SURGICAL DISEASES OF THE SUPERIOR
MAXILLA.*

BY W. P. BARNDOLLAR, M. D.,

PITTSBURG.

The surgical diseases of the superior maxilla are quite within the province of rhinologists, and it is the object of this review to bring to their attention the various infections and neoplasms which may primarily be found either upon the surface of or within the maxilla, believing that they are not usually given that attention and consideration which their frequency and imperative early diagnosis entitles them. It has always been the custom to apportion the surgery of this region to the general surgeon, the rhinologist and the surgeon dentist; and it has been the complaint of the general surgeon for some years that these conditions of the superior maxilla, especially the malignant neoplasms, reach him when all hope of cure, by operative intervention, is past. Within the last few years the dentist has awakened to this state of affairs, and is not willing to allow any of these diseases which may come under his care to continue long without positive diagnosis. It is the opinion of the writer that rhinologists should not hold themselves responsible for antral and nasal conditions only, but should have a thorough working knowledge of the diseases to which this part of the body is subjected, and while it is not necessary for them to be absolutely familiar with their operative surgery, it is essential that they be familiar with and responsible for their diagnosis by their clinical symptoms, gross appearance, by section or incision.

From the rhinologic standpoint the diseases of the superior maxilla are: 1. Infections. 2. Neoplasms.

*Candidate's thesis, presented to the American Laryngological, Rhinological and Otological Society at Chicago, June 15-16, 1915.

I.—INFECTIONS.

The infections to which the superior maxilla may be subjected are those affecting the alveolar process and those of the maxillary sinus or antrum. The presence of the teeth, with their tendency to suppuration and necrosis, is responsible for the greater number of these infections of the alveolar process; but we must not forget that certain specific and toxic inflammations are likely to show unusual activity in this region.

Alveolar or Subperiosteal Abscess.—The portal of entrance for this infection is from the diseased tooth through the root canal to the periosteal lining of the tooth socket. This condition is of rapid development and easily recognized, as the tooth affected is sensitive, painful and slightly protruding, with a small localized abscess as the result.

Periostitis and osteomyelitis also result from tooth infection, though they may also result from the specific inflammations. They require incision, not only to establish their cure, but to establish, with certainty, differential diagnosis in those cases that the lesion may lead one to think of the more serious diseases which develop under similar conditions.

Necrotic Caries.—This condition is now known to be a tubercular one, usually engrafted upon a previous pyogenic infection. It may show as a swelling and later slow forming abscess, either below the infraorbital ridge or in the canine fossa. It must often be differentiated because of its slow development and tedious course.

Actinomycosis is a specific infection of the soft tissue and rarely involves the bone until its later stages. This is a rare condition, but it must be borne in mind and differentiated from the chronic abscesses or neoplasms which it has been known to simulate, by examination of the purulent discharge.

Syphilis may affect the alveolar process, either as a periostitis or gumma; this latter may be mistaken for a true neoplasm, and in all cases of doubt the test should be applied. It is only necessary to recall that unusual forms of both lead and phosphorus poisoning must be excluded in diagnosis of affections of the upper jaw.

Maxillary sinusitis is the commonest and most obstinate

of the infections of the superior maxilla. It is almost invariably secondary to or associated with diseases of adjacent structures, the acute inflammatory conditions of the nasal mucous membrane being the most frequent factor; infections about the roots of the teeth, that are found in close proximity to the antral floor, are another frequent cause and account for about twenty-five per cent of these infections (Skillern). Cryer says that, in his opinion, "more cases of diseases of the teeth occur as secondary to diseases of the antrum, than the reverse;" a point which we are likely to overlook, though consensus of opinion does not admit the likelihood of this statement. We have learned that necrosis of the teeth is directly responsible for antral infection much less frequently than was previously supposed (Luc, fifty-five per cent). Again, infection from other sinuses may gain entrance to the antrum, either through its normal ostium or abnormal openings. From the buccal cavity infection may enter through a fistula left by the removal of a tooth, the roots of which either pierced the antral floor or perforated it when it was drawn. I have had two such cases very recently.

