

Benign Jaw Tumors and Tumor-like Conditions

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Purpose

The purpose of this educational exhibit is to illustrate imaging findings of benign tumors of the maxilla and mandible on CT and MRI.

Introduction

Odontogenic tumors are neoplasms that originate from tooth-forming epithelium, mesenchymal tissue, or both. Benign odontogenic tumors are characterized by imaging findings of expansive growth and well-defined margins with smooth borders. CT is highly useful for demonstrating the extent of bone resorption, osteolysis, cortical bone swelling, destruction, and calcification. MRI imaging is effective for differentiating between cysts and tumors, evaluating the infiltration of malignant tumors in the jawbone and surrounding soft tissue, and detecting bone marrow changes of the jaw.

Bone-destructive

Ameloblastoma (Figure 1)

- Most common and most critically significant odontogenic tumor (10% of tumors in maxillofacial region)
- Slowly growing, locally invasive epithelial odontogenic tumor of jaw
- High rate of recurrence, but with virtually no tendency to metastasize
- Most ameloblastomas occur in the ramus and posterior body of mandible (80% cases)
- Usually painless swelling (80%). Typically manifest in 2nd to 3rd decades of life.
- Typically expand with an osseous shell that represents involved bone
- Can penetrate ligamentous and cartilage adjacent soft tissues
- May appear as well-corticated, unilocular/locular lesions; often multilocular with internal septa and honey comb or soap bubble appearance
- Absorption of the stripes of adjacent teeth (seen in about 40% of cases)
- MR Imaging: Characteristic findings: multilocularly, mixed solid and cystic components, irregular thickened walls, papillary projections, and marked enhancement of the walls and septa
- Treatment: For unilocular cystic lesions in young patients, curettage or enucleation is effective treatment. Solid lesions show high recurrence rates (50%–90%), necessitating tumor excision or partial resection of the jawbone
- Although malignant transformation is rare, repeated recurrences increase the likelihood of malignancy

Ameloblastoma

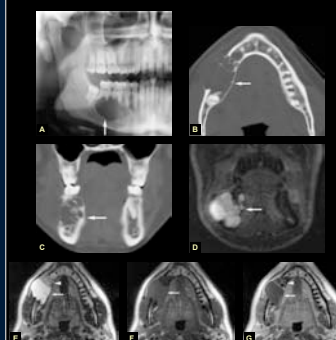


Figure 1A-G: Ameloblastoma, unilocular, mandible: 22-year-old male with painless paranasal swelling. A: Painless, slow swelling of lower lip and lower mandible. B: Axial CT image shows well-defined bone with expansion of buccal cortical bone, which is very thin and partially absent (arrow). C: Coronal CT image shows multilocular appearance in inferior part (arrow) and cortical outline (arrow). D: Coronal MRI image shows multilocular appearance and heterogeneous intermediate to high signal (arrow). E: Axial T2-weighted MRI shows high signal in posterior part (arrow) and intermediate signal in anterior part (arrow). F: Axial T1-weighted pre-contrast MRI shows low intermediate signal in posterior part (arrow) and high signal in anterior part (arrow). G: Axial T2-weighted post-contrast MRI shows no contrast enhancement in posterior part (arrow) except papillary and septal enhancement in anterior part (arrowhead).

Keratocystic Odontogenic Tumor (Figures 2 & 3)

- Pleomorphic, slow growing, locally invasive epithelial odontogenic tumor
- Benign, uni- or multi-cystic, intraparasal tumor of odontogenic origin with a characteristic lining of parakeratinized stratified squamous epithelium
- Histological aggressive, infiltrative behavior with tendency to recur
- Multiple lesions are associated with inherited nevoid basal cell carcinoma syndrome (Gorlin-Goltz syndrome)
- Growth in multilocular bosselated fashion with daughter cysts extending into surrounding bone
- Frequently occur in third molar region and ascending ramus of mandible
- On CT: Increased attenuation areas in cystic cavity
- On MRI: Heterogeneous intermediate signal on T1 and high signal on T2 W
- Bone expansion is not prominent with both resorption being rare (in contrast to ameloblastoma)

