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A HISTOPATHOLOGICAL STUDY ON THE DISTRIBUTION OF TISSUE MAST CELLS IN HUMAN UTERINE CERVIX AND STOMACH

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Indexing Words

mast cell; uterine cervix; stomach

Toshiyuki FUNABIKI. *A Histopathological Study on the Distribution of Tissue Mast Cells in Human Uterine Cervix and Stomach.* Kobe J. Med. Sci. 15, 17-37 March 1969——There are abundant tissue mast cells in the human uterine cervix and stomach. The purpose of this study is to seek after the significance of its existence and change by pathological conditions. The distribution of tissue mast cells in the human uterine cervix and gastric wall was studied according to age and disease. In the uterine cervix, the relationship with sex cycle was studied. In the stomach, the gastric wall was divided into mucosa, submucosa, muscularis, and serosa, to study tissue mast cells in each layer. The specimen obtained from biopsy materials was fixed 10% formalin and staind by 1% toluidine blue.

In the uterine cervix, tissue mast cells are most abundantly found in the 40's, followed by a decrease in advancing age. In the gastric wall of cases of gastric ulcer, tissue mast cells are most abundantly found in the muscularis, and least in the mucosa, while in normal cases they are most abundantly in the mucosa, and very rare in the muscularis. Tissue mast cells are few in acute inflammation and cancer, and abundant in chronic inflammation. The variation of tissue mast cell distribution on age difference and various diseases has been discussed.

INTRODUCTION

Mastocytoma in animals such as dogs, mice etc. has been frequently reported, being described as mast cell sarcoma from time to time. However, no mastocytoma in man has been reported so far. Marked infiltration and proliferation of tissue mast cells (subsequently abbreviated as TMC) in human body are seen in urticaria pigmentosa deseribed since Bertelotti[3] (1943). This is TMC proliferation but not a tumor. Such urticaria pigmentosa seen in man, on the other hand, has never been reported to occur spontaneously in animals.

Lennert[21,22] (1961, 1962) reported "Mastzellen Retikulose", produced by changes in the bone marrow tissue, with cellular and nuclear atypy and pictures of mitosis, probably representing a kind of functional malignancy. The ability of TMC to produce heparin,[18] and histamine[26,37] has been recognized. According to West[32] (1956) and Benditt[2] (1955), some part of the animal organism has the ability of producting serotonin. According to Stüttgen[42] (1962), however, the

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relationship between TMC in human body and serotonin has not yet been clarified, so that the production of serotonin by the TMC in human body is not definitely established today.

In view of these facts, TMC in human body and those in animals appear to be different in various aspects despite the close morphological similarity. The author has therefore studied the submucosal layer of the uterine cervix and gastric wall containing especially abundant TMC in the biopsy material obtained from human body. The following results were obtained.

MATERIALS AND METHODS

Biopsy materials obtained from uterine cervix and stomach provided by the Section of Pathology, Public Health Research of Kobe City from April 1963 to August 1966 were used. The biopsy materials obtained from the uterine cervix mostly consisted of those from the cases of acute cervicitis, subacute cervicitis, chronic cervicitis and cancer of the uterine cervix, together with some other cases for a total of 165 cases.

Specimens obtained operatively from the cases of chronic gastritis, chronic peptic ulcer, and gastric cancer, for a total of 100 cases, were utilized for the study on TMC in the stomach. Nine cases with normal stomach served as the control. Fixation of all the material was carried out with 10% formalin solution. Paraffin slices were stained with hematoxylin-eosin, toluidine blue and PAS. Toluidine blue stain was conducted using the toluidine blue solution with pH 2.6, 4.1 and 4.9. The following method was employed in the toluidine blue stain, after improving Lennert's method[23] (1961). In the method using solution of pH 4.9, the procedures were as follows:

(1) Following paraffin removal, 1% toluidine blue solution of pH 4.9 was used for the staining for 7—8 minutes.
(2) After washing in water, the specimen was immersed in a buffer solution of pH 4.9 for 5 minutes.
(3) The specimen was decolorated with 96% ethanol for 2 minutes.
(4) It was then immersed in 100% ethanol for about 1 minute.
(5) The specimen was then made transparent with xylol.
(6) Sealing was conducted with balsam.

As the buffer solution, Michaelis universal buffer was used. For the calculation of the quantitative distribution of TMC, optic microscopy was conducted under 400 times magnification. Since the uterine cervix is a small tissue, only seldom did the specimen contain muscle layer, so that the examination was conducted only in the submucosal layer. In the uterine cervix, the total TMC count in 5 visual fields of 400 times magnification was obtained. This figure was used as the number of TMC in this case. Since the size of the specimen of the stomach was large, the total TMC count of 10 visual fields was used as the amount of TMC in this case. TMC between 1 and 50 was shown by (+), 51–100 (++), and above 101 (+++).

The site of determination of TMC in gastric ulcer was selected in the gastric wall close to the granulation tissue without ulceration. In the normal stomach

tissue specimen obtained as the control, TMC in the gastric wall on the lesser curvature side close to the pylorus was selected. The site of determination in gastric cancer was selected, except the necrotic layer, from the tumor tissue and surrounding connective tissue at random.

EXPERIMENTAL RESULTS

A. TMC in human uterine cervix.

1. Age difference in TMC in various diseases of the uterine cervix.

In 8 cases of acute cervicitis, 17 cases of subacute cervicitis, 102 cases of chronic cervicitis, 26 cases of malignant tumor and 12 miscellaneous cases for a total of 165 cases, the rate of appearance of TMC in the uterine cervix was determined according to age group regardless of the disease. The results on TMC in the submucosa of the uterine cervix are shown in Table 1. This is most frequent in the 40's (average number of TMC in 5 fields of 88.3), followed by the 30's (average TMC in 5 fields of 75.7), 20's (average TMC in 5 fields of 59.7) and 50's in a decreasing order. Decrease is especially pronounced in the 60's and 70's.

