

# Oral Pathology

## Odontogenic Cysts

Odontogenic cysts and tumors constitute an important aspect of oral and maxillofacial pathology . Odontogenic cysts are encountered relatively commonly in dental practice ,while odontogenic tumors, by contrast, are uncommon lesions.

A cyst is defined as an epithelial-lined pathologic cavity . Cysts of the maxilla, mandible, and perioral regions vary markedly in histogenesis, incidence, behavior, and treatment. Most jaw cysts are lined by epithelium that is derived from odontogenic epithelium, so these are referred to as odontogenic cysts. Odontogenic cysts are sub classified as developmental or inflammatory in origin .Developmental cysts are of unknown origin, but they do not appear to be the result of an inflammatory reaction.Inflammatory cysts are the result of inflammation.

### DEVELOPMENTAL CYSTS

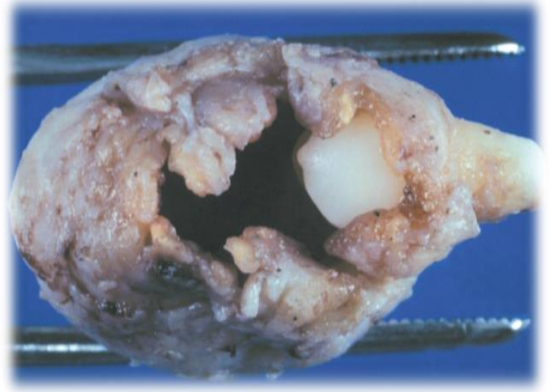
1. Dentigerous cyst
2. Eruption cyst
3. Odontogenic keratocyst
4. Orthokeratinized odontogenic cyst
5. Gingival (alveolar) cyst of the newborn
6. Gingival cyst of the adult
7. Lateral periodontal cyst
8. Calcifying odontogenic cyst .
9. Glandular odontogenic cyst.

### INFLAMMATORY CYSTS

1. Periapical (radicular) cyst
2. Residual periapical (radicular) cyst
3. Buccal bifurcation cyst.

## Dentigerous Cyst

- Dentigerous or follicular cysts are the **second most common** type of odontogenic cyst, and the **most common developmental cyst of the jaws**. By definition, a dentigerous cyst is attached to the tooth cervix at the enamel-cementum junction, and it encloses the crown of the unerupted tooth.



### Etiology and Pathogenesis.

- A dentigerous cyst develops from proliferation of the enamel organ remnant or reduced enamel epithelium. As with other cysts, expansion of the dentigerous cyst is related to an increase in cyst fluid osmolality and the release of bone-resorbing factors.

### Clinical Features:

Dentigerous cysts are most commonly seen in association with third molars and maxillary canines, which are the most commonly impacted teeth. The highest incidence of dentigerous cysts occurs during the 2nd and 3rd decades. A greater incidence in males has been noted. Symptoms generally are absent, and delayed eruption is the most common indication of dentigerous cyst formation.

This cyst is capable of achieving significant size, occasionally with associated cortical bone expansion, but rarely does it reach a size that predisposes the patient to a pathologic fracture.

### Radiographically:

A dentigerous cyst presents as a well-defined, unilocular radiolucency with corticated margins in association with the crown of an unerupted tooth. The unerupted tooth is often displaced.

These cysts range in size from several millimeters to several centimeters, where they may compromise jawbone integrity and produce facial asymmetry. Resorption of roots of adjacent erupted teeth may occasionally be seen. The cyst-to-crown relationship shows several radiographic variations. In the **central variety (a)**, which is the most common, the cyst surrounds the crown of the tooth and the crown projects into the cyst. **The lateral variety (b)** is usually associated with mesioangular impacted mandibular third molars that are partially erupted. The cyst grows laterally along the root surface and partially surrounds the crown. In the **circumferential variant (c)**, the cyst surrounds the crown and extends for some distance along the root so that a significant portion of the root appears to lie within the cyst.



