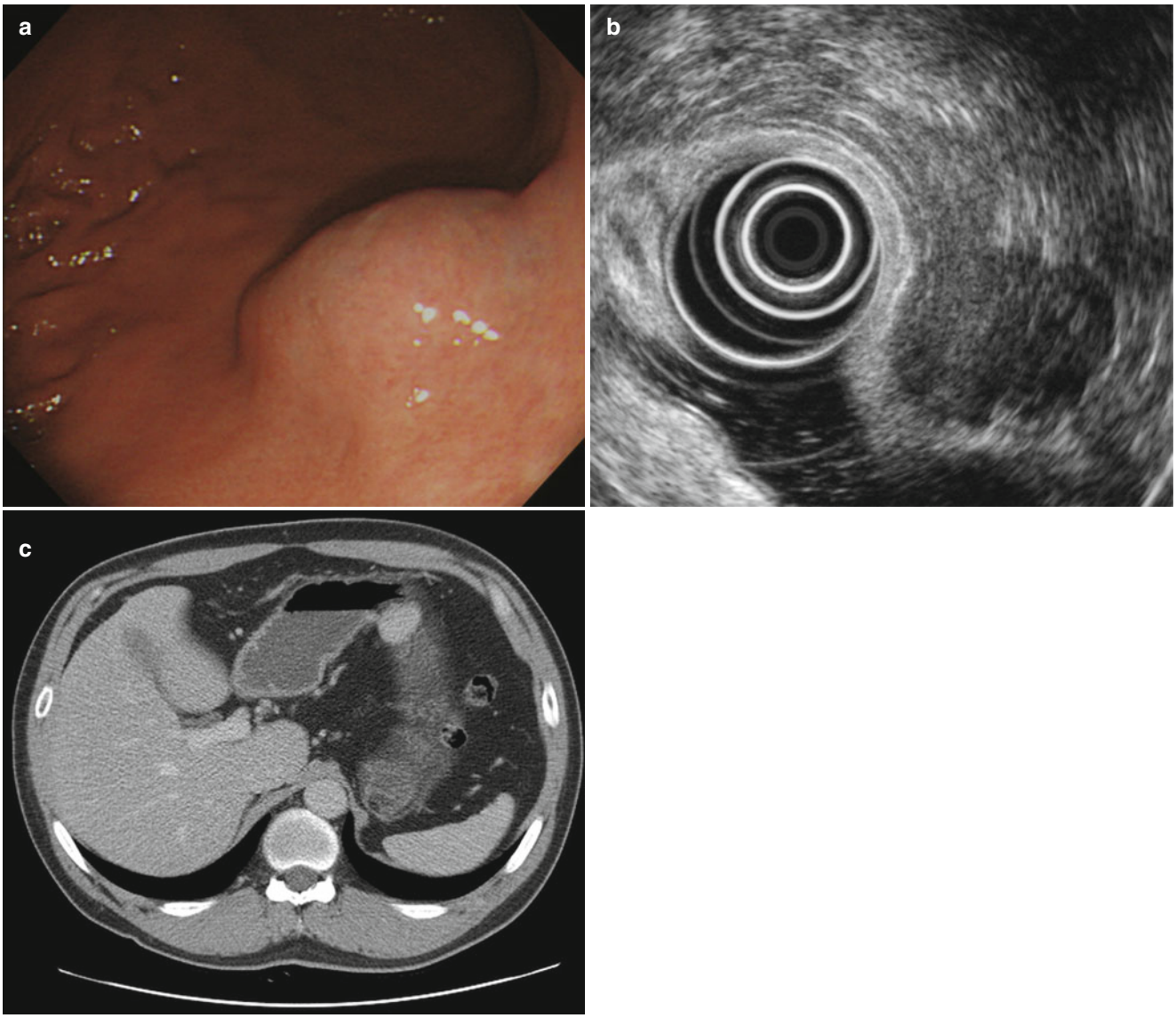

Fig. 9.14 Glomus tumor in the stomach. (**a**) A 3-cm subepithelial mass with a smooth surface was noticed on the posterior wall of the lower body. (**b**) On EUS examination, a 30×25 mm sized homogenous hypoechoic tumor was noticed and lesion was originated from the proper muscle layer. (**c**) Highly enhanced mass lesion was noticed on abdominal pelvic CT. For treatment, wedge resection was performed. Histologic and immunochemical analyses of the tumor cells were compatible with glomus tumors

9.3.3 Leiomyoma

Leiomyomas are benign tumors composed of well-differentiated smooth muscle cells. In the stomach, they are usually small and well circumscribed. The tumors appear as rounded submucosal lesions with intact overlying mucosa and feel rubbery when gently palpated with the endoscope (Figs. 9.15, 9.16, 9.17, and 9.18). Growth may be intraluminal, extraluminal, or a combination with a dumbbell shape. Ulceration or bleeding is uncommon. These tumors can range in size from less than 0.5 cm (microleiomyomas) to as large as 30 cm. Most leiomyomas originate from the muscularis propria but occasionally originate from the muscularis mucosa or a vessel wall within the 3rd layer. EUS shows a hypoechoic well-circumscribed homogenous lesion developed in the second or fourth layer (Figs. 9.15, 9.16, 9.17, and 9.18).

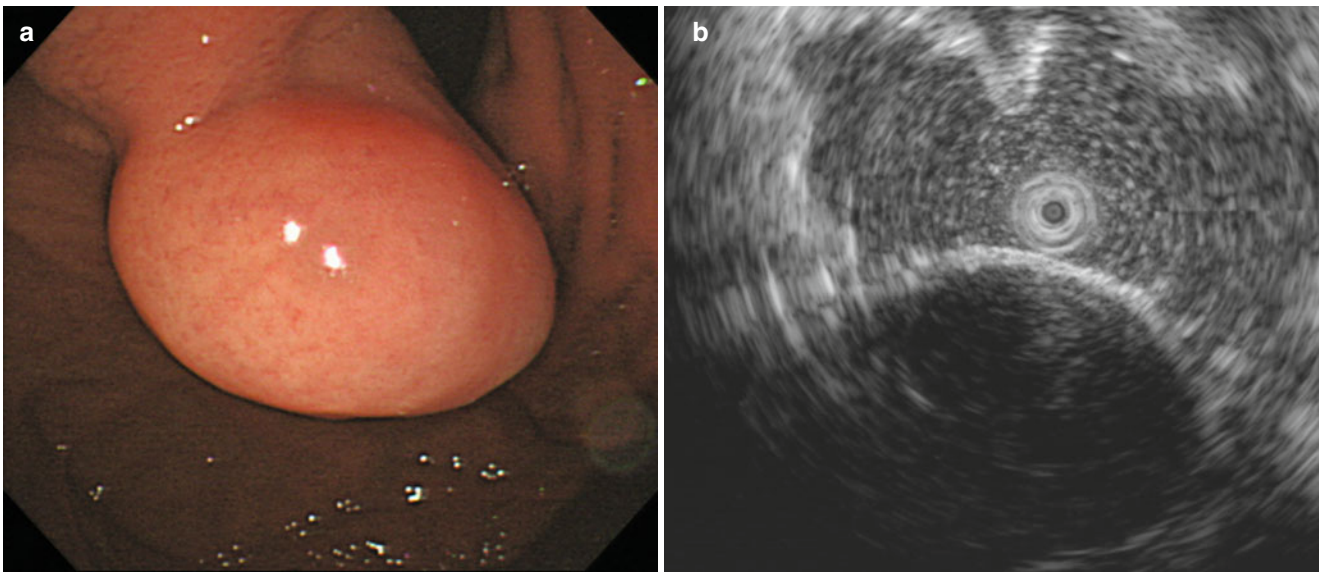

Fig. 9.15 Gastric leiomyoma. (**a**) About 2-cm subepithelial tumor in the gastric cardia. (**b**) Homogenous hypoechoic mass arising from the proper muscle layer was noticed on EUS examination

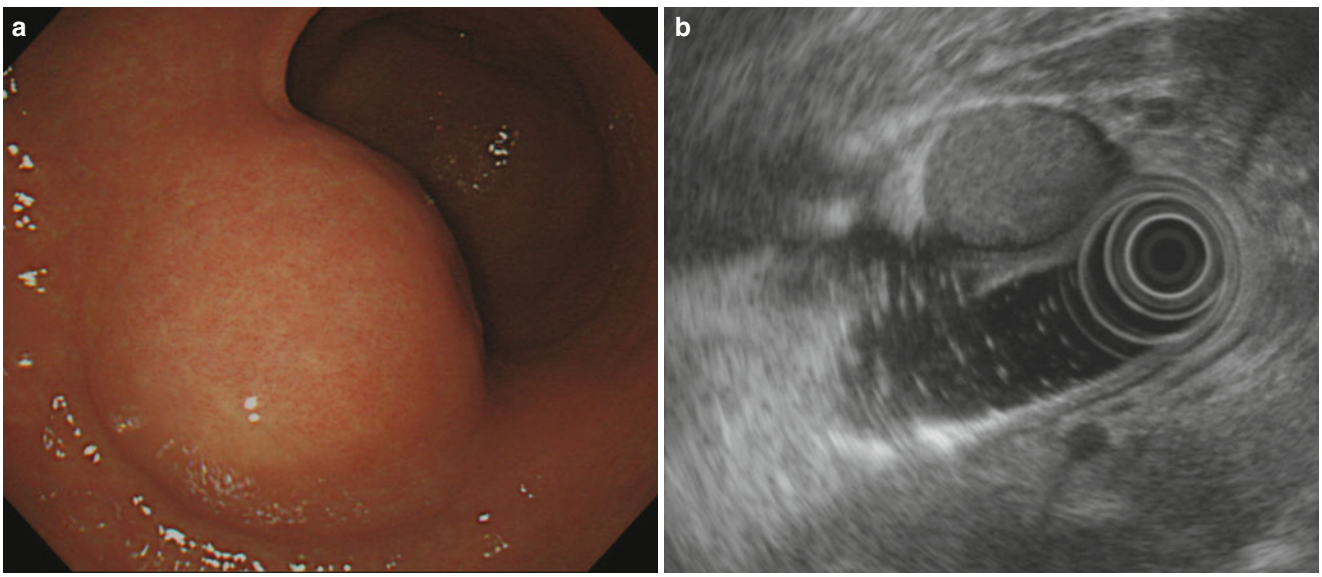

Fig. 9.16 Gastric leiomyoma. (**a**) About 3-cm subepithelial tumor was noticed on anterior wall of the antrum. (**b**) Homogenous hypoechoic round mass arising from the proper muscle layer was noticed on EUS examination. Wedge resection was performed for tissue confirming

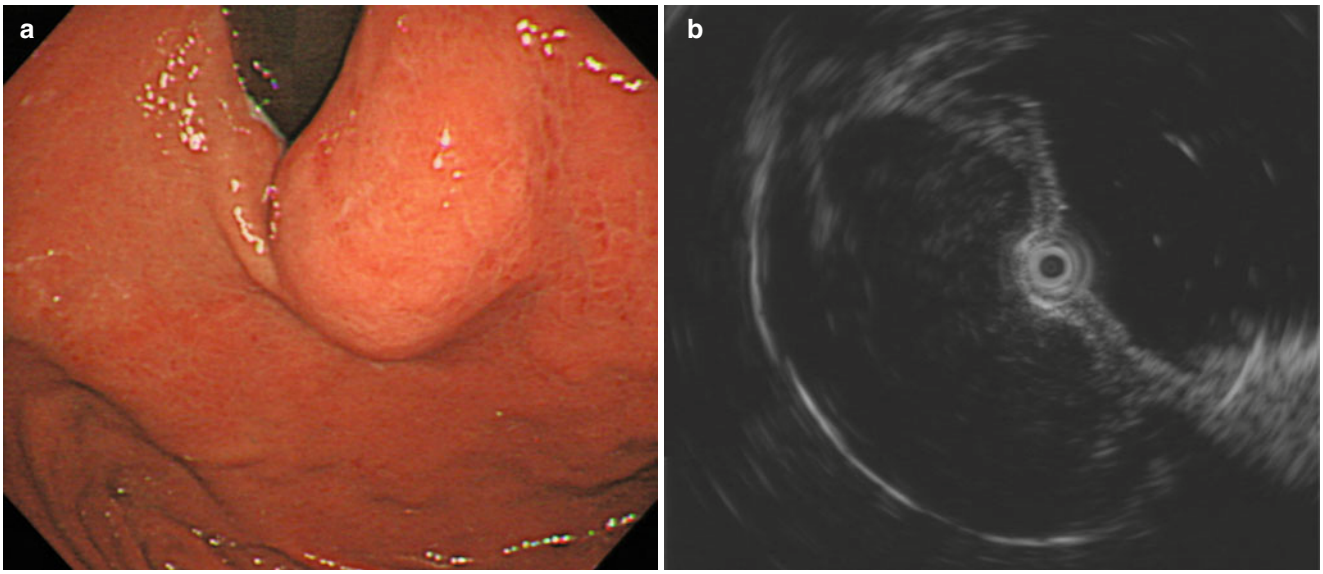

Fig. 9.17 Gastric leiomyoma. (**a**) Large subepithelial mass lesion in the gastric cardia, (**b**) EUS shows the lesion arises from the muscularis propria, confirming a leiomyoma

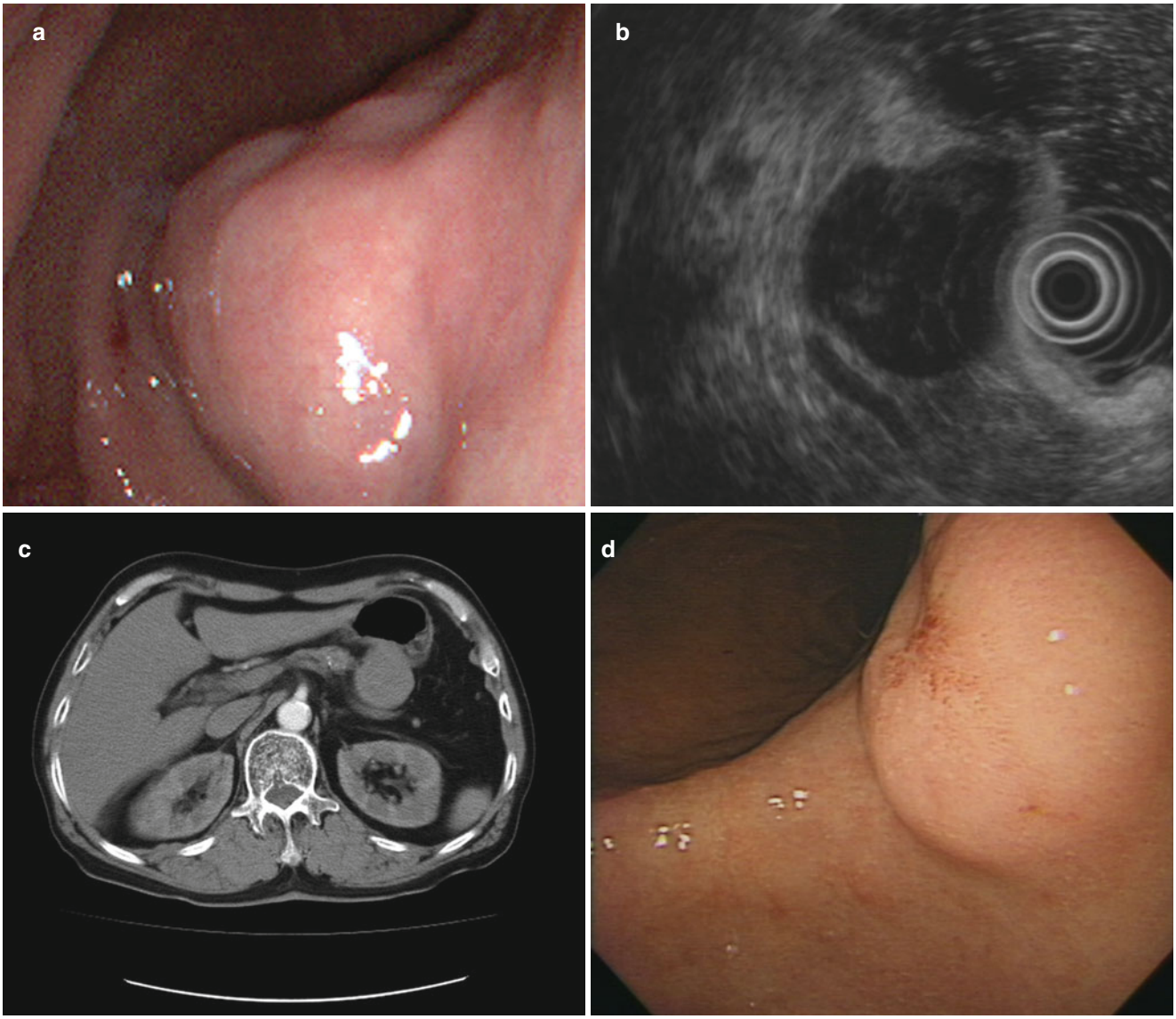

Fig. 9.18 Gastric leiomyosarcoma. (**a**) About 4-cm subepithelial mass was noted on posterior wall of the mid-body. (**b**) Hypoechoic heterogeneous mass was noted on the back of gastric wall. It looks like an originating mass from the outer circular muscle layer. It was mainly located in the tail of the pancreas. It has hyperechoic septum and lobulated contour. It was measured by 46×42 mm in diameter. (**c**) Abdomen CT shows about 5-cm submucosal tumor in posterior wall of the stomach. For treatment, laparoscopic wedge resection was performed. Pathological analysis of the tumor cells was compatible with leiomyosarcoma. (**d**) Newly found subepithelial tumor on posterior wall of the gastric antrum after 1 year

9.3.4 Pancreatic Rest (Ectopic Pancreas)

A pancreatic rest or heterotopic pancreatic tissue represents ectopic pancreatic tissue within the wall of the stomach. Pancreatic rests are typically located in the gastric antrum within the submucosal layer.

