Oral Pathology

**Periapical Pathology**

Lecture 3

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**Periapical Pathology**

Inflammation in the periapical area of the periodontal ligament is similar to that occurring elsewhere in the body. The tissue reaction to irritation is a dynamic response, vacillating with time between acute and chronic inflammation. Most periapical inflammation will resolve spontaneously once the causative agent has been removed.

The **four** major factors follow:

1. Presence of an open or closed pulpitis.
2. Virulence of the involved microorganisms.
3. Extent of sclerosis of the dentinal tubules.
4. Competency of the host immune response.

When condition is the presence of an open

chronic pulpitis, bacteria of low virulence, an older tooth with sclerotic dentinal tubules, and a healthy patient, the changes at the apex of the tooth are mild and chronic.

Multiple factors are associated with little or no activation of the inflammatory response; instead they act as stimulants to the fibroblastic, osteoblastic cells, scar tissue and dense bone produced in the area.

When condition is the presence of a closed acute pulpitis, large numbers of highly virulent bacteria, and open dentinal tubules of young teeth, the inflammation at the apex of the tooth will rapidly intensify and large amounts of bacterial toxins and autolytic enzymes will be produced and disseminated. Result in rapid destruction of the periapical tissue and surrounding bone takes place; the process quickly extends into the adjacent marrow spaces.

# Etiology:

The main causes of periapical periodontitis are:

* Pulpitis and pulp necrosis.
* Trauma.
* Endodontic treatment.

# PERIAPICAL GRANULOMA (CHRONIC APICAL PERIODONTITIS)

The term periapical granuloma refers to a mass of chronically or subacutely inflamed granulation tissue at the apex of a nonvital tooth.

The name of granuloma is commonly used name is not totally accurate because the lesion does not show true granulomatous inflammation microscopically.

# Clinical Features:

🗷 Chronic lesions (Periapical granulomas) often are asymptomatic.

🗷 The involved tooth does not demonstrate mobility or significant sensitivity to palpation and percussion.

🗷 The soft tissue overlying the apex may or may not be tender.

🗷 The tooth does not respond to thermal or electric pulp tests unless the pulpal necrosis is limited to a single canal in a multirooted tooth.

🗷 Pain may associate with acute exacerbation of a chronic lesion.

# Radiographic Features:

Most lesions are discovered on routine radiographic examination and demonstrate little additional change radiographically which may show:

* + The associated radiolucencies are variable, ranging from small to

lucencies exceeding 2 cm in diameter.

* + Affected teeth typically reveal loss of the apical lamina dura.
	+ The lesion may be circumscribed or ill-defined and may or may not demonstrate a surrounding radiopaque rim.
	+ Root resorption may be seen

# Histopathology:

A periapical granuloma is composed of an outer capsule of dense fibrous tissue and a central zone of granulation tissue. The central zone will often contain macrophages with a foamy cytoplasm caused by phagocytized cholesterol.

Some cholesterol crystals may be present, surrounded by multinucleated giant cells and areas of red blood cell extravasation with hemosiderin pigmentation. Epithelial rests of Malassez may be identified within the granulation tissue.

# Treatment and Prognosis:

The treatment of a periapical granuloma depends on the condition of the tooth as a whole. Because of the anatomic complexity of the root canal systems, that the goal of endodontics is to reduce the microbial load to a level that is insufficient to maintain periapical inflammation.

If the tooth is restorable, the root canal can be filled.

If the root canal cannot be filled and the apical area is in a location accessible for surgery, an apicoectomy may be performed to remove the granuloma; it is reserved for lesions larger than 2 cm or those associated with teeth that are not appropriate for conventional endodontic therapy; otherwise, the tooth is

extracted and the periapical granuloma is curetted through the tooth socket.

Failure to resolve or remove a periapical granuloma commonly results in

* The development of a periapical cyst.
* Fibrous periapical scars occur most frequently when both the facial and lingual cortical plates have been lost; the development of a periapical scar is not an indication for future surgery.
* Failure can occur in cases with excellent endodontic therapy but poor coronal restoration.
* Suppuration and sinus formation.
* Periradicular infection.
* Periodontal disease.

# Sequelae of Periapical Granuloma:

1. The granuloma will continue to enlarge and be associated with continued resorption of bone.
2. Acute exacerbation and may progress to abscess formation.
3. Suppuration may occur in the granuloma. This may continue to enlarge to form an acute periapical (alveolar) abscess.
4. Proliferation of the epithelial cell rests of Malassez associated with the inflammation may lead to the development of an inflammatory radicular cyst.
5. Low-grade irritation to the apical tissues may result in bone apposition (osteosclerosis) rather than resorption and may also result in the opposition of cementum on the adjacent root surface to produce hypercementosis.

# PERIAPICAL CYST (RADICULAR CYST; APICAL PERIODONTAL CYST)

Epithelium at the apex of a nonvital tooth presumably can be stimulated by inflammation to form a true epithelium lined cyst, or periapical cyst. The source of the epithelium is usually a rest of Malassez but also may be traced to crevicular epithelium, sinus lining, or epithelial lining of sinus tracts.