A

B

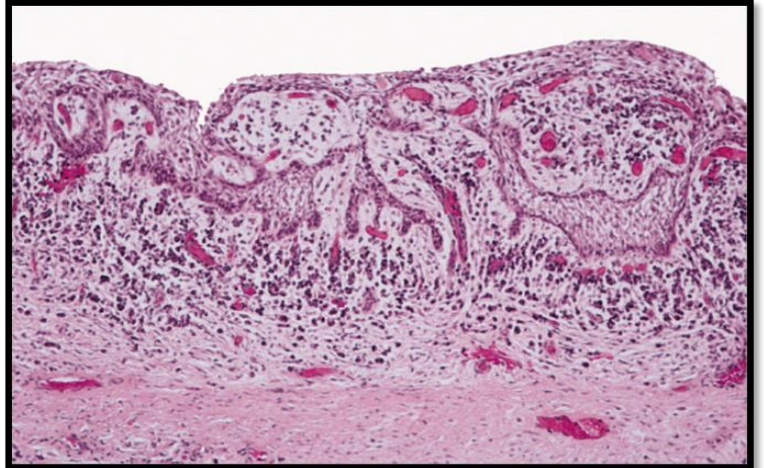
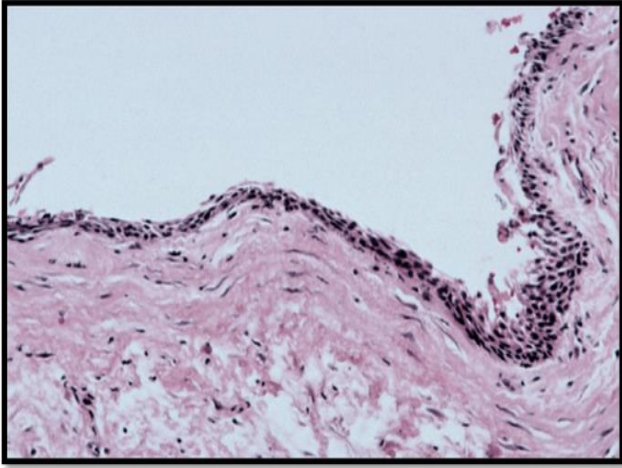
C

Rarely, a third molar may be displaced to the lower border of the mandible or higher up into the ascending ramus. Maxillary anterior teeth may be displaced into the floor of the nose, and other maxillary teeth may be moved through the maxillary sinus to the floor of the orbit. Dentigerous cysts may displace the involved tooth for a considerable distance. Root resorption of adjacent erupted teeth can occur.

A variant of the dentigerous cyst arising at the bifurcation of molar teeth is the paradental cyst or buccal bifurcation cyst. Originally, this cyst was described along the buccal root surface of partially erupted mandibular third molar teeth, but later involvement of other mandibular molar teeth was recognized. Often in these latter circumstances, the molar teeth are fully erupted. Radiographically, paradental cysts are characterized as well-circumscribed radiolucencies in the buccal bifurcation region. Often buccal tipping of the crown can be demonstrated by occlusal radiography.

### Histopathology:

Microscopically, the dentigerous cyst is formed by a fibrous connective tissue wall and is lined by stratified squamous epithelium. In an uninfamed dentigerous cyst, the epithelial lining is nonkeratinized and tends to be approximately four to six cell layers thick. On occasion, numerous mucous cells, ciliated cells, and, rarely, sebaceous cells may be found in the lining of the epithelium. The epithelium-connective tissue junction is generally flat, although in cases of secondary inflammation, epithelial hyperplasia may be noted.



### Treatment:

Removal of the associated tooth and enucleation of the pericoronal soft tissue component . In cases in which cysts affect significant portions of the mandible, an acceptable early treatment approach involves exteriorization or marsupialization of the cyst to allow for decompression and subsequent shrinkage of the lesion, thereby reducing the extent of surgery to be done at a later date.

Complications of untreated dentigerous cysts include transformation of the epithelial lining into an ameloblastoma and, rarely, carcinomatous transformation of the epithelial lining .

### Odontogenic Keratocyst/Keratocystic Odontogenic Tumor

OKCs/KCOTs may exhibit aggressive clinical behavior, a significant recurrence rate, and an association with nevoid basal cell carcinoma syndrome (NBCC). They are found anywhere in the jaws and can radiographically mimic other types of cysts. Microscopically, however, they have a consistent and unique appearance.

### Etiology and Pathogenesis :

It is generally agreed that OKCs/KCOTs develop from dental lamina remnants in the mandible and maxilla. However, origin of this cyst from extension of basal cells of the overlying oral epithelium has also been suggested.

This cyst shows a different growth mechanism and biologic behavior from the more common dentigerous cyst and radicular cyst. Most authors believe that dentigerous and radicular cysts continue to enlarge as a result of increased osmotic pressure within the lumen of the cyst. This mechanism does not appear to hold true for odontogenic

keratocysts. and their growth may be related to unknown factors inherent in the epithelium itself or enzymatic activity in the fibrous wall. Several investigators suggest that odontogenic keratocysts be regarded as benign cystic neoplasms rather than cysts. Although there are wide variations in the reported frequency of odontogenic keratocysts compared with that of other types of odontogenic cysts. several studies that include large series of cysts indicate that odontogenic keratocysts make up 3% to 11% of all odontogenic cysts.

### **Clinical Features:**

OKCs/KCOTs are relatively common jaw cysts. .They occur at any age mostly ( 2nd and 3rd decades ).Lesions found in children are often reflective of multiple cysts as a component of NBCCS.OKCs/KCOTs represent 5% to 15% of all odontogenic cysts. Approximately 5% of patients with OKCs/KCOTs have multiple cysts, and another 5% have NBCCS. .OKCs /KCOTs are found in the mandible in 60% to 80% of cases, approximately a 2:1 ratio with a marked tendency to involve the posterior body and ramus. Small OKCs are usually asymptomatic and discovered only during the course of a radiographic examination. Larger OKCs may be associated with pain, swelling, or drainage. OKCs tend to grow in an anteroposterior direction within the medullary cavity of the bone without causing obvious bone expansion. This feature may be useful in differential clinical and radiographic diagnosis because dentigerous and radicular cysts of comparable size are usually associated with bony expansion.