In endoscopic examination, a pancreatic rest was usually diagnosed as a subepithelial tumor which was firm and slightly irregular. The diameter of lesions varies from 0.2 to 4.0 cm. The mucosa over the lesion may have a central depression or dimpling and ducts may empty into the lumen at this side (Figs. 9.19, 9.20, 9.21, and 9.22).

Pancreatic rests are hypoechoic or intermediate echogenic heterogeneous lesions with indistinct margins (Figs. 9.20 and 9.21). They most commonly arise from the third or fourth layer or a combination of the two layers of the GI tract. Anechoic areas within the lesion correlate with ductal structures.

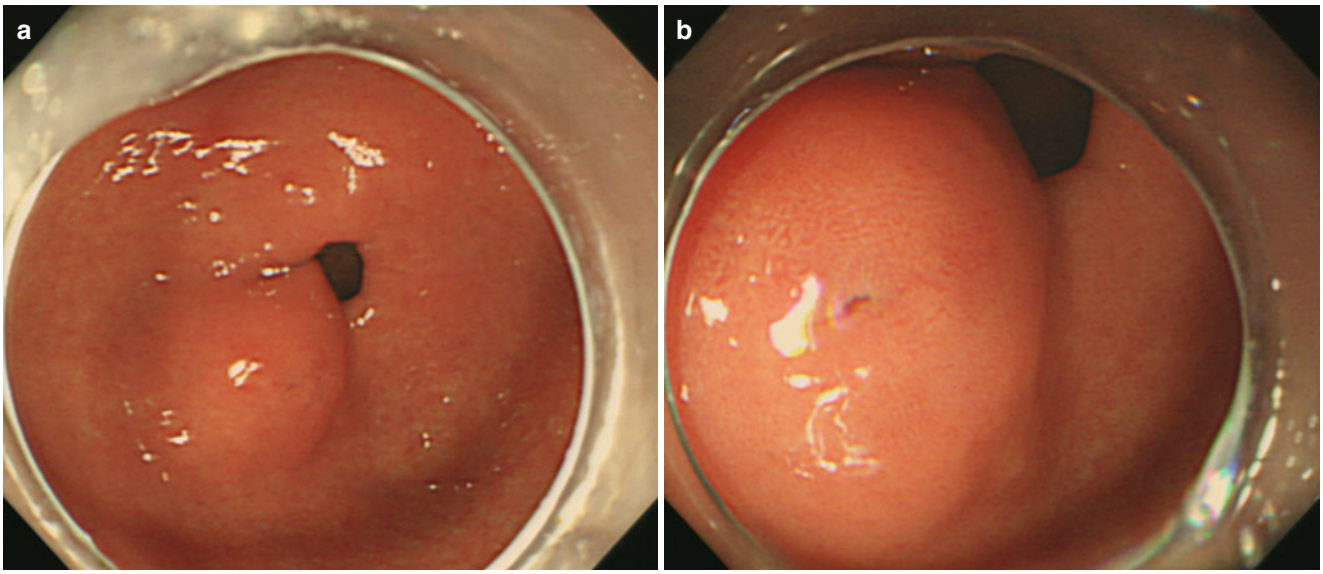

Fig. 9.19 Pancreatic rest. (**a**) About 1.5-cm subepithelial tumor was noticed on the prepyloric antrum. (**b**) Closer view shows the intact overlying mucosa with central opening

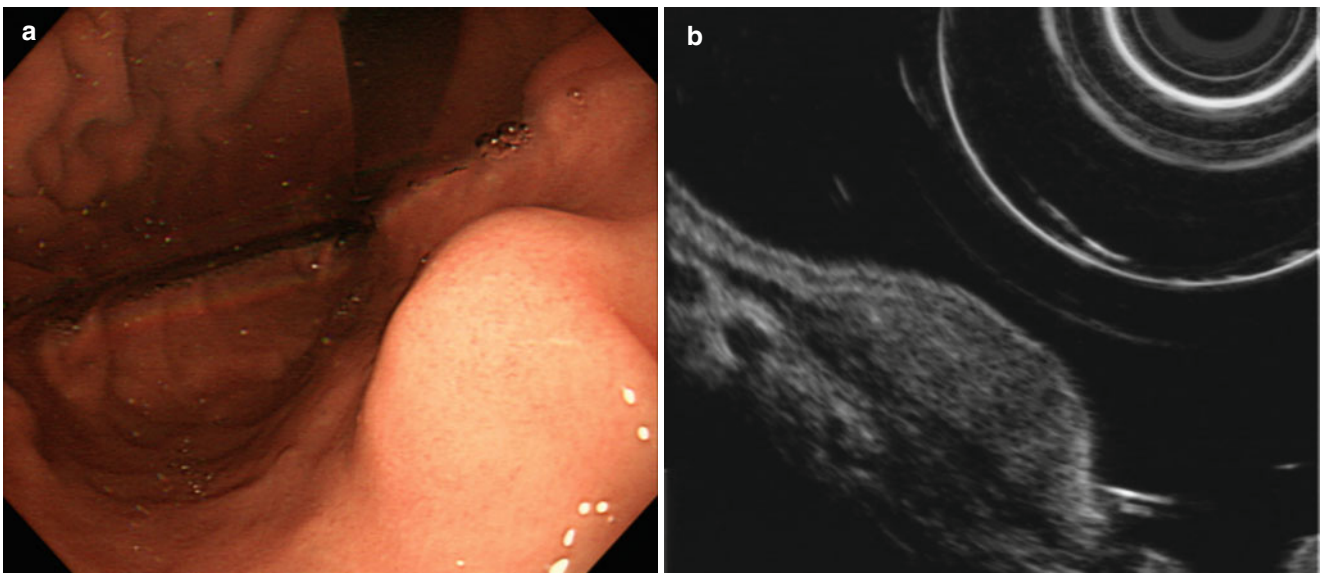

Fig. 9.20 Pancreatic rest. (**a**) About 1.5-cm subepithelial tumor was noticed on the lesser curvature of the gastric low body. (**b**) A heterogeneous, hypoechoic lesion with smooth margin (14.0×5.6 mm) was noted. This lesion originates from the submucosal layer. Bite-on-bite biopsy demonstrated an ectopic pancreas

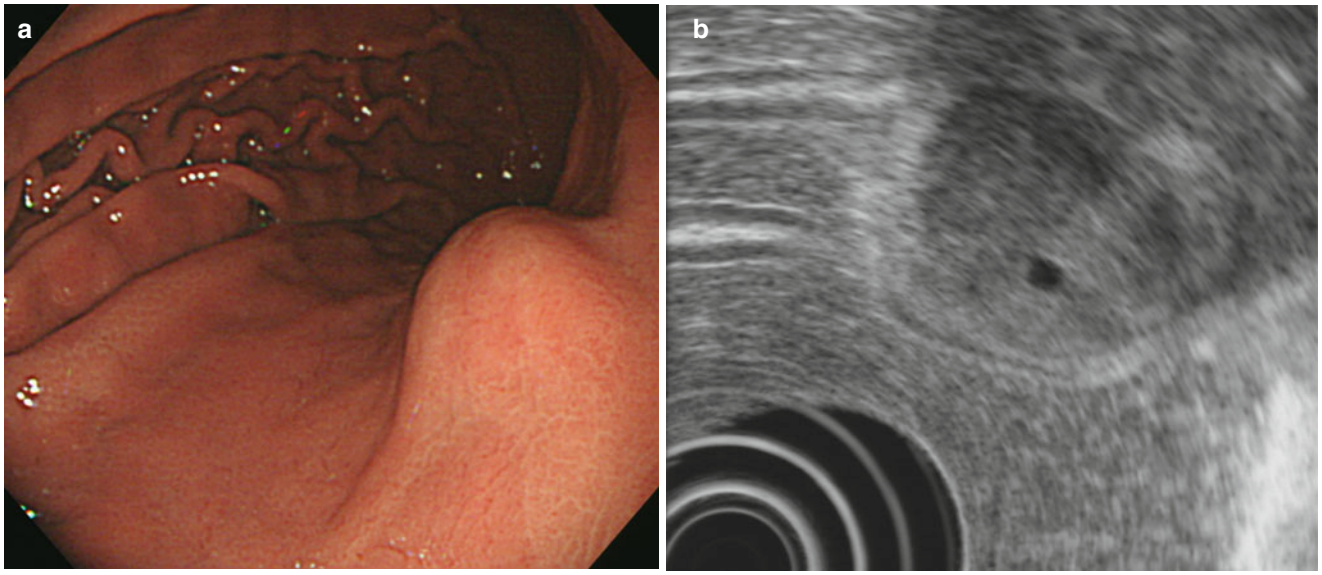

Fig. 9.21 Pancreatic rest. (**a**) About 1.5-cm round protruded lesion with normal mucosal covering was noticed on posterior wall of the mid-body. (**b**) On EUS examination, about 21-mm slightly hypoechoic lesion originates from the proper muscle layer was noticed. This lesion has a small round anechoic space and a slightly irregular outer margin

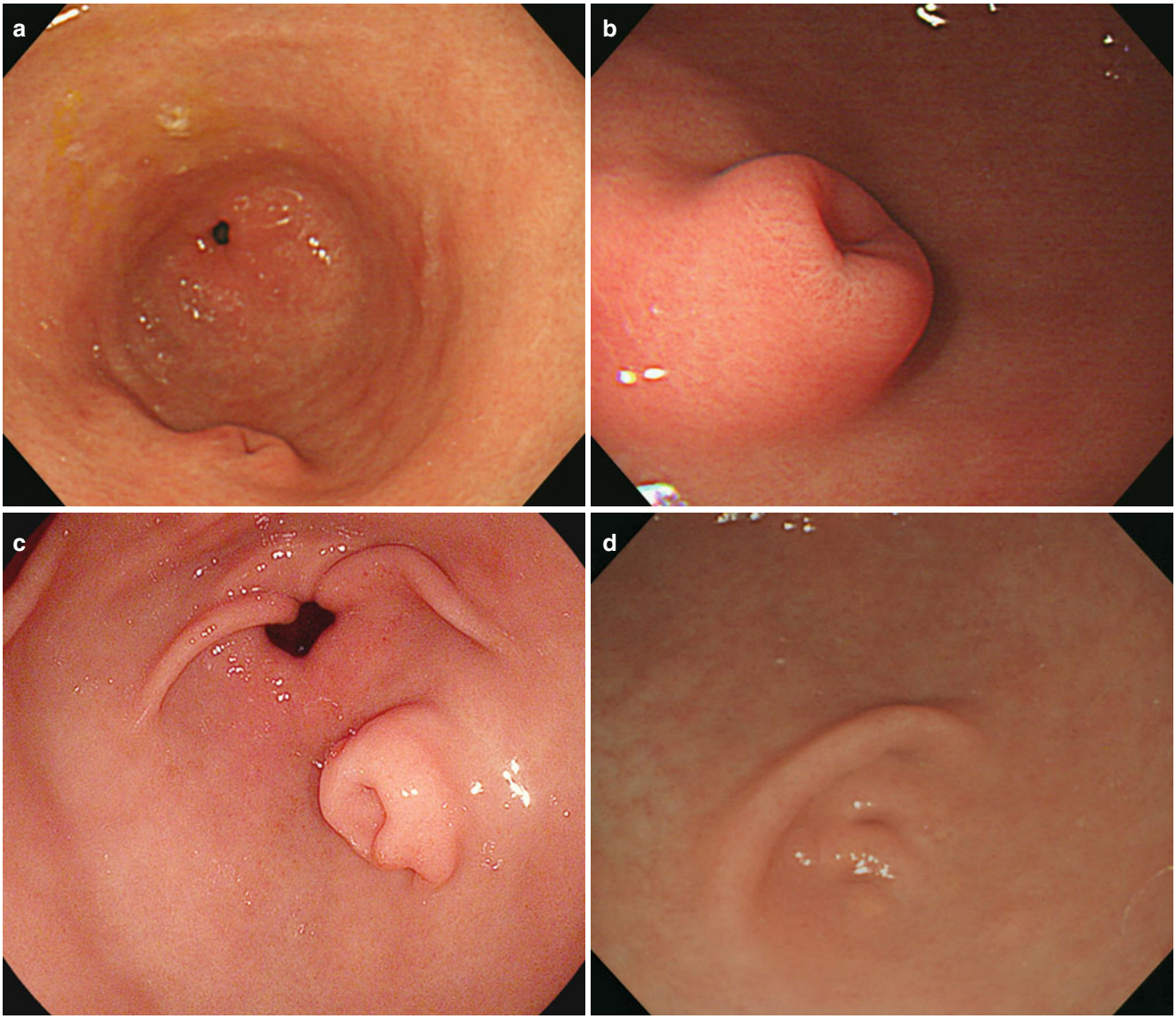

Fig. 9.22 Pancreatic rest. (**a**–**d**) Variable appearance of a pancreatic rest

9.3.5 Lipomas

Gastric lipomas are benign, slow-growing lesions that rarely ulcerate and cause bleeding. Endoscopically, gastric lipomas typically appear as smooth submucosal masses with a yellowish hue when compared with the surrounding tissue (Figs. 9.23, 9.24, and 9.25). On endoscopic examination there are some diagnostic signs which help in identifying these lesions as lipomas. These are "tenting," "cushion sign," and the "naked fat" sign. Tenting indicates that the normal mucosa overlying the lipoma is retracted easily away from the mass with a biopsy forceps. Cushion sign indicates a soft, cushioning indentation produced when a forceps is applied to the lipoma. The naked fat sign refers to the exposed adipose tissue on the surface of the lipoma that pokes through the normal overlying mucosa after multiple biopsies of the normal mucosa are performed. The EUS finding of an intensely hyperechoic, well-circumscribed mass arising from the submucosa is essentially diagnostic for a lipoma. With these findings, no further evaluation is needed if there are no related complications.

