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# HISTOPATHOLOGICAL STUDIES ON BOVINE MAMMARY GLAND

## IV. MASTITIS IN SLAUGHTERED COW

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### INTRODUCTION

As an index for diagnosis of mastitis, it is natural to attach the importance to the results of the detection of abnormal component and of bacteria in milk. However, since a well defined parallel relationship between the two does not always exist, the authors are considering that there exist such an actual state as the diagnosis of mastitis based on the results of milk examination necessarily cannot help becoming artificial and conventional procedures. As to the problem of mastitis, whereas hitherto investigations have been apt to focalize on the judgement of the quality of milk, the authors have arrived at the opinion that from the viewpoint of improvement of efficiency of dairy cows further and more intensive scrutiny should be made. In this sense, the authors have investigated the bovine mammary gland from the histopathological standpoint, and have expected amplification and intensification of the knowledge on mastitis. In the present paper attempts are to be made to allude to a general idea of the pathology of mastitis, centering around histological findings in the slaughtered bovine mammary gland indiscriminately collected in 1956.

### MATERIALS AND METHODS

In the present paper, the mammary glands of totally 143 cases, 114 cases collected from meat packing plants of many places in Hokkaido and 29 cases from Ohtsuka meat packing plant in Gifu, were used as investigated materials. These materials were collected indiscriminately regardless of the presence or absence of mastitis found by lifetime inspection, and a part of them were subjected to bacterial culture. As for the procedure of the mammary

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glands and the preparation of samples, the methods have mentioned in report I<sup>D</sup>. The number of examined tissue blocks from which section preparations were made were usually 4 block sections in every quarter and the total number of the section preparations was 822.

## RESULTS

### A. Descriptions of Cases

In 53 out of the total 143 cases no inflammatory changes could be seen in any of the section preparations. When the remaining 90 cases were classified according to the report I, the results were as seen in Chart I. In the first place, descriptions of the cases will be made on some of these, in each paragraph. In the description of microscopical findings, section preparation numbers such as Anterior 1, Posterior 2...etc. indicate the sites which were sampled from the ventral parts to dorsal parts of the udder.

#### 1. Cases in which foci of mastitis alveolaris were detected

Cases classified under this paragraph numbered 53 (37.1%). These cases consisted of 22 cases (1 quarter), 27 cases (2 quarters), 1 case (3 quarters) and 3 cases (4 quarters) according to the number of quarters examined. The total number of examined section preparations was 217.

##### *Case 1* TM 3 5 years of age

Findings in lifetime: No remarkable changes were seen.

Macroscopical findings: Diluted milk flowed out from all 4 quarters. The parenchyma appeared orangish in color and slightly swelled granularly in the cut surfaces. All areas of the mucous membrane of the lactiferous sinus and duct were smooth and no focal lesions existed.

##### Microscopical findings:

Teats: No remarkable changes were seen. Left anterior 2: There existed intermingled inactive, transitional and active features of the parenchyma. Left anterior 3: The parenchyma showed active features. In 3 acinar groups inflammatory changes were present. In addition acinar lumina containing a small number of leukocytes were scattered. Left anterior 4: Active features of the parenchyma. In 9 acinar groups inflammatory changes were present. Acini containing leukocytes in the lumen were seen numerously (Report I, Fig. 1).

*Summary of findings:* Among the 4 section preparations from the left anterior quarter, 2 section preparations (upper and middle glandular parts) showed a total of 12 foci of mastitis alveolaris.

##### *Case 2* TM 18 5 years of age

Findings in lifetime: This case was still producing milk.

Macroscopical findings: The udder was small in size. Milk flowed out from the cut surfaces. The parenchyma was orange-yellowish in color and the interstitial tissue was fine and distinct. The mucous membrane of the lactiferous sinus and duct was whitish in color and smooth.

##### Microscopical findings:

Left anterior 1: Inactive features of the parenchyma existed among active features. Inflammatory changes were seen in 7 acinar groups of the mammary gland tissue (Report I, Figs. 3 & 4). Left anterior 2: The parenchyma was the same as just above. In 8 acinar groups inflammatory changes were seen (Report I, Fig. 2). Left anterior 3: The parenchyma showed active features. Inflammatory changes were seen in 11 acinar groups. Left posterior 1: Inactive features of the parenchyma existed among active features. Inflammatory changes were seen in 8 acinar groups. In Gram-Weigert stained section preparations in the exudate of the lumina, organisms resembling streptococci were stained out. Left posterior 2: The parenchyma showed active features. Inflammatory changes were seen in 8 acinar groups. In addition acini containing leukocytes in the lumen were sporadically seen. Left posterior 3: Active features of the parenchyma. Inflammatory changes were seen in one acinar group (Report I, Fig. 7).

*Summary of findings:* In all 6 section preparations from both left quarters total 43 foci of mastitis alveolaris were seen. Organisms resembling streptococci were positive in exudate.

*Case 3* TM 23 6 years of age

Findings in lifetime: 7~8 months of pregnancy.

Macroscopical findings: Size of the udder was normal. The milk flowed out in the cut surfaces of the left quarters. The cut surface was swollen and showed slightly granular appearance. The surrounding tissue around the lactiferous sinus was well developed. The parenchyma was generally orange-yellowish in color, and the interstitial tissues were fine and edematous.

Microscopical findings:

Left anterior 1: Inactive features of the parenchyma existed among active features. Left anterior 2: The parenchyma showed active features and 5 acinar groups showed inflammatory changes (Report I, Figs. 5 & 6). Left anterior 3: The parenchyma was the same as just above. Inflammatory changes were seen in 2 acinar groups. Left posterior 1: Inactive features of the parenchyma existed among active features. Left posterior 2: The parenchyma showed active features. In one acinar group inflammatory changes were seen. Left posterior 3: The parenchyma was the same as just above. In 4 acinar groups inflammatory changes were seen.

*Summary of findings:* In 6 section preparations from both left quarters, 2 section preparations (middle and upper glandular parts) showed a total of 12 foci of mastitis alveolaris.

*Case 4* M 47 7 years of age

Findings in lifetime: In March 1955 prolapsus uteri post partum occurred. In May artificial insemination was made. A greyish white pus-like viscous mucus was excreted until time of slaughter.

Macroscopical findings: No remarkable changes were seen.

Microscopical findings:

Left anterior 1: Transitional features of the parenchyma. Inflammatory changes were seen in 35 acinar groups. The inflammation were seen multiply in a single lobule and some of the foci showed tendency of mastitis lobularis. Left anterior 2: The parenchyma was the same as just above. Inflammatory changes were seen in 24 acinar groups. Lactiferous duct of the left anterior quarter: The parenchyma was the same as just above. Inflammatory changes were seen in 14 acinar groups. Lactiferous sinus of the left anterior quarter: The

parenchyma was the same as just above. Inflammatory changes were seen in 4 acinar groups. Left posterior 1: The parenchyma showed active features. In 32 acinar groups inflammatory changes were seen (Fig. 1). Left posterior 2: The parenchyma was the same as just above. Inflammatory changes were seen in 40 acinar groups. Lactiferous duct of the left posterior quarter: The parenchyma showed inactive features. Lactiferous sinus of the left posterior quarter: Active features of the parenchyma existed among inactive features.

*Summary of findings:* Among 8 section preparations of the both left quarters 6 section preparations (consisting mainly of glandular parts) had a total of 149 foci of mastitis alveolaris.

*Case 5* TM 106 12 years of age

Findings in lifetime: Pregnant and producing milk.

Macroscopical findings: No remarkable changes were seen.

Microscopical findings:

Anterior 1: Inactive features of the parenchyma existed among active features. Anterior 2: Inactive features of the parenchyma existed among transitional features. Inflammatory changes were seen in 22 acinar groups. Posterior 1: Active features of the parenchyma existed among inactive features were seen. Posterior 2: The parenchyma was the same as just above. Inflammatory changes were seen in 4 acinar groups. Posterior 3: Inactive and transitional features of the parenchyma showed half and half. Inflammatory changes were seen in 14 acinar groups.

