

PATHOLOGY OF SINUSITIS.\*

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In this section of the symposium I have no intention of going into academic pathology. I will show a number of slides of gross and microscopic specimens secured at operation and will make the effort to connect them up in a practical way with the history and treatment of the cases.

The first three slides are shown to demonstrate the two extremes of gross pathology; also the lack of relation between the extent of the tissue changes and the seriousness of the sequelæ.

Case 1.—This case reveals the lining of an antrum with many polyps and cysts attached, as shown by Plate No. 1. The largest polyp, marked A, was hanging in the choana. At the Caldwell-Luc operation the mucoperiosteum was elevated over the entire antrum and the choanal polyp still attached was drawn back into the antrum. It was not attached near the ostium but to the external lateral wall of the antrum. This illustrates the mechanism of the recurrence of polyps of this type. This one if evulsed leaves two or three others in the antrum that may make their exit at the same place. Plate No. 2 shows the hyperplastic lining of the sphenoid and an ethmoid cell, but these sinuses show a different type of pathology than is present in the antrum. Microscopic sections of the antrum show very little inflammatory activity. The connective tissue shows typical mucoid degeneration. In the ethmoid cell, however, there is a definite inflammatory activity, with marked fibrosis and the type of pathology usually seen in hyperplastic sinusitis.

Case 2.—In Plate No. 3 is a picture of the extremely thin linings of two antrums showing very meager gross pathology.

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Throughout most of its extent the mucous membrane appears normally thin and in a few places small sessile polyps are seen. The diagnosis in this case was made by a thick mucoid material in the washings.

In the first case with the gross pathology the only complaint was nasal obstruction and repeated colds, otherwise the patient was apparently normal. In the second case, with the very meager pathology and thin membrane, the patient was seriously ill with myocarditis due to the sinus infection.

Plate No. 4 is a microscopic section from Case 2, shown merely for comparison with the following pathologic sections as an example of a normal mucous membrane lining the paranasal sinuses. There is seen no leucocyte infiltration, edema or fibrosis. The epithelium is intact and the entire section is very thin.

Case 3.—Plate No. 5 is a picture of the extremely thick pyogenic linings removed from the antra of a young woman who was allergic. She had an inheritance of allergy; her mother, maternal aunt and self all being afflicted with seasonal hay fever. She also had chronic bronchitis and perennial asthma.

She had had an intranasal ethmoidectomy and intranasal drainage of both antra two years before I saw her, with no relief of the asthma, bronchitis or hay fever. The ethmoid area was well healed. The antra still showed active infection. This plate of the gross specimens and the section in Plate No. 6 demonstrate the pathologic activity that continues for two years after perfect intranasal drainage. After complete exenteration of her antra, the bronchitis and asthma were relieved, but the seasonal hay fever continued.

The history of this girl illustrates very beautifully that sequence of events that we have quite frequently, although not always, in asthma; that is, an underlying allergic condition which lays the foundation for a sinusitis; the sinusitis producing a bronchitis with subsequent asthma. In the pathogenesis of this case it is probable that the bronchitis produced asthma, and the cure of the sinusitis relieved the bronchitis with cessation of the asthma.

Plate No. 6 shows marked inflammatory activity with a marked infiltration of polymorphonuclear neutrophils and hyperplastic changes in the epithelium. From the history of

this case one would expect a massive infiltration of eosinophiles, but in spite of the fact that this was a definitely allergic case these leucocytes were relatively inconspicuous.

There are many phagocytic leucocytes seen emigrating through the epithelium. This demonstrates purulent exudation. It will be noted that the cilia present on the cells show a degenerative change.

Case 4.—The next five plates are from a case of retrobulbar neuritis. They are pathologically important because they illustrate the nonsuppurative state. They are interesting because they demonstrate the clinical importance of latent sinus infection. There was nothing in the patient's history, past or present, to suggest chronic sinus infection, but, as you can see from the microscopic sections, there is unmistakable evidence that this is the subacute stage of an exacerbation of latent sinusitis in all the sinuses on the left side. The lining of the left antrum is seen in Plate No. 7, showing hyperplastic or polypoid changes. The specimen was everted on a ball of cotton after removal from the antrum. The left sphenoid and one of the ethmoid cells are seen in Plate No. 8.

The lining of the right antrum is seen in Plate No. 9. The neuritis was on the opposite side. This plate shows a small amount of hyperplasia in the epithelium with fibrosis of the submucous connective tissue, hyaline hypertrophy of the basement membrane and perivascular fibrosis. There is present on this side a chronic inactive process.