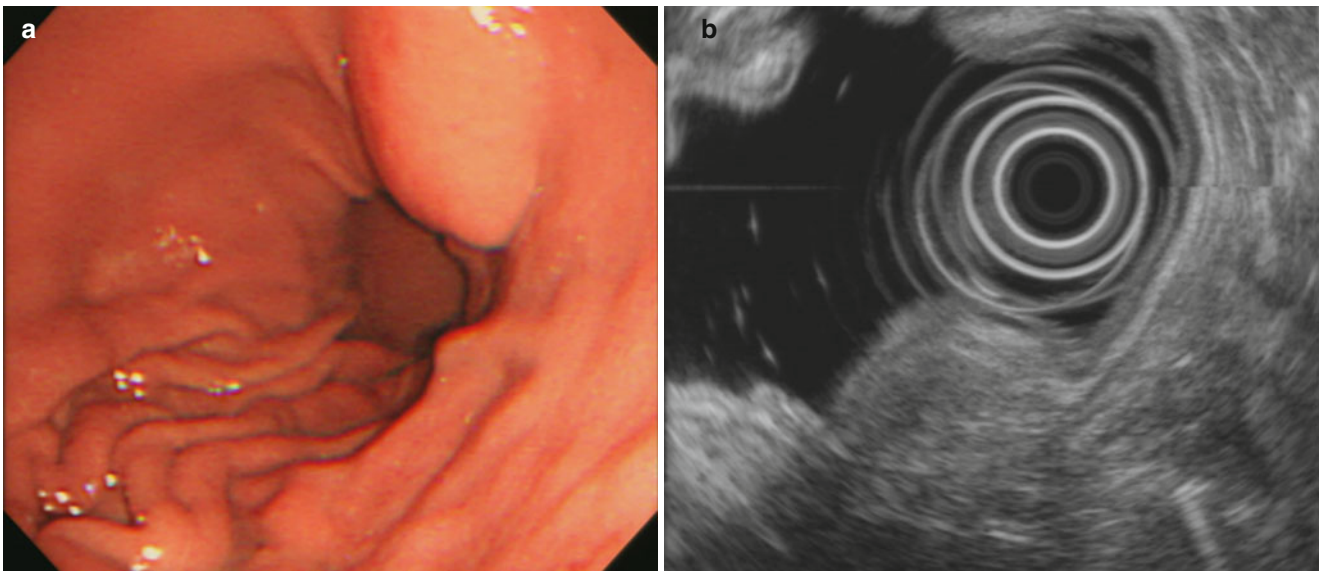

Fig. 9.23 Gastric lipoma. (**a**) A subepithelial mass was noticed on the lesser curvature of the gastric lower body. (**b**) EUS shows the lesion arises from the submucosa that is hyperechoic

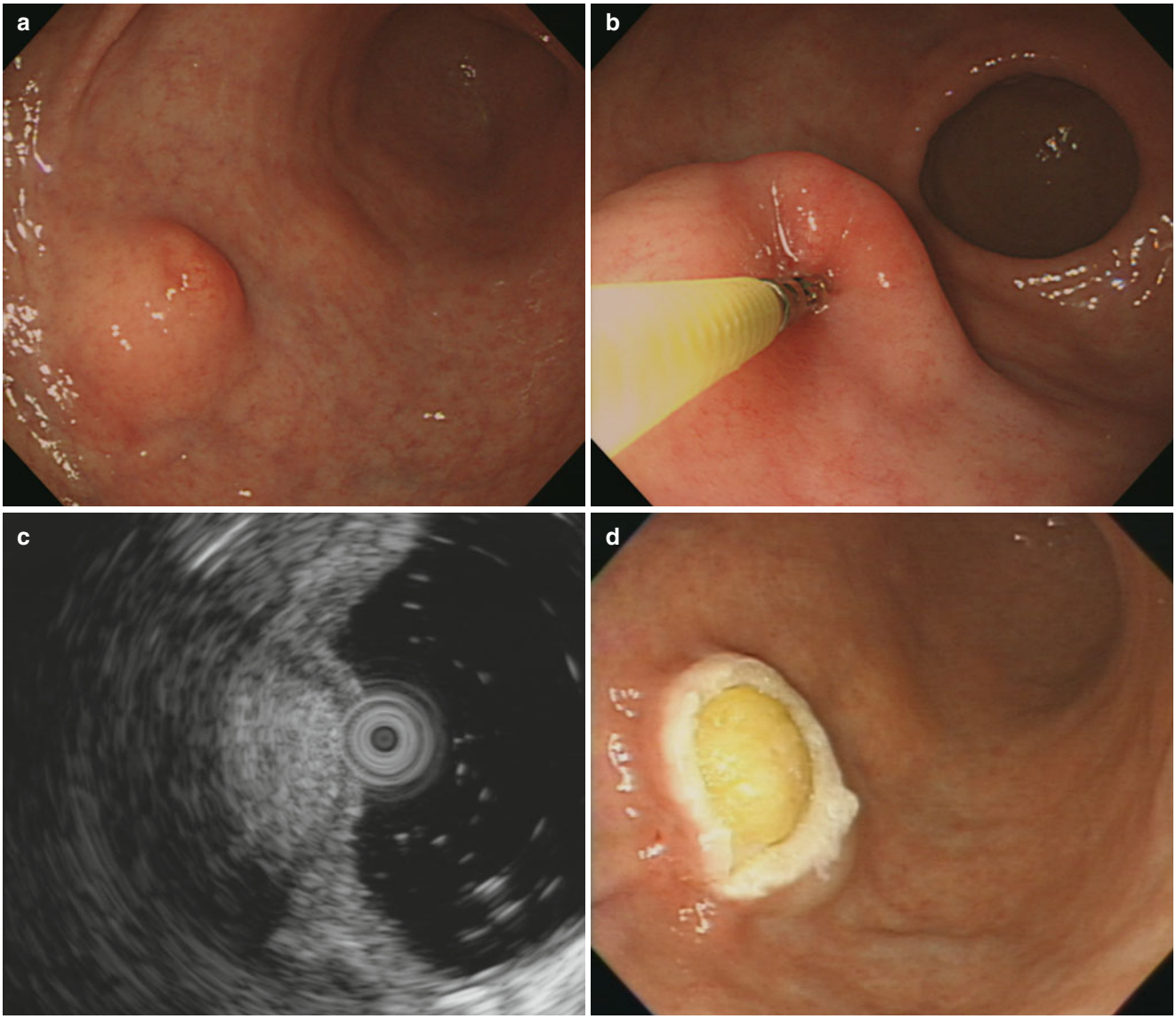

Fig. 9.24 Gastric lipoma. (**a**) A 2-cm subepithelial tumor with slightly yellowish mucosa was noticed on the antrum. (**b**) Cushion sign is present. (**c**) EUS shows a well-circumscribed lesion that is hyperechoic. (**d**) Yellow adipose tissue is shown during endoscopic resection

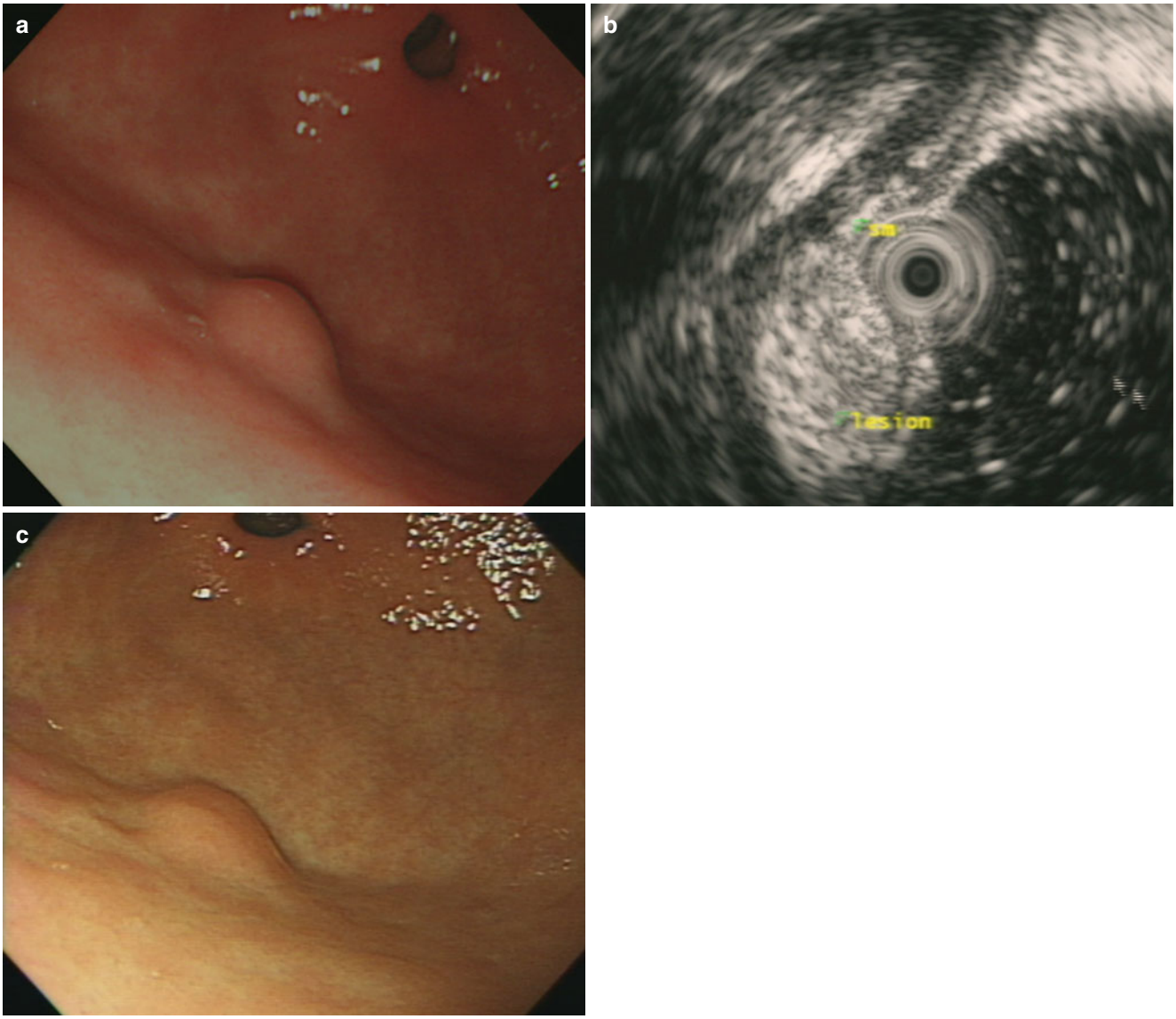

Fig. 9.25 Gastric lipoma. (**a**) About 0.7-cm subepithelial tumor in the antrum, (**b**) homogenous hyperechoic mass arising from the submucosal layer, (**c**) no interval change after 2 years

9.3.6 Granular Cell Tumor

Granular cell tumors are rare submucosal tumors of Schwann cell origin that are usually incidental findings on endoscopy. This tumor is very rare in the stomach and is virtually always less than 2 cm in size. Endoscopically, it is sessile, firm subepithelial lesion and has a yellow or white hue (Fig. 9.26). EUS findings show a homogenous hypoechoic lesion in the submucosa. When the lesion is smaller than 1 cm, it may contain echogenic foci.

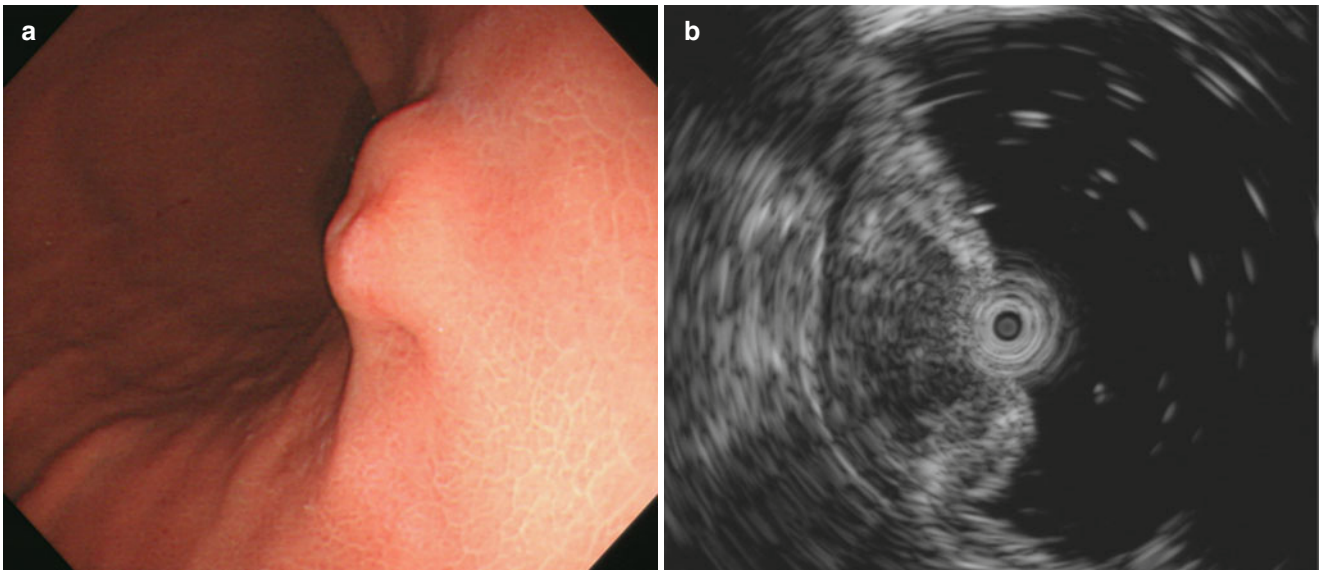

Fig. 9.26 Gastric granular cell tumor. (**a**) Subepithelial tumor with central dimpling is noted in the gastric body. This lesion looks like molar. (**b**) Homogenous hypoechoic mass located in the submucosal layer. Granular cell tumor is demonstrated by endoscopic forceps biopsy

9.3.7 Schwannoma

Schwannomas are tumors of neural origin mostly located in the proximal portion of the stomach. These tumors demonstrate S100 protein on immunohistochemistry, but not KIT expression. In standard endoscopy, gastric schwannomas may present as round or oval (multinodular) subepithelial tumors. As they usually and principally involve the submucosa and muscularis propria, endosonographically they appear as homogenous, hypoechoic, small subepithelial mass with distinct borders, arising from the third and/or forth gastric wall layer (Figs. 9.27, 9.28, and 9.29).

