Osseous Pathology of the Mandible

Chino
5/5/10
Outline

• Embryology
• Anatomy
• Dentition
• Trauma
• Tumors
Embryology
Development

- mandible arises from neural crest tissue structures early in 4th week of development
- forms from enlargement and fusion of paired mandibular prominences
- mandibular skeleton develops from cartilaginous derivative of 1st branchial arch called Meckel’s cartilage
Ossification

- ossifies in fibrous membrane covering outer surface of ventral end of Meckel’s cartilage
- each half of bone is formed from single center, the cartilaginous bar of mandibular arch
  - appears at 6th week of fetal life, near mental foramen
  - proximal portions connected w/ ear capsule
  - distal portions are connected at symphysis by mesodermal tissue
Appearance at birth

- Two mandibular halves united by fibrous symphysis which ossifies during 1st yr of life.
- Coronoid process is relatively large compared to condyle.
Odontogenesis

- each tooth develops from:
  - 1) ectodermal cells that develop into ameloblasts and other outer tooth regions
  - 2) ectomesenchymal cells that form odontoblasts and dental papillae
- by 20th week, tooth bud appears bell shaped with active:
  - ameloblastic cells forming enamel
  - odontoblastic cells forming dentin
- both processes completed during crown stage and embryonic cells die
- any remnants of embryonic cells may give rise to benign or malignant lesions later in life

Mandibular aging

**During childhood**
- body elongates and deepens to accommodate teeth
- angle becomes less obtuse due to separation of jaws by teeth

**In adult**
- mental foramen opens midway between upper and lower borders of bone
- ramus is almost vertical

**In old age**
- bone becomes greatly reduced in size secondary to loss of teeth and absorption of alveolar process
- mental foramen is close to alveolar border
- ramus is oblique
- neck of condyle is directed more posteriorly
Mandibular anatomy

• mandible + maxilla = jaw
• mandible is largest and strongest bone of face
• consists of:
  – **body** (curved, horizontal portion)
  – **rami** (two perpendicular portions)
Lateral surface

Body
- Symphysis
- Incisive fossa
  - attachment of mentalis and portion of orbicularis oris muscles
- Mental foramen
  - passage of mental vessels and nerve
- Oblique line
  - attachment of quadratus labii inferioris and triangularis muscles

Ramus
- attachment of masseter muscle

Coronoid process
- attachment of temporalis and masseter muscles

Condyloid process (condyle + neck)
- attachment of temporomandibular ligament

Mandibular notch
- passage of masseteric vessels and nerve
Medial surface

Body
- **Mental spines**
  - attachment of genioglossus, geniohyoid, and anterior belly of digastric muscles
- **Mylohyoid line**
  - attachment of mylohyoid and constrictor pharyngis superior muscles and pterygomandibular raphe
  - sublingual gland lies anteriosuperiorly
  - submaxiillary gland lies posteroinferiorly

Ramus
- attachment of medial pterygoid muscle
- mandibular foramen
  - passage of inf. alveolar vessels and nerve

Coronoid process
- attachment of temporalis muscle

Condyloid process (condyle + neck)
- attachment of lateral pterygoid muscle

Gray's Anatomy of the Human Body
Dentition
Tooth nomenclature

Permanent Teeth (32)

Deciduous Teeth (20)
Tooth anatomy

- Lamina dura
- Periodontal ligament
Dental caries

- outcome of mineral dissolution of dental hard tissues by acidic byproducts of bacterial CHO metabolism

- types based on location
  - pit and fissure (occlusal surface)
  - smooth surface (non-occlusal surface)
  - root (assoc. w/ periodontal disease)
  - recurrent (around a dental restoration)
Dental caries

Pit and fissure

Smooth surface
Periodontal disease

- chronic inflammatory process that may result in edentulism
- plaque -> calculus -> gingivitis -> periodontitis -> alveolar bone loss -> tooth loss
- normal alveolar crest lies 1-1.5mm below cementoenamel junction
Dental restoration hardware

