A Lecture

ON

THE PATHOLOGY AND TREATMENT OF TUMOURS OF THE JAWS.

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BY FREDERIC EVE, F.R.C.S.,

SURGEON TO THE LONDON HOSPITAL.

TUMOURS of the jaws present many points of interest, because of their variety and complexity. The upper jaw contains the teeth, has attached to it the hard and soft palates and gums, and is closely related to the cavities of the nose and naso-pharynx. It is not only made up of many tissues and structures from which may originate primary growths, but it may be invaded by tumours originating in neighbouring cavities.

Further, the jaws furnish some of the best examples of the truth of Cohnheim's theory of the origin of some tumours from "rests" or remnants of embryonic tissues. The review which I purpose to take of tumours of the jaws has been materially assisted by a collection of all the cases occurring at the London Hospital during the last five years, and which were submitted to microscopic examination. Mr. Russell Howard, lately Surgical Registrar, has most kindly put together and abstracted the notes; and we have gone over together the microscopic specimens. Without this collection of cases, parts of this paper could not have been written, for some of the neoplasms are so complex and variable that it is only by comparing a number of specimens that their true nature can be made out. Further, a series of consecutive cases coming from a single institution may be of some value as showing the frequency of different growths in the maxillae.

EPULIS.

This is a convenient clinical term to apply to a tumour originating from the alveolar margin of the jaws near to or surrounding one or more of the teeth. The tumour springs from the periosteum of the jaw or from the periodontal membrane of the alveolar socket. It more frequently occurs in young adolescents and adults, and affects by preference the incisor or bicuspid regions.

Thirty-eight cases of epulis were admitted to the London Hospital in five years up to 1905. Of these 17 were submitted to microscopic examination. The latter may be classified as follows:—

Epulides composed of granulation tissue springing up around the fangs of carious teeth	...	...	7 cases
Fibro-sarcomata	...	...	2 "
Mixed and fibro-sarcomata containing myeloid cells:			
Upper jaw	...	...	3 "
Lower jaw...	...	...	5 "
There was no example of endothelioma.			

I have long been of opinion that most of the so-called fibrous epulides were fibro-sarcomata. This collection of cases brings this point out strongly, for there is not a single example of pure fibrous epulis. The myeloid variety was by far the commonest. The exact pathological position of this tumour has long been doubtful. Most authors group it with central myeloid sarcoma or myeloma both of the lower jaw and of the long bones. I have taught for some years that this view is likely to give an erroneous idea of the nature and tendencies of the myeloid epulis.

The central myeloid tumours of long bones are growths from the cancellous tissue. They are composed of multinucleated giant cells lying in a tissue composed of round, or mixed round and spindle, cells with an intervening homogeneous or faintly-fibrillated intercellular substance. In addition to the giant cells, which may be considered the homologues of osteoclasts, they contain characteristic marrow cells (myelocytes). The malignancy of these tumours is so slight and local in character that they present a sharp contrast to the ordinary sarcomata of bone. All this applies equally to the somewhat rare central myelo-

mata of the lower jaw. The myeloid epulis, on the other hand, is essentially a periosteal tumour, springing either from the alveolar periosteum or the periodontal membrane. The giant cells lie in tissue composed of oval and round nuclei embedded in a distinctly fibrillar matrix. Most of them may be described as giant cell and mixed fibrosarcomata. There is a distinct tendency to fibrillation of the stroma, and in this fibrillation the giant cells themselves take a very distinct part (see Fig. 1). Unless completely removed these tumours are prone to recur. Among 30 cases at the London Hospital, and including the epulides composed of granulation tissue, 18.2 per cent. recurred. I have only met with one example of epithelioma which might clinically be called an epulis. This is a specimen in the Royal College of Surgeons Museum (2193a) which I described as an epulis from the lower jaw surrounding the second molar tooth. In its microscopic structure this specimen had the characters of an epithelioma but it contained no cell-rests. It was from a woman, aged 52, who observed a swelling in the gum five months before the operation.

