Radiographic features of cysts and benign tumors of the jaws

Cyst
A Cyst is a benign pathologic cavity filled with fluid, lined by epithelium, and surrounded by a connective tissue wall.

A = connective tissue wall
B = epithelium

Effects on adjacent structures

Types
- Odontogenic
- Non-Odontogenic
- Pseudocysts

Types of Odontogenic Cysts
- Radicular cyst
- Residual cyst
- Dentigerous cyst
- Paradental cysts (Buccal bifurcation cysts)
- Odontogenic Keratocyst (OKC)
  - Basal cell nevus-bifid rib-OKC syndrome
  - Lateral periodontal cyst
  - Calcifying odontogenic cyst

Types of Non-Odontogenic Cysts
- Nasopalatine cyst
- Nasolabial cyst
- Dermoid cyst
- Cysts formerly known as “developmental cysts”
Pseudocysts
- Simple bone cyst (Traumatic bone cyst)
- Aneurysmal Bone Cyst
- Mucous Retention Cyst
- Stafne Bone Cyst (aka Stafne Bone Defect)

Odontogenic Cysts
- Radicular cyst
- Residual cyst
- Dentigerous cyst
- Paradental cysts (Buccal bifurcation cysts)
- Odontogenic keratocyst (OKC)
  - Basal cell nevus-bifid rib-OKC syndrome
- Lateral periodontal cyst
- Calcifying odontogenic cyst

Radicular cysts
- Results from the stimulation of the epithelial cell rests in the PDL by the inflammatory products from the non-vital tooth
- Most common type of cysts in the jaws
Residual Cyst

Residual Cyst

Residual Cyst

Residual Cyst

Residual cyst with Squamous Cell Carcinoma

Residual cyst with squamous cell carcinoma
**Odontogenic Cysts**
- Radicular cyst
- Residual cyst
- Dentigerous cyst
- Paradental cysts (Buccal bifurcation cysts)
- Odontogenic keratocyst (OKC)
  - Basal cell nevus-bifid rib-OKC syndrome
- Lateral periodontal cyst
- Calcifying odontogenic cyst

**Dentigerous cyst (follicular cyst)**
- Develops around the crown of an unerupted permanent or supernumerary tooth
- Second most common type of cyst in the jaws
- Asymptomatic
- Internal aspect is completely lucent except for the crown of the involved tooth
- Either resorbs or displaces the adjacent teeth
- Follicular spaces >5mm (normal 2-3 mm) should be closely followed for potential development of dentigerous cysts.

**Dentigerous cyst**
- Root Resorption

**Dentigerous cyst**
- Root Resorption

**Dentigerous cyst**
- Root Resorption
Odontogenic Cysts
- Radicular cyst
- Residual cyst
- Dentigerous cyst
- Paradental cysts (Buccal bifurcation cysts)
- Odontogenic keratocyst (OKC)
  - Basal cell nevus-bifid rib-OKC syndrome
- Lateral periodontal cyst
- Calcifying odontogenic cyst
**Odontogenic Cysts**

- Paradental cysts (Buccal bifurcation cysts)
  - Most common in the 6- to 11-year-old age group.
  - Usually associated with the mandibular first molar, occasionally the mandibular second molar.
  - The associated tooth has an altered eruption pattern with buccal tilting of the crown.
  - The associated tooth is vital.
  - Deep periodontal pockets on the buccal aspect of the tooth.
  - +/- swelling
  - +/- pain or tenderness
  - +/- infection.

**Radiographic Features of the Buccal bifurcation cyst**

- Fine radiopaque concave line as lower limit, producing a U-shaped radiolucent lesion that appears superimposed over the roots.
- Intact periodontal ligament space and lamina dura.
- Increased prominence of lingual cusps due to tilting.
- Apices tilted toward lingual cortex.
- Intact inferior border of mandible.
- +/- periosteal reaction on buccal surface.
- +/- bony expansion, thinning and associated swelling of the buccal cortex.
- +/- displacement of adjacent unerupted teeth

**Buccal Bifurcation Cyst**

These lesions tend to resolve without intervention.

