

Textbook of Oral and Maxillofacial Surgery

Gustav O Kruger

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Chapter 24

Surgical aspects of oral tumors

Claude S La Dow

Tumors, or neoplasms, are new growths of abnormal tissue arising around the oral cavity as in other parts of the body. They may occur in the lips, cheeks, floor of the mouth, palate, tongue, and in the jaw bones. These new growths may be of epithelial tissue, connective tissue, or nerve tissue origin, although neurogenic tumors are rare in the oral cavity.

Tumors may be benign or malignant, depending on their behavior pattern and cellular structure. A benign tumor grows slowly and is usually encapsulated. It enlarges by peripheral expansion, pushes away adjoining structures, and manifests no metastasis. A malignant tumor, on the other hand, endangers the life of its host by its rapid infiltrating extension into surrounding vital structures and the phenomenon of metastasis, which creates secondary growths in distant parts of the body, usually through the lymphatic system and bloodstream.

Treatment of tumors is essentially the extirpation of the mass, although surgical intervention varies with the nature of the neoplasm. Some benign neoplasms of the mouth possess characteristics rarely encountered elsewhere in the body. These characteristics pertain to tumors of dental origin.

Oral tumors may be classified into those of dental origin and those of nondental origin. Oral tumors of dental origin arise from epithelial inclusions remaining within the jaw bones after tooth formation is completed. This occurs around the teeth and within suture lines of the developing maxilla and mandible. Epithelial tumors may be secreting or nonsecreting, depending on the presence of secretory epithelium, as occurs in cysts.

Tumors of the Hard Tissues of the Oral Cavity

Odontogenic tumors

Odontogenic cysts are discussed in detail in Chapter 14. Dental tumors arising in the jaw bones may be broadly classified into odontomas and ameloblastomas.

Odontoma. *Calcified odontomas, simple enamel pearls, and cementomas* usually consist of one or more kinds of tooth elements. Enamel pearls consist of enamel. Odontomas consist of dentine. Cementomas are of cementum. Odontomas may be composite by manifesting two or more tooth tissue elements. These simple tooth tumors arise from some aberration of the tooth germ early in life. Surgical intervention is instituted at an early age to prevent derangement of the permanent dentition. In later years multiple cementomas and

ossifying fibromas appear frequently near the roots of teeth. The teeth remain vital, with absence of subjective symptoms. Surgical intervention for these tumors is usually unnecessary, since they frequently reach a stage of inactivity and become calcified within the jaw bones without disturbing function and are only apparent in roentgenograms.

Atypical cementomas and cemento-ossifying fibromas can become locally aggressive, causing destruction of anatomical surroundings. These tumors, when occurring in the maxilla, can invade the sinuses. Extensive surgical intervention is necessary for extirpation.

Composite odontomas are excised, since they contain various tooth formations that tend toward destructive cystic change. Some of these masses grow to considerable size in the young, thus interfering with eruption of permanent teeth. They can cause considerable bone destruction. Roentgenographic diagnosis may be the only outstanding evidence of their presence besides a slight aberration of the surrounding structures. Surgical removal of these benign tumors is always conservative. They can be approached by removing the overlying bone. These masses are enucleated from the adjoining bony structures of the jaw with surgical burs or chisels. Controlled sharp dissection is preferred to elevator technique, since the surrounding tissue may be damaged when uncontrolled elevator force is applied. Primary closure of the operative site after obliteration of the cavitation with absorbable packs is the treatment of choice.

Complications after removal of odontomas may include paresthesia of the lower lip and mandible when the tumor mass contacts the inferior dental nerve, hemorrhage from the cavitation when bleeding areas are not controlled, and secondary infection with breakdown of sutures. Recurrence of these benign tumors has not been reported.

Ameloblastoma. The ameloblastoma is a tumor arising from embryonal cells of developing teeth. Although most forms of this tumor simulate other slow-growing, benign tumors, some can develop malignant tendencies. Degeneration of this tumor into carcinoma has occurred. Patients may have few subjective symptoms during tumor growth. Enlargement of the tumor may expand the buccal, lingual, or palatal bone plates. Teeth may loosen, and pressure symptoms may occur, especially in the region of the maxillary sinuses. Roentgenographic examination may demonstrate unilocular or multilocular types. Unilocular ameloblastomas may be confused with benign cysts. The tumor frequently absorbs the alveolus surrounding the roots of teeth and may absorb root ends. They occur in both jaws. Metastasis is rare, but tumor fragments may find their way into the lungs by aspiration. Ameloblastomas grow by extension into adjacent tissues and may perforate the investing bone. A biopsy should precede treatment, since these tumors frequently present individual characteristics. Some are slow-growing, expansive tumors, requiring many years to manifest subjective symptoms. Others grow more rapidly and present definite malignant tendencies. Biopsy is satisfactorily performed with the patient under local anesthesia. The overlying cortical bone is exposed through a mucoperiosteal incision, and a portion of bone is carefully removed with surgical burs or chisels. A section of the tumor mass is excised sharply without curettage or trauma. The overlying mucoperiosteum is sutured. The extent of the operative procedure will depend on the histological structure of the tumor and the extent of involvement of the surrounding tissues.

Methods of treatment include extirpation, radical resection of the jaw, selective block excision, and electrocauterization. Local excision of a small, accessible tumor is indicated in the young, provided they agree to regular follow-up and a radical resection when recurrence occurs. Recurrences are not unusual after curettage. Incomplete surgical treatment may

stimulate tumor cell growth.