Gutta percha and amalgam

Orthodontic appliance

Crown and bridge

Composite restorations
Dental implants

- 2 stage surgery:
  - initial implant placement
  - fixture installation 4-6 months later

- pre-operative CT (DentaScan) performed on patients considered for multiple implants to evaluate jaw dimensions, degree of bone mineralization, and for prosthesis construction

- preferred implant is root form
Dental implants – root form

Root form

Fracture
Loosening
Dental anomalies

- Supernumerary teeth
  - anomalies exist in size, shape, and number of teeth
  - most often occur in maxilla
  - hypodontia (absence of one or more teeth)
  - micro and macrodontia

- Pulp stones
  - idiopathic calcific foci in dental pulp
Dental anomalies

- **Enamel pearls**
  - small foci of enamel that occur at molar roots
  - a risk factor for periodontal disease

- **Hypercementosis**
  - largely idiopathic but associated w/ Paget’s, prior inflammation, hyperpituitarism
Dental anomalies

• Impaction
  – most commonly involves 3rd molar
  – unerupted or partially erupted tooth obstructed by another tooth, bone, or soft tissue
  – often painless
  – pose a risk for periodontal disease

• Supereruption
  – migration of occlusal surface from lack of contact with an opposing tooth
Dental trauma

- classified into categories based on treatment protocols
  - dental avulsion
  - crown fracture
  - root fracture
  - dental luxation
  - dental concussion and subluxation
Dental trauma

• Crown fracture
  – comprise ~ 75% of injuries to permanent teeth
  – classified based on location of fracture relative to enamel, dentin, or pulp tissue

• Root fracture
  – horizontal fracture caused by direct trauma (usually anterior teeth)
  – vertical fracture caused by clenching or trauma to mandible (usually molars)
Dental trauma

• Concussion and subluxation
  – result from crushing trauma and injury to periodontal ligament
  – concussion may cause pain and sensitivity but no mobility or displacement
  – subluxation causes bleeding at gingival margin, tooth tenderness to percussion, and mobility

• Luxation
  – lateral luxation involves angular displacement peripherally
  – tooth remains w/in socket
  – intrusive luxation involves displacement into alveolar bone w/ fracture of alveolar socket
Mandibular trauma
Mandibular fractures

- 2nd most commonly fractured bone of face
- most mandibular fractures occur at a single location
- multiple fractures and/or TMJ dislocations are common
- majority occur in body
  - often associated with a contralateral condylar process fracture

http://drdavidson.ucsd.edu/
Mandibular fractures

Favorable

Unfavorable

Masseter

Medial pterygoid

Mylohyoid

Masseter
Mandibular fracture hardware

*Erich arch bars* frequently used for closed reduction and fixation

Titanium bars are fixed w/ screws and allow jaw to function much earlier
Mandibular fracture hardware

TIATNIUM MESH PLATES
Quick Details
• Properties: Implant Materials & Artificial Organ
• Type: Organ Assist Device
• Model Number: 1.5mm micro plate
• Place of Origin: Shanghai China (Mainland)

Specifications
• Orbit fracture
• Cranio-base fracture
• Maxillary fracture
Thickness of Mesh Plates: 0.6mm&1.0mm.

Titanium implants may be fixed into place in a variety of ways. Cement or screws may be used to anchor them, or they may be held in position by the pressure of their surroundings.

Titanium Mesh Plates for neurosurgery
Titanium bone plates and screws for maxillofacial surgery

Tumors
WHO Classification

<table>
<thead>
<tr>
<th>WHO HISTOLOGIC CLASSIFICATION OF JAW TUMORS AND CYSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The classification is provided for completeness. Classifications of jaw lesions vary, and this chapter does not follow this classification exactly.</td>
</tr>
</tbody>
</table>