There are areas in the sections from the left sinuses showing the same chronic changes, but in addition to the chronic fibroses the microscopic sections of the left antrum show a great deal of subacute pathologic activity. There is marked edema and thickening. The epithelium has lost its typical columnar cells, and a degenerated type of cubical cell has piled up. No cilia are present. In Plate No. 10 the edema and metaplasia of the epithelium to degenerated nonciliated stratified cubical cells can be readily seen.

The left sphenoid shows pathologic processes that are identical with those in the antrum of this side.

Examination of the cellular infiltration reveals the presence of many eosinophiles characterized by their bilobed nuclei as

seen in Plate No. 11. Many plasma cells and lymphocytes are also present but there are practically no polymorphs seen.

Eosinophilic infiltration was pronounced in the case, yet there is no clinical evidence that the patient was allergic. We take infiltration of eosinophiles to be a reaction against toxic products. The eosinophile is not a phagocyte.

Case 5.—Shows very gross thickening in the antra of a child nine years old, afflicted with chronic chorea for three years. She had been operated on for tonsils and adenoids with no relief. Recovery followed exenteration of her sinuses. In Plate No. 12 is a portion of the left antrum, showing the ostium on the right. The fragment on the left has been sliced from the thickened membrane and turned on its side. Its thickness, as revealed by the adjoining centimeter scale, is over half a centimeter. The other antrum is seen in Plate No. 13. This specimen is everted on a ball of cotton. The ethmoid and sphenoid cells had the same type of pathology. The microscopic pathology is similar to that of the next case.

Case 6.—The following pathologic study is from a suppurative pansinusitis in a girl, fourteen years old, who had chronic bronchitis. Several intranasal operations had been done without relief of the sinusitis or bronchitis. She was cured after exenteration of the infected sinuses. The gross examination of the mucous membranes showed them to be slightly increased in thickness—not more than a millimeter and a half.

In Plate No. 14 there is seen very little increase in thickness, but, as can be readily seen, there is marked pathology with much edema and cellular infiltration of the tissues. There is a small area in the epithelium where an ulceration is forming. The epithelial cells are undergoing dissolution at this point. Leucocytic infiltration is more dense here. Elsewhere the epithelium is intact. A number of infected tuboalveolar glands are buried deep down in the spongy layer of connective tissue. The duct leading down to the infected glands is shown. This periglandular condition shows that we have something more to deal with than mere surface infection.

In Plate No. 15 is seen the compact periosteal layer in which there is less pathologic activity. The greatest reaction is limited to the softer connective tissue which lies above the periosteal stratum and particularly about the deep lying glands.

A portion of the surface epithelium is seen in Plate No. 16. It is plain that the epithelial cells are almost unchanged. Normal cilia are seen. This type of epithelium covers almost the whole sinus.

Polymorphonuclear leucocytes can be clearly seen emigrating between the columnar cells. These come up from the connective tissue and pass through the epithelium in the manner shown in Plate No. 16. I think it is important to bring out the point that we have a purulent exudate with intact epithelium. Ulcerations are very uncommon, and, when present, play a minor part in the purulent exudation.

This case demonstrates again the futility of simple drainage operations in certain conditions.

Case 7.—The next three specimens show cystic formations. In Plate No. 17 is seen a large serous cyst in an antrum lining. This cyst was much larger before we aspirated a portion of the contents for culture. We have found that in a little less than 50 per cent of our cases the contents of these serous cysts give growths of pathogenic organisms on culture. Microscopic sections of the lining of this antrum show a great number of microscopic cysts.

Case 8.—In Plate No. 18 are the linings from two antra with purulent sinusitis. When these membranes were taken out and spread on cardboard they looked like pieces of skin from an individual with smallpox. Some of the cysts had openings through which purulent contents were draining, but most of them were closed cysts.

In Plate No. 19 is seen the microphotograph of a cystic abscess containing mucopus. This is a very small cyst or a microscopic cystic abscess. The epithelium lining the cyst is intact in places.

It is usual to find numerous smaller cysts of microscopic size in the presence of larger cysts.

Case 9.—The next microphotograph demonstrates mucoid degeneration of the epithelium as commonly seen. The columnar cells have all become goblet cells and are disintegrating. In Plate No. 20 the mucoid epithelial products and numerous eosinophiles can be seen flowing over the surface of the membrane.

