UNIVERSITY OF MINNESOTA
RECEIVED
FEB
27
1941
LIBRARY

Tumors of Jaw

Volume VII | Thursday, May 7, 1936 | Number 27

UNIVERSITY OF MINNESOTA HOSPITALS
Volume VII | Thursday, May 7, 1936 | Number 27

INDEX

C O U R T E S Y O F C I T I Z E N S A I D S O C I E T Y

I. ABSTRACT

TUMORS OF JAW

E. J. Semansky

Classification

The classification of the neoplasms of the jaw is extremely difficult. The Registry of Bone Sarcoma has adopted for all bone lesions a simplified classification which has been used as a basis in the treatment of jaw neoplasms:

Oral Neoplasms

A. Peripheral Tumors of the Oral Tissues
   1. Hypertrophy or tumor-like overgrowths
   2. Fibroblastoma:
      a. Benign: - Peripheral Fibroma
         Keloid
         Xanthoma
      b. Malignant: - Peripheral Fibrosarcoma
   3. Myxoblastoma - Myxoma
   4. Lipoblastoma - Lipoma
   5. Neuroma - Amputation Neuroma
   6. Endothelioma
   7. Angioblastoma
      Vascular Nevus
      Haemangioma
      Lymphangioma
   8. Lymphoblastoma
      Lymphoma
      Lymphosarcoma
   9. Melanoblastoma
   10. Rhabdomyoma
   11. Teratoma

B. Odontogenic Tumors:
   1. Adamantinoblastoma
      Adamantinoma
      Adamantino-sarcoma
   2. Odontoma

C. Osteogenic Tumors
   1. Benign:
      Hyperostosis
      Exostoses (Torus palatinus, torus mandibulare)
      Osteoma
      Chondroma
   2. Malignant: - Osteogenic Sarcoma
      a. Osteolytic osteogenic (myxochondral)
      b. Osteoblastic osteogenic (sclerosing)
      c. Telangiectatic osteogenic

D. Central Tumors in the Bone of Non-osteogenic and Non-odontogenic Origin:
   1. Central fibroblastoma
      a. Central fibroma
      b. Central fibrosarcoma
   2. Central angioma
   3. Ewing's tumor
   4. Multiple myeloma
   5. Intra-osseous mixed tumors

E. Tumors Derived from Epithelium:
   1. Adenoma
   2. Precancerous
   3. Carcinoma
      a. Epidermoid carcinoma
      b. Basal-cell carcinoma
      c. Cylindrical-cell carcinoma
      d. Adeno-carcinoma

F. Metastatic Tumors to Jaws:
   1. Carcinoma metastatic to jaw
      a. From lip
      b. from breast
      c. from the prostate gland
      d. from the stomach
      e. from the thyroid gland
      f. from hypernephroma
   2. Sarcoma metastatic to jaw
      a. Melanosarcoma
      b. Lymphosarcoma
      c. From various soft-tissue sarcomata

Dental and benign osseous tumors
   Radicular cysts
      Follicular or dentigerous

Radicular or dentigerous cysts
   Giant cell epulis
   Central giant cell tumors

The teeth are ectodermal and imbedded in the osseous substance of the upper and lower jaws. The body of the tooth is composed of dentine and the crown of

enamel. The enamel is a secretion of epithelial cells derived from the ectoderm and corresponds to elements of the exoskeleton found in other vertebrates. In both the dental lamina and its derivatives, the enamel organ may give rise to persistent strands of undifferentiated basal-cells which may take part in tumor formation. From these cells, dental root cysts, follicular or dentigerous cysts, adamantinomas may arise. The down-growing basal cells nearest the primitive mucous membrane (known as the epithelial debris of Malassez) may differentiate to form a lining membrane of squamous cells forming dental root cysts. The cell layers of the enamel organs may expand about the non-erupted tooth to form a follicular or dentigerous cyst. More primitive elements of the enamel buds may proliferate and differentiate in several directions producing islands of enameloblasts, squamous cells, basal cells and epithelial elements characteristic of adamantinomas. The enamel buds overly the dental papillae. From the mesodermal papillae, the dentine is formed. The unossified portion of the dentine forms the tooth pulp. Proliferation of these mesodermal elements occurs in odontomas. Before eruption of the permanent teeth, giant-cell odontoclasts normally appear in the pericementum to loosen the temporary structures. These cells may give rise to giant-cell tumors of the alveolar ridge, known as giant-cell epulides.

Simplified Classification
(Pathological Types)

1. Radicular cyst
   Simple cyst arising from paradental membrane.

2. Dentigerous cyst
   Simple cyst about crown of an unerupted "normal" tooth.

3. Paradental cyst
   Identical with either of above two types but occurring around supernumary teeth and fourth molars.

4. Adamantinoma
   True neoplasm arising from cells of one tooth-germ layer (ameloblasts or dental debris). Solid, cystic, differentiated or immature.

5. Odontomas
   Malformations (or neoplasms?) involving all the tooth elements producing nests of mature or immature teeth. May be malignant.