**Odontogenic Cysts**

- Radicular cyst
- Residual cyst
- Dentigerous cyst
- Paradental cysts (Buccal bifurcation cysts)
- Odontogenic keratocyst (OKC)
  - Basal cell nevus-bifid rib-OKC syndrome
  - Lateral periodontal cyst
  - Calcifying odontogenic cyst

**Odontogenic Keratocyst (OKC)**

An OKC is a non-inflammatory odontogenic cyst that arises from the dental lamina. The epithelium in OKC appears to have innate growth potential similar to some benign tumors.
Odontogenic Keratocyst (OKC)

- First reported by Philipsen in 1956
- Peak occurrence in the 2nd and 3rd decades
- Asymptomatic, swelling on occasion
- Pain from secondary infection
- Aspiration may reveal thick yellow cheesy material (keratin)
- High recurrence rate after surgical enucleation
Basal cell nevus-bifid rib syndrome
- Age range 5-30 years
- Abnormalities including multiple nevoid basal cell carcinomas of the skin, skeletal abnormalities (bifid ribs, agenesis and/or synostosis of ribs, kyphoscoliosis, vertebral fusion, temporoparietal bossing, etc.), CNS abnormalities (calcification of falx cerebri), eye abnormalities, multiple OKCs

Multiple OKC’s

Odontogenic Cysts
- Radicular cyst
- Residual cyst
- Dentigerous cyst
- Paradental cysts (Buccal bifurcation cysts)
- Odontogenic Keratocyst (OKC)
  - Basal cell nevus-bifid rib-OKC syndrome
- Lateral periodontal cyst
- Calcifying odontogenic cyst

Lateral periodontal cyst
- Usually unicystic, it may also appear as a cluster of small cysts → botryoid odontogenic cysts
- Arise from the epithelial rests in the periodontium lateral to the root
- 50-75% develop in the mandible from lateral incisor to the premolar region
- In the maxilla, they appear between lateral incisor and canine
Lateral Periodontal Cyst

Lateral periodontal cyst
- Botryoid lateral periodontal cyst
- Origin from dental lamina?

Odontogenic Cysts
- Radicular cyst
- Residual cyst
- Dentigerous cyst
- Paradental cysts (Buccal bifurcation cysts)
- Odontogenic keratocyst (OKC)
  - Basal cell nevus-bifid rib-OKC syndrome
- Lateral periodontal cyst
- Calcifying odontogenic cyst

Calcifying odontogenic cyst
- Calcifying odontogenic cysts have a wide age distribution that peaks at 10 to 19 years of age, with a mean age of 36 years.
- Clinically, the lesion usually appears as a slow-growing, painless swelling of the jaw. Occasionally the patient complains of pain. In some cases the expanding lesion may destroy the cortical plate, and the cystic mass may become palpable as it extends into the soft tissue.
- Aspiration often yields a viscous, granular, yellow fluid.
Calcifying odontogenic cyst

Non-Odontogenic cysts
- Nasopalatine cyst
- Nasolabial cyst
- Dermoid cyst
- Former “developmental cysts”
Nasopalatine Duct Cyst

Nasopalatine duct cyst

Nasopalatine duct cyst

Nasopalatine duct cyst

If it involves the posterior hard palate, termed median palatal cyst. Anteriorly, may be called median anterior maxillary cyst, depending on the radiographic features.

Non-Odontogenic cysts

Nasopalatine cyst

Nasolabial cyst

Dermoid cyst

Former “developmental cysts”

Nasolabial cysts

Source of the epithelium may be embryonic nasolacrimal duct, which initially lies on the bone surface.

Thyroglossal duct cyst

Thyroglossal duct cyst

Courtesy of Dr. Sharon Brooks
Pathoses formerly known as “Globulomaxillary” Cysts

- Discredited as a developmental cyst
- Most are found, upon re-examination of histopathological and radiographic evidence, to be radicular or lateral periodontal cysts.

Pseudocysts

- Simple bone cyst (Traumatic bone cyst)
- Aneurysmal Bone Cyst
- Mucous Retention Cyst
- Stafne Bone Cyst (aka Stafne Bone Defect)

Pseudocysts

- Simple bone cyst (Traumatic bone cyst)
- Aneurysmal Bone Cyst
- Mucous Retention Cyst
- Stafne Bone Cyst (aka Stafne Bone Defect)

Simple Bone cyst
Simple Bone Cyst

Pseudocysts
- Simple bone cyst (Traumatic bone cyst)
- Aneurysmal Bone Cyst
- Mucous Retention Cyst
- Stafne Bone Cyst (aka Stafne Bone Defect)

Aneurysmal Bone Cyst (ABC)
- The aneurysmal bone cyst (ABC) is an expansible osteolytic pseudocystic lesion that most often affects persons during their second decade of life. Although virtually any bone of the skeleton may be affected, ABCs are most frequent in the long tubular bones and spine. There are several reports of the occurrence of this pathological entity in the jaws and other craniofacial bones.

