
TRANSABDOMINAL ULTRASOUND OF GASTRIC TUMOR

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ABSTRACT

Ultrasound is often used as a primary procedure in the patient with a nonspecific abdominal complaint. Finding of atypical target pattern or pseudokidney sign anteriorly located in left upper abdomen to mid upper abdomen, adjacent to the visceral surface of left lobe of liver, suggested that the lesion may be originated from stomach. Although differentiation between benign or malignant patterns cannot be definitely made, recognition of ascites, intraabdominal lymphnode, invasion to adjacent structure or evidence of intraabdominal metastasis may be helpful for the indications of malignancy. Four cases of stomach tumor were preliminary diagnosed by ultrasound. The Upper Gastrointestinal study and gastroscopy were performed for definite diagnosis.

Many gastric diseases including gastric tumor usually present with nonspecific abdominal symptoms, such as dyspepsia or abdominal pain. Delayed diagnosis and treatment may lead to unsatisfactory result. In general, radiographic evaluation of the gastrointestinal tract using barium or gastroscopy have been the gold standard for the diagnosis of gastric diseases. However, the investigations mentioned above are not available in our out patient clinic or in some hospitals. The ultrasound is readily available to be used for examination as it is cheaper and being a noninvasive technique. So the ultrasonography is usually performed as a preliminary screening test prior to radiographic study or gastroscopy. Recognition of the sonographic patterns arising from the stomach is of practical important in patient care, since gastric mass may be encountered initially on sonography. Certain sonographic pattern arising from normal and abnormal stomach and ultrasonographic anatomy of stomach related to adjacent abdominal structures have been recognized to improved the accuracy of diagnosis.

CASE REPORT I

A 81 years old male patient came to the hospital with left upper abdominal pain for 3 days. Ultrasonographic finding revealed a hypoechoic mass with central echoic core located at anterior portion of left upper abdomen. The mass is just posterior to the left lobe of liver. The distance between peripheral hypoechoic wall to central echoic cavity was 2cm., represented thickened gastric wall, by which stomach malignancy was suggested. Gastroscopy found a gastric tumor. The tumor was ulcerative type, located at the fundus of stomach, extending upward to the esophagus. Unfortunately patient denied surgery.

CASE REPORT II

A 57 years old male patient complained of abdominal dyspepsia. Physical examination revealed ill defined mass at left upper abdomen. The ultrasonographic study showed multiple irregular target appearance mass, anteriorly located at left upper abdomen, just posterolateral to the visceral surface of left lobe of liver. Gastric

cancer was first considered. The average gastric lesion wall thickness was about 2.2cm. The upper gastrointestinal study was done and revealed multiple malignant ulcers at the body of stomach. Gastroscopy also confirmed multiple ulcerative masses from fundus to body of stomach. The pathological report was poorly differentiated adenocarcinoma.

CASE REPORT III

A 67 years old man complained of progressive dyspepsia and weight loss. On physical examination and laboratory finding showed anemia and leukocytosis. Ultrasound of abdomen revealed mild hepatomegaly and marked splenomegaly. There is a large sonolucent mass at left upper abdomen, adjacent to the visceral surface of left lobe of liver. Stomach mass was suggested with a variable thickening gastric fold ranging from 0.7 to 1.5 cm. Most of the gastric wall thickness was about 7 mm. Additional paraaortic lymphadenopathies were detected. Intraabdominal Lymphoma with stomach involvement was first considered. Gastroscopy confirmed marked thickening and edematous folds of the whole stomach. The pathology of gastroscopic biopsy was malignant lymphoma, small lymphocytic type.

CASE REPORT IV

A 71 years old man, known case of stomach cancer, poorly differentiated adenocarcinoma, complained of progressive dyspepsia and dysphagia. Near total gastrectomy, Billroth II anastomosis and splenectomy was performed 7 months ago. Ultrasound screening showed a 5x5.6 cm. hypoechoic mass at the stomach location, adjacent to the visceral surface of left lobe liver. Another 3.2 cm. hypoechoic aortocaval lymphnode was also demonstrated. Recurrent stomach cancer was diagnosed. The upper gastrointestinal study confirmed a polypoid mass in the remnant stomach.