Table 1. Age difference in TMC in various diseases of the uterine cervix.

Age	Cases	TMC in 5 fields
20's	13	59.7
30's	51	75.7
40's	58	88.3
50's	25	54.5
60's	10	16.6
70's	8	8.0
Total	165	68.9

Table 2. Frequency of appearance of each disease according to the age group.

Age	Acute cervicitis	Subacute cervicitis	Chronic cervicitis	Malignant tumor	Others	Cases
20's	0	2	9	0	2	13
30's	2	8	32	8	1	51
40's	4	5	43	4	2	58
50's	2	0	12	8	3	25
60's	0	1	5	2	2	10
70's	0	1	1	4	2	8

In the 60's and 70's, the number of TMC in the submucosa of uterine cervix is decreased. Then in 6 of 18 cases, cancer is demonstrated. In 12 cases except 6 cancer cases, TMC is counted. The average of the total of fields is 18.0, representing a low value. No great difference is noted as compared with the data before removal of the cancer cases. Although cancer cases might be present in other age group, the above mentioned results including cancer do not appear to indicate a large error of TMC due to cancer. Table 2 summarizes the frequency of appearance of each disease according to the age group.

Cytologically, no difference due to age is noted in the morphology, size, density of granules and the state of degranulation. In the site where the interstitial connective tissue is loose, TMC are round or oval. TMC among dense fibers appear slender and spindle-shaped. No difference in the degree of metachromasia is noted between the round ones and spindle-shaped ones. The size of the cells and density of the granules varied. Some have large cytoplasm and dense granules, while others have large cytoplasm and coarse granules or small cytoplasm and dense or loose granules. As a whole, the cells with small cytoplasm frequently show loose granules in the uterine cervix.

2. Attitude of TMC in various diseases of the uterine cervix.

Specimens are classified into acute cervitis, subacute cervicitis, chronic cervicitis and malignant tumor, to study the rate of appearance of TMC in each disease. The results are summarized in Table 3. In the experimental results shown in the Table, age and sex cycle are not considered. Of the total 153 cases, 26 cases are the malignant tumors, most of which consisted of epidermoid carcinoma. Others consist of 1 case of adenocarcinoma, 2 cases of carcinoma simplex and 1 case of carcinoma in situ.

Table 3. TMC content in various diseases of the uterine cervix.

Disease	Cases	TMC in 5 fields
Acute cervicitis	8	29.0
Subacute cervicitis	17	69.0
Chronic cervictis	102	81.9
Malignant tumor	26	27.8
Total	153	68.9

The TMC in the submucosa of uterine cervix is most frequently seen in cases of chronic cervicitis (the average of the total of 5 fields of 81.9) followed by subacute cervicitis. In acute cervicitis and the malignant tumor, the number of

TMC in the submucosa is quite small, corresponding to about 1/3 of the number in chronic cervicitis.

Cytologically, TMC is almost the same as stated in section 1 regarding age difference, but in acute cervicitis showed slightly more degranulation than in other disease. TMC in cancer of the uterine cervix fail to show a distinct difference from TMC appearing in the state of inflammation morphologically. TMC under such circumstances is seen in the part adjacent to the tumor tissue. In chronic cervicitis, TMC is very rarely seen in the portion adjacent to the epithelium with intense cell infiltration, but rather frequent in the deeper loose connective tissue. Perivascular agmination was also frequently seen. No TMC was present in the squamous epithelium and between cylinder epithelial cells.

3. Relationship between TMC in the submucosa of uterine cervix and sex cycle.

When the appearance of TMC in each disease is disregarded and only age difference is studied, TMC in the submucosa of the uterine cervix show a high rate of appearance in the 30's and 40's. In cases of chronic cervicitis, relationship between sex cycle and TMC in the submucosa of uterine cervix is studied.

Every 5th day after menstruation is one group made, to compare the average number of appearance of TMC in the submucosa of the uterine cervix. Table 4 shows the results. In cases of chronic cervicitis, TMC increase during the 6–10th and 16–20th day after menstruation. In menopausal cases, TMC is decreased. Morphologically, size and form of the cells, density of granules and state of degranulation show no difference according to the days after menstruation.

Table 4. Relationship between TMC in the submucosa of uterine cervix and sex cycle.

Day after menses	cases	TMC in 5 fields
0 — 5	3	83
6 — 10	10	128
11 — 15	10	52
16 — 20	7	129
21 — 25	14	94
26 — 30	7	102
31 — 35	2	80

B. TMC in human stomach.

1. TMC in normal stomach.

The stomach was divided into the mucosa, submucosa, muscularis and serosa, to compare the number of TMC. The results are shown in Table 5. In normal stomach, TMC is most abundantly seen in the mucosa (average of the total of 10 fields of 43.4) followed by submucosa (average of the total of 10 fields of 34.2).

Very few TMC is seen in the muscularis (average of the total of 10 fields of 7.1). The shape of TMC is mostly round or oval and very rarely slender. The granules in the cytoplasm is slightly loose in the submucosa. Degranulation is seen only rarely.

Table 5. TMC in normal stomach.