### **Radiographically:**

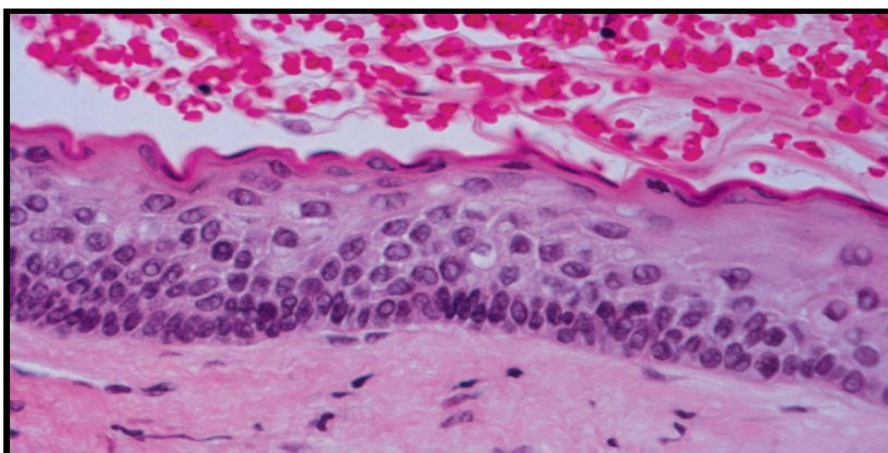
An OKC/KCOT characteristically presents as a well-circumscribed unilocular radiolucency with smooth radiopaque margins . Multilocularity is often present and tends to be seen more commonly in larger lesions .Noted adjacent to the crown of an unerupted tooth .Mandibular lingual enlargement is occasionally seen.The radiographic

findings, although often highly suggestive, are not diagnostic. Approximately 30% of maxillary and 50% of mandibular lesions produce buccal expansion. Mandibular lingual enlargement is occasionally seen.



### Histopathology:

The epithelial lining is uniform of stratified squamous epithelium, generally ranging from 6 to 10 cell layers thick .The basal layer exhibits a characteristic **palisaded pattern with polarized and intensely stained nuclei** of uniform diameter .The luminal epithelial cells are parakeratinized and produce an uneven or corrugated profile .Focal zones of orthokeratin are occasionally seen .Additional histologic features that may occasionally be encountered include budding of the basal cells into the connective tissue wall and microcyst formation. The fibrous connective tissue component of the cyst wall is often free of an inflammatory cell infiltrate and is relatively thin.The epithelium–connective tissue interface is characteristically flat . The cystic lumen may contain a clear liquid that is similar to a transudate of serum, or it may be filled with a cheesy material .

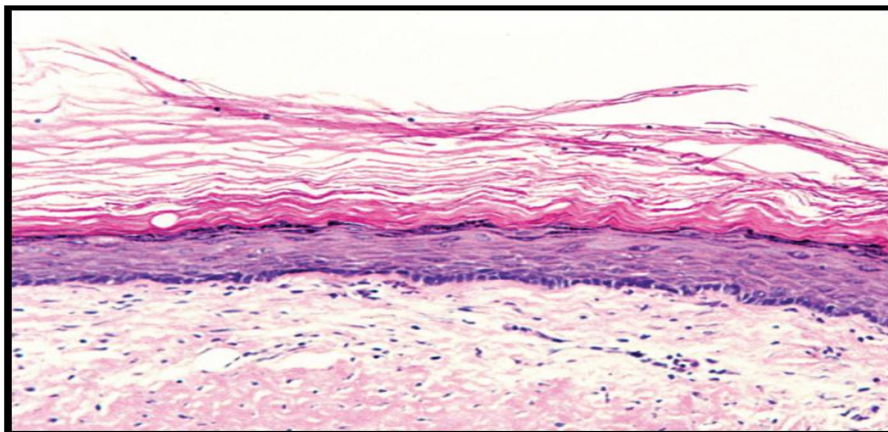


### Treatment and Prognosis:

Surgical excision with peripheral osseous curettage or ostectomy is the preferred method of management due to its high recurrence rate . Some have advocated marsupialization to permit cyst shrinkage, followed by enucleation as an alternative. The recurrence rate of 10% to 30% . Small dental lamina remnants or satellite cysts in the bone adjacent to the primary lesion may contribute to recurrence . Follow-up examinations are important for patients with this lesion. Patients should be evaluated for completeness of excision, new keratocysts, and NBCCS . Most recurrences become clinically evident within 5 years of treatment . Patients with multiple keratocysts have a significantly higher rate of recurrence than those with single keratocysts .