### WHO Classification of Odontogenic Tumors

#### Neoplasms and Other Tumors Related to the Odontogenic Apparatus

<table>
<thead>
<tr>
<th>Tumor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteogenic sarcoma</td>
</tr>
<tr>
<td>Ameloblastoma</td>
</tr>
<tr>
<td>Squamous odontogenic tumor</td>
</tr>
<tr>
<td>Calcifying odontogenic tumor (Pindborg tumor)</td>
</tr>
<tr>
<td>Clear cell odontogenic tumor</td>
</tr>
<tr>
<td>Odontogenic epithelioma-osteogenic carcinoma</td>
</tr>
<tr>
<td>Ameloblastic fibroma</td>
</tr>
<tr>
<td>Ameloblastic fibroma (fibrolastic) and ameloblastic fibrodentinoma</td>
</tr>
<tr>
<td>Odontoclastoblastoma</td>
</tr>
<tr>
<td>Aneurysmal odontogenic tumor</td>
</tr>
<tr>
<td>Calcifying odontogenic cyst</td>
</tr>
<tr>
<td>Complex odontoma</td>
</tr>
<tr>
<td>Compound odontoma</td>
</tr>
<tr>
<td>Odontogenic osteoclastoma with or without included odontogenic epithelium*</td>
</tr>
<tr>
<td>Odontogenic fibroma</td>
</tr>
<tr>
<td>Myxoma (odontogenic myxoma, myxofibroma)</td>
</tr>
<tr>
<td>Benign cementoblastoma (cementoblastoma, true cementoma)</td>
</tr>
<tr>
<td>Malignant</td>
</tr>
<tr>
<td>Odontogenic sarcoma</td>
</tr>
<tr>
<td>Malignant ameloblastoma</td>
</tr>
<tr>
<td>Primary intraosseous carcinoma</td>
</tr>
<tr>
<td>Malignant variants of other odontogenic epithelial tumors</td>
</tr>
<tr>
<td>Malignant (other) odontogenic cyst</td>
</tr>
<tr>
<td>Odontogenic sarcoma</td>
</tr>
<tr>
<td>Ameloblastic fibroma (ameloblastic sarcoma)</td>
</tr>
<tr>
<td>Ameloblastic fibroma (ameloblastic fibrodentinoma)</td>
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<tr>
<td>Odontogenic osteoclastoma</td>
</tr>
</tbody>
</table>

#### Neoplasms and Other Lesions Related to Bone

<table>
<thead>
<tr>
<th>Bone Tumor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteogenic sarcoma</td>
</tr>
<tr>
<td>Cystoma (cementifying fibroma, ossifying fibroma)</td>
</tr>
<tr>
<td>Nonneoplastic bone lesions</td>
</tr>
<tr>
<td>Fibrous dysplasia of the jaws</td>
</tr>
<tr>
<td>Cementoosseous dysplasia</td>
</tr>
<tr>
<td>Peripheral odontogenic dysplasia (peripheral fibrous dysplasia)</td>
</tr>
<tr>
<td>Florid cementoosseous dysplasia (gigantiform cementoma, florid multiple cementoma)</td>
</tr>
<tr>
<td>Other cementoosseous dysplasia</td>
</tr>
<tr>
<td>Chondroblastoma (chondromatous benign lesion)</td>
</tr>
<tr>
<td>Central giant cell granuloma</td>
</tr>
<tr>
<td>Ameloblastic bone cyst</td>
</tr>
<tr>
<td>Solitary bone cyst (traumatic, simple, haemorrhagic bone cyst)</td>
</tr>
</tbody>
</table>

#### Other Tumors

<table>
<thead>
<tr>
<th>Tumor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melanotic neuroendothelial tumor of infancy (melanotic progonoma)</td>
</tr>
</tbody>
</table>

### Epithelial Cysts

#### Developmental

<table>
<thead>
<tr>
<th>Cyst Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odontogenic</td>
</tr>
<tr>
<td>Gingival cyst of inclusions (epithelial pearls)</td>
</tr>
<tr>
<td>Odontogenic keratocyst (preradicular cyst)</td>
</tr>
<tr>
<td>Descriptive (follicular) cyst</td>
</tr>
<tr>
<td>Emperger cyst</td>
</tr>
<tr>
<td>Lateral periodontal cyst</td>
</tr>
<tr>
<td>Gingival cyst of adults</td>
</tr>
<tr>
<td>Glandular odontogenic cyst</td>
</tr>
</tbody>
</table>