# Clinical and Radiographic features

Radicular cysts are subdivided into apical, lateral, and residual types depending on the anatomical relationship of the cyst to the root of the tooth.

When small they are frequently symptomless and are usually discovered during routine radiological examination.

**Apical radicular cysts** (periapical cysts) are the most common cystic lesions in the jaws and are always associated with the apices of non-vital teeth. They account for about 75 per cent of all radicular cysts.

As they enlarge they produce expansion of the alveolar bone and ultimately may discharge through a sinus.

The cyst may perforate the cortex and present as a bluish, fluctuant, submucosal swelling.

The cyst can arise at any age, but are rare in deciduous dentition. They are most common between age (20 – 60). They can occur in relation to anterior tooth in the arch although 60% are found in the maxilla where there is a particular high incidence in anterior teeth.

Patients with periapical cysts have no symptoms unless there is an acute inflammatory exacerbation which may readily progress to abscess formation.

The radiographic pattern is identical to that of a periapical granuloma. Periapical Cyst present as round or ovoid radiolucency at the root apex.

The lesion is well circumscribed and may be surrounded by radiopaque margin continuous with lamina dura of involved tooth.

Also there is a loss of the lamina dura is seen along the adjacent root, and a rounded radiolucency encircles the affected tooth apex. Root resorption is common. These are most frequently associated with molar teeth and appear as a radiolucent zone that surrounds the roots and fills the interradicular space at the bifurcation.

# Residual Periapical Cyst

The residual cyst is a radicular cyst that has remained in the jaw and failed to resolve following extraction of the involved tooth. The residual periapical cyst appears as a round to oval radiolucency of variable size within the alveolar ridge at the site of a previous tooth extraction. As the cyst ages, degeneration of the cellular contents within the lumen occasionally leads to dystrophic calcification and central luminal radiopacity.

# Lateral Radicular Cyst

The lateral type is very uncommon and arises as a result of extension of inflammation from the pulp into the lateral periodontium along a lateral root canal.

Radiographically cysts appear as discrete radiolucencies along the lateral aspect of the root. Loss of lamina dura and an obvious source of inflammation may not be detected without a high index of suspicion.

Before surgical exploration of laterally positioned radiolucencies, a thorough evaluation of the periodontal status and vitality of adjacent teeth should be performed. Many examples of the so-called globulomaxillary cyst prove to be of inflammatory origin and represent lateral radicular cysts.

# Pathogenesis

Radicular cysts arise from proliferation of the rests of Malassez within chronic periapical granulomas, but not all granulomas progress to cysts.

The factors which determine why cystic transformation occurs in some, and the mechanisms involved in the formation of the cyst are controversial.

It is assumed that the environment within the chronically inflamed granuloma, which is likely to be rich in cytokines including growth factors, stimulates the rests of Malassez to proliferate. Strands and sheets of squamous epithelium derived from proliferation of the rests are common findings in periapical granulomas.

The mechanism of formation of an epithelial lined cyst cavity within the granuloma is unclear. Two main mechanisms have been proposed:

1. Degeneration and death of central cells within a proliferating mass of epithelium. Epithelium is avascular and transport of metabolites and gaseous exchange occur by diffusion. The microcyst so formed then continues to expand.
2. Degeneration and liquefactive necrosis of granulation tissue. It is suggested that areas of granulation tissue within the granuloma may undergo necrosis due to release toxic products from a dead pulp or from infecting organism. Epithelial proliferation to surround such an area of necrosis results in the formation of a cyst.

# Histopathology

Radicular cysts are lined wholly or in part by non-keratinized stratified squamous epithelium supported by a chronically inflamed fibrous tissue capsule. Most radicular cyst cavities are separated from the apex by the chronically inflamed capsule.

The wall of the cyst consists of dense fibrous connective tissue often with an inflammatory infiltrate containing lymphocytes variably intermixed with neutrophils, plasma cells, histiocytes, and is richly vascular.

Breaks in the lining epithelial discontinuities are common. Hyperplasia is a prominent feature in long anastomosing cords of epithelium forming complex arcades extending into the surrounding capsule.

Metaplasia of the epithelial lining may give rise to mucous cells, found in about 40 % of radicular cyst linings and, although some maxillary periapical cysts lined by pseudostratified columnar epithelium, ciliated cells that are areas of respiratory-type epithelium may have originated from the adjacent sinus lining. In approximately 10 % of cases the lining contains hyaline eosinophilic bodies; linear or arch-shaped calcifications known as Rushton bodies of varying size and shape. Cholesterol clefts with multinucleated giant cells, red blood cells, and areas of hemosiderin pigmentation may be present in the lumen, wall, or both.

# Treatment and Prognosis

A periapical cyst is treated in the same manner as a periapical granuloma. When clinical and radiographic features indicate a periapical inflammatory lesion, extraction and the periapical cyst is curetted through the tooth socket or conservative nonsurgical endodontic therapy is performed.

Periapical surgery typically is performed for lesions exceeding 2 cm and those associated with teeth that are not suitable for conventional endodontics. Biopsy is indicated to rule out other possible pathologic processes.