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A HISTOPATHOLOGICAL STUDY ON THE ADENOMATOID AMELOBLASTOMA
REPORT OF FOUR CASES

by

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INTRODUCTION

The so-called "adeno-ameloblastoma" is a rare tumour of the jaw region. It has attracted the attention of investigators for many years because its histological features vary from those of the simple ameloblastoma. More than twenty cases have been described in the Western literature, under such names as pseudo-adenoma adamantinum (*Dreibladt* 1907), glandular adamantinoma (*L'Esperance* 1910), epithelial tumor associated with developmental cyst (*Stafne* 1948), cystic complex composite odontome (*Miles* 1951), unusual pleomorphic adenoma-like tumor (*Oehlers* 1956), tumour of enamel organ epithelium (*Lucas* 1957), pseudoadenomatöses Typ des Adamantinoms (*Langer* 1958), etc. The most commonly accepted term appears to be adenoameloblastoma (*Bernier* 1950, *Thoma* 1955).

The general behaviour of this tumour has been clearly demonstrated in several papers especially that of *Bernier & Tiecke*

(1956). There remain, however, some obscure problems concerning its true nature, especially the origin of the duct-like structures.

Nine cases of "adeno-ameloblastoma" have been reported in Japanese literature, but only *Ito et al.* (1957) and *Ono* (1958) have presented detailed descriptions. Formerly one of us (*Ishikawa* 1957) reported briefly the histological findings of one case, and this was followed by a histochemical study of three cases, including the above mentioned one (*Ishikawa & Mori* 1961). Recently an additional case came to our knowledge thereby bringing the total number of cases of this tumour examined in our laboratory (The Department of Oral Pathology, Dental School, Tokyo Medical and Dental University) to four.

In this paper some characteristic histopathological features will be described in detail, followed by a discussion as to the origin of the tumour.

OWN OBSERVATIONS

Case 1

A girl aged 13 presented with a tumour in the periapical region of the upper right canine. The roentgenogram revealed an appearance similar to a follicular cyst, with impaction of the lateral incisor in the cystic wall. Local removal of the mass was performed. Six years have elapsed without evidence of recurrence.

The gross appearance of the removed tissues showed the general features of a follicular cyst. Most of the cystic wall was, however, much thicker than that typical of a follicular cyst. There was a distinct fibrous capsule with a soft parenchymatous layer between the capsule and the cystic cavity.

The histological examination of neutral-formalin fixed tissue showed features typical of an "adeno-ameloblastoma" the tumour being well-encapsulated by fibrous connective tissue (Fig. 1). The lumen of the large cyst was lined by epithelial nests of tumour tissue and in some places by a flattened layer of epithelium, similar to that found in follicular cysts (Fig. 2). In most places the tumour tissue was composed both of solid epithelial alveoli, and of scattered duct-like structures, lined on their inner surfaces by columnar epithelium. Scattered calcified foci were also noticed

within the tumour which had a poorly developed connective tissue stroma. In some parts, the nests of epithelium were arranged in strands, with rather broad degenerating areas of the stroma (Fig. 3). Both the collagen fibers and the cellular components were scarcely visible in this stromal area, only a few blood vessels being noted. A few areas having an appearance similar to that of stellate reticulum were also found (Fig. 4).

Most of the duct-like structures, especially the larger ones, showed lumina apparently devoid of content. A more detailed examination of the lumen, however, revealed the presence of a fibrillar material adherent to its inner surface. This fibrillar material showed the following staining characteristics: pinkish with hematoxylin-eosin stain, reddish with van-Gieson's stain, blue with Mallory stain, positive PAS-reaction, argyrophilic with Pap's silver impregnation (Figs. 5 and 6). A fluid-like homogeneous material, or sometimes a very fine fibrillar material apparently devoid of cells, was seen to be filling out the lumen in other sections (Figs. 7 and 8). The former showed a faintly positive reaction for mucicarmine as well as a faint metachromasia with toluidine blue. The duct-like structures were frequently obstructed by an overgrowth of epithelial cells. The seemingly solid alveoli were composed mostly of polygonal epithelium, in which scattered, delicate argyrophilic fibers were demonstrated. In this area a fine, eosinophilic material like hyaline droplets was also found. The calcified masses did not show any structure similar to that of dental hard tissue but appeared to be merely dystrophic calcifications.

Case 2

A girl aged 16 had a small swelling in the buccal sulcus in the upper left canine region. The tumour, approximately 0.8 cm in diameter with a thick connective tissue capsule, was extirpated locally. There was no recurrence during an observation time of three years.

Macroscopically the removed tumour seemed to be solid. The histological examination also revealed it to be mainly solid with numerous, small cystic spaces of irregular shape at the periphery (Fig. 9). Scattered calcified foci were observed in the peripheral

part near the fibrous capsule. In general, the fine structure of this case was similar to that of case 1. The small cystic spaces at the periphery of the tumour were composed of degenerating stromal tissue (Fig. 10). Some of the calcified foci resembled cementicles somewhat, but could not be identified as ordinary cementum (Fig. 11).

Case 3

A male aged 30 had a buccal swelling in the lower right canine region. A roentgenogram revealed the presence of an impacted canine. The condition was diagnosed as "adeno-ameloblastoma" by biopsy and no recurrence has yet followed local excision.

The greater part of the removed tissue was fixed in neutral formalin but in order to allow histochemical examinations, some pieces of the tissue were fixed in Bouin's solution, Zenker's solution, cooled absolute alcohol, etc. Serial sections of the tumour tissue were prepared in an attempt to clarify the origin of the duct-like structures.