Case 10.—Another type of epithelial change is seen in Plate No. 21, which shows a marked metaplasia of the epithelium in an old chronic pyogenic sinusitis. The normal single layer of columnar ciliated cells has been changed by the chronic infection to a stratified layer of nonciliated cubical cells. The epithelium is seldom lost in sinus infections, but usually undergoes the various degenerative changes seen in this series of plates.

There are certain interstitial accumulations of lymphocytes frequently seen in sinusitis which have never been described before. These structures resemble the so-called "Flemming's secondary nodules," recently described by Wilhelm Ehrlich of the Rockefeller Institute. These nodes, according to Ehrlich, are the result of a reaction to infection and are not germinal centers in lymphoid tissue as Flemming supposed. In Plate No. 22 is seen such a formation with large, clear vesicular cells in the center and a definite ring of lymphocytes around the periphery. Plate No. 15 shows a similar arrangement of lymphocytes. We believe these to be definite structures developed as a result of infection in the sinuses.

It is interesting to observe repair in sinuses that have been operated upon. In Plate No. 23 is seen a microscopic section from a healed antrum after subperiosteal exenteration of the lining. I have biopsies from eight patients who had subperiosteal exenteration. This one shows a definite stratified squamous epithelium like skin. The others show scar tissue with cubical or columnar cells in the overlying epithelia.

A short time ago some experimental work was done on dogs to determine what happened after a sinus was denuded of its lining. The experimenters curetted the "antrums" of dogs; and the regeneration was so rapid that the new epithelium grew over the blood clot before it was absorbed, and not only the ciliated epithelium but also the subepithelial tissues, glands and bone were "regenerated."

In none of our biopsies have we seen regenerated glands or ciliated epithelium.



Plate No. 1. Marked pathology grossly with no systemic complaint. The polyp marked "A" was hanging in the choana and was attached on the external lateral wall of the antrum.



Plate No. 2. Ethmoid and sphenoid from same case as above. The sphenoid shows a dusky red inflammatory activity. Both are hyperplastic.

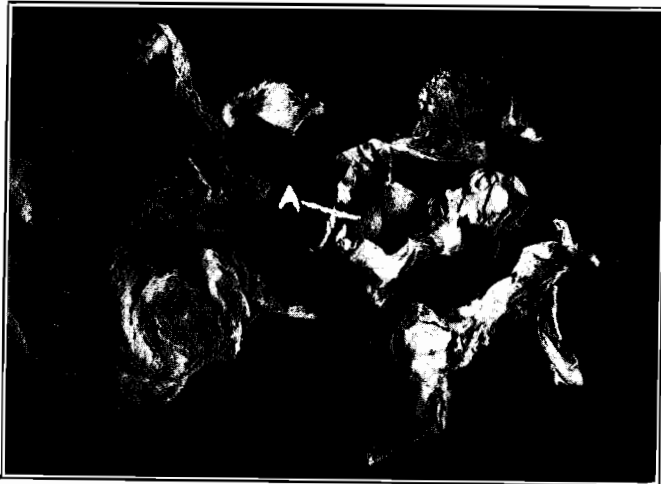


Plate No. 3. Very thin membranes from antra. At point "A" is seen a small sessile polyp. This case was seriously ill with myocarditis.

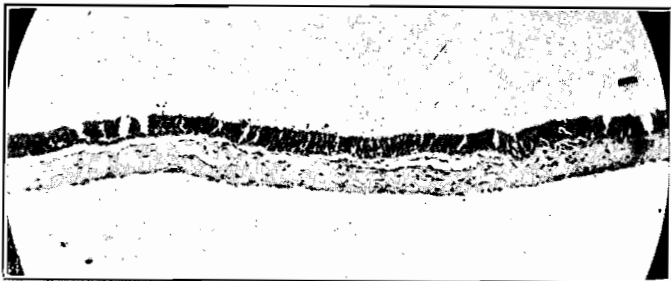


Plate No. 4. This is an example of a normal appearing area taken from a thin portion of the above. Microscopically there is no edema, no fibrosis, no leucocytic infiltration, and the epithelium is composed of a definite layer of pseudo-stratified columnar ciliated cells. No goblet cells are present.

