Maxilla and Mandible

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11.1 Introduction

A bewildering variety of lesions occurs in the maxilla and the mandible. Although a specific diagnosis of these can be difficult on imaging, it is important to be familiar with the key imaging characteristics of a few common entities and to be facile at detecting imaging signs of aggressive neoplastic, inflammatory, and infectious processes. This chapter describes a fundamental approach to commonly encountered jaw lesions; it does not address dental or temporomandibular joint pathology in detail.

11.2 Anatomy

The term "jaws" refers to the teeth-bearing bones including both the mandible and the maxilla. Because of their arched contour, the anatomic positions anterior and posterior are somewhat inexact, and the terms mesial (toward the midline) and distal (toward the molars) are favored.

The mandible is comprised of a body and paired rami, coronoid processes, and condylar processes. The ramus meets the body at the angle. The midline of the body is the mandibular symphysis (Fig. 11.1). The buccal surface of the mandible attaches multiple muscles: the lateral pterygoid at the condylar process, the medial pterygoid at the posterior-inferior ramus near the angle, the temporalis at the coronoid process, and the masseter at the ramus. The temporalis, medial pterygoid, and masseter close the jaw. The lateral pterygoid opens the jaw and moves it from side to side (Fig. 11.2).

The lingual surface of the ramus contains the inferior alveolar foramen through which pass the inferior alveolar nerve and artery into the canal of the same name. The inferior alveolar nerve, a branch of the mandibular (third) division of the trigeminal nerve (V3), exits the mandible through the mental foramen on the buccal aspect of the body. The mental foramen is generally in line with the longitudinal axis of the second premolar.

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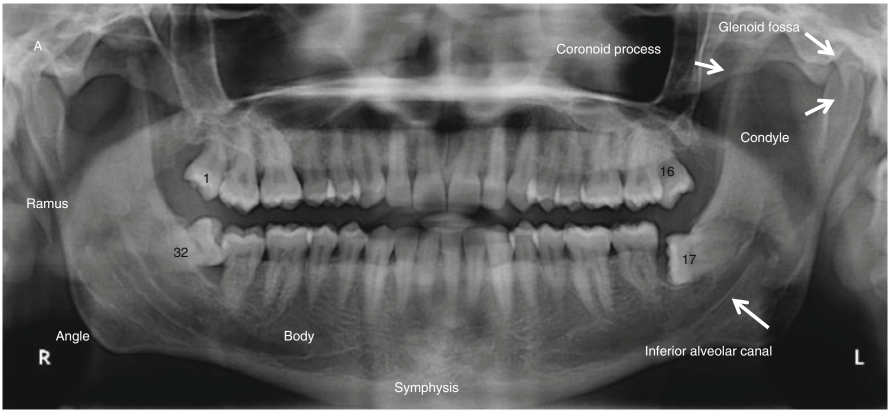

Fig. 11.1 Orthopantomogram depicting mandibular anatomy and teeth numbering

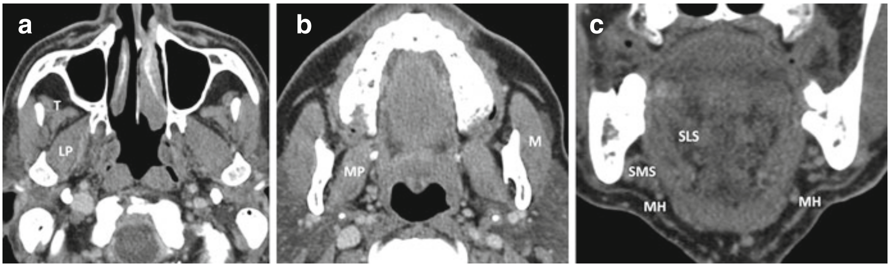

Fig. 11.2 Muscles attached to the mandible. *LP* lateral pterygoid, *MP* medial pterygoid, *M* masseter, *T* temporalis, *MH* mylohyoid, *SMS* submandibular space, *SLS* sublingual space

The lingual surface of the body attaches to the mylohyoid muscle at the mylohyoid line. The left and right mylohyoid muscles combine to form a sling that separates the submandibular and sublingual spaces (Fig. 11.2). Posteriorly, the mylohyoid sling has a free margin where the two spaces are contiguous. In the midline, the lingual surface contains the genial tubercle that attaches to the genioglossus superiorly and the geniohyoid inferiorly. Below the genial tubercle on each side is a shallow groove for the attachment of the anterior belly of the digastric.

The alveolar process of both the mandible and maxilla supports the teeth. The mandibular alveolar process tapers distally to a triangular plateau called the retromolar trigone (Fig. 11.1). Lateral to this is a depression, the retromolar fossa, limited externally by a ridge contiguous with the coronoid process called the temporal crest. Squamous cell carcinomas arising from the mucosa in this region can present with early osseous and deep space invasion.

The temporomandibular joint (TMJ) is formed by the articulation of the mandibular condyle with the concave glenoid fossa in the temporal bone which is positioned just posterior to a convex articular eminence. The TMJ space is divided by a biconcave fibrocartilaginous disc that moves in conjunction with the mandibular condyle.

The 32 adult teeth are bound to dental sockets in the alveolar processes by the periodontal ligaments that form the lucencies around the tooth roots seen on radiographs. The teeth may be named by descriptors including the side, the jaw (mandibular or maxillary), the position (lateral/medial, first/second/third), and the tooth type (incisor, canine, premolar, molar) or by a single number from 1 to 32, starting at the right upper jaw and ending in the right lower. Children have 20 deciduous teeth which are numbered from the right upper jaw to the right lower. The teeth have occlusal, buccal, lingual, mesial, and distal surfaces.

11.3 Imaging Evaluation

Plain radiographs and pantomograms are extremely useful in the initial evaluation of the jaws. It is possible to characterize some small jaw lesions definitively using plain films alone. Lesions greater than 2 cm are better evaluated with CT or MRI. In a setting of suspected odontogenic infection, osteomyelitis, or osteonecrosis, CT is the modality of choice. CT is also useful in the detection of osseous invasion by malignancy. The role of MRI is limited to those cases where CT or plain radiography is equivocal.

11.4 Benign Lesions

11.4.1 Cystic Lesions

It is important to note that the term “cystic” as used here refers to the imaging appearance (bone lysis with resulting cystic appearance) and does not necessarily indicate a pathological characteristic. Radiographically, these lesions present as discrete, well-marginated, sometimes expansile osteolytic lesions.

The vast majority of small discrete lytic jaw lesions are *periapical cysts*. These are associated with chronic infection that progresses from the pulp of a tooth through its root into the alveolar bone. Initially, a periapical granuloma is formed, which transforms with time into a sterile cavity (Fig. 11.3).

Dentigerous cysts arise from odontogenic epithelium around the crown of an unerupted tooth, usually a molar. They typically appear as a well-defined expansile lytic lesion which contains an unerupted tooth. Very rarely, an ameloblastoma may arise from the lining of a dentigerous cyst (Fig. 11.4).

Odontogenic keratocysts are lined by stratified squamous epithelium and contain keratin. They tend to grow along the long axis of the mandible, insinuating themselves between the dental roots and thus do not contain a tooth. When multiple odontogenic keratocysts are seen, a diagnosis of basal cell nevus (Gorlin’s) syndrome must be entertained. This syndrome is characterized by the appearance of nevoid basal cell carcinomas at a young age (Fig. 11.5).

