Histopathological study was made on 473 polypoid lesions in the stomach obtained surgically from 297 patients. The maximum diameter of each polypoid lesion was measured. Histological gradation based on the extent of the epithelial pseudostratification was used as the indicator of the process in the development of a polypoid lesion. Polypoid lesions were also classified histogenetically into the metaplastic and gastric types. The latter type was subdivided into the pure form and the mixed form with secondary metaplasia. The metaplastic type of polypoid lesions revealed a clear correlation between their size and histological grade, and showed a high incidence of cancerous lesions. Almost all polypoid lesions of this group had a diameter less than 20 mm in the grades below V. Of the gastric type polyps, on the other hand, the pure form not associated with intestinal metaplasia rarely underwent malignant change; and the average size of the lesions in each grade was larger than that of the metaplastic type. Approximately 10% of the pure form lesions in grades I, II, and III were found to have diameters larger than 20 mm. The gastric type with secondary metaplasia revealed a combined character of both the metaplastic type and the pure gastric type in terms of the size as well as the malignant potential.

Although there are diverse opinions on the malignant potential of gastric polyps, Nakamura demonstrated an apparent difference in malignant potential of gastric polyps among the following three types: I (type of foveolar epithelium), II (type of regenerating epithelium), and III (type of intestinal epithelium). The presence of two groups in gastric polyps with different malignancy was also reported by Marshak and Feldman, Ming and Goldman, and by Tomasulo. These two groups were named regenerative (hyperplastic) polyps and adenomatous polyps by Ming and Goldman, and by Tomasulo.

However, we noticed that some regenerative polyps underwent malignant change through the secondary involvement in intestinal metaplasia. Moreover, when regenerative polyps had severe intestinal metaplasia, it became difficult to distinguish them from adenomatous polyps. Therefore, we proposed a histogenetic classification of polypoid lesions with special reference to intestinal metaplasia.

The present work was undertaken to know more clearly the difference in the nature of the histogenetic types by a study of correlation between the size and histological grade of polypoid lesions.

MATERIALS AND METHODS

A total of 473 polypoid lesions obtained surgically from 297 patients were examined histologically. The maximum diameter of each polypoid lesion was also measured. Sections of formalde-
hyde-fixed and paraffin-embedded tissues were stained with Hematoxylin and Eosin. Selected cases were stained also with periodic acid-Schiff and Alcian Blue stains.

Histogenetic Types of Polypoid Lesions  The presence of intestinal metaplasia was used as the criterion, and polypoid lesions of the stomach were histogenetically classified into (A) metaplastic type and (B) gastric type. The latter type was subdivided into (a) a pure form and (b) a form with secondary metaplasia.

The metaplastic type refers to the polypoid lesions originating from the mucosa with intestinal metaplasia and is characterized by proliferation of metaplastic epithelium (Photos 1 and 2). Most lesions of this group show a flat or sessile elevation with a broad base. Sometimes mushroom-like lesions are also found, but their pedicles are short and broad.

The pure gastric type indicates the lesions characterized by the proliferation of foveolar glands and gastric glands proper (Photos 3 and 4). Most lesions show a marked enlargement of foveolar glands. Macroscopically the lesions are pedunculated with slender pedicles, but the small lesions are sessile in shape. There is no intestinal metaplasia in the lesions.

The gastric type with secondary metaplasia indicates the lesions of the gastric type which are involved secondarily in intestinal metaplasia (Photos 5~8). Extent of intestinal metaplasia varies greatly from a patchy focus to an entire glandular portion of the polypoid lesions. Identification of the gastric type with secondary metaplasia is usually easy. However, when intestinal metaplasia is highly extended, it becomes difficult to distinguish the lesions of this type from those of the metaplastic type. In the present study, therefore, the histogenetic classification of some lesions was deferred to a further study and they were grouped into the unclassified type.