6. Bone and soft tissue tumors
   Variety and characteristics generally as in other areas.

Dental Root Cysts

Radicular cysts generally form at the apex of the tooth but in rare instances they may form at the lateral surfaces of the root (paradental cysts). They derive their origin from chronic inflammatory changes of the paradental membrane such as hemorrhage, infection, instrumentation or chemical. Radicular cysts develop at any age. They occur on deciduous teeth, and must be carefully distinguished from extensive bone infection. On permanent teeth, they are of frequent occurrence in the maxilla, as well as in the mandible. If they are of small size, they give no subjective or objective symptoms. If they assume larger proportions, they will at first expand between the cortical walls of the bone, but later resorption occurs on the inner side of the cortex and the thin wall expands with a change in the outline of the jaw. In the mandible the expansion generally involves the external surface of the bones; while in the maxilla, these cysts expand both the outer surface and invade the maxillary sinus, palate or nasal fossa. The cysts may be found in edentulous parts of the jaws. Symptoms of large cysts occur rather gradually. This is especially true of the change in contour of the oral surfaces. If the bony wall has become thin, palpation may give a crepitating sensation. Occasionally, paresthesia of the terminal branches at the fifth nerve is produced. In many old cases, the bone finally is

penetrated and an opening is formed into the mouth or nose. The patient then complains of bad taste, sometimes salty in character, discharge or odor produced by it. Malignant tumors and adamantinomas may arise from radicular cysts.

Pathology

In most radicular cysts, the sac can be removed in toto. The fluid, if aspirated, may be thick, mucous-like, watery, or thin. Generally, it has a yellowish and more often a brownish color. Microscopic examination shows a fibrous connective tissue wall of varying thickness, covered by an epithelial lining, usually of the squamous type but rarely columnar. Inflammatory cells and cholesterin is present.

Radicular cysts are generally single but may be multiple. They are falsely called multilocular cysts. They expand the intervening bones but become condensed into a thin substance. Cholesterin crystals may become a very prominent feature and give the appearance of a cholesteatoma.

Diagnosis

Most radicular cysts are diagnosed by routine roentgen examinations. The cyst gives a shadow which has a characteristic outline caused by the cortical layer of bone lining the cavity. A central area of rarefaction with well-defined outlines extends in semi-circular fashion about the root of the devitalized tooth. This outline distinguishes the cyst from the ordinary root granuloma with hazy margins. Expansion of the cyst about the apex rather than the crown of the tooth in the absence of a non-erupted tooth distinguished these growths from dentigerous or follicular cysts. The cavity in the roentgenogram is usually monolocular but rarely multiple cysts forming around several neighboring teeth may give the impression of multilocularity. The involvement of neighboring structures, as well as the relation of the adjoining teeth, must be studied if the cyst is large.

Treatment

Treatment of radicular cysts consists of extraction of the tooth, opening of the cavity and evacuation of its contents, including removal of the epithelial lining and the cyst wall. The material removed should always be subjected to pathological examination. With such treatment, occurrences are practically unknown.

Dentigerous Cysts

Dentigerous cysts arise from the epithelium of the enamel organ during the development of the teeth. They are characterized by the presence of a non-erupted tooth, the cyst expanding about the crown of the tooth rather than the root. Because of their relationship to developing teeth they are usually found in young individuals. These lesions are frequently found in the region of the third molar. There are no striking physical signs except failure of the tooth to erupt and expansion of the jaw at the tumor site. As the cyst expands, the pressure exerted by the increasing contents of the cyst acts on the occlusal surface of the tooth, causing it to move apically, resulting in the extreme malpositions which are so frequently observed. They show in the roentgenogram a non-erupted tooth within a monolocular cyst. The tooth is pushed away from the gum by the growth of the cyst from the gum by the growth of the cyst which expands about the crown. Any of the various stages of development, from a poorly formed dense area of enamel to a complete tooth may be found. Exploration reveals a fibrous cyst wall lined by stratified epithelium, containing a serous or amber colored fluid.

Treatment

Complete evacuation of the contents of the cyst, including the lining membrane, and the non-erupted tooth. Recurrence is rare except in these cases which may be classified as cystic adamantinomas with non-erupted teeth.

Simple Follicular Cysts

Follicular cysts are derived from the epithelium of the enamel organ of the developing tooth.

Etiology of Follicular Cyst

Bock and Jorgenson believe that follicular cysts are of an inflammatory genesis caused by chronic peri-odontitis of deciduous teeth. The reaction in the tooth germ causes an exudation and the accumulation of exudate in the enamel organ of the forming tooth produces a cyst. The tooth is not included in the cyst. The fluid increases through transudation from the peri-follicular tissue. The bone cavity is enlarged to correspond with the expansion of the cyst. This is accomplished by pressure resorption at the inner side of the bone cyst. The expansion of the cyst depends on the obstructions encountered. It grows in the direction of least resistance and hence destroys the spongiosa easier than the cortex of the bone. Obviously, it has a tendency to expand more along the long axis of the jaws and even if it is not circular, it always shows a rounded circumference. They are most common in the third molar region, invading the ramus, attaining very large dimensions before being discovered. Paresthesia of the lip due to pressure on the mandibular nerve is often found, while in other cases perforation and formation of the fistula discharging into the mouth is the primary and most prominent symptom. Multiple cysts may be formed through malformation of two or more adjoining tooth germs.