The antrum is practically a closed cavity, lined with mucous membrane, and with bony walls of varying thickness; so that we have a cavity favorably formed to retain and nourish infection. The mucous lining is more of the endothelial type, hence has less resisting power, so that caries of the bone from its infection is a more frequent occurrence. As the antral cavity is rudimentary up until the sixth or seventh year, sinusitis is practically unknown in childhood. Maxillary sinusitis may be either acute or chronic.

Acute sinusitis produces a feeling of distention and pressure in the maxilla; sensitiveness to pressure in the canine fossa; pain usually continuous and severe, due, Cryer says, to the fact that the branches of the inferior dental nerves which cross the floor of the cavity are protected only by the mucous membrane lining the cavity, and hence exposed almost directly to both irritation and pressure; pus in the nasal cavity, often seen escaping from the normal ostium under the middle turbinate bone. These are characteristic of this infection, together with the general symptoms of pus absorption: chills, temperature, and

sometimes sweats. As in its acute stage sinusitis could scarcely be mistaken, it is, however, necessary to differentiate between the chronic form and some of the local conditions found in the superior maxilla.

Chronic sinusitis is usually the prolongation of the acute form. The pain is far less marked or even absent; the feeling of distention and pressure, however, still persist; constitutional symptoms are very slight or absent, yet the patient is much more likely to be mentally depressed and indefinite. Positive diagnosis may be made by puncture only; even in the hands of the experienced, considerable difficulty may be met with in diagnosing the presence of malignant growths and excluding the possibility that the antrum may be distended with pus and granulation tissue. Where the slightest doubt exists, incision through the canine fossa should be carried out and thorough inspection made. Glandular involvement is not present, nor is there ever bulging of the walls of the sinus. Sinuses do not form, nor does the diseased area grow progressively larger.

II.—NEOPLASMS.

In no other part of the body do we find new growths developing with such relative frequency or variety as in the superior maxilla. Not only do we see the usual types of malignant and benign growths which spring from epithelium, the connective tissue and the bone, but also a number of neoplasms of special characteristics, which develop directly or indirectly from the teeth. These latter are of great importance, both because of their frequency and in that they represent a large percentage of the neoplasms which may be cured by operative intervention.

Broca states that "the prognosis of tumors of the maxilla, at all times and in all forms, is far from good, and for this reason early diagnosis and differentiation is essential." I am, however, convinced that if this latter part of Broca's statement be observed, the prognosis of neoplasms of the maxilla need not be unfavorable. That carcinoma and the more malignant forms of sarcoma are not cured by operation, no matter how radical that procedure, is admitted; yet we know that these primary malignant growths are in the minority, and if the nonmalignant and less malignant tumors be early dif-

ferentiated, so that less radical surgery be practiced upon them, the number of operative cures will be and already has been increased and our prognosis of neoplasms of this region much more favorable. Bearing in mind that these new growths of the maxilla have the same general characteristics which distinguish them in other parts of the body, an effort will be made to include all of them which have been found, as well as to point out any special characteristics which they may exhibit in this particular situation.

It is usual to classify new growths as follows: Benign, when they grow by expansion and are encapsulated, or malignant, when they grow by infiltration. This would be an ideal working basis, if all of the neoplasms found in the maxilla could be definitely placed in one or other of these two classes. The rule that "malignant growths cause death, no matter in what situation they occur, and that benign ones may cause death, depending on their environments," is a well proven one. Yet in attempting to divide all neoplasms into these two groups, we find some new growths which are "border-line tumors," and others which we must class as both benign and malignant, depending on their type. Epulis, for instance, should be classed as a benign growth, and is, in its commoner form; yet the fibrosarcoma type is malignant. Neoplasms grow by the multiplication, through indirect division, of their own cells, not by the transformation or degeneration of these cells into tumor cells. They are independent, uncontrolled overgrowths of normal cells, though apparently possessing greater vitality. Tumors all tend to differentiate as do normal cell tissues. If the growth is rapid, as is seen in the malignant forms, this differentiation is not marked, but if the growth is slow, it is likely to be typical and sectional diagnosis comparatively easy. "The type cell is the one important element in every tumor, and from it the tumor should be named, not from some peculiarity of minor importance, such as method of growth, arrangement of cells or form of retrograde change" (Mallory).