In excising an epulis it cannot be too strongly insisted that the teeth in its immediate neighbourhood should be removed, together with the portion of the alveolus involved; and the section should be carried right to the bottom of the alveolus.

Fig. 1.—Myeloid epulis undergoing fibrillation, in which giant cells take part.

TUMOURS OF THE JAWS.

The following is a summary of the tumours of the jaws admitted to the London Hospital and submitted to microscopic examination during the period named:

Cancellous osteoma	1
Myxo-fibroma of antrum (polypoid)	1
Sarcoma and fibro-sarcoma, upper jaw	5
" " lower jaw	8
Squamous-celled carcinoma, upper jaw	7
" " lower jaw	4
Malignant tumours, probably originating from embryonic dental structures	7
Endothelioma	1

This summary will give some idea of the number of different forms of tumour found in the jaws. Among the sarcomata of the superior maxilla were two examples of round-celled and three of mixed-celled sarcoma. Those of the mandible comprised one round-celled, one mixed, and six fibro-sarcomata. It is not, however, my object to deal with them in detail, but I shall select for consideration one or two interesting groups.

It is well recognized that certain tumours in the jaws originate in aberrant dental structures or in "rests" or remains of portions of the embryonic structures set aside for the development of the teeth, especially in those remains of the enamel organ found in the alveoli, and first observed by Malassez. The paradental epithelium of Malassez is evidently identical with the sheath of Hertung, which is a growth of the epithelium of the dental germ extending in the form of a fold towards the apex of each fang (see Fig. 2). In the gum itself are also remains of the dental lamina and of the neck of epithelium connecting this with

the tooth germ (see Fig. 2, Z.L. and V.B., from *Quain's Anatomy*, vol. iii, part iv, Fig. 64). "Rests" of the tooth papilla may give rise to central sarcomatous tumours of the jaws.* This will be proved by reference to certain sarcomatous tumours containing strands of epithelium evidently derived from the enamel organ.

The importance of these tumours does not reside in the growths themselves, but in the light they throw on the etiology of morbid growths generally. On account of the specialized character of certain structures in the jaws we are able to trace the origin of the tumour, whereas such a clue fails, for example, in the sarcomata of the long bones. We can show definite grounds for stating that a large group of tumours clinically presenting the characters of sarcomata and carcinomata are derived from "rests" of embryonic dental structures.

We therefore recognize two great groups of tumours—one originating from embryonic "rests," the other, mainly carcinomata, arising as the result of chronic irritation and inflammation, and possibly from micro-organisms. Following Cohnheim, we must remember, however, that any irritation producing hyperaemia may cause a latent "rest" to grow and become active. Returning now to tumours arising from "rests" of dental structures, I shall exclude the calcified odontomes and confine myself to what may be termed "tooth tumours" or embryoplastic odontomes. I recognize so far two varieties:

1. Composite odontome, containing all the elements of a tooth follicle.
 - (a) A composite or mixed embryoplastic odontome (innocent).
 - (b) A composite or mixed embryoplastic odontome (sarcomatous).
2. Epithelial odontome derived from enamel organ cells.
 - (a) Epithelial odontome (cystic variety) or cystic epithelial tumour.
 - (b) Epithelial odontome (carcinoma), usually described as spheroidal or columnar-celled carcinoma.

Of this group (2 a), the epithelial odontomes or cystic epithelial tumours are quite familiar. They are composed mainly of collections of cysts and usually involve the

lower jaw. Microscopically they consist of anastomosing and branching epithelial columns (Fig. 3), which are made up of a peripheral layer of columnar cells, while the central cells undergo a peculiar form of degeneration, resulting in the formation of a reticulum. Elsewhere I have shown that this degeneration is due to a colloid metamorphosis of the protoplasm of the cell, and not to compression and flattening of the cells by effusion of fluid between them.¹ These changes are in exact imitation of those which take place in the formation of the enamel cap. The tumours are usually only locally malignant, but I have cited cases in which metastasis took place.²

1. (a) Composite Embryoplastic Odontome (Innocent).