Histological Gradation of Polypoid Lesions on the Basis of Epithelial Pseudostratification  The polypoid lesions were histologically graded by the extent of the epithelial pseudostratification to analyze the process of their malignant transition. Standards of the gradation were reported in detail in our previous paper.3) In the present study, grade 0 refers to the polypoid lesion where the number of gastric glands proper, e.g., fundic glands or pyloric glands, increases and there is no proliferation nor enlargement of foveolar glands. Grades I to V are applied to the epithelia of either enlarged foveolar glands or glands showing intestinal metaplasia.

Cancerous lesions are characterized by distorted glandular structures, such as intraglandular budding, glands within glands, glands arranged back-to-back, disappearance of glandular structures, etc.

Cancerous lesions were classified into mucosal cancer (M), submucosal cancer (SM), and advanced cancer. In mucosal cancer the change itself is limited within the mucosa of polyps. Submucosal cancer is the invasive cancer which infiltrates the submucosa but not the muscular layer proper. When cancerous invasion reaches the muscular layer proper or deeper layers, it is called advanced cancer. However, polypoid lesions of advanced cancer were excluded from the present series.

The histological grade representing a polypoid lesion was that of the most advanced pseudostratification in the lesions, though a polypoid lesion usually includes various glands of different grades.

RESULTS

Relationship between the size of polypoid lesions and the incidence of cancerous lesions is shown in Table I. In general, the incidence of cancerous change became higher as the polypoids became larger. About 80% of polypoid lesions with diameter of more than 40 mm underwent cancerous change. However, there was a huge (60 mm in diameter) pedunculated polyp which was apparently benign in the histological feature, while there was a tiny mucosal cancer of less than 5 mm in diameter.

Classification according to their histogenetic types was made on 473 polypoid lesions (Table II). About one-half of these polypoid lesions belonged to the pure gastric type showing a very low incidence of cancerous change. The gastric type with secondary metaplasia exhibited an apparently higher incidence of cancerous change than the pure gastric type. The highest incidence of cancerous change was found in the metaplastic type.

Concerning 16 lesions of the unclassified in Table II, determination of the histogenetic type was deferred for further study because, when the lesion was almost completely occupied by cancerous or atypical epithelium of metaplastic origin, it became difficult to distinguish a pedunculated lesion of the gas-
Table I. Incidence of Noncancerous and Cancerous Polypoid Lesions in the Stomach according to Their Diameter

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>No. of noncancerous lesions</th>
<th>No. of mucosal cancer</th>
<th>No. of submucosal cancer</th>
<th>Total no. of polypoids</th>
<th>Incidence of cancer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 4</td>
<td>22</td>
<td>1</td>
<td>1</td>
<td>23</td>
<td>4.3</td>
</tr>
<tr>
<td>5~9</td>
<td>146</td>
<td>3</td>
<td>1</td>
<td>150</td>
<td>2.7</td>
</tr>
<tr>
<td>10~14</td>
<td>112</td>
<td>8</td>
<td></td>
<td>120</td>
<td>6.7</td>
</tr>
<tr>
<td>15~19</td>
<td>59</td>
<td>3</td>
<td>2</td>
<td>64</td>
<td>7.8</td>
</tr>
<tr>
<td>20~24</td>
<td>38</td>
<td>6</td>
<td>3</td>
<td>47</td>
<td>19.1</td>
</tr>
<tr>
<td>25~29</td>
<td>16</td>
<td>1</td>
<td>4</td>
<td>21</td>
<td>23.8</td>
</tr>
<tr>
<td>30~39</td>
<td>14</td>
<td>3</td>
<td>3</td>
<td>30</td>
<td>30.0</td>
</tr>
<tr>
<td>40~49</td>
<td>3</td>
<td>7</td>
<td>6</td>
<td>16</td>
<td>81.3</td>
</tr>
<tr>
<td>50≤</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>12</td>
<td>83.3</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>37</td>
<td>24</td>
<td>473</td>
<td>12.9</td>
</tr>
</tbody>
</table>