### ORTHOKERATINIZED ODONTOGENIC CYST

Originally called the orthokeratinized variant of odontogenic keratocyst, is **less clinically aggressive, has a lower rate of recurrence, and generally is not syndrome associated**. In the orthokeratotic odontogenic cyst, a prominent granular layer is found immediately below a flat, non-corrugated surface. The basal cell layer is less prominent and has a more flattened or squamoid appearance in comparison with the parakeratotic type.



### Nevoid basal cell carcinoma syndrome (gorlin syndrome)

Nevoid basal cell carcinoma syndrome (Gorlin syndrome) is an autosomal dominant inherited condition that exhibits high penetrance and variable expressivity. It is caused by mutations in patched (PTCH) , a tumor suppressor gene that has been mapped to chromosome 9q22,3-q31. The chief components are multiple basal cell

carcinomas of the skin , odontogenic keratocysts, intracranial calcification, and rib and vertebral anomalies. Many other anomalies have been reported in these patients and probably also represent manifestations of the syndrome, The prevalence of Gorlin syndrome is estimated to be about 1 in 60,000.

### **Clinical and Radiographic Features:**

There is great variability in the expressivity of nevoid basal cell carcinoma syndrome and no single component is present in all patients, The patient often has a characteristic faces, with frontal and temporoparietal bossing, which results in an increased cranial circumference, The eyes may appear widely separated, and many patients have true mild ocular hypertelorism. Mild mandibular prognathism is also commonly present. Basal cell carcinomas of the skin are a major component of the syndrome. They usually begin to appear at puberty or in the second and third decades of life, although they can develop in young children. The tumors may vary from flesh colored papules to ulcerating plaques. They are often appear on non-sun exposed skin but are most commonly located in the mid face area. The number of skin tumors may vary from only a few to many hundreds. Blacks with the syndrome tend to have fewer basal cell carcinomas than whites, probably because of protective skin pigmentation. Palmar and plantar pits are present in about 65% of patients. These punctate lesions represent a localized retardation of the maturation of basal epithelial cells. Basal cell carcinomas may develop at the base of the pits.

### **Lateral Periodontal Cyst & Gingival cyst in adult**

Is a non-keratinized developmental cyst occurring adjacent or lateral to the root of a tooth .Gingival cysts of the adult are histogenetically and pathologically similar and are also discussed here.

### **Etiology and Pathogenesis:**

The origin of this cyst is believed to be related to proliferation of rests of dental lamina .The lateral periodontal cyst has been pathogenetically linked to the gingival cyst of the adult; the former is believed to arise from dental lamina remnants within bone, and the latter from dental lamina remnants in soft tissue between the oral epithelium and the periosteum (rests of Serres). The close relationship between the two entities is further supported by their similar distribution in sites containing a higher concentration of dental lamina rests, and their identical histology.



### Clinical Features:

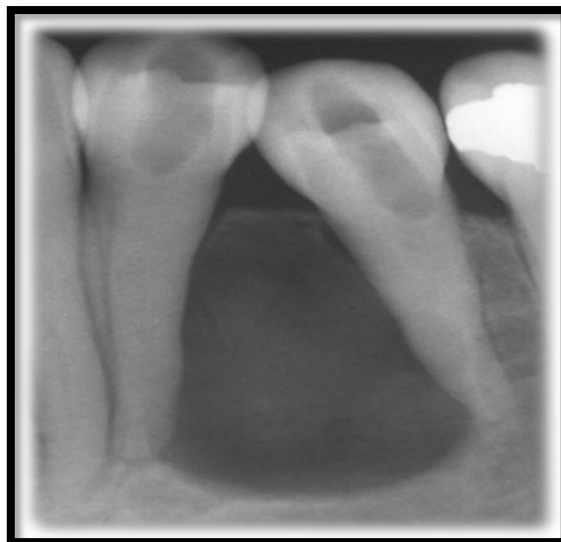
Most lateral periodontal cysts and gingival cysts of the adult occur in the mandibular premolar and cuspid regions and occasionally in the incisor area .In the maxilla, lesions are noted primarily in the lateral incisor region .A distinct male predilection has been noted with greater than 2:1 distribution. Gingival cysts show a nearly equal gender predilection .The median age for both types of cysts is between the fifth and sixth decades of life, with a range of 20 to 85 years for lateral periodontal cysts, and 40 to 75 years for gingival cysts of the adult.



Clinically ,a gingival cyst appears as a small soft tissue swelling within or slightly inferior to the interdental papilla. It may assume a slightly bluish discoloration when it is relatively large. Most cysts are less than 1 cm in diameter. Radiography reveals no findings.

