

Imaging of the Stomach

Pantongrag-Brown L

Imaging modalities used in stomach include plain radiographs, UGI study, US, CT, PET CT and MRI. UGI study is declining in popularity and is replaced by endoscopy. In this article, several gastric abnormalities will be demonstrated, using case-based approach, and emphasizing on imaging findings.

Case 1. A 42-year-old man presented with abdominal pain and fever.

Perforation occurs in about 5-10% of patients with peptic ulcer disease. Most cases present with extraluminal air or lesser sac abscess. Subcapsular liver abscess secondary to peptic ulcer perforation is uncommon⁽¹⁾. However, CT may be able to suggest the diagnosis, so that appropriate treatment could be implemented.

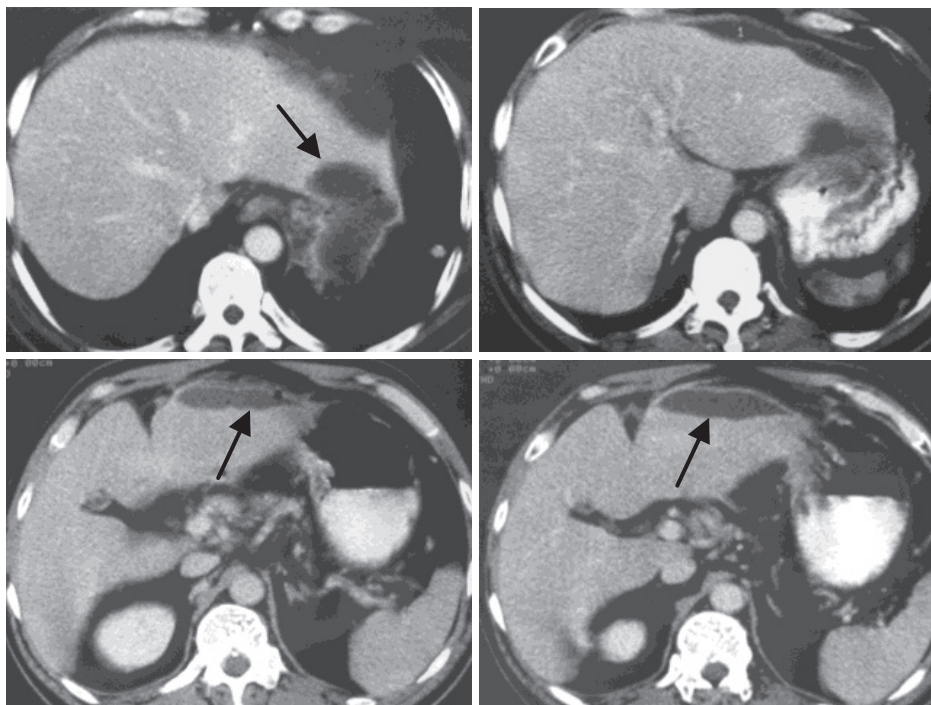


Figure 1. CT scan reveals left peri-hepatic and subcapsular collections containing a few air bubbles, consistent with abscesses. The stomach is attached to left hepatic lobe, adjacent to the abscess, and is likely a source of infection. Surgery confirms peptic ulcer perforation. Final diagnosis is penetrating gastric ulcer presenting as a subcapsular liver abscess.

Advanced Diagnostic Imaging Center, Ramathibodi Hospital, Bangkok, Thailand.

Address for Correspondence: *Linda Pantongrag-Brown, M.D., Advanced Diagnostic Imaging Center, Ramathibodi Hospital, Bangkok, Thailand.*

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Case 2. A 35-year-old woman presented with abdominal discomfort.

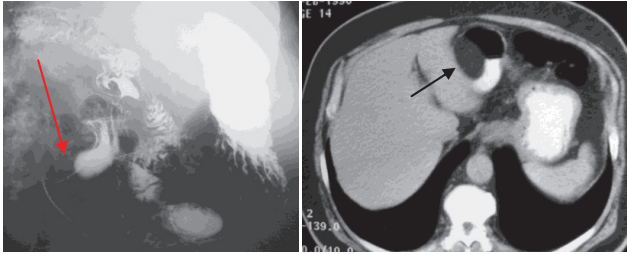


Figure 2. UGI study shows smooth surface mass of the gastric antrum, forming obtuse angle with the gastric wall, suggestive of a submucosal mass. Differential diagnosis includes GIST, lymphoma, neurogenic tumor, and lipoma. CT scan reveals the mass to be fatty density, consistent with a benign gastric lipoma.