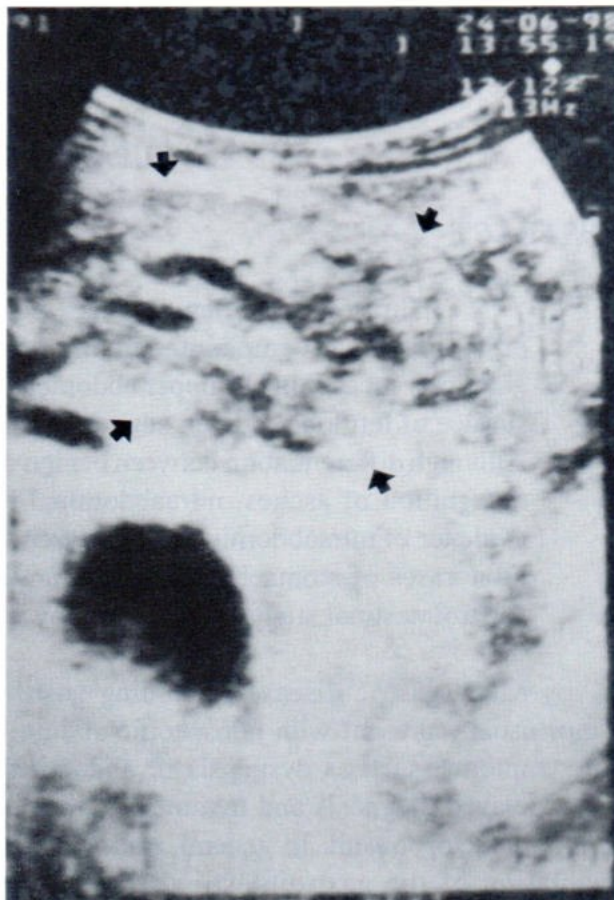


Fig. 1. Ultrasound done on an axial plane of left upper abdomen, revealed lobulated soft tissue mass (arrow), anteriorly located at left upper abdomen and just antero-left laterally to proximal abdominal aorta. Stomach mass was suggested.

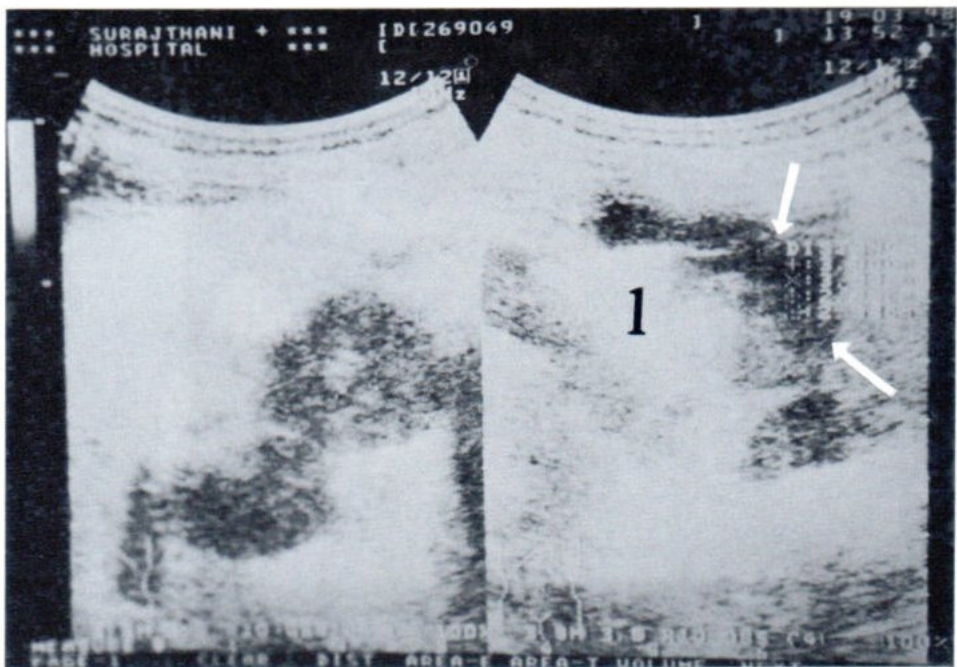
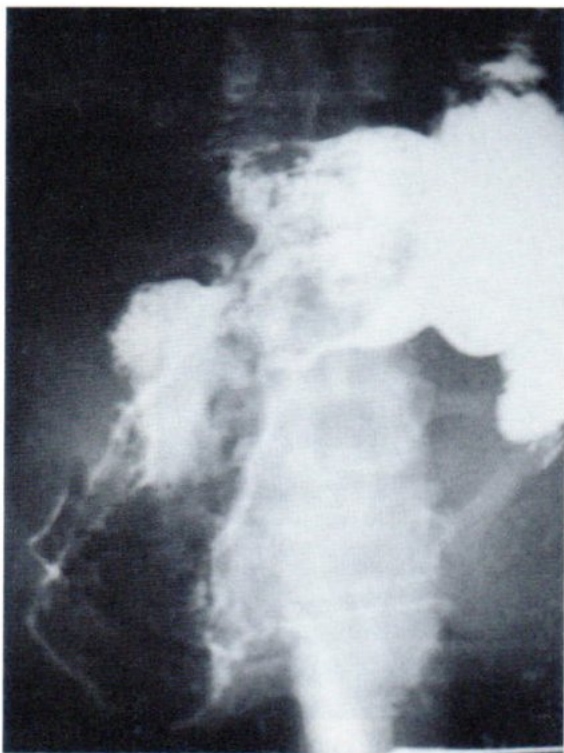


Fig. 2a and 2b Multiple atypical target appearance or pseudokidney-like lesions at the stomach location. These lesions were included in Fleischer's characteristic of abnormal bowel mass pattern. The long arrow on Fig 2b demonstrated a focal thickened gastric wall. 1 referred to gastric lumen.



2C



2D

Fig. 2c and 2d Supine and prone projection of upper gastrointestinal study showed multiple malignant ulcerative masses at the body of stomach.