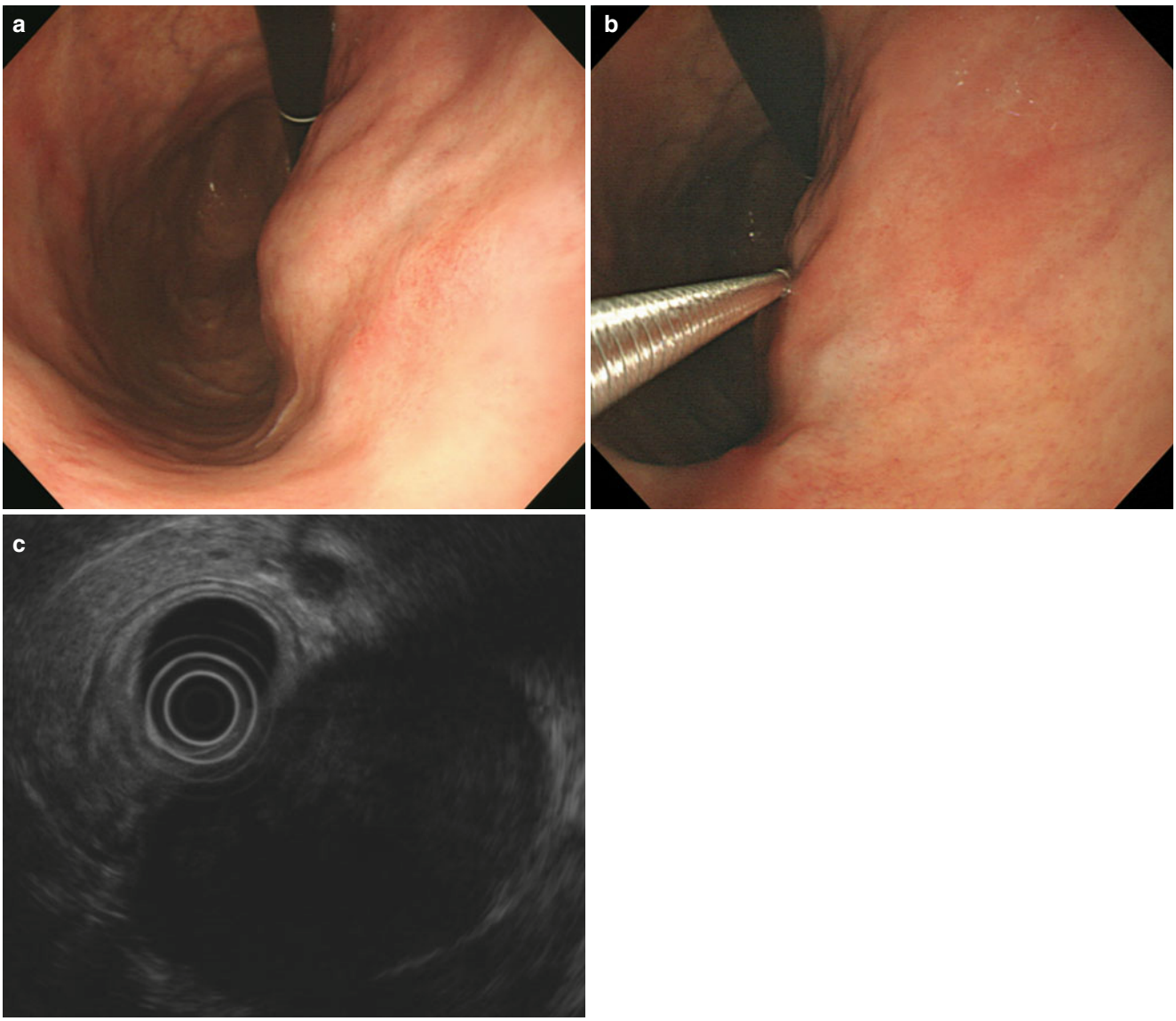

Fig. 9.27 Gastric schwannoma. (**a**) About 6-cm round protruded lesion with normal mucosal covering was noticed on anterior wall of the upper body. (**b**) This lesion had a firm consistency. (**c**) On EUS examination, heterogeneous and bean-like mass was noted. It was originated from the proper muscle layer and grows out to peritoneal space. It was measured by 70×44 mm in diameter. Laparoscopic wedge resection was performed. Pathological analysis of the tumor cells was compatible with schwannoma

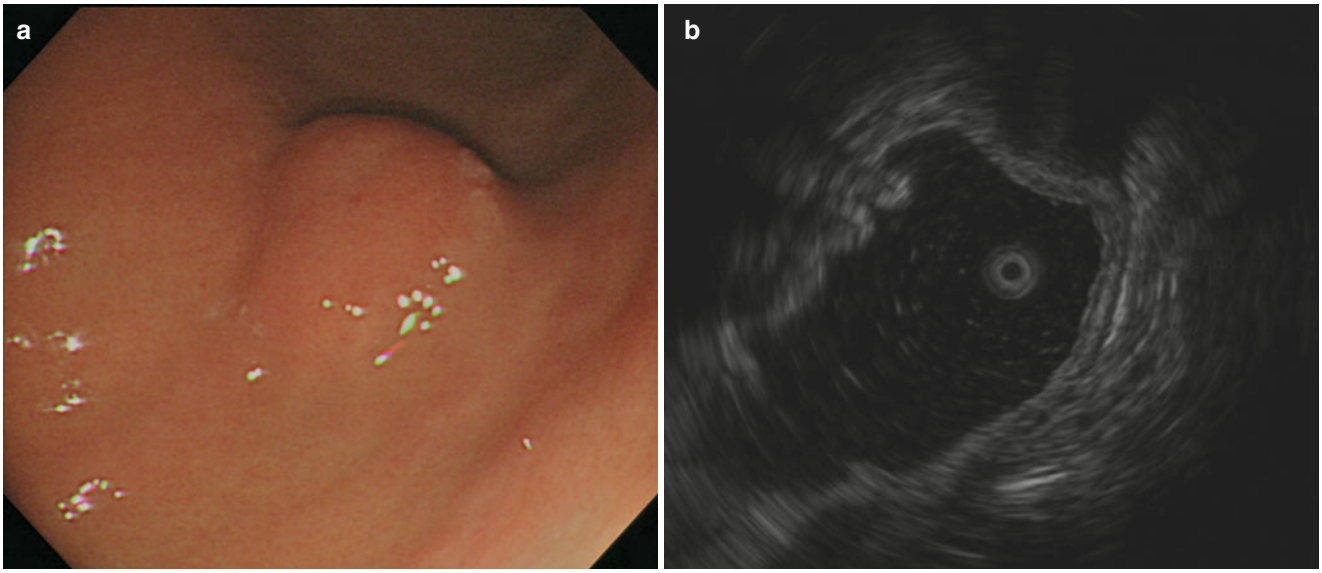

Fig. 9.28 Gastric schwannoma. (**a**) About 2-cm subepithelial tumor was noticed on the greater curvature of the gastric lower body. (**b**) EUS shows a homogenous, hypoechoic lesion located in the proper muscle layer. Resected specimen demonstrates a gastric schwannoma

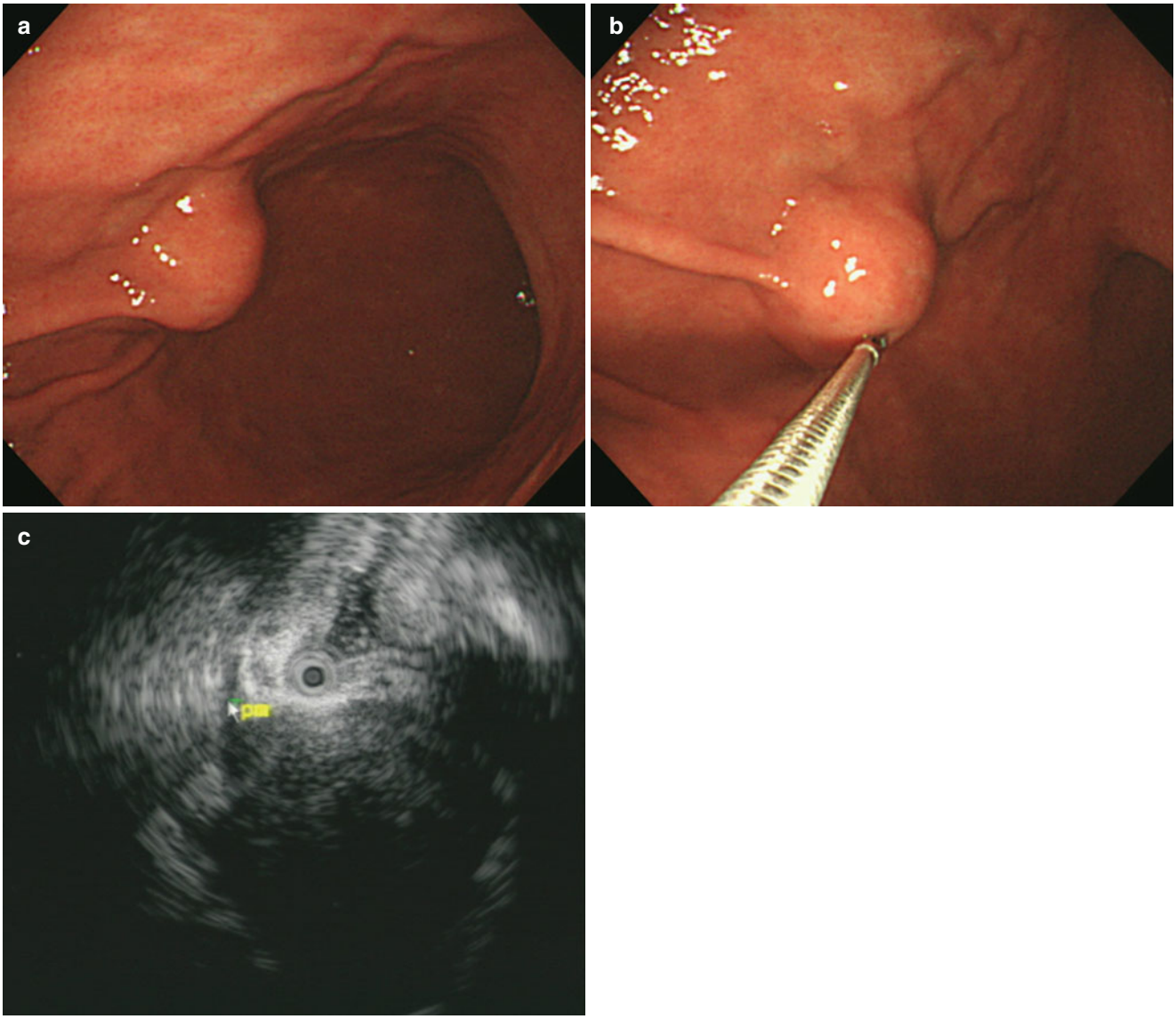

Fig. 9.29 Gastric schwannoma. (**a**) About 2.5-cm subepithelial tumor in the greater curvature of the mid-body. (**b**) This lesion has a firm consistency. (**c**) Heterogeneous hypoechoic oval-shaped mass arising from the proper muscle layer, confirming a schwannoma

9.3.8 Inflammatory Fibrinoid Polyp

Gastric inflammatory fibrinoid polyps are rare benign lesions of the stomach that are characterized histologically by nonencapsulated fibrous tissue. Usually, the lesion is located in the antrum near the pylorus and is usually less than 3 cm in size. They may show surface ulceration. On EUS examination, the polyps are located in the deep mucosa or submucosa without involvement of the muscularis propria. They are typically hypoechoic, with a homogenous echotexture and indistinct margins (Figs. 9.30, 9.31, 9.32, 9.33, and 9.34).

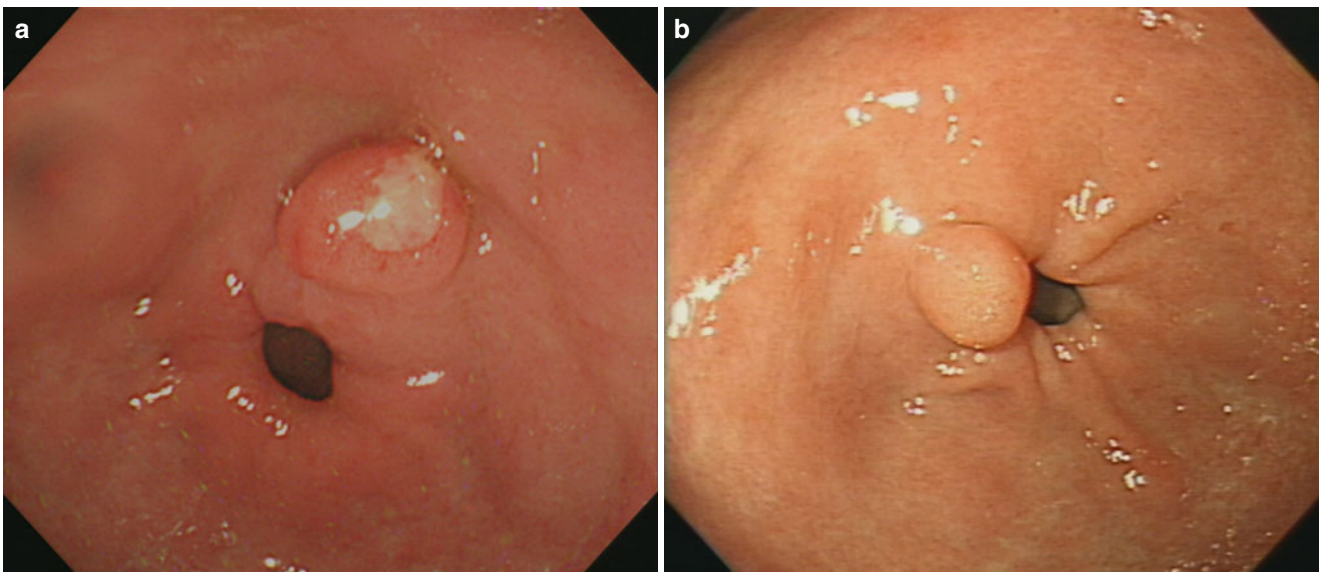

Fig. 9.30 Inflammatory fibrinoid polyp. (**a**) Conventional endoscopy reveals a semipedunculated protrusion covered with normal mucosa and located in the prepyloric area. An ulceration on the central surface is visualized. Histologically, inflammatory fibrinoid polyp was diagnosed. (**b**) About 0.7-cm round protruded lesion with normal mucosal covering was noticed on the prepyloric antrum

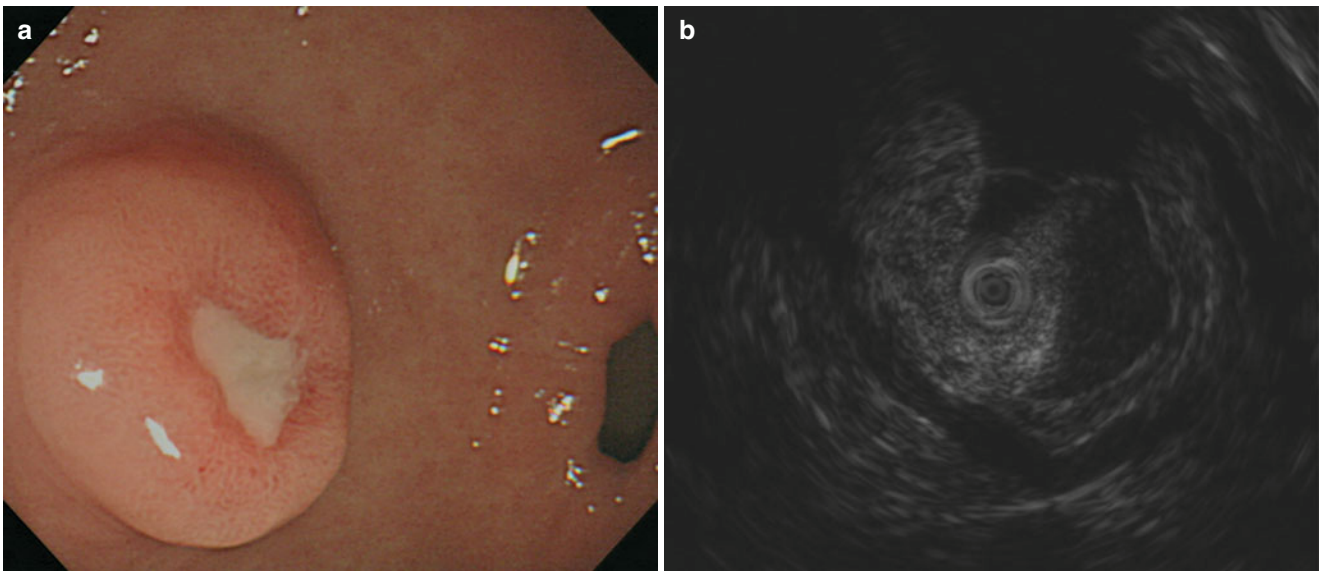

Fig. 9.31 Inflammatory fibrinoid polyp. (**a**) Conventional endoscopy showed about 1.5-cm subepithelial tumor in the antrum of the stomach with central ulceration. (**b**) Endoscopic ultrasound showed a hypoechoic oval lesion located in second layer. This lesion was resected by endoscopic mucosal resection and resected specimen demonstrated an inflammatory fibrinoid polyp