In 1886 I published³ an account of a tooth tumour of this description which was evidently non-malignant, as shown both by its microscopic characters and clinical history. The patient was a man aged 24, with a swelling of the left side of the lower jaw which had been growing four years. It was surrounded by a capsule of bone, and was shelled out after removing only the outer wall of the cavity. Two years later there was no return of the disease. Microscopically, the tumour was composed of anastomosing bands of enamel epithelium lying in fibrillar connective tissue (see Fig. 4). In places were elongated bands of columnar enamel cells (Fig. 4a).

1. (b) Composite Embryoplastic Odontome (Sarcoma).

This group is the counterpart of the preceding, the stroma, however, being malignant. In the same paper I described as embryoplastic odontomes two sarcomatous tooth tumours, which contained bands and columns of enamel epithelium. Both were in the Royal College of Surgeons Museum. One was presented by the late Mr. Christopher Heath. It is a very large central tumour involving the left half of the lower jaw, and was removed from a man aged 32. It had existed for eleven years. The mass of the tumour was a fibro-sarcoma, and embedded in it were irregularly-shaped masses and columns of enamel epithelium (Figs. 5, 6, 7) (Specimen 2234 Royal College of Surgeons Museum). In the second specimen, also a lower jaw, the bulk of the tumour was composed of round cells. The patient was 67 years of age. In 1847-

Fig. 2. (After Quain).—Section of the first milk incisor of a human embryo (Röse). D.K., papilla; Od., odontoblasts; K., bone of alveolar process; S.E.a., S.E.i., outer and inner layers of enamel organ; S.P., enamel pulp, or reticulum produced by degeneration of the central cells of enamel organ; Z.F., dental furrow; M.E., mouth epithelium; Z.L., remains of dental lamina; V.B., cell bridge connecting this with tooth germ; E.L., reserve germ for permanent tooth; J.L.I., germ of second milk incisor.

Fig. 3 (low power).—Multilocular cystic tumour of lower jaw (enamelogenous odontome). St. Bartholomew's Hospital Museum, No. 536 (described in Mr. Eve's Erasmus Wilson Lectures, BRITISH MEDICAL JOURNAL, 1883, vol. i, p. 1).

* See specimen No. 2233, Royal College of Surgeons Museum, described by me.

Sir W. Fergusson removed from the right side of the lower jaw a "fibroid" tumour, containing a cyst, of many years' duration. In July, 1877, a cystic tumour, which had developed in the left half of the lower jaw, was operated upon by opening the cysts and scooping out their contents. In November, 1877, and again a year later, the operation was repeated for recurrences of the cystic disease. In November, 1879, the patient reappeared with a large solid tumour which had grown on the left side of the jaw in the site of the cystic tumour. This recurrent growth was removed. The patient died three months afterwards with recurrence of the tumour in the skin of the cheek, with a round-cell sarcoma beneath the right biceps muscle, and a tumour of a similar nature in the pelvis. This case fully proves the malignancy of these tumours.

In the London Hospital series of cases are two examples of sarcomatous mixed odontome, one being from a case of my own. This patient, a woman 33 years of age, had observed a swelling on the outer side of the left half of the mandible for two years. The tumour was surrounded

Fig. 4.—Composite embryoplastic odontome composed of anastomosing bands of epithelium in fibrillar connective tissue.

by a complete bony capsule, and on section looked like a sarcoma. A portion of the whole thickness of the jaw was excised. The microscope showed that the growth was a fibro-sarcoma containing branching strands of enamelogenous epithelium (Figs. 8 and 9). Another case was a woman, aged 53, who had observed a swelling of the alveolar margin of the right upper jaw for four

Fig. 4a.—Columnar enamel cells from the same tumour as Fig. 4.

months. A fungating mass projected from the alveolar margin (this point should be noted). The strands of epithelium (Fig. 10) were wider in this case and showed typical reticular degeneration (Fig. 11). They were distributed in an abundant stroma of sarcoma tissue.