The histological appearance of the tumour showed a resemblance to the above described cases (Fig. 12). Abundant glycogen was demonstrated in the epithelial cells by PAS-stain with or without previous diastase digestion, especially in the columnar cells lining the duct-like spaces (Fig. 13). Some of the serial sections gave an interesting finding, indicating a direct transition between the duct-like lumen and the degenerated stromal tissue (Figs. 14 and 15). It was noteworthy, moreover, that the flattened epithelial cells around the columnar epithelium of the duct-like structures showed a strong positive reaction with alkaline phosphatase by Gomori's method (Fig. 16). This reaction is usually negative in the epithelial portion of the simple ameloblastoma.

Case 4

A female aged 18 presented with a buccal swelling of four months duration in the lower right lateral incisor to premolar region. A roentgenogram showed a radiolucent area of approximately 1.0 cm diameter at the periapical region between the

canine and the first premolar. The tumour was extirpated locally and the removed tissue was well-encapsulated with a relatively dense connective tissue.

The histological examination showed the typical features of an "adeno-ameloblastoma" in which a fairly large cyst was noted (Fig. 17). The fine structure of the duct-like tissue was similar to that of the previous cases.

Eosinophilic, coarse droplet-like material was found in some of the epithelial clusters. Some of the droplets appeared to have been secreted by the epithelium. They stained reddish with van-Gieson's stain, bluish with Azan stain and positively with Lillie's Diazo-method although they showed a negative result with Alcian blue.

Scattered, calcified foci were noticed mostly in the clusters of epithelium. Some of the foci appeared to be formed by deposits of mineral salt into the droplet-like material. These calcified foci showed a distinct positive reaction with the Diazo-method. Cystic structures filled with an eosinophilic, colloidal material were observed in another region of the tissue (Fig. 18). This material showed no similarity to prismatic substance and it is questionable whether this material should be considered an active product of the lining cells.

DISCUSSION

The "adeno-ameloblastoma" is a rare tumour. This is clearly demonstrated by the fact that only four cases were observed in our laboratory during the past thirty years, while 143 cases of the simple ameloblastoma have been found during the same period.

It is known that the clinical features of the "adeno-ameloblastoma" are somewhat different from those of the simple ameloblastoma.

Firstly, the predilected site of "adeno-ameloblastoma" is the canine region, the occurrence in the upper jaw being rather frequent, while the simple ameloblastoma most frequently occurs in the lower molar region.

Secondly, the "adeno-ameloblastoma" is more frequently seen in females than in males (usually twice as common). The greater

percentage of the reported cases of "adeno-ameloblastoma" are found in the second decade of life. In the simple ameloblastoma there is no significant difference in occurrence between the sexes, and these tumours have usually been detected in the third decade (although not representative of the actual age of onset).

Thirdly, the "adeno-ameloblastoma" is much smaller in size and is well-encapsulated (Figs. 9 and 17), while the simple ameloblastoma may frequently attain a large size and, although not very aggressive, sometimes shows a more or less invasive character. No recurrent case of "adeno-ameloblastoma" has hitherto been reported, while recurrence of the simple ameloblastoma is not unusual.

Fourthly, an intimate association of the tumour with a follicular cyst is more common in the "adeno-ameloblastoma".

Gorlin & Chaudhry (1958) stated that the clinical behaviour and history of the "adeno-ameloblastoma", in many respects, are similar to those of ameloblastic odontomas or ameloblastic fibromas, especially with regard to age and non-recurrence.

The reason why the above-mentioned differences exist is still obscure, but one might suggest that some of them can be related to the preferred anatomical location of the "adeno-ameloblastoma", namely the bend of the dental arch. More cases will have to be examined before this problem can be solved.

The histological appearance of this tumour is quite characteristic, as the epithelial cells proliferate in an unusual pattern and form duct-like structures. There has been considerable discussion about the nature and origin of these structures as well as about the origin of the tumour. Some investigators have considered the duct-like structures to be similar to glandular tissue.

Thoma (1954) stated that the epithelium in its differentiation may tend towards glandular tissue and arrangement, and that this is due to the oral epithelium having the potential ability to form dental as well as glandular structures. *Oehlers* (1956) published a report of a case entitled "an unusual pleomorphic adenoma-like tumor in the wall of a dentigerous cyst", in which he agreed with Thoma's opinion.

The glandular origin of this tumour has been denied by most investigators, as it has never been seen in either major or minor salivary glands. No one has presented incontrovertible evidence

of the glandular nature of the duct-like structures. Previously, some authors have stated that the material in the duct-like lumen showed a negative result with mucicarmine stain. In some of the tissue of the present study, however, the homogeneous material in the duct-like lumina showed a faintly positive reaction with mucicarmine stain as well as metachromasia with toluidine blue. It should not be concluded that this material is to be regarded as of mucous or glandular origin, as myxoid degeneration in the mesenchymal tissue, for example the degenerated stroma of the simple ameloblastoma, may often show a similar, but somewhat weaker reaction to mucus. It is still questionable if the cystic structure described in case 4, which was lined partly by columnar epithelium, should be considered glandular tissue.