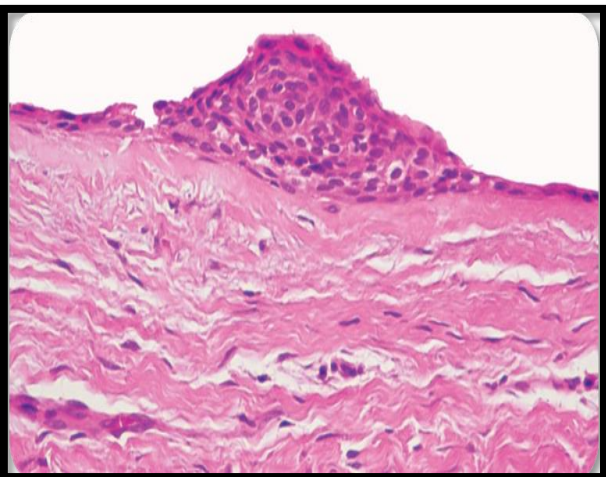
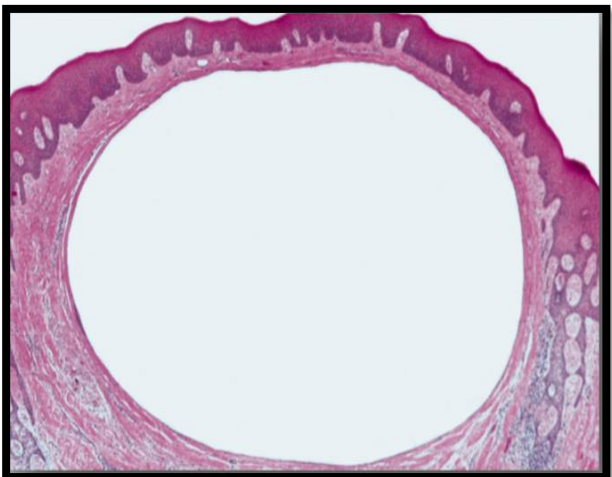
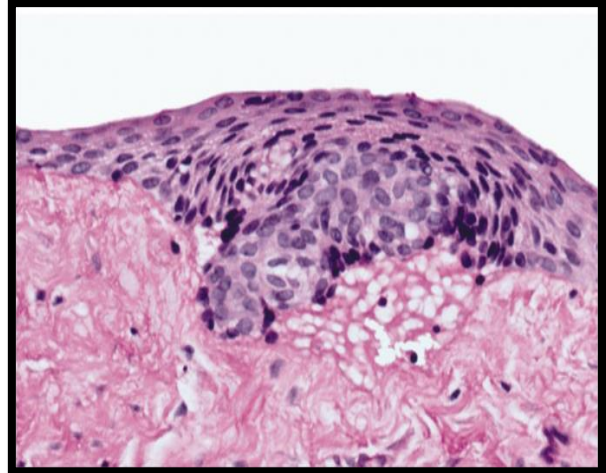
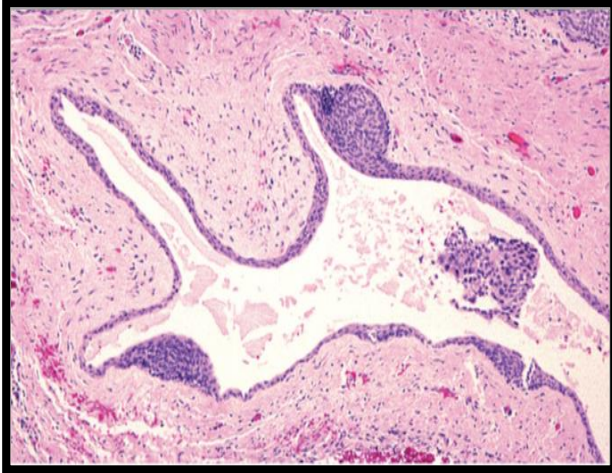
### Radiographically:

A lateral periodontal cyst presents as an asymptomatic, well-delineated, round or teardrop-shaped unilocular (and occasionally multilocular) radiolucency with an opaque margin along the lateral surface of a vital tooth root .Root divergence is rarely seen .The term botryoid odontogenic cyst is sometimes used when the lesion is multilocular.



### Histopathology:

Both the lateral periodontal cyst and the gingival cyst of the adult are lined by a thin, non-keratinized epithelium. Clusters of glycogen-rich, clear epithelial cells may be noted in nodular thickenings of the cyst lining.



### Treatment and Prognosis:

Local excision of both gingival and lateral periodontal cysts is generally curative. The multilocular variant, botryoid odontogenic cyst, seems to have increased recurrence potential. Follow-up, therefore, is suggested for treated multilocular odontogenic cysts.

## Gingival Cyst of the Newborn

Gingival cysts of the newborn are also known as dental lamina cysts of the newborn or Bohn's nodules. These cysts typically appear as multiple nodules along the alveolar ridge in neonates. It is believed that fragments of the dental lamina that remain within the alveolar ridge mucosa after tooth formation proliferate to form these small, keratinized cysts. In the vast majority of cases, these cysts are self-limiting and degenerate, and they involute or rupture into the oral cavity within a few weeks to a few months.