Age	Sex	Cause of death	Mucosa	Submucosa	Muscularis	Serosa	Total
14	M	Wilson's disease	30	29	7	21	
23	M	Cryptoccosis in C.N.S.	59	43	13	19	
26	M	Meningitis	18	15	4	7	
39	M	Kimmelstiel-Wilson's disease	45	32	8	11	
39	M	Lung cancer	19	20	2	10	
45	M	Cerebral softening	31	54	15	28	
42	F	Pneumonia	80	35	5	11	
49	F	Reticulosarcoma of lymph nodes	24	14	6	7	
66	F	Hepatoma	85	66	4	12	
Average			43.4	34.2	7.1	14.0	98.7

TMC is seen in the stroma of the propria mucosa in the mucosa, and also many in the mucosa muscularis. None is seen in the lymph follicle. TMC in the muscularis is mainly seen in the connective tissue among muscle fibers. Perivascular agmination is also seen frequently.

2. TMC in gastric ulcer.

As stated in the experimental method, distribution of TMC is investigated in gastric walls around the edge of the ulcer with remaining mucosa but not in the ulcer itself. The results are shown in Table 6. A marked difference is seen in the

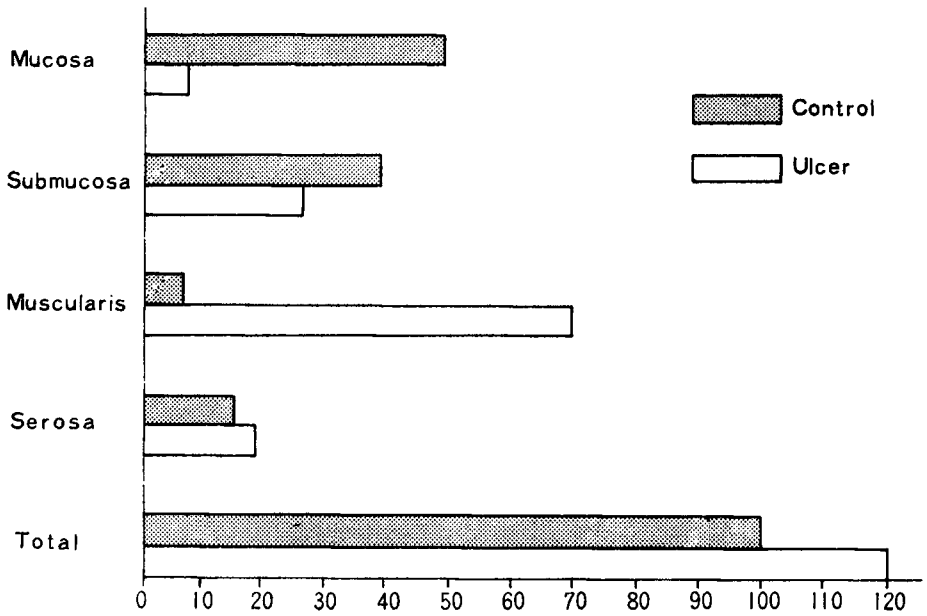
Table 6. TMC in gastric ulcer.

Age	Sex	Site of ulcer	Mucosa	Submucosa	Muscularis	Serosa	Total
29	M	Smaller curvature	17	10	23	16	
31	M	〃	15	53	159	41	
31	M	〃	1	34	41	25	
43	M	〃	8	36	44	26	
53	M	〃	5	35	136	22	
49	F	〃	0	3	21	4	
48	M	Body	0	10	32	11	
58	M	〃	1	27	63	25	
45	M	Pyloric region	3	27	74	13	
56	M	〃	22	31	86	10	
Average			7.2	26.6	68.9	19.3	122

distribution of TMC between normal and ulcerated stomach. In cases of ulcer, TMC is distributed most abundantly in the muscularis (average of total of 10 fields of 68.9) followed by submucosa (26.6). In the mucosa, the amount of TMC is markedly few as compared with the control cases, giving the average in total of 10 fields of 7.2.

When TMC in the stomach is compared between the control and the ulcer cases, the result shown in Fig. 1 is obtained. TMC in ulcer cases are large in

Fig. 1. —Comparison in TMC of each gastric layer between control and ulcer.



the shape than those in the controls, and granules in the cytoplasm are more dense frequently. Degranulation is also more frequently seen in cases of ulcer. The shape is mostly round or oval. The granules in the cytoplasm are loose in the TMC in the mucosa but are dense in other 3 layers. Degranulation also frequently occurs. However, the degranulation of TMC in the serosa is milder than in other layers. The distribution of TMC in the ulcer part reveals a complete absence in the necrotic layer. The borderline between the outer granulation tissue and scar tissue is poorly defined, but in the granulation tissue, TMC are scarcely seen. Only a few are seen in the scar tissue. The amount of TMC in the muscularis of the ulcer part and serosa shows scarcely any difference in distribution as compared with the area around the ulcer statistically studied. Morphological aspects are approximately the same.

3. Appearance of TMC in the stomach in various diseases according to age and diseases.

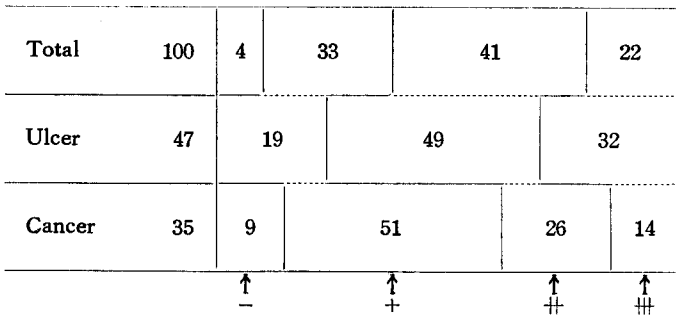
In 100 cases of chronic gastritis, chronic peptic ulcer and cancer, the amount of TMC is studied according to age. The results are shown in Table 7. No marked quantitative difference is seen in TMC according to age.

Table 7. Age difference in TMC in the stomach.

