

Ultrasonographic Diagnosis of Gastric Carcinoma^{*)}

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ABSTRACT

Among various gastric carcinoma diagnosis including upper gastrointestinal radiography, computed tomography (CT) and angiography, scintigram using isotope, endoscope method and ultrasonography (US), the only one that gives on harm nor pain to the patient is the ultrasonography. Moreover, the US equipment has been so remarkably improved that a sufficient US diagnosis will be able to provide more useful information than others will. Recently, we performed US on 10 gastric carcinoma patients and diagnosed invasion of carcinoma into gastric wall and other organs and its lymphatic and hepatic metastasis. The information thus obtained was very useful in determining the presence of operative indication and the operational method. This fact led us to consider US the first choice of examination methods, as reported hereunder.

INTRODUCTION

Among various gastric carcinoma diagnosis including upper gastrointestinal radiography, CT, angiography, scintigram, endoscope method, US, etc., the only one that gives on harm nor pain to the patient is US. US can be performed anywhere and anytime as long as its equipment is available. The use of a remarkably improved modern US equipment with sufficient per-examinational treatment, fluid-filled stomach¹³⁾, etc., will be able to provide more useful information than other methods will. Especially, US is capable of easily obtaining findings from the serosa side which are in good agreement with the operative findings.

Other examination methods such as angiography, CT, scintigram, etc., are often unable to be performed due to restrictions in equipment, facility, location, etc. Even if all other examinations than US are performed, we have sometimes experienced cases that indicate entirely different operative findings from the grade of invasion obtained before operation. Although

US is a readily available examination, HIJIKATA, A.⁴⁾ reports that US performed on pre-operative patients of gastric carcinoma was found especially useful for pre-operative staging of advanced gastric carcinoma. From this point of view, we performed US on 10 gastric carcinoma patients and studied its effectiveness in diagnosing pre-operative and operative indications of gastric carcinoma.

MATERIALS AND METHODS

US was performed on 10 patients who had been diagnosed by the upper gastrointestinal radiography or the endoscope method as gastric carcinoma and that most probable advanced one. Two cases of liver metastasis, one inoperable and the other not operated, and one probe laparotomy were included.

The equipment used were SSD-256 (ALOKA C. C., Tokyo) and U-SONIC RT2000 (YOKOGAWA M. S., Tokyo), each with a 3.5 MHz probe. The patients were forced to abstain from food and water from the night before examination.

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The examination procedure used was in the order of liver, gallbladder, kidneys and spleen; para-aortic lymph nodes; pancreas; and stomach. In 4 cases, administration of an anti-spasmodic and fluid-filled stomach by water were used at the time of examinations of pancreas and stomach.

The water bath experiments were performed in saline in accordance with MATHUE, H.⁹⁾

By depicting the center of tumor as far as possible, the staging was judged by thickness of gastric wall, irregularity of gastric wall layers, and loss or disturbance of echo from serosal echogenesity. In particular, the deformations of the serosal layer were judged as S₀ or S₁ and those of the outer gastric layer, as S₂ and S₃ for severe cases.

Lymphatic nodes were examined on more than one group of para-aortic lymph nodes, one of which were to the extent of identifying larger nodes.

Metastasis to peritoneum was unable to be detected and disregarded. The staging was made in accordance with the general rules for the gastric cancer study by the Japanese Research Society for Gastric Cancer⁶⁾.

RESULTS

The results of US performed on 10 patients of gastric carcinoma is shown in Table. The results were almost in agreement with the operative and pathological findings except those cases which were not able to be exposed sufficiently to US due to their poor risk for changing body position. Cases 9 and 10 are of H₃ and H₂, respectively. Case 9, in particular, being unable to be operated due to severe liver and lymph node metastasis, died 2 months later. Cases 2, 6, 7, and 10 represents the invasion to pancreas and colon. Case 2 was diagnosed as S₃ serosal invasion to lesser curvature but not as direct invasion to pancreas despite of the suspicion of such invasion by CT. Case 7 was observed as the direct invasion to colon, which had not been detected by either CT or US. CT showed its superior capability to US's in diagnosing direct invasion to other organs, providing that US made erroneous judgements of invasion to serosal layer in 8 case only. This fact proves that US is excellent in judging the invasion to serosa.