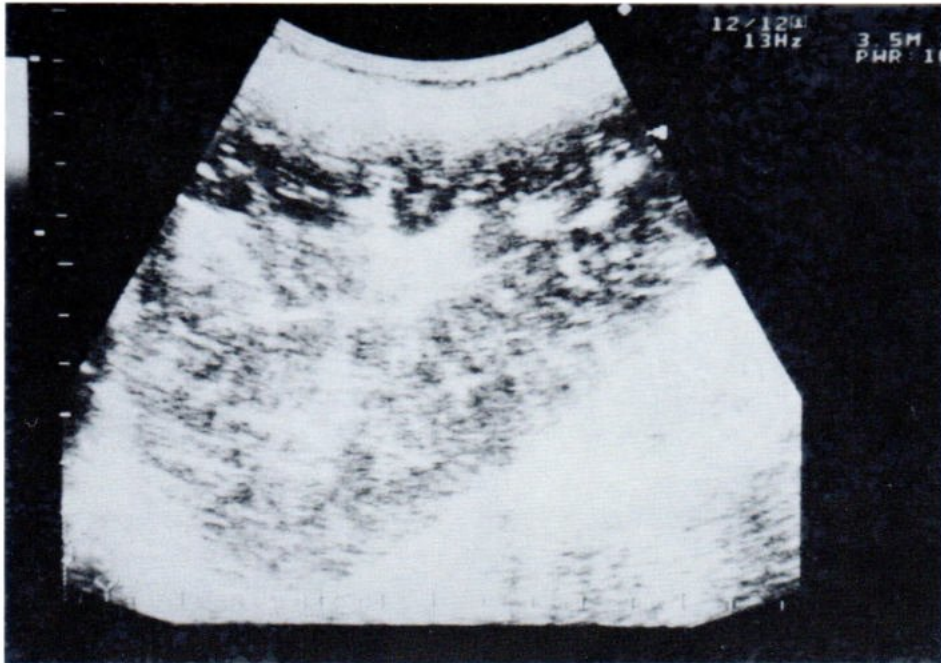


Fig. 3a. Ultrasound finding of gastric lymphoma, revealing sonolucent gastric masses with variable thickened gastric fold.



Fig. 3b. The stomach mass is anteriorly located in the left upper to mid upper abdomen, adjacent to the visceral surface of left lobe of liver. We can definitely separated the stomach mass from the left lobe of liver.

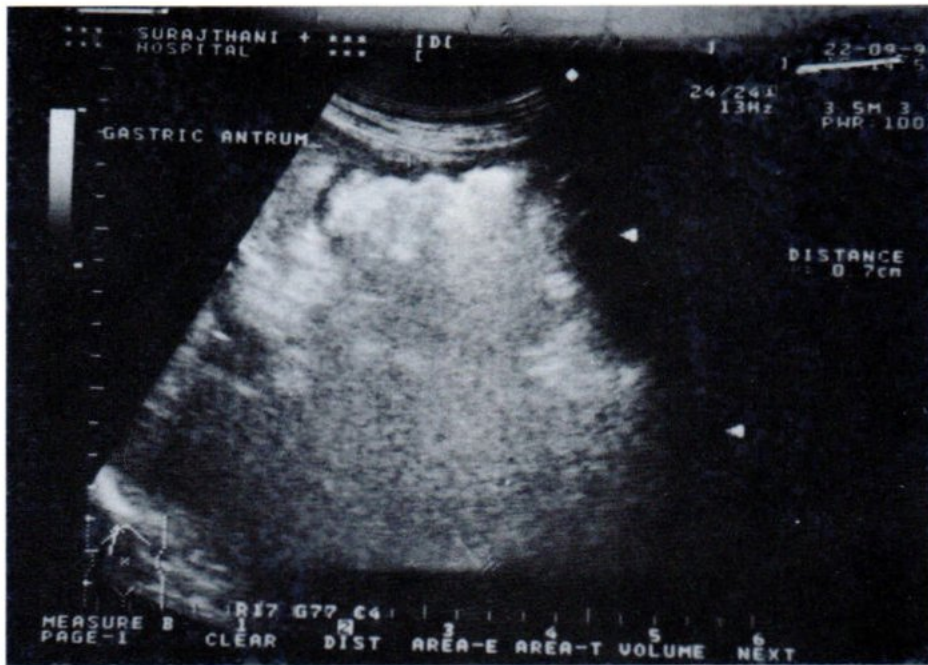


Fig. 3c. Sagittal plane of the stomach mass demonstrated diffuse thickened gastric wall about 7mm.