#### Nonodontogenic

<table>
<thead>
<tr>
<th>Cyst Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonsalivary duct (maxillary canal) cyst</td>
</tr>
<tr>
<td>Nasolabial (maxillotemporal) cyst</td>
</tr>
</tbody>
</table>

#### Inflammatory

<table>
<thead>
<tr>
<th>Cyst Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radicular cyst</td>
</tr>
<tr>
<td>Apical and lateral</td>
</tr>
<tr>
<td>Retained</td>
</tr>
<tr>
<td>Peridental (inflammatory collateral, transpalatal infected macular) cyst</td>
</tr>
</tbody>
</table>

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*The maxillary sinus derives from the odontogenic epithelium, developing from the ectoderm of the oral cavity. The dental papilla and follicle are considered odontogenic, derived partly from the neural crest. Lesions that retain odontogenic characteristics, as well as the odontogenic epithelium, have the capability of producing dentin and enamel. Those without odontogenic content, some lesions arise primarily from the maxillary sinus and appear to incidentally include "odontogenic epithelium" but the odontogenic epithelium does not play a key role in producing the lesion.

Jaw lesions covered in this lecture

Epithelial cysts
- Inflammatory
  - Radicular cyst
- Odontogenic
  - Dentigerous cyst
  - Odontogenic keratocyst

Neoplasms & other related to bone
- Giant cell granuloma
- Osteoclastoma
- ABC/Simple cyst
- Ossifying fibroma (early)
- Ossifying fibroma (mature)
- Cementoosseous dysplasia
- Cherubism
- Fibrous dysplasia
- Odontogenic neoplasms/other
- Complex
- Compound
- Odontoma
- Pindborg tumor
- Ameloblastoma
- Malignant neoplasms
  - Sarcomas
  - Lymphoma/leukemia
  - Locally invasive carcinomas
  - Etc.

Osteomyelitis
- Osteomyelitis (early)
- Osteomyelitis (mature)
- Vascular lesions
- Salivary inclusion gland defect
- Histiocytosis X

Neoplasms & other related to bone
- ABC/Simple cyst
- Giant cell granuloma
- Osteoclastoma
- Ossifying fibroma (early)
- Ossifying fibroma (mature)
- Odontogenic keratocyst
- Odontogenic neoplasms/other
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- Compound
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- Ameloblastoma
- Malignant neoplasms
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  - Lymphoma/leukemia
  - Locally invasive carcinomas
  - Etc.

Also covered in this lecture:
- Tori
- Osteoma
- Vascular lesions
- Salivary inclusion gland defect
- Histiocytosis X
Epithelial cysts
- Inflammatory
  - Radicular cyst
- Odontogenic
  - Dentigerous cyst
  - Odontogenic keratocyst
Neoplasms & other related to bone
- Giant cell granuloma
- Osteoclastoma
- ABC/Simple cyst
  Odontogenic neoplasms/other
- Ameloblastoma
Other
- Osteomyelitis (early)
- Vascular lesions
- Salivary inclusion gland defect
- Histiocytosis X

Mostly cystic or radiolucent

Mixed Appearance

Mostly radiopaque

Jaw lesions covered in this lecture

Neoplasms & other related to bone
- Ossifying fibroma (early)
- Cementoosseous dysplasia
- Cherubism
- Fibrous dysplasia

Osteomyelitis
  Odontogenic neoplasms/other
- Odontogenic myxoma
- Pindborg tumor

Malignant neoplasms
- Sarcomas
- Lymphoma/leukemia
- Locally invasive carcinomas
- Etc.