*Summary of findings:* In 3 (middle and upper glandular parts) of 5 section preparations from one side of the udder, a total of 40 foci of mastitis alveolaris were seen.

*Case 6* TM 26 13 years of age

Findings in lifetime: Producing milk.

Macroscopical findings: Right quarters of the udder were slightly enlarged. A large amount of milk flowed out from the cut surface. Proliferation of the interstitial tissue was seen in the upper part of the posterior quarter.

Microscopical findings:

Right anterior 1: Transitional and inactive features of the parenchyma were seen intermingled together. In one acinar group inflammatory changes were seen. Right anterior 2: The parenchyma was the same as just above. In 2 acinar groups inflammatory changes were seen (Report I, Figs. 8 & 9). Right posterior 1: The parenchyma showed transitional features and inflammatory changes were seen in 14 acinar groups. Right posterior 2: The parenchyma was the same as just above. In 22 acinar groups inflammatory changes were seen. Right posterior 3: Transitional and inactive features of the parenchyma were seen intermingled together. Inflammatory changes were seen in 5 acinar groups.

*Summary of findings:* All of the 5 section preparations (upper, middle and lower glandular parts) in one side of the udder showed a total of 44 foci of mastitis alveolaris.

*Case 7* M 75 Age unknown

Findings in lifetime: Unknown.

Macroscopical findings: No remarkable changes were seen.

Microscopical findings:

Right anterior 1 and 2: The parenchyma showed transitional features. Lactiferous duct of the right anterior quarter: The parenchyma was the same as just above. Some of the acini contained leukocytes in the lumina. Lactiferous sinus of the right anterior quarter:

The parenchyma was the same as just above. Inflammatory changes were seen in 2 acinar groups. Right posterior 1: The parenchyma showed transitional features. In one acinar group inflammatory changes were seen. Some of the acini contained leukocytes in the lumina. Right posterior 2: The parenchyma was the same as just above. Lactiferous duct of the right posterior quarter: The parenchyma was the same as just above. Some of the acini contained leukocytes in the lumen were seen. Lactiferous sinus of the right posterior quarter: The parenchyma was the same as just above. Inflammatory changes were seen in 3 acinar groups. Left anterior 1: The parenchyma showed transitional features. In 12 acinar groups inflammatory changes were seen. Acini containing leukocytes in the lumen were numerous seen. Left anterior 2: The parenchyma was the same as just above. Lactiferous duct of the left anterior quarter: The parenchyma was the same as just above. In 12 acinar groups inflammatory changes were seen. Lactiferous sinus of the left anterior quarter: The parenchyma was the same as just above. Left posterior 1: The parenchyma was the same as just above. In 13 acinar groups inflammatory changes were seen. Acini containing leukocytes in the lumen were numerous seen. Left posterior 2: The parenchyma was the same as just above. In 10 acinar groups, inflammatory changes were seen. Lactiferous duct and sinus of the left posterior quarter: The parenchyma was the same as just above.

*Summary of findings:* A total of 53 foci of mastitis alveolaris were seen in 7 (each part of the udder) out of 16 section preparations from the 4 quarters.

## 2. Cases in which foci of mastitis lobularis were detected

There were 16 cases (11.2%) coming under this category, namely 5 cases (1 quarter), 6 cases (2 quarters), 1 case (3 quarters) and 4 cases (4 quarters) according to the number of quarters examined. The total number of section preparations examined came to 138. Twelve cases out of all the cases showed foci of mastitis alveolaris at the same time. Moreover, 7 cases out of the cases of mastitis lobularis were cases of granulomatous staphylococcal mastitis, which were described in report III<sup>3</sup>).

*Case 8* M 60 6 years of age

Findings in lifetime: Sterility.

Macroscopical findings: No remarkable changes were seen.

Microscopical findings:

Right 1: The parenchyma showed transitional features and acini containing leukocytes in the lumen were seen sporadically. Right 2: The parenchyma was the same as just above. Inflammatory changes were seen in 7 acinar groups and in 2 lobules. Lactiferous duct of the right quarter: The parenchyma showed inactive features of the parenchyma. Inflammatory lesions were seen in 3 acinar groups. Acini containing leukocytes in the lumen were seen sporadically. Lactiferous sinus of the right quarter: The parenchyma showed inactive features.

*Summary of findings:* In 2 (middle glandular part and area of the lactiferous duct) out of 4 section preparations from one quarter, a total of 10 foci of mastitis alveolaris were seen. Further, in the former section preparation 2 foci of mastitis lobularis were seen.

*Case 9* TM 52 8 years of age

Findings in lifetime: Sterility.

Macroscopical findings: No remarkable changes were seen.

## Microscopical findings :

1: The parenchyma showed transitional features. Emigration of eosinophil leukocytes was seen in the interstitial tissue. Inflammatory changes were seen in one lobule. 2: The parenchyma showed transitional features. 3: The parenchyma showed active features.

*Summary of findings* : In one (lower glandular part) out of 3 section preparations from one quarter, a single focus of mastitis lobularis was seen.

*Case 10* M 58 9 years of age

Findings in lifetime : Inanition due to liver distomiasis.

Macroscopical findings : No remarkable changes were seen.

## Microscopical findings :

Right anterior 1, 2 and lactiferous duct: The parenchyma showed transitional features. Right anterior lactiferous sinus: The parenchyma was the same as just above. In one lobule inflammatory changes were seen. Right posterior 1, 2 and lactiferous duct and sinus: The parenchyma was the same as just above. Left anterior 1: The parenchyma showed transitional features. Left anterior 2: The parenchyma was the same as just above. Two inflammatory lesions were seen respectively as large as a acinar group and a lobule. Lactiferous duct of the left anterior quarter: The parenchyma showed transitional features. Lactiferous sinus of the left anterior quarter: The parenchyma showed inactive features. Left posterior 1: The parenchyma showed transitional features. Two inflammatory lesions were seen respectively as large as an acinar group and a lobule. Left posterior 2: The parenchyma was the same as just above. Inflammatory changes were seen in 13 acinar groups and 3 lobules. Lactiferous duct of the left posterior quarter: The parenchyma was the same as just above. Inflammatory changes were seen in 12 acinar groups and 3 lobules. Lactiferous sinus of the left posterior quarter: The parenchyma showed inactive features.

*Summary of findings* : In 4 (upper and middle glandular parts and the lactiferous duct of the 2 quarters) out of 16 section preparations of 4 quarters, a total of 27 foci of mastitis alveolaris were seen. Also in the same 4 section preparations a total of 8 inflammatory lesions were seen as large as a lobule and in the other one section one inflammatory lesion was seen as large as a lobule.

*Case 11* TM 10 10 years of age

Findings in lifetime : Unknown.

Macroscopical findings : No abnormalities were seen.

## Microscopical findings :

Left anterior 1, 2 and 3: The parenchyma showed transitional features. Left posterior 1: The parenchyma was the same as just above. Inflammatory changes were seen in one acinar group and one lobule (Fig. 2). Left posterior 2: The parenchyma was the same as just above. A single acinar group showed inflammatory changes. Left posterior 3: The parenchyma showed inactive features, and there existed transitional features among inactive features. One acinar group showed inflammatory changes.

*Summary of findings* : Three section preparations of one quarter (each sites) out of 6 from the left 2 quarters showed 3 foci of mastitis alveolaris and 1 focus of mastitis lobularis.

### 3. Cases of mastitis diffusa

Cases listed in this category numbered 21 (14.7%); these cases consisted of 9 cases

(1 quarter), 7 cases (2 quarters), 3 cases (3 quarters) and 2 cases (4 quarters) classed by the number of quarters examined. The total number of examined section preparations was 203. Of all the cases, 7 cases simultaneously possessed foci of mastitis alveolaris and one case simultaneously possessed foci of mastitis lobularis.

*Case 12* TM 69 6 years of age

Findings in lifetime: Good condition of nutrition, but not milked.

Macroscopical findings: The udder was atrophied.

