A Statistical Evaluation on the Age and Sex Distribution of Basal Serum Gastrin and Gastric Acid Secretion in Subjects with or without Peptic Ulcer Disease

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ABSTRACT

The basal serum gastrin concentration and stimulated gastric acid secretion (MAO) were measured in 837 patients at Hiroshima University Hospital.

The basal serum gastrin concentration was significantly higher in males than females in the control group (normal and atrophic gastritis) and it was similar in patients with duodenal (DU) and gastric ulcer (GU), while MAO was significantly higher in males than females in all the groups.

The basal serum gastrin concentration increased and MAO decreased with age in the control group. In patients with DU and GU the basal serum gastrin concentration did not change but MAO decreased with age. In patients with DU below 20 years of age, both the basal serum gastrin concentration and MAO were higher than those of age above 20, and were higher than those of the control group less than 20 years old.

These findings may support the concept that in the control group increased gastrin release and decreased MAO with age result from achlorhydria or hypochlorhydria or from atrophy of the gastric mucosa; however, in patients with DU, especially in younger patients, gastrin plays a role in hypersecretion of gastric juice.

INTRODUCTION

It is well known that acid in gastric juice constitutes aggressive factors causing peptic ulcer, and gastrin is considered a principal humoral agent responsible for stimulation of gastric acid secretion. An elevated serum gastrin concentration has been found in Zollinger-Ellison syndrome, pernicious anemia, renal insufficiency and several types of gastritis. However, in peptic ulcer diseases the serum gastrin concentration is controversial. A low serum gastrin concentration was found by Korman et al., while others found a normal or high serum gastrin concentration in patients with peptic ulcer, Archimandritis et al., and Ganguli et al.5
found no significant difference in the basal serum gastrin concentration in a healthy group of various ages, but Trudeau and McGuigan found that a serum gastrin concentration increased with age. In contrast, MAO decreased significantly with age in a healthy group. Ganguli et al. also found no significant difference in a basal serum gastrin concentration between males and females, whereas MAO in males was significantly higher than in females.

The aim of this study is to analyze statistically the basal serum gastrin concentration and MAO in a control group and patients with DU and GU matched in age and sex, and to discuss the pathogenetic role of gastric acid and gastrin in peptic ulcer.

MATERIALS AND METHODS

Samples were collected from 837 patients at Hiroshima University Hospital during the period from 1974 to 1982. These patients consisted of 205 patients with DU at the mean age of 41.17±0.97 SE (13-79 years), 279 patients with GU at 50.25±0.87 SE (16-83 years) and 353 patients without any gastroduodenal lesion as a control group at 41.68±0.84 SE (15-78 years). The control group was confined to radiographically and endoscopically normal subjects with MAO above 7.25 mEq/hr, and also included those with atrophic gastritis, regardless of the acid output.

Gastric acid secretion test was performed by the method of the Committee for Evaluation of Gastric Acid Secretion Test organized by Japanese Society of Gastroenterology. Determination of immunoreactive gastrin (IRGa) in the serum was performed using 125I gastrin from Dainabot Co., antigastrin serum from Dr. Omata of Yokohama Municipal Citizens Hospital and synthetic human gastrin-17 (SHG-17) from ICI as a standard. Separation of free from bound gastrin was performed using Amberlite IRP 58 resin by modification of the Yallow and Berson's method.

Statistical analysis was made by Student's t test. The p level below 0.05 was defined as statistically significant.

RESULTS

The mean basal serum gastrin concentration and MAO in normal subjects and patients with DU and GU are shown in Table 1. The mean age of normal subjects was significantly lower than that of patients with DU (p<0.01) and GU (p<0.001). And it was significantly lower in patients with DU than GU (p<0.001). The basal serum gastrin concentration in patients with DU was similar to that in normal subjects and significantly lower than that in patients with GU (p<0.01). However, in patients with GU the basal serum gastrin concentration was significantly higher than that in normal subjects (p<0.001). MAO in patients with DU was significantly higher than that in normal subjects (p<0.001) and patients with GU (p<0.001). MAO in patients with GU was significantly lower than that in normals (p<0.001).

Fig. 1 shows the age distribution of the basal serum gastrin concentration in the control group, and patients with DU and GU. The basal serum gastrin concentration in the control group increased gradually with age. However, in patients with DU and GU the basal serum gastrin concentration was found almost evenly distributed in all age-matched groups.

Fig. 2 shows the age distribution of MAO

| Table 1. Mean basal serum gastrin concentration and MAO in control, DU and GU |
|-----------------|-----------------|-----------------|-----------------|
|                 | n   | Age   | Serum Gastrin (pg/ml) | MAO (mEq/hr) |
| Normal          | 195 | 37.35±1.06 | 74.66±3.07 | 15.35±0.62 |
| Duodenal Ulcer  | 205 | 41.17±0.97 | 76.93±3.26 | 20.45±0.62 |
| Gastric Ulcer   | 279 | 50.25±0.87 | 92.27±3.42 | 11.05±0.05 |

※ p<0.05
※※ p<0.01
※※※ p<0.001
Age and Sex Distribution of Gastrin and Gastric Acid Secretion

Fig. 1. Age distribution of basal serum gastrin concentration in control, DU and GU

Fig. 2. Age distribution of MAO in control, DU and GU

Table 2. Mean basal serum gastrin concentration and MAO in control, DU and GU of both sexes