Gastric lipoma is uncommon, accounting for about 5% of all gastrointestinal tract lipomas. Most gastric lipomas are found in the submucosa of the pyloric antrum. Most gastric lipomas are asymptomatic lesions, and are detected incidentally. Diagnosis of gastric lipoma could be definitive by CT because it could accurately measure the density of fat with attenuation between -70 to -120 HU⁽²⁾.

Case 3. A 75-year-old man presented with abdominal pain, nausea, vomiting, and weight loss.

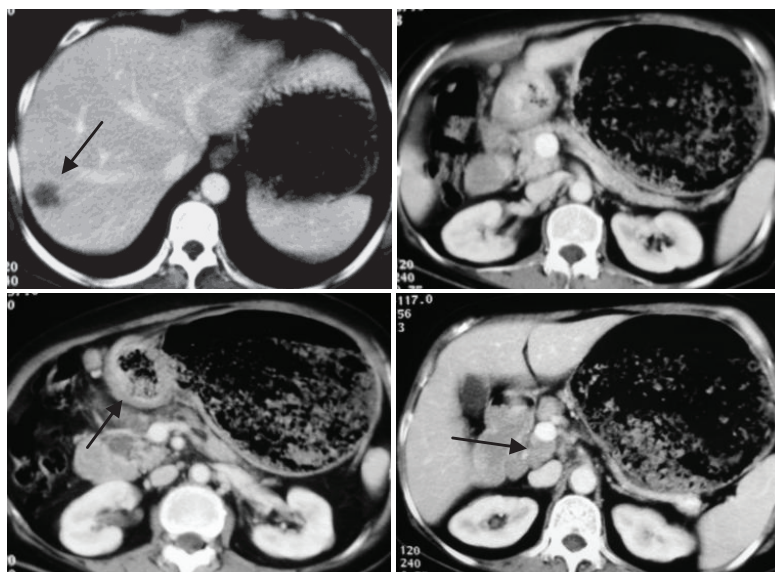


Figure 3. CT scan shows circumferential mass of the gastric antrum causing gastric outlet obstruction, consistent with primary gastric cancer. Lymphadenopathy along the gastrohepatic ligament and a small liver nodule are suggestive of nodal and liver metastasis. CT staging is T3N1M1.

Gastric cancer continues to be one of the leading causes of cancer death. Accurate staging is important for determining appropriate treatment. CT is currently the imaging of choice for pre-treatment staging because it can identify the primary tumor, assess for local spreading, and detect nodal and liver metastasis⁽³⁾.

Case 4: A 34-year-old man presented with abdominal pain.

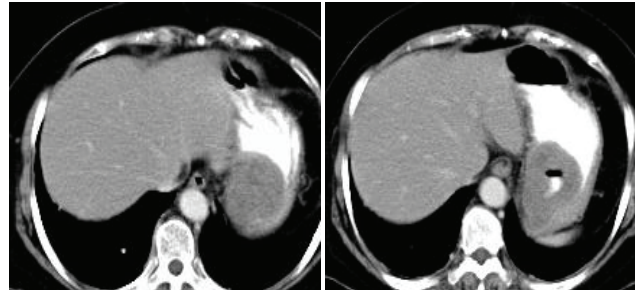


Figure 4. CT scan shows a smooth contour mass with central ulceration (target or bull's eye lesion), suggestive of submucosal origin. Differential diagnosis includes GIST, lymphoma, and neurogenic tumor. Surgery confirms GIST.

Gastrointestinal stromal tumor (GIST) is the most common mesenchymal neoplasm of the GI tract. Stomach is the most common location of involvement. GIST is usually large, hypervascular, and associated with necrosis or cystic degeneration. Lymphadenopathy is

not a feature of GIST. CT plays an important role for diagnosis and determination of response to treatment after imatinib. Modified Choi's criteria using CT is currently a standard for surveillance of GIST after imatinib therapy⁽⁴⁾.

Case 5. A 41-year-old female presented with abdominal pain.