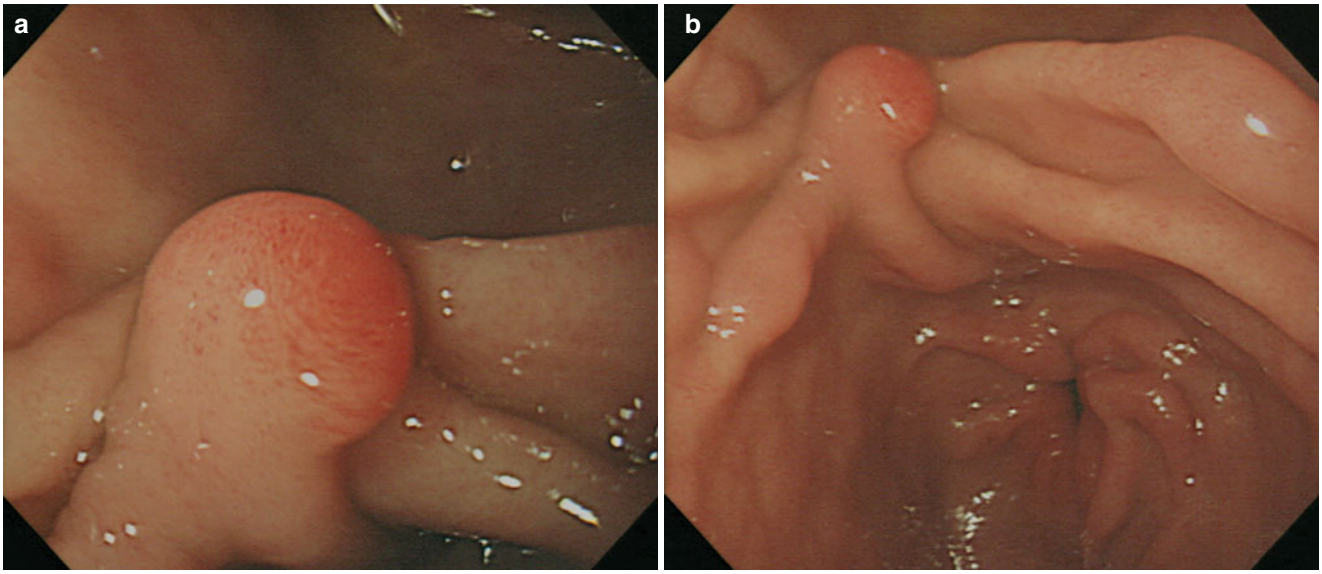

Fig. 9.32 Inflammatory fibrinoid polyp. (**a**, **b**) About 1.0-cm round elevated polypoid lesion with fold convergence was noticed on the antrum

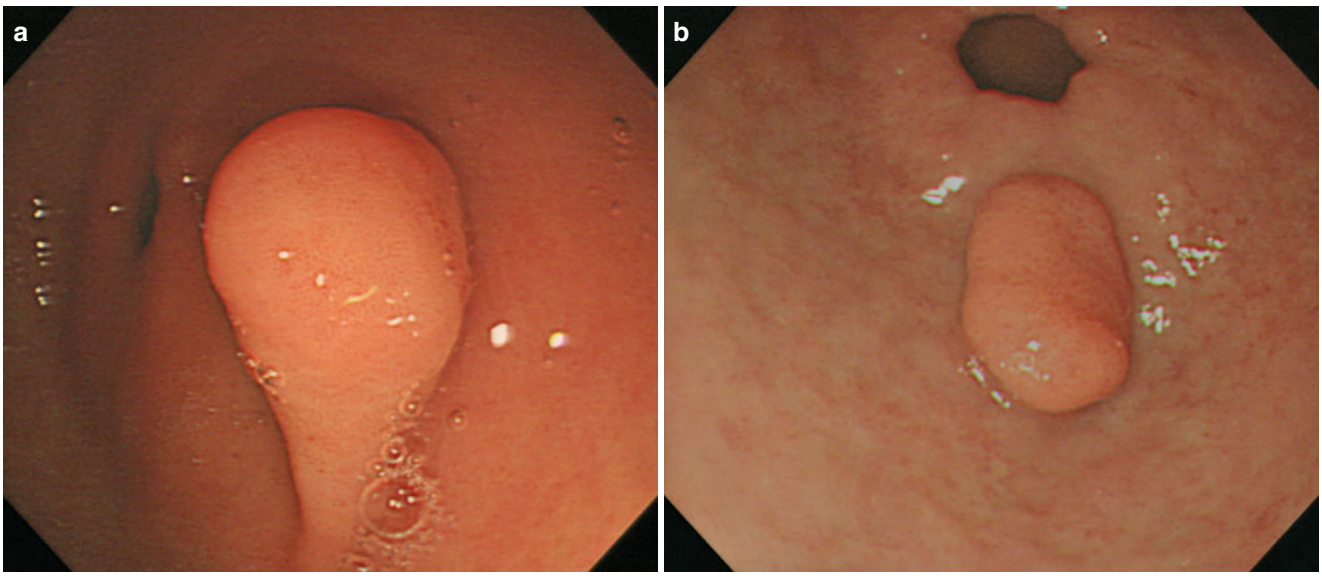

Fig. 9.33 Inflammatory fibrinoid tumor. (**a**) About 1.0-cm Is-type polypoid lesion was noticed on the prepyloric antrum. (**b**) About 2.0×1.0 cm sized polyp with lobulated contour was noticed on the antrum

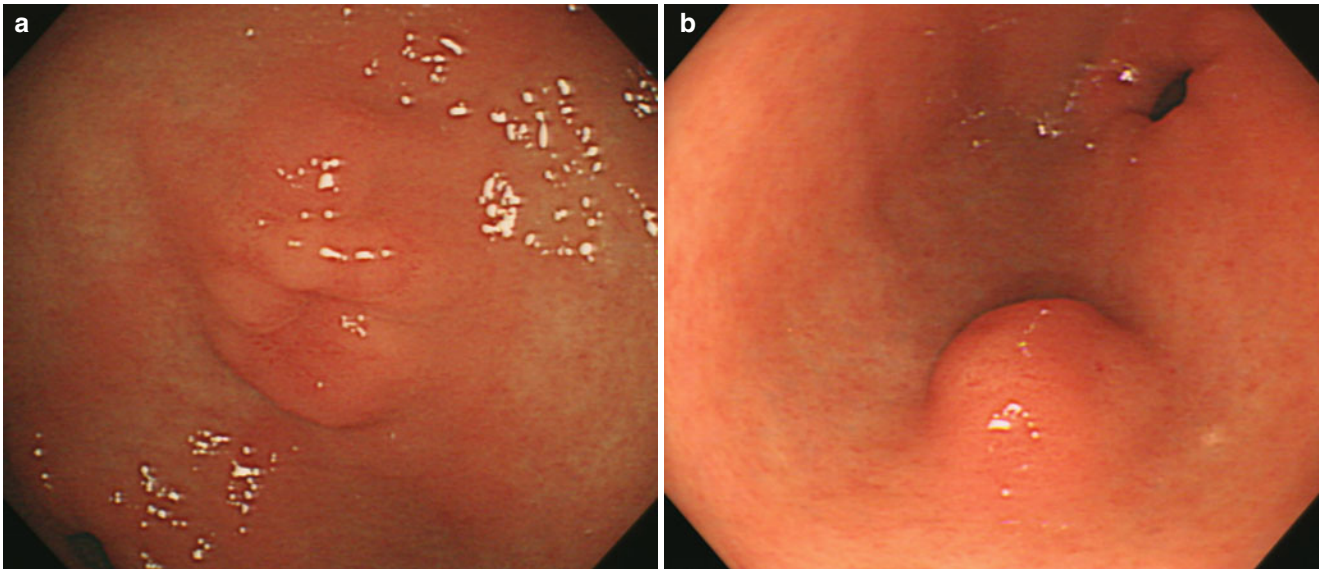

Fig. 9.34 Inflammatory fibrinoid tumor. (**a**, **b**) Two inflammatory fibrinoid tumors were noticed on the antrum

9.3.9 Gastric Varix

Gastric varices may have the appearance of a subepithelial mass or large gastric fold on endoscopy. Endoscopic examination may reveal the presence of portal hypertensive gastropathy, and probing the varices with closed biopsy forceps will reveal a pillow sign. Close examination may reveal a bluish hue seen with venous structures (Figs. 9.35, 9.36, 9.37, 9.38, 9.39, and 9.40). EUS examination may be performed to confirm that the lesion is a varix. Imaging will show a round or tubular anechoic structure located in the submucosa (third layer) that will become serpiginous when moving the transducer. If available, color Doppler examination will demonstrate flow within the structure.

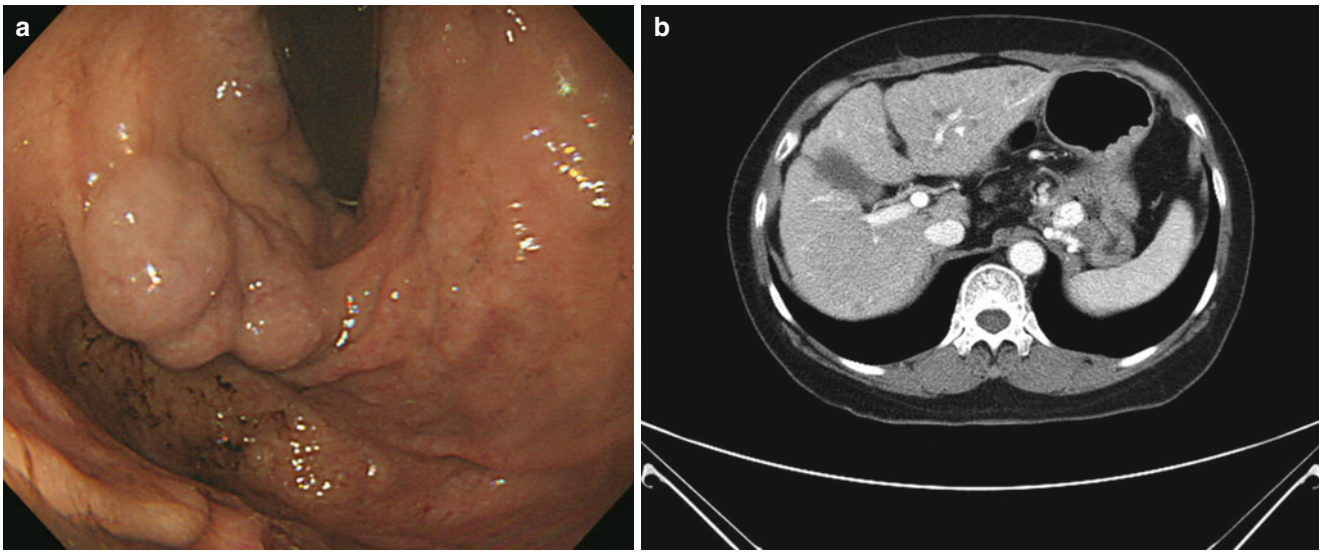

Fig. 9.35 Gastric varix. (**a**) Endoscopic image of gastric varix presenting as thick serpiginous structures, covered by normal mucosa. (**b**) Abdominal CT scan showed marked dilatation of gastric varix

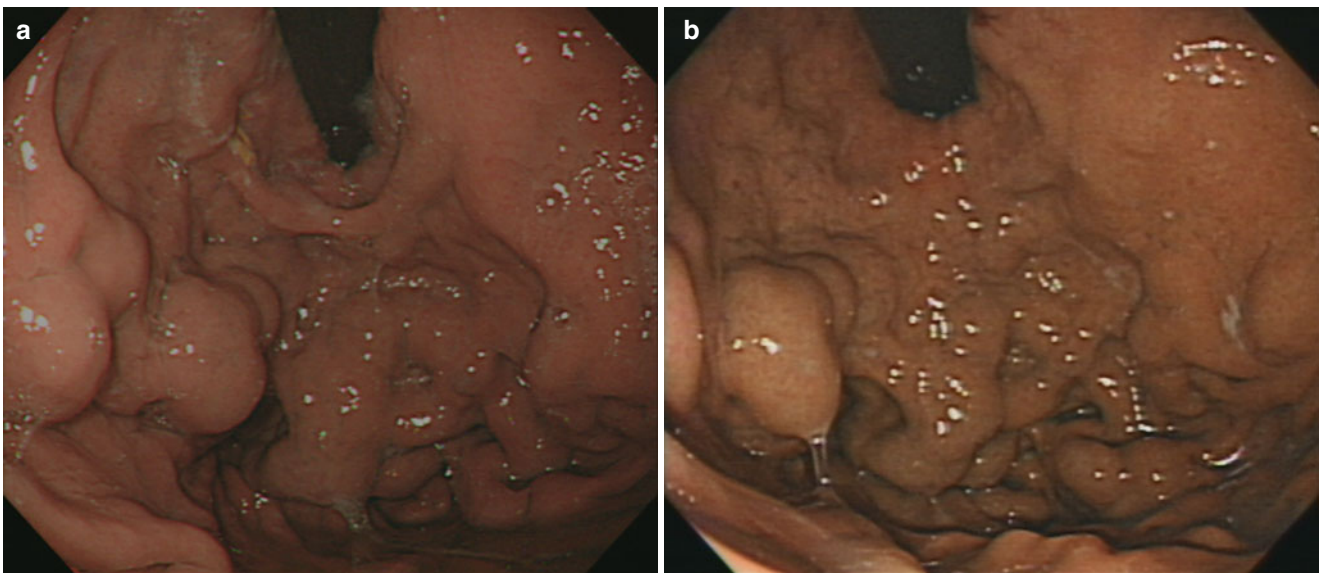

Fig. 9.36 Gastric varix. (**a**) Conventional gastroscopy showed tortuous folds and multiple grapelike nodules in the gastric fundus. (**b**) Two years later, a follow-up gastroscopy was performed that showed no interval change