Pathology

The contents of follicular cysts vary a great deal. Generally, there is a thin, clear amber colored fluid containing cholesterin crystals which give it a dark metallic sheen; at other times, the contents may be thick and of a mucoid character. This may contain products of decomposition and of infection. The cyst sac in most instances is substantial and may be peeled out. The base shows a wall of compact bone with evidence of osteoclastic resorption and new formation in the peripheral marrow spaces. On the inner surface of the cyst sac, there is a lining of several rows of flattened squamous epithelium which in some cases becomes stratified. The pressure of the cyst, besides causing bone resorption, may also cause the resorption of the roots of the teeth.

Paradental Cysts

Are identical with the preceding follicular or radicular simple cysts except that they occur on supernumerary teeth (4th molars or others). They occur most frequently in the ramus of the mandible.

Adamantinoma

Historical (Simmons)

Synonyms: Adamantine epithelioma, crypto sarcoma, adeno carcinoma, epithelial odontoma. Often confused with bone cysts, benign giant-cell tumors and carcinoma. The term, adamantinoma, is derived from the Greek word "adamas," meaning hardness of stone, and the enamel forming cell is called "adamantoblast." Malassez (1885) suggested the term "adamantine epithelioma" for tumors derived from the enamel forming tissue. Borst (1902) instituted a now generally accepted term "adamantinoma." The first description of true adamantinoma seems to have been made by Falkson in 1879.

Pathology

They vary in size from small insignificant cellular overgrowths to enormous cystic enlargements extending from the jaw to the surrounding parts. (One tumor weighed 1.5 kilograms). Ewing states that an adamantinoma as large as a child's head was once observed. They may be cystic or solid. The surrounding bone becomes thin and as it enlarges the cystic areas may rupture and their

cavities become secondarily infected. The cysts are invariably multilocular. The cavities may be smooth walled or lined with epithelial projections. The solid tumors and the walls of the cystic ones are composed of fibrous tissue with occasional calcareous areas and masses of bone and cementum and epithelium. In rare instances, bits of well-formed enamel are present lying on shallow beds of dentine. Masses of epithelium in broad anastomosing strands are a prominent characteristic of the tumor. These epithelial masses undergo central degeneration forming cysts. There may be present a distinct layer of tall columnar cells resembling ameloblasts. The cysts may be microscopic and may on section resemble glandular structures that have been misnamed "adenoma adamantinum." Degeneration of septa may lead to breaking down of walls, and larger and larger cysts may develop.

Origin

One may find many theories of genesis. Of these two are most accepted: (1) origin from the inner layer of the enamel organ (ameloblasts); and (2) origin from the dental debris layer of Malassez. It is interesting that the tumor is common in negroes (due to rickets with secondary irregular malformed enamel organ?).

Metastasis

Adamantinoma of the jaw is locally malignant but systemically benign. In the literature, a few cases of adamantinoma with metastasis have been reported.

Clinical

Facial deformity is quite a common feature. Loose teeth are also a striking symptom. The tumors are slow, symptomless growths. There may be a loss of teeth in the area involved with no inflammatory infiltration. Voeller states that adamantinoma should be suspected when an area of bone destruction is larger than a five-cent piece but never to make a diagnosis until biopsy. Bloodgood mentions that the differential diagnosis between dentigerous cysts and adamantinoma cannot be made until exploratory operation is done.

X-Ray Findings in Adamantinoma

Adamantinoma is a monocystic or polycystic central tumor of sharp outline without an overlying periosteal reaction as is seen in sarcoma and without the worn edge of cancer or the association of bone production as seen in osteomyelitis. The polycystic type with a honeycomb appearance is to be differentiated from the trabeculated giant-cell tumor or the monocystic radicular or follicular cysts. Differentiation in the roentgenogram is by no means absolute as occasionally many of the central tumors of the jaw may produce the same picture.

Reported Cases

McFarlane and Patterson, in a review of reported cases of adamantinoma, found 166 cases.

Sex: (18 cases)
73 females and 45 males.

Age: (114 cases)
Youngest 6 months; oldest 73 years; average slightly less than 40 years.

The average length of time between the onset of symptoms and examination of a physician (14 cases): 9 years.

Site of tumor: (114 cases)
96 were in lower jaw,
17 upper jaw.
(In one, tumors in upper and lower jaws.)

In the lower jaw, the side was not given in 5, in 12 the tumor was in midline and extended to both sides; in 27, the tumor was on the right and in 52 on the left. In 16 upper jaw, the right was infected in 18, and left in 8, and both in one. In 74 cases, the character of the tumor was described:

49 cystic, 8 solid, and 12 both solid and cystic areas.

Treatment

The consensus of opinion is that radical resection should be done at the first operation if this is not too mutilating a procedure. Incision, drainage, curettage, excision of the tumor with part of the jaw, excision of the tumor along with x-ray and coagulation, cautery and total or partial resection were all attempted in the report of 166 cases.