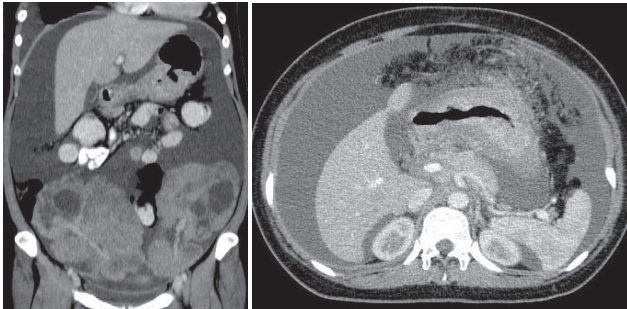


Figure 5. CT scan shows bilateral large ovarian masses. Bilateral involvement suggests ovarian metastasis. Searching for primary cancer shows diffuse thickening of the gastric wall with poor distension, suggestive of linitis plastica pattern of gastric cancer. Ascites and omental infiltration (omental cake) are indicative of peritoneal carcinomatosis. Surgery confirms the diagnosis of Krukenberg's tumors from primary signet ring, gastric adenocarcinoma.

Krukenberg's tumors refer to signet ring subtype of ovarian metastasis. The stomach, and colon are the 2 most common primary cancers, followed by breast and lung. The time from diagnosis of the primary tumor to the development of ovarian metastasis is variable, and can range from several months to > 10 years. Differentiation between primary and metastatic ovarian carcinoma is very important regarding treatment and prognosis⁽⁵⁾. CT is usually the imaging of choice to identify a primary cancer accompanying ovarian masses. Krukenberg is named after Friedrich E. Krukenberg, a Germany pathologist.

Case 6. A 54-year-old woman presented with abdominal pain and weight loss.

Differential diagnosis of omental cake includes peritoneal carcinomatosis, pseudomyxoma peritonei, peritoneal mesothelioma, TB peritonitis, and disseminated lymphoma. Lymphoma can occur at any site in the body, but diffuse and extensive involvement of the peritoneum is rare. Ascites without loculation, multiple organ involvement, and lymphadenopathy may be an important clue in imaging to distinguish lymphoma from other more common etiologies⁽⁶⁾.

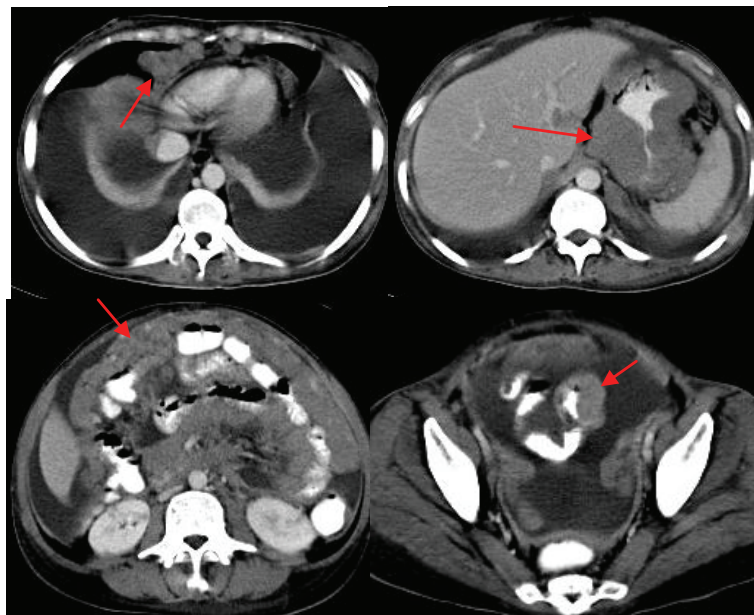


Figure 6. CT scan shows a thick omental cake, and ascites without loculation. Additional findings of diaphragmatic lymphadenopathy, irregular thickened wall of the stomach and ileum makes disseminated lymphoma the most likely diagnosis.

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Case 7. A 46-year-old woman presented with abdominal pain and loss of appetite.