Bernier (1955) pointed out that the material in the duct-like structure is probably residual from degenerated stromal tissue and that in no instance has the cylindromatous or canalicular pattern, common in the mixed tumour group, been seen. The cytological appearance of the columnar cells lining the duct-like lumen is reminiscent of the epithelial cells immediately adjacent to the stroma of the simple ameloblastoma. A high glycogen content was also demonstrated by us in both types of epithelial cells (*Mori,* 1959). In the simple ameloblastoma, "Stromazyste" which is a microcyst formed by a degeneration of the stromal tissue is not uncommon. *Miles* (1951) stated that in his case the high-columnar cells resembling ameloblasts were situated in the central portion of the epithelial cluster and that they had their nuclei basally located, while the opposite is true in the simple ameloblastoma. *Gorlin & Chaudhry* (1958) have also stated the same opinion. There is, however, no fundamental difference between the two lesions in this respect, if the duct-like lumen corresponds to a "Stromazyste". Formerly, one of us (*Ishikawa* 1957) stated that the apparent area of degeneration of the stromal tissue, which is thought to form the duct-like structure, could not be found. The findings obtained by study of an additional three cases led to an alteration of this former opinion. In most cases the contents of the duct-like lumen, especially the fibrillar ones, show the same staining characteristics as mesenchymal fibrous tissue. The membranous structure composed of argyrophilic fibers at the inner surface of the duct-like lumen should be regarded as

a basal membrane, which is formed usually at the boundary between the epithelial and the mesenchymal tissues. Furthermore, direct transition between the duct-like lumen and the degenerated stromal tissue was clearly seen in case 3. It seems reasonable to assume, therefore, that the genesis of the duct-like lumen is similar to the process of "Stromazyste" formation.

Stafne (1948) found a clearly defined hyaline-like ring in many of the glandular spaces. He thought this might be evidence of an attempt to form an enamel matrix, although he could not determine the real nature of this substance. Similar opinions have been put forward by *Miles* (1951), *Thoma* (1955), *Ishikawa* (1957), and *Lucas* (1957). *Gorlin & Chaudhry* (1958) have stated that the luminal content showed a negative reaction in mucin tests, but Alcian blue revealed the presence of acid mucopolysaccharides. They have also put forward the view that this material is "pre-enamel", referring to the work of *Wislocki* and his co-workers (1948, 1950) indicating that acid mucopolysaccharide is elaborated by ameloblasts and enters the enamel at the time of calcification. *Topazian & Simon* (1960) have also made the same statement. According to our observations, however, not only the luminal content but also the degenerating area of apparent stromal tissue showed a distinct positive reaction with Alcian blue. Thus the positivity with Alcian blue is not definite proof of enamel matrix, although there is no doubt that pre-enamel contains an acid mucopolysaccharide. According to *Suga & Gustafson* (1962), the developing enamel matrix can be distinguished specifically from the mesenchymal element in the tooth germ by using Lillie's Diazo-method. In case 4, however, the content of the duct-like structure did not show a different reaction from that of the mesenchymal component. On the other hand, a distinct positive reaction was observed in the calcified foci, which were thought to be dystrophic calcifications. At present, there is no staining method strictly specific for enamel matrix or pre-enamel. In pathological circumstances, for example in the case of tumours, it is impossible to determine whether a certain substance belongs to enamel or not, unless the characteristic prism-structure can be demonstrated in the substance. It is commonly accepted, moreover, that well-differentiated epithelial as well as mesenchymal tissue is necessary to initiate an

odontogenesis, and that amelogenesis does not begin without the presence of dentine-like substance. *Miles* (1951) assumed the presence of both dentine matrix and mesodermal pulp tissue in his case. His assumption seems to be uncertain, however, as the "mesodermal pulp tissue" might be an epithelial tissue according to the photomicrographs presented in his paper. He also found a tissue which could be identified as being tubular dentine but the relation of this tissue to the glandular structures is somewhat uncertain. In our cases we could see neither a mesenchymal stroma, (composed of young cellular connective tissue like dental papilla) nor a distinct dentine-like substance. Therefore, the opinion that the material in some of the duct-like lumina is pre-enamel seems unlikely, although not impossible.

If distinct enamel as well as dentine can be seen in this tumour, it should be called an "adeno-ameloblasto-odontoma".

Bernier (1955) mentioned an interesting case seen by *Dierdorff* in which cementum was found. He called this particular lesion an adeno-ameloblastic odontoma, but the calcified material was separated from the soft tumour tissue by fibrous connective tissue septa. Usually, scattered small foci of calcification have been detected in "adeno-ameloblastomas". *Thoma* (1955) considered some of them to be cementicles, but few investigators agree. The calcified material in our cases does not seem to be clear-cut cementum, because the histological appearance of this material is rather similar to that of dystrophic calcification, and an active participation of the cells was rarely seen.

It is interesting to note that a distinct, positive reaction for alkaline phosphatase was demonstrated by Gomori's method in the flattened epithelium around the columnar cells of the duct-like structures in case 3. This reaction is usually negative in the epithelial portion of the simple ameloblastoma. This area showed a similar appearance to the stratum intermedium of an enamel organ. It is well known that the stratum intermedium shows a positive reaction for alkaline phosphatase and that it plays an important role in amelogenesis. Distinct enamel formation could not be found in case 3, although the appearance of the flattened epithelium was similar to that of stratum intermedium. This is probably due to a lack of the induceable mesenchyme in this tumour, as stated above.

Both the proliferating and differentiating ability of the epithelial component in this tumour is much more forceful than that of the mesenchymal tissue which is uninfluenced by the organizing capacity of the epithelium. Thus the characteristic duct-like structures may be produced.

Lastly, the question has been evoked as to whether this tumour should be classified as a subdivision of the ameloblastoma, although odontogenic origin has been supported by most investigators. *Miles* (1951) used the term "cystic complex composite odontome". *Cahn* commented on the case reported by *Thoma* (1955) in which he has mentioned the term "teratoid odontoma", because enamel-like substance and cementicle formation were found. The presence of a distinct dental hard tissue in the "adeno-ameloblastoma" is still not conclusive, so that the term "-odontoma" should be avoided for this tumour. *Lucas* (1957) advocated that the term "tumour of enamel organ epithelium" would be more appropriate than the term "adeno-ameloblastoma" because this tumour differs from ameloblastoma in significant clinical and pathological respects. In our cases, areas resembling the stellate reticulum were also demonstrated though in restricted areas. It does not seem unreasonable to classify this tumour as an ameloblastoma in the widest sense in so far as the tumour has its origin from the odontogenic epithelium, even if not from the ameloblasts themselves. The term "adeno-ameloblastoma" should be avoided, as the duct-like structure does not seem to be true adenomatous tissue. The terms "pseudo-adenomatous ameloblastoma" or "adenomatoid ameloblastoma" are regarded as more appropriate designations.