Ameloblastomas are exposed widely by removing overlying bone, including the buccal plate, as far as the base of the tumor. The buccal plate may be thin because of the expansive enlargement of the underlying tumor. Whenever possible, the inferior border of the mandible is preserved and retained to maintain continuity of the jaw. Block section of the involved bone should extend into and include 10 mm of normal peripheral bone surrounding the tumor mass. Sharp cutting instruments are used to separate this area from normal osseous structures. The entire base and surrounding margins are then electrocauterized to destroy completely the residual tumor cells. Sedative dressing is placed for drainage, to reduce pain, and to allow healing by secondary intention from the bottom of the cavity. The mucoperiosteum is partially approximated, leaving an orifice for removal and renewal of the dressing. The wound dressing is renewed and gradually reduced in size in small amounts each time the packing is changed during the reparative process.

Ameloblastomas that have extended within the maxilla may perforate palatal mucoperiosteum and nasal mucosa. Radical resection of the tumor and the immediate surrounding osseous structures is the accepted treatment of choice. Since these tumors grow by extension into adjoining tissues, adequate surgical resection is accomplished. Frequently, a stump of normal bone at one periphery of the resection is retained as in the condylar region of the mandible. This bone may be utilized as a base of attachment for reconstruction of the missing section of the mandible by bone grafts. Bone grafts may be inserted at the time of surgical intervention because of the low incidence of metastasis in this type of new growth. Whenever radical procedures are performed to eradicate the ameloblastoma, conservative efforts are made to maintain function and esthetics.

The ameloblastic fibroma and the ameloblastic adenoma are also tumors related to dental epithelium. These benign neoplasms grow slowly and expand the cortical plates of the jaws. They may simulate the ameloblastoma in roentgenographic and clinical examinations. These tumors occur most frequently in the second and third decades of life and are painless in the early stages of growth. Surgical treatment is accomplished by complete local excision after a preoperative incision biopsy.

Osteogenic tumors

Neoplasms arising from the jaw bones are classified as osteomas, fibro-osteomas or fibrous dysplasia, myxomas, chondromas, sarcomas, Ewing's tumor, and the central giant cell tumor.

Osteoma. Osteomas of the jaws appear as areas of circumscribed, benign, bony new growths. Osteomas arising from the inner surface of bone cortex are called *enostoses* or *central osteomas*. Tumors of this kind consist of dense cortical bone extending into the spongiosa of the jaw. They can be demonstrated in roentgenograms as circumscribed, dense, bony tumors. Treatment may be unnecessary unless symptoms of pain resulting from pressure on nerve fibers are manifest or superficial ulceration occurs in overlying tissues. All forms of osteoma cast a radiopaque shadow in roentgenograms. Osteomas consisting of spongiosa are much less dense, with outlines more difficult to differentiate from the adjoining bone.

Some forms of osteoma arise from the periosteum proper, from aberrant cartilage cells, and from the cortical plates. These will occasionally assume considerable disfiguring size, in which case surgical removal is indicated to reestablish facial harmony and obviate interference

with function. These osteomas are composed of spongy bone with only a thin layer of covering cortex. They cast light shadows on roentgenograms. These tumors may be sharply dissected at their base, where they are contiguous with the bony cortex of the jaws. Osteomas rarely recur after complete excision.

Locally circumscribed bony growths developing outside the cortical plates are called exostoses or peripheral osteomas. These bony outgrowths are benign and slow growing and seem to develop in young adults. They may occur after trauma or irritation. Areas of exostosis may occur at sites of muscle insertion or at the junction of two bones. A frequent site of exostoses is the midline region of the hard palate. This is known as a torus palatinus. A torus mandibularis may occur on the lingual aspect of the mandible in the premolar and molar regions.

Fibro-osteoma. The fibro-osteoma, or ossifying fibroma, a fibrous dysplasia of bone, is a benign, slow-growing tumor of bone that tends to have its greatest growth in the second decade of life. It is a diffuse, poorly differentiated endosteal tumor, replacing the normal spongiosa with fibrous tissue. Increased irregular areas of calcification may occur as new bone formations develop in this tumor. The enlarging neoplasm may displace teeth and expand cortical plates of the jaw bones. A fibro-osteoma tends to occur more frequently in women than in men and is seen more often in the maxilla than in the mandible. This tumor may obliterate the maxillary sinus and may extend into other bone landmarks. It does not invade the nasal structures. This is of diagnostic importance, since in both hyperostoses and Paget's disease the nasal meati are obliterated. This tumor is occasionally confused with the fibrosarcoma because of similar histological patterns.

The fibro-osteoma grows slowly. It usually will begin to develop radiopacity soon after its initial developments, as calcification occurs. Extensive involvement of the mandible will be shown as an enlarged, curved lower border. The tumor mass can be surgically extirpated, providing peripheral normal bone margins are included. Most authors agree that these tumors should be treated conservatively during periods of normal active bone development. Excision of large, active lesions during the second and third decades of life may require resection of the involved segment of the jaw.

Dormant fibro-osteomas that have not demonstrated histological changes or increase in size can be contoured surgically to reestablish normal facial symmetry and maintain masticatory function. They can be approached either through an intraoral or extraoral approach, depending on which provides proper exposure. Since these tumors tend to bleed freely during contour reduction, pressure packs and electrocoagulation are essential.

The active fibro-osteoma or ossifying fibroma frequently recurs when surgical excision does not include a 10 to 12 mm margin or when treatment has been instituted at an early age. Radical treatment is less likely to lead to a later recurrence. These tumors do not respond favorably to radiation therapy. Osteosarcomas and fibrosarcomas have developed after a long latent period following irradiation treatment to fibro-osteomas.