### Histologically:

This cyst is lined by a bland stratified squamous epithelium. Treatment is not necessary because nearly all involute spontaneously or rupture before the patient is 3 months of age. Similar epithelial inclusion cysts may occur along the midline of the palate (palatine cysts of the newborn, or Epstein's pearls). These cysts are of developmental origin and are derived from epithelium that is included in the fusion line between the palatal shelves and the nasal processes. No treatment is necessary because they fuse with the overlying oral epithelium, discharge their contents, and resolve spontaneously.

## Eruption Cyst

An eruption cyst results from fluid accumulation within the follicular space of an erupting tooth. The epithelium lining this space is simply reduced enamel epithelium. With trauma, blood may appear within the tissue space, forming an eruption hematoma. No treatment is needed because the tooth erupts through the lesion. Subsequent to eruption, the cyst disappears spontaneously without complication.



## Glandular Odontogenic Cyst

The rare glandular odontogenic cyst, or sialo-odontogenic cyst, was first described in 1987 and has some histologic features that suggest a mucus-producing salivary gland tumor (low-grade mucoepidermoid carcinoma).

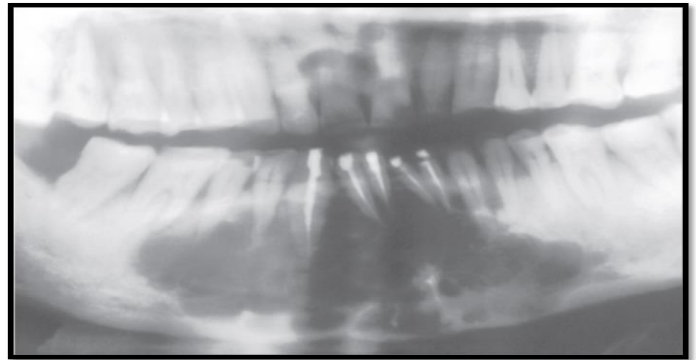


### Clinical Features:

The glandular odontogenic cyst mostly seen in the mandible (80 %) especially the anterior mandible. Maxillary lesions tend to be localized to the anterior segment. A slow growth rate is characteristic and symptoms are absent. Jaw expansion is not uncommon, particularly in association with mandibular lesions. The gender ratio is approximately 1:1. The mean age is 50 years, with a wide age range from the second through ninth decades.

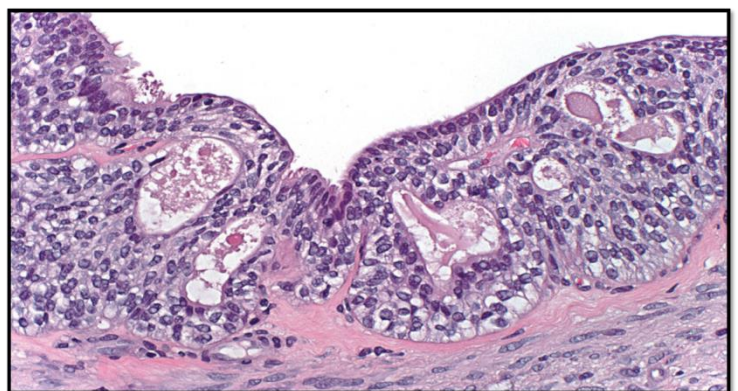
### Radiographic :

Most cases are radiographically multiloculated. In cases in which a unilocular radiolucency has been noted initially, recurrent lesions have tended to be multiloculated. Lesions that have been reported have exhibited a wide variation in size, from smaller than 1 cm to involving most of the mandible bilaterally. Radiographic margins are well defined and sclerotic and scalloped. Teeth may be displaced, and root resorption is noted in some cases. More aggressive lesions have shown an ill-defined peripheral border.



### Histopathology:

Multilocular cyst is lined by **non-keratinized epithelium** with **focal thickenings** in which the epithelial cells assume a **swirled appearance**.



The epithelial lining consists of cuboidal cells, often with cilia at the luminal surface . Mucous cells are clustered in the cyst lining along with mucin pools .The overall histomorphology is reminiscent of a cystic low-grade mucoepidermoid carcinoma.

### **Treatment and Prognosis:**

This lesion can be considered locally aggressive; therefore, surgical management should be dictated by the clinical and radiographic extent of the disease. Where adequate healthy bone remains beyond the extent of the cystic lesion, peripheral curettage or marginal excision is appropriate .Long-term follow-up is essential given the local aggressiveness and recurrence rate (approximately 25%) of this lesion.