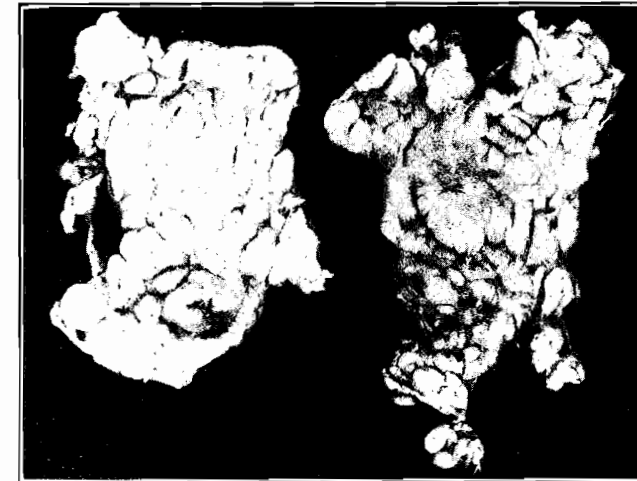


Plate No. 5. Very thick roughened pyogenic linings from the antra of an allergic patient. Good intranasal drainage was present for two years but pathologic activity continued.

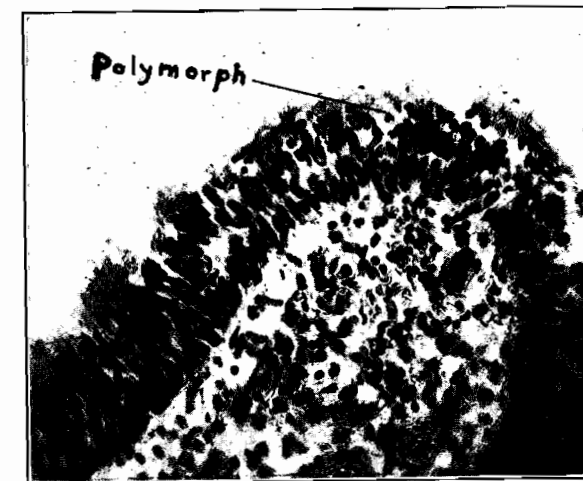


Plate No. 6. Microscopic sections show degeneration of the epithelium with dense infiltration of polymorphs and exudation of these leucocytes through the epithelium. Edema is moderate.



Plate No. 7. Left antrum from a patient with retrobulbar neuritis on this side. Specimen is inverted on a ball of cotton. Grossly there is thickening and polypoid changes. Case IV.



Plate No. 8. Left sphenoid and ethmoid cell from same case. The same kind of pathology is present in these sinuses. The opposite side has little or no pathologic change. Case IV.



Plate No. 9. Right antrum showing a chronic fibrous condition with a thickened basement membrane and fibrosis of the arterioles. Case IV.

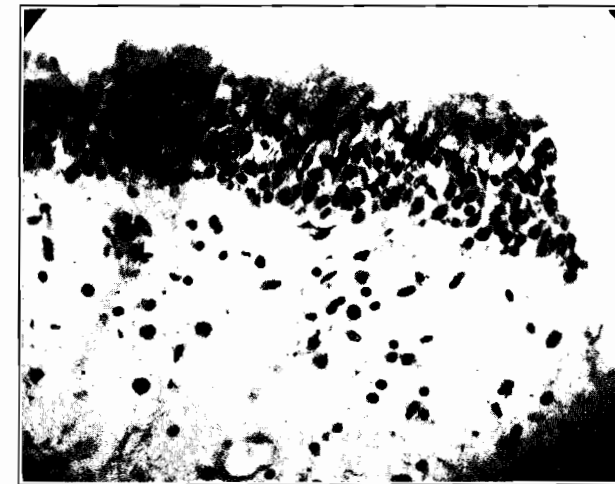


Plate No. 10. Left antrum showing subacute activity with tremendous edema and loss of cilia. The epithelium is degenerated, the columnar cells have been replaced by cubical cells with very poor cell boundaries. This same change is also present in the sphenoid of this side. Case IV.

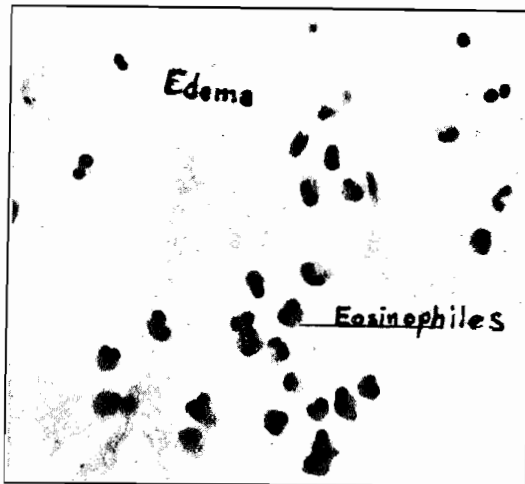


Plate No. 11. High power microphotograph showing typical eosinophiles with bilobed nuclei and marked edema in the left sphenoid Case IV.