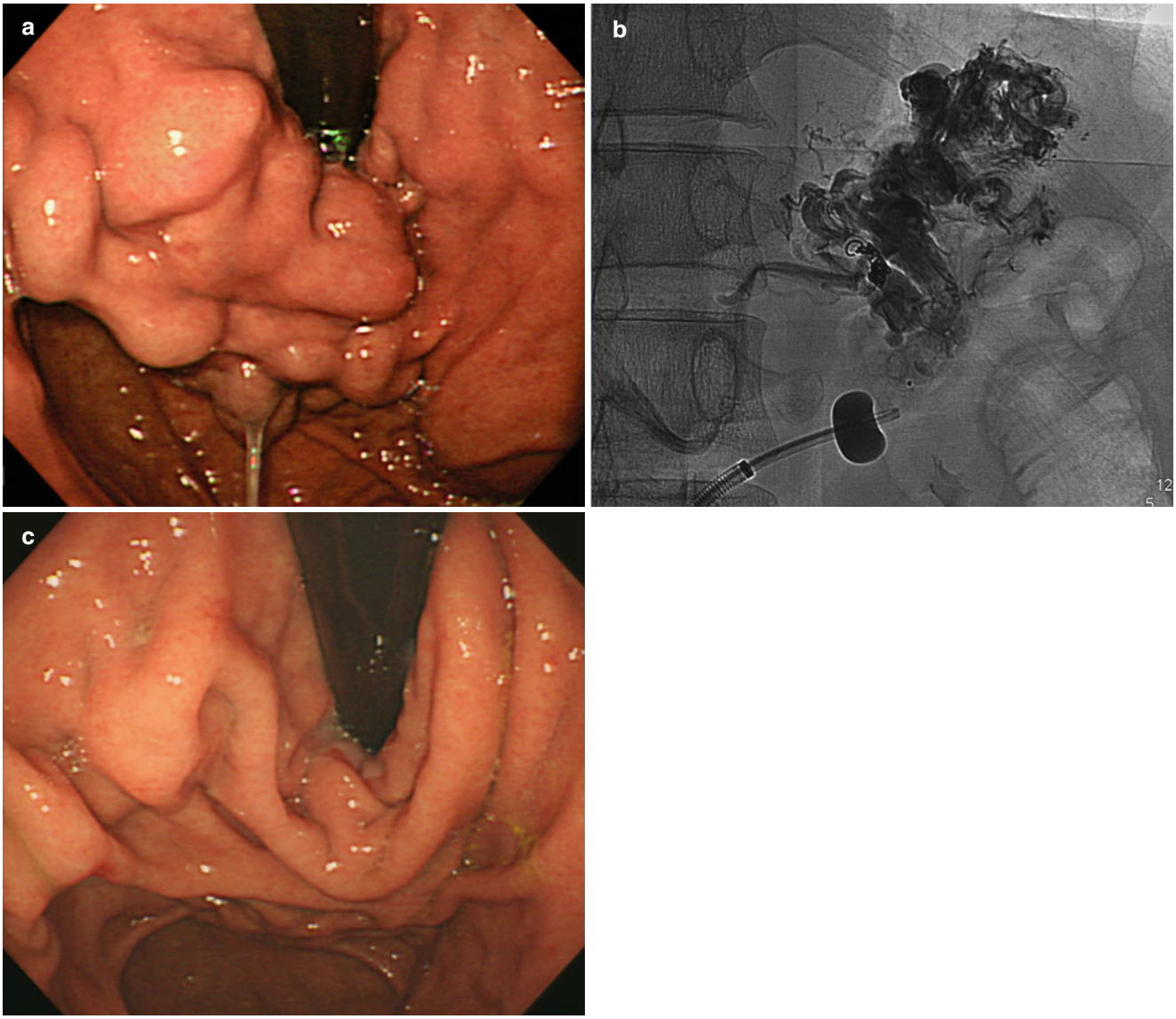

Fig. 9.37 Gastric varix. (**a**) Conventional gastroscopy revealed bulky gastric varices. (**b**) Balloon-occluded retrograde transvenous variceal obliteration was done via the right femoral vein and left renal vein. (**c**) Much decreased gastric varices are visible 5 months after the BRTO procedures

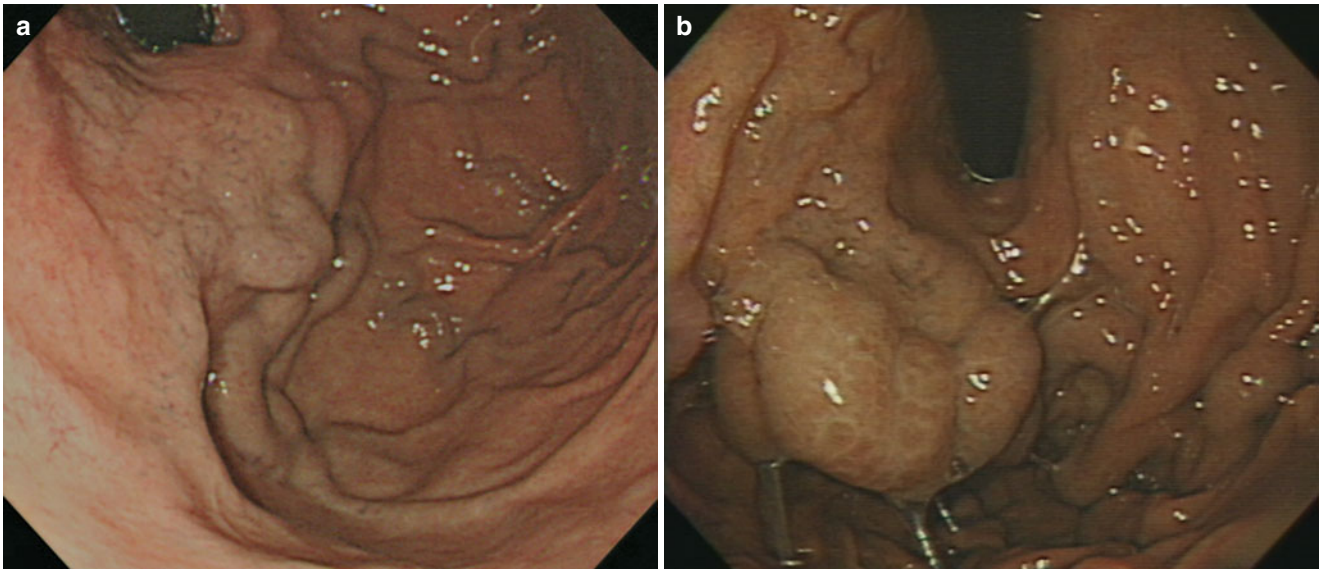

Fig. 9.38 Gastric varix. (**a**) On the retroflexed view, small varices in the cardia were noticed. (**b**) Much increased gastric varices are visible 3 years after

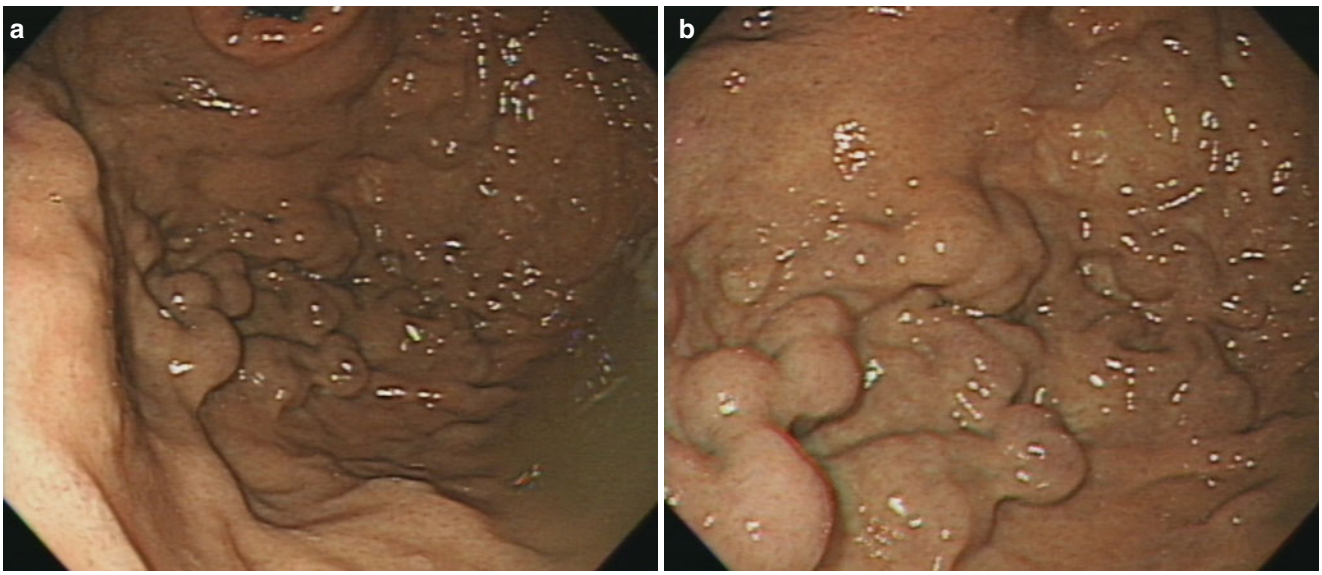

Fig. 9.39 Gastric varix. (**a**, **b**) Multiple tortuous engorged veins were noticed on the fundus

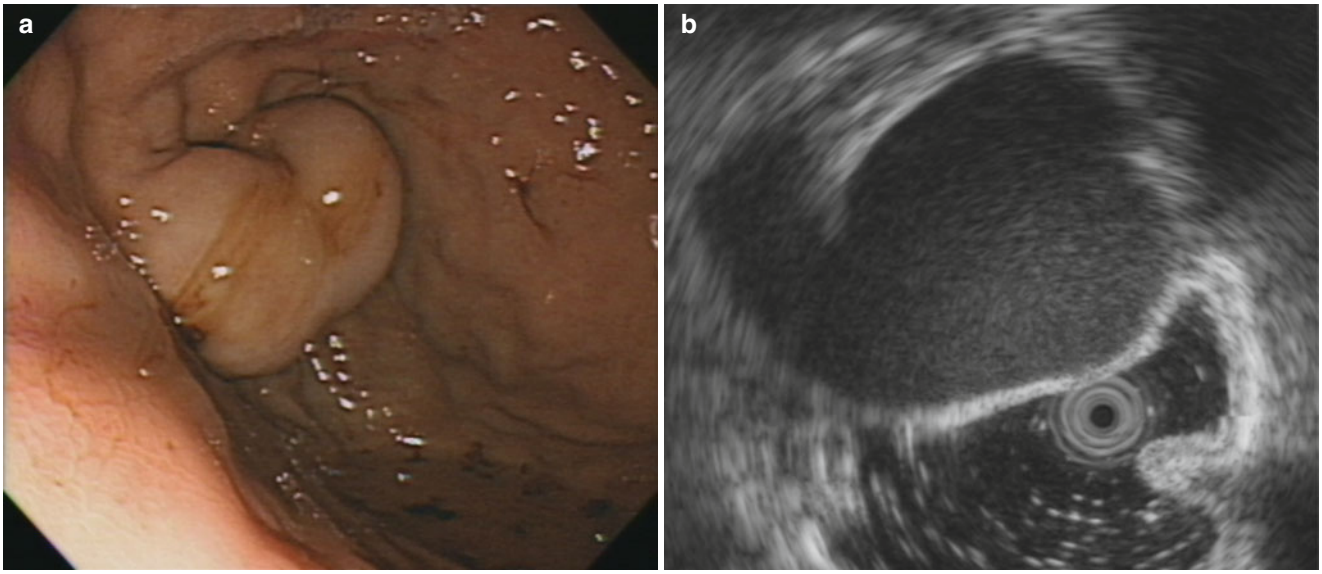

Fig. 9.40 Gastric varix. (**a**) Huge subepithelial tumorlike lesion with lobulated contour was noticed on the fundus. (**b**) On EUS examination, hypoechoic tubular lesion was noted in the fundus, and shape of lesion and internal echo were changeable by motion

9.3.10 Lymphangioma

Gastric lymphangioma is a rare benign gastric tumor composed of unilocular or multilocular lymphatic spaces. Their inner wall is covered by an epithelial layer, and they are subdivided by irregular septal structures that consist of smooth muscle or connective tissue. Endoscopically, a semitransparent white submucosal tumor is the characteristic finding. They are easily compressible with forceps. On EUS, a homogenous anechoic and lobulated structure with internal septum is seen in the submucosal layer. The EUS pattern is characteristic, allowing easy differentiation from other submucosal lesions (Figs. 9.41, 9.42, 9.43, 9.44, 9.45, and 9.46).

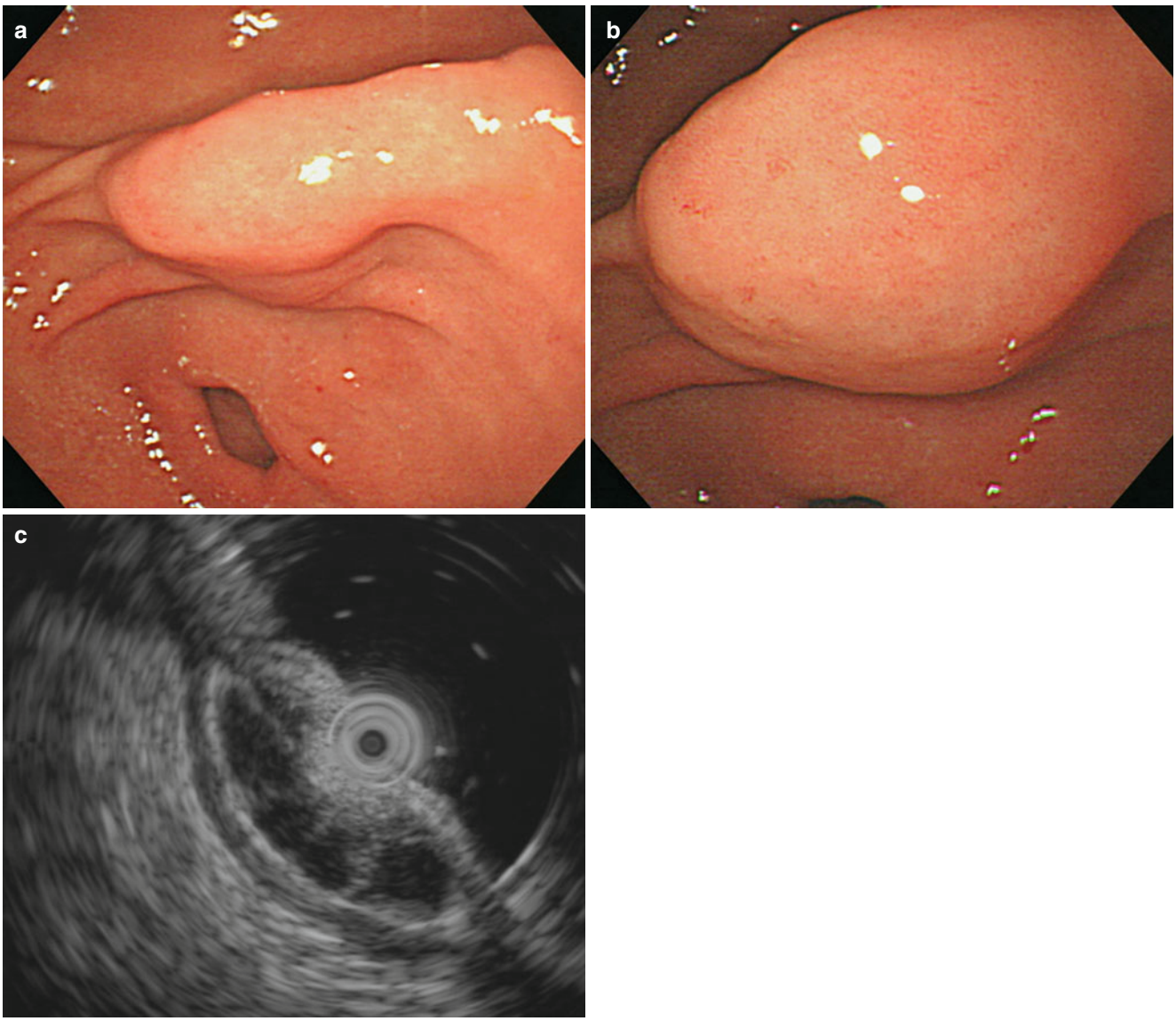

Fig. 9.41 Gastric lymphangioma. (**a**, **b**) A 1.8-cm subepithelial tumor without mucosal abnormality was noted on the distal antrum. (**c**) On EUS examination, a 15-mm, well-demarcated, relatively homogenous hypoechoic lesion with internal septa is noted. This lesion originates from the submucosal layer