The cases except those observed by US as liver metastasis were neither observed in the

Table Operative, pathological and ultrasonographic diagnosis

case	age	F/M	operative findings					pathological findings				ultrasonographic findings			
			P	N*	H	S	stage	patho.	PS()	N*	stage	N*	H	S	stage
1) TT	64	M	0	0	0	0	I	tub2.	-	0	I	-1	0	0	I-II
2) TM	70	F	1	4	0	3	IV	por.	Sei +	4	IV	3-	0	3	IV
3) TM	44	M	0	0	0	1	II	por.	-	0	II	-1	0	0	I-II
4) KN	60	M	0	0	0	1	II	tub2.	pm -	1	II	-1	0	1	I-II
5) GH	66	M	0	0	0	2	III	pap.	-	0	I	-1	0	0	I-II
6) SK	79	F	1	X	0	3	IV	tub2.	+	1-	IV	-1	0	3	IV
7) HH	70	M	1	1-	0	3	IV	tub2.	Sei +	1-	IV	-1	0	3	IV
8) TK	35	F	0	1	0	2	III	por.	+	0	II	-1	0	0	I-II
								sig.							
9) ST	59	M	.....				IV	tub.	.....		IV	3-	3	3	IV
10) SY	49	M	.....				IV	.....			IV	3-	2	3	IV

por. : poorly differentiated adenocarcinoma
 tub2. : moderateli differentiated tubular adenocarcinoma
 pap. : papillary adenocarcinoma
 sig. : Signet-ring cell carcinoma
 tub. : tubular adenocarcinoma
 * -N means lymph node metastasis above N-number group.
 N- means lymph node metastasis below N-number group.

operative findings. In case 9 and 10, US only was capable of determining their operative indications. That is, case 9 showed no operative indication due to $H_3N_3S_3$, as shown in Table and case 10 of $H_2N_3S_3$ showing the presence of pylorus stenosis was determined as bypass operative indication.

DISCUSSION

The US diagnosis of gastric carcinoma have been reported since the 1970s along with the progress of the gray-scale. BANDAI, K. et al.³⁾ taking a step forward to obtain the entier image of gastric carcinoma, have succeeded in achieving the similar results to those by CT and angiography, as a pre-operative examination, by diagnosing liver and lymph node metastasis and direct invasion to colon. Noting that the gastric wall is pictured in 5 layers at the time of pancreas examination with fluid-filled stomach, MATSUE, H. have performed water bath experiments and found that the gastric wall shows the similar findings. They consider that these 5 layers corresponds to pathological mucosae layer, muscularis mucosae layer, submucosae layer, muscularis propria layer and subserosae layer including serosae and can be diagnosed for the degree of invasion. Based on this we performed US on 10 cases to determine preoperative or operative indication.

Figs. 1-4 show the specimens taken to indicate the degree of invasion to gastric wall.

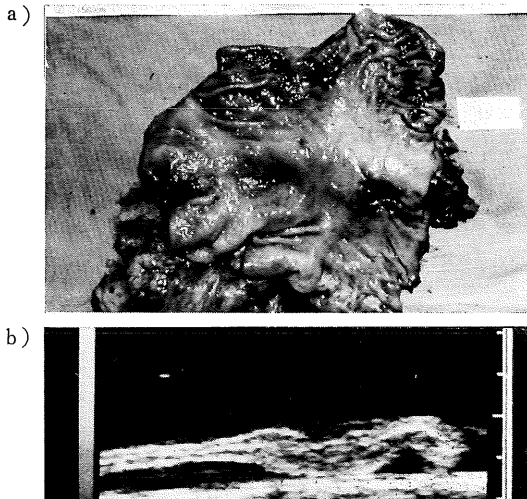


Fig. 1. Operative specimen (a) and its ultrasonography of case 1. Borrmann 3. I1c like advanced