### **Calcifying Odontogenic Cyst**

The calcifying odontogenic cyst is an uncommon lesion that demonstrates considerable histopathologic diversity and variable clinical behavior .Although it is widely considered to represent a cyst, some investigators prefer to classify it as a neoplasm. Some calcifying odontogenic cysts appear to represent non neoplastic cysts; other members of this group, variously designated as dentinogenic ghost cell tumors or epithelial odontogenic ghost cell tumors, have no cystic features, may be infiltrative or even malignant, and are regarded as neoplasms. The WHO Classification of odontogenic Tumors groups the calcifying associated with other recognized odontogenic tumors, most commonly odontomas. However. Adenomatoid odontogenic tumors and ameloblastomas have also been associated with calcifying odontogenic cyst with all its variants as an odontogenic tumor rather than an odontogenic cyst. although it admits that further experience may provide more reliable criteria for classification of the variants. Lesions with a cystic component represent 85% of the cases, whereas a solid pattern reminiscent of a neoplastic process is seen in 15%.A summary of the basic features follows:

- Cystic, non-proliferative:** In this predominantly cystic lesion, the epithelial lining may only be a few cells thick. Sparse dentinoid may be present, but no other hard tissues are seen. Such lesions constitute approximately 45% of all cystic calcifying odontogenic cysts.
- Cystic, proliferative/ameloblastomatous;** A prominent central cystic component is usually associated with various satellite cysts in the wall. Odontogenic epithelial

proliferations that superficially resemble ameloblastoma extend into the lumen as well as the connective tissue wall of the lesion.

- Odontoma-associated:** Odontoma-like tissues are seen in the wall of the lesion.
- Epithelial odontogenic ghost cell tumor:** This form has a growth pattern that is most consistent with a neoplasm, characterized by ameloblastoma-like strands and islands of odontogenic epithelium that infiltrate the connective tissue. Varying amounts of an eosinophilic calcified material (dentinoid) are typically present; thus, this lesion has been termed dentinogenic ghost cell tumor, although epithelial odontogenic ghost cell tumor and odontogenic ghost cell tumor are other names that have also been used.

### **Etiology and Pathogenesis:**

COCs are believed to be derived from odontogenic epithelial remnants within the gingiva or within the mandible or maxilla .Ghost cell keratinization, the characteristic microscopic feature of this cyst, is also a defining feature of the cutaneous lesion known as calcifying epithelioma of Malherbe, or pilomatrixoma . In the jaws, ghost cells may be seen in other odontogenic tumors, including odontomas, ameloblastomas, adenomatoid odontogenic tumors, ameloblastic fibro-odontomas, and ameloblastic fibromas .Mutations of genes in the WNT signaling pathway, including the beta-catenin gene, have been reported in COCs.

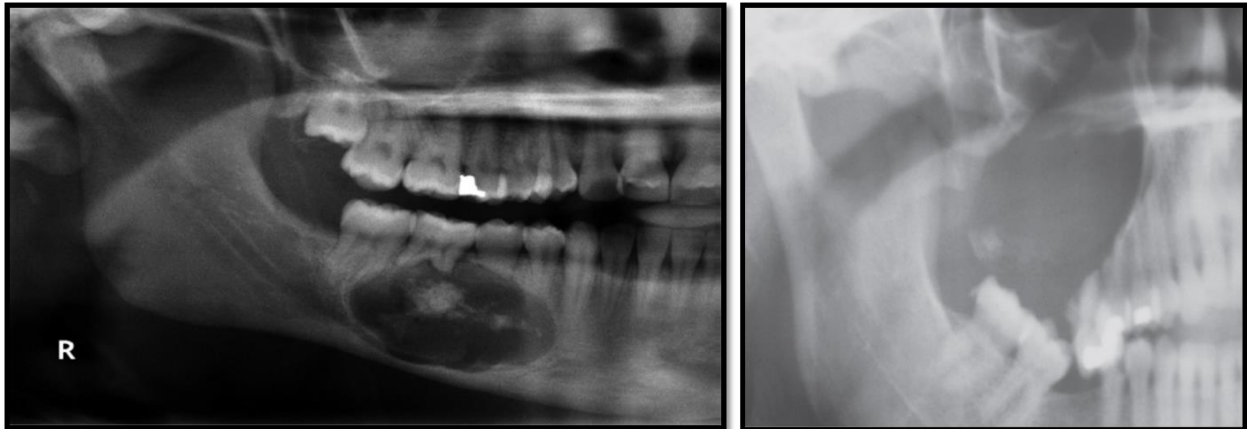
### **Clinical Features:**

A peak incidence in the second decade .It usually appears in individuals younger than 40 years of age and has a decided predilection for females .More than 70% of COCs are seen in the maxilla. Rarely, COCs may present as localized extraosseous masses involving the gingiva.Those presenting in an extraosseous or peripheral location are usually noted in individuals older than 50 years of age and are found anterior to the first molar region.