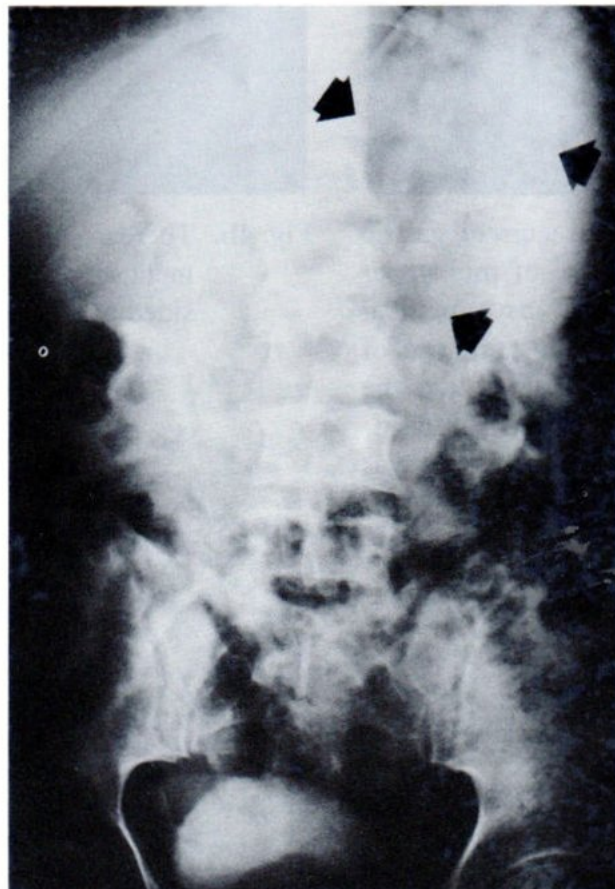


Fig. 3d. Excretory urogram of the same patient revealed air trapped between the enlarged folds from fundus to antrum of stomach (thick arrow).

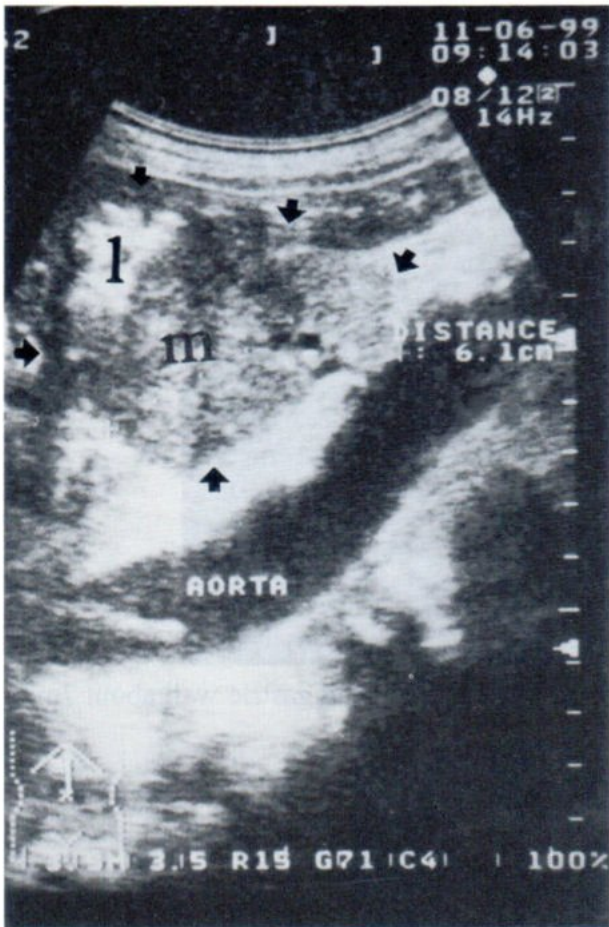


Fig. 4a. Ultrasound finding of recurrent gastric cancer, the sagittal plane of mid upper abdomen demonstrated asymmetrical target lesions, thickened posterior wall of gastric remnant (m) protuded into the gastric lumen. Thin arrows demonstrated the whole gastric remnant, which was anteriorly located in mid upper abdomen.