Simmons, Zoeller and Bloodgood report a series of cases in which no previous operations had been done. In all the bone involved was completely resected and there was a permanent cure.

Conservative operations are insufficient. Some permanent cures have been reported after such treatment, but rarely are incision, curettage, or partial excision followed by anything except recurrence of the tumor. Adamantinomas are radio-resistant and radiation osteitis of the jaw is prone to complicate an adequate dosage of x-ray. Permanent cures were obtained in about 80% in the Johns Hopkins series reported by Geschickter and Copeland.

Adamantinoma of the Hypophysis

Of 166 cases, 26 were adamantinoma of the hypophysis. The location (in 22 cases) was: 17 supersellar, 1 in front of the sella, and 4 in the sellar substance itself. Fourteen of these were females and 12 were males. Age ranged from 16 to 60 years, with an average slightly less than 24. Removal is recommended. The mortality is very high without operation. A few successful operations are reported.

Other Locations

A few cases of adamantinoma have been observed elsewhere than in the jaws or pituitary: tibia, lip, eyelids.

McFarland and Patterson were able to draw the following conclusions from their review of the cases reported in the literature:

1. Adamantinomas arise in the jaws from paradental epithelial debris and in the hypophysis from squamous epithelial debris of the hypophyseal duct.

2. Irritation may be a cause of the tumor of jaw, probably not in the pituitary.

3. Adamantinoma in whatever location has approximately the histological structure.

4. The tumor is locally malignant but generally benign and does not metastasize. Two cases have been reported, however, which seemed to be the exception to the rule.

5. Cases have been reported elsewhere - 2 in the tibia, 1 in the upper lip, and a doubtful 1 in the nasal region.

6. Adamantinomas of the jaw are more common than in the pituitary.

7. They are more frequent in women than in men in a proportion of 3 to 2.

8. The average age is 40 years at the time the patient entered the hospital.

9. The average duration of symptoms is 7 years.

10. They occur in the upper and lower jaws in the proportions of 5 to 1; twice as often in the left lower than in the right.

11. In the upper jaw, the two sides were evenly affected.

12. There were about 6 cystic to 1 solid tumor.

13. Complete radical excision seems to be the only method to obtain a cure.

14. Twenty-six cases of adamantinoma

of the pituitary have been reported, 90% of which were supersellar in position.

15. The average age is 24. The average duration of symptoms is 3 years.

16. The two sexes are about equally affected.

17. About 95% of these tumors are cystic.

18. Operation is indicated for this type of lesion.

Odontomas

Odontomas are mixed tumors closely related to adamantinomas containing derivatives of the enamel epithelium and of the connective tissue of the dental papilla. Epithelium strands like those in adamantinomas occur also in odontomas but are over-shadowed in quantity by mesenchymal elements. In so-called immature or soft odontomas, large amounts of undifferentiated connective tissue with varying amounts of myxomatous change are combined with epithelium of the adamantinoma type. Clinically, these tumors behave like adamantinomas and represent a transitional group which merges with the more frequent and benign hard odontomas. The hard or differentiated odontomas are about twice as frequent in occurrence as adamantinomas of all types. They are usually found in the lower jaw of young individuals at the site of an unerupted tooth. They may arise from the imperfectly differentiated elements replacing the unerupted tooth or from accessory tooth germs adjoining the unerupted tooth (composite odontoma). When two or more tissues of the germ are involved, these tumors have the potential ability to form all types of tissue found in the tooth, namely enamel, dentin, cementum, pulp and peridental tissue. They are caused by faulty tooth formation. They are more common in the mandible than the maxilla. They may be solid or cystic.

Classification of odontomas:

1. Mature benign hard odontomata.
   a. Geminated composite odontoma.
   b. Compound-composite odontoma.
   c. Complex-composite odontoma.

2. Mature benign soft odontomata.
   a. Fibrous odontoma.

3. Immature odontomata.
   a. Hard odonto-adamantinoma.
   b. Soft adamantino-sarcoma.

Mature Benign Hard Odontomata

Benign odontomata consist generally of various mature parts of tooth substances. There may not only be the 3 types of calcified tooth structure - enamel, dentin and cementum, but also the soft tissue, pulp and peridental connective tissue. In many cases, they contain true bone and often enamel organ epithelium.

A. Geminated Composite Odontoma

Gemination implies the union of two or more teeth. This union generally prevents eruption of the teeth and they are found unerupted and retained in the bone of the jaws. In very rare cases, however, the teeth will erupt partially or even completely. Fusion may occur in either the crowns or the roots. The disturbance may involve teeth in the deciduous and permanent set. The tumor may involve supernumerary teeth in various states of perfection. Sometimes geminated composite odontomata are caused by faulty development. One enamel organ may give rise to dentin papilla so that one crown develops with several roots fused or separate. At other times, the enamel organ divides and forms several crowns while the dentin organs fuse and connect their roots. Geminated composite odontomata occur in any part of the jaws. The only clinical indication, as a rule, is the absence of one or more

teeth. Their tooth germs have given rise to the tumor and it may have been prevented from erupting by the tumor mass. They are benign in character and seldom cause disturbances which is the reason why they remain undiscovered, often for many years. At times, however, they produce enlarged spaces in the dental arch and prevent normal eruption or position of neighboring teeth. When partly erupted, they are likely to cause infection of the peridental tissue. If dental caries set in and progress, the pulp becomes infected, in such cases, dental neuralgia results. These tumors may readily be enucleated but sometimes on account of projection and curvature of the roots coming from the tumor mass the mechanical interference requires a considerable amount of bone resection.