Microscopical findings:

Right posterior 2: Transitional features of the parenchyma existed among inactive features. Right posterior 3: The parenchyma was the same as just above. Inflammatory changes were seen in 9 acinar groups. Some of the foci were seen in one and the same lobule. Right posterior 4: The parenchyma showed transitional features. Numerous darkly stained parts were already seen scattered with naked eye. These were all inflammation sites as large as a lobule and intralobular lactiferous ducts in the lesions showed inflammatory changes, also. Colonies of bacteria were seen in the foci.

*Summary of findings:* In one (middle glandular part) out of 3 section preparations in one quarter 9 foci of mastitis alveolaris were seen. In addition in another one section preparation numerous foci of mastitis lobularis were seen.

*Case 13* TM 43 7 years of age

Findings in lifetime: Parturition on 2/IX '56. No changes were seen until next evening. Abnormalities were noted from early morning of 4/IX '56; T. 40°C., P. 120; At 1.00 P. M. abnormalities were noted in the udder. No improvement of general conditions was noted in the evening; dysorexia, adipsia and disappearance of peristalsis were seen; the left anterior teat and a portion of the ventral part of the udder were greyish white to blackish violet in color; the left lateral side was also discolored slightly. This case was diagnosed as mastitis gangrenosa.

Macroscopical findings: Bacterial culture of the various glandular tissues showed *Escherichia coli* markedly positive.

Milk:--Left anterior: Yellowish in color and normal. Left posterior: Bloody in color. Right anterior: Yellowish red in color. Right posterior: Yellowish red in color.

Udder:--Large in size. The shape was almost normal. The appearance of the cut surfaces was as follows. Left anterior: Greyish yellow in color. The cut surface was slightly swollen and milk overflowed. No abnormal contents were seen in the teat canal and the lactiferous sinus and the mucous membrane showed normal appearance. The parenchyma consisted of secretory tissue and the interstitial tissue was fine. Left posterior: The cut surfaces showed slight swelling, while the lactiferous sinus, and 1/3 portion of the ventral and 1/3 portion of the posterior glandular parts were dark-reddish in color. In addition, in the other glandular parenchymal tissue, various-sized reddish spots were seen numerously. In general, increase in hardness of the parenchyma and exsiccated appearance were seen. The parenchyma possessed orangish, reddish or dark-reddish tones in color. Diffuse hemorrhages were seen in the mucous membrane of the lactiferous sinus, and in the mucous membrane of the lactiferous duct of the ventral and posterior glandular parts. Right anterior: The mucous membrane of the lactiferous sinus was dark-reddish in color, while marked hemorrhages together with increase in hardness were seen in the surrounding parenchyma

and the dorso-anterior glandular part. The figure of the acinus was obscure. Dark-reddish spotted parts were seen sporadically. The interstitial tissue had a fine appearance. Right posterior: The mucous membrane of the lactiferous sinus was dark-reddish in color with numerous petechiae in the surrounding tissue. The dorso-posterior glandular part showed marked hemorrhages and increase in hardness.

Microscopical findings:

Left anterior 1: Inactive and transitional features of the parenchyma were seen intermingled each other. Left anterior 2: Transitional features of the parenchyma. Left anterior 3: The parenchyma was the same as just above. The interstitial tissue was edematous. Left posterior 1 (Fig. 3), 2 and 3: Inactive features of the parenchyma. The interstitial tissue showed hemorrhages and edema. Numerous bacterial colonies were seen in the acini and lactiferous ducts. Partial desquamation of the epithelia of the acini and small lactiferous ducts was seen. Emigrating cells were a few. Left posterior: Intralobular lactiferous ducts showed inflammation accompanying with marked hemorrhages. Right anterior 1, 2 and 3: Active features of the parenchyma. Inflammatory changes were seen in the interstitial tissue and the lactiferous duct. The parenchyma was showed slight inflammatory changes. Right posterior 1: The interstitial tissue and the lactiferous duct showed initial inflammatory changes. Right posterior 2: Inactive features of the parenchyma. Right posterior 3: The parenchyma was the same as just above. There were focal hemorrhages.

*Summary of findings:* With the exception of the events in the left anterior quarter and the dorsal parts of the right anterior and posterior quarters, hemorrhages and edema were exceedingly conspicuous and numerous bacterial colonies were seen. The interlobular and intralobular lactiferous ducts showed acute catarrhal inflammatory changes.

*Case 14* TM 28 8 years of age

Findings in lifetime: Traumatic subcutaneous hematoma in the left udder.

Macroscopical findings: Left anterior: The interstitial tissue was fine. In the lactiferous duct grey-yellowish flocculi were contained. Left posterior: No abnormalities were seen in the glandular tissue. Right anterior: The same as just above.

Microscopical findings:

Left anterior 2, 3, 4 and 5: Transitional features of the parenchyma existed among inactive features. The epithelial cells of the lactiferous duct increased in number and the wall of the lactiferous duct increased its thickness; emigration of a large number of inflammatory cells consisting mainly of plasma cells was seen in the submucosa and interstitial tissue. In some parts metaplasia of the epithelia of the lactiferous duct was seen (Report I, Figs. 27 & 35). Left posterior 2: Both transitional and inactive features were seen intermingled in the parenchyma. Subacute inflammatory features were seen in the interlobular lactiferous ducts. Left posterior 3: The parenchyma was the same as just above. Numerous leukocytes were seen in the acinar lumina. Left posterior 4: The parenchyma was the same as just above. Inflammatory changes were seen in one acinar group. Left posterior 5 and 6: Inactive and transitional features were seen in approximately equal proportions in the parenchyma. Right anterior 2: The parenchyma was the same as just above. Right anterior 3: The parenchyma showed transitional features. Inflammatory changes were seen in one acinar group. Right anterior 4: The parenchyma was the same as just above. In 5 acinar groups inflammatory changes were seen. Right posterior 3 and 4: The parenchyma was the

same as just above. Right posterior 6 and 7: The parenchyma showed transitional features.

*Summary of findings:* Figures of mastitis diffusa subacuta were seen in the most of the ventral part of the left anterior quarter and the ventral part of the left posterior quarter. In addition, independently of these changes in 3 section preparations from 3 quarters a total of 7 foci of mastitis alveolaris were seen.

*Case 15* TM 29 8 years of age

Findings in lifetime: Chronic mastitis was seen in the right anterior quarter. The other quarters were still producing milk.

Macroscopical findings: Right anterior: The majority of the part from the teat to 3/4 of the ventral part of the mammary gland tissue consisted of connective tissue and at the dorsal portion of the lactiferous sinus a child's-head-sized spherical cavity was seen. The cavity was filled with a malodorous turbid liquid and whitish solid substances. The inner surface of the cavity was smooth and greenish or reddish in color. The wall itself was thick and showed gradual transition into the surrounding interstitial tissue, and in the area where the upper part of the quarter and the adjacent quarter were bounded, remainder of the atrophic parenchyma was noted. As the result of bacterial culture, streptococci and corynebacterium were detected in the cavity. In other everywhere staphylococci and streptococci were positive.

Microscopical findings:

Right anterior 2 and 4: Stratified epithelia were seen in the wall of the cavity. In the connective tissue inactive features of the parenchyma were embedded. Right anterior 5: Dilatation of the lactiferous duct was seen. Right posterior 2: The parenchyma showed transitional features. In one acinar group inflammatory changes were seen. Right posterior 3: The parenchyma was the same as just above. Inflammatory changes were seen in 3 acinar groups. Right posterior 4: The parenchyma was the same as just above. Inflammatory changes were seen in 4 acinar groups. Right posterior 5: The parenchyma was the same as just above. Right posterior 6: The parenchyma was the same as just above. In 6 acinar groups inflammatory changes were seen. Left anterior 2: Transitional and inactive features of the parenchyma were seen intermingled. In one lobule inflammatory changes were seen. Left anterior 3: The parenchyma was the same as just above. Inflammatory changes were seen in 6 acinar groups. Left anterior 4: The parenchyma was the same as just above. In 7 acinar groups inflammatory changes were seen. Left posterior 2: The parenchyma showed transitional features. Left posterior 3: The parenchyma was the same as just above. In 2 acinar groups inflammatory changes were seen. Left posterior 4: The parenchyma was the same as just above. In 2 acinar groups inflammatory changes were seen.