Myxoma and chondroma. The myxoma and chondroma are closely allied tumors of embryonic tissue origin, developing from immature primitive bone or cartilage cells. The myxoma may simulate a cystic lesion because of its honeycomb appearance in roentgenograms. Expansion of the bone cortex occurs with the appearance of mucoid material replacing bone architecture. The chondroma arises from aberrant fetal cartilage in specific regions of the mandible, such as the symphysis and coronoid and condyloid processes, as well

as the alveolomalar and paraseptal cartilages of the maxilla. The chondroma may cast a faint shadow outside of the bone in roentgenograms. A chondroma may calcify and cease to enlarge, in which case it is known as an osteochondroma. Both forms of this precocious tumor occur early in life. Myxomas, chondromas, and the osteochondromas may be detected clinically by pain, swelling, and limitation of motion. These tumors grow slowly. They are extirpated surgically.

Some osteochondromas tend to undergo malignant change, thus becoming chondrosarcomas. Chondrosarcomas consist of cartilagenous masses, areas of ossification, and mucoid degeneration. In young individuals they occur between bone and periosteum in areas of active bone growth. Cortex and spongiosa become secondarily invaded. These tumors are extremely difficult to eradicate; hence conservative surgical intervention is never attempted. The absence of early subjective symptoms leads to undetected progression of the disease. The histopathology of the chondrosarcoma is obscure, thus making early diagnosis difficult. Surgical intervention with its necessary trauma stimulates cellular activity. Radical resection of chondrosarcoma is performed with thoroughness by including in the excision some of the normal bone surrounding the tumor mass, The resulting cavitation is adequately electrocauterized. Although this tumor spreads principally by local extension, it tends to metastasize elsewhere in the body. Radiation therapy does not seem to have any beneficial effects on chondrosarcomas.

Sarcoma. Osteogenic sarcomas originate from bone-producing cells. These highly malignant tumors are rare and generally occur in children during periods of active growth. Three general types are recognized:

1. *Osteolytic* sarcomas, accompanied with considerable bone destruction and immature tumor cells with little new bone formation.

2. *Osteoblastic* sarcomas, producing abundant new bone with manifestations of smaller areas of tumor activity interspersed throughout the bone.

3. *Telangiectatic* sarcomas, highly vascular, developing more rapidly, and invading by extension into the surrounding soft tissue.

Trauma is considered the main etiological factor in the history of all osteogenic sarcomas. The subjective symptoms include pain, swelling of the jaw bone, interference with jaw function, and loosening and displacement of the teeth. Anesthesia of the lip and jaw may be present. Roentgenograms reveal a poorly demarcated tumor mass, with areas of bone destruction and areas of new bone formation giving a sort of mottled appearance. The characteristic "sun-rays" appearance in the osteoblastic sarcoma results from the radiating spicules of bone extending outward from the cortex. The more poorly differentiated forms of osteogenic sarcoma develop rapidly and invade surrounding tissues. The sclerosing and osteoblastic forms seem to grow slowly. All types of sarcomas metastasize to the lungs through the bloodstream. Treatment of osteogenic sarcoma is instituted early and consists of radical resection of the bone containing the tumor. The adjoining blood supply leading into the tumor mass is included in any attempts of resection. Roentgenograms of the chest are taken early to detect any metastatic lesions. X-irradiation is given to these metastatic areas. Some clinicians believe preliminary x-irradiation of primary sites is helpful in reducing the incidence of metastatic lesions. Bone grafting of the sectioned portion of the jaw bone is not indicated at the time of surgical intervention because of the high incidence of metastasis and exposure of the areas to x-irradiation. A prosthetic appliance is positioned immediately after

resection to maintain jaw bone continuity until bone grafting is possible. This maintains facial form and aids jaw function. Prognosis is poor, since much depends on the accessibility of the tumor, its state of activity, the presence of metastasis, and the thoroughness of operative intervention.

Ewing's tumor. Ewing's tumor is of obscure etiology. It is believed to arise from the endothelial lining of the blood or lymph vessels or both. Some pathologists regard the tumor as a primary lymphoma of bone. Trauma is the common important factor in its etiology. This neoplasm is seen during the first two decades of life. Subjective symptoms include elevation of body temperature, pain, swelling, and interference with jaw function. The last three subjective symptoms are the usual triad noted with bone sarcomas. Roentgenograms reveal expansion of bone cortex with apparent areas of increased density. The periosteum is thickened and pushed away from the bone. Areas of new bone are formed over areas of bone destruction. Treatment of Ewing's tumor is primarily by x-irradiation, since the growth is extremely radiosensitive. This may be followed by radical surgical treatment after the acute symptoms caused by x-irradiation subside. Metastasis occurs in almost all cases of Ewing's tumor. Favorite sites for metastatic new growths are the lungs, lymph nodes, spine, and ribs. The prognosis in Ewing's tumor is grave, since less than 20% of patients survive once metastasis has occurred.

Multiple myeloma. Multiple myeloma may occur anywhere in the body, although the first indication of its presence may be apparent in the jaw bone. This tumor is of obscure etiology. It is believed to originate from bone marrow cells. Multiple myelomas are seen in older individuals between 40 and 70 years of age. In 90% of cases the ribs, sternum, clavicles, and vertebrae reveal small, round lesions that appear radiolucent in roentgenograms. The skull and jaw bone are less often affected but should be surveyed roentgenographically in all cases of this disease.

Pain of a wandering type is an outstanding symptom. The presence of Bence Jones bodies in the urine is a diagnostic sign. Alkaline phosphate level is normal in multiple myeloma. Hypercalcemia is frequent. Local biopsy of an accessible lesion confirms the diagnosis. Anemia accompanies this disease. Fractures occur when the long bones, ribs, or mandible become involved. Treatment consists of x-irradiation of involved areas to suppress growth of tumor cells and to alleviate pain. Chemotherapy is used to augment treatment. Hormones and nitrogen mustard are employed as adjuncts in therapy. Hormones aid in alleviating pain. Chemotherapy may retard progress of the disease.