Age	Cases	−	+	++	+++	++, +++ (%)
20's	4	0	2	1	1	50
30's	11	0	5	4	2	55
40's	24	2	6	10	6	67
50's	30	1	9	12	8	67
60's	24	1	7	13	3	67
70's	7	0	4	1	2	43
Total	100	4	33	41	22	

In 47 cases of chronic peptic ulcer and 35 cases of cancer, TMC is studied. TMC increase in chronic peptic ulcer, (++) and (+++) reaching 81%. However, appearance of TMC is rare in the cancer cases, (++) and (+++) occupying only 40%. A tendency towards the increase of TMC in chronic peptic ulcer and the decrease in cancer is thus noted. These results are shown in Fig. 2.

Fig. 2. Appearance of TMC in gastric ulcer and cancer.



DISCUSSION

As for special stains for TMC, pigments such as alcian blue, astra-blue, azur, bismark brown, carmine, fuchsin, feulgen, methylene blue, night blue, pyronine methyl green, safranin, thionine, and toluidine blue have been reported so far. Jasmin and Bois[17] (1961) conducted double stain using alcian blue and cresyl violet,

demonstrating two kinds of TMC. TMC which can be stained by cresyl violet represents maturity of TMC with sulfated polysaccharide, while alcian blue stains immature TMC containing non-sulfated polysaccharide according to these authors. Moreover, Lennert et al.[23] (1959) used toluidine blue at changing pH to demonstrate different kinds of TMC. According to Lennert et al., as the maturity of the granules of TMC advances, SO_4 radicals in the mucopolysaccharide increase. The metachromasia due to toluidine blue is seen in mature TMC at high pH but immature TMC at mastocytosis at low pH.

In the present study, pH range was divided into 2.6, 4.1 and 4.9 but scarcely any quantitative difference was seen in TMC according to the range of pH, so that the author has defined TMC as the cells showing toluidine blue metachromasia at pH 4.9. As for mastocytosis in human body, urticaria pigmentosa may be considered as previously stated. As far as the cases in this experiment is concerned, no findings compatible with the description of mastocytosis was found. Only TMC infiltration was noted, according to the findings of metachromasia. According to Jorpes et al.[19] (1948), PAS positive substances are localized within the TMC granules. According to Glegg et al.[18] (1952) and, Niebauer et al[28] (1958), however, not all the TMC show positive PAS. In the author's experiment, PAS stain was also conducted and it was found that toluidine blue metachromasia was far more reliable than PAS reaction in staining TMC. Not all TMC were demonstrated by PAS reaction. Studies on TMC especially quantitative distribution were therefore conducted in this experiment with toluidine blue metachromasia. Since the basic studies of Ehrlich[11] (1891), Maximow[24,25] (1910, 1913) and others, TMC and basophile leucocytes have been distinguished. Michelis[27] (1938) pointed out a co-relationship between these two. According to Riley[36] (1959) and Boseila[4] (1959), these two are distinctly different despite chemical or functional similarity. In this experiment, cytological distinction between basophilic leucocytes and TMC was not always possible. Increase in basophile leucocyte in blood was not seen clinically. Accordingly from the standpoint of which TMC and basophile leucocytes appeared to be different, following considerations on TMC are described.

Kanthack and Hary[20] (1894) demonstrated a sudden change of granules in these cells upon contact with stimulus. Webb[46] (1931) demonstrated vacuolation and degranulation of intraperitoneal mast cells of rat upon intraperitoneal injection of India ink or egg white. Chakravary et al.[7] (1967) observed an alteration in distribution, size and electron density of the granules at the anaphylaxic changes in rat peritoneal mast cells by ovalbumin. At the site of contact with intense stimuli and antigen, such changes occur. Through intraperitonial injection of egg white, Selye[39] (1937) caused urticaria-like symptoms in rats, probably through histamine liberator at the site of stimulus, sudden degranulation occurs in TMC in relation to histamine and 5-HT release.

In the results of these experiments, the number of TMC was large in chronic inflammation such as chronic cervicitis and chronic peptic ulcer. In acute cervicitis, TMC with degranulation was greater in number than in chronic cervicitis. The amount of TMC, moreover, was considerably less in acute cervicitis than in chronic cervicitis. Paplanus[31] (1963) also reported similar findings in experiments on

inflammation in the skin. According to his results, degranulation of TMC was noted in the initial stage of inflammation, while regranulation occured in the reparatory process of inflammation. Schauer and Eder[38] (1961) stated that TMC contains leucylaminopeptidase, ATPase, acid phosphatase and partially alkaline phosphatase, therefore it does high protein and phosphorus metabolism. Also TMC containing mucopolysaccharide may have important role on the metabolism of connective tissue. Subsequently it may be considered that TMC increases in relation to the metabolism of the connective tissue which proliferates in chronic inflammation.

Studies on TMC in human uterine cervix are scarce. According to the studies of Absoe-Hansen[1] (1951), TMC in uterine cervix decreases in number as age advances. Iversen[15] (1960) compared the TMC in uterine cervix above and below the age of 60. The number was far larger in below the age of 60 than in above the age of 60, by about 3 times as many. This is probably due to the structural changes of connective tissue component after menopause. Staemler[41] (1921) studied TMC in corpus uteri and failed to detect difference according to age. The results of these experiments approximately agree with those of Iversen[15] (1960) and Absoe-Hansen[1] (1951), TMC being smaller in number in advanced age. However, in these experiments TMC in normal uterine cervix are not dealed with but pathological ones. Whether the same tendency is seen in normal TMC or not, remains an open question at the present stage. The amount of TMC in uterine cervix thus showed variation according to age. The relationship with sex cycle was then studied. At 6-10th day aften menstruation corresponding to proliferative phase, TMC increased and TMC again increased on the 16-20th day after menstruation corresponding to the secretory phase. According to the results of Boseila[4] (1959) and Iversen[15] (1960) in human body, TMC increases in the uterine cervix towards the terminal stage of secretory phase. Iversen[15] (1960), moreover, studied human uterine cervix following estrogen injection, demonstrating a decrease of TMC following estrogen injection as compared with the level before injection. According to the results of Iversen, TMC in the uterine cervix should decrease in the proliferative phase with estrogen secretion. In this experiment, however, TMC shows a temporary increase even in the proliferative phase, being different from the results of Iversen. The significance of such difference is not clear.