In these composite tooth tumours I surmise that the epithelial element is derived from the enamel organ and the sarcomatous stroma from the tooth papilla.

The dental character of these tumours cannot be doubted, owing to the characteristic appearance and arrangement of the epithelium. In Figs. 7 and 9 the peripheral layer of columnar cells is very well shown. At places in the columns are rounded or flask-shaped enlargements due to microscopic cysts, or to small, rounded areas of stroma which appear to penetrate the epithelial columns just as the tooth papilla invaginates the enamel organ (see *b* in Fig. 7).

The degeneration of the central cells of the columns, leading to the formation of a reticulum, was present in all the specimens, and is shown at *a* in Figs. 7, in 9 and 11. A wavy or crenated outline of the margins of the epithelial strands is a feature of some of these growths. (See Figs. 5 and 8 and compare with Fig. 3, cystic odontome.) The tumours were sarcomata, as shown by their appearance and progress. In Mr. Heath's specimen the duration was unusually long—namely, eleven years. The patients were 21, 33, 53, and 55 years respectively when the tumours commenced. The tumour in the upper jaw was evidently the most malignant, for it had existed only four months.

Fig. 7 (high power).—Composite embryoplastic odontome with basis of sarcomatous tissue. The figure shows a rounded strand of enamel-epithelium, lined externally with columnar cells. The intermediate layer exhibits a reticulum (*a*). At its centre, the strand is penetrated by a rounded area of stroma (*b*).

I am not aware that this interesting group of tumours has been fully described before.

2. (*b*) Epithelial Odontome (Carcinoma).

The study of the composite sarcomatous odontomes leads up to this important group, and, in fact, gives the clue to their nature—epithelial odontome (carcinoma), usually described as spheroidal or columnar-celled carcinoma.

Among the tumours of the upper jaw is a large group exhibiting many general characteristics. They are usually described as springing from the epithelium and mucous glands of the lining of the antrum. They consist of rounded masses or of columns of epithelium, often tortuous, branched, and anastomosing. The epithelium is mainly of the spheroidal type, with sometimes columnar or elongated cells at the periphery of the columns; in one specimen the cells were entirely columnar. The central cells of the epithelial columns undergo vacuolation by mucoid or colloid degeneration, with the result that in typical examples a reticulum is produced; and the margins of the columns are often crenated. The ground substance or connective tissue is, as a rule, very abundant and proliferative; in fact, it may have all the appearance of sarcoma tissue, and the growth might be described as a carcinoma sarcomatodes. The connective tissue may be composed of fibrillar tissue containing large numbers of small round nuclei, or of elongated or spindle shaped nuclei; or, again, of fibrous tissue. The following examples of these tumours indicate their chief features:

A man, aged 61, was admitted with a fungating mass springing from the alveolus at the position of both bicusps and the first molar of the upper jaw. It had existed for six weeks. The upper jaw was removed. The microscopic characters of the growth are shown in Figs. 12, 13, and 14. Fig. 12 shows under a lower power the epithelial columns with crenated edges; and Figs. 13 and 14 (under higher powers) show elongated cells at the margins of the columns, and a well-marked reticular structure. The stroma penetrates the columns in places, as in Fig. 7. This tumour appeared to spring from the alveolus, yet it is clearly not a squamous-celled carcinoma.

A young man, aged 20, was admitted under my care with a firm tumour situated on the outer side of the maxilla over and below the malar eminence; it had been growing five months. I removed the maxilla. Figs. 15 and 16 show the microscopic characters of the tumour under a low and high power. The reticulum in Fig. 16 is well shown. The stroma is very abundant, and the tumour closely resembles that shown in Figs. 10 and 11, and classed among the mixed sarcomatous tooth tumours.