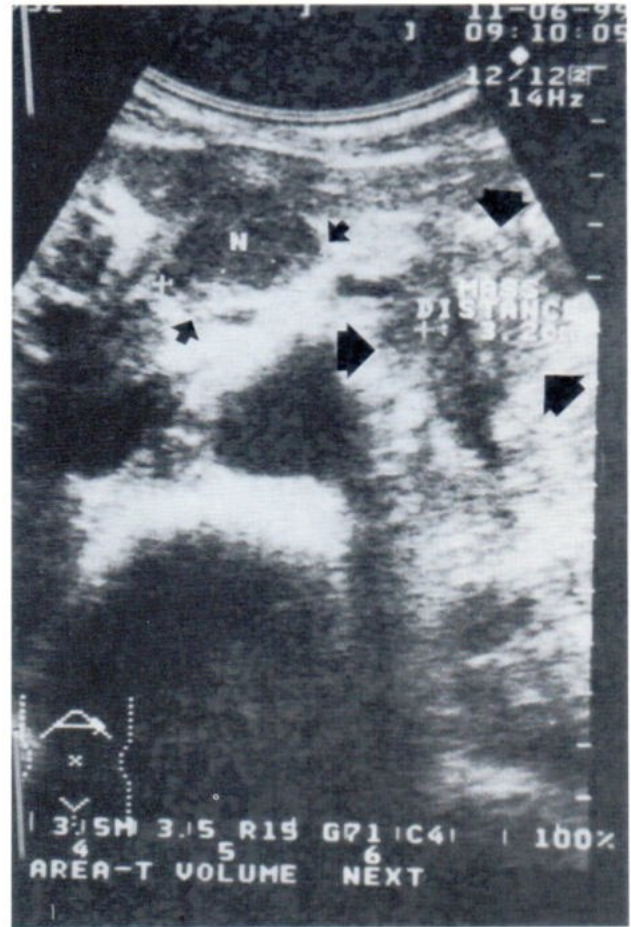
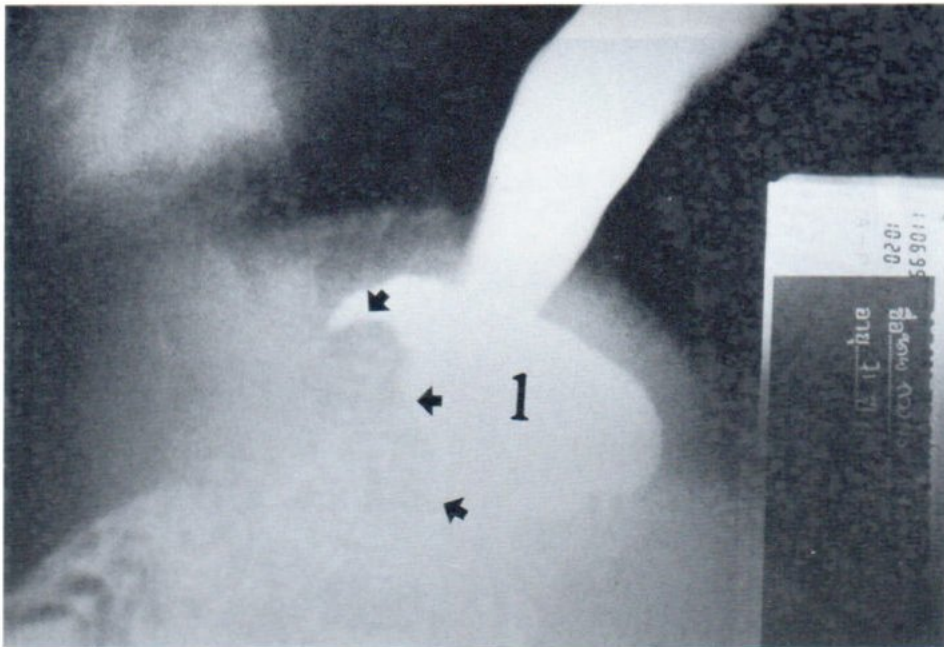
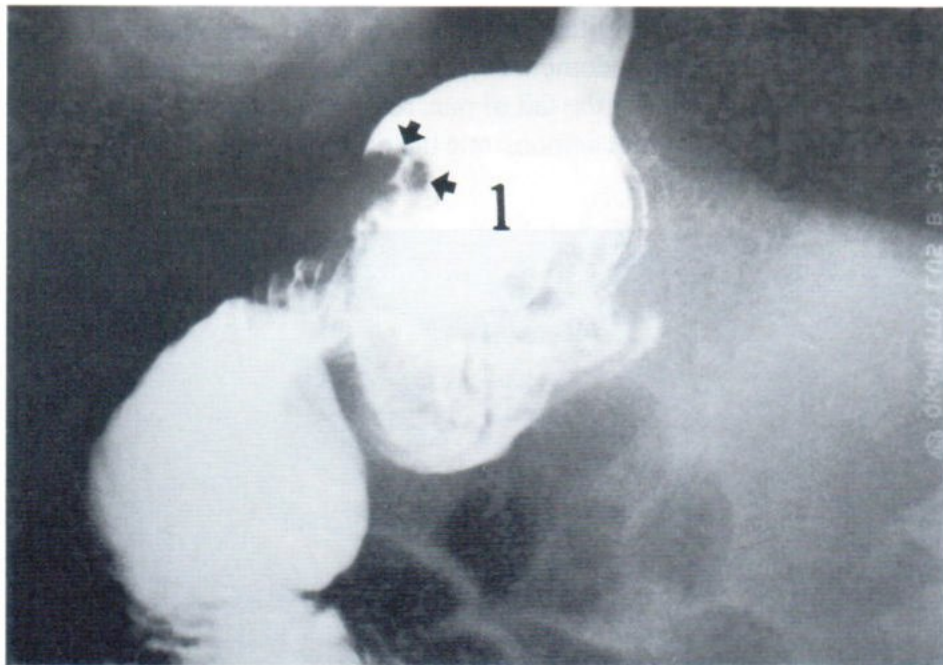


Fig. 4b. There is a 3.2cm. lymph node enlargement (thin arrows) adjacent to the right sided of gastric mass (thick arrows).



4C



4D

Fig. 4c, 4d. Upper gastrointestinal study confirmed a polypoid mass (thin arrows) protuded into the posterior aspect of gastric remnant's lumen.¹