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SUMMARY

Based on a study of four cases, the histological features of the so-called "adeno-ameloblastoma" ("adenomatoid ameloblastoma") are discussed in detail. It seems reasonable to assume that most of the duct-like structures are formed by degeneration of the stromal tissue, as some of the luminal content showed the same staining characteristics as the mesenchymal fibrous tissue. A direct transition between the duct-like lumen and the degenerating stroma could clearly be found in one case. Furthermore, a distinct positive reaction for alkaline phosphatase was demonstrated in the epithelial cells around the columnar epithelium of the duct-like structures. This area showed the same appearance as the stratum intermedium of the tooth germ but nevertheless we were not able to demonstrate a distinct dental hard tissue. At the present time, it is questionable whether some of the material in the tumour tissue should be regarded as an abortive enamel matrix or not.

The characteristic features of this tumour are probably due both to the highly differentiating ability of the epithelial component and to the lack of mesenchymal tissue receptive to the influence of the epithelium. The appropriate term for this tumour is also discussed.

RÉSUMÉ

ÉTUDE HISTO-PATHOLOGIQUE DE L'ADAMANTINOME PSEUDO-ADÉNOMATEUX

COMPTE-RENDU DE QUATRE CAS

Les particularités histologiques de ce qu'on appelle "adéno-adamantinome" (adamantinome pseudo-adénomateux) font l'objet d'une discussion détaillée basée sur l'étude de quatre cas. Il semble raisonnable de présumer que la plupart des structures ressemblant à des canaux sont formées par la dégénération du tissu de la trame, puisque le contenu de certains des canaux présentait au point de vue de la coloration les mêmes caractéristiques que le tissu fibreux du mésenchyme. Une transition directe entre la lumière canaliculaire et la trame en voie de dégénération était nettement visible dans un des cas. De plus une réaction positive

certaine pour la phosphatase alcaline était mise en évidence dans les cellules épithéliales autour de l'épithélium cylindrique des structures canaliculaires. Cette zone présentait le même aspect que le stratum intermedium du germe dentaire, mais il ne nous a cependant pas été possible de mettre en évidence un tissu dentaire dur distinct. On peut à l'heure actuelle se demander s'il faut oui ou non considérer certains des éléments du tissu tumoral comme une matrice adamantine abortive.

Les traits caractéristiques de cette tumeur sont probablement dus d'une part au grand pouvoir de différenciation de l'élément épithélial et d'autre part à l'absence de tissu du mésenchyme susceptible de réagir sous l'influence de l'épithélium. La dénomination appropriée de cette tumeur fait aussi l'objet d'une discussion.

ZUSAMMENFASSUNG

ÜBER VIER FÄLLE VON SOGENANNTEN ADENO-AMELOBLASTOMEN MIT BESONDERER BERÜCKSICHTIGUNG DER HISTOPATHOLOGISCHEN BEFUNDE

Auf Grund von Untersuchungen an vier Fällen von sogenannten „Adeno-Ameloblastomen" wird der feinere Bau dieser Geschwülste, besonders die Natur und die Genese des tubulären Gebildes, erörtert. Das tubuläre Gebilde ist kein echtes adenomatöses Gewebe, sondern entsteht durch eine Degeneration des Stromas. Der Inhalt einiger tubulärer Lumina zeigt dieselbe Farbreaktion wie mesenchymales Gewebe. In dem einen Fall konnte der Verfasser einen direkten Übergang zwischen dem adenomatösen Lumen und degenerierendem Stroma feststellen. Im Gegensatz zu den gewöhnlichen Ameloblastomen zeigt diese Variation eine stark positive Reaktion für Alkaliphosphatase in den Epithelien, die rings um die hochzylindrischen Epithelien des adenomatösen Gebildes liegen. Dieses Epithelgebiet zeigt auch dasselbe Aussehen wie Stratum intermedium des Schmelzorgans. Trotzdem war in unseren Fällen kein Zahnhartgewebe in der Geschwulst sichtbar. Zur Zeit ist die Auffassung, dass der Inhalt einiger der tubulären Gebilde mit abortiver Schmelzmatrix verglichen werden kann, noch fraglich. Man kann vermuten, dass der charakteristische Feinbau dieser Geschwülste durch hoch-differenzierte Fähigkeit

der epithelialen Bestandteile zustande kommt. Weiterhin kann man annehmen, dass der induzierende Einfluss des Epithels ungenügend ist im Mesenchym eine Veränderung hervorzurufen.

Der Name dieser Geschwülste wird diskutiert, und es wird angenommen, dass bis auf weiteres der Name „Adenomatoides Ameloblastom" oder „pseudo-adenomatöses Ameloblastom" vorzuziehen ist.

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PLATES

Plate 1.

Fig. 1. Case 1. Note the scattered duct-like structures and calcified foci in the mostly solid tumour tissue. (H.-E.).

Fig. 2. Case 1. Region showing a part of the wall of a large cyst. Note the nodular epithelial proliferation and a layer of the flattened epithelium at the inner surface of the cyst wall. (H.-E.).