In the case of a boy, aged 11, a tumour of seven weeks' growth sprang from the alveolus between the upper central incisors, and separated them. I have the specimen before me; the growth is entirely confined to the alveolus, does not extend as far as either the inferior meatus or the antra. Its microscopic characters are most interesting, and are shown in Figs. 17 and 18. Fig. 17, from the centre of the tumour, shows columnar cells arranged in rounded masses or in tubular columns with a central space formed by degeneration of the central cells. Fig. 18, taken vertically through the gum, shows the columnar-celled growth beneath but entirely distinct from the epithelium of the gum. Here there is distinct cystic degeneration similar to that found in cystic epithelial tumours.

I consider this tumour to have been derived from "rests" of the columnar cells of the enamel organ. If there had been any trace of continuity between it and the nasal or antral cavities I should have been in doubt as to its nature.

The last example I shall quote should, I think, be included in this group.

The patient, a woman aged 58, had a tumour stated to have begun in the left side of the hard palate at the age of 19 years. From the appearance of the specimen it seems probable, however, that the growth commenced in the posterior part of the left alveolar process and spread to the hard palate. I saw her in 1899 when a growth projected from the whole surface of the hard palate and involved the alveolus only at the point stated, although it had spread up to it in front and to the left. The tumour had extended into both antra, expanding their walls and absorbing rather than infiltrating. I removed both superior maxillae after tying the external carotid on the left side, which was chiefly affected. The patient did not recover consciousness and died on the third day. Fig. 19 shows the growth under a low power. The columns are composed of spheroidal epithelium and their arrangement is very similar to Fig. 12. In places there was extensive cystic degeneration. Apart from the matter under consideration, the case may merit recording owing to the long duration—thirty-nine years—and the peculiar nature of the tumour.

In regard to its duration and progress this case presents a close parallel with some examples of mixed sarcomatous odontome.

In this series of cases I have placed five in the group under consideration. The tumour occupied the maxilla in four cases and the mandible in one. The majority were rapidly growing; recurrence took place in two, two patients were lost sight of and one died of shock.

Upon the evidence given above, I therefore submit that some of the carcinomatous tumours of the antrum arise from "rests" of the germinal epithelium of the teeth, which make their way in the direction of the least resistance, namely, into the antral cavity. This opinion is based on the arrangement of the epithelial columns, the presence in most instances of the peculiar degeneration of the cells characteristic of amelogenous tumours, and in some of a peripheral layer of columnar cells. Further, in some instances there was definite evidence that the tumour originated in the alveolar process.

It is not my intention to suggest that the lining of the antrum does not produce tumours, but I think they are usually of the columnar-celled type, as might be anticipated from the nature of the epithelium. Columnar-celled carcinomata also originate from the lining membrane and mucous glands of the nose, and may secondarily involve the antrum.

The nature of the morbid growths springing from the lining of the antrum may be gauged by the accompanying photographs (Figs. 20 and 21) of papillomata associated with chronic suppuration of the antrum. These, with

other similar specimens, I described in the *Clinical Society's Transactions*, vol. xxxii, p. 200.

Not unlike them in some respects is the photograph (Fig. 22) of a malignant antral growth from a gentleman aged 62, whose maxilla I excised. He had suffered with nasal polypi for fifteen years. Mr. Hovell, who transferred the case to me, states that for three or four years polypi were seen protruding into the nose from the antrum, but the patient would not consent to the antrum being explored. The bulk of the tumour consisted of fibrillar connective tissue, and intersecting it were numerous well-defined tubules (each possessing a lumen filled with mucus) lined with long columnar cells (Fig. 22). Some goblet cells were observed. Many years ago I examined for Mr. Heath a localized papillary outgrowth springing from the lining of the antral cavity. I described it thus: The mucous membrane of the antrum was observed to be exceedingly thickened by an overgrowth of epithelium with cells for the most part of an elongated form (R.C.S. Museum, No. 2246).

ENDOTHELIOMA.