Unicameral bone cysts, similar to those seen in the long bones, may also be encountered in the maxilla and mandible of young people. They are well-defined

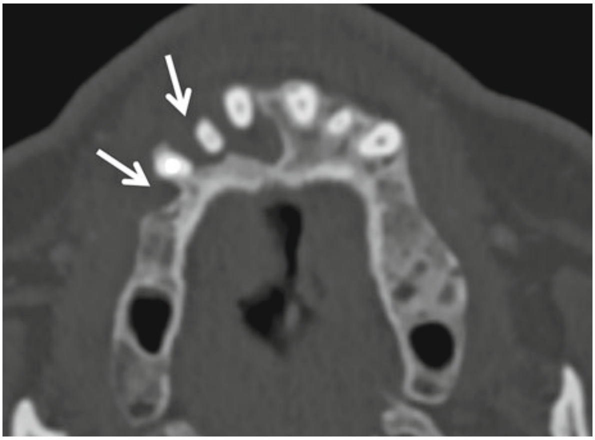

Fig. 11.3 Typical periapical granulomas on CT

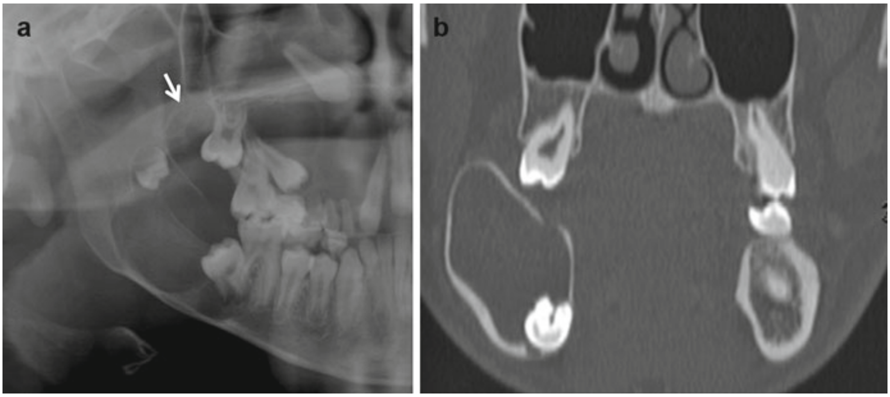

Fig. 11.4 Dentigerous cyst. Radiograph (**a**) and CT (**b**) images of dentigerous cysts. A typical dentigerous cyst is an expansile unilocular lesion containing an unerupted tooth. Occasionally more than one cyst may be present (*arrow*, **a**)

expansile lesions with no other distinguishing characteristics. They are postulated to arise as a consequence of liquefaction of an intraosseous hematoma.

A *Stafne cyst* or cavity is a developmental variation found at the angle of the mandible. They may be bilateral and contain a rest of salivary glandular tissue.

Fissural cysts occur along mandibular and maxillary embryonic fusion lines. The most common fissural cyst is the nasopalatine duct (incisive canal) cyst seen between the premaxilla and the hard palate in the midline. These are usually incidentally detected but occasionally erode into the oral cavity forming a submucosal mass on the anterior hard palate (Fig. 11.6).

Ameloblastomas (Fig. 11.7) are benign tumors arising from odontogenic epithelium that appear as unilocular or multilocular expansile lytic masses. When septations are present, they can produce a characteristic "soap bubble" appearance. Although ameloblastomas tend to breach the cortex and extend into adjacent soft tissues, only a tiny fraction is malignant. Ameloblastomas can exhibit

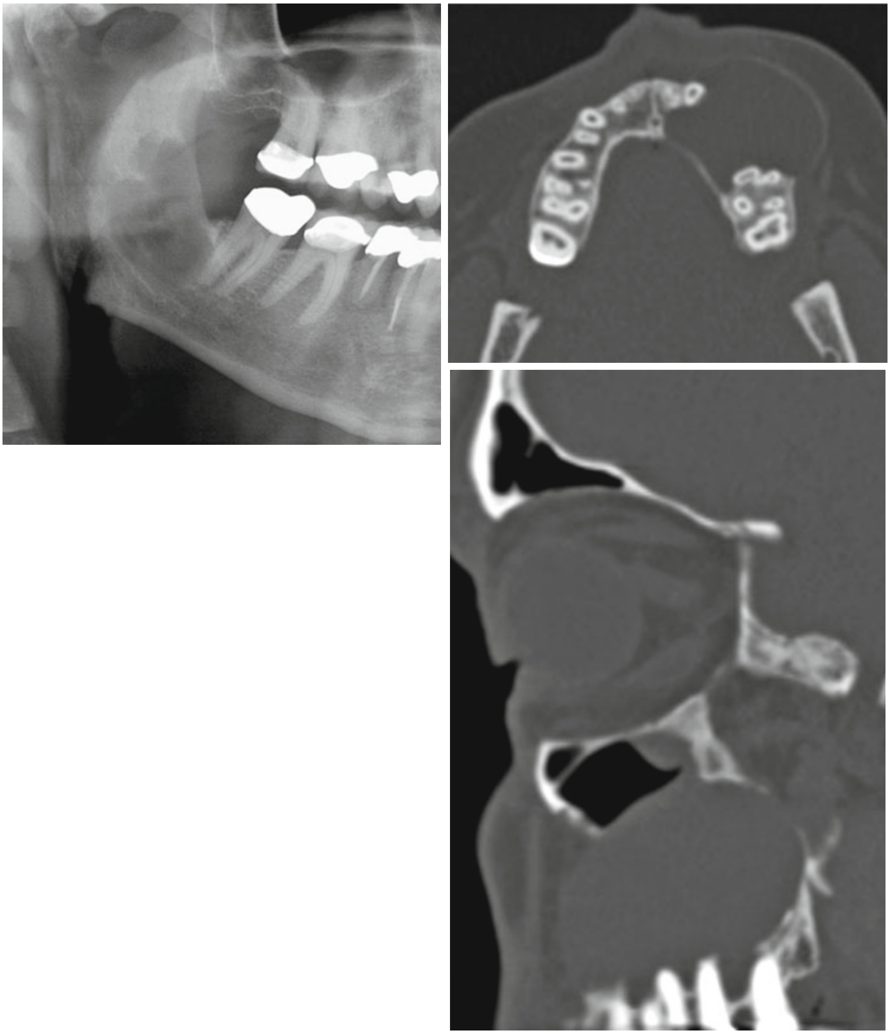

Fig. 11.5 Odontogenic keratocyst. A typical OKC is expansile, is unilocular, and does not contain an unerupted tooth. Multiple odontogenic keratocysts suggest Gorlin's syndrome, a condition characterized by multiple nevoid basal cell carcinomas in childhood, cardiac and ovarian fibromas, and macrocephaly along with higher incidence of medulloblastomas

enhancing papillary projections that distinguish them from other radiographic cysts (lytic lesions) that are not tumors; these projections can sometimes be seen on contrast-enhanced CT but are more reliably detected with MRI.

When one encounters a lytic expansile jaw lesion in a middle-aged or older patient that does not conform to the appearance of one of the more typical benign cysts discussed above, a contrast-enhanced CT or MRI must be recommended to characterize it further. These can demonstrate the enhancing papillary projections that, when present, are highly suggestive of ameloblastoma. Ameloblastomas are treated with wide excision as they have a tendency to recur.

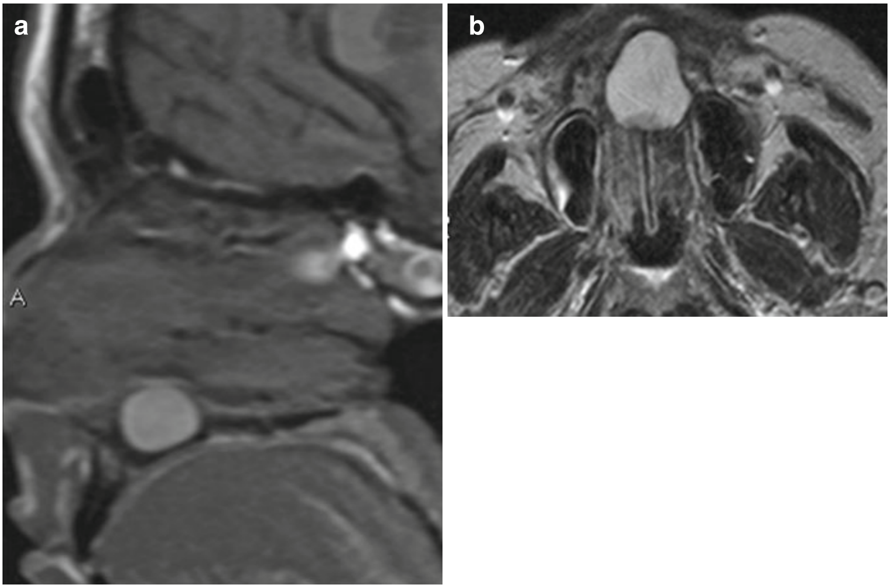

Fig. 11.6 Incisive canal or nasopalatine duct cysts. (**a**, **b**) Are examples of incisive canal cysts. They occur in the midline at the junction of the hard palate and premaxilla and are usually found incidentally. Occasionally they may be large enough to cause cosmetic deformity. Rarely secondary infection may occur. The high T1 signal of the cyst contents in these images reflects elevated protein concentration

Odontogenic myxomas are benign but locally aggressive expansile tumors seen in young adults; they may be indistinguishable from ameloblastomas (Fig. 11.8).