Central giant cell tumor. The central giant cell tumor is a benign neoplasm developing in bone of cartilaginous origin. The symphysis and the angles of the mandible and the canine fossa of the maxilla are typical locations. These tumors occur in the second or third decade of life, with trauma as the suspected factor. Pain and swelling of the mandible with occasional fractures occur whenever the tumor reaches a large size. Expansive enlargement of the jaw reduces the vitality of the tissue, thus precipitating fractures. Roentgenograms show no uniform, clear-cut picture of central giant cell tumor, since the growth appears as multicystic areas with irregularly outlined, fine trabeculations. The teeth are frequently loosened, with evidence of absorption of their roots. Biopsy is essential to establish adequate diagnosis. These tumors destroy spongy bone and tend to thin out the cortical bone to a frail shell, thus leading to ultimate perforation. The tumor tissue is soft and highly vascular and tends to undergo free hemorrhage when traumatized. This tumor may look yellowish red because of blood pigment.

Treatment consists of enucleation of the growth after complete exposure. The walls and bed of the resulting cavitation are thoroughly electrocauterized to destroy possible residual areas leading to regrowth. Since this tumor is benign and slow growing, conservative treatment is carried out for ultimate preservation of the bone continuity of the jaw.

The central giant cell reparative granuloma is a tumor characterized histologically by many giant cells and seems to occur more frequently in the mandible in the first and second decades of life. Trauma would appear to be an important factor in the etiology of this tumor. Gradual swelling from expansion of the cortical plates encompassing medullary bone neoplasm may be the only objective symptom. Subjective symptoms may be absent, delaying dental consultation. Roentgenographi examinations may demonstrate expansions of the cortical plates and erosion of root surfaces. Since these examinations are not diagnostic, preliminary biopsy is essential. Surgical treatment consists of enucleation of the thin vascular margins of the tumor after aspiration of the hemorrhagic area. Wide exposure through the expanded buccal cortical plate gives adequate access to the peripheral margins of the tumor. Smaller lesions can be enucleated and permitted to heal by primary intention. Large lesions are packed with medicated gauze and permitted to heal by secondary intention after excision.

Tumors of the Soft Tissues of the Oral Cavity

Papilloma. Papillomas are benign tumors arising from the epithelial tissue of the mucous membranes of the oral cavity. They may be pedunculated or sessile and consist of keratinized epithelium on a connective tissue base. Papillomas are usually small, although they may grow to the size of a grape before the patient seeks treatment. These tumors undergo irritation from the natural dentition or artificial appliances. Malignant changes may occur after trauma. The papilloma is treated by surgical extirpation and electrocauterization of the connective tissue base. Excision is accomplished through a curved incision running around the periphery of the tumor and extending sufficiently into normal tissue to complete removal from the base of attachment. Bleeding may be controlled with electrocautery. Closure is accomplished with coaptation by means of nonabsorbable sutures. Recurrences are not common if adequate excision has been accomplished.

Fibroma. Fibromas are benign tumors arising from the submucous and subcutaneous connective tissues of the mouth and face after trauma. They may arise from the periosteum of the jaws. A fibroma is a sessile or pedunculated tumor. It is usually rounded and firm. Fibromas are more vascular than papillomas. They may assume a considerable size and become traumatized from dentures and mastication. Treatment of the fibroma is surgical excision through a curved incision in the normal tissue surrounding the periphery of the growth. The edges of the resulting wound may require freeing and undermining for some distance to permit coaptation of the edges with nonabsorbable sutures. Fibromas will not recur if complete excision, including the base, is accomplished. A fibroma may arise from the jaw periosteum as well as from the connective tissue of the submucosa. These sessile and pedunculated benign tumors are frequently called fibrous epulides.

Fibrous epulis. Fibrous epulides occur around the gingiva frequently and seem to arise from chronic irritation of the bone periosteum or dental periodontium attaching to the teeth. Epulides may reach the size of large grapes and may become irritated readily from the act of mastication. The treatment of fibrous epulis demands complete excision of the tumor from the surrounding gingival tissues whenever it is of bone periosteum origin. Epulis of dental periodontium origin calls for removal of the tooth involved in the epulis formation to obviate recurrence and ensure proper healing. Although an epulis is benign, it tends to recur if

incompletely removed. The exposed bone after excision of the epulis is protected with a covering of surgical cement to permit normal granulation formation and act as a soothing dressing. Surgical packing of this type can be left in position for a period of 7 to 10 days.

Peripheral giant cell tumor. The peripheral giant cell tumor is sometimes called a *giant cell epulis*. It arises from the connective tissues of the dental periodontium that gives teeth their attachment to the alveolus. This tumor is usually bluish red because of its highly vascular nature. It may be sessile or pedunculated. Peripheral giant cell tumor occurs at any age and seems to be more common among females. It can assume an extensive size when it pushes the teeth from their normal position. It invades the adjoining bone as enlargement proceeds. Treatment of these tumors is excision. Adjacent teeth should be removed to provide access to the tumor mass. A portion of the sound gingival tissue and bone is included in the excision. The resulting cavitation is electrocauterized to destroy any residual remnants and to control bleeding. The cavitation is finally filled with a sedative pack to permit normal granulation and alleviate pain. Peripheral giant cell tumor does not recur after complete excision.