The following case probably falls under this classification: A woman, aged 52, was admitted under my care with a tumour of the left superior maxilla which expanded the outer wall, depressed the hard palate, raised the orbital floor, and blocked the nostril. It had existed for three and a half months. I removed the maxilla after preliminary laryngotomy and ligature of the external carotid, with a favourable result. Microscopically the tumour was composed of large rounded masses or of narrow rods of spheroidal cells with large nuclei. These lay in sharply defined spaces in the connective tissue lined in places with flattened cells like endothelium (see *a* in Fig. 23).

OPERATIVE TREATMENT.

The mortality of excision of the maxilla is still high, some of the latest statistics showing a percentage of 20 to 30 per cent. of deaths. Kronlein found a mortality of 21.5 per cent. in 158 cases of total resection of the maxilla during the antiseptic period. Koenig estimated the mortality at 30 per cent.

The chief causes of death are from septic lung affections, or from loss of blood directly at the time of the operation, or more indirectly, at a subsequent period, from exhaustion. Some deaths also occur from secondary hæmorrhage.

Pulmonary complications due to inhalation during anaesthesia account for half the cases of death after this operation. Kronlein, therefore, abandoned general anaesthesia, and operated after a morphine injection and under suggestive anaesthesia. The relatively high mortality of resection of the upper jaw, even with modern aseptic precautions, from the above causes must have been noted by every observant surgeon. Being impressed with the great value of ligature of the external carotid and laryngotomy as a preliminary measure in the removal of malignant tumours of the tonsils and soft palate, I have adopted it for some time in all cases of fairly extensive malignant disease of the maxilla. I first performed ligature of the external carotid in 1899, in the case, already quoted, of removal of both upper jaws for a tumour in the left superior maxilla which had spread over to the right side.

In cases of disease of limited extent, it is sufficient if the patient is kept well in the lateral position so that the blood can flow from the mouth.

In my opinion the operations of preliminary ligature of the carotid and laryngotomy do not prolong the operation, and tend to decrease the amount of the shock. The average period required for both these operations is under fifteen minutes, when no glands require removal. Very few vessels need ligature; in some cases none, except one or two in the cheek flap. Thus much time is saved in securing vessels, sponging, etc., and what is much more important, the operator can see exactly what he is doing, and remove the disease more thoroughly. I also regard the incision in the neck for ligature of the external carotid as a distinct advantage, in that it permits the surgeon to ascertain the condition of the glands behind the angle of the jaw and around the upper part of the internal jugular vein. My own cases lead me to believe that the tendency to implication of glands in both

Fig. 5 (low power).—Composite embryoplastic odontome showing strands of enamel-epithelium lying in a sarcomatous ground substance. The strands enclose small cysts, and areas of stroma.

Fig. 9 (high power).—From the same tumour as Fig. 8, under a higher objective. The peripheral cells of epithelial strand are columnar, and the intermediate cells form a reticulum.

Fig. 6 (low power).—The same as Fig. 5, but under a higher objective. See also Fig. 7, under still higher objective.

Fig. 10 (low power).—A similar tumour from the upper jaw, showing masses of rounded epithelium in a sarcomatous ground substance.

Fig. 8 (low power).—A similar tumour to the above, Figs. 5 and 6. The columnar cells lining the strands of enamel-epithelium are well shown.

Fig. 11 (high power).—From the same tumour as Fig. 10, showing a reticulum formed by the cells of the epithelium.

Fig. 12 (low power).—Epithelial odontome (carcinomatous). The tumour is composed of strands of epithelium with crenated edges, lying in a fibrous stroma. The epithelial element greatly predominates over the stroma.

Fig. 15 (low power).—Epithelial odontome (carcinomatous), showing strands of epithelium in a fibrillar stroma.

Fig. 13 (high power).—From the same tumour as Fig. 12 under a higher objective, showing a reticulum formed by the epithelium in the strands.

Fig. 16 (high power).—From the same tumour as Fig. 15, showing the reticulum in the epithelial strands.

Fig. 14 (high power).—The same as Fig. 13, under a higher objective, showing elongated epithelium at the margins of the epithelial strands and a reticulum.

Fig. 17 (low power).—Growth from alveolus of upper jaw, composed of rounded and elongated spaces lined with columnar epithelium.