Keratocystic Odontogenic Tumor

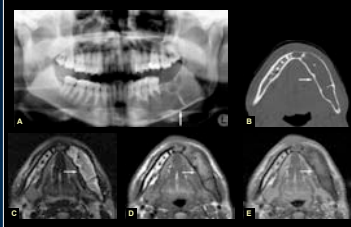


Figure 2A-E: Keratocystic odontogenic tumor, mandible: 33-year-old male, painless paranasal swelling of lower lip. A: Painless, slow swelling of lower lip and lower mandible. B: Axial CT image shows well-defined bone with expansion of buccal cortical bone, which is very thin and partially absent (arrow). C: Coronal CT image shows multilocular appearance in inferior part (arrow) and cortical outline (arrow). D: Coronal MRI image shows multilocular appearance and heterogeneous intermediate to high signal (arrow). E: Axial T2-weighted MRI shows high signal in posterior part (arrow) and intermediate signal in anterior part (arrow).

Keratocystic Odontogenic Tumor, maxilla and mandible: Gorlin-Goltz syndrome. A: Axial MRI image showing a well-defined, unilocular radiolucent lesion with a sclerotic border. B: Axial MRI image showing a well-defined, unilocular radiolucent lesion with a sclerotic border. C: Axial MRI image showing a well-defined, unilocular radiolucent lesion with a sclerotic border.

Figure 3A-C: Keratocystic odontogenic tumor, maxilla and mandible: Gorlin-Goltz syndrome. A: Axial MRI image showing a well-defined, unilocular radiolucent lesion with a sclerotic border. B: Axial MRI image showing a well-defined, unilocular radiolucent lesion with a sclerotic border. C: Axial MRI image showing a well-defined, unilocular radiolucent lesion with a sclerotic border.

Odontogenic Myxoma (Figure 4)

- Uncommon, benign neoplasm arising from mesenchymal odontogenic tissue
- Locally invasive neoplasm consisting of rounded, angular cells lying in abundant myxoid stroma
- 3rd decade of life
- Higher prevalence among women, and occurs mainly in the mandibular molar area
- Painless swelling or incidental finding
- Often multilocular with internal osseous trabeculae
- MR: Prolongation of T1 and T2 reflecting high myxoid stroma. Gradual contrast enhancement is typically seen on contrast-enhanced images
- Treatment: Enucleation or partial resection of the jawbone
- High rate of local recurrence due to infiltrative growth pattern

Odontogenic Myxoma

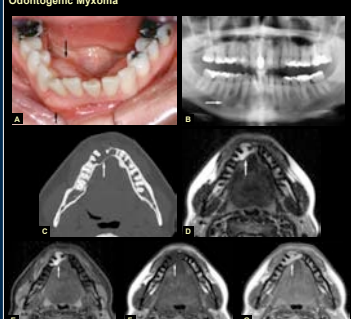


Figure 4A-B: Odontogenic myxoma, mandible: 45-year-old female with painless swelling which the patient did not notice because tumor was "filling out" mandibular fossa on right side. A: Clinical photograph shows buccal and lingual expansion (arrows). B: Panoramic view shows scattered radiolucency without clear borders (arrow). C: Axial CT image shows expanded, but intact buccal and lingual cortical bone. Note honey comb appearance (arrow). D: Axial MRI image shows well-defined, unilocular lesion with mixed solid and cystic components. E: Axial MRI image shows well-defined, unilocular lesion with mixed solid and cystic components.

Odontogenic Fibroma

- Fibroblastic neoplasm containing variable amounts of apparently/inactive odontogenic epithelium
- Relatively uncommon tumor of young people (aged 5–20 years)
- Benign, expansive, well-circumscribed, probably lobulated (arrowhead). Axial CT image shows low intermediate signal in anterior part (arrow) and high signal in posterior mandible (arrowhead)
- Treatment: Block excision with a border of normal bone

Bone-destructive & Bone-productive Tumors

Osteoblastoma (Figure 5)

- Active production of osteoid or primitive woven bone occurs
- Osteoid osteoma—similar tumor but of much smaller size
- Usually present as painful swelling in second decade
- Course: fibrovascular—ground glass appearance
- 15% recurrence rate for mandibular osteoblastomas

Osteoblastoma



Figure 5A-B: Osteoblastoma, mandible: 29-year-old male, painless swelling of anterior part of mandible. A: Axial CT image shows extensive bone production (arrow). B: Axial CT image shows low intermediate signal (arrow). C: Axial CT image shows low intermediate signal (arrow).

