Odontogenic cysts
Definition

- A cyst is a pathological cavity having fluid, semifluid or gaseous contents & which is not created by the accumulation of pus. It is frequently, but not always, lined by epithelium. (Kramer 1974)
Classification
CYSTS OF THE JAWS

A. **EPITHELIAL**

1. **Developmental**
   a) **Odontogenic**

   i) **Odontogenic Keratocyst (Primordial cyst)**

   ii) **Gingival cyst of infants**

   iii) **Gingival cyst of adults**

   iv) **Eruption cyst**

   v) **Dentigerous (follicular)**

   vi) **Lateral periodontal cyst**

   vii) **Botryoid odontogenic Cyst**

   viii) **Glandular Odontogenic Cyst**

   ix) **Calcifying Odontogenic Cyst**
b) Non-odontogenic

i) Nasopalatine duct (incisive canal) cyst

ii) Nasolabial (nasoalveolar) cyst

iii) Midpalatal raphe cyst of infants

v) Median palatine, median maxillary and median mandibular cysts

v) Globulomaxillary cysts
2. **Inflammatory**

i. Radicular cyst

ii. Residual cyst

iii. Paradental cyst and mandibular infected buccal cyst

iv. Inflammatory collateral cyst
Non-Epithelial

1. Solitary bone cyst (traumatic, simple, hemorrhagic bone cyst)

2. Anurysmal bone cyst
Odontogenic Keratocyst
First described by **Mikulicz, 1876**  → “Dermoid cyst”

**Hauer, 1926**  → “Cholesteatoma”

**Robinson, 1945**  → “Primordial cyst”
- The terminology has been discarded

**Philipsen, 1956**  → “Odontogenic Keratocyst”

Because of its potential aggressive behavior some researchers have suggested that OKC is a benign cystic neoplasm and recently the name “Keratocystic Odontogenic Tumor” has been suggested
Pathogenesis

*Robinson, 1945* → derived from enamel organ by degeneration of stellate reticulum before any calcified structure has been laid down → *Primordial cyst*

- Evidence against this theory
  - Frequency of aplasia of teeth is relatively higher than that of keratocysts
  - Site distribution of these cysts and supernumerary teeth is different
Remnants of dental lamina

Origin from overlying oral epithelium as basal cell hamartias
Clinical features

- Frequency
  - 11.2% of all jaw cysts

- Age
  - Bimodal age distribution
    - 2nd and 3rd decade
    - Second peak in 5th and 6th decade

- Sex
  - Male preponderance
Site

- Mandible most frequent (75%)
- Almost half of keratocysts occur at the angle of mandible
Clinical presentation

- Remarkably free of symptoms until the cyst have reached a large size
- Pain, swelling or discharge
- Pathologic fracture
- Maxillary cysts → more likely to become infected → diagnosed earlier
- Displacement of teeth
- Other
  - Displacement and destruction of the floor of orbit
  - Proptosis of eyeballs
  - Neurological symptoms

- “Peripheral OKC” → cysts occurring outside the bone

- Multiple cysts with or without naevoid basal cell carcinoma syndrome
The naevoid basal cell carcinoma syndrome

*Gorlin and Goltz (1960)* established the association of

- Multiple basal cell epitheliomas
- Jaw cysts
- Bifid ribs

*Gorlin-Goltz Syndrome*
Inherited as autosomal dominant characteristics with strong penetrance

Other features include
- Frontal bossing
- Ocular hypertelorism
- CNS and eye lesions

Keratocysts → 65-75% cases
Recurrences

- First pointed by Pindborg and Hansen, 1963
- Various studies have shown recurrence rates ranging from 3% to 62%
- Mostly within first 5 years of surgery
- Higher recurrence rate when cysts are located in the angle or ascending ramus
- Recurrences more frequent in patients with Gorlin-Goltz syndrome
- Cyst enucleated in one piece → less recurrence
- Infection, fistula formation, bony perforations → more recurrence
- Multilocular → higher recurrence
Suggested reason for recurrences