Tori
- Osteoma
Neoplasms & other related to bone
  - Ossifying fibroma (mature)
  Odontogenic neoplasms/other
- Odontoma
  - Complex
  - Compound

Odontogenic neoplasms/other
- Ossifying fibroma (mature)
  Odontogenic neoplasms/other
Periapical inflammatory process

Caries

Caries → Necrotic pulp → Apical periodontitis

Trauma

Necrotic pulp

Periapical abscess

Acute

Periapical abscess → Osteomyelitis

Chronic

Periapical granuloma

Periapical granuloma → Periapical cyst

Periapical granuloma
Inflammatory epithelial cyst – *Periapical cyst*

- synonym: *radicular cyst*
- most common jaw cyst
- quiescent, end stage form of underlying tooth infection
- geographic, periapical, unilocular, often >1cm
- may displace teeth and cause recurrent sinusitis
- treatment: most resolve w/ endodontic therapy of tooth
- DDx: *periapical rarefying osteitis*, early *periapical cemental dysplasia*

Odontogenic tumors

- Neoplasms originating from tooth-forming epithelium, mesenchymal tissue, or both
- Benign tumors characterized by imaging findings of expanding growth and well-defined margins with smooth borders
- CT demonstrates extent of osteolysis, osteosclerosis, cortical thickening, and calcification
- MRI differentiates between cysts and tumors and evaluates infiltration of tumors in bone and surrounding soft tissues
Odontogenic epithelial cyst - Dentigerous cyst

- synonym: follicular cyst
- most common non-inflammatory odontogenic cyst
- geographic, pericoronal, unilocular lesion w/ acute angle to cervical area of tooth and occasional sclerotic margin
- develops w/in normal dental follicle surrounding unerupted tooth, typically mandibular 3rd molar
- can be large and expansile, most often small
- treatment: tooth and cyst extraction
- DDx: unilocular odontogenic keratocyst

Odontogenic epithelial cyst - 

**Odontogenic keratocyst**

- **synonyms:** keratocystic odontogenic tumor, primordial cyst
- 3rd most common odontogenic cyst
- geographic, often multilocular, minimally expansile, bosselated w/ daughter cysts
- mult. assoc. w/ basal cell nevus syndrome
- aggressive, fast growing, difficult to resect, w/ frequent recurrences
- frequently occur near 3rd molar and ascending ramus of mandible (90% posterior to canines)
- CT: high attenuation areas in cystic cavity
- MR: heterogeneous intermediate signal on T1WI and high signal on T2WI
- treatment: curettage
- DDx: adamantinoma; if pericoronal-> indistinguishable from dentigerous cyst

Other odontogenic cysts

- **Residual cyst**
  - no tooth remains to identify lesion
  - likely retained periapical cysts from removed teeth

- **Primordial cyst**
  - rarest odontogenic cyst
  - develops instead of a tooth
  - cystic degeneration of dental follicle w/o completion of odontogenesis
  - may represent residual cysts

- **Lateral periodontal cyst**
  - radiolucent, small, always well marginated
  - majority in mandibular premolar area
Neoplasms & other related to bone -

Giant cell granuloma

- synonym: *central giant cell granuloma, giant cell reparative granuloma*
- majority in females <30 yo
- most frequent in posterior mandible
- slow growing and varied
- early lesions: usually small, unilocular may be expansile
- older lesions: geographic, multilocular, expansive, may have ground-glass matrix, may cross symphysis and displace/absorb teeth
- suspect brown tumor if recurrence
- MR: heterogeneous intermediate signal on T1 and T2WI, enhances
- treatment: enucleation
- DDx: *traumatic bone cyst, brown tumor, adamantinoma, odontogenic keratocyst*

Neoplasms & other related to bone - *Osteoclastoma*

- synonym: *brown tumor*
- chronic hyperparathyroidism
- osteopenia and resorption of lamina dura differentiate from other processes
- confirmed w/ serum assays
- variable well or ill-defined margins
- treatment: can resolve w/ hyperparathyroidism tx
- DDx: *giant cell granuloma*

Neoplasms & other related to bone -  

**Traumatic bone cyst**

- synonyms: *solitary bone cyst, hemorrhagic cyst, extravasation cyst, unicameral bone cyst, simple bone cyst, idiopathic bone cavity*
- most incidental by 2\(^{nd}\) decade
- most common in mandible near inferior alveolar canal
- geographic, lucent defect w/ characteristic scalloped superior margin extending between roots w/o resorption or displacement
- treatment: often unnecessary
- DDX: *vascular lesions, giant cell granuloma, ossifying fibroma*