Ossifying Fibroma (Figure 6)

- Synonym: Cemento-ossifying fibroma, juvenile (aggressive) ossifying fibroma
- Painless swelling mostly in posterior mandible
- Typically encapsulated, well-demarcated lesion composed of varying amounts of fibrovascular tissue and mineralized matrix
- Grow slowly and symmetrically
- Juvenile (active, aggressive)—occurs in younger patients and has greater tendency to recur

Ossifying Fibroma

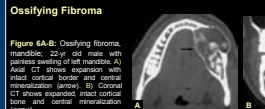


Figure 6A-B: Ossifying fibroma, mandible: 29-year-old male, with painless swelling of left mandible. A: Axial CT image shows well-defined bone with intact cortical border and central radiolucency (arrow). B: Coronal CT image shows expanded, but intact cortical border (arrow).

Adenomatoid Odontogenic Tumor

- Rare neoplasm characterized by duct formation by its epithelial component.
- Slowly increasing painless swelling in second decade
- Anterior maxilla, especially canine region
- Unilocular, expansile, well-demarcated cystic radiolucent lesion with impacted teeth (canine) and foci of calcifications
- Treatment: Simple excision

Calculifying Epithelial Odontogenic Tumor

- Benign, locally infiltrating epithelial tumor
- Occurs between the third and seventh decades of life
- Well-defined, expansile, unilocular radiolucent, containing varying amounts of radiopaque material. It is associated with unerupted or impacted teeth in 80% cases
- Treatment: Enucleation

Desmoplastic Variant of Ameloblastoma (Figure 7)

- Scattered calcifications in an expansile osteolytic lesion with ill-defined margins
- Tends to recur locally due to infiltrative growth pattern

Desmoplastic Ameloblastoma



Figure 7A-D: Ameloblastoma desmoplastic, mandible: 43-year-old male with numerous ameloblastomas 2 years after surgery. A: Panoramic view shows small unilocular radiolucency (arrow), and small radiopacity in the right mandible (arrow). B: Axial CT image shows expanded, but intact buccal and lingual cortical bone. Note honey comb appearance (arrow). C: Axial CT image shows well-defined, unilocular lesion with mixed solid and cystic components. D: Axial CT image shows well-defined, unilocular lesion with mixed solid and cystic components.

Hard Tissue-producing Tumors & Malformations

Osteoma (Figure 8)

- Benign, slow growing lesion composed of well-differentiated mature bone with a predominantly lamellar structure
- Incidental finding or painless hard swelling

Osteoma

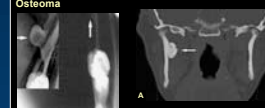


Figure 8: Osteoma, mandible: 23-year-old male with incidental finding of multiple dental radiolucency. A: Coronal CT image shows osteoma tumor proximal to crown of lower molar (arrow). B: Axial CT image shows osteoma tumor proximal to crown of lower molar (arrow).

Exostoses (Figure 9)

- Mandible: Torus Mandibularis in premolar regions lingually and buccally
- Maxilla: Torus palatinus in midline

Exostoses



Figure 9: Torus mandibularis, painless hard lingual swellings. Axial CT image shows bilateral exostoses (arrows).