The classification of Bland-Sutton—who presents it saying: "the study of the minute structures of tumors convinces us that they are composed of tissues normally existing in the body; pathologists realize that the structure of a tumor invariably corresponds with that of the tissue in which

it grew"—seems to me to be the most reasonable and the one best suited for this review of tumors of the superior maxilla.

1. Neoplasms of the Connective Tissue:

Chloroma.

Chondroma.

Endothelioma.

Epulis.

Fibroma.

Myeloma.

Osteoma.

Sarcoma.

2. Neoplasms of the teeth:

Odontoma.

3. Neoplasms of the epithelial tissues:

Carcinoma.

4. Cysts.

Chloroma is a diffuse hypertrophy of the alveolar border, occurring simultaneously in both upper and lower maxilla and extending uniformly in every direction. This is an exceedingly rare condition and has always been seen associated with lymphatic leukemia. It occurs as a diffuse overgrowth, apparently of the superficial tissue, in which the teeth may be completely or partially buried; does not markedly involve the bony structure and never the tissues of the face.

The differentiation of the neoplasm should give no difficulty, as the parent disease, leukemia, is always very evident with its remarkable increase in the circulating leucocytes, enlargement of the spleen, etc.

Chondroma.—This is another of the rarely found neoplasms of the superior maxilla. Composed of cartilage cells which spring from the periosteum of the canine fossa. They have been known to reach large size and are usually encapsulated. Clinically, chondroma cannot be differentiated from the chondrosarcoma, except in the two instances: that it is less likely to produce secondary deposits in other organs, especially the lungs, and that its rate of growth is likely to be much slower.

Endothelioma is a rare neoplasm originating from the endothelial cells of the inner walls of the veins or more rarely the lymph spaces. While these tumors are rare, they are said to occur by preference in the mucoperiosteum of the superior

and inferior maxilla (Bland-Sutton), but I have been unable to find reports of endothelioma in literature as occurring in this region.

They usually form nodules, rather soft in consistency, which do not grow to any size, and are prone to degeneration, though very little to infiltration, hence of not very malignant type. Clinically indistinguishable from epithelioma, in its early stages, especially when it occurs within the antrum.

Epulis is a connective tissue tumor arising from the periosteum of the alveolar process or from the connective tissue of the tooth in its socket. This growth is the least malignant of all forms of sarcoma, though it is of the pigmented variety and giant cell type.

Two forms of epulis are recognized: the myeloid or soft cell type, which is an inflammatory fibroma, and the fibroid, a true fibrosarcoma. In my own experience I have not seen the fibroid form in the superior maxilla, nor have I found reference to it in the investigation of writers on this subject, except that of Eve, who says that they do occur, and advises that microscopic differentiation be made in all cases, so that the surgeon may know how radically he may have to deal with this growth, since the myeloid or inflammatory form is distinctly benign and the fibroid is likely to recur. In this differentiation it is to be noted that the myeloid form springs from the cancellous tissue and has a homogeneous intercellular substance, containing within it some giant cells in small proportion; while the fibrous form shows a distinctly fibrillar matrix and is entirely made up of giant cells.

The myeloid epulis is a disease of early adult life and primarily is confined to the alveolar surface of the maxilla, appearing at the mucous margin of the tooth, or less frequently in the cavity left by the removal of a tooth. Its growth is slow and may be either in concentric or cauliflower form; covered with mucous membrane and without pain or tenderness. As it increases in size the epulis extends outward from the bone in all directions, but does not involve it, the color becoming a deep red, due to its great vascularity. Epulis is a curable growth. Most authorities recognize a marked tendency to recurrence, but my experience with their removal leads me to share, with Bloodgood, the belief that the occurrence is due to incomplete removal. Epulis does not

produce metastases or glandular involvement, unless secondary infection of the growth takes place. That an epulis is ever epitheliomatous is very doubtful. A microscopic study of nine cases has proven them all of the myeloid type.