Pregnancy tumor. Pregnancy tumors arise on the gingival tissues of the jaw bones as pedunculated growths during pregnancy as a result of an obscure hormonal reaction. They appear about the second or third month of pregnancy and persist until parturition, when they begin to disappear. A pregnancy epulis consists of highly vascular connective tissue. It is bluish red, fading slightly on compression, occurring in either dental arch and bleeding readily on the least trauma. Pregnancy tumors attain considerable size, are unsightly, and may interfere with mastication. Treatment of a pregnancy tumor is local excision followed by electrocoagulation when the tumor is large enough to disturb the patient's state of mind. Surgical intervention offers better results after parturition whenever these tumors persist, since the stimulating hormonal factor is then absent. Pregnancy tumors may be multiple.

Hemangioma and lymphangioma. Hemangiomas and lymphangiomas arise in connection with the blood vessels and lymphatics. They are benign tumors, seem to exhibit a congenital trend, and appear in the young. Their etiology is obscure, being attributed to aberrant remains of developing blood and lymph tissue elements within areas in which they are not usually found.

Hemangiomas may be classified into capillary and cavernous types. Capillary hemangioma is known as "port-wine stain". It may occur on the face or within the mouth. This tumor fades on compression and has a dark, bluish red hue. The cavernous hemangioma has large blood sinuses and tends to invade the soft tissue or erode the adjoining bony structures by pressure. A pulsation may be detected in the cavernous types. Preliminary biopsies of these bluish, pulsating lesions should never be attempted in the office because of extensive hemorrhage.

Capillary hemangioma has been treated by local excision when the tumor was small. Injection of boiling water into the afferent vessels has been employed to sclerose the vessels. Radium applications and x-irradiation have been used to accomplish the same results. Conservative measures are followed in children. Excision and skin grafting is the treatment of choice whenever surgical intervention is justified. Radium applications and x-irradiation are deferred in infants whenever possible, to obviate injury to developing teeth and jaws.

Cavernous hemangiomas involving soft tissues of the oral cavity may be excised with a scalpel or endothermy knife. The excision should extend around the tumor in normal tissue.

Feeding vessels are isolated and ligated prior to extirpation of the tumor. Sclerosing solutions have been successfully employed to reduce the size of larger hemangiomas prior to surgical treatment by fibrosing the blood supply. A 5% solution of sodium morrhuate is injected into the immediate surrounding areas in multiple, small applications. The resulting reduction in size of the tumor lessens injury to adjacent vital structures and enhances esthetic results.

Interosseous hemangiomas do not present a clear radiographic appearance and may simulate other osseous lesions such as giant cell tumors, traumatic bone cysts, fibrous dysplasias, and ameloblastomas. Changes in normal bony architecture are poorly defined, with lytic areas in the medullary portion. A history of swelling, pigmentation of a bluish red color, spontaneous bleeding without severe trauma, and mobility of teeth should be an admonition that uncontrollable hemorrhage will occur after the most insignificant surgical procedure in the suspected area.

Preoperative examination of undiagnosed central bony lesions of questionable vascular etiology should include objective symptoms of a bruit heard by stethoscope, compression of overlying tissues that are decompressed by the vascular system, and tooth movement in harmony with peripheral pulses. Selective arteriography must be accomplished to determine anomalous arteriovenous circulations and extensions of tumor beds.

Management of these vascular neoplasms may be accomplished by several divergent methods. Control and reduction of the tumor bed and its blood supply may be attempted by application of x-irradiation or radium proximal and to the vascular area in adult patients. The resulting fibrosis may eliminate the neoplasm or allow resection without excessive blood loss. Wide resection with necessary blood replacement while the patient is under hypotensive anesthesia and ligations of major blood vessels are usually employed. Cryotherapy, which freezes the tumor bed and causes subsequent necrosis, is a new technique. Selective embolization with macerated, striated muscle to occlude proximal circulation and the tumor bed with resulting fibro-osteolytic consolidation is used. Embolization using selected, main arterial feeders with 0.5 to 1 mm barium impregnated silicone pellets to accomplish a similar occlusion has been successful.

The *lymphangioma* is a benign tumor frequently occurring on the lips and cheek, but it may occur in the nasopharynx and tongue. It presents a soft, doughy texture of the tissues. The overlying skin tends to present a wrinkled appearance. Distortion occurs as a result of periods of active growth followed by formation of fibrous tissue. Treatment of the lymphangioma is surgical excision when the tumor has not assumed a large size. Large tumors may be reduced surgically by partial excision in succeeding operations. Sclerosing solutions have been employed with some success for further reduction of drainage channels to these tumors. The lymphangioma is radioresistant. No recurrence follows complete excision, but this is rarely accomplished.

Lipoma. Lipoma is a benign tumor consisting of adipose tissue, developing anywhere in the oral cavity where fat tissue is present. The lips and cheeks are favorite sites for this tumor. The overlying mucosa may be stretched by the pressure enlargement of the lipoma. A lipoma is a firm and freely movable mass, yellowish in color. It is demonstrable roentgenographically as a hazy mass within soft tissues. Lipoma may be single or multiple and may present extensions into adjoining soft tissues. This tumor grows slowly.

Treatment of the lipoma is surgical extirpation. The tumor is dissected easily from surrounding soft tissues. Primary closure is accomplished with nonabsorbable sutures in the

mucosal tissue and absorbable sutures in the deep layers of tissues, such as muscle.

Myoma. Myomas are benign, well-defined, muscle tissue tumors commonly occurring in the tongue, lips, and soft palate. They appear as firm, sessile masses that may not be encapsulated. A myoma has few subjective symptoms. The patient may be aware of a painless "lump" in the tongue, cheek, or lips. The tumor is readily traumatized by mastication. Surgical excision is the treatment of choice. The growth is bluntly freed from surrounding structures through an incision in the overlying mucosa or skin. The wound is closed with coaptation sutures. Myomas rarely recur after complete excision.