TMC in the uterine cervix is then studied according to diseases. The largest number of TMC is noted in chronic cervicitis while the number is considerably less in malignant tumor. Dunn and Montgomery[10] (1957) studied the TMC directly underneath the epithelium of the uterine cervix, but failed to detect a marked change in acute inflammation, chronic inflammation, and cases with metaplasia, while a marked rise was seen in carcinoma. In other tumors in human body, TMC was reported to increase around the tumor.[5] In these experiments, appearance of TMC around the tumor is confirmed but no quantitative increase is evident. In the results of Staemler[29] (1921) on the studies of cancer of corpus uteri, TMC was markedly decreased and scarcely recognized. In chroic inflammation, a considerably large amount of TMC is demonstrated but the small amount of TMC in malignant tumor is hard to explain at present.

Concerning TMC in human stomach, Norris et al.[29] (1963) studied the distribution of TMC in normal gastric wall in a 30 year-old colored female. According to these workers, gastric TMC showed scarcely any change until the 9th hour after death, quantitatively and morphologically. In these experiments, the gastric specimen of the autopsy cases used as the control was obtained within 9 hours after death. The results on TMC in normal gastric wall obtained by Norris agreed with ours. TMC was most abundantly found in the mucosa followed by submucosa, serosa, and muscularis.

Concerning the fluctuations of TMC in diseases of the stomach, reports of Janes et al.[16] (1949), Bruni et al.[5] (1952), Squartini et al.[40] (1956), Räsänen[34] (1958), and Sundberg et al.[43] (1959) are available. In these cases, however, the results are quite variable. Squartini et al.[40] (1956) found a decrease in TMC in gastric ulcer, while Räsänen[34] (1958) found no change. Janes et al.[16] (1948) demonstrated an increase in gastric ulcer, giving an amount 4 times as much as in gastric cancer. In these experiments, TMC showed a definite increase in gastric ulcer, especially markedly in muscularis where the content is the smallest in normal state, while a pronounced fall was seen in the mucosa. Concerning the pathogenesis of gastric ulcer, various theories are available. The "peptische Theorie" of Günsberg[14] (1852) has generally been recognized. An intense gastric secretion occurs in response to histamine injection in hungry animals. Büchner et al.[6] (1927) produced acute peptic ulcer in rats through repeated injection of histamine. Continuous injection of histamine elevates gastric secretion under hungry state, probably leading to peptic ulcer. Paul et al.[38] (1966) studied TMC in gastric ulcer of rats, demonstrating degranulation of TMC in the gastric mucosa, when stress was given to a rat, resulting in a release of vasoactive substance, vascular engorgement, weakening of resistance against acid pepsin digestion finally leading to ulcer formation. The small TMC content in gastric mucosa in gastric ulcer and abundant content in muscularis might suggest degranulation of TMC in the mucosa resulting in consumption for the secretion of histamine as Räsänen[35] (1963) mentioned. The increase of TMC in the muscular layer might be due to the demand secondary to the consumption in the mucosal layer.

Concerning TMC in gastric cancer, Janes et al.[16] (1948), Bruni et al.[5] (1952), Squartini et al.[40] (1956), Räsänen[34] (1958), and Sundberg et al.[43] (1959) reported variable results. Räsänen failed to see changes in TMC in gastric cancer, while Squartini et al. found more or less a decrease of TMC in gastric cancer. Janes et al., on the other hand, found more TMC in the noncancerous part than in the cancerous part of the same cases. Bruni also reported abundant TMC in tissues surrounding gastric cancer. Sundberg et al. pointed out a marked increase of TMC in gastric cancer and corresponding increase was also seen in atrophic gastritis, so that the increase of TMC in gastric cancer probably originates from atrophic gastritis. Concerning the relationship between gastric cancer and TMC, Twort[45] (1930) denied any relationship between TMC and tumor. TMC appears with inflammatory reaction according to this author. Ozzello[30] (1960) and Sylvén[44] (1945) stated that TMC facilitated tumor growth. Cramer and Sympson[8] (1944), Dunn and Montgomery[10] (1957), Csaba[9] (1961), Fisher[12] (1965) and others, on

the other hand, are of the opinion that TMC inhibits tumor growth.

According to the author's experimental results, TMC is far less in cases of gastric cancer than in cases of gastric ulcer. In both uterine cervix and stomach, TMC was far less in case of cancer than in case of chronic inflammation. This might indicate the biological or biochemical characteristics of cancer cell, but the details are not yet fully understood.

CONCLUSION

Distribution of TMC in the submucosa of human uterine cervix and gastric wall has been studied according to age and diseases, the sex cycle in the uterine cervix, and each layer in the gastric wall in normal subjects and cases of gastric ulcer. Quantitative difference in the TMC distribution in uterine cervix and gastric wall according to disease is as follows. TMC is most abundantly found in chronic inflammation (chronic cervicitis, chronic peptic ulcer) followed by subacute inflammation, while the number is rather small in acute inflammation and malignant tumor.