- Occurrence of satellite cysts → left behind during enucleation

- Thin and fragile lining → difficult to enucleate in toto

- Epithelial lining of keratocysts have intrinsic growth potential → *benign neoplasm*

- Recurrence from residual basal cell proliferations
Radiological features

- Small, round or ovoid, radiolucent areas
- Sometimes more extensive
- Well demarcated with distinct sclerotic borders
- Unilocular or multilocular
- May have scalloped margins
- Expansion is seen late and may be buccal or lingual
- Can mimic
  - Radicular cyst
  - Dentigerous cyst $\rightarrow$ follicular primordial cyst
  - Lateral periodontal cyst
  - Nasopalatine duct cyst

- Radiographically classified into 4 types (*Main, 1970*)
  - Replacement
  - Envelopmental
  - Extraneous
  - Collateral
Histopathology

- Regular keratinized stratified squamous epithelium
- 5-8 cell layer without rete ridges
- Corrugated surface
- Well defined, palisaded basal layer
  - Columnar
  - Nuclei → away from basement membrane and intensely basophilic
- Suprabasal cells → polyhedral and often show intercellular edema
Desquamated keratin in cyst cavity
- Mitotic activity → more in suprabasal layer
  - Higher in patients with syndrome

- Epithelial dysplasia

- Fibrous capsule
  - Usually thin with relatively few cells
  - Stroma rich in mucopolysaccharide and resembles mesenchymal connective tissue
- Inflammatory cells
  - infrequent
  - mild infiltration of lymphocytes and monocytes

**Inflammatory cells**

intense inflammation

epithelium looses its keratinised surface

thicken & develop rete processes or may ulcerate
Attachment between epithelium and the connective tissue capsule tends to be weak and in many areas separation occurs.
collapsed and folded thin-walled cysts

erroneous impression of multilocunarites in histological section
Satellite cysts or daughter cysts
Epithelial rests and proliferating dental lamina
Orthokeratinized variant

- Previously thought to be a type of OKC

- Due to characteristic histological differences and a less aggressive clinical course it is now thought to be a separate entity → “Orthokeratinized Odontogenic Cyst (OOC)”
### Histological differences between OKC and OOC

<table>
<thead>
<tr>
<th>OKC</th>
<th>OOC</th>
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</thead>
<tbody>
<tr>
<td>Predominantly parakeratinized lining</td>
<td>Predominantly orthokeratinized lining</td>
</tr>
<tr>
<td>Basal cells cuboidal or columnar</td>
<td>Basal cells flat or low cuboidal</td>
</tr>
<tr>
<td>Palisading of basal layer</td>
<td>No palisading of basal cells</td>
</tr>
<tr>
<td>Nuclei of basal cells show hyperchromatism</td>
<td>Basal cells do not show hyperchromatism</td>
</tr>
<tr>
<td>Corrugated surface of the epithelial lining</td>
<td>Surface epithelium is flat with no corrugations</td>
</tr>
<tr>
<td>No hypergranulosis</td>
<td>Accentuated granular layer</td>
</tr>
</tbody>
</table>
Fluids from keratinising cysts have soluble protein levels below 3.5gm / 100 ml

- Values for non-keratinising cysts → 5.0-11.09gm per 100ml
- Protein level of less than 4.0 gm / 100 ml indicate a diagnosis of keratocyst
Gingival cyst and midpalatal cyst of infants
Clinical features

- Frequently seen in new born infants

- Rare after 3 months of age
  - Undergo involution and disappear
  - Rupture through the surface epithelium and exfoliate

- Along the mid palatine raphe → Epstein’s pearls

- Buccal or lingual aspect of dental ridges → Bohn’s nodules
- 2-3 mm in diameter