Pigmented nevus. Pigmented nevi are benign, epithelial tumors seen occasionally in the oral cavity on the buccal mucosa, gingiva, and tongue. They contain melanin pigment. Nevi in the mouth may vary in color from a light blue to black. They may be flat, sessile, or papillary in form. A nevus may simulate pigmented papilloma, hemangioma, or the normal pigmented areas present in people from tropical climates. This tumor can exhibit malignant changes in later life as a result of continued chronic irritation. Symptoms of malignant change are rapid increase in growth rate, darkening in color, superficial ulceration, and bleeding on the least trauma. The nevus usually precedes the malignant melanoma. Incisional biopsy should never be attempted. The malignant melanoma can metastasize early through the lymphatic channels to the lungs and liver. Treatment consists of wide excision and complete dissection of the regional and related lymph nodes early in the course of the disease. This tumor is radioresistant. Prognosis is poor despite extensive radical excision.

Mixed tumor. Mixed tumors are new growths arising from salivary gland tissue. They may occur in the lips, cheeks, floor of the mouth, or soft and hard palates within the area of distribution of the major or minor salivary glands. Almost 90% of all mixed tumors occur in the parotid gland. Most clinicians agree that these tumors are of epithelial origin. Lymphoid and mucin-producing cells may be present in these epithelial patterns. The mixed tumor is encapsulated and can be defined from normal structures on palpation. It may be lobulated, firm, and slightly movable. The tumor may be attached by stalks to the normal gland tissue or present extensive protrusions of the capsule into surrounding structures. Large mixed tumors of the oral cavity and major salivary glands tend to recur after removal, a result of further growth from remnants of these extensions. The growth rate is slow, but incomplete surgical intervention tends to activate recurrences. Although mixed tumors of the oral cavity are essentially benign, some may become malignant, since the occurrence of regrowth is common.

The diagnosis of mixed tumor is accomplished by clinical examination and biopsy. The presence of an encapsulated, firm, lobulated tumor with well-defined borders and a history of slow growth usually indicates mixed tumor. Confirmation of the diagnosis is established by biopsy.

Treatment of mixed tumor is complete surgical removal after adequate exposure of the tumor mass; most of these tumors are radioresistant. Mixed tumors known as papillary cystadenomas can be easily extirpated, including their capsular extensions. Cylindromas, on the other hand, are difficult to extirpate completely, since they tend to recur because of their highly malignant nature. Electrocauterization may be necessary in some cases to destroy all residual tumor cells. Prognosis depends on the pathological characteristics of the mixed tumor and its wide excision.

Adenocarcinoma. Adenocarcinoma is a highly malignant tumor usually arising from salivary gland tissue. This tumor can occur in aberrant gland tissues of the lips, cheeks, palate, and oropharynx as well as in the major salivary glands. Primary adenocarcinoma may be differentiated from the benign mixed tumor by the rapidity of growth, early pain from sensory nerve pressure, anesthesia of tissue peripheral to neoplasm, and immobility of the tumor mass from extensions into adjacent tissues. Adenocarcinomas metastasize to regional lymph nodes, lungs, and the skeletal system. Diagnosis is established from biopsy. Roentgenograms of the chest are advisable to determine the presence of metastatic lesions. Treatment of adenocarcinoma includes radical excision of the tumor and its accessible extensions. Irradiation therapy may be employed to treat distant metastatic lesions when present. Prognosis is much less favorable when metastasis has occurred.

Adenocarcinoma metastasizing to the jaws from the prostate gland in men and the breast tissues in women is not an unusual sequela. It may be present without early roentgenographic evidence. Anesthesia of the lip on the involved side of a patient with a history of prostate or breast surgery may be an important indication of metastasis. Careful scrutiny of the past medical history and selective bone biopsies should be instituted.

Sarcoma. Sarcomas of the soft tissues are generally classified according to their cell of origin. They arise from poorly differentiated mesenchymal tissue of fat, muscle, vascular epithelium, and connective and fibrous nature. The most frequently encountered soft tissue sarcomas in the head and neck regions are the rhabdomyosarcomas and neurogenic fibromas. Surgical excision and postoperative irradiation reduces recurrence of these malignant tumors.

Fibrosarcomas are rarely encountered in the soft tissues of the oral cavity. The most common sites are in the cheeks and pharyngeal regions. Wide local excision is the recommended treatment. Additional investigative efforts with the newer chemotherapeutic agents such as bleomycin and actinomycin could enhance present methods of treatment for the sarcomas.

Neurilemmoma (Schwannoma) and Ganglioneuroma. Neurilemmoma and ganglioneuroma are rare nerve tumors. These tumors occur principally around nerve tissue in the maxilla and mandible. Usual roentgenographic studies are negative. Tomograms and myographic studies may help localize the tumor area. Subjective symptoms are vague. Myalgia and anesthesia in areas of involvement of the peripheral nerves may be an indication of tumor activity. Since these tumors are potentially malignant, they should be biopsied promptly. Malignant variations of these nerve neoplasms are difficult to eradicate. They creep into every foramina in the skull, following nerve roots, and may cause many bizarre subjective symptoms. Surgical treatment necessitates wide exposure and vigorous and extensive excision.