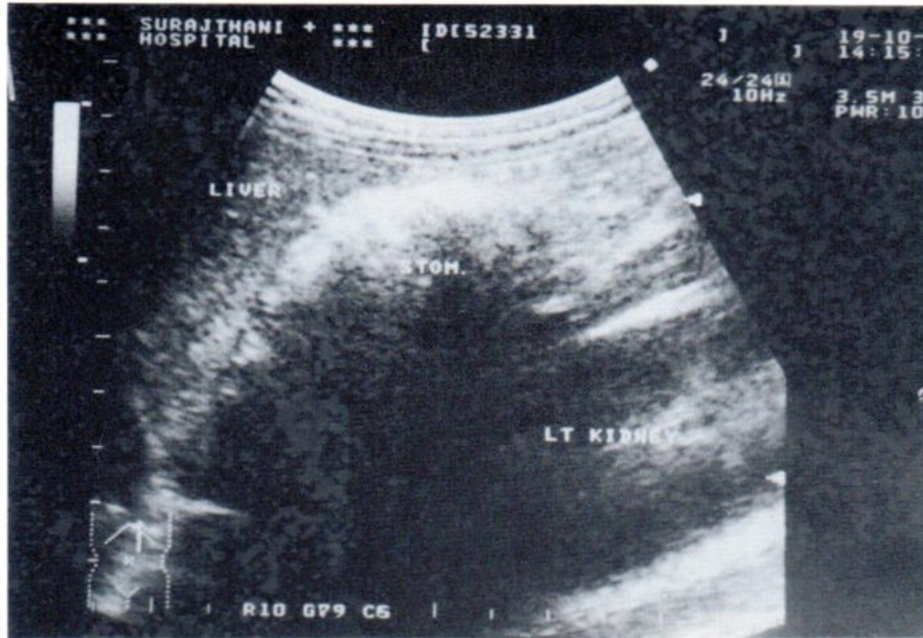


Fig. 5. Normal anatomy of gastric body by ultrasound

The examination was done in sagittal plane of left upper abdomen. The gastric body was located anteriorly in left upper abdomen, adjacent to the visceral surface of left lobe liver. The gastric body should be anterior to the tail of pancreas. The anterior wall of gastric body should be thin smooth outline. We cannot demonstrate the posterior wall of gastric body clearly, except in fluid filled stomach situation.

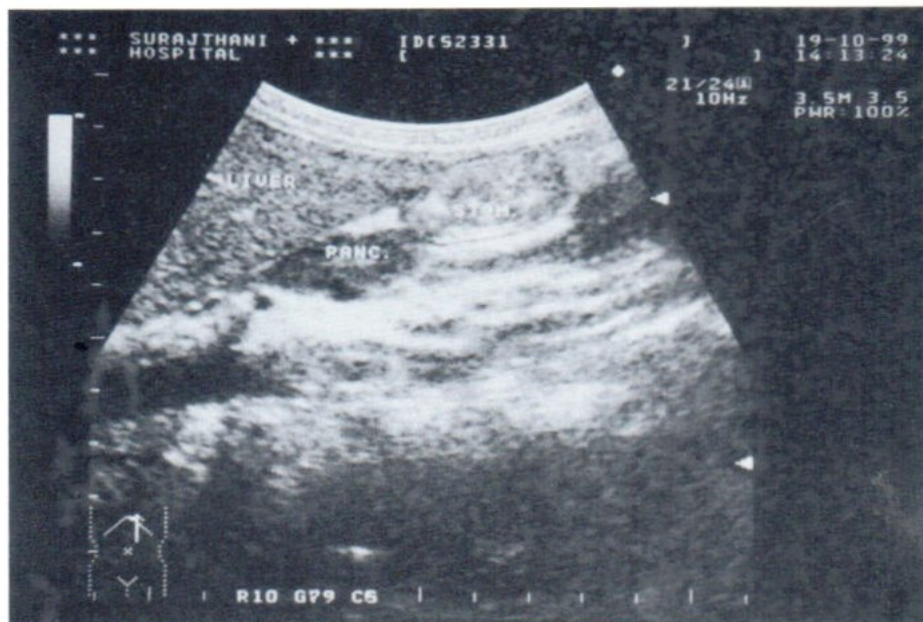


Fig. 6. Normal anatomy of gastric antrum by ultrasound

The gastric antrum was connected to the gastric body, anteriorly located from left upper abdomen to mid upper abdomen. The gastric antrum was anteriorly located to the pancreas body. Ultrasound can demonstrated well the whole gastric antrum as a thin round sonolucent ring structure (antrum wall) with symmetrical central echogenic core (antrum lumen).

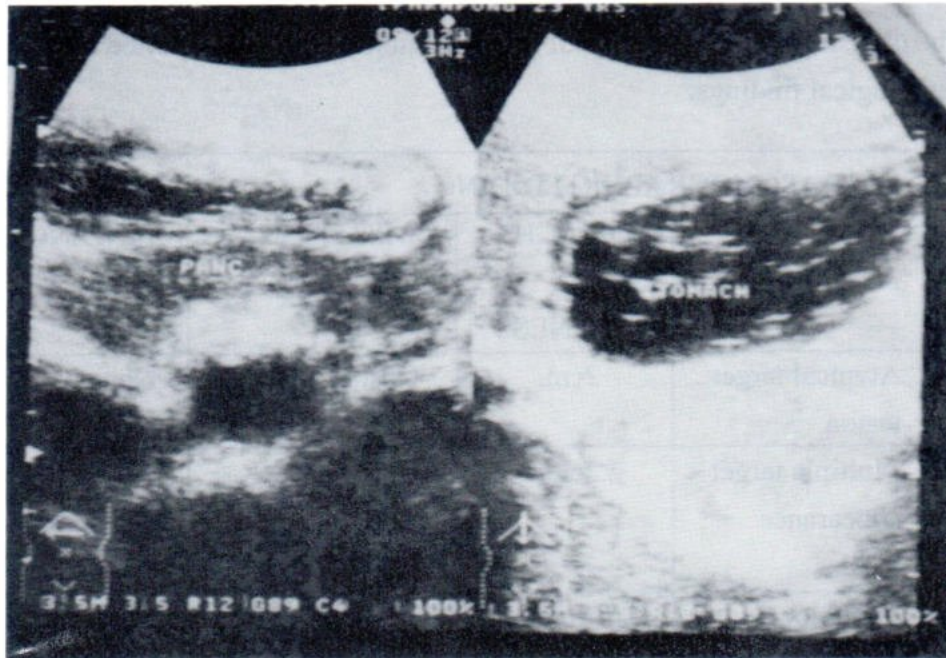


Fig. 7a,b Normal anatomy of stomach after intake of water 500ml.