X-ray Examination

Careful studies by x-ray are important, especially if the tumor is deep in the bone as it gives information about the shape of the tooth and its relation to neighboring teeth.

B. Compound Composite Odontoma

This type of odontoma contains a large number of teeth, sometimes as many as several hundred. The mass is incorporated within either a cyst or a fibrous membrane. They are produced by the dental epithelium which instead of forming the normal organ produces many small enamel organs which all develop into teeth germs and give rise to all kinds and shapes of small teeth. They may be united by fibrous connective tissue, cementum or bone.

Clinical Features

This type of odontoma may be of considerable size and may cause swelling of the jaw visible on examination. Often the neighboring teeth erupt in irregular position with abnormally large spaces where the teeth which form the tumor are missing. A crown of a tooth, part of the tumor may erupt and cause irritation and inflammation of the gingiva. If the parts are connected with fibrous tissue, they may be removed singly without the main part of the odontoma being discovered. If they are united by calcified tissue, attempted tooth extraction will produce difficulty. As odontoma are often formed from deciduous tooth germs, they should be discovered and removed promptly to prevent malocclusion of the permanent set. If a tooth is absent, the x-ray examination will disclose whether an odontoma is present. Permanent teeth are prevented from eruption by an odontoma. At operation in large composite odontoma, some of the particles may be overlooked and the results should be checked with immediate postoperative x-rays.

C. Complex Composite Odontomata

In this tumor, the arrangement of the tissue is not regular and tooth-like, and contains tissue in various stages of development. It is not as highly developed a tumor as the previous form of odontomata and may bear no resemblance to a tooth or compound dental structure. The tumor is contained in the jaw and generally presents a rounded, hard, calcified mass which may vary in size from a small pea to one of 5 to 6 cm. in diameter. These tumors though frequently found in childhood may often remain undiscovered for a long time. The growth may not become active until the neighboring teeth which sometimes hold it in place have been extracted. The mechanical pressure exerted by a plate in turn may become a stimulus. These tumors consist of a hard, solid mass of rounded or oval shape surrounded by a fibrous capsule from which they usually may readily be shelled out at the time of operation. The tumor may be geminated, fairly smooth, lobulated, or the surface may be covered with cementum or have nodules of enamel distributed over it. Microscopically, great variation of the structure and proportion of the tooth elements are found. In some cases, the tumors contain an arrangement of tissue along the lines of normal tooth formation interrupted by a regularly formed tissue. In other tumors, abnormal arrangement of tooth substances is the feature. Enamel, dentin or cementum may be pre-

dominant and these tissues may be arranged in lamellar or radial fashion. Soft tissue, such as enamel epithelium and dental pulp, may be seen between the calcified layers.

X-Ray Diagnosis

X-ray shows a uniform striation or radial arrangement of calcified structure. X-ray examination is useful in determination of location of the tumor and its relation to normal structures for necessary surgical procedures.

D. Soft Benign Fibrous Odontoma

The soft or fibrous odontoma is very rare clinically. Grossly, it is not possible to distinguish it from a true central fibroma. Microscopic examination, however, shows that though consisting of connective tissue it contains scarce amounts of dental epithelium. It resembles adamantinoma except for the fact that the tumor is primarily a fibroma and the epithelium plays an unimportant role.

E. Immature Odontoma

These are infiltrating tumors which have a tendency to recur and some may be malignant. The odonto-adamantinoma has the general characteristics of adamantinoma but contain teeth or tooth particles. The adamantino-sarcoma is a soft odontoma in which both the epithelial as well as the mesodermal part of the tooth forming tissue has become neoplastic, the latter having malignant properties. They show a marked tendency to recur after operation.

Giant-Cell Epulis

These tumors occur most frequently in children and young adults, the majority between 10 and 20 years of age during the period of eruption of the permanent teeth. The most common site is near the canine, bicuspid or incisor teeth and about the roots of those permanent teeth which are preceded by a deciduous dentition. The new growths arise from the alveolar dental periosteum (cementum) and form a mass beneath the mucous membrane of the gum, immediately surrounding a tooth, or rarely protrudes from the interior of the root socket of an extracted tooth. Symptoms other than a localized swelling are rare. A history of trauma or local irritation may be elicited. The tumor expands outwardly and anteriorly or between the crevices of the teeth and may be distinguished from a malignant growth by the restriction of the point of attachment to one side of the alveolar margin. These are usually firm and somewhat redder than the surrounding mucous membrane. Tumors of more than 1 or 2 cm. in circumference are rare although in one case reported the masses were of sufficient size to include the entire oral cavity. Microscopically, the mucous membrane is hypertrophied and beneath this are seen many multinucleated giant-cells and a fibrous stroma containing small spindle and round-cells. The growths when not too large may be treated by simple excision with cauterization of the box without extraction of the neighboring teeth. Recurrences are rare with such treatment. External irradiation with x-ray or radium is also successful in some instances but care must be exercised to avoid irradiation osteitis.