Concerning the state of distribution of TMC in cervix uteri, they are found most abundantly in the 40's followed by the 30's. As age advances, the number of TMC tends to decrease. In relation to sex cycle, two increases are seen, one in the proliferative phase, and the other in the secretory phase. In the stomach, gastric wall was divided into 4 laters. In the state of distribution of TMC, TMC is most abundantly found in the mucosa in normal cases, and least in the muscularis (there are 6 times as much in the mucosa as in muscularis). In cases of ulcer, it is most abundant in the muscularis, while the least amount is found in the mucosa (there are 10 times as much in the muscularis as in the mucosa).

Cytologically degranulation is frequently seen in the mucosa near the ulcer site of gastric ulcer and in acute inflammation, and granules are also loose. The morphology of TMC is apparently governed by the property of the surrounding tissue, for instance the amount of fibers or directions of fibers. The size of cytoplasm is larger in chronic inflammation rather than that in acute inflammation with intense degranulation, and in the muscularis rather than in the mucosa adjacent to the ulcer.

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LEGENDS

Photo 1. TMC in acute cervicitis. These granules are generally dilute. Toluidine blue stain. (×400)

Photo 2. TMC in acute cervicitis. Granules in TMC are loose and degranulation is seen. Toluidine blue stain. (×1000 Interference phase contrast)

Photo 3. TMC in chronic cervicitis. These are many TMC having dense granules in the cytoplasm. Toluidine blue stain. (×100)

Photo 4. TMC in chronic cervicitis. The granules in the cytoplasm are dense and cytoplasms are commonly large. Toluidine blue stain. (×1000 Interference phase contrast)

Photo 5. TMC in chronic cervicitis. The cytoplasm is filled with granules. Toluidine blue stain. (×1000 Interference phase contrast)

Photo 6. TMC in cervical cancer. TMC neighboring the tumor tissue. Toluidine blue stain. (×400 Interference phase contrast)

Photo 7. TMC in the mucosa of normal stomach. Toluidine blue stain. (×400)

Photo 8. TMC in gastric ulcer, to the submucosa from the mucosa. TMC is not seen in the mucosa. Toluidine blue stain. (×100)

Photo 9. TMC in gastric ulcer, to the muscularis from the submucosa. The shape of TMC is mostly round or oval. There are more in the intramuscular bundle than in the musclar fiber in the muscularis. Toluidine blue stain. (×100)

Photo 10. TMC in the muscularis of gastric ulcer. Cytoplasm is filled with granules. Toluidine blue stain. (×400)

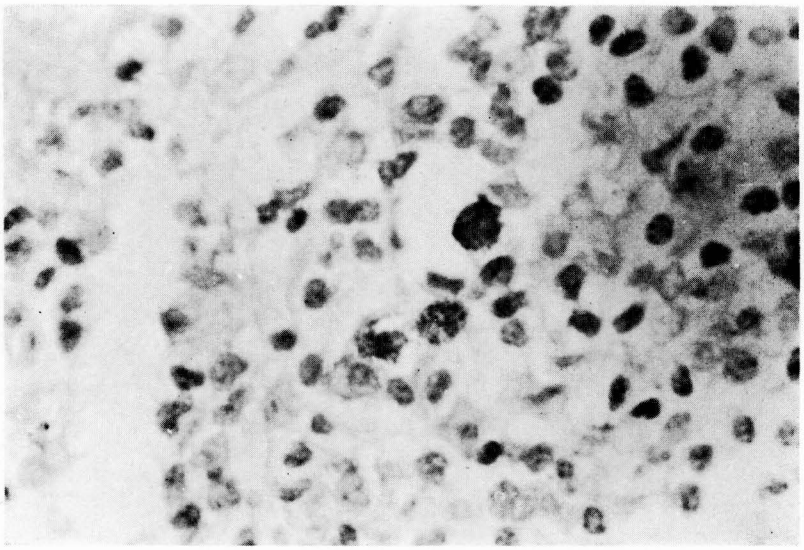
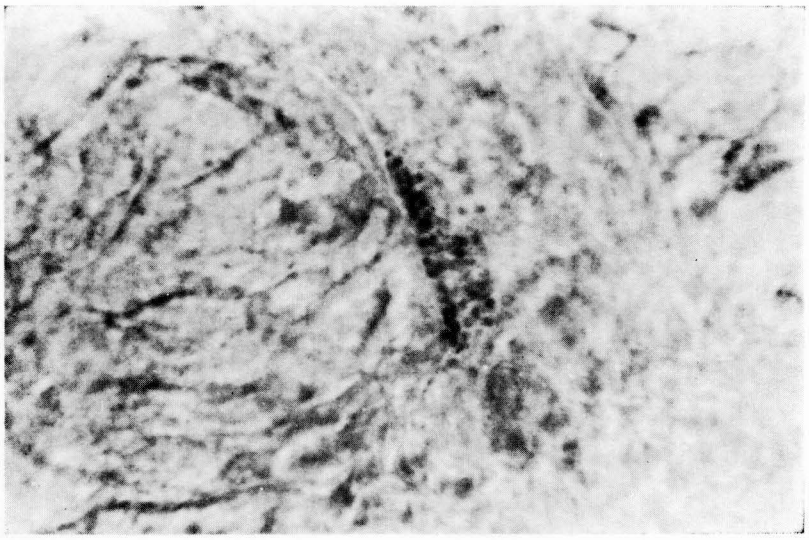