Aneurysmal bone cysts of the jaws present as expansile multilocular masses containing characteristic blood-fluid levels on MRI. They resemble giant cell lesions, a category that includes brown tumors of hyperparathyroidism, giant cell reparative granulomas, and true giant cell tumors. Brown tumors are unilocular lesions that may be associated with loss of the lamina dura, a finding typical of the bone resorption of hyperparathyroidism. Giant cell reparative granulomas and giant cell tumors are multilocular expansile lesions that may be indistinguishable from ameloblastomas and aneurysmal bone cysts (Fig. 11.9).

When one encounters a lytic jaw lesion in an older patient, especially one with irregular margins, the possibility of metastasis and myeloma should be considered. Likewise, the possibility of eosinophilic granuloma must be entertained in a child with a discrete punched-out lytic focus, especially if associated with fever and systemic signs of inflammation (Fig. 11.10).

11.4.1.1 Sclerotic Lesions

These lesions demonstrate a predominant pattern of increased bone density on radiographs and CT scans. The increased density may be due to the presence of osseous or odontogenic elements.

Fig. 11.7 Ameloblastoma. The radiograph (**a**) demonstrates a lytic multiloculated lesion. The contrast-enhanced CT (**b**) depicts the solid papillary projections (*arrow*) that characterize this tumor. Ameloblastomas can sometimes be unilocular. When a benign lesion cannot be definitively excluded on radiography, it is prudent to obtain a cross-sectional study to characterize the internal architecture of these lesions and establish the diagnosis as in the fat-suppressed contrast-enhanced image, (**c**) (Courtesy of Dr William P. Dillon, University of California, San Francisco), where *solid areas* of enhancement are evident

Odontomas are benign tumors comprised of normal dental elements (enamel, cementum, dentine, and/or pulp). When well differentiated, they tend to occur in the anterior mandible and are called compound odontomas. These are well defined on radiographs and contain numerous dense toothlike elements. When less well differentiated, they tend to occur in the posterior mandible and are called complex odontomas. They are similar to compound odontomas radiographically, but the internal densities are more amorphous and less toothlike. Rarely, an odontoma may be associated with an undifferentiated component that histologically resembles an ameloblastoma (ameloblastic odontoma). The lesions contain a lytic component in addition to the typical radiodensities of odontomas (Fig. 11.11).

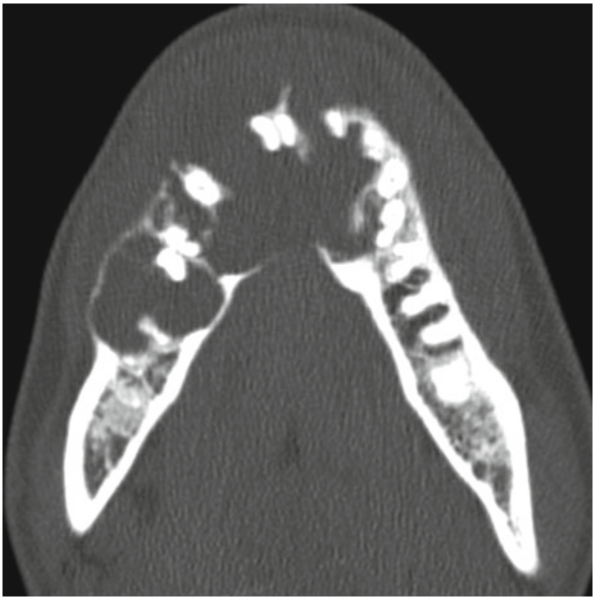

Fig. 11.8 Odontogenic myxoma. These tumors resemble ameloblastomas on imaging and must be suspected when an expansile multiloculated lesion is encountered in a young patient

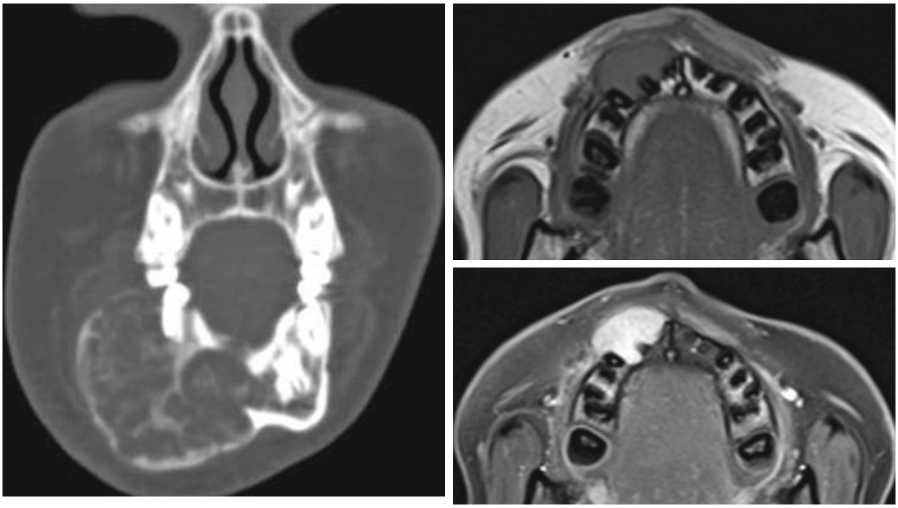

Fig. 11.9 Giant cell reparative granuloma. GCRGs are poorly understood nonneoplastic lesions that may represent a reparative response to intraosseous hemorrhage from prior trauma. They can occur on the jaw bones as well as in the overlying gingiva (epulis). They resemble brown tumors of hyperparathyroidism histologically. There is nothing specific about the radiological appearance of GCRGs, and they can be indistinguishable from aneurysmal bone cysts, giant cell tumors, ameloblastomas, and myxomas. The most common finding is that of an expansile multiloculated mass with variable degrees of cortical thickening, usually affecting the mandibular body. However, as seen in the pre- and postcontrast T1-weighted image from a 12-year-old with tooth pain, they may be unilocular as well