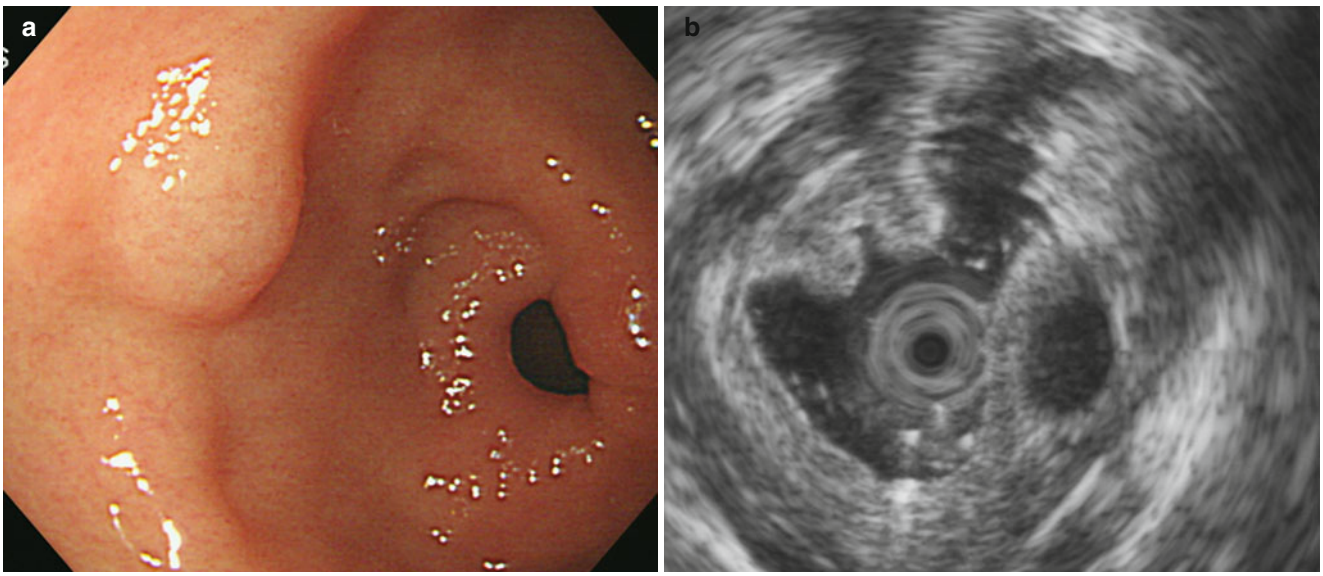

Fig. 9.42 Gastric lymphangioma. (**a**) About 0.6-cm round, sessile subepithelial tumor was noticed on the antrum. (**b**) EUS findings showed a homogenous anechoic lesion in the submucosa

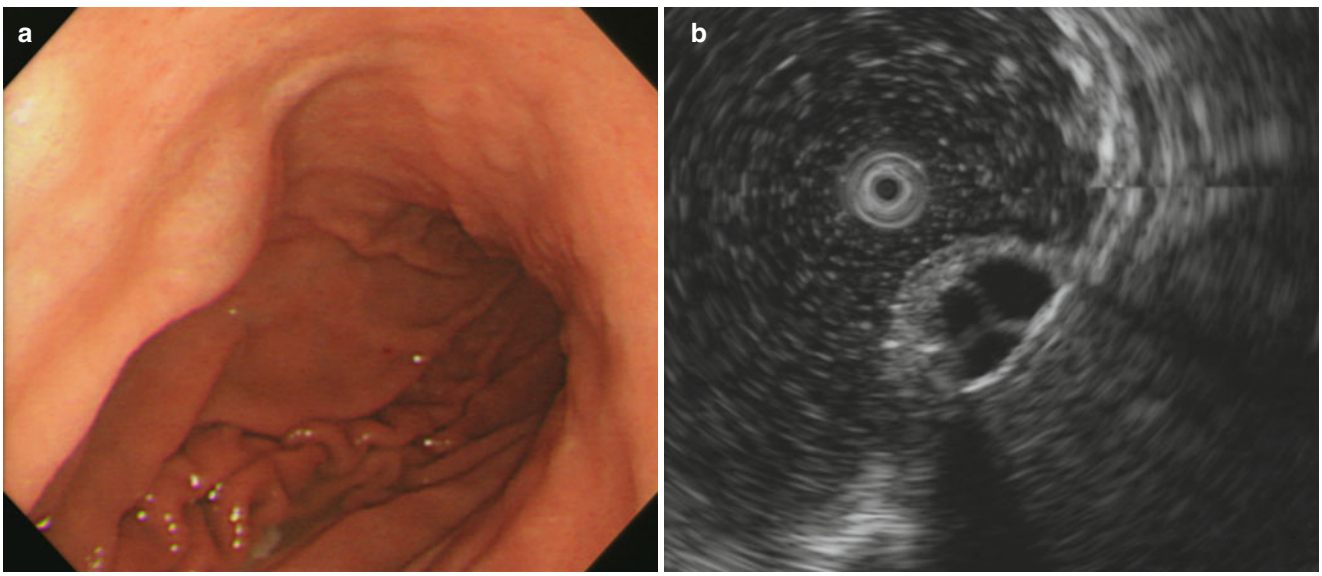

Fig. 9.43 Gastric lymphangioma. (**a**) About 1-cm broad-based subepithelial tumor was noticed on the antrum. (**b**) EUS shows a homogenous, anechoic lesion with internal septation located in the submucosal layer

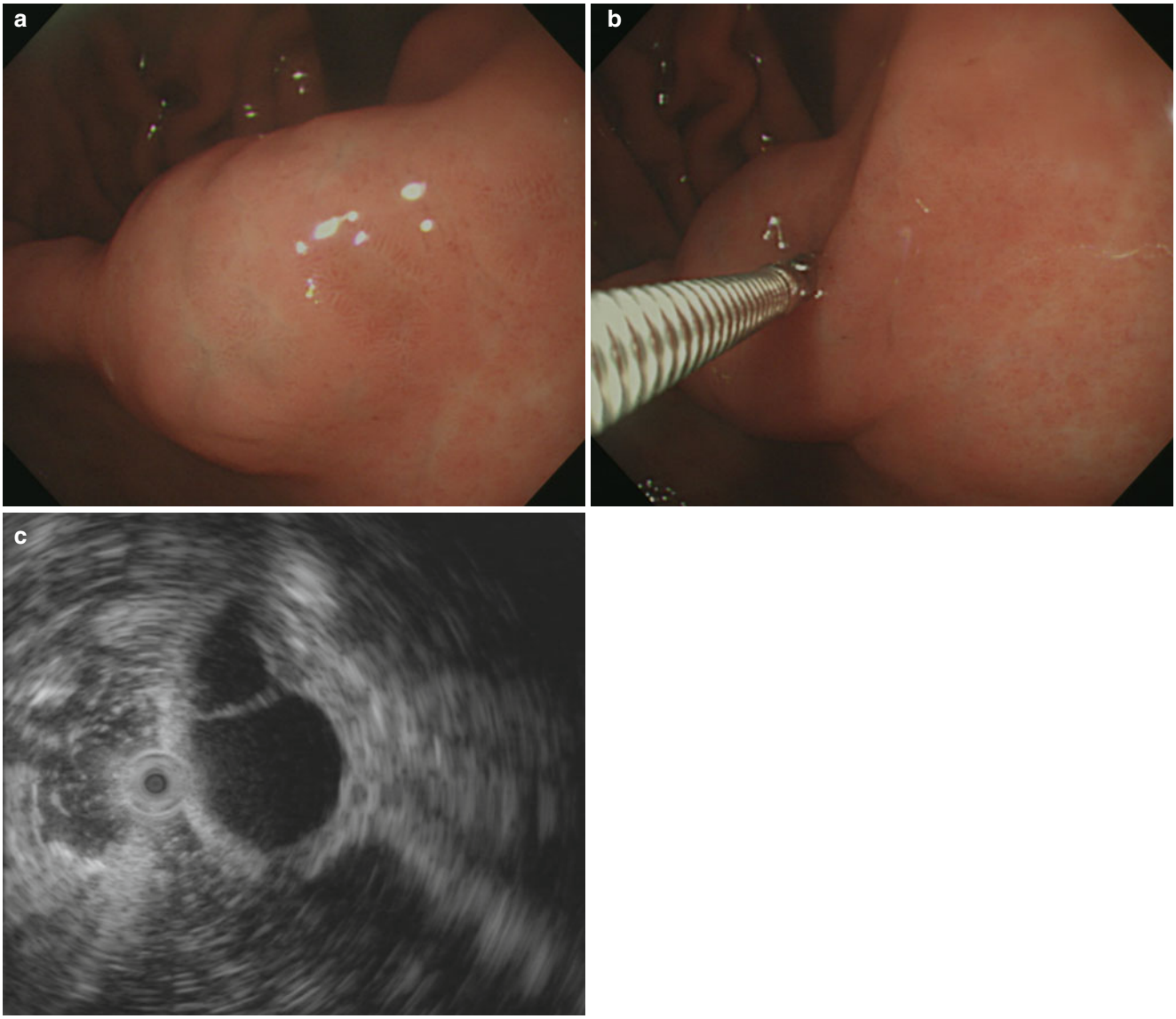

Fig. 9.44 Gastric lymphangioma. (**a**, **b**) About 2.0-cm round protruded lesion with normal mucosal covering was noticed on angle (cushion sign +). (**c**) On EUS examination, a well-demarcated homogenous anechoic lesion with septation is noted at the angle. This lesion originates from the submucosal layer

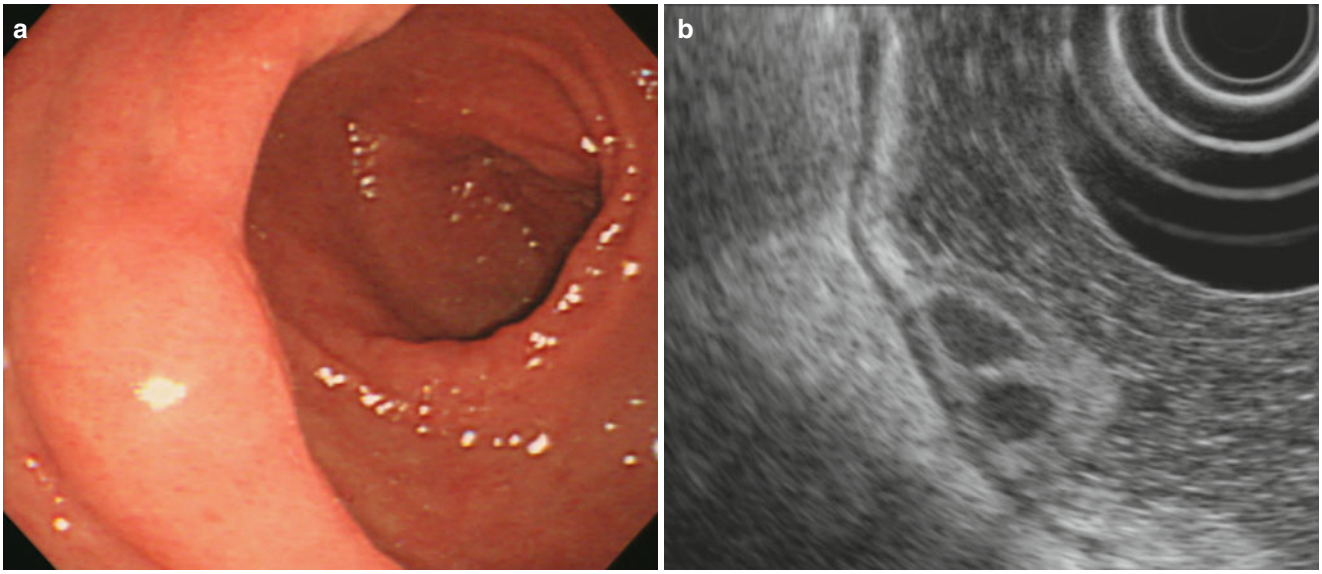

Fig. 9.45 Gastric lymphangioma. (**a**) About 1.0-cm round protruded lesion with normal mucosal covering was noticed in the posterior wall of the gastric lower body. (**b**) A homogenous hypoechoic lesion with septation was noted. This lesion originates from the submucosal layer

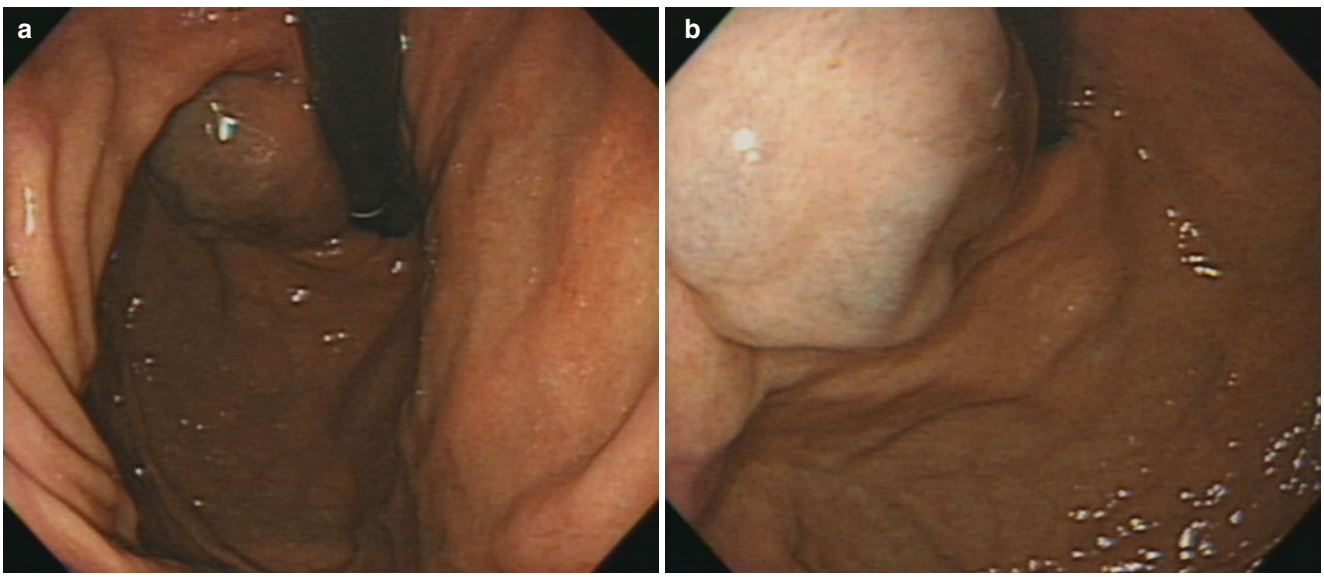

Fig. 9.46 Gastric lymphangioma. (**a**, **b**) Bluish-colored subepithelial lesion was noted on the cardia. Wedge resection was performed for tissue confirming

9.3.11 Duplication Cyst

Duplication cysts are benign lesions that result from an error in the embryonic development of the foregut and are primarily seen in the pediatric population. Duplication cysts in adults are often found incidentally and are usually asymptomatic. On endoscopy, duplication cysts can appear as a bulge with normal overlying mucosa or as a diverticulum that can vary in size from several millimeters to over 5 cm. The diagnosis of a gastric duplication cyst can easily be made using EUS, which will show an anechoic, smooth, spherical, or tubular structure with a well-defined wall.

9.4 Extrinsic Compression

Distinguishing whether the lesion is intramural or due to extrinsic compression during endoscopic examination can be facilitated by changing the patient's position to see if the location and appearance of the mass changes. Also, a change in appearance of the mass with either air insufflation or deflation is helpful in determining if the lesion is due to extrinsic compression. The most common source of extraluminal compression in the stomach is from the spleen and splenic vessels. Other sources of extraluminal compression include normal abdominal structures such as the left lobe of the liver, gallbladder, colon, and pancreas (Figs. 9.47, 9.48, 9.49, 9.50, 9.51, and 9.52). In addition, pathological lesions such as tumors, abscess, pancreatic pseudocysts, renal cysts, and enlarged lymph nodes can appear as gastric subepithelial lesions on endoscopy.