Photo 1



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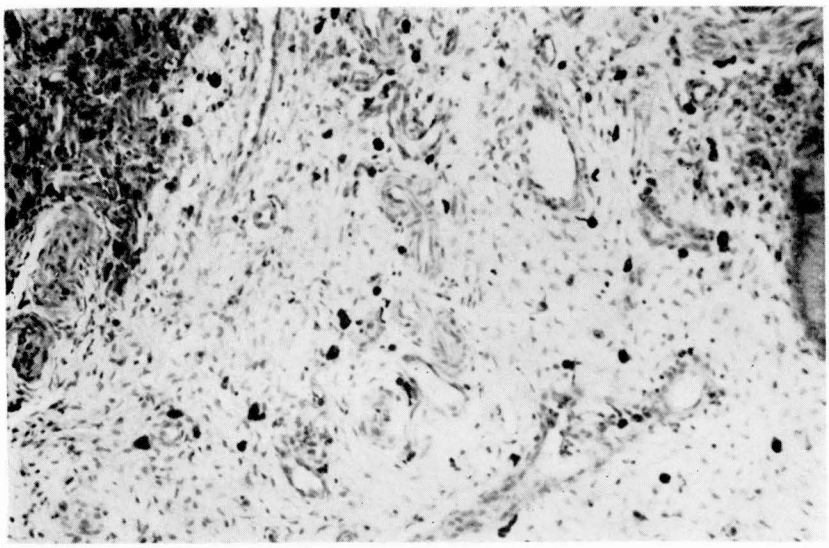

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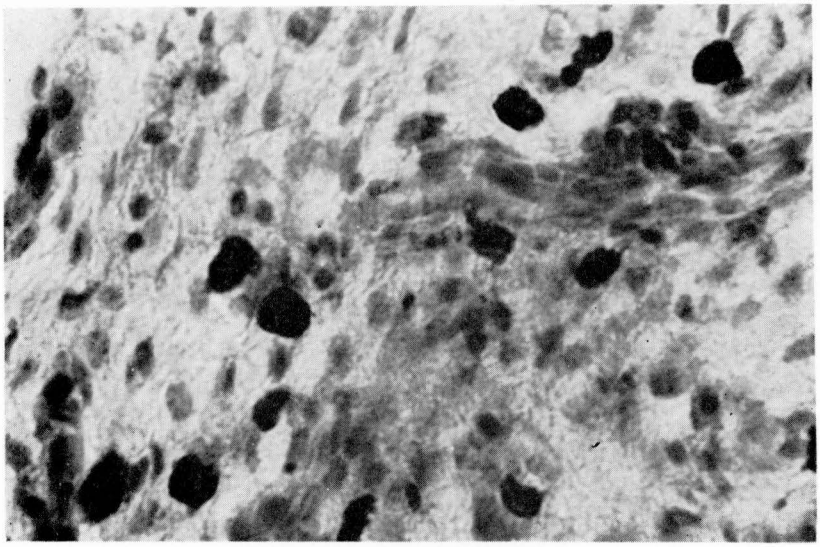

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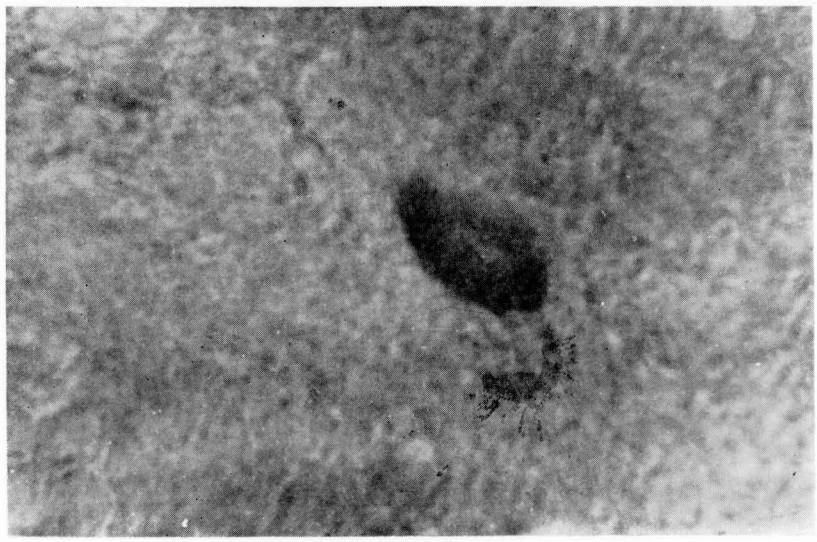

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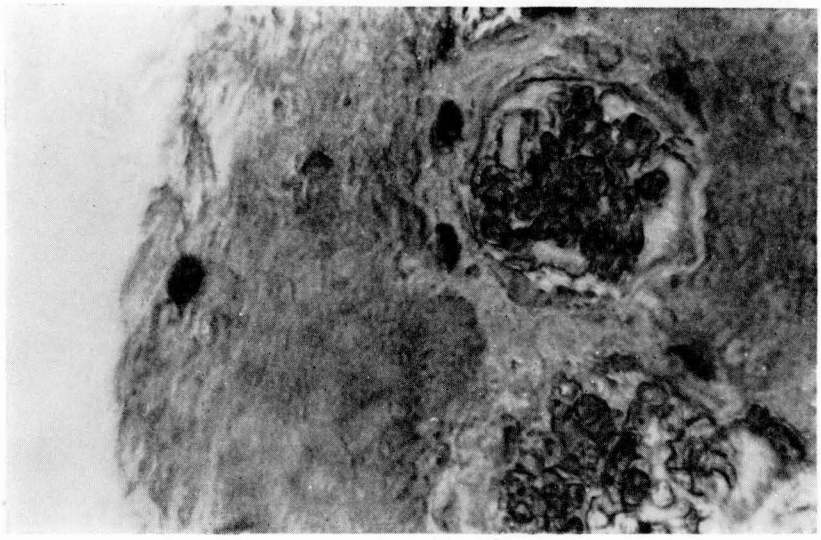