Carcinoma of the Oral Cavity

Carcinoma arises in connection with the cutaneous surface of the face and mucous membrane of the mouth. The *basal cell* form of carcinoma develops on the skin of the lips and face. *Squamous cell* carcinoma occurs on the vermilion borders and mucosa of the mouth. Carcinoma of the mouth accounts for approximately 5% of all carcinomas occurring in man. Carcinoma of the oral cavity develops as a result of invasion of malignant epithelial cells through the normally intact basal cell layer into subcutaneous and submucosal tissues. The etiology is obscure, although certain contributing factors may be present. *Chronic irritation* from overexposure of the lips to sunlight and traumatism by jagged teeth and ill-fitting

dentures are among the predisposing factors in some individuals. The use of *tobacco* is considered an etiological factor. Areas of leukoplakia are frequently present as premonitory lesions in the history of squamous cell carcinoma. Leukoplakia is a lesion of the mucous membranes, appearing as a painless, hard, bluish-white, shiny patch. It occurs in older patients after continued, chronic irritation. Patches of leukoplakia may undergo malignant change by malignant cells in the mucosa invading the underlying tissue.

Clinical staging and grouping of carcinoma of the oral cavity may be accomplished by careful examination of the local and regional area prior to biopsy. Objective findings with the magnifying lens, gentle palpation of the tumor and peripheral tissues, and bilateral palpations of the regional lymph nodes will elicit important information. Subjective symptoms of local or referred pain, trismus of the jaw, fixation of local musculature, and paresthesia are aids in clinical staging of the neoplastic disease.

The TNM system advocated by the American Joint Commission for Cancer Staging was modified in 1977.

Carcinoma may have an ulcerative or verrucous lesion. Squamous and basal cell carcinomas invade submucosa and subcutaneous tissues, including bone. They may arise insidiously, with little pain in their early growth. The patient may be aware of a "blister" on the lip or an ulcer or "lump" in the mouth that persists. Clinical examination may demonstrate an ulcerated area presenting raised or rolled borders, with infiltration and induration about the margins. Induration of the surrounding tissue may not be present in early stages. Superficial ulceration or areas of leukoplakia may precede the neoplasm. Inflammatory lesions may complicate carcinoma of the tongue. Carcinoma of the mouth metastasizes to regional lymph nodes during its extension. Metastasis to the cervical nodes may be detected by bimanual palpation of the local sites of lymphatic drainage. Metastatic nodes may be discrete and difficult to palpate, but lymphatic dissemination of the neoplasm has progressed. Large, extensive, fixed metastatic nodes indicate an advanced primary tumor.

Diagnosis is established from a biopsy, which is taken as early as possible with little trauma. Local anesthesia is indicated for biopsy, provided the injection is not delivered into the tumor area. Excision biopsy is done if the lesion is small. When the lesion is large, an incision biopsy is performed prior to surgical intervention. This is accomplished by removing a wedge-shaped segment of the tumor, using the scalper or the electrocautery. The electrocautery is advantageous for controlling hemorrhage, since it seals off the bleeding vessels and prevents passage of tumor cells into the circulation. Sutures are avoided to prevent extension of the neoplasm. Multiple sampling may be necessary from the perimeter of the tumor for accurate diagnosis. The biopsy material should extend into submucosal tissues as demonstrated. Aspiration biopsy is useful in cases of deep, inaccessible sites of metastasis. Aspiration biopsy is performed by employing a specially constructed, large-caliber needle and glass syringe. Some tumor cells are drawn or aspirated into the syringe after the tip of the needle is introduced into the tumor bed. This technique is difficult, even in the hands of an experienced clinician.

Biopsy material may be obtained by rubbing the tumor site gently with a tongue blade, thus transferring some of the tumor cells to the sponge for histological examination. This is an adequate method when screening large numbers of patients with suspicious oral lesions. It has been employed with satisfactory results in gynecology and is known as the Papanicolaou test. A negative pathological report could be misleading because the tumor surface may contain only inflammatory exudate or necrotic tissue. A positive report would still require an

incision or excision biopsy for confirmation of the diagnosis.

Treatment

Treatment planning for malignant tumors will depend on the histology of biopsy, location of the neoplasm, its radiosensitivity, the degree of metastasis, and the age and physical condition of the patient.

The location of the tumor in the oral cavity may complicate treatment. Neoplasms in the posterior part of the mouth are less accessible and frequently encroach on vital structures. Adjunctive irradiation therapy may be indicated in certain cases. Eighty percent of cancers of the lip may be successfully treated by prompt therapy, but carcinoma of the floor of the mouth, tongue, and gingiva presents a poorer prognosis. Carcinoma arising in the posterior part of the mouth is not always diagnosed and treated early in the course of the disease. These carcinomas infiltrate rapidly into adjacent structures and metastasize early to cervical lymph nodes. Less than 25% of these neoplasms may be successfully treated after extensive metastasis.

The age and physical condition of the patient are important in the treatment plan. Aged, debilitated patients can withstand extensive surgical procedures only after careful preoperative preparation. This may delay treatment and permit progression of the disease.

Irradiation therapy. Sensitivity of the tumor to irradiation therapy influences treatment. Radiosensitive tumors may be advantageously treated with x-ray or radium emanations alone or in combination with surgery.

Treatment of carcinoma is the responsibility of a team consisting of the pathologist, radiologist, internist, oncologist, and oral surgeon. Irradiation therapy for treatment of malignant neoplasms is based on the fact that tumor cells in stages of active growth are more susceptible to radiation than adult tissue. The more undifferentiated these cells appear histologically, the more radiosensitive the tumor is likely to be. The more the cells appear like normal adult cells, the less their reaction to irradiation. Mode of action on the active, growing neoplasm by irradiation is the immediate or delayed death of the tumor cells and a suppression of reproduction. Agents employed for irradiation are the short-wavelength roentgen rays or the gamma rays of radium. Although these agents have a selective effect on active neoplastic tissues, normal tissue must be protected.

Three methods are generally used for application of irradiation. The emanations are delivered to the tumor area from a distance, the radioactive agents are implanted into the tumor bed, or a combination of both methods may be used with or without surgery.