Fig. 7a Axial plane in mid upper abdomen, revealed dilated stomach body and antrum. The stomach was anteriorly located to the pancreas. Smooth thin symmetrical 4 mm. Gastric wall was noted.

Fig. 7b Sagittal plane in mid upper abdomen, demonstrated dilated with fluid filled stomach.

TABLE I Sonographic measurement of normal bowel wall thickness¹

BOWEL SEGMENT	NONDISTENDED			DISTENDED		
	No. patients	Range (mm.)	Average (mm.)	No. patients	Range (mm.)	Average (mm.)
STOMACH	12	2-6	5	6	2-4	4
SMALL BOWEL	4	2-3	3	7	2-3	3
LARGE BOWEL	3	4-9	6	4	2-4	3
TOTAL	19	2-9	5	17	2-4	3

TABLE II The ultrasonographic findings of gastric tumors of the four reported cases correlated with pathological findings.

CASE	ULTRASONOGRAPHIC FINDING			PATHOLOGICAL FINDING
	APPEARANCE	STOMACH WALL THICKNESS	LOCATION	
CASE I	Atypical target lesion	2cm.	Gastric fundus	None
CASE II	Multiple target appearance lesions	2.2cm.	Body of stomach	Poorly differentiated adenocarcinoma
CASE III	Variable thickened fold with dilated fluid filled stomach	7mm.	Whole stomach	Malignant lymphoma, small lymphocytic type.
CASE IV	Lobulated hypoechoic mass	-	Posterior wall of gastric remnant	Recurrent poorly differentiated adenocarcinoma

DISCUSSION

Fleischer proposed the ultrasonographic measurement of normal bowel wall thickness in non distended and distended status, as demonstrated in table I. The average difference in wall thickness between the distended and non-distended bowel segment was 2mm.. Especially the thickness of normal gastric body and antral wall, when nondistended measured upto 5mm..¹⁻²

The ultrasonographic appearance of gastric and colonic tumor has been described since 1976,³ as a round or an oval homogenous hypoechoic mass with a central collection of strong echo, doughnut shaped liked lesion: the so called "pseudokidney" or "target" pattern.¹⁻⁶ The abnormal configuration or atypical target pattern

described by Fleischer must have the following characteristics: (a) A sonolucent halo greater than 5mm., represent the thickening of bowel wall. (b) Asymmetrically located central echogenic core, (c) A lack of demonstrable movement or change in configuration of the bowel on real time ultrasound scanning and (d) Irregular contour of the mass. Majority of the patients with bowel tumor will at least show two positive findings of these features.⁵

The ultrasonographic specific location of stomach was described in left upper abdomen, particular anterior location, adjacent to the visceral surface of left lobe of liver.^{4,7-9} Whalen et al have demonstrated this anatomical relationship.¹⁰ Wall reported the diagnostic accuracy of B scan ultra-

sonography in 11 patients with malignant gastric neoplasm, by using the criteria of atypical target lesion arising in the specific location of stomach as described by Whalen et al. as 73%.⁸ In our report, all the 4 cases were initially diagnosed as gastric tumor by ultrasound, confirmed by upper gastrointestinal study using barium and gastroscopy (Fig. 1,2,4). However, we cannot definitely differentiated between benign and malignant lesion.

Most reports also indicated that many types of gastric lesion either benign or malignant conditions can result in atypical target pattern.²⁻⁷ However, there is only Schoelmerich's study which reported patients with target sign relating to stomach was more likely to have malignancy disorder (72% positive predictive value) rather than those with target sign related to bowel (16% positive predictive value).¹¹ In our report, we regard the evidence of distant metastasis, ascites, abdominal lymphadenopathy or adjacent organ invasion to be helpful for evaluation. Additional irregular thickening of gastric wall with asymmetrical central echogenic gastric lumen referred to more malignant status as shown in case report I, II and IV. Whereas smooth symmetrical thickening of gastric wall and gastric lumen lesions, are more likely to be benign.^{4,7}

Adenocarcinoma of stomach may appear in diffuse infiltrative or localized pattern. The target pattern was found in localized formed.^{2-9,11} Whereas the finding of diffuse thickening of the wall of stomach may be seen in the infiltrative adenocarcinoma of stomach, as well as gastric lymphoma. Lymphoma cells infiltrated submucosal layer causing diffuse thickened gastric fold,¹² therefore the common finding of gastric lymphoma was a sonolucent mass with varying thickened gastric fold of the whole stomach (Fig. 3). In the case report III, additional intraabdominal lymphadenopathies and diffuse hepatosplenomegaly were helpful for the differentiation between gastric

lymphoma and adenocarcinoma of stomach.