Table II. Histogenetic Types of Polypoid Lesions in the Stomach

<table>
<thead>
<tr>
<th>Histogenetic type</th>
<th>No. of noncancerous lesions</th>
<th>No. of cancerous lesions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Gastric type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Pure form</td>
<td>237</td>
<td>2</td>
<td>239</td>
</tr>
<tr>
<td>(b) With metaplasia*</td>
<td>128</td>
<td>14</td>
<td>142</td>
</tr>
<tr>
<td>(B) Metaplastic type</td>
<td>44</td>
<td>32</td>
<td>76</td>
</tr>
<tr>
<td>(C) Unclassified</td>
<td>3</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>61</td>
<td>473</td>
</tr>
</tbody>
</table>

*Gastric type lesions secondarily involved in intestinal metaplasia.

gastric type with secondary metaplasia from that of the metaplastic type.

Relationship between the size of polypoid lesions and histological grades based on epithelial pseudostratification was compared among the three histogenetic types.

In the metaplastic type, the average size of lesions increased steadily with advance of the histological grade (Fig. 1), though the average size of grade II was slightly larger than that of grade III, possibly because of the small number of samples collected. Almost all polypoid lesions below grade V had a diameter of less than 20 mm and the frequency of polypoid lesions in each grade varied little except in grade II.

On the other hand, more than half of the polypoid lesions in the pure gastric type belonged to grade II (Fig. 2). In general, the average size of the pure gastric type polypoids was larger than that of the metaplastic type throughout all grades. Approximately 10% of the pure form lesions in grades I, II, and III were found to have a larger diameter of more than 20 mm, and the largest pedunculated polyp in grade I measured 60 mm. The correlation between size and histological grade was not recognized. Stromal edema as well as dilatation of the foveolar glands, which were frequently found in the gastric type lesions (Photo 5), seemed to be related intimately to the enlargement of the lesions besides actual growth of the lesions.

In the gastric type with secondary metaplasia, the average size of the grade V lesions and cancerous ones was apparently larger than that of grades II, III, and IV (Fig. 3). However, the grades II, III, and IV lesions showed a similar size distribution and they
were larger in the average size than the metaplastic type lesions with the same grades. The pattern of size distribution in the gastric type with secondary metaplasia seemed to show a combination of the two different natures. One was the nature of the pure gastric type and the other was that of the metaplastic type. The former was also reflected on the pedunculated shape of the lesions.

**DISCUSSION**

Premalignancy of intestinal metaplasia has been indicated by many investigators, and the polypoid lesions derived from metaplastic epithelium have been given many different names, including IIa subtype, metaplastic polyp, type III, and atypical epithelium. In the present study, the lesions of this group were named the metaplastic type. However, malignancy potential of these lesions has not been definitely clarified. In order to clarify the premalignant nature of the metaplastic type lesions, a study was made on the relationship between the size and histological grade of the lesions. The average size of the metaplastic type lesions increased steadily with advance of their histological grades. In other words, the lesions of this group seemed to advance gradually their histological grade to reach the cancerous condition with growth.

There is, however, a problem that gastric cancer induced in the flat mucosa may produce a polypoid lesion. Therefore, Nakamura insisted that recognition of malignant change in gastric polyps requires the coexistence of both benign and malignant changes.
TYPE AND SIZE OF GASTRIC POLYP

Fig. 3. Relationship between size and histological grade of the polypoid lesions classified as gastric type with secondary metaplasia.

- polypoid lesion, O average size in each grade.

within a polyp. However, there may be no residue of benign change in the polypoid lesion, when cancerous change extends widely to the adjacent mucosa. The size-grade relationship of the metaplastic type in Fig. 1 showed a continuous transition without any abrupt discrepancy between non-cancerous lesions and cancerous ones, and there was only a few polypoid cancers of less than 10 mm in diameter. This indicates that polypoid lesions of the metaplastic type may frequently transform into the polypoid cancer, though some polypoid cancers may arise in flat mucosa with intestinal metaplasia.