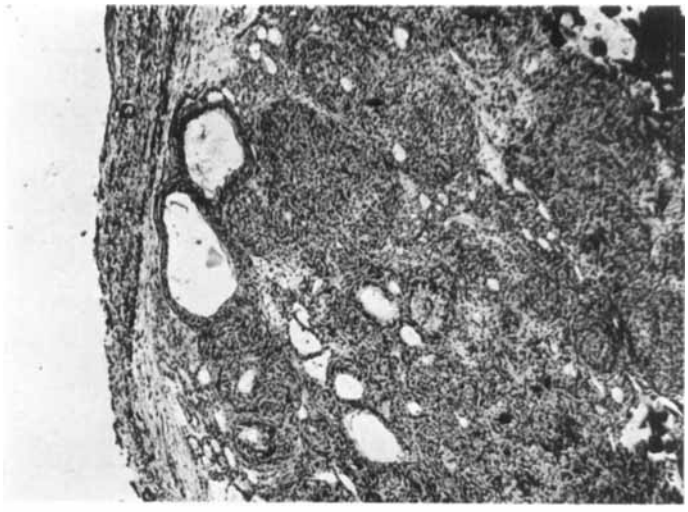

Fig. 1.

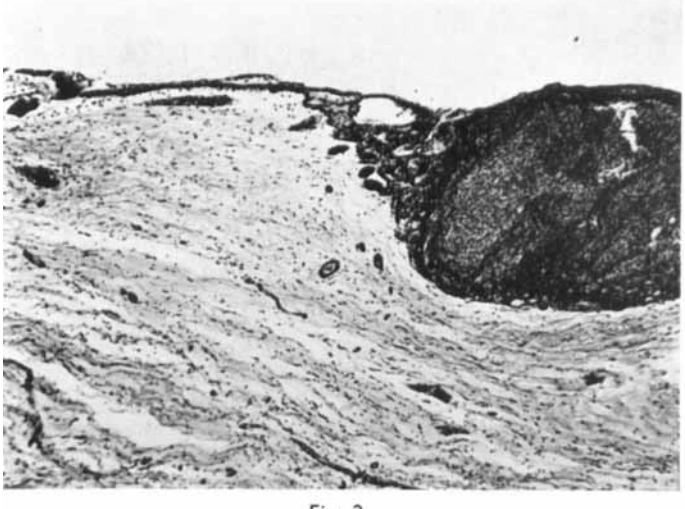

Fig. 2.

Plate 2.

Fig. 3. Case 1. The epithelial nests arranged in strands. The stromal space is broad and has degenerated. (H.-E.).

Fig. 4. Case 1. Region showing the area resembling stellate reticulum. (H.-E.).

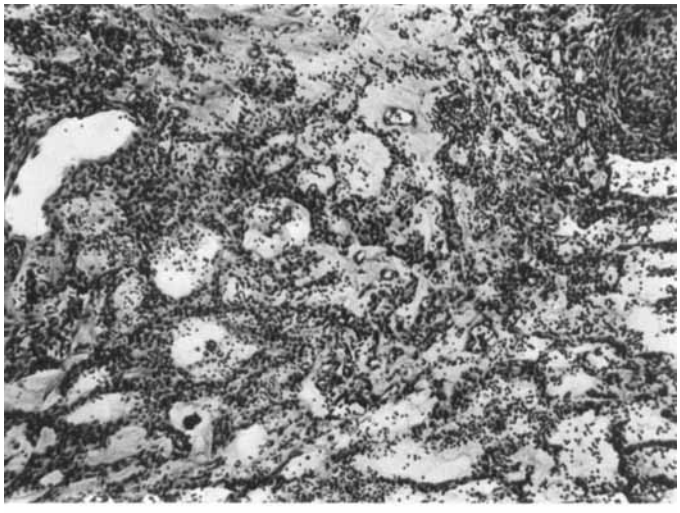

Fig. 3.

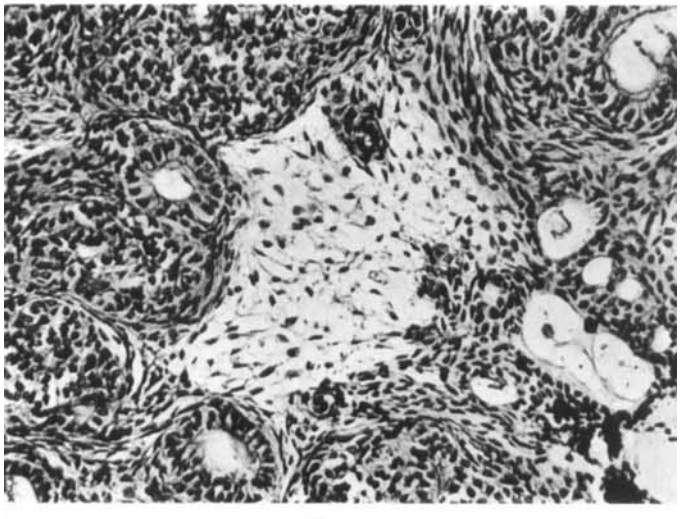

Fig. 4.

Plate 3.

Fig. 5. Case 1. Note the fibrillar material in the duct-like lumen. (PAS-stain, digested with diastase).

Fig. 6. Case 1. Note the net of argyrophilic fibers at the inner surface of the duct-like lumen. (Pap's silver impregnation).