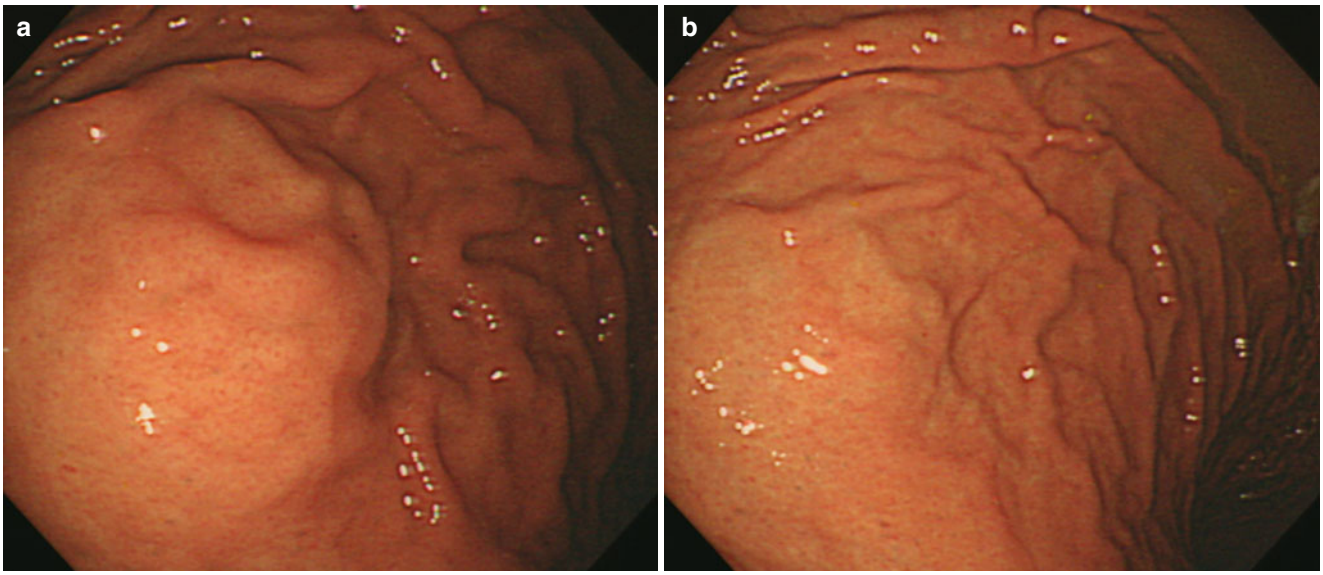

Fig. 9.47 Gastric extrinsic compression (air). (**a**, **b**) A submucosal bulging was noticed on the greater curvature of the high body. During air insufflations, subepithelial lesion was disappeared

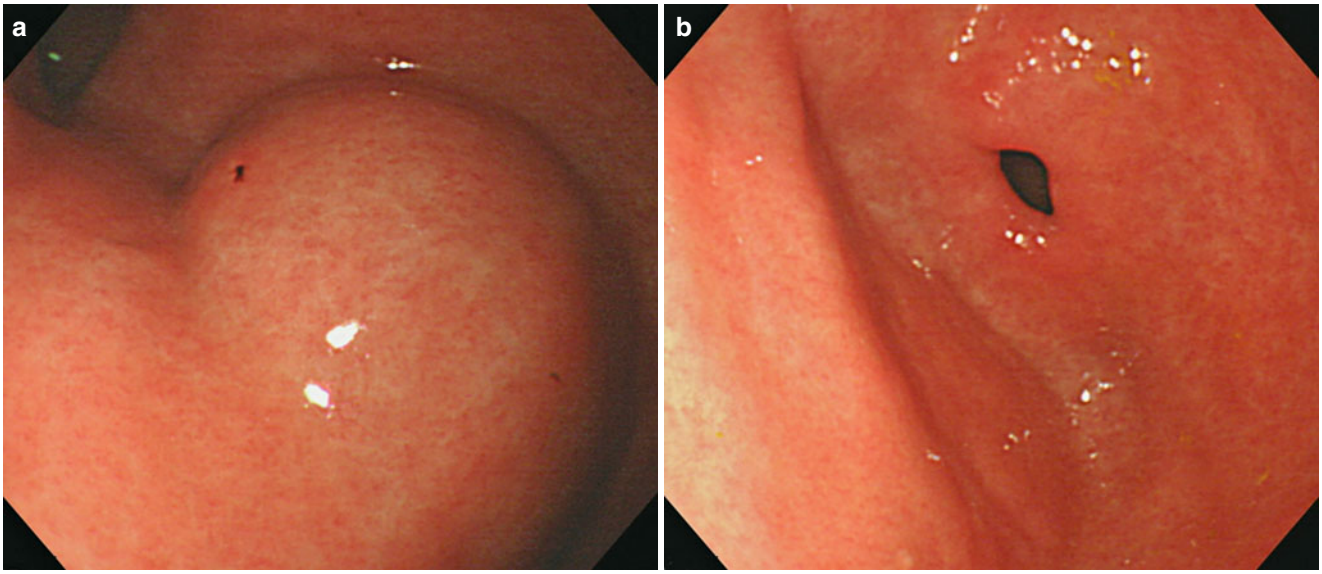

Fig. 9.48 Gastric extrinsic compression (position). (**a**, **b**) Subepithelial tumorlike lesion was noticed in the gastric antrum. This lesion disappeared by position change

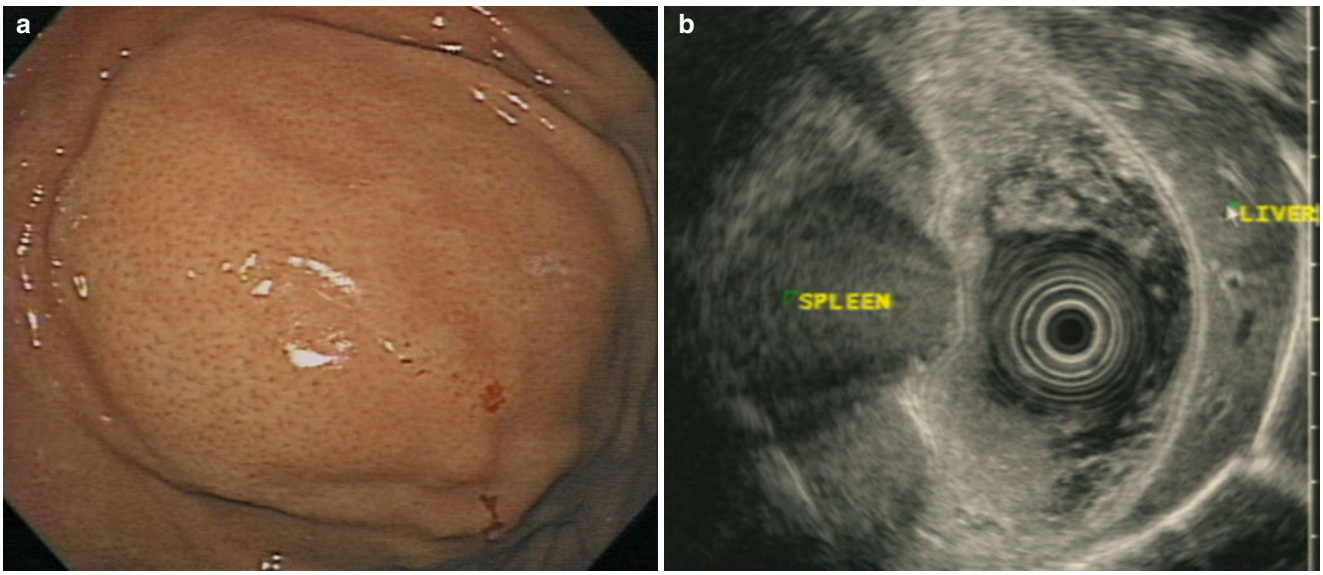

Fig. 9.49 Extrinsic compression by the spleen. (**a**) About 2-cm subepithelial lesion was noticed on the greater curvature of the high body. (**b**) A submucosal bulging reveals the abnormality to be the result of extrinsic compression by the spleen on EUS

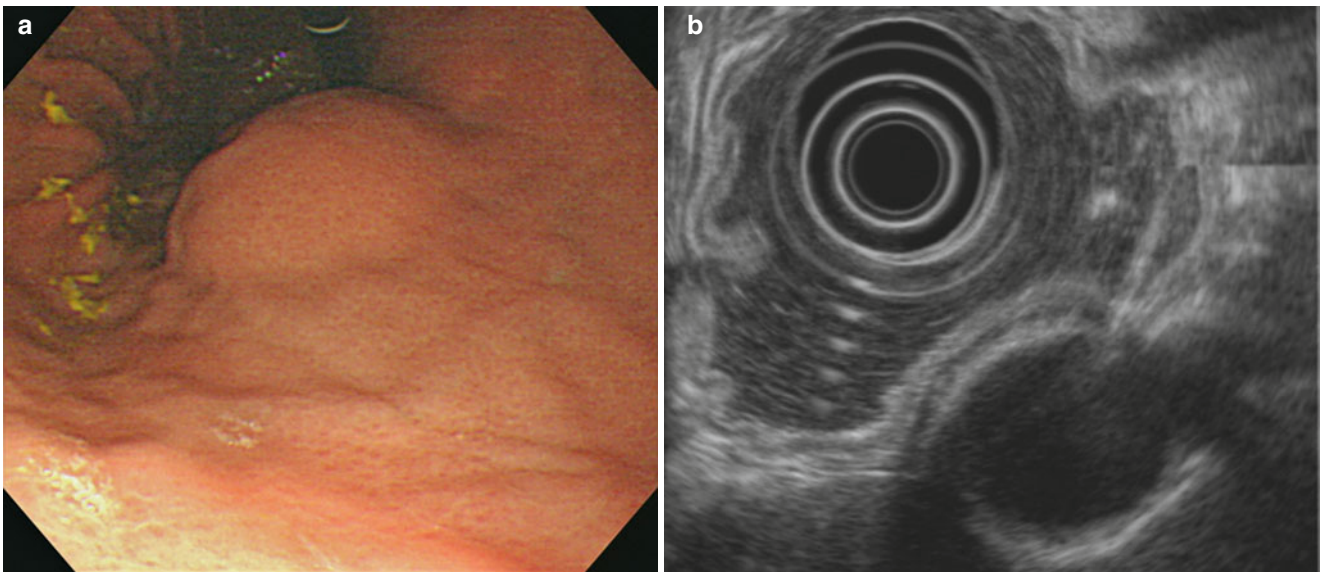

Fig. 9.50 Extrinsic compression by the gallbladder. (**a**) Endoscopically, there is a subepithelial lesion on the lesser curvature of the lower body. (**b**) At EUS the cause is seen to be an enlarged gallbladder

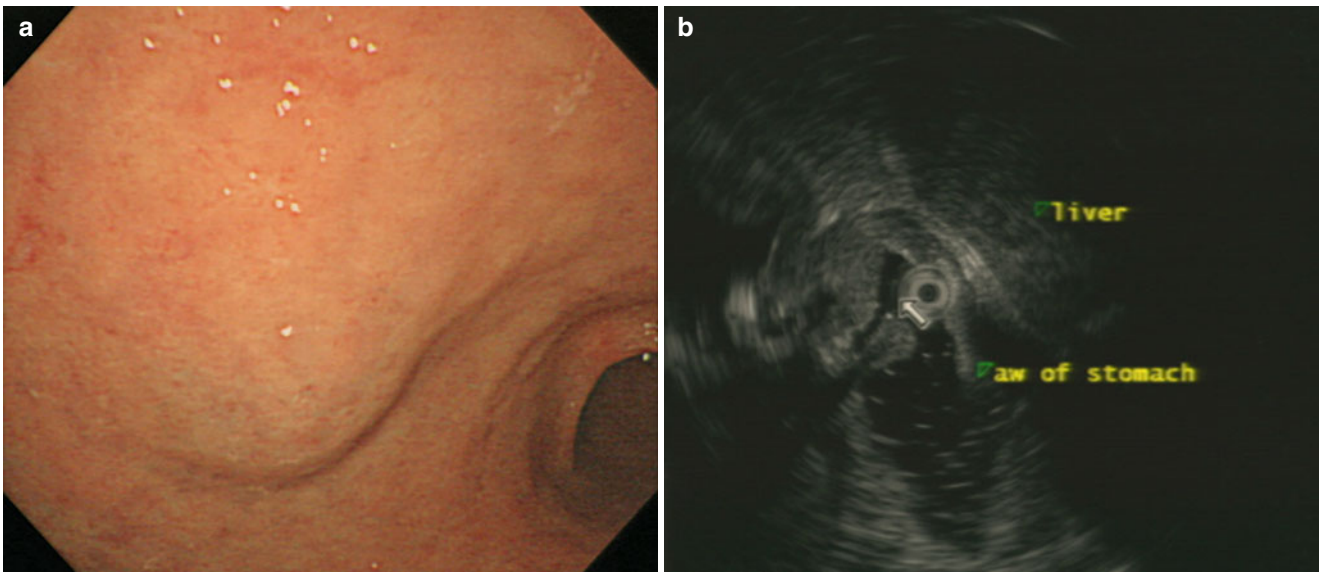

Fig. 9.51 Extrinsic compression by the liver. (**a**) Subepithelial tumorlike lesion was noticed on the anterior wall of the antrum. (**b**) EUS shows extrinsic compression by the liver without any gastric wall mass

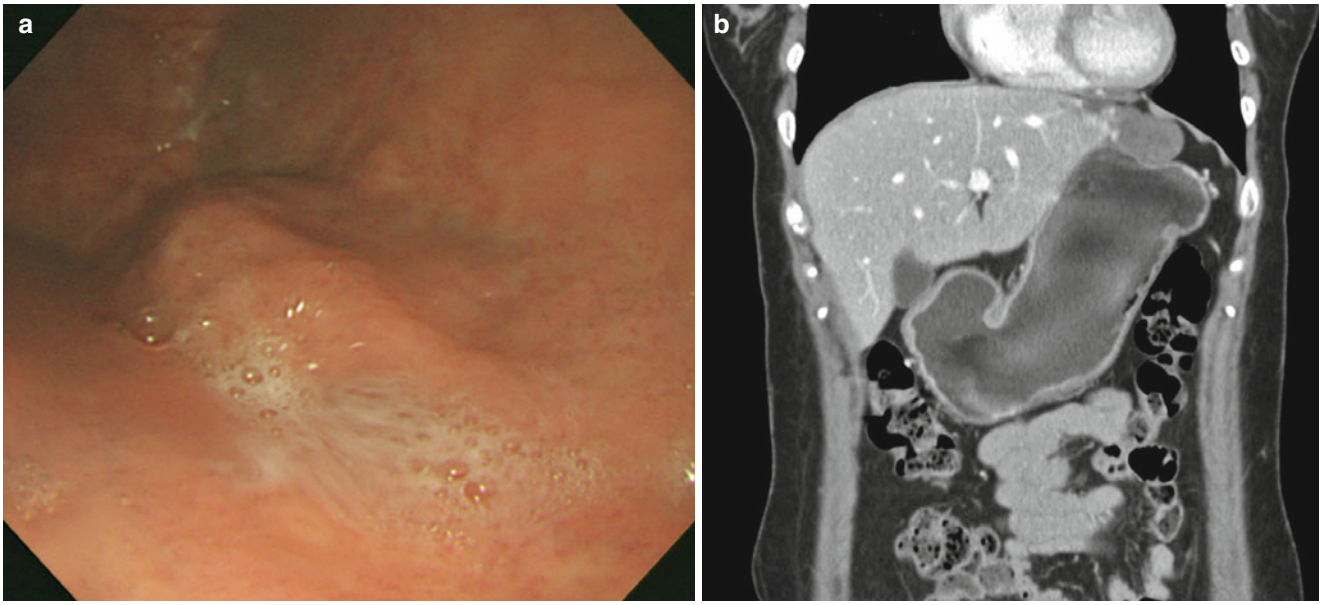

Fig. 9.52 Extrinsic compression by liver hemangioma. (**a**) Endoscopic finding showed an intraluminal protruding lesion of the fundus, covered with normal gastric mucosa. (**b**) A reconstructive coronal view of CT scan revealed liver hemangioma

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