Odontogenic neoplasms - Ameloblastoma

- most common in 3rd to 5th decade
- ~10% of odontogenic tumors
- expansile, uni or multilocular, geographic, can extend into soft tissues
- slow growing, locally aggressive, painless lesion
- ~80% occur in ramus and body, often arising from dentigerous cyst (near impacted tooth)
- often absorbs apices of adjacent teeth
- high rate of recurrence, but w/ virtually no metastatic potential
- CT: well-corticated, unilocular radiolucent lesion vs. multilocular w/ internal septae and honeycomb/soap bubble appearance
- MR: multilocularity, mixed solid and cystic, irregularly thickened walls, papillary projections, marked enhancement of walls and septae
- treatment: wide surgical excision
- DDx: odontogenic keratocyst, giant cell granuloma, dentigerous cyst

Odontogenic neoplasms - Ameloblastoma
Other mostly radiolucent lesions - AVM

- radiolucent lesions involving mandibular canal
- can have an aggressive appearance
- most often in body or ramus
- treatment: embolization, surgery
- DDx: traumatic bone cyst, giant cell granuloma, ossifying fibroma

Other mostly radiolucent lesions - Lingual salivary gland inclusion defect

- synonym: Stafne cyst
- probably a congenital or developmental defect
- well defined ovoid radiolucency in lingual aspect of body anterior to angle
- no tooth contact
- may contain aberrant lobe of submandibular gland or fat
- treatment: unnecessary
- DDx: possibly AVM

Other mostly radiolucent lesions - *Langerhans cell histiocytosis*

- **synonym:** *eosinophilic granuloma*
- spectrum of diseases involving histiocyte proliferation and significant inflammation
- male predilection, 1-10 yo
- single or multiple geographic, non-sclerotic “punched out” lesions (floating tooth)
- have associated soft tissue mass
- treatment: steroids, XRT, surgery, cryoablation
- **DDx:** *periapical granulomas, other cysts*
Jaw lesions covered in this lecture

Mostly cystic or radiolucent

Epithelial cysts
- Inflammatory
  - Radicular cyst
- Odontogenic
  - Dentigerous cyst
  - Odontogenic keratocyst

Neoplasms & other related to bone
- Giant cell granuloma
- Osteoclastoma
- ABC/Simple cyst
- Odontogenic neoplasms/other
- Ameloblastoma
- Other
- Osteomyelitis (early)
- Vascular lesions
- Salivary inclusion gland defect
- Histiocytosis X

Mixed Appearance

Neoplasms & other related to bone
- Ossifying fibroma (early)
- Ossifying fibroma (mature)
- Cementoosseous dysplasia
- Cherubism
- Fibrous dysplasia

Osteomyelitis
- Odontogenic neoplasms/other
  - Odontogenic myxoma
  - Pindborg tumor

Malignant neoplasms
- Sarcomas
- Lymphoma/leukemia
- Locally invasive carcinomas
- Etc.

Mostly radiopaque

Tori
- Osteoma
- Odontogenic neoplasms/other
  - Ossifying fibroma (mature)
- Odontoma
  - Complex
  - Compound
Cemental dysplasia

- synonym: cemento-osseous dysplasia
- 9x more common in females
- replacement of periapical alveolar bone w/ cementoossous tissue
- 3 radiographic stages:
  1) osteolytic: well defined, periapical lucency associated w/ lamina dura loss
  2) cementoblastic: lesion of mixed mineralization
  3) mature: mineralized radiopaque mass w/ radiolucent rim
- frequently multiple, can be expansile
- treatment: follow-up imaging
- DDx: Paget’s, chronic sclerosing osteomyelitis