*Summary of findings:* As a subsequent feature of mastitis diffusa chronica formation of large cavity (right anterior quarter) and fibrosis in the surrounding wide-spread area were seen. In addition in 8 other section preparations 31 foci of mastitis alveolaris and in one other section preparation a single focus of mastitis lobularis were seen.

*Case 16* TM 15 9 years of age

Findings in lifetime: Mastitis (left under).

Macroscopical findings: The udder was remarkably large in size. In the left anterior quarter and the ventral part of the right quarter a child's-fist-sized or hen-egg-sized indurations were palpated. At the cut surfaces in each quarter the lactiferous sinus and duct contained

a large amount of mucus-like substances mixed with pus-like yellowish-whitish flocculi. The mucous membrane had orangish in color and showed a roughness. The cut surfaces of the parenchyma were swollen and had an orangish yellow color. Yellowish white mucus-like substances filled up the small lactiferous duct. The induration areas mentioned above showed increase in width of the interstitium and contained cysts.

Microscopical findings :

Left anterior 2, 3 and 4: Galactophoritis and perigalactophoritis subacuta were seen. The parenchyma also showed inflammatory changes. Left anterior 5: The parenchyma showed transitional features. Subacute interstitial inflammatory changes were seen. Left posterior 3, 4 and 5: The parenchyma showed inactive features. Galactophoritis and perigalactophoritis were seen. The parenchyma also showed inflammatory changes. Left posterior 6 and 7: In the parenchyma slight passive inflammatory changes were seen. Right anterior 2, 3 and 4: Inactive and transitional features of the parenchyma were seen intermingled. Galactophoritis and perigalactophoritis were seen. Right posterior 3: The parenchyma was the same as just above. Galactophoritis and perigalactophoritis were seen. Right posterior 4: The parenchyma was the same as just above. Acute inflammatory changes in the interlobular tissue were seen. Right posterior 5: The parenchyma showed inactive features. Acute or subacute inflammatory features were observed (Report I, Fig. 33). Right posterior 6: The parenchyma showed inactive features. Galactophoritis and perigalactophoritis were seen; characters of both acute and subacute inflammatory changes were seen. Right posterior 7: The same as in right posterior 6 just above (Report I, Fig. 32). Right posterior 8: The parenchyma showed inactive features. Galactophoritis in the small lactiferous duct and indications of passive parenchymatous inflammation were seen. Right posterior 9: The parenchyma was the same as just above. Intralobular fibrosis was seen. Right posterior 10: The same as right posterior 8 (Report I, Figs. 28 & 29).

*Summary of findings:* In all 4 quarters, features of galactophoritis and perigalactophoritis were seen; subacute inflammatory character is distinct excepting in the interstitial tissue where there were extended inflammatory changes.

*Case 17* TM 22 9 years of age

Findings in lifetime: Mastitis.

Macroscopical findings: The udder was remarkably large in size and showed 3 to 4 times as large as the size of a man's head; hanging to such an extent that it slightly touched the ground. The teats were all short and thick. The skin of the udder was exceedingly thick and the ventral portion was solid to the touch. Considerable difficulty was encountered in the paring of the posterior quarters. Whereas paring in the anterior quarters was relatively easy, but the subcutaneous tissue of the anterior quarters was edematous. Left anterior quarter: The teat was small in size. No abnormal contents were seen in the lumen. The mucous membrane was smooth and the lactiferous sinus was dilated with an approximately normal mucous membrane. Generally in the cut surfaces the parenchyma was swollen with granular appearance and was orangish in color. In the area of the lactiferous sinus the corresponding subcutaneous tissues were proliferated and the surrounding glandular tissue was atrophied; while the interstitial tissue showed remarkable proliferation accompanied with a scattering of cyst formation. No other focal lesions were seen. Left posterior quarter: Large in size and extremely solid to the touch. In the cut surfaces the lactiferous sinus

was completely occupied by connective tissue and its lumen could hardly be seen. Lumen of the teat barely remained. The parenchyma was barely seen in only a spotted form. The cut surfaces also showed an irregular depressions and in the dorsal glandular part remarkable proliferation of the interstitium was seen with yellowish glandular tissue lying dotted within. Right anterior quarter: Large in size. In the teat and the large lactiferous duct milk was contained and the mucous membrane was normal. The parenchyma was orange-yellowish in color and swollen with granular appearance and somewhat rich in blood. Area of the lactiferous sinus abounded in the interstitial tissue while the parenchyma was atrophic. Right posterior quarter: The subcutaneous tissue was thick, solid and edematous. The lumen of the lactiferous sinus was narrow. The adjacent parenchyma was fibrous and firm; proliferation of the interstitial tissue was seen and the parenchyma was dotted within the interstitium. In proportion to the dorsal site of the mammary gland, increase in width of the interstitium became inconspicuous.

Microscopical findings :

Left anterior 3: The parenchyma showed inactive features. Left anterior 4: Inactive features of the parenchyma existed among transitional features of the parenchyma. Left anterior 5: The parenchyma was the same as just above. One inflammatory lesion was seen as large as the acinar group. Left anterior 6: Inactive and transitional features of the parenchyma were seen intermingled together. Left posterior 2: This area was almost completely occupied by indurated part. Left posterior 3: Indurative and inactive features of the parenchyma were seen. Left posterior 4: The same as just above. Left posterior 5: The parenchyma showed transitional features and indurative appearance. Right anterior 3: Inactive and transitional features of the parenchyma were seen intermingled each other. Indurative appearance was seen. Right anterior 4, 5 and 6: The parenchyma showed transitional features. Right posterior 3: Transitional and inactive features of the parenchyma were seen intermingled together. Right posterior 4, 5 and 6: The parenchyma showed transitional features of the parenchyma.

*Summary of findings:* Remarkable induration was seen in the left posterior quarter. In one (middle part of the mammary gland) out of 16 section preparations from left and right both quarters, a single focus of mastitis alveolaris was seen.

*Case 18* TM 30 9 years of age

Findings in lifetime: Mastitis (Left udder).

Macroscopical findings: The left quarters were remarkably large in size, and the posterior quarter was especially solid to the touch and was more remarkable in the lower part. In the cut surfaces the lactiferous sinus was dilated; it was filled with malodorous pus; the wall was edematously thickened; proliferation of the granulation tissue surrounding the lactiferous sinus was remarkable. As a result of the bacterial culture streptococci were detected from the milk and parenchyma of the left posterior quarter.

Microscopical findings :

Left posterior 3: Inactive and transitional features of the parenchyma were seen intermingled together. Galactophoritis and perigalactophoritis subacuta were seen. Left posterior 4 and 5: The parenchyma showed transitional features. Both intralobular and interlobular galactophoritis were seen (Report I, Fig. 30). Right anterior 3, 4, 5, 6 and 7 showed inactive features of the parenchyma. Right posterior 1 and 2: The same as just above.

*Summary of findings:* Galactophoritis and perigalactophoritis subacuta were seen in the left posterior quarter.

*Case 19* M 4 10 years of age

*Findings in lifetime:* This case suffered from abdominal contusion in the previous year. Following an operation the mammary gland became suppurated.

*Macroscopical findings:* The right udder was swollen and solid to the touch.

*Microscopical findings:*

Right anterior 6 and 9: The parenchyma showed transitional features. Galactophoritis and perigalactophoritis acuta were seen. The parenchyma also showed inflammatory changes. The lactiferous sinus was filled with exudate. Right posterior 7 and 8: The same as just above. Left posterior 4, 5 and 6: Transitional features of the parenchyma. Left posterior 7 and 8: Inactive features of the parenchyma.

*Summary of findings:* Acute inflammation was seen in the lactiferous sinuses and ducts in both right quarters.

