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## Ultrasonographic Measurements of the Normal Gastric Wall

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## 正常胃壁の超音波による測定

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正常胃100例の胃壁の厚さを超音波検査にて測定し、かつ胃壁の厚さと性、年齢、及び体型との相関関係の有無についても検討を行なった。100例の胃壁の厚さの平均値は $2.5 \pm 1.0$ mmであった。また、身長・体重、年齢、性の各因子と、胃壁の

厚さとの間には明らかな相関関係は認められなかった。平均値よりも胃壁の厚い症例、特に厚さ4—5 mm以上のものは何らかの胃病変の存在を疑う必要があると考えられた。

Recently, the importance of ultrasonographic evaluations of the gastrointestinal tract has been increasingly stressed by authors<sup>1-8)</sup>. However, there have been no reports of attempts to measure precisely the thicknesses of gastric walls of normal individuals. In the present study the thicknesses of 100 normal patients' gastric walls were measured. The data were analyzed for correlations with age, sex, and body habitus.

**Materials and Methods**

One hundred randomly selected patients without evidence of gastric lesions during upper gastrointestinal series were examined using two real time ultrasonographic scanners (one Toshiba electronic linear scanner SAL-20A; one Aloka echo camera SSD-254). The distribution of patients by age, sex, and body habitus is shown in Table 1. 3.5 MHz focused transducers were used with both apparatus. The images were photographed using 35 mm negative roll film (Fuji Neopan F), and prints were made on photographic glossy paper (Fuji Co.).

Measurements were made at the maximum sonolucent level below the liver (Fig. 1 arrowheads), which indicated the anterior wall of the gastric body or antrum in the median longitudinal scan.

All patients were scanned in the fasting state. We did not uniformly use "The Fluid-filled Stomach Method<sup>9)</sup>" or an anticholinergic agent (e.g. Buscopan, Schering Pharmaceutical Co.). There was a subtle difference in bowel wall thickness as measured in the distended and undistended states (Fig. 2). The effect of peristalsis was not considered in this study.

Table 1 Subjects by sex, age group and body habitus

Materials: 100 patients							
1. Sex							
Male: Female=59:41							
2. Age							
10—19	20—29	30—39	40—49	50—59	60—69	70—79	80—
1	8	13	22	31	14	8	3
3. Body habitus							
Thin		2					
Moderate		77					
Obese		21					
Total		100					

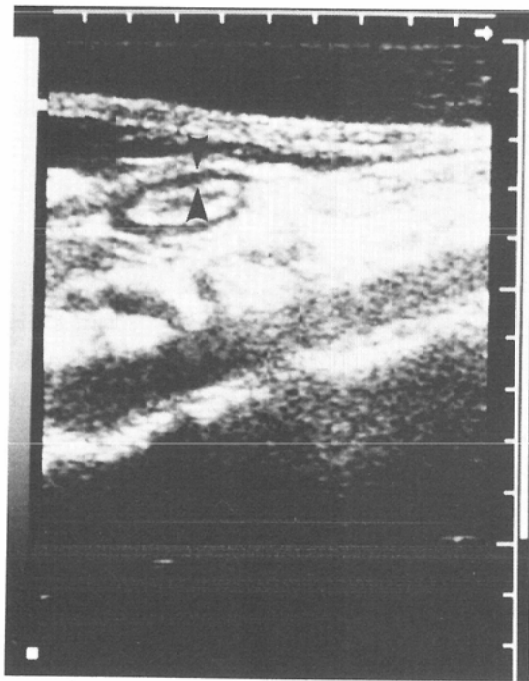


Fig. 1 Longitudinal scan. The maximum sonolucent level below that of the liver (arrowheads) was measured, and is shown.

### Results

There were 59 males and 41 females in this study, and their ages ranged from 19 to 87 and from 22 to 81, respectively. Their numbers by age groups are shown in Table 1. The gastric wall measurements obtained are shown in Tables 2—3 by sex and age.

For the 100 patients, the gastric wall thicknesses ranged from 1.0 to 7.0 mm, with a mean of  $2.5 \pm 1.0$  mm (S.D.).

Among the 59 males patients, the thicknesses ranged from 1.0 to 7.0 mm, with a mean of  $2.4 \pm 1.0$  mm. For the females the range was 1.0—5.0 mm and the mean,  $2.5 \pm 0.9$  mm. There was no significant difference between gastric wall thicknesses for males and females (Table 2).