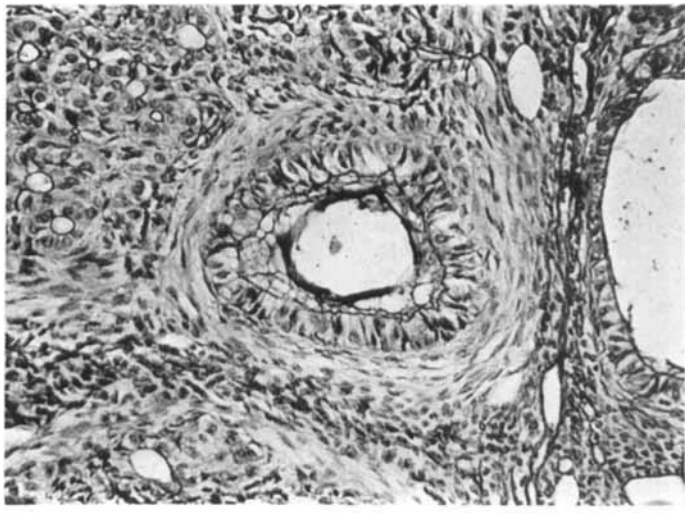

Fig. 5.

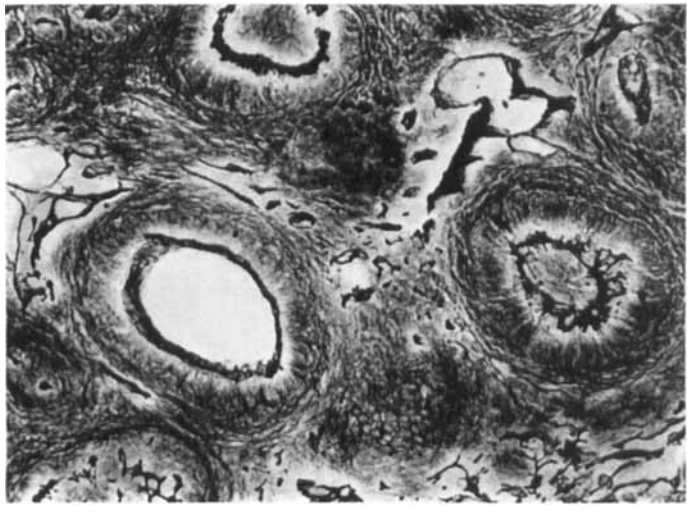

Fig. 6.

Plate 4.

Fig. 7. Case 1. Note the fluid-like, homogeneous material in the duct-like lumen (left) and the nodular pattern of the epithelial growth, in which an invagination of the columnar cells is seen (right). (H.-E.).

Fig. 8. Case 1. The duct-like lumen is filled with a fine, fibrillar material. (H.-E.).

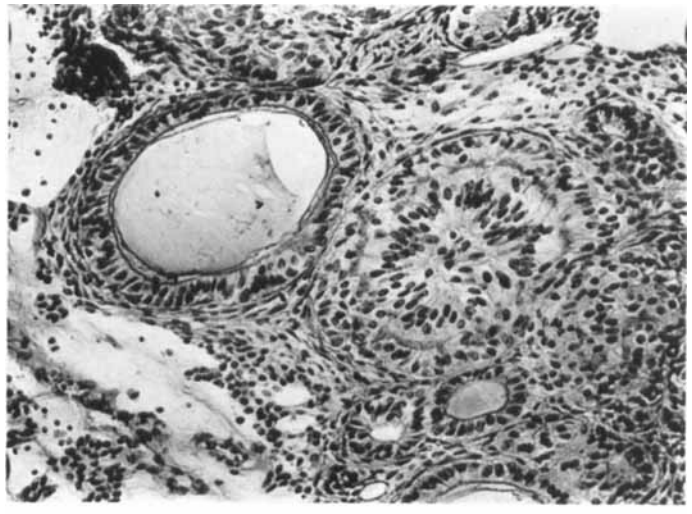

Fig. 7.

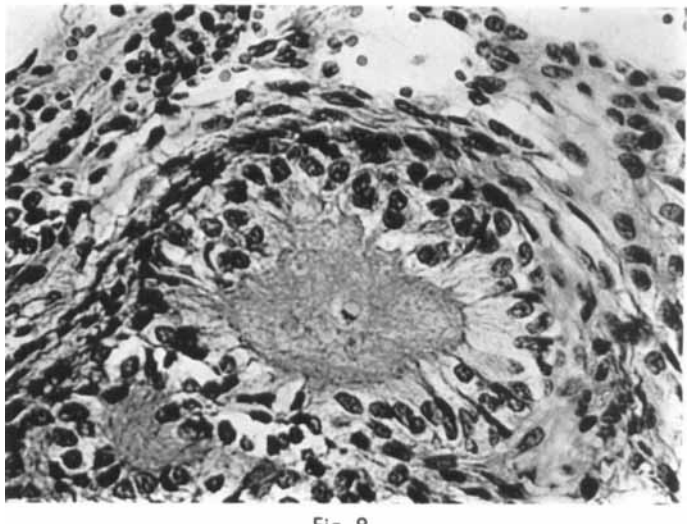

Fig. 8.

Plate 5.

Fig. 9. Case 2. Low power magnification of the tumour. (H.-E.).

Fig. 10. Case 2. Region showing the cystic spaces formed by degeneration of the stromal tissue. (H.-E.).

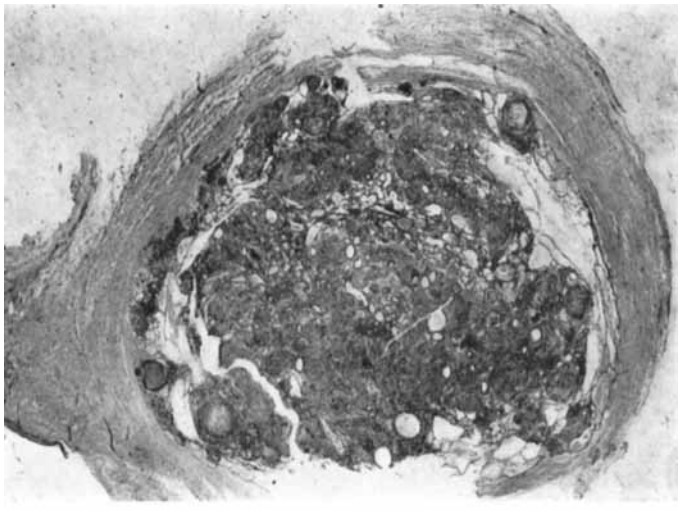

Fig. 9.