*Case 20* M 56 10 years of age

*Findings in lifetime:* Sterility.

*Macroscopical findings:* No remarkable changes were seen.

*Microscopical findings:*

Right anterior 1: Inactive features of the parenchyma existed among transitional features. Acute inflammatory changes were seen in the interlobular and intralobular lactiferous ducts (Fig. 4). The acini showed inflammatory changes in general (passive). Right anterior 2: Inactive features of the parenchyma. Some of the acini contained leukocytes in the lumen. Right anterior lactiferous sinus: Active features of the parenchyma existed among inactive features. Some of the acini contained leukocytes in the lumen. Right posterior 1: Transitional features of the parenchyma. In 6 acinar groups inflammatory changes were seen. Right posterior 2: The parenchyma was the same as just above. A single inflammatory lesion was seen as large as the acinar group. Right posterior lactiferous duct: The parenchyma was the same as just above. In 4 acinar groups inflammatory changes were seen. A considerable number of acini contained leukocytes in the lumen were seen. Right posterior lactiferous sinus: Inactive and transitional features of the parenchyma were seen intermingled. Inflammatory changes were seen in 4 acinar groups.

*Summary of findings:* In one out of 8 section preparations from one side of the udder, indications of acute diffuse, interlobular and intralobular galactophoritis were seen. As the same time in 4 other section preparations a total of 15 foci of mastitis alveolaris was seen.

*Case 21* TM 11 10 years of age

*Findings in lifetime:* Mastitis (Left udder).

*Macroscopical findings:* The udder was large in size. The left quarters were solid to the touch. In the left posterior quarter, in the lactiferous sinus and duct yellowish white flocculi were contained, while in some parts yellowish viscous liquid was contained. The mucous membrane showed a roughness.

*Microscopical findings:*

Left posterior 1: Both inactive and transitional features of the parenchyma were seen side by side. In the lumen of the interlobular and intralobular lactiferous ducts there were contained colonies of organisms resembling streptococci and it showed indications of acute

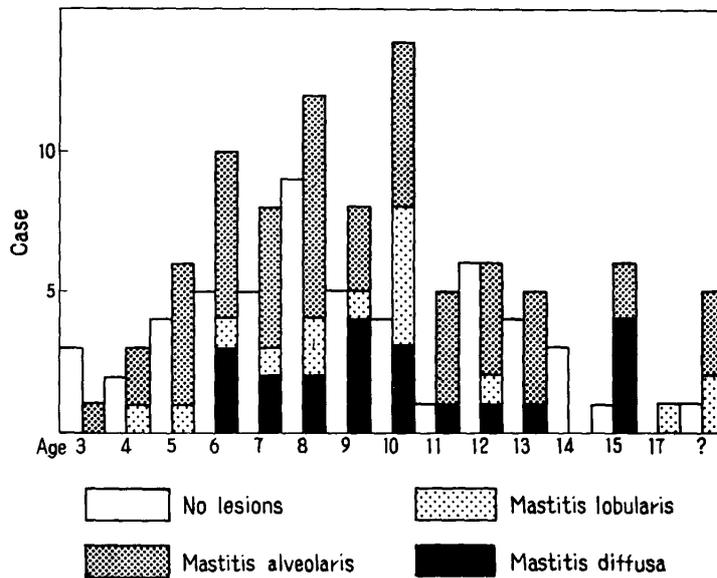
inflammation. Slight inflammatory changes were seen in the parenchyma. Left posterior 2: The same as just above (Report 1, Figs. 16 & 17). Left posterior 3: The same as just above. Left posterior 4: Transitional features of the parenchyma. One inflammatory lesion of the acinar group was seen. Left anterior 1: Transitional features of the parenchyma. Left anterior 2: The parenchyma was the same as just above. Three inflammatory lesions were seen as large as the acinar group. Left anterior 3: The parenchyma was the same as just above. Right posterior 1: The parenchyma was the same as just above. Inflammatory changes were seen in 9 acinar groups. Right posterior 2: Both transitional and inactive features were seen mixed together. A large number of acinar groups showed inflammatory changes and at the same time the lactiferous duct showed inflammatory changes.

*Summary of findings:* The larger part of the left posterior quarter and the right posterior quarter showed findings of mastitis acuta. In addition in 3 section preparations from 3 quarters a total of 13 foci of mastitis alveolaris was seen.

B. Mastitis alveolaris, Mastitis lobularis and Mastitis diffusa,  
Being Observed Mainly from Point of Calculation

In the mentioned above, there was described merely a part of the mastitis cases as divided into the 3 categories. In the present part, on the findings of the cases examined a summarized description will be done in each various item.

CHART 1



1. Incidence of mastitis lesions (Chart 1)

From the viewpoint of the number of cases, cases with detected foci of mastitis alveolaris showed the highest incidence (53 cases). This was followed by cases of mastitis diffusa (21 cases) and cases in which mastitis lobularis foci were detected (16 cases). However, 12 cases out of the cases with detected foci of mastitis lobularis and 7 cases out of the cases of mastitis diffusa possessed the foci of mastitis alveolaris at the same time; also in one case

out of the cases of mastitis diffusa, foci of mastitis lobularis were detected in parallel with the mastitis alveolaris foci. According to such a view-point, it comes to that foci of mastitis alveolaris were detected in 72 cases (80% of all the mastitis cases examined) and that foci of mastitis lobularis were detected in 17 cases (about 19% of all the mastitis cases examined).

## 2. Relationship of age and incidence of cases of mastitis foci (Chart 1)

It was found that cases in which foci of mastitis alveolaris and lobularis were detected existed throughout various age levels in general.

The following order is seen when the percentage of the cases in which mastitis foci were observed against all the examined cases was calculated and was compared by age: 15 years (86%), 11 years (83%), 10 years (78%), 6 years (67%), 7 and 9 years (62%), 4 and 5 years (60%), 8 years (57%), 13 years (56%), 12 years (50%) and 3 years (25%).

Next, it is noted that there were found no cases of mastitis diffusa in ages 3, 4 and 5 years. When the percentage of the cases of mastitis diffusa was calculated against the total mastitis cases including the cases of mastitis alveolaris and lobularis and was compared according to age, it comes as follows: 15 years (67%), 9 years (50%), 6 years (30%), 7 years (25%), 10 years (21%), 11 and 13 years (20%), 8 and 12 years (17%).

## 3. Relationship of cases of mastitis lesions and clinical findings

Of the cases in which foci of mastitis alveolaris were detected none supplied evidence from both lifetime nor macroscopical findings to indicate the presence of mastitis. However, it was noted that in a few cases irregularity of size and atrophy of the udder were reported. This may possibly be considered as figures of functional conversion. Next, in regard to the cases in which foci of mastitis lobularis were detected, it has been observed that 5 cases out of the 7 of granulomatous staphylococcal mastitis presented in report III<sup>3)</sup> showed induration by palpation and atrophy, etc.; these abnormalities were observed in lifetime or macroscopically.

## 4. Relationship of cases of mastitis lesions and the course

In all cases of foci of mastitis alveolaris in which no abnormalities were found in lifetime and in 9 cases except the 7 cases presented in report III<sup>3)</sup> among the cases of foci of mastitis lobularis, histopathologically only acute inflammatory lesions were proven. In regard to all the 7 cases of the granulomatous staphylococcal mastitis it was interpreted that they have run subacute or chronic process.

In regard to the mastitis diffusa cases, 14 out of 21 cases showed definite abnormalities in their lifetime. From the histological findings the cases may be classified as follows: 7 cases were of acute, 5 cases were of subacute and 2 cases were of chronic. Of the remaining 7 cases, 5 cases showed negative lifetime findings, however these were definitely diagnosed macroscopically as mastitis. These may also be classified histologically into acute 4 cases and subacute one case. Lastly the remaining 2 cases could not be diagnosed as mastitis diffusa either from lifetime or macroscopical findings. However, histologically it was definitely possible to diagnose these cases as mastitis diffusa (TM 69 & M 56).