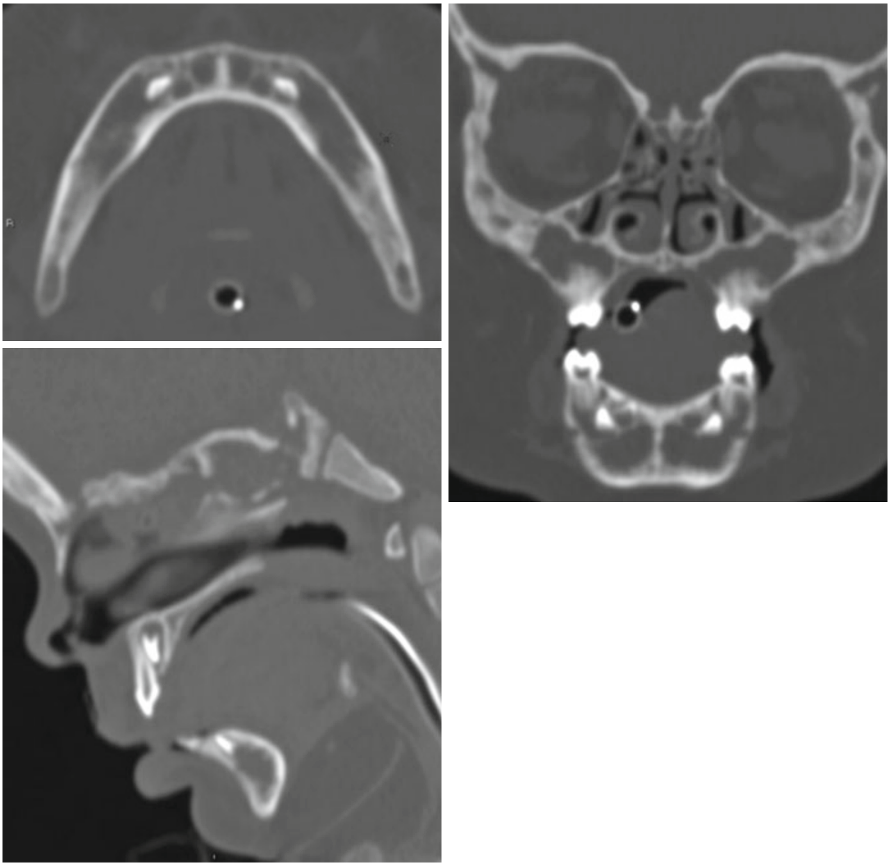

Fig. 11.10 Disseminated Langerhans cell histiocytosis. When a lytic jaw lesion is encountered in a child, histiocytosis must always be suspected. It may be a unifocal process or, as in this case, present with widespread lytic foci and systemic manifestations

Cemento-osseous dysplasia of the mandible occurs in two forms. The more common periapical type can be painful, is common in black females, and presents as a discrete radiodensity with a lucent periphery adjacent to a tooth root. The less common florid type involves several teeth and is usually asymptomatic.

*Tori a*re benign, usually asymptomatic osseous excrescences that arise from characteristic locations in the mandible (torus mandibularis), hard palate (torus palatinus), and maxilla (torus maxillaris) in response to chronic irritative stress. Clinically, these can be misidentified as tumors by unfamiliar practitioners (Fig. 11.12).

Fibrous dysplasia (Fig. 11.13) of the jawbones has two distinct appearances depending on the degree of mineralization: (1) a well-defined lucent expansile lesion containing foci of mineralization and confined by a sclerotic rind or (2) a more homogeneous sclerotic lesion with a ground-glass matrix. Ossifying fibromas are benign fibrous neoplasms containing bony trabeculae. These are slow-growing tumors that begin as lucent lesions that gradually mineralize. Often they are

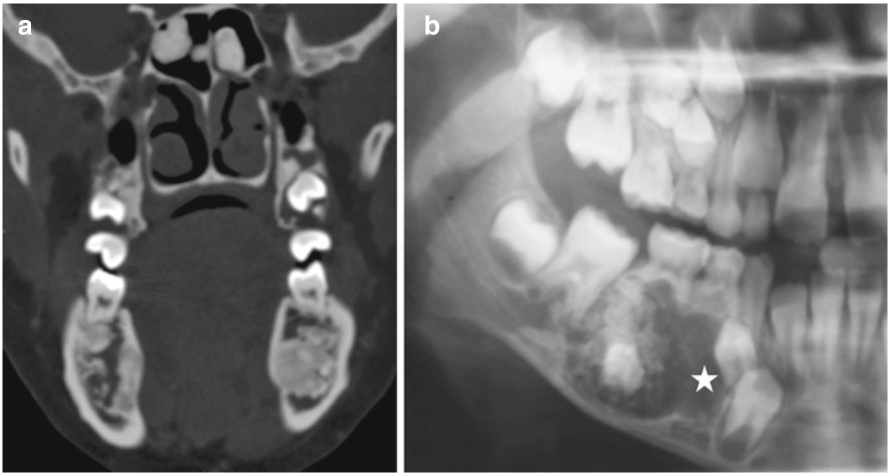

Fig. 11.11 Odontomas are usually incidentally detected lesions and are comprised of numerous dense toothlike elements. They can sometimes be associated with pain. Multiple odontomas can be seen in Gardner's syndrome (**a**). Rarely an ameloblastoma (*asterisk*, **b**) may be associated with an odontoma (ameloblastic odontoma)

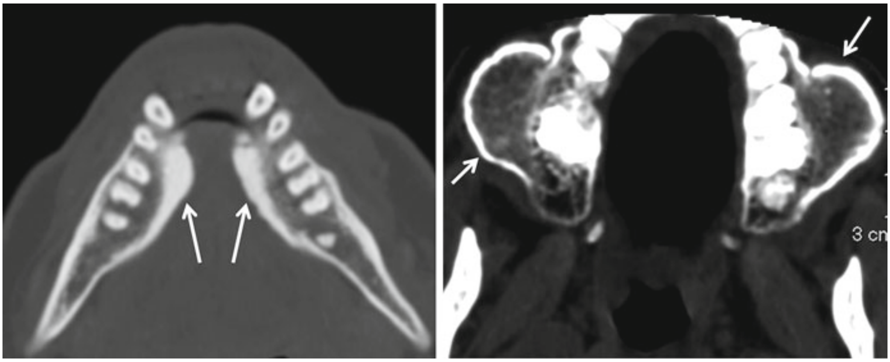

Fig. 11.12 Mandibular and maxillary tori. Tori are reactive osseous excrescences that arise as a consequence of repetitive trauma. Maxillary tori are also called buccal alveolar exostoses

indistinguishable from fibrous dysplasia. It is important to remember that fibro-osseous lesions may demonstrate bizarre signal intensities and enhancement patterns on MRI that can lead to a misinterpretation of malignancy; their true nature is easier to recognize on plain radiographs or CT. Cherubism, an extremely rare autosomal dominant condition that may be considered a variant of fibrous dysplasia, is characterized by symmetric overgrowth of the maxillae and mandible due to the formation of multiple cystic fibro-osseous lesions.

Osteochondromas tend to arise from the coronoid or condylar processes. Like long bone osteochondromas, these osseous excrescences have a medullary cavity that is contiguous with the mandibular medullary cavity, a characteristic radiographic appearance. They can cause cosmetic deformity and TMJ malalignment (Fig. 11.14).

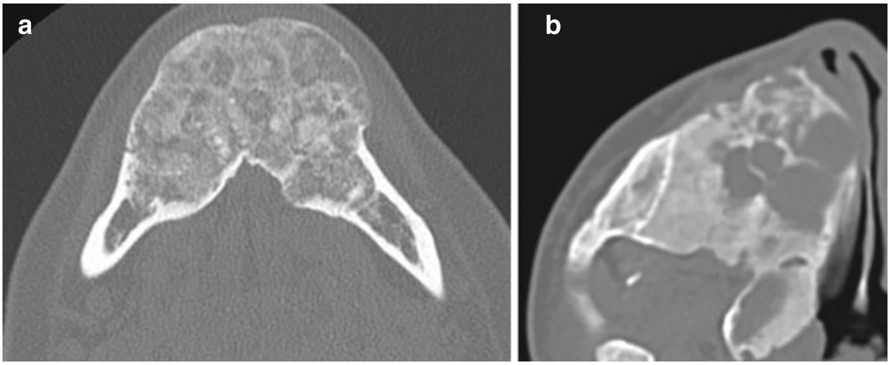

Fig. 11.13 Fibrous dysplasia of the mandible (**a**, Courtesy of Dr William P. Dillon, University of California, San Francisco) and maxilla (**b**). Note the "ground-glass" appearance of the expanded bone