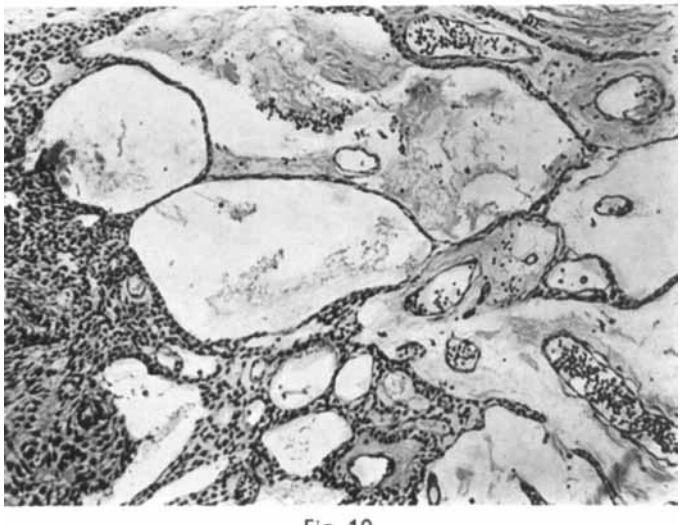

Fig. 10.

Plate 6.

Fig. 11. Case 2. Region showing calcified foci at the peripheral part of the tumour. Some of them resemble to cementicles somewhat. (H.-E.).

Fig. 12. Case 3. Note the duct-like structures and degenerating stromal spaces. (H.-E.)

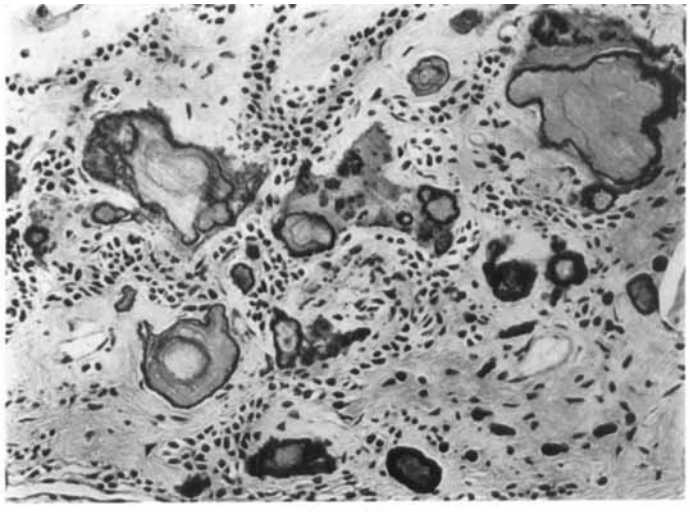

Fig. 11.

Fig. 12.

Plate 7.

Fig. 13. Case 3. Note an abundant glycogen in the columnar epithelium. (PAS-stain. PAS-reactive material in the cell body disappeared with diastase digestion).

Fig. 14. Case 3. Region showing a direct transition between the duct-like lumen and degenerated stromal tissue. (H.-E.).

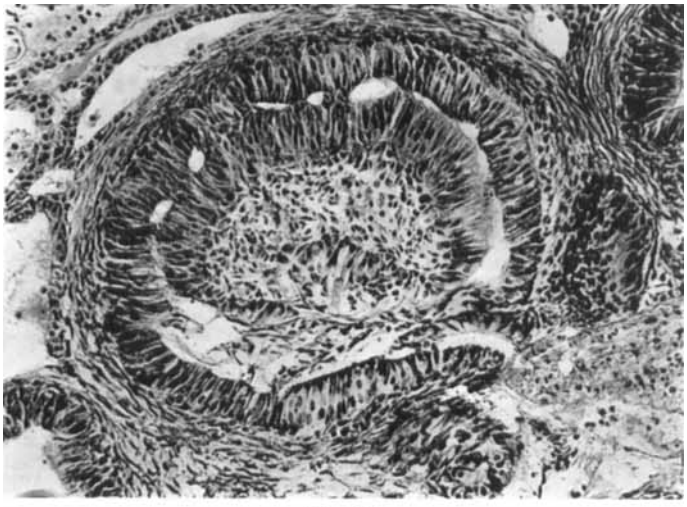

Fig. 13.

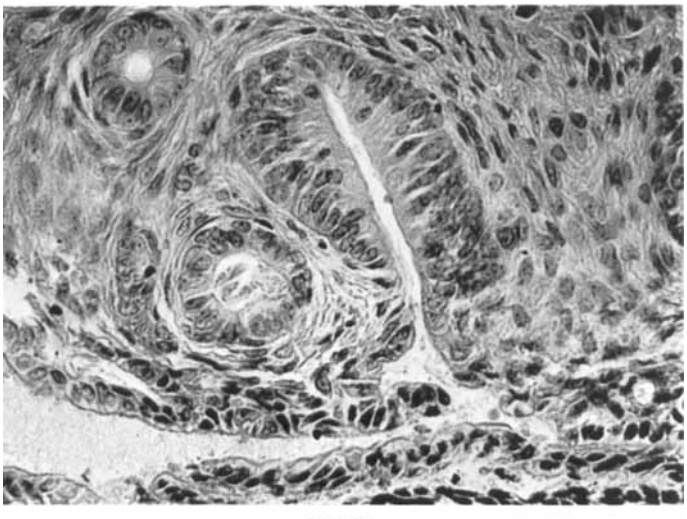

Fig. 14.