- White or cream coloured

- Single or multiple (usually 5 or 6)
Pathogenesis

Gingival cyst of infants

- Arise from epithelial remnants of dental lamina (cell rests of Serre)

- These rests have the capacity to proliferate, keratinize and form small cysts
Midpalatal raphe cyst

- Arise from epithelial inclusions along the line of fusion of palatal folds and the nasal process
  - Usually atrophy and get resorbed after birth
  - May persist to form keratin filled cysts
Histopathology

- Round or ovoid
- Smooth or undulating outline
- Thin lining of stratified squamous epithelium with parakeratotic surface
- Cyst cavity filled with keratin (concentric laminations with flat nuclei)
- Flat basal cells
- Epithelium lined clefts between cyst and oral epithelium
- Oral epithelium may be atrophic
Gingival cyst of adults
Clinical features

- Frequency
  - 0.5%
  - May be higher as all cases may not be submitted to histopathological examination

- Age
  - 5\textsuperscript{th} and 6\textsuperscript{th} decade

- Sex
  - No predilection

- Site
  - Much more frequent in mandible
  - Premolar-canine region
Clinical presentation

- Soft and fluctuant
- Well circumscribed, slowly enlarging, painless swelling
- Attached gingiva or interdental papilla
- Facial aspect
  - Usually less than 1 cm
  - Smooth surface
  - Colour of overlying mucosa → normal or bluish
- Adjacent teeth usually vital
- Slight erosion of surface of the bone
Radiological features

- No change
- Faint round shadow
Pathogenesis

- Odontogenic epithelial cell rests
- Traumatic implantation of surface epithelium
- Cystic degeneration of deep projections of surface epithelium
- From glandular elements
- Junctional epithelium
- May be derived from reduced enamel epithelium
Histopathology

- Extremely thin epithelium resembling REE
  - 1-3 layers of flat to cuboidal cells
  - Darkly staining nuclei

Or

- Thicker stratified squamous epithelium without rete ridges
Epithelial cells may show
- Pyknotic nuclei
- Perinuclear cytoplasmic vacoultization
- Atrophic with ghost outlines

Localized epithelial thickenings or plaques
- Some protrude in the cystic lumen
- Some extend into fibrous cyst wall
- Cells
  - Whorled configuration
  - Compact and fusiform
  - Swollen and clear (*water clear cells*)

Low columnar cells on the surface of epithelium → origin from ameloblasts
Attachment of epithelium to connective tissue is tenuous

Easily peels off

Epithelial discontinuities
- Fibrous connective tissue wall
  - Usually uninflamed
  - Except close to junctional epithelium → chronic inflammatory cell infiltrate

- May contain epithelial islands
Lateral periodontal cyst
Cysts which occur in the lateral periodontal position and in which an inflammatory etiology and a diagnosis of collateral keratocyst have been excluded on clinical and histopathological grounds
Clinical features

- **Frequency**
  - 0.7%

- **Age**
  - Prominent peak in the 6th decade

- **Sex**
  - No sex predilection
  - Some studies show slight male preponderance

- **Site**
  - Mandibular premolar area
  - Anterior maxilla
Clinical presentation

- Asymptomatic
- Gingival swelling on facial aspect
- Pain, tenderness on palpation

Consistency

- Springy with egg shell crackling
- Gelatinous feel

- Associated teeth usually vital
Radiographic features

- Round or oval, well circumscribed radiolucency
- Sclerotic margin
- Between the apex and cervical margin of tooth
- Usually less than 1 cm in diameter
- Mean growth → 0.7mm per year  
  (Rasmusson, Magnusson, Borrman, 1991)
Pathogenesis

- Developmental odontogenic origin

- Three possibilities
  - Reduced enamel epithelium
  - Remnants of dental lamina
  - Cell rests of Malassez
Reduced enamel epithelium

- Arises initially as a dentigerous cyst developing by expansion of the follicle along the lateral surface of crown.
Support of this hypothesis