The giant-cell epulis is related to a normal proliferation of odontoclasts occurring in the cementum about the root of the deciduous teeth. The function of these is to absorb the cementum and provide for the shedding of these structures. Since these deciduous teeth are loosened during the first decade, the majority of these giant-cell tumors occur in the second decade. Subsequent development of the tumors is accounted for by the slow growth of these benign tumors and by the occasional activation of the odontoclasts in pregnancy. The occurrence of giant cell epulis as an initial manifestation in multiple giant-cell tumors and bone cysts, associated with adenoma of the parathyroid gland, relates these growths to disturbances of the parathyroid hormone. The increase in parathormone in the blood in early pregnancy

probably bears some relation to these cases of alveolar giant-cell tumor which have their onset or increase in size during gestation. The tumors are frequently referred to as pregnancy tumors of the alveolar margin.

Giant-Cell Tumors (Central)

The lower jaw is most frequently involved in the ratio of 2 to 1. Like giant-cell epulis these lesions occur in young adults between the ages of 10 and 25 years. This is in contrast with giant-cell tumors of long bones which are rare under 20 years of age. In the lower jaw, these tumors affect the region of the symphysis or the angle in the upper jaw. In the upper jaw, they show a tendency to invade the antrum and orbit. Central giant-cell tumors grow and destroy bone rapidly. The average duration at the time of operation was about 7 months in the series reported by Geschickter and Copeland. In the roentgenogram, a central trabeculated area of reabsorption expands a thin shell of bone. In younger patients, unerupted teeth may be found in the vicinity of the lesion leading to the erroneous diagnosis of dentigerous cysts.

Clinical Findings

Giant-cell tumors may be peripheral (periosteal) and endosteal (central). The peripheral types are generally on the external surface of the bone and produce a painless swelling in the mouth. The swelling may be pedunculated but generally it is attached to the bone and on a wide base. It is usually well-circumscribed, of firm consistency and early shows a characteristic bluish, livid color. The teeth are frequently pushed apart from the tumor. The central form of giant-cell tumors occurs both in the maxilla and mandible. It chooses the part of the bone of cartilaginous origin, the so-called "chondro-cranium or its remnants"; the condylar process of the mandible where Meckel's cartilage and its accessory cartilages have been built into the bone, the maxilla, the region of the canine fossa, ethmoid region and the sphenoid process. The maxillary sinus in the upper jaw is frequently invaded. The tumor involves the mucous membrane of the antrum and fills the sinus like a carcinoma. Generally, however, the tumor expands the bone both in the maxilla and mandible. The wall of the antrum and the palate may show distinct bulging and in the mandible the bone is often greatly enlarged with normal appearance of the mucous membrane and a hard, cystic feeling on palpation. Destruction of the spongiosa takes place and later even the cortex may be involved. The periosteum, however, is not broken through. Instead new periosteal cortex is often formed. The teeth become displaced, later they become loose and may even drop out.

X-Ray Examination

The x-ray study of giant-cell tumors must be carefully made. In some cases, there may be only a defect in the bone of irregular and often lobulated outline with sharp demarcation. In cases of long standing, bulging of the thin, unbroken cortex may be observed. The shadow is one of an asymetrical globular nature. There is almost always coarse trabeculation present which, however, may not be distinctly visible, if the tumor area is over-exposed. The trabeculae are not constant and vary considerably in size and clearness in the picture. The tumors may be distinguished from adamantinoma because the areas of the tumor subdivisions made by the septae are not circular in giant-cell tumors. The antrum may be filled by tumor tissue and appears radio-opaque.

Treatment

Treatment should always be conservative. In the lower jaw curettage followed by chemical cauterization is preferable In large tumors of the upper jaws, particularly those extending into the antrum and temporal fossa, irradiation should be combined with surgery. Thoma recommends the use of a sclerosing solution following operation. It causes less local reaction than phenol or Zenker's

solution. It consists of absolute alcohol (6 cc.), chloroform (3 cc.), glacial acetic acid (1 cc.) and ferric chloride (1 gram).

The question of recurrence is of utmost importance. Any tumor tissue after operation will continue to grow. Recurrence therefore is no doubt frequently due to incomplete removal of the tumor. Very little has been written concerning the possibility that some of the recurrent cases might have a systemic factor exciting its recurrence, i.e., hyperparathyroidism. It should prove interesting to study the calcium and phosphorus metabolism in such cases.

Tumors with Skeletal and Jaw Involvement

Paget's osteitis deformans, von Recklinghausen's fibrocystic disease and multiple myeloma may show lesions in the jaws. Enlargement of the jaw produced by large deposits of porous bone and characterized roentgenologically by widening and increase in the size of the trabeculae may antidate by many years the appearance of Paget's disease in the rest of the skeleton. In some instances of multiple osteitis fibrosa cystica the onset of the condition may be a giant-cell tumor of the alveolar margin. Thuma has described a case of multiple myeloma, with initial involvement of the lower jaw.