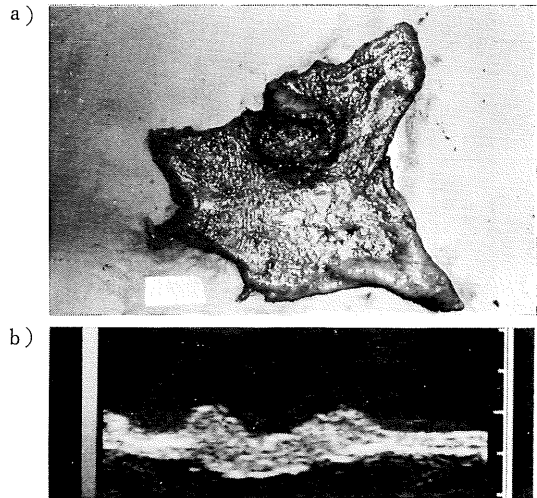


Fig. 2. Operative specimen (a) and its ultrasonography (b) of case 2. Borrmann 2.

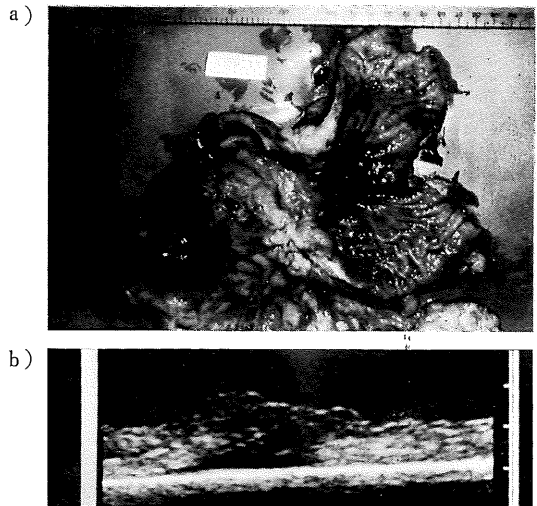


Fig. 3. Operative specimen (a) and its ultrasonography (b) of case 6. Borrmann 4.

Fig. 1 shows the I1c-like advanced Borrmann 3 type, in which the 5-layer construction of normal gastric wall is clearly pictured corresponding to that reported by MATSUE, H. A tumor is hypoechoically pictured reaching the subserosal layer. Fig. 2 is a US photo. of Borrmann 2 case clearly showing a tumor very locally developed and also invasion reaching subserosal layer. Fig. 3 shows a case of entire periphery of Borrmann 4. This cross section is determined as S_2 with total loss of serosal layer. Fig. 4 shows a localized case of Borrmann 4. This case is of S_2 , pathologically, with subserosal layer observed in US. This

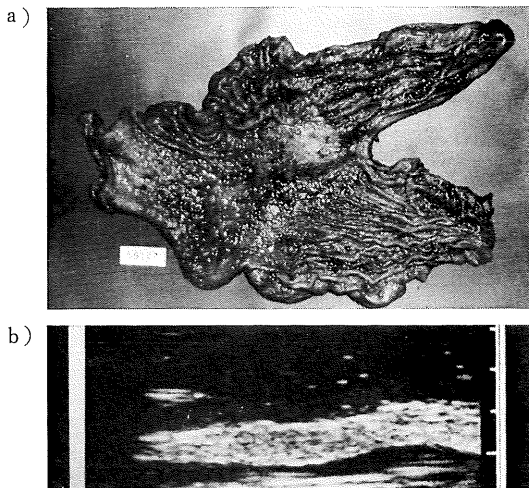


Fig. 4. Operative specimen (a) and its ultrasonography (b) of case 7. Borrmann 4. Localized type.

finding corresponds to those in the report by HIJIKATA, A. et al.⁵⁾ stating that the layer construction of Borrmann 4 can be relatively observed. Thus, we have confirmed that US is capable of diagnosing invasion to gastric wall.

Cases 1, 3, 5 and 9 are compared as show in Fig. 5, 6, 7 and 8, respectively, between the upper gastrointestinal radiography and the US examination. The condition of gastric wall and

its surrounding area is clearer in US than in the radiography.

ASAI, H. et al.¹⁾ reports that US was able to diagnose gastric carcinoma in the first screening and especially effective for Borrmann 4. Diagnosis of gastric carcinoma by CT have been reported by LEE, K. L.⁷⁾ on differential diagnosis reaching stomach, by BALFE, D. M. et al.²⁾ one differential diagnosis and staging of malignant disease of the stomach, etc. MOSS, A. A. et al.¹⁰⁾ have positively applied CT to determine operative indications. It is certain that CT is more capable of easily grasping the entire image than US and considered effective. However, US is more suitable for the Japanese physical structure than for the Westerners' and more effective for examining gastric carcinoma, as show in Figs. 5-8.