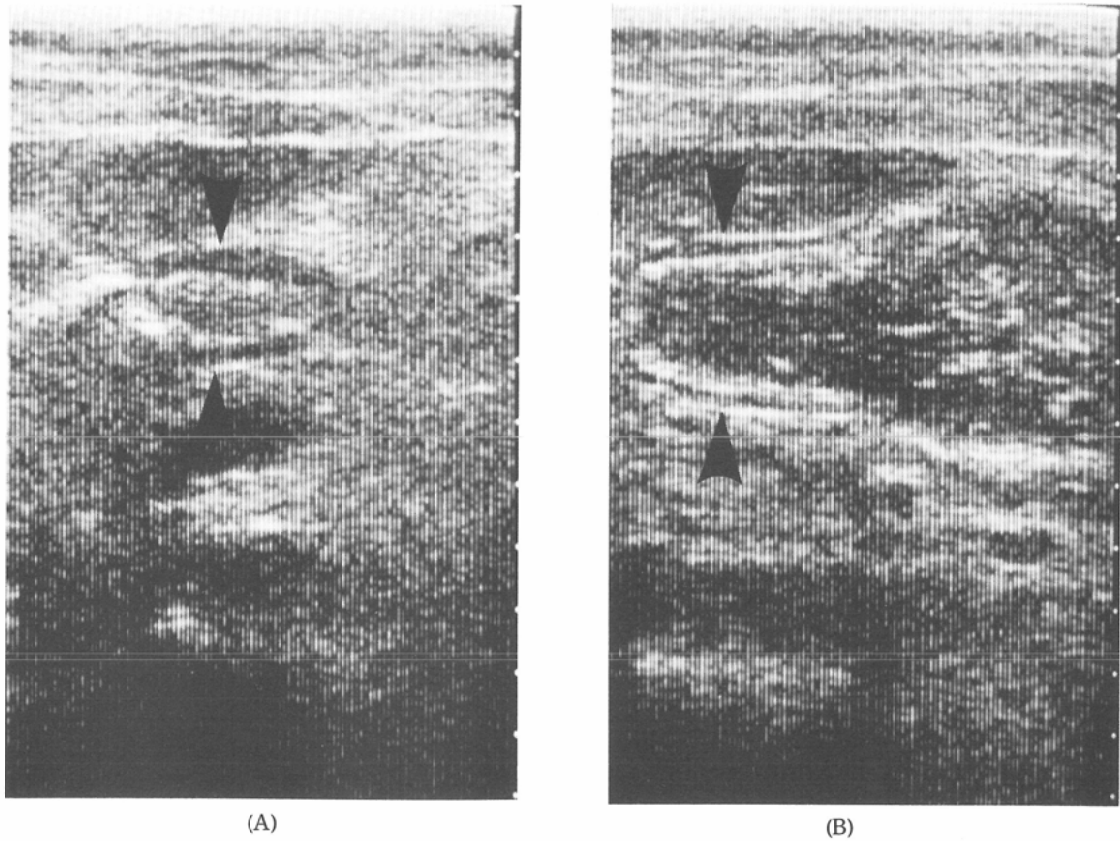


Fig. 2 (A) Undistended state (B) Distended state. Transverse scan. In this case, there is a slight difference in thickness between (A) and (B).

Arrowheads indicate the anterior and posterior walls of the stomach.

Table 2 Gastric wall thickness by sex

Sex	Thickness $\pm$ S.D. (mm)	Range (mm)
Male (n=59)	2.4 $\pm$ 1.0	1.0-7.0
Female (n=41)	2.5 $\pm$ 0.9	1.0-5.0
Total 100	2.5 $\pm$ 1.0	1.0-7.0

\*P>0.2

The mean thickness of the gastric wall by age group is shown in Table 3. There was no correlation between gastric wall thickness and age.

The patients were categorized in three groups according to body habitus. The criteria are based on Japanese body weights by the Japanese Nutritional Council, 1970. There were 2 thin, 77 moderate, 21 obese patients. There was no correlation between gastric wall thicknesses and body habitus.

### Discussion

Ultrasonographically, the most readily detectable characteristic of gastric lesions is the corresponding gastric wall thickening<sup>5-7</sup>.

In order to objectively determine whether a gastric wall is truly thickened, standards for thicknesses of

Table 3 Gastric wall thickness by age group

Age	Thickness±S.D. (mm)	Range (mm)
10—19 (n= 1)	1.0±0.0	1.0
20—29 (n= 8)	2.1±1.0	1.0—4.0
30—39 (n=13)	2.3±0.4	1.9—3.3
40—49 (n=22)	2.3±0.8	1.0—4.7
50—59 (n=31)	2.4±1.1	1.0—7.0
60—69 (n=14)	3.0±1.1	1.5—5.0
70—79 (n= 8)	2.3±0.9	1.0—4.0
80— (n= 3)	3.7±0.5	3.0—4.0
Total 100	2.5±1.0	1.0—7.0

\*P&gt;0.05

Table 4 Gastric wall thickness by body habitus

Body habitus	Thickness±S.D. (mm)	Range (mm)
Thin (n= 2)	2.1±0.4	1.7—2.5
Moderate (n=77)	2.4±1.0	1.0—7.0
Obese (n=21)	2.5±0.8	1.5—4.5
Total 100	2.5±1.0	1.0—7.0

\*P&gt;0.25

normal gastric walls are needed.

Fleischer et al reported that the thicknesses of the normal gastric body and antral walls measured ultrasonographically ranged up to 5 mm in the undistended state<sup>1)</sup>. A thickened bowel wall imaged ultrasonographically is referred to as the "pseudokidney sign"<sup>2)</sup> or an atypical "target" configuration<sup>3)</sup>. This sign is suggestive of nonspecific bowel lesions, unrelated to malignancy<sup>4)</sup>. Thus, this sign does not always indicate the presence of a lesion of clinical significance<sup>5)</sup>. Even among our normal patients this sign was occasionally observed.

Consequently, it is difficult to determine whether the thickness of a gastric wall is abnormal. Our results indicated that thicknesses greater than 4—5 mm suggest a gastric lesion and that in such cases further examination should be performed. Bluth, et al did not encounter gastric wall thicknesses greater than 10 mm among normal cases<sup>2)</sup>, and neither did we. We measured thicknesses in all patients, but the thicknesses of normal gastric walls did not correlate with age, sex, or body habitus.

We were able to identify the gastric walls of all the patients studied. During the first screening examination of an abdomen, if a gastric wall has a thickness greater than 4—5 mm, a gastric lesion should be suspected.

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