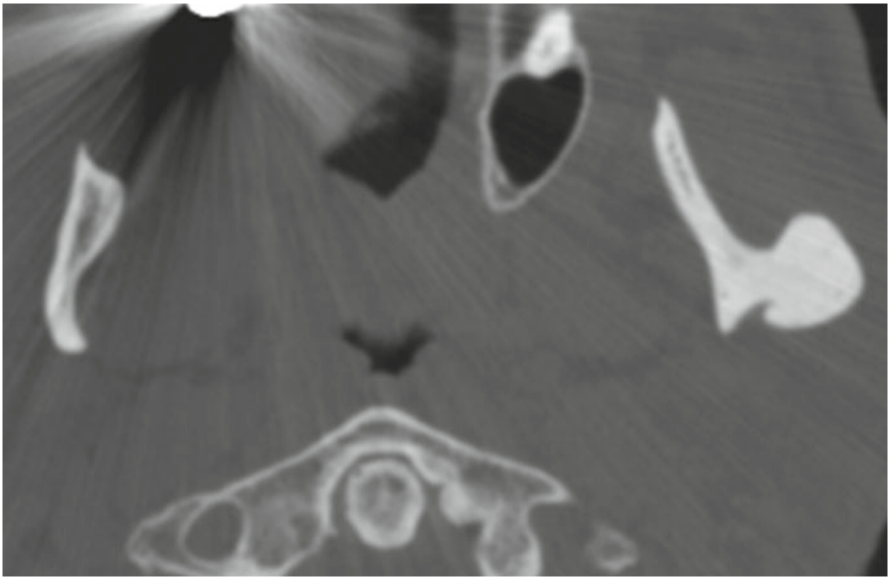

Fig. 11.14 Osteochondromas present as pedunculated mushroom-shaped excrescences usually from the mandibular ramus. They may cause cosmetic deformity or, if located in proximity to the condyle, result in TM joint malalignment

11.5 Malignant Lesions

11.5.1 Osteosarcoma

The diagnosis of osteosarcoma must always be considered in the setting of a destructive jaw lesion. Gnathic osteosarcomas occur across a wide age range and have a better prognosis than long bone osteosarcomas. The imaging appearance is

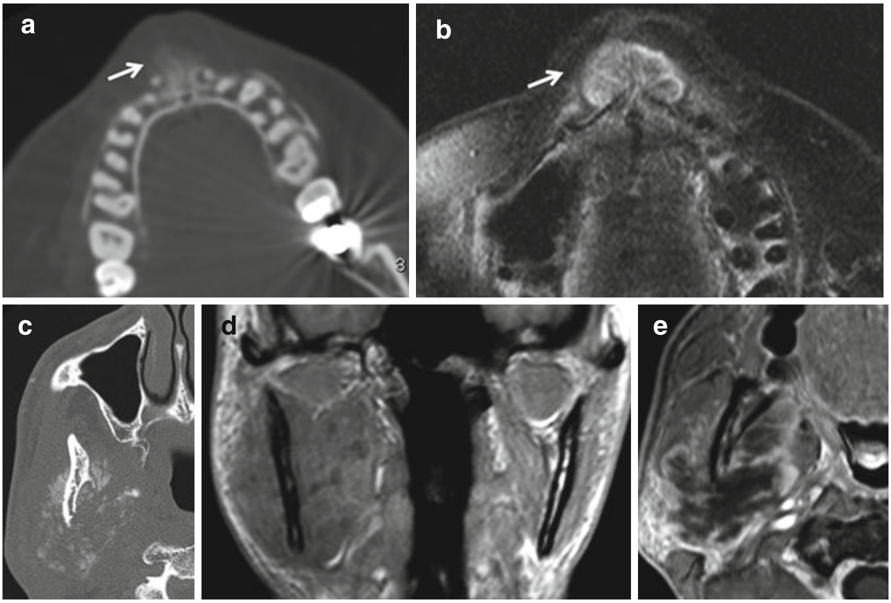

Fig. 11.15 Osteosarcoma. (**a**, **b**) Are from a patient with a premaxillary osteosarcoma. The presence of ill-defined tumor bone (*arrows* **a** and **b**) is a clue to the diagnosis. (**c**–**e**) Are from a patient with a radiation-induced mandibular osteosarcoma. Tumor bone is evident in CT, while the soft tissue component and extent of mandibular medullary involvement are better demonstrated on the MR images. Tumor bone, however, by no means is a universal radiological feature of osteosarcoma

extremely variable; the classic "sunburst" pattern of periosteal tumor bone formation seen in the long bones is infrequently seen in the jaws. More commonly, there is a nonspecific expansile, destructive mass associated with a soft tissue component. Tumor bone, when visible, may be amorphous and irregular. MRI is necessary to clearly define tumor extent, but there are no MR characteristics that are specific of this tumor (Fig. 11.15).

11.5.2 Osseous Involvement by Squamous Cell Carcinoma

Penetration of the cortical bone of the maxilla or mandible by upper aerodigestive squamous cell carcinoma (SCCA) upstages the primary tumor to T4. On CT, cortical involvement typically appears as a saucer-shaped bone defect adjacent to the tumor (Fig. 11.16). Subtle cortical invasion can also be detected on CT by using dedicated processing software (DentaScan, GE, Milwaukee) but is not routinely required. Loss of medullary trabeculae and replacement of fatty marrow by soft tissue imply deep bony invasion. MRI can also be used to evaluate the extent of mandible invasion but is best reserved for equivocal cases. On MRI, the tumor is of low to intermediate signal intensity on T1-weighted images, is intermediate to high signal intensity on T2-weighted images, and enhances with gadolinium. However,

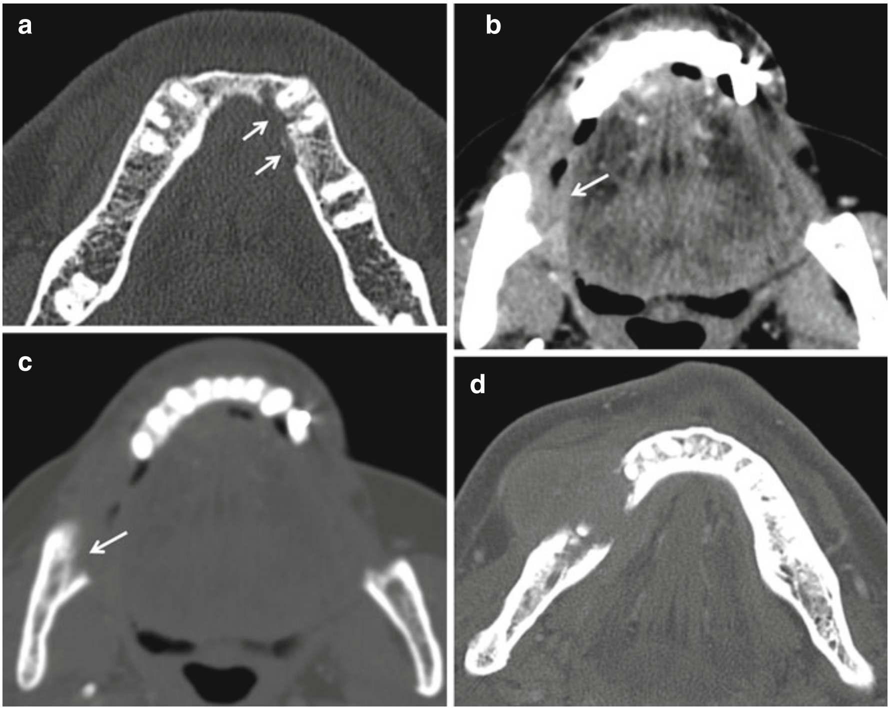

Fig. 11.16 Mandibular invasion (*arrows*) in squamous cell carcinoma. In (**a**), the lingual mandibular cortex is invaded by tumor. (**b**, **c**) Show a retromolar trigone squamous cell cancer invading the adjacent mandibular cortex. RMT cancers are notorious for early bone involvement. In (**d**), full-thickness mandibular invasion by a gingival mucosal squamous cell cancer is evident

edema and granulation tissue can also demonstrate similar characteristics, which may lead to overestimation of bone involvement by MRI (Fig. 11.17).

11.6 Osteomyelitis

The simplest classification of osteomyelitis defines two broad varieties – acute and chronic. Chronic osteomyelitis (COM) is either primary, when there is no antecedent episode of acute osteomyelitis (AOM), or secondary, when AOM persists beyond 4 weeks.