Angiography, CT, US, etc., are used in diagnosing lymph node metastasis. NAKAYAMA, T.⁸⁾ reports that angiography was effective by 76% in diagnosing lymph node metastasis of the 2nd and 3rd groups. OZAKI, M.¹²⁾ reports that CT was capable of diagnosing lymph node metastasis by 80% of 1st group and over 90% of the 2nd group and up and also that almost no lymph node metastasis below 0.5 cm was observed. However, from our experience of operations that small hard metastasis, not to mention of large hard ones, have often been

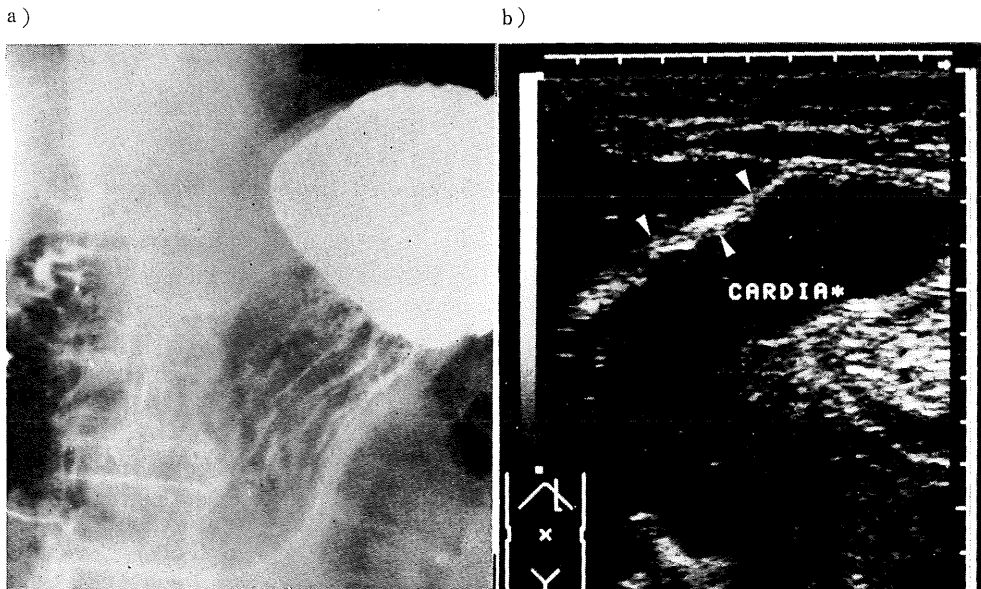


Fig. 5. X-ray (a) and ultrasonography (b) of case 1.
▼ shows tumor lesion, and ▲ shows crater.