Fibroma is one of the less frequent neoplasms of the superior maxilla; in this position it does, however, develop and may grow to large size. In the reports of some years back we find descriptions of unusually large tumors, particularly in the antrum, which are said to be fibromata.

This growth differs, in the maxilla, very little from fibroma in other parts of the body and is, particularly in physical characteristics, like fibroma of the uterus; being dense, hard, irregular or nodulated in surface, not given to metastases nor to the invasion of surrounding tissues, except by direct pressure in the line of its growth.

In this region we recognize two forms: the periosteal, from the alveolar process, and the endosteal, from the interior of the bone; the latter more frequently making its way through pressure necrosis into the antrum or the nasal cavity, where it often hangs remarkably free. Fibromata are of slow growth and are particularly disposed to calcareous or necrotic degeneration, though the latter occurs most frequently through mechanical irritation, such as puncture, section or efforts at removal. It does not involve either the skin or the lymphatic structures, and since it grows expansively it is not dangerous to life, except through its size, location or pressure which it may exert. The periosteal type, in its early growth, must be distinguished from the true epulis.

A case of unusual interest is that of a man of fifty years, who presented himself with a hard, dense mass, irregular in surface, covered with normal mucous membrane, upon the hard palate, extending from the canine tooth of the left side to the middle line of the hard palate. Section of this growth proved it a fibroma, and removal was effected with little difficulty. Six months later the external wall of the antrum was noted to be slightly bulging and the lower eyelid became edematous. The patient complained of no pain, showed no glandular involvement, nor any sign of recurrence at the seat of operation. The antrum was then opened and a fibroid mass exposed which occupied nearly the whole cavity and apparently sprang from the lower anterior wall and floor.

This was removed, and the alveolar process, together with part of the anterior wall and floor, were resected, with no recurrence to date (two and one-half years). This was a fibroma of evidently periosteal origin, with the growth into the antrum and roof of the mouth synchronous.

Myeloma develops from the cancellous tissue of the bone, showing on the alveolar border of the maxilla as a deep red, very vascular tumor, usually of small size. They are exceedingly rare in any part of the body, but are said to exhibit a marked tendency for the alveolar border of the maxilla. Here it cannot be differentiated clinically, though microscopically it is often typical. This growth is given to diffuse infiltration, though glandular involvement is not marked. It is a disease of the young, having been rarely seen after the twenty-first year.

Osteoma or ossifying periostitis is a bony new growth, and in the superior maxilla gives rise to a uniform swelling, with a broad base upon the alveolar surface, just above the tooth margin, due to the deposition of new bone tissue. Syphilis has always been thought to be the cause of these neoplasms, but their almost invariable coexistence with the pyorrhea alveolaris has led to the recent belief that the latter is the determining factor in this disease.

The mixed form, both cancellous and compact, is the osteoma most frequently found in the maxilla. They are, in themselves, benign and painless, unless they encroach upon nerve trunks in their growth; and while they never reach any great size, may cause considerable inconvenience because of their position. From a differential diagnosis standpoint they are important, as an osteoma might readily be mistaken for osteosarcoma. The former involves only the surface and is a new growth upon that surface, while the sarcoma is a neoplasm of the body of the bone, tending to growth in the direction of its surface.

That osteoma occurs on the antral surface of the maxilla is very doubtful. A few have been reported—some of them to have reached great size—but both Sutton and Broca believe that these antral growths are odontomes.

Sarcoma is, of the malignant neoplasms, the one most frequently found in the superior maxilla. In this situation it preserves the same characteristics which distinguish sarcoma in other parts of the body, though it is far more frequently seen

developing from the periosteal cells than from the medulla. All of the connective tissues contribute to this group of sarcomata, so we have:

- (a) Fibrosarcoma.
- (b) Myxosarcoma.
- (c) Chondrosarcoma.