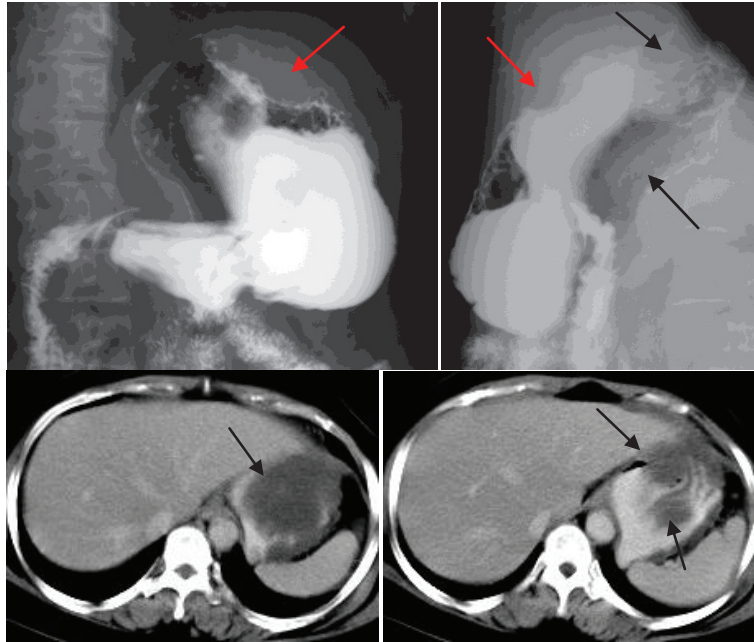


Figure 7. UGI study shows several masses with smooth surface, suggestive of submucosal or mural masses. CT confirms low-density masses of the gastric wall. Differential diagnosis of multiple gastric masses includes lymphoma and metastasis. The patient had the history of ovarian cancer; therefore, these masses are consistent with gastric metastasis.

Gastric metastasis is uncommon. Primary tumors commonly metastasize to stomach includes melanoma, breast, lung, and esophageal cancers. Ovarian cancers usually spread along the peritoneal surface, and involvement of the stomach is rare. In spite of its rarity, it should be considered in the patients who have his-

tory of ovarian cancers or concurrent stomach and ovarian masses⁽⁷⁾.

Case 8. A 34-year-old woman presented with abdominal discomfort.

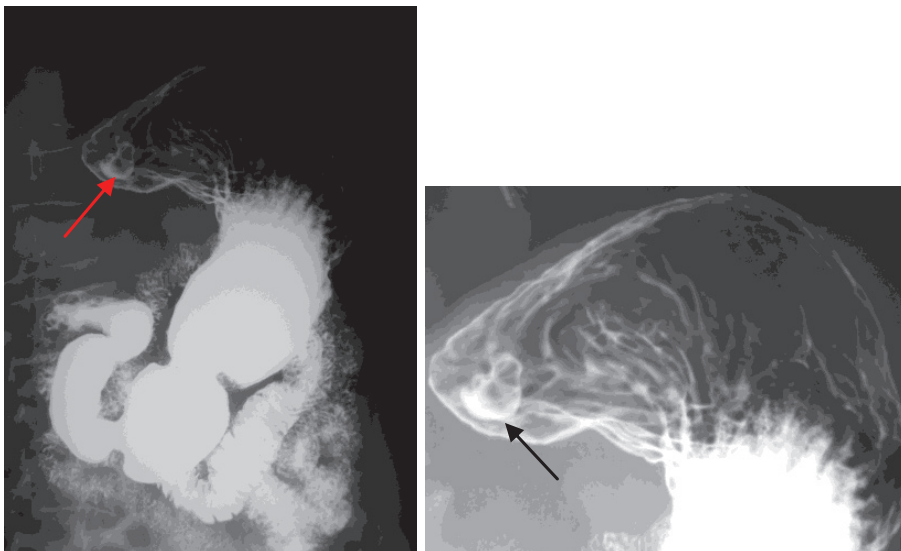


Figure 8. UGI study shows an out-pouching lesion with smooth surface at the posterior aspect of the gastric cardia. The surrounding gastric mucosal folds are normal. Findings are typical for a gastric diverticulum.

Gastric diverticulum is rare, and considered a developmental or congenital abnormality. Patients are usually asymptomatic or have vague symptoms. Most cases are detected incidentally by imaging studies. This diverticulum is usually small, and located on the posterior wall of the cardia. UGI pattern is quite typical and should not be misinterpreted as a gastric ulcer. Treatment is not necessary. However, laparoscopic repair has been suggested⁽⁸⁾.

Case 9. A 23-year-old woman presented with abdominal pain and vomiting.