X-irradiation is frequently used to sterilize the tumor from a distance outside the oral cavity. Filters of aluminum and copper may be employed to protect tissues. Intraoral cones have been devised to increase tumor dosage and reduce exposure of normal tissues. Newer methods of treatment include other radioactive metals. Radioactive cobalt is used extensively to irradiate tumor sites. Increased kilovoltage of roentgen equipment is now employed so that undesirable side effects of irradiation are reduced.

Radioactive agents such as radium, radon gas, or activated iridium can be implanted directly into the neoplasm. Radium and radon gas are enclosed in gold or platinum to reduce immediate tissue necrosis and permit even distribution of the emanations. Careful irradiation

treatment planning is essential so that proper distribution of the radioactive agents is accomplished to sterilize the tumor. Consideration of the surrounding normal tissue is given since it receives some of the emanations. Areas of irradiation develop erythema, and normal tissue function is impaired. Skin tolerance to irradiation must be determined to avoid severe injury. Necrosis of bone also occurs after intensive treatment. Osteoradionecrosis may follow irradiation therapy because of the interference with normal bone nutrition by the radioactive agents in the presence of infection. Progressive necrosis can involve the entire jaw, necessitating sequestration or resection. Teeth in the irradiated area should be removed prior to therapy so that this retrograde process is avoided.

Surgical treatment. Surgical treatment of malignant tumors of the oral cavity requires wide excision. Squamous cell carcinoma of the oral mucosa invades adjacent tissues and metastasizes more readily than cutaneous carcinoma. Prompt, adequate treatment is essential to eradicate the growth. Wide excision is important, since growth of the tumor extends into surrounding normal tissues with considerable invasion, which may not be visible clinically. Scalpel and electrocautery are employed to excise the tumor. Primary healing does not always occur after excision with the electrocautery, since scar tissue formation is extensive in this case. Scar tissue is removed after successful treatment of malignant disease because extensive scar formation interferes with function.

Extension of the neoplasm into the periosteum and bone requires complete or partial resection of the jaw. Resection can be extensive when the bony cortex is invaded. Partial resection may be indicated whenever the periosteum alone is involved. Malignant tumors can involve the medulla of bone, thus revealing osteolytic areas in roentgenograms. Infiltrating carcinoma of the jaw may cause paresthesia by invading branches of the trigeminal nerve. Extensive resections of the jaws for squamous cell carcinoma should include an adequate resection of blood vessels of the affected side. The adjoining soft tissue should be supported whenever possible by prosthetic appliances attached to the bone stumps. Immediate bone grafting is not advisable after radical resection for carcinoma. A period of observation is necessary to ensure no recurrence.

Squamous cell carcinoma may metastasize to the cervical lymph nodes early in the progress of the disease. Regional lymph nodes become enlarged and can be detected by palpation. These lymph nodes are excised widely before further extension occurs. Skin flaps are reflected widely to expose underlying involved tissues. Although some lymph nodes within the operative field may appear normal, their removal in continuity with fascial attachments is imperative. Some normal structures are sacrificed in this procedure. Ligations and excisions of some blood vessels are necessary to control hemorrhage and completely extirpate contiguous lymph tissues. Closure is accomplished with non-absorbable coaptation sutures after drains have been positioned to reduce hematoma formation. Pressure bandages are useful to aid healing.

Chemotherapy. New advances in therapy, better patient management, and advanced anesthetic technique have improved the prognosis of oral carcinoma. Infusion of chemotherapeutic agents into major blood vessels supplying tumor areas around the oral cavity has been successful in some cases. These agents seem to have a predilection for anaplastic cells and destroy the tumor. A promising group of synthetic chemical agents used for treatment of oral cancer are the antimetabolites. These chemicals interfere with the metabolism of the rapidly growing and dividing cancer cells. Agents such as methotrexate and 5-fluorouracil are infused under controlled pressure into the arterial stream nourishing the tumor site. The quantity of the chemical compound necessary for consistent cancericidal effect

may have to be reduced in concentration because of depressant effects on the hemopoietic system of the patient. Oral administration of these agents may also need to be increased or reduced according to the results of frequent complete blood counts and clinical and histological examinations of the tumor site following initial arterial infusion.

Nausea, vomiting, and general malaise are anticipated subjective symptoms. Remission of tumor activity occurs, and the local site usually sloughs. Follow-up treatment may be threefold and consist of additional chemotherapeutic agents, x-irradiation, and surgical extirpation of a smaller and less aggressive tumor.

Cryosurgery. Recent improvements in freezing of selected tissues have given new impetus to the treatment of benign and malignant neoplasms, and cryosurgery has recently been successfully attempted in treatment of tumors. The technique of freezing selected areas in the oral cavity is accomplished by a probe tip contacting neoplastic tissue after liquid nitrogen has entered the tip in controlled amounts. The temperature of the contacted tissues is lowered to around -180°C . Cell injury and death occur as a result of this brief contact. Usual sequelae of swelling, necrosis, and slough of affected tissues follow this treatment.

The advantages of using chemotherapeutic infusion agents and selective cryosurgery are inclusion of the poor-risk patient with advanced neoplastic disease in treatment, conservation of bony support to contiguous soft tissues involved with tumor tissue, minimal blood loss because of more conservative treatment, and less postoperative pain and cosmetic deformity.

Comment

The dentist has the opportunity to regularly examine patients for all aspects of oral diseases. He should maintain a high index of suspicion regarding any changes in the character of the oral mucosa. Recognition of early malignant changes in oral tissues should be a challenge and stimulate continued study to improve diagnostic ability. Prompt referral of patients for definitive treatment is most important for satisfactory results.