Neoplasms & other related to bone - 
*Cemental dysplasia*

Courtesy of Dr. F. Rodriguez
Neoplasms & other related to bone -

Fibrous dysplasia

- most common in 2\textsuperscript{nd} and 3\textsuperscript{rd} decades
- monostotic: craniofacial bones account for 25%
- polyostotic: may be part of McCune-Albright Syndrome, mandibular involvement more frequent
- non-neoplastic, self limited, nonencapsulated lesion
- painless swelling, often unilateral and expansile
- CT: ill-defined, mixed sclerotic/lytic lesion (ground glass appearance) w/ bone expansion
- MR: intermediate signal on T1 and heterogeneous low signal on T2WI, enhances
- treatment:
  - polyostotic: facial symmetry, not total tumor resection
  - monostotic: mandibular lesions excised en-bloc and mandible reconstructed w/ vascularized bone graft

Neoplasms & other related to bone - Cherubism

- sporadic and autosomal dominant forms
- self-limited proliferation of fibrous tissue, rapidly progressive from 0.5 to 7 yo, gradually regresses following adolescence
- bilateral, expansile, multilocular cystic lesions of mandibular angles and rami, progresses to maxilla and often displaces teeth
- CT: well delineated, sclerotic margins, bilateral multiloculated radiolucencies; soap bubble appearance
- treatment: surgical (highly variable)
- DDx: giant cell reparative granuloma, fibrous dysplasia (both similar but not typically bilateral)
Other mixed appearance lesions - **Osteomyelitis**

- **sources:** periodontitis, iatrogenic, trauma, hematogenous spread
- **most common in mandibular body**
- **symptoms and periosteal reaction** help differentiate
- **dual isotope bone scan** can confirm
- **DDx:** malignancy, osteonecrosis

Other mixed appearance lesions - **Osteonecrosis**

- varied etiologies:
- XRT (for head and neck cancer)
  - range from small, stable, asymptomatic bone exposures that can heal to severe necrosis needing surgical intervention and reconstruction
- bisphosphonate therapy
  - one of world’s most prescribed drug classes
  - mechanism unclear
  - variable appearance includes sclerotic, lytic, or mixed lesions w/ possible periosteal reaction, pathologic fractures, and extension to soft tissues

Odontogenic neoplasms - Odontogenic myxoma

- uncommon, benign neoplasm arising from mesenchymal odontogenic tissue
- most common in women, 3rd decade
- painless swelling or incidental finding
- mainly in mandibular molar area
- locally aggressive w/ bone destruction, potential soft tissue infiltration, high rate of local recurrence
- CT: often multilocular, mixed lucent and sclerotic, w/ trabeculae and well or ill-defined margins
- MR: low SI on T1WI and high SI T2WI, gradual contrast enhancement
- treatment: excision or partial resection of mandible
- DDx: broad, includes malignancy, giant cell granuloma

Odontogenic neoplasms -  
Calcifying epithelial odontogenic tumor

- synonym: *Pindborg tumor*
- occurs between 3\textsuperscript{rd} and 7\textsuperscript{th} decades
- benign, locally infiltrating epithelial tumor
- 50% develop around erupted/impacted tooth
- CT: mixed radiolucent/sclerotic, expansile lesion often multilocular with ill-defined, irregular borders
- treatment: enucleation
- DDx: *adamantinoma, odontoma*

Malignant neoplasms -

- rarely a site for primary or secondary tumor
- majority are secondary to invasion from surrounding mucosa
- primary carcinomas are odontogenic versus nonodontogenic
- metastases most common in posterior body and angle (increased marrow vascularity)
- treatment: hemi-mandibulectomy w/ mandibular reconstruction by free iliac bone graft or vascularized fibula
Malignant neoplasms -

Most common
  Squamous cell carcinoma arising from adjacent mucosa*
Fairly common
  Multiple myeloma and plasmacytoma*
  Lymphoma*
  Leukemia*
  Metastasis*
  Mucoepidermoid carcinoma arising from adjacent mucosa*
  Adenoid cystic carcinoma arising from adjacent mucosa*
Rare
  Nonodontogenic sarcoma*
  Odontogenic carcinoma (ameloblastic carcinoma, etc)
  Odontogenic sarcoma
  Odontogenic carcinosarcoma