AOM (Fig. 11.18) is usually a pyogenic infection that follows periodontal disease. Infection spreads from the root of the affected tooth to the alveolar bone. Suppuration in the affected bone leads to increased intraosseous pressure, necrosis, cortical destruction, and formation of soft tissue abscesses in the adjacent spaces. Bone destruction, periostitis, and abscesses are best demonstrated on contrast-enhanced CT. Abscesses in this setting are often small and may be obscured by dental artifact; to detect these, it is important to examine CT images in narrow

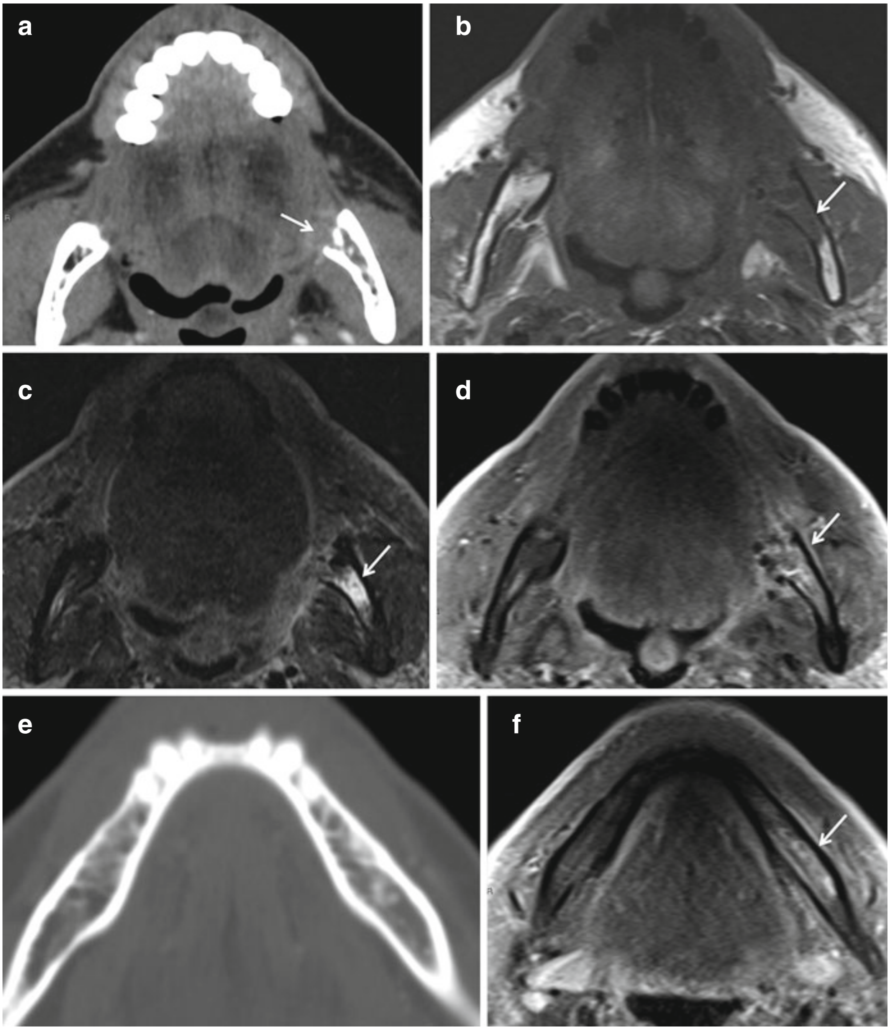

Fig. 11.17 Role of MRI in osseous invasion by squamous cell carcinoma. In (**a**), erosion of the cortex by a retromolar trigone cancer is noted. On the T1 (**b**) and fat-suppressed T2 (**c**) MR images, abnormal marrow signal is present in the medullary cavity (*arrows*). This is observed to enhance on the contrast-enhanced T1W fat-suppressed image (*arrow*, **d**). Abnormal marrow signal is non-specific and may indicate edema or tumor infiltration. In (**e**), an image through the mandibular body in the same patient, no osseous abnormality is apparent. However, the enhanced MR image (**f**) indicates that the marrow cavity is infiltrated with tumor. MR can aid in assessing tumor involvement in bone in equivocal cases, but the presence of masticator space abscess enveloping the mandibular ramus is noted

window. Secondary COM may follow untreated or inadequately treated AOM. Permeative bone destructions, periosteal thickening, fragmented bone representing sequestra, soft tissue inflammatory changes, and sinus tracts may be seen on CT.

Primary COM is a complex disorder. It may be caused by an identifiable infectious organism (*Actinomyces*, *Mycobacteria*, or fungi) or may occur as an idiopathic

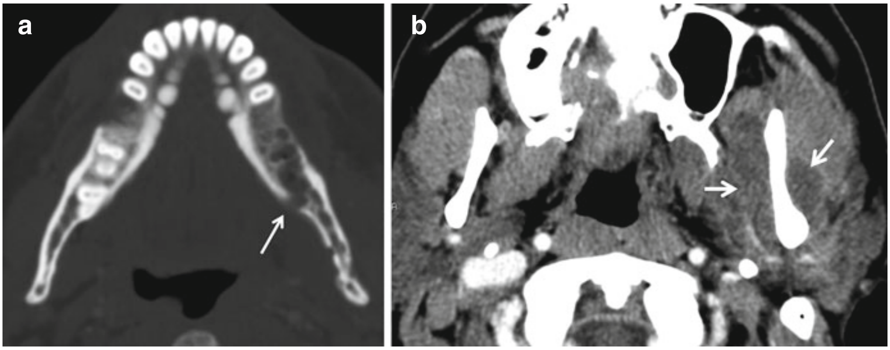

Fig. 11.18 Acute osteomyelitis arising from odontogenic infection. Mottled bone destruction is present in the left hemimandibular body and angle. A focal breach of the lingual cortex adjacent to the root of the third molar is present (*arrow*). In (**b**), a large masticator space abscess enveloping the mandibular ramus is noted

disorder (Fig. 11.19). A subset of patients with idiopathic COM fall under the spectrum of chronic recurrent multifocal osteomyelitis (CRMO), also known as the SAPHO (synovitis, acne, palmoplantar pustulosis, hyperostosis, and osteitis) syndrome characterized by recurrent episodes of osteomyelitis of the long bones and thoracic spine, sternoclavicular hyperostosis, and polyarthritis. Dense sclerosis and periostitis on CT and plain radiographs are characteristic of this entity. The mandible is involved in about 10 % of cases (Fig. 11.19).

11.7 Osteonecrosis

Osteonecrosis of the mandible is seen either as a consequence of radiotherapy or due to bisphosphonate treatment. Radiation-induced osteonecrosis (osteoradionecrosis, ORN) can be seen in patients with upper aerodigestive tract cancers who receive radiation to the jaw in excess of 60 Gy. The disease may be precipitated by a seemingly innocuous event that results in bony exposure, e.g., progressive dental decay, dental extraction, or minor trauma. ORN is a consequence of failure of the radiated bone to mount adequate immunologic and reparative responses. Grade 1 ORN is limited to the alveolar process and characterized clinically by exposure of devitalized bone. In grade 2 ORN, the necrosis extends to involve the body to a greater depth, down to the inferior alveolar canal. Grade 3 ORN involves the mandible below the level of the inferior alveolar canal and may be associated with pathological fractures. On CT, a combination of permeative bone loss and sclerosis in the absence of a significant soft tissue abnormality is typical. Foci of gas may be evident in necrosed bone (Fig. 11.20). ORN can sometimes be difficult to distinguish from tumor recurrence. Absence of a soft tissue mass adjacent to destroyed bone favors ORN over tumor.