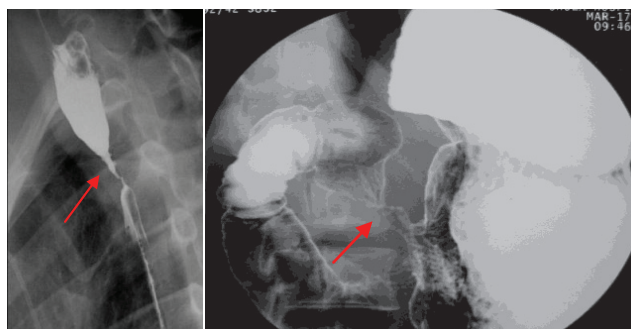


Figure 9. UGI study shows stricture of the gastric antrum causing gastric outlet obstruction and dilatation of the proximal stomach. By appearance, this could be either benign or malignant stricture. However, additional stricture of the esophagus in a young female is highly suggestive of corrosive stricture.

Gastric outlet obstruction, as a complication of corrosive ingestion, is rare. Concomitant stricture of the esophagus is usually found. Although both acid and alkali substances could damage both esophagus and stomach, it is well documented that the acid damages the stomach, and the alkali damages the esophagus. This preferential damage occurs because of the rapid transit of acid through the esophagus, the resistance of the esophageal squamous epithelium, and the reflex pyloric spasm, in response to the entry of acid. Conversely, alkali tends to coat the esophagus, thereby, causing more damage to this site⁽⁹⁾.

Case 10. A 6-year-old girl presented with abdominal pain.



Figure 10. CT scan shows a large, lamellate, gastric-shaped mass situated within the stomach. Multiple mottled airs are trapped within the mass. Findings are typical for trichobezoar.

Trichobezoar is a gastric bezoar formed from hair. “Rapunzel syndrome” has been termed if the tail of trichobezoar extends some distance through small bowel. Risk of trichobezoar is greater among mentally retarded or emotionally disturbed children. Females are mostly affected. Removal of trichobezoar may be succeeded by endoscopic or surgical removal⁽¹⁰⁾.

CONCLUSIONS

Ten diseases of stomach are illustrated, emphasizing on the imaging appearances. These cases are as following:

1. Congenital pathology: gastric diverticulum

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2. Neoplastic pathology: gastric lipoma, gastric carcinoma, gastric GIST, Krukenberg tumors form signet ring gastric carcinoma, gastric lymphoma with disseminated lymphomatosis, gastric metastasis from primary ovarian cancer.

3. Inflammatory pathology: penetrating gastric ulcer with subcapsular liver abscess, gastric corrosive stricture.

4. Miscellaneous pathology: trichobezoar.

REFERENCES

1. Hsu L, Tsai Y, Wang W, Yang B. Penetrating gastric ulcer presenting as a subcapsular liver abscess: a case report. *Clin J Radiol* 2008;33:103-7.
2. Thompson WM, Kende AI, Levy AD. Imaging characteristics of gastric lipomas in 16 adult and pediatric patients. *AJR* 2003;181:981-5.
3. Chen C, Hsu J, Wu D, *et al.* Gastric cancer: preoperative local staging with 3D multi-detector row CT -correlation with surgical and histopathological results. *Radiology* 2007;242:472-82.
4. Hong X, Choi D, Loyer EM, *et al.* Gastrointestinal stromal tumor: role of CT in diagnosis and in response evaluation and surveillance after treatment with imatinib. *RadioGraphics* 2006;26:481-95.
5. Cho KC, Gold BM. Computed tomography of Krukenberg tumors. *AJR* 1985;145:285-8.
6. Kim Y, Cho O, Song S, *et al.* Peritoneal lymphomatosis: CT findings. *Abdom Imaging* 1998;23:87-90
7. Taylor RR, Phillips WS, O'Connor DM. Unusual intramural gastric metastasis of recurrent epithelial ovarian carcinoma. *Gynecol Oncol* 1994;55:152-5.
8. Rashid F, Aber A, Ifthikar SY. A review on gastric diverticulum. *World J Emerg Surg* 2012;7:1-4
9. Kaushik R, Singh R, Sharma R, *et al.* Corrosive-induced gastric outlet obstruction. *Yonsei Med J* 2003;44:991-4.
10. Balaguera JC, García-Almenta MM, Herrera JI, *et al.* Giant gastric trichobezoar in a female teenager. *The Internet Journal of Surgery* 2008;21(2):1.