Tumors, Metastatic, to the Jaw

Neoplasms metastatic to the jaw are comparatively rare. Thoma reports metastasis to the jaw from carcinoma of the lip, breast, prostate, thyroid, hypernephroma and from sarcoma. Erhardt reported 30 cases of metastasis to the jaw from primary malignancy of the thyroid.

Exostoses

Exostosis is not a true neoplasm although it is sometimes difficult to draw a line between self-limited hyperplastic growths and true osteoma. They may be round, nodular or tuberous or globular. Cases of multiple exostosis may occur. Most frequently, this condition occurs on the internal surface of the mandible. Round protuberances, generally multiple, symmetrical and bilateral, are found on the lingual aspect of the mandible in the premolar region. This is spoken of as torus mandibulare. A favorite location is the vault of the hard palate. Here we find an oblong bony elevation, a ridge, and in more extreme cases an overhanging lobulated, bony mass which often has the appearance of being connected with the palate by a pedicle extending along the median line. This is known as torus palatinus. Both the mandibular and palatine tori are found in older individuals. According to Crane, 12% of adults have torus palatinus in some form. Patients are rarely conscious of its existence until they have artificial teeth made. At this time, the overgrowth may interfere with proper fitting of the denture. Torus palatinus arises as two distinct masses from the median line but is covered by a mucous membrane and appears as a single growth. 7% of these lesions undergo degenerative changes and become chondromyxo-sarcomas They are apt to become malignant after 30 years of age. If symptomless, they should nevertheless be observed with x-rays every 6 months. If changes are found or if the lesion is growing, excision should be carried out.

Osteogenic Sarcoma

In the Registry of Bone Sarcoma, there are among 44 tumors of the jaws, 12 osteogenic sarcomas, 8 in the maxilla, 4 in the mandible. The giant-cell tumors are more common: 17 in both bones. Osteogenic sarcoma, therefore, occurs more frequently in the maxilla than in the mandible.

Symptoms

The symptoms are pain in the teeth, paresthesia of the face and changeable symptoms of pressure in the jaw. At other times, the tumor spreads rapidly, especially in the mandibular canal of the

lower jaw, and gives pain of the most severe nature, producing loosening of the teeth. Such symptoms unfortunately are still often misunderstood and many tumor patients are not treated as modern procedure would incidate. While hoping for relief by tooth extraction and medication, valuable time is often lost. Late symptoms are those of a spreading tumor mass. There may be fever, especially in the presence of pulmonary metastasis.

X-ray Examination

The roentgenographic appearance of osteogenic tumors of the jaws presents the characteristics of these tumors as found in other bones.

Chondroma, Myxochondroma and Myxoma

Chondroma is a rare neoplasm of the jaw. Occasionally they reach enormous size.

Non-osteogenic and Non-odontogenic Bone Tumors

These neoplasms arrive from the fibrous tissue, from the marrow cells or from the blood vessel walls and perineurial sheaths contained in bone and have no osteogenic or odontogenic tissue. Without consideration for the length of time they may grow, the tumor cells never produce bone though they induce the formation of normal bone about or even in a tumor owing to stimulation of normal osteoblasts not related to the neoplasm. Likewise, osteolytic action on the bone is affected not generally through their own activity but presumably through pressure effect and circulatory disturbances.

Classification

1. Central fibroblastoma.
   a. Central fibroma
   b. Central fibrosarcoma
2. Central angioma
3. Ewing's tumor
4. Multiple myeloma
5. Intra-osseous mixed tumors

Ewing's Tumor

The jaw cases permitted to the Registry showed a solitary lesion.

Incidence of tumor of the jaw (Surgical and Pathological Laboratories of Johns Hopkins) is as follows:

1. Dental and benign osseous tumors - 265 cases.

Osteomas and ossifying fibromas	70 cases
Radicular cysts	57
Giant-cell epulis	51
Adamantinomas	45
Central giant cell-tumors	25
Follicular or dentigerous cysts	12
Odontomas	5

2. Malignant osseous tumors composed of osteogenic sarcoma - 44 cases.

Ewing's sarcoma	19 cases
Sclerosing type	10
Tumors with skeletal and jaw involvement	8
Chondral type	7

Incidence of jaw neoplasms (University of Minnesota Dental School) during last 10 years:

Epulis - 151 cases

1. Chronic inflammatory	39 cases
2. Giant-cell	29
3. Pyogenic granuloma	17
4. Hard fibroma	16
5. Fibroma	14
6. Soft fibroma	10
7. Papilloma	4
8. Angioma	3
9. Xanthoma	1
10. Neurofibroma	1
11. Keloid	1
12. Miscellaneous	16

Cysts and Tumors - 162 cases

1.	Dental root	96 cases
2.	Dentigerous	18
3.	Exostosis	15
4.	Undetermined	14
5.	Adamantinoma	13
6.	Osteitis fibrosa cystica	12
7.	Giant-cell tumors	10
8.	Mixed tumors (salivary)	8
9.	Submucous cysts	8
10.	Osteogenic sarcoma	7
11.	Compound composite odontoma	6
12.	Compound odontoma	5
13.	Naso-palatine	4
14.	Cementoma	4
15.	Sarcoma	3
16.	Osteoma	3
17.	Complex composite odontoma	3
18.	Adenoma	2
19.	Chondro-sarcoma	1
20.	Fibro-sarcoma	1
21.	Osteo-fibroma	1
22.	Hyperostosis	2
23.	Miscellaneous	26

Incidence of Bone Tumors of Jaw
(University of Minnesota Hospital)
(Incomplete index)

Those involving maxilla - 6 cases.