## 5. The density of mastitis lesions and others

### a) In the case of lesions of mastitis alveolaris

According to the individual cases, it was done to calculate the average number of

TABLE 1. *The Average Number of Mastitis Foci in a Single Section Preparation*

	LESS THAN 1 FOCUS	LESS THAN 4 FOCI	MORE THAN 5 FOCI
Mastitis alveolaris*	36 cases	29 cases	7 cases
Mastitis lobularis**	13 "	2 "	2 "

\* Twelve cases of mastitis lobularis and 7 cases of mastitis diffusa were included

\*\* One case of mastitis diffusa was included

alveolar foci per a single section preparation. The circumstances are summarized in table 1. It is easily understood that if the foci were observed according to the individual cases in the majority of cases their average density would be found to be not high (in this connection, including cases complicated by other types of mastitis, the number of quarters examined were as follows: in one quarter 26 cases, in 2 quarters 34 cases, in 3 quarters 2 cases and in 4 quarters 10 cases.).

Further, also in the actual number of foci of mastitis alveolaris detected in each section preparation, the localized density was generally low. However, it was noted that among section preparations with more than 20 lesions, there existed 3 section preparations which had over 30 lesions (M 47, M 49) and 1 section preparation which had over 40 lesions (M 47) (Table 2).

TABLE 2. *Number of Lesions in Each Section Preparation*

	LESS THAN 4 FOCI	MORE THAN 5 FOCI	MORE THAN 10 FOCI	MORE THAN 20 FOCI
Mastitis alveolaris	125 section preparations	29 s.p.	24 s.p.	7 s.p.
Mastitis lobularis	20 s.p.	3 "	7 "	8 "

Next, the circumstances on the character of the mammary gland tissue in section preparations in which foci of mastitis alveolaris were detected are lumped together in Table 3.

TABLE 3. *Relationship of Number of Section Preparations in which Mastitis Foci Were Detected and Their Histological Character*

FEATURES OF THE PARENCHYMA	TRANSITIONAL	BOTH TRANSITIONAL AND INACTIVE	ACTIVE	BOTH ACTIVE AND INACTIVE	INACTIVE
Mastitis alveolaris	97 (425)	45 (199)	17 (153)	13 (83)	12 (26)
Mastitis lobularis*	8 (15)	1 (1)	1 (1)	5 (26)	19 (217)

Parenthesized numerals indicate the number of lesions

\* In the case of mastitis lobularis, groups of lobules are included

On account of the circumstances such as the investigated materials yielded, the examined section preparations (section preparations with no lesions included) consisted mainly of ones

in which the parenchyma showed transitional features and the features concerned. Therefore it is natural that foci of mastitis alveolaris were proven in larger number such section preparations as the parenchyma showed transitional features and the features concerned.

After all, from the data of Tables 2 and 3, it becomes apparent that foci of mastitis alveolaris were found in many section preparations such as the parenchyma showed transitional features and the features concerned, however, the number of foci found were small in number in the majority of cases. However, from Table 3, it is understood that found ratio-wise the number of foci is highest in section preparations which showed active features of the parenchyma and lowest in section preparations which showed inactive features. Namely the average number of lesions in a single section preparation is as follows: 9.0 (active features), 6.3 (both active and inactive features), 4.4 (both transitional and inactive features), 4.3 (transitional features) and 2.1 (inactive features).

b) In the case of foci of mastitis lobularis

According to the individual cases, it was done to calculate the average number of foci of mastitis lobularis per one single section preparation. The circumstances are summarized in Table 1. It is easily understood that if the foci were observed in each individual case in the majority of the cases average density of the foci is not high (in this connection, including cases complicated by other types of mastitis, the number of quarters examined were as follows: 1 quarter in 6 cases, 2 quarters in 6 cases, 3 quarters in 1 case and 4 quarters in 4 cases).

Also, in the actual number of foci of mastitis lobularis detected in each section preparation, the localized density was generally low (Table 2). However, it must be remembered that a single lobule is able to include at least more than 20 foci of mastitis alveolaris.

Further, the circumstance on the character of the mammary gland parenchyma in section preparations in which foci of mastitis lobularis or foci of lobular groups were detected, are presented in Table 3, en masse. Either in number of section preparations or foci, contrary to the case of mastitis alveolaris foci, it was shown that such an occasion as the parenchyma showed inactive features were most numerous. The average number of lesions in a single section preparation is in following order: 11 (inactive features), 5 (both inactive and active features), 2 (transitional features), 1 (both transitional and inactive features) and 1 (active features). This is approximately the opposite of the cases of foci of mastitis alveolaris.

c) In the case of mastitis diffusa cases

Contrary to the cases of mastitis alveolaris or lobularis foci it is not logical to consider the number of foci. In this case, with the exception of 2 cases, (TM 56, TM 69) in the remaining 19 cases, since lesions were recognized in the lifetime and at least macroscopically, it would seem appropriate to scrutinize the number of affected quarters and affected parts. Thus when the numbers of affected quarters are placed in order, the result thus: 1 quarter in 9 cases, 2 quarters in 7 cases, 3 quarters in 3 cases and 4 quarters in 2 cases. Further, when the frequency of affection by quarters is expressed in the order of the number of cases, the sequence is as follows: right posterior quarter in 13 cases, left posterior quarter in 11 cases, left and right each anterior quarter in 7 cases respectively.

After all it was shown that cases of one or two quarters affected with mastitis diffusa. As to the frequency of lesions by quarters it was shown that more than half of the cases were found in the posterior quarter. Further, when a survey of affected parts in each quarter

was made, it was shown that there were 8 cases (11 quarters) in which the dorsal part of the mammary gland was maintaining a normal feature.

#### 6. Relation between histological findings and results of bacterial detection

##### 6. Relation between histological findings and results of bacterial detection

In the cases of mastitis alveolaris foci, organisms resembling streptococci were stained out in one focus of the TM 18. In the other one case (TM 17) corynebacterium and staphylococci were detected from the milk of the left posterior and right anterior quarters, however, in 10 section preparations from the corresponding quarters, no lesions were found.

Next, in the cases of mastitis lobularis foci, while not all 21 cases are subjected to bacterial culture, the 7 cases described in report III<sup>3)</sup>, were histologically diagnosed as staphylococcal.

In regard to the cases of mastitis diffusa, 6 cases were subjected to bacterial culture; from the milk and lesions, streptococci in 3 cases (TM 41, TM 30, TM 2) and from the lesions corynebacterium, and streptococci and staphylococci in one case (TM 29), and corynebacterium and streptococci in one case (TM 36), were detected positively. Furthermore, in the tissue of the lesions in one case (TM 11) organisms resembling streptococci were stained out. As a special case, in the culture and histological findings, one case can be cited in which *Escherichia coli* played an important role in the pathogenesis (TM 43).

### DISCUSSION

In regard to the character of the lesions information has presented in report I<sup>1)</sup>; the histological features of the mammary gland due to functional conversion have previously reported in report III<sup>3)</sup>. Therefore, in the present paper only 21 cases were picked out and described.

From the present findings, features of mastitis alveolaris, mastitis lobularis and mastitis diffusa are not only easily differentiated, but also in the former 2 types it is not very difficult to count the number of foci. However, in the cases of foci of mastitis lobularis, when many foci were found in a single section preparation, some of the cases were dealt with as showing lobular groups of lesions. At any rate, in the foci of mastitis alveolaris and mastitis lobularis, it is characteristic that inflammatory processes are situated mainly in the acini as parenchyma. Therefore, the intralobular and interlobular lactiferous ducts present nearly normal appearance. However, as seen in the case descriptions, emigrated cells were seen diffusely in the lumen of the acini or the interstitial tissue other than the focal lesions in a considerable number of section preparations, but considering normal features in epithelial cells of the acini, etc., the authors decided to disregard these changes. Etiologically, the authors only find the fact that in only a single section preparation (TM 18) organisms resembling streptococci were clearly stained out. This was probably due to the fact that the multiplication of bacteria was weak contrary to the case of foci of galactophoritis which will be discussed in the following.