Odontoma (Compound and Complex) (Figure 10)

- Most common odontogenic tumors
- Tumor-like malformation (hamartoma) (when enamel and dentin, and sometimes cementum is present)
- WHO Classifies into 2 categories: may appear as multiple, miniature, or rudimentary teeth (compound odontoma) or it may appear as amorphous conglomerations of hard tissue (complex odontoma)
- Compound odontomas—younge individuals—most commonly seen in maxillary anterior alveolar bone
- Complex odontomas, mainly in the second and third decades of life—mandibular molar and premolar regions
- Treatment: Radiographic observation or simple excision. Do not recur

Odontoma



Figure 10A-B: Odontoma, maxilla: 15-year-old female with incidental finding of radiopaque consolidation. A: Panoramic view shows large radiopaque mass in right maxillary sinus (arrow). B: Coronal CT image shows large mass of cortical or enamel (arrow) in right maxillary sinus (arrow), surrounded by torus capsulatus with destroyed lateral alveolar wall and root resorption.

Giant Cell Granuloma (Figure 11)

- Localized benign but sometimes aggressive osteolytic proliferation of fibrous tissue with hemorrhage and hemosiderin deposits
- Most frequent in posterior mandible in females from third to third decades
- Uni- or multi-locular, may expand bone
- MR: Heterogeneous intermediate signal on T1 and T2 WJ with contrast enhancement

Giant Cell Granuloma

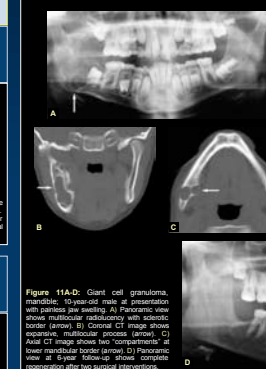


Figure 11A-D: Giant cell granuloma, mandible: 10-year-old male at presentation shows multilocular radiolucency with sclerotic border (arrow). A: Axial CT image shows extensive radiolucency, multilocular masses (arrow). B: Axial CT image shows low intermediate signal (arrow) in lower mandibular border (arrow). C: Panoramic view shows radiolucency in lower mandibular border (arrow). D: Panoramic view shows radiolucency in lower mandibular border (arrow).

Fibrous Dysplasia (Figure 13)

- Monoclonal or polyclonal (may be part of McCune-Albright Syndrome)
- Craniofacial bones form up to 25% of monoclonal forms
- Non-neoplastic, self-limiting but nonencapsulated lesion
- Maxilla, lateral region in particular
- Painless swelling, jaw asymmetry
- 2nd and 3rd decades
- Ground glass appearance with bone expansion
- MR: Intermediate signal on T1 and heterogeneous low signal on T2 WJ with contrast enhancement

Fibrous Dysplasia



Figure 13A-D: Fibrous dysplasia, maxilla: 14-year-old male with painless facial asymmetry. A: Panoramic view shows radiolucency in anterior part of maxilla (arrow). B: Axial CT image shows extensive radiolucency with ground glass appearance (arrow). C: Coronal CT image shows poorly mineralized cortical bone and cortex (arrow). D: Coronal CT image shows poorly mineralized cortical bone and cortex (arrow).

Cherubism (Figure 14)

- Inherited, autosomal dominant
- Histology: radiolucency in giant cell granuloma
- Mandible, posterior region, in early childhood
- Symmetric bilateral swellings
- Well-demarcated, bilateral multiloculated radiolucencies; soap bubble appearance

Cherubism

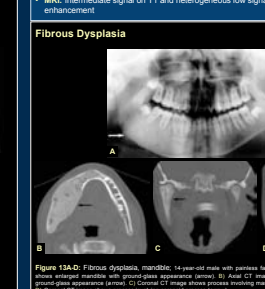


Figure 14: Cherubism (familial fibrous dysplasia): 13-year-old male with radiolucency in bilateral posterior region. Axial CT image shows extensive radiolucency with sclerotic border in both sides (arrows).

Conclusion

Benign odontogenic tumors are characterized by imaging findings of expansive growth and well-defined margins with smooth borders, and their appearance is very similar to that of odontogenic and nonodontogenic cysts. Combining plain radiography with advanced imaging techniques, including CT and MR imaging, can improve the accuracy of diagnosing odontogenic tumors. This exhibit illustrates the imaging characteristics of benign jaw tumors and will give the practicing radiologists an opportunity to become familiar with appearances of jaw tumors.

Acknowledgments

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