1.	Osteogenic sarcoma	4 cases
2.	Osteoma	1
3.	Fibrosarcoma	1

Those involving mandible - 16 cases

1.	Central giant-cell tumors	6 cases
2.	Adamantinoma	4
3.	Osteogenic sarcoma	3
4.	Osteochondrosarcoma	1
5.	Osteoma	1
6.	Myxosarcoma	1

DIFFERENTIAL DIAGNOSIS

Characteristics	Ewing's Tumor	Osteogenic Sarcoma	Chronic Osteomyelitis
1. Age	Children and young adults. Lesion usually single in early stage.	Young adults and middle age. Lesion single.	More common in youth. Single or multiple.
2. Antecedent local trauma	In 50%	In 50%	In 33%
3. Duration	Short	Short	Apt to be longest
4. Pain	Usually first symptom.	First symptom.	First symptom.
5. Local swelling	Few weeks or months following pain	Few weeks or months after pain	More slowly developing
6. Local swelling	Rare in early stages. Common in later.	Few weeks or months after pain	Rare in early stages. Common in later.
7. Temperature	Usually elevated	Rare	Rare or low
8. Blood picture	If leucocytosis differential is normal	----------	Leucocytosis with change in differential
9. Location tumor	No difference (jaw)	No difference (jaw)	No difference (jaw)
10. Multiple in bone	Usually	Rarely	Rarely
11. Pathological reactions	Osteolytic. Widens bone. Destroys cortex evenly and vertically. Only slight proliferative reaction excited. New bone if any parallel to shaft. Osteophytes may occur. Destroys periosteum and elevates it.	Osteoblastic. Does not widen bone. May narrow it. Does not destroy cortex. New bone if any. Does not change periosteum much.	Osteolytic and osteoblastic. Destroys bone irregularly. Marked proliferative reaction. New bone irregular or perpendicular; eburnation.
12. Metastasis to glands.	Not infrequent.	Very rare	Rarely
13. Radium effect	Radio-sensitive	Radio-resistant	No response
14. Toxin (Coley's effect)	Very sensitive	Resistant in most cases	No response
15. Spontaneous fractures	Often present	Often present	Rarely

1. Bloodgood, J. C.
Lewis' Practice of Surgery, IV,
Chapt. IV.

2. Scudder, C. L.
Tumors of Jaw.
W. B. Saunders, 1912.

3. Thoma, K. H.
Clinical Pathology of Jaws,
Chas. C. Thomas, Springfield, Ill.,
1934.

4. Ziskin, D. E., Blackberg, S. N.,
Stout, A. D.
Gingivae during pregnancy.
Surg., Gyn. and Obst. 57: 719, 1933.

5. Geschickter, C. F.
Tumors of Jaw.
Am. J. of Cancer, 24: 90 (May) 1935.

6. Kolodny, A.
Bone Sarcoma.
Surg. Pub. Ca. of Chicago, 1927.

7. Gatewood
Surg. Clin. North Am., 7: 547, 1927.

8. Codman, E. A.
Surg., Gyn. & Obst., 42: 381, 1926.

9. Bunting, R. W.
Oral Pathology, Lea and Febiger.

10. Conner, C. L.
Calif. & West. Med. J., 34: 325, 1931.

11. Ivy, R. H.
Ann. Surg., 85: 27, 1927.

12. Ewing, J.
Neoplastic diseases.
Phila. W. B. Saunders Co.

13. Figi, F. A.
Surg. Clin. North Amer., 10: 110-113,
1930.

14. Codman, E. A.
Am. J. Roentgen., 13: 105-126, 1925.

15. Cutler, E. C. and Zollinger, R.
Am. J. Surg., 19: 411, 1933.

16. New, G. B.
Surg., Clin. of North Amer., 4: 524,
1924.

17. Lewis, D.,
Geschickter and Copeland.
Tumors of Bone.
Am. J. Cancer, 1931.

II. LAST WEEK

Date: April 30, 1936

Place: Recreation Room,
Nurses' Hall

Time: 12:15 to 1:15

Program: Movie: Timber Giants
Biophysics,
Physical Therapy,
Radiation Therapy

Present: 100

Discussion: K. W. Stenstrom
A. L. Abraham
C. N. Borman
L. G. Jacobs
I. C. Vigness
J. C. Litzenberg

III. MOVIE

Title: Attention - Suckers

Released by: M-G-M