Fig. 18 (high power).—From the same tumour as Fig. 17. The section is taken vertically through the gum; beneath this, and distinct from it, is the columnar-celled growth undergoing cystic degeneration.

Fig. 19 (low power).—Tumour of upper jaw of thirty-nine years duration.

Fig. 20.—Papilloma of antrum associated with chronic suppuration.

Fig. 21.—Growth in antrum, mainly papillomatous, associated with chronic suppuration.

Fig. 22.—Columnar-celled carcinoma of antrum.

Fig. 23.—? Endothelioma of antrum. Rounded mass of spheroidal cells lying in a space lined with flattened cells. a, Endothelial cells lining (?) lymphatic spaces.

carcinoma and sarcoma of the maxilla has been much under-estimated. In the majority of them I found the external carotid obscured by overlapping enlarged glands. Preliminary ligation of the external carotid, therefore, gives the surgeon the opportunity of investigating the condition of, and, if necessary, of dissecting out and following up secondary disease in the glands of the neck—a procedure now generally adopted where feasible in malignant disease elsewhere. To ascertain the condition of the glands, and in view of the fact that the position of the bifurcation of the common carotid is often higher than usual, I have always made it a practice to thoroughly expose the bifurcation. The ligation is usually applied between the superior thyroid and lingual arteries.

Returning now to preliminary laryngotomy. This should be performed after the ligation of the external carotid, as in opening the air passage the hands must necessarily be soiled. Laryngotomy, in addition to greatly diminishing the chance of inhalation pneumonia, also diminishes shock. The anaesthetist's task is easier, and therefore likely to be more efficient. Cyanosis is entirely avoided, and with it the danger of overstraining of heart muscle from distension of the right side of the heart. I much prefer laryngotomy to tracheotomy; the former can be very rapidly performed, there is little haemorrhage, and little disturbance of soft parts. After the insertion of the tube the air passages are protected by a large marine sponge thrust into the pharynx. The disadvantages associated with Trendelenburg's or Hahn's tubes are thus avoided. The tube is taken out immediately after the operation, or the next morning.

During the last two years I have in five consecutive cases performed removal of the upper jaw with preliminary ligation of the external carotid and laryngotomy without a death. One patient died of gangrene of lung in whom the external carotid was tied *without laryngotomy*. Taking all my hospital cases during the last six years and adding my private cases, I have removed the maxilla twelve times with two deaths—a mortality of 16.6 per cent. None of my cases have had secondary haemorrhage either from the cavity in the mouth or the external carotid.

In the operation of excision of the upper jaw the median or Fergusson's incision is now invariably used; the horizontal incision across the facial aspect of the maxilla should be only just above the level of the lower edge of the malar bone, and should not extend further outwards than the speno-maxillary fissure or the fibres of the facial nerve passing to the inferior half of the orbicularis oculi will be divided.

In severing the bones I have for some time used a Gigli's saw. It effects its purpose much more cleanly and quickly than an ordinary saw and bone forceps. After reflecting the cheek flap and raising the soft parts from the floor of the orbit, a strong silk thread is passed from above downwards through the speno-maxillary fissure by means of a large narrow aneurysm needle. The Gigli's saw is drawn through the fissure by the silk, and the section then completed. The section of the hard palate is carried out in a similar manner by making a puncture in the middle line at the junction of the hard and soft palate. The aneurysm needle loaded with silk is passed through the nose and through the puncture into the mouth, where the silk is seized, and by it the saw is drawn through the nose into the mouth. The section of the hard palate is then completed. Although this method is not, I think commonly employed, I find that Schlatter has preceded me in publishing it.

When the position of the growth admits of the orbital floor being preserved I have found it inadvisable to completely sever the malar bone at the level of the speno-maxillary fissure. A better plan is to chisel or saw through the lower two-thirds of the malar; and from this osseous incision I divide the anterior wall of the maxilla in a direction horizontally inwards parallel with the orbital margin until the cavity of the nose is reached. By this means not only is the floor of the orbit preserved, but also its bony margin. There is, therefore, less falling in of soft parts, and less tendency to tear the floor of the orbit away with the bone than when the incision is carried through the whole thickness of the malar bone and along the orbital plate just within the orbital margin, as is often recommended.