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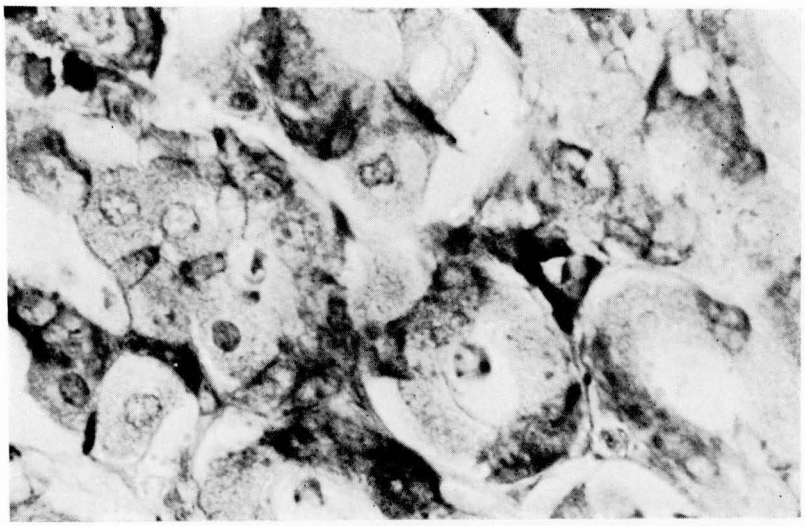

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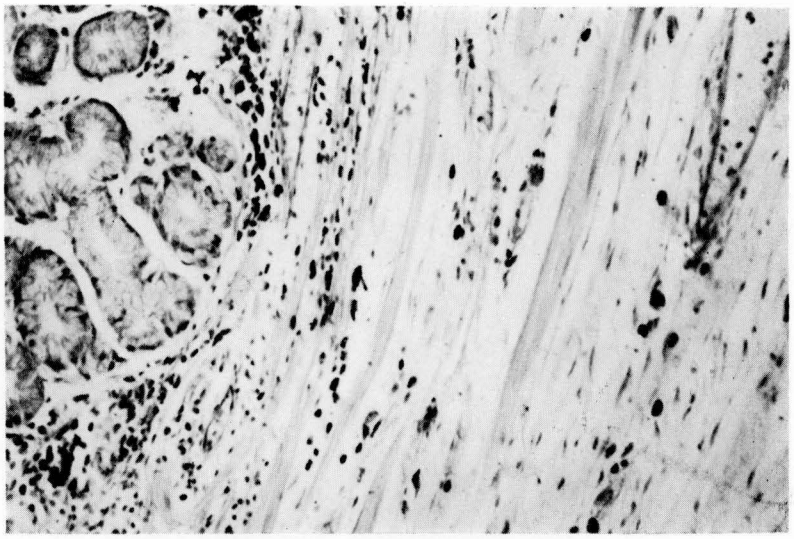

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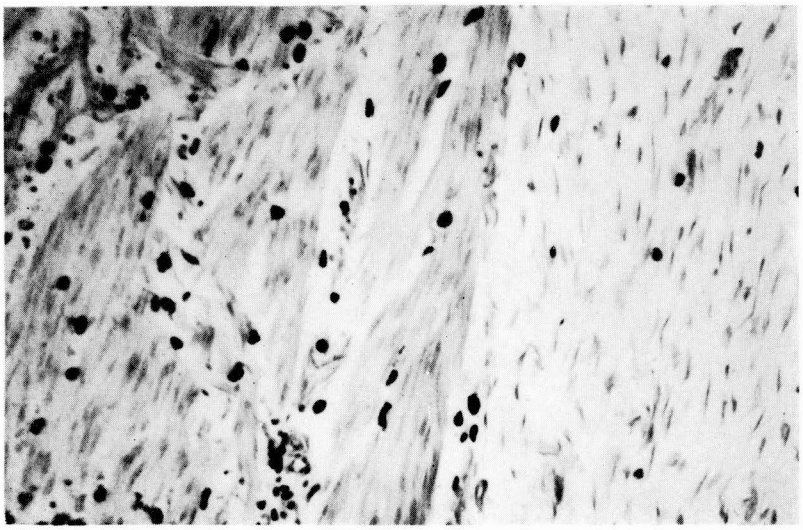

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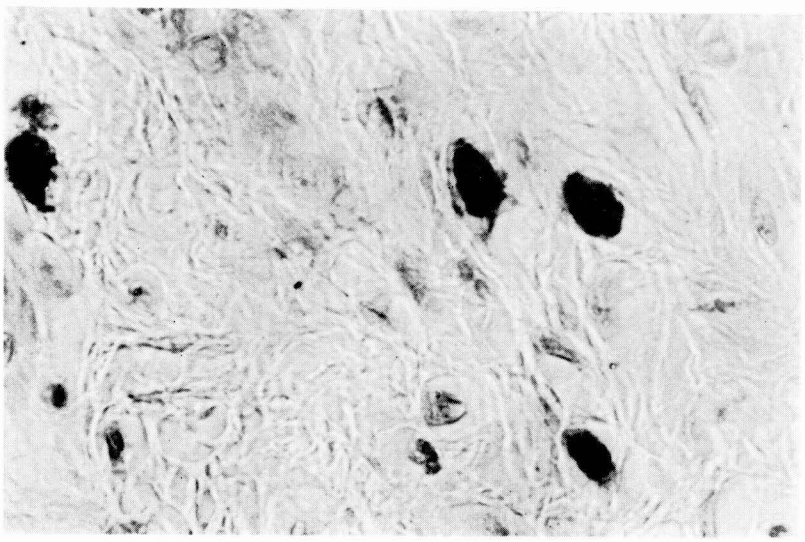

Photo 10