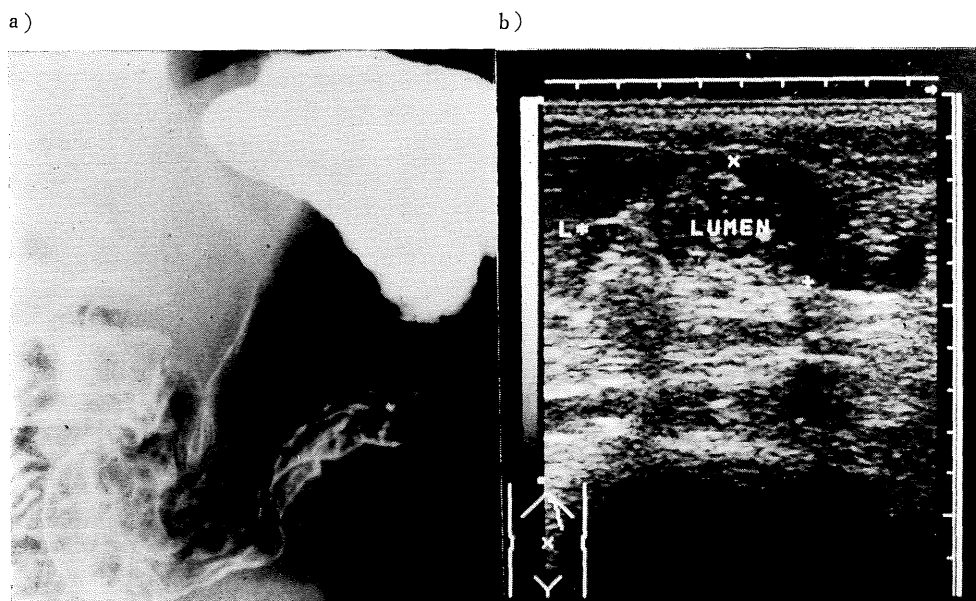


Fig. 6. X-ray (a) and ultrasonography (b) of case 3.

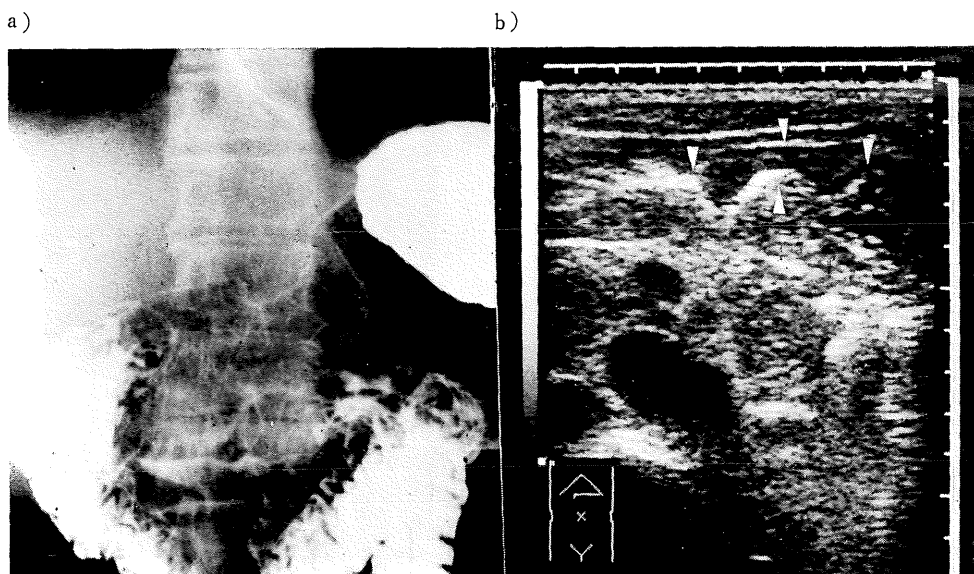


Fig. 7. X-ray (a) and ultrasonography (b) of case 5.
 ▼ shows tumor lesion, and ▲ shows crater.

observed, it is considered that CT involves a possibility of picturing lymph node metastasis smaller than 0.5 cm as normal lymph node.

Contrary to this, US, when used outside the patient's body, detects almost only lymph node metastasis but not normal lymph nodes¹¹⁾. In this study, the detected lymph node metastasis of Nos. 1 and 2, Nos. 7 and 8, No. 12 and

No. 14 are show in Fig. 9. Most of these lymph nodes are from the 2nd group and up, which were carefully examined because those of the 1st group to be removed with the excised stomach were considered to be a problem in operation. The results of our study show that US is sufficiently applicable to the staging of operative and pre-operative indications.