When an epitheliomatous growth has commenced in the

alveolus or hard palate and does not appear to have extensively involved the antrum, only the lower half of the maxilla may require removal. But before this limited operation is performed an exploratory opening should be made into the antrum, in order to make sure of the extent of the disease. If the latter be found limited, the removal of the lower half of the bone is completed by sawing from the nasal cavity horizontally outwards; or a Gigli's saw may be passed through the pterygo-maxillary fissure into the nose (Schlatter).

When, in cases of disease of the maxilla requiring its removal, the muco-periosteum of the hard palate is not involved, I have with considerable advantage in two cases preserved it by carrying an incision along the inner surface of the teeth on the affected side and reflecting the muco-periosteum towards the middle line, as suggested by Watson Cheyne; the maxilla is then removed in the ordinary way, and the edge of the flap of muco-periosteum is stitched to the cut edge of the mucous membrane of the cheek. The roof of the mouth is thus restored.

I have to thank Messrs. Longman for their kind permission to use Fig. 2.

REFERENCES.

- ¹ *Odontological Society's Transactions*, vol. xviii, New Series, p. 44.
² *BRITISH MEDICAL JOURNAL*, vol. i, 1883, p. 3. ³ *Odontological Society's Transactions*, vol. xviii, New Series, p. 52.

A NEW METHOD OF DEALING WITH CLEFT PALATE.*

By F. N. G. STARR, M.B.Tor.,

ASSOCIATE PROFESSOR OF CLINICAL SURGERY, UNIVERSITY OF TORONTO; ASSOCIATE SURGEON, HOSPITAL FOR SICK CHILDREN; ASSISTANT SURGEON, TORONTO GENERAL HOSPITAL.

THOSE of us who have had much experience with cases of cleft palate have all met with more or less disappointment in our results. It has more than likely happened in the practice of all who have undertaken these cases that certain ones, though they looked promising at the time of operation, have broken down at some point in the line of closure, if not throughout. This experience has been mine upon more than one occasion. In looking about for causes, the following points presented themselves: (1) Tension along the line of suture; (2) sucking of the stitches by the patient; (3) infection from the mouth.

When searching for some means to overcome these difficulties I read a paper by Charles H. Peck, of New York,¹ in which he made reference to a plan suggested by C. H. Mayo—namely, the introduction of a tape through the lateral incisions, completely surrounding the flaps, and thus preventing tension. I tried this at the first opportunity; but, though it took off the tension, I am satisfied that in the three cases upon which it was used the risk of infection was increased, for after forty-eight hours it became most offensive, and by the end of a week the patients almost hated themselves. It therefore became necessary to find something better, and, finally, as a substitute for the tape I chose aluminium, sufficiently beaten out to make it pliable. I have no doubt that silver would answer the purpose equally well, but it is more expensive.

My technique varies somewhat from the Langenbeck operation, and, I think, saves time, which is an important point. The child is placed upon a table with a sandbag under the shoulders to throw the head well back, while the surgeon stands to the left of the patient. Hewitt's gag is placed in position and the tongue drawn well forward by means of a silk suture. I make the first lateral incision well out to the alveolar margin of the hard palate, carrying it beyond the anterior extremity of the cleft, if the cleft does not extend through the alveolar margin. With the periosteal elevator the muco-periosteum is quickly denuded from this side, then with Lane's curved scissors the palate aponeurosis is snipped from the posterior margin of the hard palate, thus freeing the flap from its bony attachment. The flap should be freed anterior to the cleft. This incision may then be packed with a piece of sea sponge while one proceeds to the opposite side to deal with it in the same way. The first packing may now be removed, when one finds that all haemorrhage

* Read at a meeting of the Toronto Medical Society, May 2nd.