Bisphosphonate-associated osteonecrosis (sometimes referred to as osteochemonecrosis) (Fig. 11.20) is seen in patients who receive one of these drugs for management of osteoporosis, osseous metastatic disease, or Paget's disease. Bisphosphonate

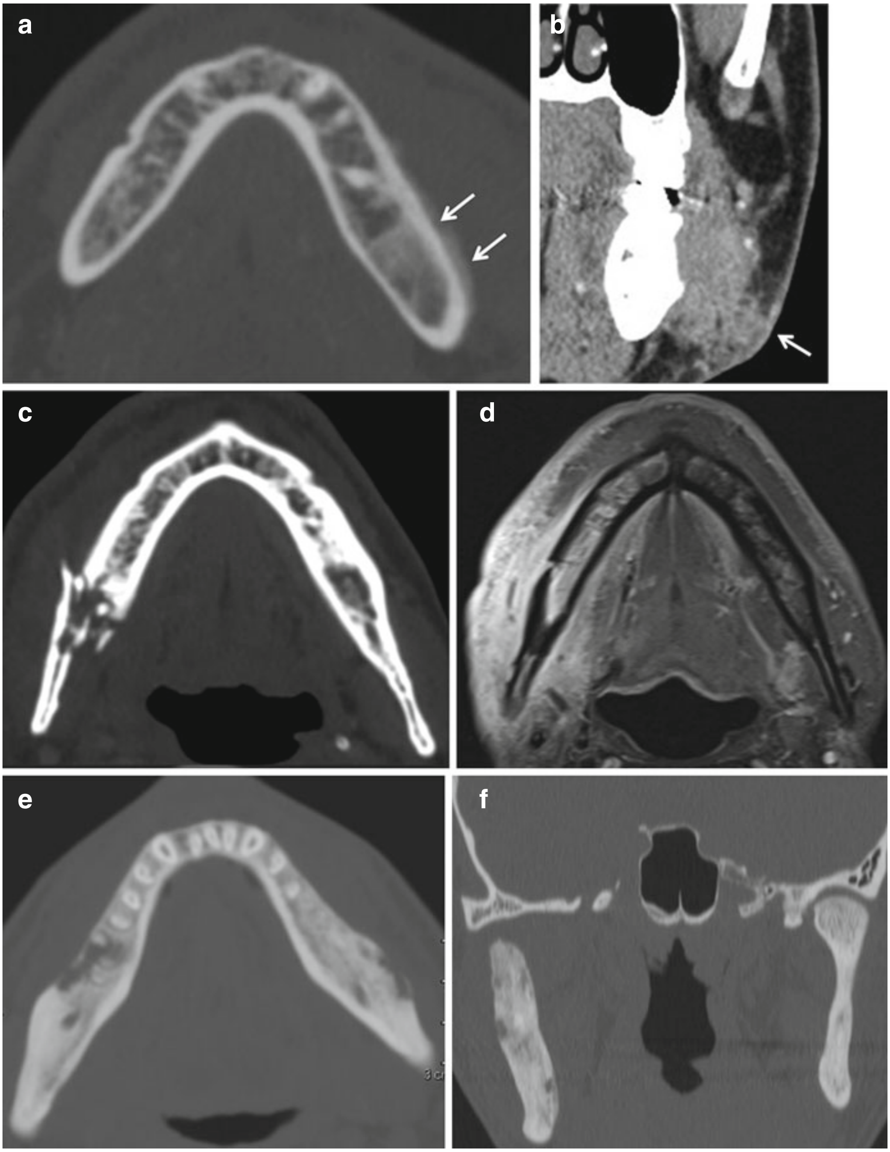

Fig. 11.19 (**a**, **b**) Chronic actinomycotic infection of the mandible. Sclerosis, a periosteal reaction (*arrow*), and an adjacent soft tissue abnormality (*arrow*) that extends to the skin surface, where draining sinuses were present, are evident. (**c**–**e**) Chronic candida osteomyelitis. The CT image shows a pathological fracture and small sequestra. On the enhanced MR image, extensive marrow inflammation/edema and loss of adjacent tissue planes are observed. (**e**, **f**) Chronic osteomyelitis in a patient with the SAPHO syndrome. Note the dense sclerosis and periosteal thickening cloaking the entirety of the mandible

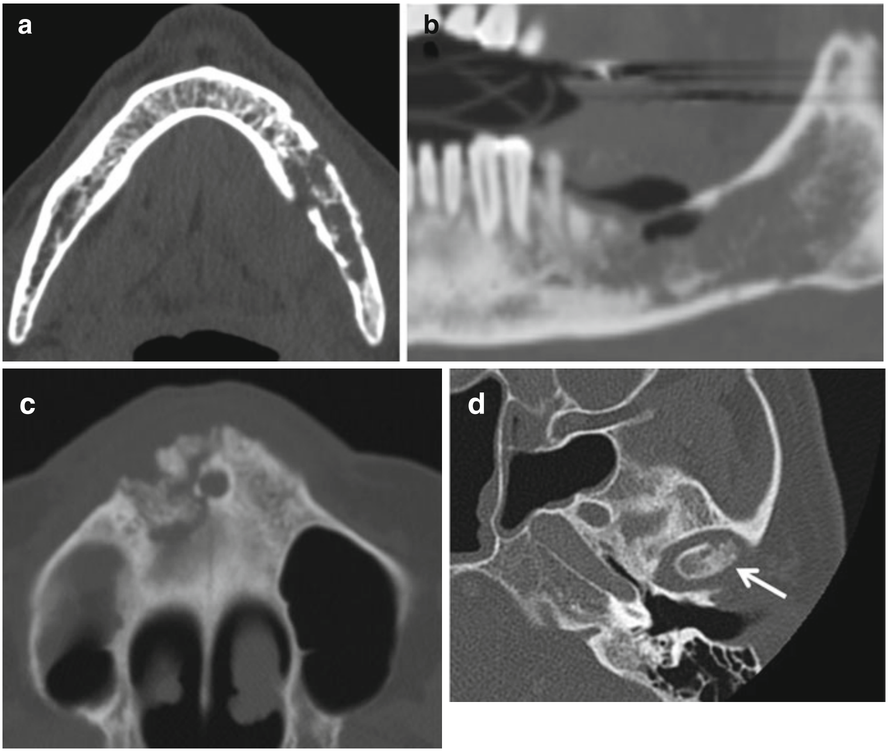

Fig. 11.20 (**a**, **b**) Osteonecrosis in a patient who received radiotherapy for a tonsillar malignancy. Note the osseous fragmentation and pathological fracture in (a) and the focus of gas in the medullary cavity in (b). The typical picture of a patient with ORN is that of bone exposure, pain, and the absence of an adjacent soft tissue mass. (**c**, **d**) depict mottled osteolysis from maxillary alveolus and mandibular condyle osteonecrosis respectively in patients receiving bisphosphonate (Image **d**, Courtesy of Dr William P. Dillon, University of California, San Francisco)

inhibits bone turnover and therefore prevents the mandible from mounting a reparative response to insults such as dental extraction. The risk of developing osteonecrosis increases with the dose of bisphosphonate and with IV administration. Early bisphosphonate-induced osteonecrosis is seen on CT as subtle foci of sclerosis adjacent to a dental socket or wound. With time, increased fragmentation, sclerosis, and formation of sequestra can be seen. MRI can demonstrate marrow edema, sclerosis, and enhancement but does not offer any significant advantage over CT.

11.8 The Surgeon's Perspective

As a general rule, definitive treatment of jaw lesions requires surgical resection and appropriate reconstruction. Rather than the exact histologic diagnosis, the most fundamental question to be answered by imaging is whether the process is benign, malignant, or infectious/necrotic.

Benign lesions tend to grow slowly but persistently and are detected when they cause dental symptoms (dental pain, loose teeth, etc.), masses, or functional deficits (masticatory pain, dental malalignment, etc.). While many of the benign cystic lesions can be successfully treated with curettage or even marsupialization (e.g., maxillary cysts opened into the maxillary sinus endoscopically), they have a high recurrence rate after these approaches. Thus, consideration must be given to the specific patient context when the treatment approach is determined. Unless resection is contraindicated, conservative treatment should not be repeated multiple times as this can lead to much more extensive anatomic deficits when compared to early definitive treatment. Odontogenic keratocysts and ameloblastomas, in particular, have a high recurrence rate after conservative approaches.