Plate 8.

Fig. 15. Case 3. Region showing a direct transition between the duct-like lumen and degenerated stromal tissue. (H.-E.).

Fig. 16. Case 3. Note the distinct positive reaction in the flattened epithelial cells (not a mesenchymal tissue) around the columnar epithelium of the duct-like structure. (Gomori's alkaline phosphatase reaction).

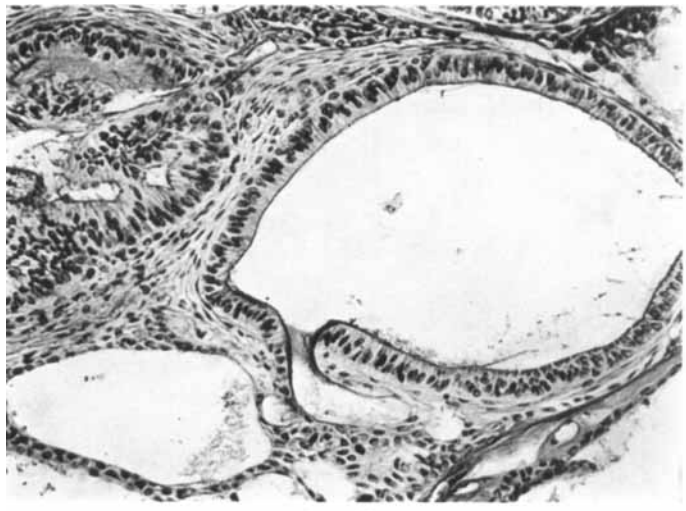

Fig. 15.

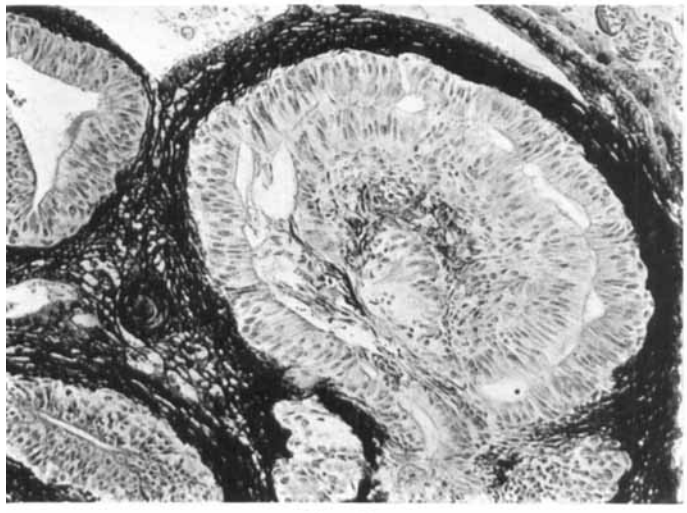

Fig. 16.

Plate 9.

Fjg. 17. Case 4. Low magnification of the tumour. (H.-E.).

Fig. 18. Case 4. Region showing a fairly large cystic space, containing aneosinophilic colloid-like material. (H.-E.).

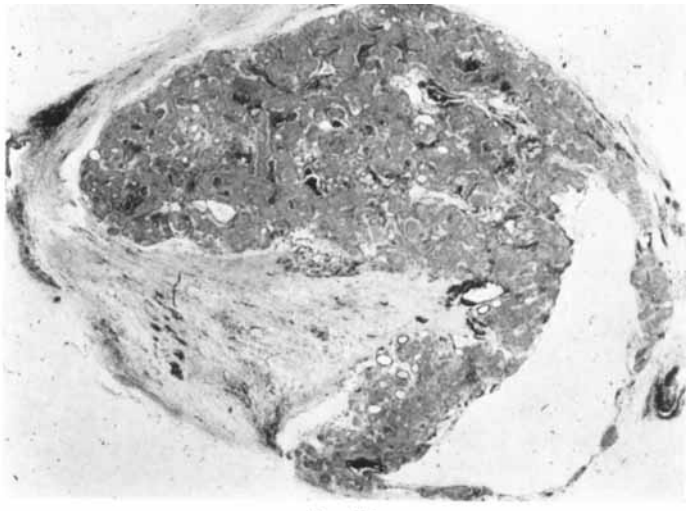

Fig. 17.

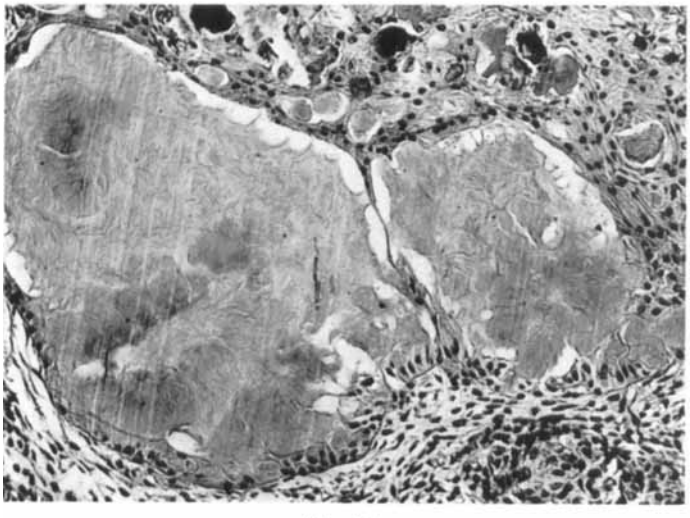

Fig. 18.