Fibrosarcoma originates in the same tissues as does the fibroma, but is more frequently seen than its prototype. It is distinctly a periosteal growth, and because the mass is made up of spindle shaped cells held together by heavy masses of fibrils, it is, perhaps, better known as the spindle cell sarcoma. It is characterized by its rapidity of growth; its tendency to infiltration of surrounding tissues; slight metastases by way of the blood stream and no apparent glandular involvement.

Myxosarcoma, of the three forms, is the one most frequently found in the superior maxilla, particularly within the antrum, where they are classed as the most malignant of the sarcomata. They may reach considerable size, are soft to the touch, and are rather paler in color than most new growths. Though usually encapsulated, it is given to the formation of finger-like projections which invade even the cheek. Glandular involvement has been noted, but it is always slight.

Chondrosarcoma is the least frequent and least malignant of the sarcomata of the upper maxilla. They arise from the periosteum as nodulated, encapsulated tumors, usually growing expansively without glandular involvement. Hard to the touch and mottled in color, due to the grouping of the mixed cells which go to make its mass. Chondrosarcoma of the maxilla is said to have a peculiar tendency to metastases of the lung tissues. Sarcoma in this region is most common between the ages of eighteen to twenty-eight years, differing from carcinoma, which is a disease of past middle age. All forms are characterized by rapidity of growth, a certain regularity of form, a tendency to the involvement of the whole structure by expansion of growth, the early appearance of pain and the lack of definite glandular involvement.

Odontoma is a neoplasm of dental origin, composed of the hypertrophied tooth elements, either in their germinating stage or from teeth still in the process of development, never from fully developed teeth. (Broca.) The three histologic

elements which enter into the formation of the teeth are, in this growth, found in various arrangements, containing spaces in which are found fragments of tooth structure or an imperfectly developed tooth or teeth.

Two distinct types are recognized: the follicular, and the adamantinoma. Follicular odontoma usually develop from the molar teeth, and is sometimes known as a dentigerous cyst, though in this classification we do not recognize them as true cysts. It occurs as a small mass within the alveolar process with fibrous walls, which tend to calcification. The adamantinoma (composite) occurs as a new growth composed chiefly of the cementum and enamel forming epithelial cells, hence exceedingly hard, in branching masses. This latter form is particularly likely to invade the antrum.

The history of all odontomata is of interest, in that they may and usually do remain quiescent for years, then suddenly begin to grow, inducing irregular neuralgic attacks and, as they increase in size, mild constitutional symptoms of peculiar range. I have recently seen two cases of odontoma of the superior maxillary, one a man aged twenty-six years, the other a lady of forty years, in whom neuralgia of very severe type and slight swelling of the alveolar process just above the tooth margin were the only symptoms. Both have been completely relieved of this pain by the removal of the neoplasms.

Odontoma grows by expansion, and very slowly, though they may reach considerable size and destroy much tissue by pressure. Does not give rise to metastases or glandular involvement; so is benign. The bone-like swelling, however, is not characteristic, and because of its frequency, all neoplasms of the maxilla from which we cannot absolutely exclude the odontomata should either be explored or have X-ray pictures made; the growth is usually shown characteristically by the latter.

Carcinoma occurs as a primary neoplasm of the superior maxilla less frequently than as a secondary new growth, yet it ranks next to the sarcomata as being third among the primary tumors of this region. It is an epithelial overgrowth, and hence may spring from either the alveolar surface or the surface of the antrum and nasal plates, therefore, we recognize two forms: the squamous, from the squamous cells of the buccal surface, and the tubular, from the antral and nasal

mucous membrane. Of these two forms, that from the squamous is far the more frequent.

The squamous type (epithelioma) is primarily a small, circular ulcer with irregular raised edges, or more rarely as a small fungus-like growth upon the alveolar mucous; in either case the indurated edges are characteristic. It is very slow of growth at first, but progresses very rapidly when once its growth is established, due to the fact that at first the cell nutrition is limited; when they reach into the larger lymph spaces and begin infiltration of the capillaries of the sub-mucous connective tissue, their growth becomes rapid. Infiltrating irregularly and rapidly, it destroys the normal mucous membrane, the teeth, the bone substance and finally the skin. Secondary infection of this mass of growing cells and detritus takes place early, and we find a foul, fetid, semifluid discharge thrown off. It is usually at about this time that the pain begins, growing progressively more severe.