Jaw lesions covered in this lecture

Mostly cystic or radiolucent
- Epithelial cysts
  - Inflammatory
    - Radicular cyst
  - Odontogenic
    - Dentigerous cyst
    - Odontogenic keratocyst

Neoplasms & other related to bone
- Giant cell granuloma
- Osteoclastoma
- ABC/Simple cyst
- Ossifying fibroma (early)
- Cementoossseous dysplasia
- Cherubism
- Fibrous dysplasia

Odontogenic keratocyst

Other
- Vascular lesions
- Salivary inclusion gland defect
- Histiocytosis X

Mixed Appearance

 Mostly radiopaque
- Tori
- Osteoma

Neoplasms & other related to bone
- Ossifying fibroma (mature)
- Odontogenic neoplasms/other
- Odontoma
  - Complex
  - Compound

Osteomyelitis
- Odontogenic neoplasms/other
- Odontogenic myxoma
- Pindborg tumor

Malignant neoplasms
- Sarcomas
- Lymphoma/leukemia
- Locally invasive carcinomas
- Etc.
Neoplasms & other related to bone -

Ossifying fibroma

- synonyms: cemento-ossifying fibroma, juvenile (aggressive) ossifying fibroma
- benign encapsulated neoplasm of fibrous tissue w/ irregular areas of ossification
- most common in 3rd-4th decades, F>M
- most common in posterior mandible
- early lesions: radiolucent
- mature lesions: dense, irregular matrix, thin lucent rim (capsule) w/ sclerotic margin
- often asymptomatic, can displace teeth
- treatment: enucleation, resection w/ bone grafting for larger lesions, rarely recur
- DDx: includes fibrous dysplasia, Pindborg tumor, giant cell granuloma, malignancy

Other mostly radiopaque lesions - *Torus*

- synonym: exostosis
- named according to location: torus mandibularis<torus palatinus
- torus mandibularis usually near premolars above location of mylohyoid muscle attachment
- bilateral in 90% of cases
- prevalence ranges from 5% - 40%
- more common in Asians and Inuits, slightly more common in males, early adult life
- result of local stresses, bruxism, genetic factors
- painless, size may fluctuate throughout life, traumatic ulcers may form
- treatment: none or can be resected (can recur)

Other mostly radiopaque lesions - **Osteoma**

- benign, slowly growing lesion composed of well differentiated mature bone w/ a predominant lamellar structure
- incidental finding or painless hard swelling
- mandible is 2nd most frequent location
- Gardner’s syndrome: multiple osteomas, impacted teeth, multiple colonic polyps, epidermoid and sebaceous cysts, and desmoid skin tumors
- CT: sclerotic cortical bone
- treatment: resection/ablation if symptomatic

Odontogenic neoplasms - *Odontoma*

- most common odontogenic tumor
- hamartoma of odontogenic components (enamel, cementum, dentin, pulp) in various states of differentiation
- WHO classifies into 2 categories:
  - 1) complex: occur in 2nd and 3rd decades of life near mandibular molar and premolars
  - 2) compound: occur in younger individuals near maxillary anterior alveolar bone
- both frequently associated w/ unerupted teeth
- treatment: radiographic observation or simple excision, do not recur
- DDx: *focal cemental dysplasia, Pindborg tumor*
Odontogenic neoplasms - *Complex odontoma*

- well defined radiopaque mass of amorphous, disorganized odontogenic tissue bearing no morphological similarity to normal or rudimentary tooth
- often w/ lucent rim
Odontogenic neoplasms - *Compound odontoma*

- well defined radiopaque mass w/ radiolucent rim and appearance of multiple, miniature, or rudimentary teeth
- more common
Conclusion

• widespread, routine imaging of the face necessitates radiologists’ familiarity with anatomy and pathology of the mandible
• predictable patterns of trauma to mandible and dentition exist
• tumors of the mandible are generally benign and have various appearances
  – identification dependent upon location, imaging characteristics, effects upon adjacent structures, patient demographics and history
  – can narrow differential diagnosis but most cases require excision and histologic evaluation
References