Chronic gastritis finding (Fig. 5) closely resembled diffuse form of gastric cancer or gastric lymphoma. However, the wall was not actually as thick as in tumor infiltration.^{4,7} Gastric ulcer appeared as small echoes within focal thickening of the gastric wall, just liked ulcerated cancer. However, ulcerative gastric tumor had more irregular thickened gastric fold. Barium studies were often necessary.⁷ In this study, case report I and case report II were ulcerative gastric tumor. However, only irregular thickened gastric wall were demonstrated. The ulceration on top of the tumor cannot be seen.

Many reports also described stomach mass in gastric cardia or gastroesophageal junction which were usually difficult to delineate with ultrasound, because of the overlying rib cage.^{4,7,8,11} The posterior wall of gastric body was not well demonstrated by ultrasound. Too small lesions or lesions infiltrating mucosa and muscularis layer only were usually difficult to be detected. Many recent reports proposed that dedicated transabdominal gastric ultrasound performed after ingestion of water and injection of a hypotonic agent may provided more detail and unique informations about both normal and abnormal gastric wall. The five layers of gastric wall and small lesion with only infiltrated mucosa or muscularis layer can be demonstrated by graded compression technique with high frequency transducer.¹³⁻¹⁶ Ultrasound is good for demonstration of mass in the gastric antrum or anterior wall of body of stomach. These lesions should be located in the left upper quadrant close to the left costal margin, posterior or posterolateral to the left lobe of liver and can be separated from liver. The mass from gastric antrum should be anterior to the body of pancreas (Fig 6). Whereas the mass at the gastric body should be anterior to the tail of pancreas^{4,7,8,11} (Fig7). Pancreatic tumor could also invade stomach and produce similar ultrasonographic

finding of an intramural gastric lesion, the same as a large intramural gastric tumor which is more difficult to be demonstrated. Spleen or splenic flexure colon lesions were also differentiated from gastric lesions by a more posterior location.^{4,9,10}

CONCLUSION

Routine study of stomach with transabdominal ultrasound examination is very useful for evaluating patient with nonspecific abdominal dyspepsia. Although transabdominal ultrasound is not suitable as a screening test for early detection of gastric tumor. Transabdominal ultrasound cannot also definitely differentiate gastric lesions between a benign or a malignant one. However, by using the criteria as discussed previously, the ultrasound may suggest the gastric origin of a lesion and the evaluation of the patient may be expedited. Ultrasound can guide the proper use of the investigations and management.

REFERENCE

1. Fleischer AC: Sonographic Assessment of the Bowel Wall. *AJR* 136 : 887-891, 1981.
2. Fleischer AC: Sonographic patterns of Distended, fluid-filled bowel. *Radiology* 133: 681-685, 1979
3. Lutz HT, Petzoldt R: Ultrasound pattern of Space occupying lesion in Stomach and Intestine. *Ultrasound Med Biol* 2: 129-132, 1976.
4. Yeh Hsuchong: Ultrasonography and Computed Tomography of Gastric wall lesions. *Radiology* 141:147-155,1981.
5. Fleischer AC, Muchletaler CA: Sonographic patterns Arising from Normal and abnormal Bowel. *Radiologic Clinics of North America* 18(1): 145-159, 1980.
6. Bluth EI, Merrit CRB: Ultrasonic Evaluation of Stomach, Small Bowel and Colon. *Radiology* 133 : 677-680, 1979.
7. Derchi LE, Biggi E: Ultrasonographic Appearance of Gastric Cancer. *BJR* 56 : 365-370, 1983.
8. Walls Willium J: The evaluation of Malignant Gastric Neoplasm By Ultrasonic B-Scanning. *Radiology* 118 : 159-163, 1976.
9. Sandler Michael A, Ratanaprakan Sirimana : Ultrasonic findings in intramural Exogastric lesions. *Radiology* 121: 189-192, July 1978.
10. Whalen Joseph P: Vector Principle In the differential Diagnosis of Abdominal masses: The left Upper Quadrant. *Radiology* 113 (1): 104-118, Sep 1971.
11. Shoelmerich Juergen, Diaz A: Clinical Significance of Abnormalities of the Gastrointestinal Tract Detected by Abdominal Ultrasound. *Digestive Diseases* 33 (3): 257-262, 1988.
12. Krudy Adrian G, Long LJ: Gastric manifestations of North American Burkitt's Lymphoma. *BJR* 56 (670): 697-702, 1983.
13. Miyamoto Y, Tsujimoto F: Ultrasonographic diagnosis of Submucosal tumors of the stomach, *J Clin Ultrasound* 16: 251, 1988.
14. Miyamoto Y et al: Ultrasonographic finding in Gastric Cancer : Invitro and Invivo studies, *J Clin Ultrasound* 17 : 309, 1989.
15. Wonlieck H, Dunz D: Ultrasonic examination of the wall of the fluid-filled stomach, *J Clin Ultrasound* 17: 514,1989.
16. Sijbrandy LS, Op Den Orth JO: Transabdominal Ultrasound of the Stomach- A Pictorial Essay. *Eur J Radiology* 13: 81, 1991.