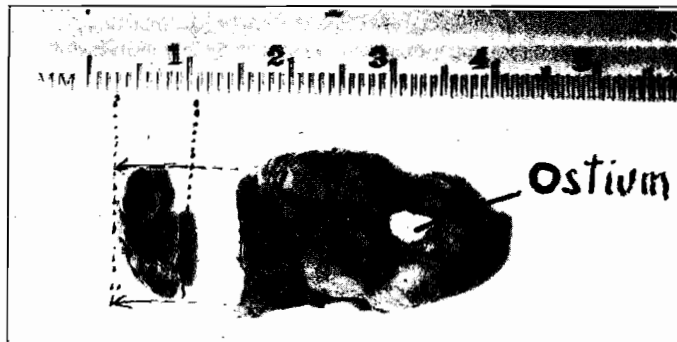


Plate No. 12. Gross thickening in antrum of a child with chronic chorea. The piece on the left has been cut and turned on its side so its thickness can be seen. It is over half a centimeter thick.



Plate No. 13. Antrum from case with chronic chorea inverted on a ball of cotton. The chronic pathologic condition is bilateral.

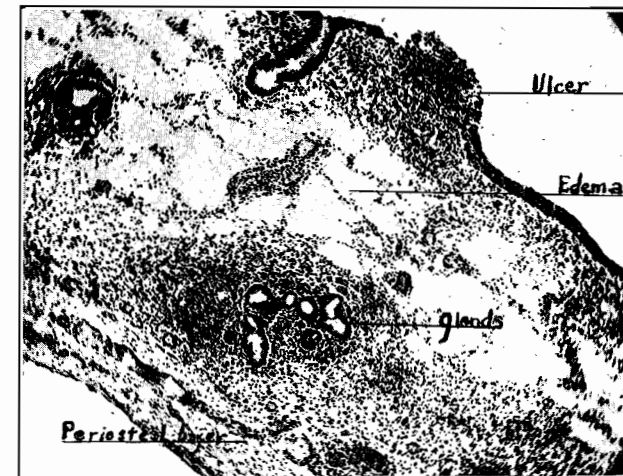


Plate No. 14. Microscopic appearance of antrum from case with chronic bronchitis. Deep seated infection is seen around the glands. Marked edema is present. There is an ulcer forming in the epithelium where the cells are undergoing necrosis. Case VI.

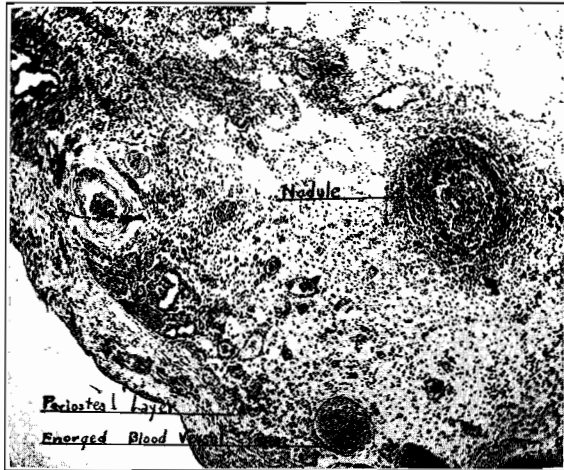


Plate No. 15. Infection is deep seated but is most marked in the loose spongy connective tissue. A lymphoid collection is seen. Case VI.

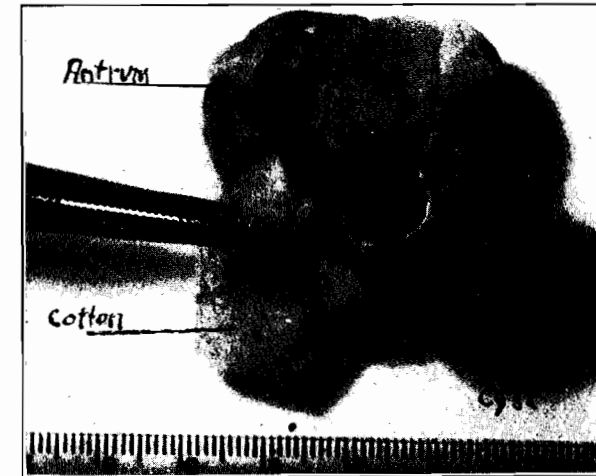


Plate No. 17. Antrum lining with a large serous cyst attached. The lining is inverted on a ball of cotton after removal.