The tubular form is an extremely insidious disease, as its primary lesion is within the antral cavity and usually does not make its presence known. The first symptom of its presence is pain in the region below the orbit, a brawniness of the cheek, followed by edema of the tissues of the cheek.

Antral carcinoma is characterized by its soft consistency and exceedingly rapid growth; this latter well illustrated by the following case: A perfectly healthy looking man, aged forty-eight years, presented himself at the hospital dispensary for the relief of epistaxis. Examination showed a new growth of small size, apparently from the antrum, and section was taken for examination, proving it a carcinoma of the tubular type. Patient did not return, however, for three weeks, when second examination disclosed the left lower fossa of the nose completely filled with the growth, as well as most of the lower antral space. He was admitted to hospital, though past operative intervention, and died in six weeks. Histologically it is marked by the fact that infiltration is so gradual that it is impossible to determine where the growth ends and normal tissue begins. This way of infiltration has earned for it the title of "boring cancer."

Carcinoma is distinctly a neoplasm of middle life, scarcely ever occurring before the forty-fifth year. Is painless in its early stages, but later pain is very severe. Metastasis is fre-

quent and glandular involvement constant. Irregular, rapid infiltration into all surrounding tissues is its growth, with ulceration, liquefaction and sloughing resulting from the mass occluding its own blood supply and the constant presence of septic infection.

Cysts of the superior maxillary bone are among the most common of its surgical affections. They develop from the root of a permanent tooth, by the growth of the tooth sack with its contained fluid, the remains of the enamel forming organ. As these tumors may develop long after the tooth has been removed, it is not always possible to establish direct connection between one of these cysts and a particular tooth, but smaller cysts have often been accidentally found directly attached to the tooth root, and as the histology of both are identical, it may safely be assumed that their origin is the same. Buchtmann's theory, that these tumors develop from the ingrowth of buccal mucous membrane along the root of carious teeth, though accepted by many, does not seem to explain their complicated formation so well as that of their development from the epithelial layer of the sheath of Hertwig. These cysts, like the odontomata, may remain within the bone quiescent for years, to be suddenly stimulated to proliferation and tumor formation. Until lately these cysts, especially the multilocular form, were supposed to occur but rarely in the superior maxilla; a fact that Becker explains by the statement that these neoplasms early invade the antrum, where their true nature is less easily recognized, slowly replacing the bone by absorption and pressure, the cyst reaches the surface of the bone, where the external layer may become so thinned as to give a parchment-like crackle on palpation; in most cases, however, the cyst wall, of connective tissue with its epithelial lining, is so heavy that this cannot be noted. Eventually this external layer of bone will be destroyed and there appears on the surface a uniform, painless swelling, with well defined margins, bluish in color and fluctuating with difficulty. Incision of the tumor will release a quantity of fluid and disclose a cavity heavily lined with a membranous wall, into which no tooth elements or bone project.

Of those that invade the antrum, few are recognized in life, though many are found at autopsy. The well known

mucocoele of the antrum is in most instances an unrecognized maxillary cyst. In this location the developing cyst produces little pressure, hence no pain; and so the patient's attention is not called to its existence until it reaches the surface, where it may show as a cyst swelling over the antrum directly opposite the ala of the nose, or more rarely it may force inward the lateral wall of the nose toward the septum. This bowing-in of the antral wall is a distinguishing point between the cyst and the maxillary sinusitis.

Cysts of the maxilla are most common about the age of thirty, though several have been reported as occurring in childhood, from the developing permanent teeth. Among my own cases, three have developed during pregnancy, and although unnoticed up to that time, grew with such unusual rapidity that they had to be surgically treated during that period.

The mucous membrane over the exposed surface of these growths does not tend to ulceration, nor are there any inflammatory symptoms, except where infection has been secondarily induced by incision or puncture. These neoplasms show exceedingly well in X-ray photographs, while incision is absolutely diagnostic.

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