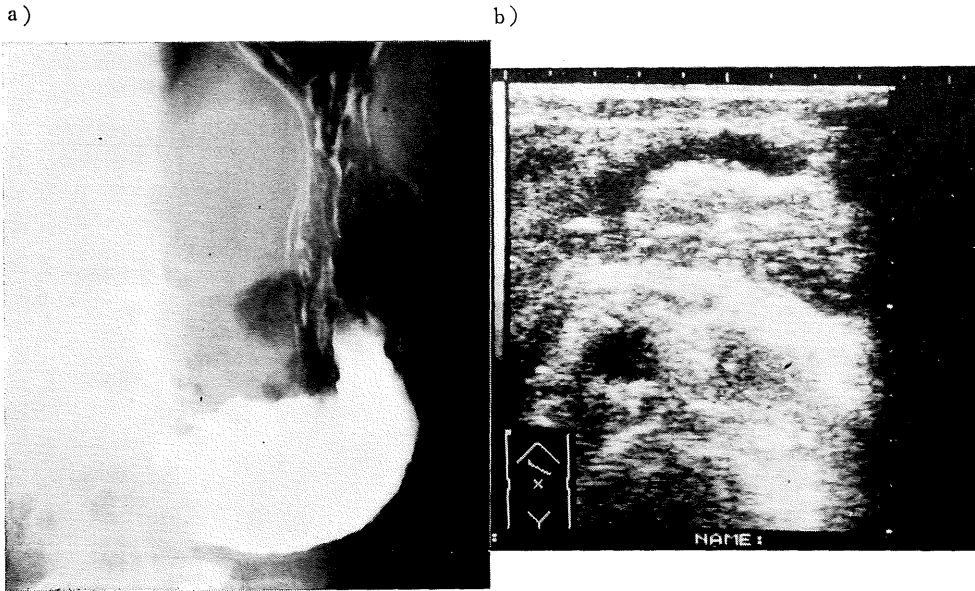


Fig. 8. X-ray (a) and ultrasonography (b) of case 9.

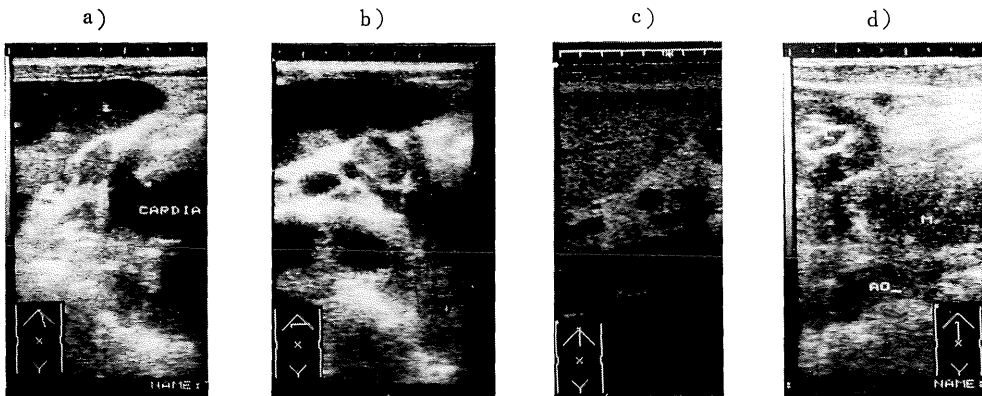


Fig. 9. Lymph node metastasis No. 1 or No. 2 (a), No 7 orNo 8 (b), No 12 (c) and No. 14 (d).

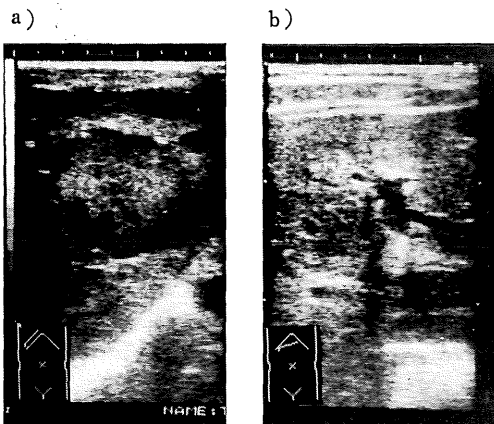


Fig. 10. a) is liver metastasis of case 9 and b) is liver metastasis of case 10.

Although US has a dead angle of the lesion of liver covered by diaphragm and lung, the use of US diagnosing hepatic metastasis is as effective as scintigram, CT, etc. In this study, hepatic metastasis was found in Cases 9 and 10 (Fig. 10). Other cases examined by US as no hepatic metastasis showed the similar indications to their operative findings.

As mentioned above, the degree of infasion of gastric carcinoma, invasion to the adjacent organs, lymph node metastasis, etc., were studied. As a result, it has been found that, after detecting gactric carcinoma, US is an unharful examination to be performed at first before composing the examination schedule. Also, sufficient US only may determine even operative

indication and operative method.

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