On the other hand in regard to mastitis diffusa its character is already a matter of common knowledge in veterinary medicine hence it will not be necessary to dwell on this point. In short, while there is no doubt as to its being mastitis, event which exhibits the precursory changes of mastitis and also plays an important role in mastitis is galactophoritis. In regard to this the present 2 acute initial cases will be sufficient to explain the above meanings. Furthermore, it would seem that etiologically streptococci play an important role in mastitis diffusa. It is pointed out here that TM 43 is an exception; it was shown to be caused by *Escherichia coil*, and the pathological changes were characterized by extensive hemorrhages and edema in parallel with galactophoritis catarrhalis.

In the present paper it was the writers' hope to make an intensive critical observation on the quantitative circumstances of mastitis alveolaris and mastitis lobularis. As previously shown in the tables presented, it may be said in general that the number of the lesions encountered in the section preparations was not necessarily large. However, when the udder is considered as a whole, it may easily be surmised that a considerable number of macroscopically invisible small lesions of this kind are scattered throughout the udder; at the same time, it may not uncommon that numerous occurring foci of mastitis alveolaris within a single lobule would eventually develop into foci of mastitis lobularis. In addition, from the character of pathological changes the foci of mastitis alveolaris were almost entirely of acute features and even in the foci of mastitis lobularis, with the exception of 7 cases diagnosed as staphylococcal, 9 cases showed acute or subacute features. In other words, it may be surmised from a pathogenetic point of view that in the parenchyma of the mammary gland, minute acinar group lesions appear sporadically or multiply, and on such occasions as the lesions are numerous the inflammatory process may possibly show retrogression or disappearance after the lapse of time. However, in the staphylococcal mastitis cases, such process may developed into granulomatous lesions; even in such cases, from the view point of advance in lesions, it could not be accepted that these lesions were diffusely extended intracanalicularly or through the interstitial tissue. The foci of mastitis alveolaris and mastitis lobularis may tend to terminate to the end as focal lesions; however, cases in which a large number of lesions appeared multacentrally or were seen close together actually existed; thus it must be said that there is sufficient bases for the diagnosis of mastitis on the mammary gland which contain such small lesions. Moreover, one must not forget the importance of the fact that, in the case of granulomatous staphylococcal mastitis, it is possible to recognize the presence of small indurated foci by careful palpation in lifetime.

Next, the character of the parenchyma where lesions are present will be discussed briefly. In the case of foci of mastitis alveolaris, the actual number of foci was found to be highest in the section preparations which the parenchyma

showed the transitional features and the features concerned; however, speaking ratio-wise the average number of foci in a single section was higher in the active features and the features concerned. From the functional point of view, both features belong to the histological features of lactation. In contrast, in the section preparations of the inactive features, it was seen that the grade of appearance of foci was by far low in both the actual number and ratio.

It is interesting to note that in the case of lobular foci the situation was in complete reverse against in the case of mastitis alveolaris foci. In this case, it may be natural that, since 7 cases out of 17 cases with foci were granulomatous staphylococcal mastitis, the problem of inactivity of function of the parenchyma due to the protracted course should be taken into consideration. However, insofar as the other remaining cases are concerned, since acute or subacute features were indicated, it cannot be denied that the inflammatory process would tend to develop within the parenchyma which showed the inactive features.

In short, considering fact that an overwhelming number of examined section preparations showed a transitional feature including the non lesion section preparations, it must be fully remembered that the foci of mastitis alveolaris show a predilection in the active parenchyma while the foci of mastitis lobularis show a predilection in the functionally inactive parenchyma. As one of the explanation of such circumstances, it may be considered that there is a duration to be expended in the formation of lobular foci.

#### SUMMARY

1. The actual state of the existence of inflammatory foci in the mammary gland was investigated using slaughtered bovine materials. Of the total 143 cases, with the exception of 53 cases, there were recognized 53 cases of mastitis alveolaris, 16 cases of mastitis lobularis and 21 cases of mastitis diffusa.

2. As a result of considering the histological findings of the 3 kinds of mastitis, it was found that the following divisions would be most logical: From old times and most widely known mastitis diffusa has its origin in galactophoritis. Mastitis alveolaris and mastitis lobularis which were ascertained by the authors in a large number of cases have their origin in acinar inflammation.

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## EXPLANATION OF PLATES

## PLATE I

- Fig. 1 Mastitis alveolaris, M 47, Left posterior part of the mammary gland,  
Hematoxylin and eosin stain,  $\times 4.7$
- Fig. 2 Mastitis lobularis, TM 10, Left posterior 1, H.-E.  $\times 47.5$

## PLATE II

- Fig. 3 Mastitis diffusa, TM 43, Left posterior 1, H.-E.,  $\times 117.5$
- Fig. 4 Mastitis diffusa, M 56, Left anterior part, H.-E.,  $\times 117.5$