Histological gradation based on the epithelial pseudostratification was first introduced in the study of colorectal polyps.\(^3\^-5\) The reliability of this gradation as a histological and chronological indicator of the process from the onset of polyps to their cancerous transformation was substantiated by the analysis of histological transition\(^3\) and the comparison of average ages of patients.\(^4\)

In contrast to the colorectal cancer, which arises usually in the pre-existing polyps with severe epithelial pseudostratification,\(^5\) gastric cancer appears often in flat mucosa without epithelial pseudostratification. It is particularly true for adenocarcinoma of mucocellular type, but cancer of this type is rare in the gastric polyp. The present result concerning the metaplastic type lesions suggested that the histological gradation based on the epithelial pseudostratification is useful as an indicator of epithelial atypism in non-cancerous polypoids of the stomach.

The gastric type lesions in the present study agreed almost completely with Nakamura's type I,\(^16\) and the regenerative (hyperplastic) polyps of Ming and Goldman.\(^9\) However, malignant change was usually found in the metaplastic epithelium of this group of lesions, as it was in the metaplastic type lesions. Therefore, the gastric type lesions were subdivided into the pure form and the form with secondary metaplasia. Although Nakamura,\(^16\) and Ming and Goldman\(^9\) mentioned that intestinal metaplasia was absent or mild in the regenerative polyps, about one-third of lesions of the gastric type were more or less involved secondarily in intestinal metaplasia.

Adenomatous polyps of Ming and Goldman,\(^9\) and of Tomasulo\(^10\) might include both the metaplastic type lesions originating from metaplastic mucosa and the adenomatous lesions derived from the regenerating (hyperplastic) polyps through the secondary involvement in intestinal metaplasia, because the lesions of these two types exhibited a similar histological feature which was characterized by the severe proliferation of metaplastic epithelium.

In the present study, different patterns were found in the relationship between the size and histological grade of the lesions.
among the metaplastic type, pure gastric type, and gastric type with secondary metaplasia. This indicated the presence of at least two types of gastric polypoid lesions which transformed frequently into adenomatous condition as well as to a cancerous one.

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REFERENCES


EXPLANATION OF PLATES

Photo 1. A polypoid lesion (grade IV) with a broad base. The lesion as well as the adjacent mucosa exhibits marked intestinal metaplasia. This polypoid lesion is classified as the metaplastic type. Hematoxylin-Eosin stain. × 6.7.

Photo 2. A higher magnification of Photo 1. There are many goblet cells in the gland at the bottom. The surface is occupied by the metaplastic epithelium with severe pseudostratification (grade IV). Hematoxylin-Eosin stain. × 160.

Photo 3. A pedunculated polyp of the pure gastric type (grade II). There is no intestinal metaplasia. Hematoxylin-Eosin stain. × 3.8.

Photo 4. A higher magnification of Photo 1. There are enlarged foveolar glands. The epithelium lines relatively closely in some parts, but there is no pseudostatification of epithelium (grade II). Hematoxylin-Eosin stain. × 85.

Photo 5. A pedunculated polyp (grade III) of the gastric type with secondary metaplasia. There are marked stromal edema and cystic dilatation of foveolar glands. There is also focal involvement in intestinal metaplasia (indicated by arrows). Hematoxylin-Eosin stain. × 5.3.

Photo 6. A higher magnification of Photo 5. The glands in the surface of the polyp exhibit intestinal metaplasia and mild epithelial pseudostatification (grade III). There are also foveolar glands at the bottom. Hematoxylin-Eosin stain. × 85.

Photo 7. A pedunculated polyp with mucosal carcinoma. Most parts of the head of the polyp are occupied by metaplastic epithelium with carcinomatous change (indicated by arrows), but non-metaplastic glands are found in the pedicle as well as in some parts of the head of the polyp. This polyp is classified as the gastric type with secondary metaplasia. Hematoxylin-Eosin stain. × 3.7.

Photo 8. A higher magnification of Photo 7. Cancerous change is seen in the upper part and gastric glands remain in the lower left. Hematoxylin-Eosin stain. × 85.
TYPE AND SIZE OF GASTRIC POLYP