Malignant tumors require aggressive resection, and defining the extent of tumor radiographically is crucial. When tumor is in contact with the periosteum on imaging but mobile on examination, tumor excision with removal of the adjacent periosteum is adequate. When tumor is immobile on exam, periosteal invasion is likely. In this case, if imaging does not show frank cortical invasion, an alveolectomy/rim mandibulectomy is appropriate. This approach is generally adequate even when there is subtle cortical erosion, but penetration of the cortex (i.e., T4 tumor) requires segmental mandibulectomy. In this situation, the degree of progression through the medullary cavity is important in determining the extent of mandibular resection. If the extent is unclear on CT, MRI is often helpful. The head and neck surgeon will often encounter tumors in the context of a recently extracted tooth (at which time the dentist or oral surgeon performed a biopsy and documented cancer), and this can complicate the interpretation of bony erosion somewhat since the dental socket sometimes mimics cortical erosion on CT. Such sockets have smooth margins as opposed to invaded bone which is invariably irregular. It should be noted that alveolar carcinomas often cause significant erosion of the alveolar ridge without progression to medullary invasion, and these are often treated with alveolectomy only despite somewhat more extensive apparent cortical destruction on CT. Again, MRI can be helpful to clearly define the status of the medullary bone.

In the maxilla, in addition to jaw lesions, bony destruction can occur from maxillary sinus tumors which require partial or total maxillectomy and appropriate reconstruction.

Osteonecrosis of the jaws is becoming more common with the increasing use of radiation for head and neck cancer therapy and the increasing use of bisphosphonates. Careful imaging evaluation is important because biopsies can actually worsen osteonecrosis and should be avoided if possible. In addition to review of the imaging for evidence of recurrent tumor, careful and thorough clinical exam is crucial. Osteonecrosis should always be managed as conservatively as possible, remembering that clinical findings and symptoms are more important that the apparent degree and extent of abnormal bone on imaging. When aggressive treatment is appropriate, CT is the modality of choice to determine the extent of bone necrosis and plan reconstruction.

When planning advanced jaw reconstruction, it is common to use high-resolution CT to produce medical models and/or perform software-based planning of plate and flap size, position, and contour.

Conclusion

Jaw lesions on imaging may be broadly classified as those that are lytic, those that are sclerotic, and those that demonstrate both features (Box 11.1). They may also be divided into those with well-defined margins and those that produce more diffuse permeative bone loss. Well-defined lytic lesions may be unilocular or multilocular. The commonly encountered unilocular lesions are periapical cysts, dentigerous cysts, odontogenic keratocysts, unicameral bone cysts, and, sometimes, ameloblastomas. Multilocular lesions include ameloblastomas, aneurysmal bone cysts, and giant cell lesions. Predominantly sclerotic lesions include odontomas, cemento-osseous dysplasia, tori, and fibro-osseous lesions. Diffuse aggressive destructive processes include osteomyelitis, osteonecrosis, and malignancies such as osteosarcoma and invasive squamous cell carcinoma. The key imaging characteristics of these lesions are presented in Box 11.2. Jaw imaging is almost always most effectively performed with CT, but MRI and plain films have a place depending on the clinical situation. Figure 11.21 illustrates the key imaging appearances of the more commonly encountered jaw lesions.

Box 11.1. Differential Diagnosis of Jaw Lesions

- Cystic lesions
  - Unilocular
    - Periapical cyst
    - Dentigerous cyst
    - Odontogenic keratocyst
    - Unicameral bone cyst
    - Stafne bone cavity
    - Ameloblastoma
    - Brown tumor
    - Eosinophilic granuloma
  - Multilocular
    - Ameloblastoma
    - Odontogenic myxoma
    - Aneurysmal bone cyst
    - Giant cell lesions
- Sclerotic lesions
  - Odontoma
  - Cemento-osseous dysplasia
  - Fibro-osseous lesions
  - Tori
  - Osteoma
- Diffuse destructive processes
  - Osteomyelitis
  - Osteonecrosis
  - Invasion by squamous cell carcinoma
  - Metastatic disease
  - Sarcoma – osteosarcoma, Ewing's sarcoma

Box 11.2. Key Imaging Characteristics of the More Common Discrete Jaw Lesions

Lesion	Key imaging feature(s)
Periapical cyst	Well defined, related to root of tooth
Dentigerous cyst	Unerupted tooth at base of cyst
	Multiple, consider Gorlin's (basal cell nevus) syndrome
Unicameral bone cyst	Smoothly marginated unilocular lesion, no distinguishing characteristics
Stafne bone cavity	Well-defined lucent focus at angle of mandible, contains rest of submandibular salivary tissue
Incisive canal cyst	Midline cyst at junction of hard palate and premaxilla
Ameloblastoma	Uni- or multilocular expansile lytic lesion, papillary projections on enhanced CT or MR
Odontogenic myxoma	Resembles ameloblastoma, seen in younger patients
Aneurysmal bone cyst	Multilocular expansile cyst with blood-fluid levels on MRI
Giant Cell Lesions	Multilocular expansile lesions indistinguishable from aneurysmal bone cysts
Odontoma – complex	Posterior mandible, contains amorphous densities
Odontoma – compound	Anterior mandible, contains well-defined small toothlike densities
Cemento-osseous dysplasia	Periapical circumscribed density with lucent periphery adjacent to tooth root; florid type – widespread lesions
Fibro-osseous lesions	Lytic focus with sclerotic rim, ground-glass mineralized matrix, may involve other craniofacial bones
Tori	Well-defined osseous excrescences arising from the inner surface of the mandibular body, from the undersurface of the hard palate in the midline, or from the outer aspect of the maxillary alveolus
Osteochondroma	Pedunculated osseous excrescence arising most commonly from the mandibular ramus with a cartilage cap
Osteosarcoma	Variable appearance, destructive lesion with a soft tissue mass sometimes containing tumor bone, sunburst periosteal reaction if present is highly suggestive

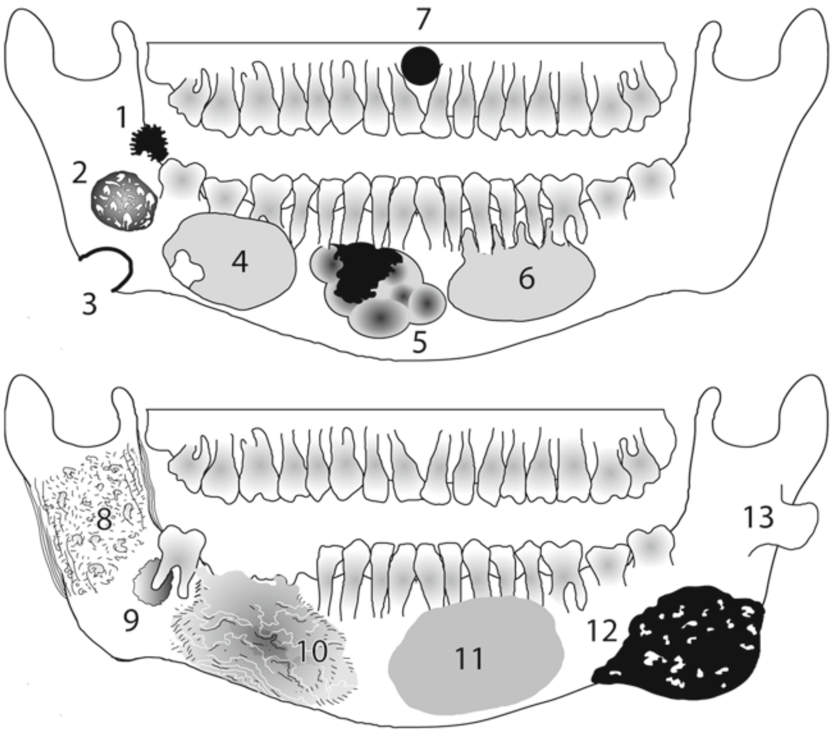

Fig. 11.21 Graphic demonstrating the basic imaging appearances of the more common jaw lesions. (*1*) Invasion by a retromolar trigone squamous cell cancer, (*2*) odontoma, (*3*) Stafne bone cavity, (*4*) dentigerous cyst, (*5*) ameloblastoma, (*6*) odontogenic keratocyst, (*7*) incisive canal cyst, (*8*) osteomyelitis, (*9*) periapical abscess, (*10*) osteoradionecrosis, (*11*) fibrous dysplasia, (*12*) osteosarcoma, (*13*) osteochondroma

Further Reading

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