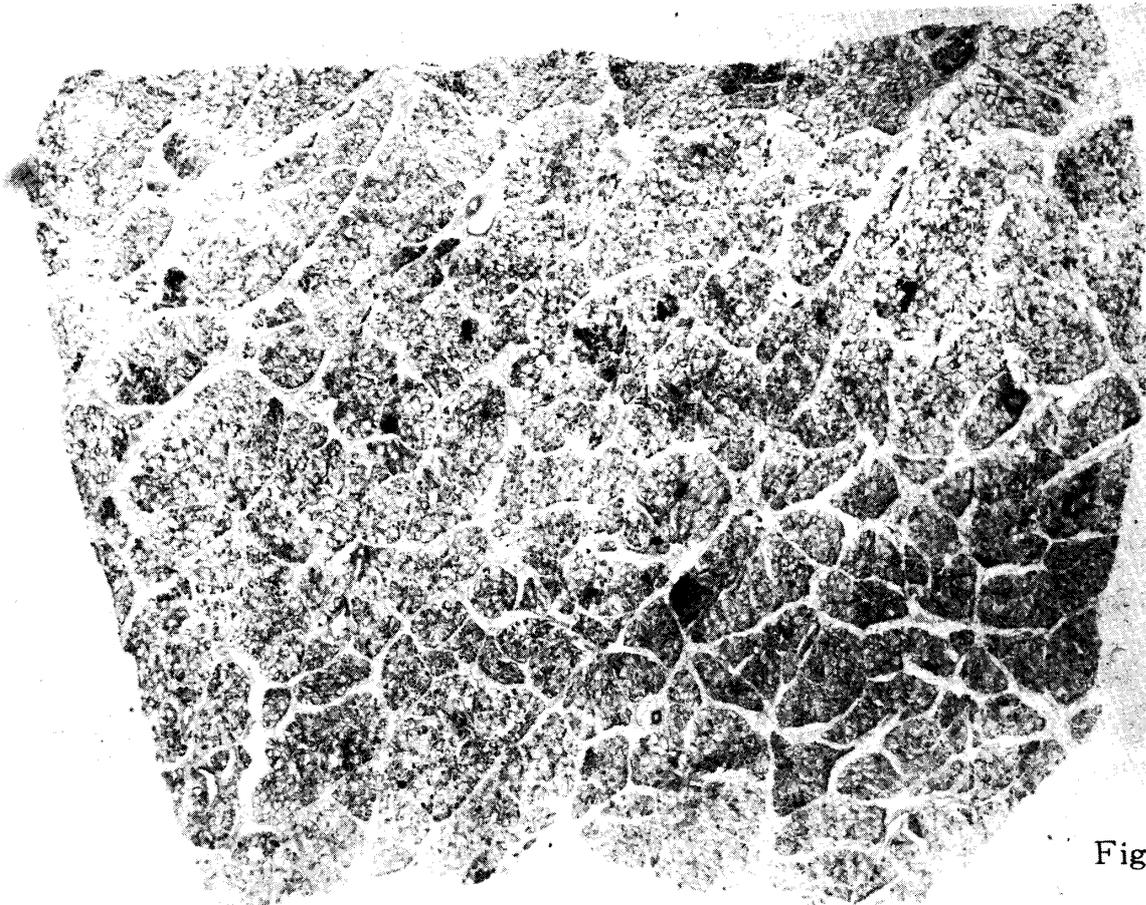
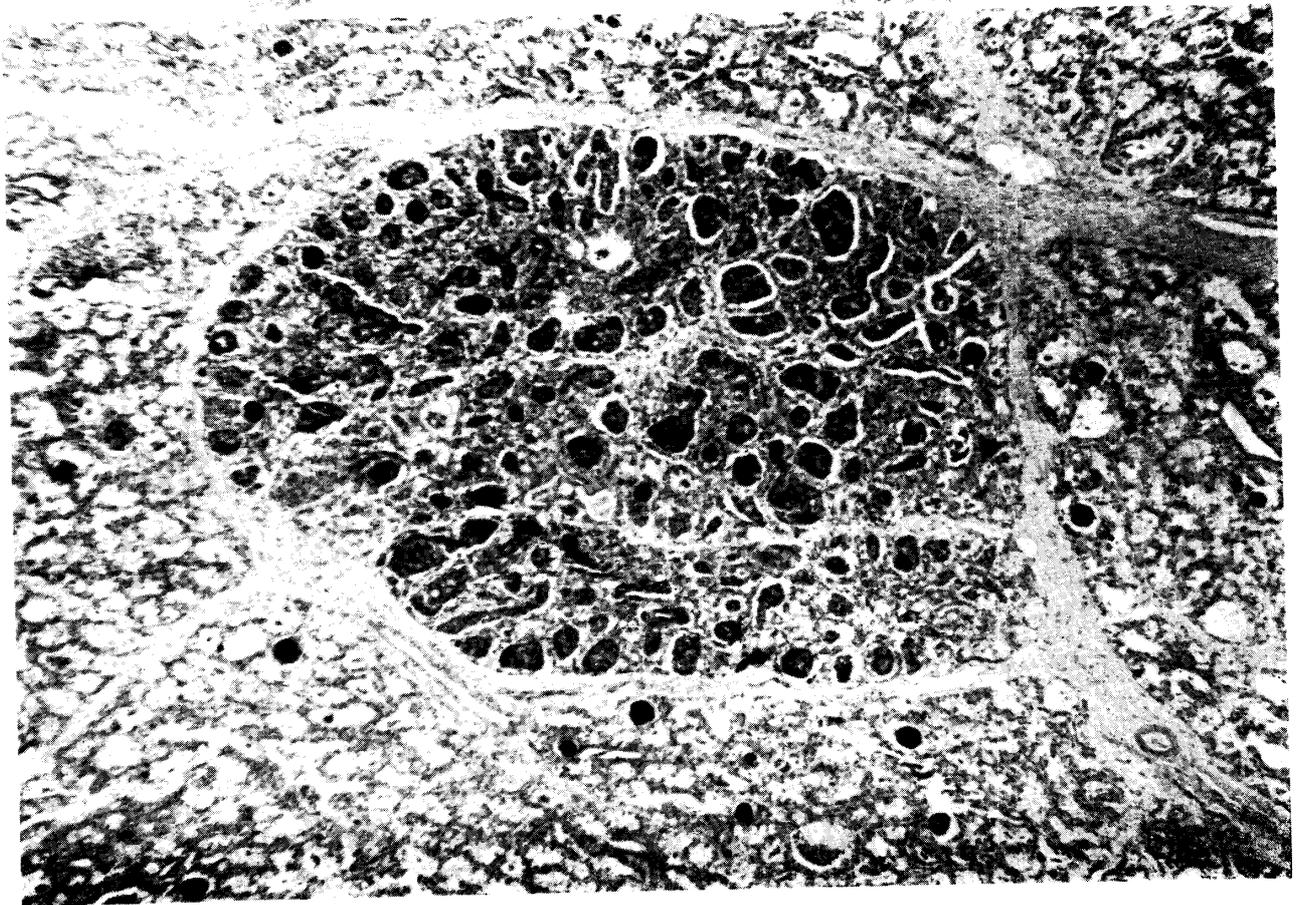


Fig 1



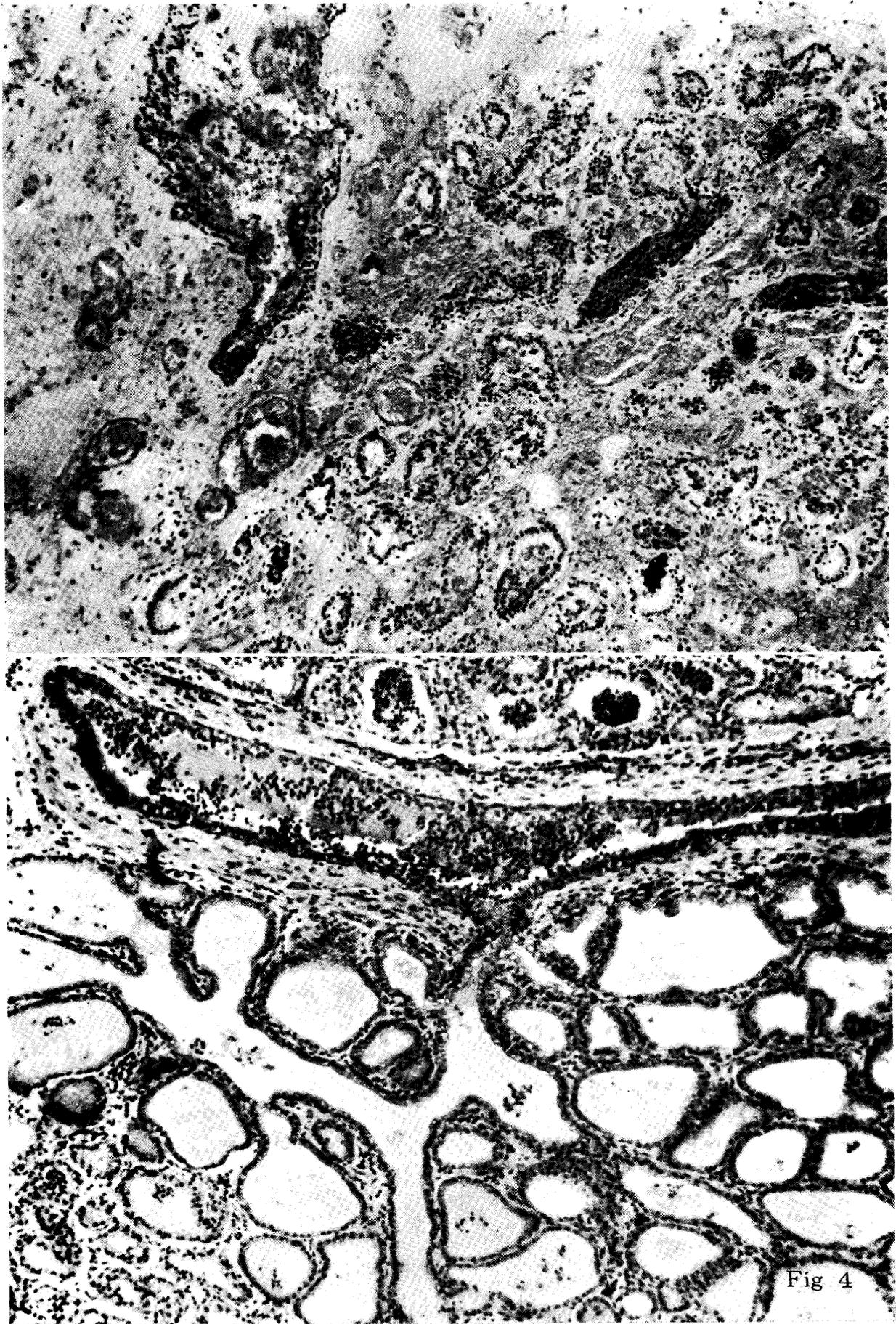


Fig 4