Mucous retention cyst
- Dome shaped opacity in the floor of the maxillary sinus
- Non-epithelial lined
- Fluid filled
- Usually asymptomatic

http://www.thejcpd.com/issue022/martins/03martins.htm
Mucous retention cyst

Pseudocysts
- Simple bone cyst (Traumatic bone cyst)
- Aneurysmal bone cyst
- Mucous retention cyst
- Stafne bone cyst (aka Stafne bone defect)

Mandibular salivary gland depression

Break Time!

Benign Tumors of the Jaws
### Benign Jaw Tumors

- **Hyperplasias (tori, exostosis and enostosis)**
- **Odontogenic tumors**
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid odontogenic tumor (AOT)
    - CEOT/Pindborg's tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
- **Mesodermal tumors**
  - Odontogenic myxoma, Benign cementoblastoma
  - Central odontogenic fibroma

- **Non-odontogenic tumors**
  - Ectodermal (neurilemoma, neuroma)
  - Mixed tumors (neurofibroma, neurofibromatosis)
  - Mesodermal tumors (osteoma, Gardner's syndrome, central hemangioma, A-V fistula, osteoblastoma, osteoid osteoma)
- **Pseudotumors:** Central giant cell granuloma

### Effects on adjacent structures

- Torus palatinus

- Palatal and mandibular tori

### Benign Jaw Tumors

- Hyperplasias (tori, exostosis and enostosis)
- Odontogenic tumors
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid odontogenic tumor (AOT)
    - CEOT/Pindborg's tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
- Mesodermal tumors
  - Odontogenic myxoma, Benign cementoblastoma
  - Central odontogenic fibroma

*Adapted from: White and Pharoah: Oral Radiology-Principles and Interpretation, page 380*
The next step
- R/O vascular lesions/A-V malformations
  - Auscultate for “bruit”
  - Palpate for “thrills”
- Aspirate
- Plan for biopsy
  - Advanced imaging
    - CT/MR

Advanced Imaging

Bone Window

Case 1
Courtesy Nagasaki University

Bone Window

Case 2
Courtesy Nagasaki University

Bone Window
Coronal CT in bone windows
T1W MRI
T2W MRI

Confirm your diagnosis:
Ameloblastoma

OKC v. Ameloblastoma
Case courtesy of the KAOMFR
Benign Jaw Tumors

- Hyperplasias (tori, exostosis and enostosis)
- Odontogenic tumors
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid Odontogenic tumor (AOT)
    - CEOT/ Pindborg's tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
  - Mesodermal tumors
    - Odontogenic myxoma
    - Benign cementoblastoma
    - Central odontogenic fibroma

Adenomatoid Odontogenic Tumor

- Adenomatoid Odontogenic Tumor
- Most common location: maxillary canine and premolar region. 2:1 female to male ratio.
- Average age = ~16 yrs
- Tumors contain specks of calcified material
- Low recurrence rate

Radiographs courtesy of Akitoshi Kawamura DDS, Ph.D
Department of Oral Radiology
Asahi University, School of Dentistry

Radiographs courtesy of Department of Oral Radiology
Okayama University, School of Dentistry
Benign Jaw Tumors

- Hyperplasias (tori, exostosis and enostosis)
- Odontogenic tumors
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid Odontogenic tumor (AOT)
    - CEOT/Pindborg’s tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
- Mesodermal tumors
  - Odontogenic myxoma, Benign cementoblastoma
  - Central odontogenic fibroma

CEOT (Pindborg Tumor)

- Behaves like ameloblastoma
- Predilection for mandible-premolar/molar area
- >half of the lesions will have associated impacted or unerupted tooth
- Periphery well defined to diffuse
- Cystic lesion with numerous scattered, radiopaque foci of varying size and density giving it the appearance of “Driven Snow”
- Presence of amyloid and calcified “Liesegang Rings”