<table>
<thead>
<tr>
<th>Sex</th>
<th>n</th>
<th>Age</th>
<th>Serum Gastrin (pg/ml)</th>
<th>MAO (mEq/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>184</td>
<td>40.32±1.17</td>
<td>104.77±5.97[*]</td>
<td>10.79±0.64[*]</td>
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<tr>
<td>F</td>
<td>169</td>
<td>43.15±1.20</td>
<td>86.53±5.08</td>
<td>8.87±0.51</td>
</tr>
<tr>
<td>Duodenal Ulcer</td>
<td></td>
<td></td>
<td>21.93±0.69[**]</td>
<td>16.54±1.17[**]</td>
</tr>
<tr>
<td>M</td>
<td>150</td>
<td>40.53±1.13</td>
<td>76.97±3.99</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>55</td>
<td>42.91±1.88</td>
<td>76.82±5.92</td>
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</tr>
<tr>
<td>Gastric Ulcer</td>
<td></td>
<td></td>
<td>91.73±3.99</td>
<td>12.03±0.55[***]</td>
</tr>
<tr>
<td>M</td>
<td>210</td>
<td>49.65±0.99</td>
<td>93.93±6.67</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>69</td>
<td>52.07±1.83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05  
** p<0.01  
*** p<0.001
in patients with DU were significantly higher than those in the control group (p<0.05 and p<0.001 respectively), and the basal serum gastrin concentration in patients with GU was slightly higher than that in the control group, whereas MAO was significantly higher than that in the control group (p<0.001).

**DISCUSSION**

In this study, the basal serum gastrin concentration in males was significantly higher than females in the control group and it was similar in patients with DU and GU.

Lam et al.\(^6\) reported that the postprandial serum gastrin concentration has no sexual difference. MAO was significantly higher in males than females in the three groups. Kekki et al.\(^6\) suggested that the lower acid output in females is due to the small area of gastric surface and a lesser number of parietal cells but not due to lower reactivity of the cells to stimulation.

In the control group, the basal serum gastrin concentration increased significantly with age, and the highest concentration was found in subjects over 70 years old. This finding may reflect the increasing frequency of atrophy of
the mucosa at old ages.

Archimandritis et al.\textsuperscript{11}, Trudeau and McGuigan\textsuperscript{16} and Lambert\textsuperscript{9} also found that the mean fasting serum gastrin concentration in a healthy group increased with age. They speculated that it was caused by achlorhydria or hypochlorhydria. Ganguli et al.\textsuperscript{8} and Lambert\textsuperscript{9} found a significantly higher serum gastrin concentration in subjects with achlorhydria or hypochlorhydria than in a normal group. We also found a significant decrease of MAO with age in the control group and patients with DU and GU. Decreasing MAO may have a relation to increasing atrophy of the gastric mucosa at older ages. Miyoshi et al.\textsuperscript{18} have previously reported that the basal acid output (BAO), tetragastrin-stimulated acid output (MAO) and pepsin secretion decreased significantly with age in subjects with and without peptic ulcer disease.

Cornet et al.\textsuperscript{9} noted superficial gastritis and atrophic gastritis in 45% and 29% respectively of an old aged group with and without gastric symptoms.

Trudeau et al.\textsuperscript{17} suggested that the direct relation between the serum gastrin concentration and age was the result of reduction in the rate of gastric acid secretion commonly observed at old ages. They also found an inverse correlation between the serum gastrin concentration and rate of gastric acid secretion, i.e., the lowest mean serum gastrin concentration was found among patients with a highest mean gastric acid secretion rate, and the highest mean serum gastrin concentration was found among patients with a lowest gastric acid secretion rate.

Most studies have shown that the fasting serum gastrin concentration of patients with DU does not differ from that of normal subjects. Previously, Sumii et al.\textsuperscript{16} have shown that the fasting serum gastrin concentration in patients with DU was similar to or slightly higher than that in normal subjects not including those with atrophic gastritis, and after test meal which is a physiological stimulant for gastrin release, the serum gastrin concentration greatly increased in patients with DU, as compared with normal subjects. These findings indicated that the inhibitory feed-back mechanism of gastrin release which should follow acidification of the antrum and duodenum may be impaired in patients with DU. Sumii et al.\textsuperscript{16} suggested that impairment of the feed-back mechanism resulted from the increased antral gastrin content and decreased antral somatostatin content in patients with DU.

In our present study, comparison of the basal serum gastrin concentration and MAO was made between the control group and patients with DU. Although MAO decreased significantly with age, the basal serum gastrin concentration did not increase in patients with DU and was higher than that in the control group of only young ages (less than 20). Thus at young ages both the basal serum gastrin concentration and MAO were higher in patients with DU than in the control group. It suggests that gastrin contributes to hypersecretion of gastric acid in young patients with DU.

Trudeau and McGuigan\textsuperscript{17} reported that the serum gastrin concentration in patients with GU was significantly higher than that in normal subjects. In this study, we also found a significantly higher serum gastrin concentration in patients with GU than in normal subjects; however, when compared with the control group which consisted of normal subjects and patients with atrophic gastritis, no significant difference was noted. The basal serum gastrin concentration in the control group increased with age, while MAO decreased with age in both the control and patients with GU. In age-matched groups the basal serum gastrin concentration of the control group was similar to that of patients with GU. In young patients with GU, MAO was significantly higher than that in the control group and the basal serum gastrin concentration was slightly higher than that in the control group. In younger peptic ulcer patients (less than 20), aggressive factors in our present study increased not only in DU but also in GU. Furthermore, several investigators have been impressed by the frequency of a positive family history in many young patients with DU. Therefore, genetic factors seem to contribute to gastrin hypersecretion in those patients.

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REFERENCES