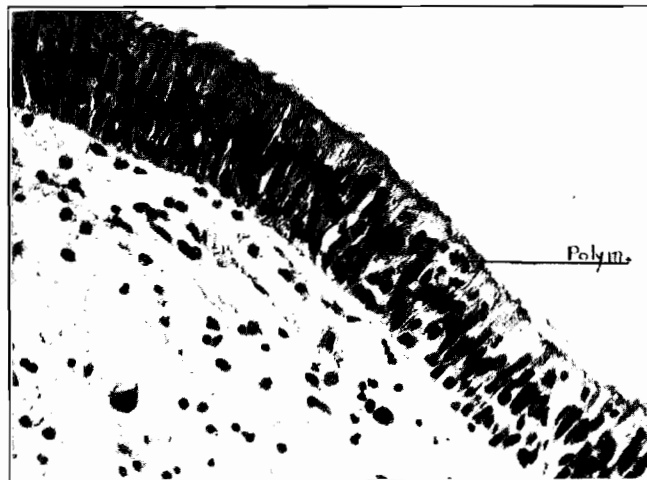


Plate No. 16. High power view of epithelium in the above case showing ciliated columnar cells and emigration of polymorphs between them.

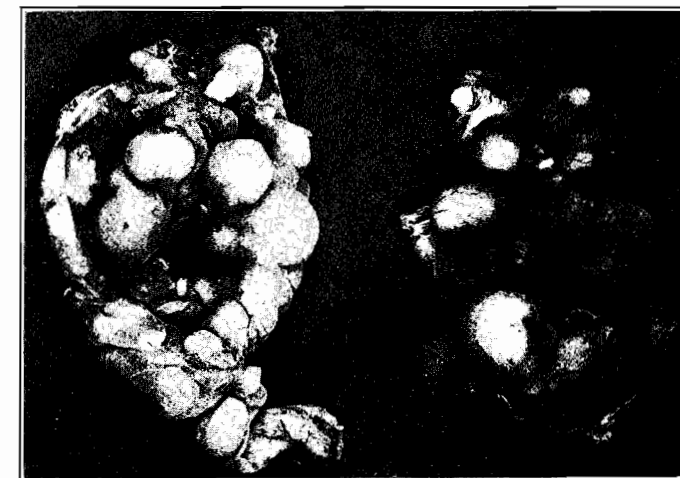


Plate No. 18. Multiple cystic abscess of moderate size in both antra.





Plate No. 19. Microscopic cyst the result of dilatation in an infected gland.



Plate No. 21. Degenerative metaplasia in chronic pyogenic sinusitis. The ciliated columnar cells have been replaced by a thick epithelium composed of a multilayered cubical cell structure.



Plate No. 20. Mucoid degeneration of the epithelium in an allergic patient. Note the extensive formation of goblet cells and disintegration of the columnar epithelium. Many eosinophiles are present in the exudate.

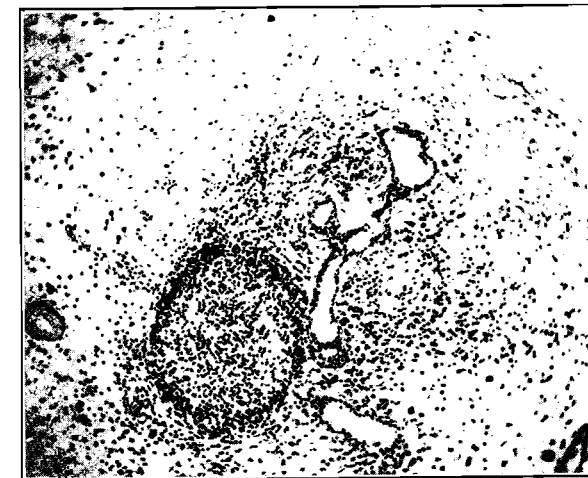


Plate No. 22. Flemming's Secondary Nodule seen in antrum lining of an allergic patient. These are so-called germinal centers of lymphoid tissue but are only seen in infected sinuses.



Plate No. 23. Stratified squamous epithelium found lining an antrum several months after a complete subperiosteal exenteration of the original lining.