Benign Jaw Tumors

- Hyperplasias (tori, exostosis and enostosis)
- Odontogenic tumors
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid Odontogenic tumor (AOT)
    - CEOT/Pindborg’s tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
- Mesodermal tumors
  - Odontogenic myxoma, Benign cementoblastoma
  - Central odontogenic fibroma

Odontoma

- Complex
- Compound

Odontomas

- Complex
- Compound
Benign Jaw Tumors

- Hyperplasias (tori, exostosis and enostosis)
- Odontogenic tumors
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid Odontogenic tumor (AOT)
    - CEOT/Pindborg’s tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
  - Mesodermal tumors
    - Odontogenic myxoma, Benign cementoblastoma
    - Central odontogenic fibroma

Ameloblastic fibroma
(Soft odontoma)
Benign Jaw Tumors
- Hyperplasias (tori, exostosis and enostosis)
- Odontogenic tumors
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid Odontogenic tumor (AOT)
    - CEOT/ Pindborg's tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
  - Mesodermal tumors
    - Odontogenic myxoma, Benign cementoblastoma
    - Central odontogenic fibroma

Odontogenic Myxoma
- If odontogenic myxomas have a gender predilection, they slightly favor females. Although the lesion can occur at any age, more than half arise in individuals between 10 and 30 years. This tumor often is associated with a congenitally missing or unerupted tooth. It grows slowly and may or may not cause pain. It may also invade the maxillary sinus and cause exophthalmos. Recurrence rate is as high as 25%. This high rate may be explained by the lack of encapsulation of the tumor, its poorly defined boundaries, and the extension of nests or pockets of myxoid (jellylike) tumor into the trabeculae.
Benign Jaw Tumors

- Hyperplasias (tori, exostosis and enostosis)
- Odontogenic tumors
  - Epithelial tumors
    - Ameloblastoma
    - Adenomatoid Odontogenic tumor (AOT)
    - CEOT/ Pindborg's tumor
  - Mixed (ecto-mesodermal)
    - Odontoma
    - Ameloblastic fibroma
    - Ameloblastic fibro-odontoma
- Mesodermal tumors
  - Odontogenic myxoma, Benign cementoblastoma
  - Central odontogenic fibroma

Benign Cementoblastoma

- Benign cementoblastomas are slow-growing, mesenchymal neoplasms, composed principally of cementum. The tumor manifests as a bulbous growth around and attached to the apex of a tooth root. Its histologic characteristics are similar to those of osteoblastomas, and it is composed of cementoblasts that arise from the mesenchyme of the periodontal ligament.

Non-odontogenic tumors

- Ectodermal (neurilemoma, neuroma)
- Mixed tumors (neurofibroma, neurofibromatosis)
- Mesodermal tumors (osteoma, Gardner’s syndrome, central hemangioma, A-V fistula, osteoblastoma, osteoid osteoma)
Neurofibroma

Central Hemangioma

Osteoblastoma

Benign Jaw Tumors

- Non-odontogenic tumors
  - Ectodermal (neurilemoma, neuroma)
  - Mixed tumors (neurofibroma, neurofibromatosis)
  - Mesodermal tumors (osteoma, Gardner’s syndrome, central hemangioma, A-V fistula, osteoblastoma, osteoid osteoma)

- Non-odontogenic tumors
  - Ectodermal (neurilemoma, neuroma)
  - Mixed tumors (neurofibroma, neurofibromatosis)
  - Mesodermal tumors (osteoma, Gardner’s syndrome, central hemangioma, A-V fistula, osteoblastoma, osteoid osteoma)

- Non-odontogenic tumors
  - Ectodermal (neurilemoma, neuroma)
  - Mixed tumors (neurofibroma, neurofibromatosis)
  - Mesodermal tumors (osteoma, Gardner’s syndrome, central hemangioma, A-V fistula, osteoblastoma, osteoid osteoma)
Gardner’s syndrome: Gardner’s syndrome, inherited as an autosomal dominant disorder, is characterized by intestinal polyposis, multiple osteomas, fibromas of the skin, epidermal and trichilemmal cysts, impacted permanent and supernumerary teeth, and odontomas.

Acknowledgement

Thanks to Dr. M. Mupparapu, DMD of the Department of Diagnostic Sciences, Division of Oral and Maxillofacial Radiology at UMDNJ-NJDS for the use of his materials.