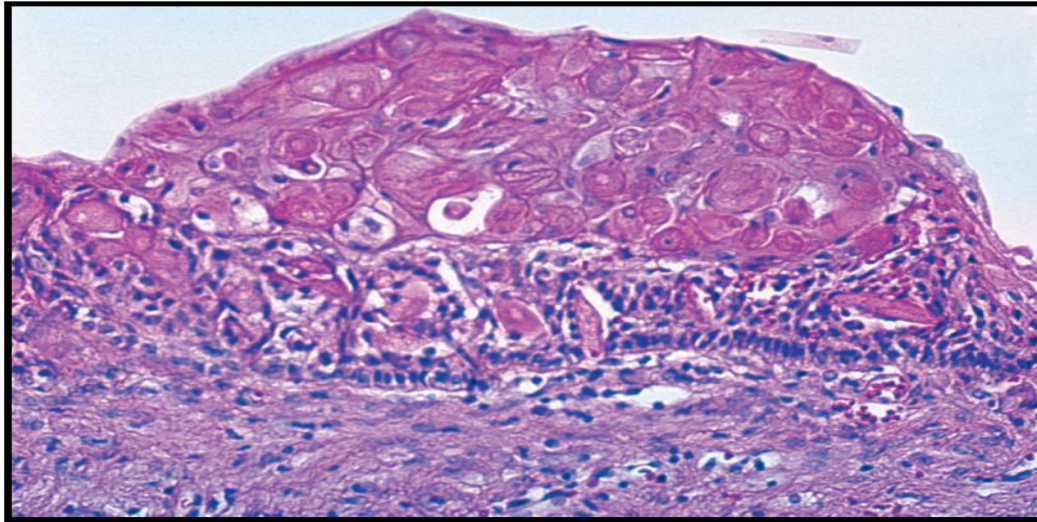
### Radiographically:

COCs may present as unilocular or multilocular radiolucencies with discrete, well-demarcated margins. Within the radiolucency may be scattered, irregularly sized calcifications. Such opacities may produce a salt-and-pepper type of pattern, with an equal and diffuse distribution. In some cases, mineralization may develop to such an extent that the radiographic margins of the lesion are difficult to determine.

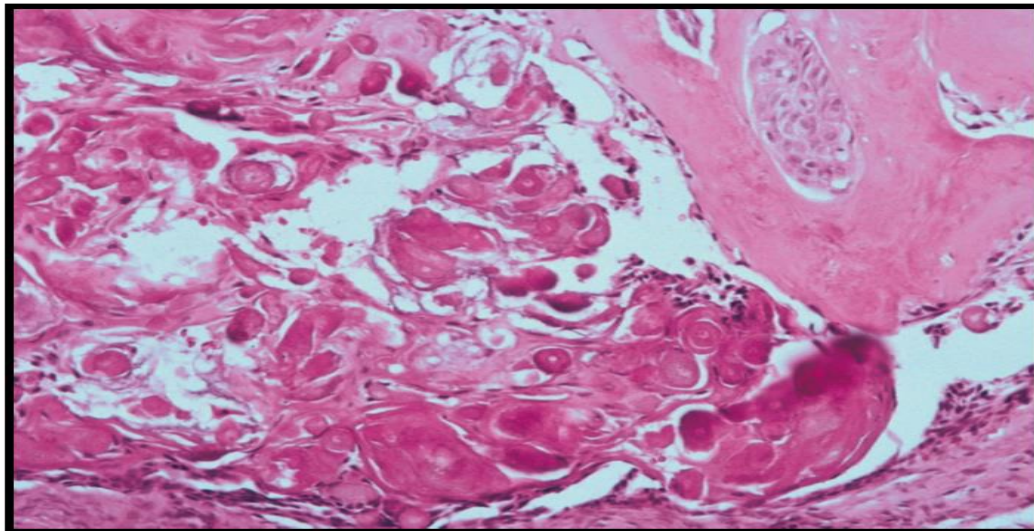


### Histopathology:

Most COCs present as well-delineated cystic proliferations with a fibrous connective tissue wall lined by odontogenic epithelium. Intraluminal epithelial proliferation occasionally obscures the cyst lumen, thereby producing the impression of a solid tumor. The epithelial lining is of variable thickness. The basal epithelium may be prominent focally, with hyperchromatic nuclei and a cuboidal to columnar pattern. Above the basal layer are more loosely arranged epithelial cells, sometimes resembling the stellate reticulum of the enamel organ. The most prominent and unique microscopic feature is the presence of so-called ghost cell keratinization. Ghost cells are anucleate and retain the outline of the cell membrane. These cells undergo dystrophic mineralization characterized by fine basophilic granularity, which may eventually result in large sheets of calcified material. On occasion, ghost cells may become displaced in the connective tissue wall, eliciting a foreign body giant cell response.



The cyst lining shows Ameloblastoma -like epithelial cells, with a columnar basal layer. Large eosinophilic ghost cells are present within the epithelial lining.



Eosinophilic dentinoid material is present adjacent to a sheet of ghost cells.

#### **Treatment and Prognosis:**

Treatment is usually more aggressive than simple curettage due to the unpredictable biological behavior of this lesion. Patients should be monitored following treatment because recurrences are not uncommon. Management of the extraosseous or peripheral variant is conservative because recurrence is not characteristic.