- LPC occur in areas where dentigerous cysts are likely to be associated with vertically impacted teeth

- Epithelial plaques similar to those seen in LPC may also be seen sometimes in dentigerous cysts

- Cytokeratin 18 strongly expressed in LPC & some dentigerous cysts (Hormia et al, 1987 & Heikinheimo et al, 1989)
Cell rests of dental lamina (Wysocki et al, 1980)

- Cystic change in a single rest $\rightarrow$ unicystic forms
- Concomitant changes in several adjacent rests $\rightarrow$ polycystic

Support for this hypothesis

- Limited growth potential of LPC $\rightarrow$ derivation from post functional cells of dental lamina

- Glycogen containing clear cells seen in rests of dental lamina may also be seen in LPC
Cell nests of Malassez

- Occur in the periodontium
- Well positioned for a lateral periodontal cyst
- Has not received much support
Histopathology

- Thin, non-keratinized squamous or cuboidal epithelial lining

- 1-5 cell layers

- Resembles reduced enamel epithelium

- Sometimes stratified squamous
Localized plaques or thickenings of the epithelial lining

- Extend into the surrounding cyst wall
- Mural bulges

- Cells are sometimes fusiform with long axis parallal to basement membrane

- Cells of the plaque may differentiate to take a spinous shape
Glycogen rich clear cells in the epithelial lining
What produces this localized proliferations??????

- Spontaneous process occurring in odontogenic epithelium

- *Odontogenic epithelium recapitulating ontogeny under pathological conditions*

- Similar to early stages of tooth development
- Small epithelial nests of follicles in the fibrous cyst wall
- Epithelial lining may separate from the cyst wall
- Areas of juxta-epithelial hyalinization of collagen
- Usually free of inflammation
Histochemical findings

- Positive reactions for:
  - NADH₂ and NADPH₂ diphorase
  - Glutamate dehydrogenase
  - Lactate dehydrogenase

- Unreactive for:
  - Acid and alkaline phosphatase
Other findings

- Melanin containing cells in the epithelial lining (Grand and Marwah, 1964)

- Extensive granular cell change in the epithelial lining → granular-cell odontogenic cyst (Gold and Christ, 1970)
Botryoid odontogenic cyst
First reported by *Weathers and Waldron, 1973*, who also proposed the name → resemblance to cluster of grapes

- **Variant of LPC**

- Microscopically similar to LPC with some differences
- Multilocular with thin fibrous connective tissue septa

- Smaller cyst cavities are oriented towards the larger ones

- Usually lined by thin non-keratinized epithelium, 1-2 layer thick

- In some areas thicker stratified squamous epithelium
- Foci of plaque like thickenings
- Flat fusiform cells
- Clear cells are unusual
- Plaques show convoluted zone on electron microscopic examination → similar to AOT (Greer & Johnson, 1988)
  - May arise from stratum intermedium
- Strong expression of cytokeratin 18
Glandular odontogenic cyst
- Sialo-odontogenic cyst
- Glandular odontogenic cyst (Gardner, 1988)
- Mucoepidermoid odontogenic cyst (Sadeghi, 1991)
- Wide age range

- Can occur in either jaws

- Propensity to grow to a large size and to recur

- Radiologically
  - Unilocular or multilocular
  - Smooth or scalloped margin
Histologically

- Non-keratinized stratified squamous epithelium
- Chronic inflammatory infiltration of connective tissue wall
- Superficial layer of epithelial lining
  - Columnar or cuboidal cells, occasionally with cilia
  - Glandular or pseudoglandular structure
  - Intraepithelial crypts or microcysts

may open onto the surface of epithelium

Papillary or corrugated surface
Numerous goblet cells may be present

Occasionally epithelium resembles REE

Epithelial thickenings or plaques may be present
- Protrude into the cyst cavity
- Extend into the connective tissue wall

Islands of odontogenic epithelium

Microcysts

Irregular calcifications
To be contd.
thank you