

Radicular Cyst: Newer Avenues Explored- Review article

Brajesh Kumar, Sujata Saxena, Ravi Seth, Sunita Pathak , Aparna Shukla*

Rama Dental College, Hospital & Research Centre, Rama University, Kanpur, Uttar Pradesh

E-mail ID: bkrajpootkdc@gmail.com

ABSTRACT

Radicular cysts or periapical cysts are the most common types of inflammatory cysts to affect the jaw bones. Radicular cysts may account for up to as many as 70% of all cystic jaw bones lesions. These cysts are through to be the end results of epithelial cell rests proliferating during inflammation of teeth with infected and necrotic pulp, and apical periodontitis. Unless the cyst becomes infected, they are usually asymptomatic. Typically, they present as osteolytic periapical lesions detected with radiographic imaging. Radicular cysts, when seen on radiographic imaging, tend to appear pear shaped or round. Lesions are typically less than 1 cm in size and are situated in the periapical region of teeth with unilocular and lucent characteristics.

During the past few decades several authors have perpetuated the notion that nearly half of all periapical lesions are radicular cysts. A few studies, based on meticulous serial sectioning of periapical lesions retrieved have shown that the actual incidence of radicular cyst is only about 15% of all periapical lesions. Equally significant was the discovery in 1980 and recent confirmation that radicular cysts exist in two structurally distinct classes namely, those containing cavities completely enclosed in epithelial lining (periapical true cysts) and those containing epithelium-lined cavities that are open to the root canals (periapical pocket cysts). From a clinical point of view a periapical pocket cyst may heal after conventional root canal therapy whereas an apical true cyst is less likely to be resolved without surgical intervention.

KEY WORDS

Apical periodontitis, apical pocket cysts, radicular cysts, apical true cysts

INTRODUCTION

A radicular cyst is generally defined as a cyst arising from epithelial residual (cell rests of Malassez) in the periodontal ligament as consequence of inflammation, usually following the death of dental pulp. Radicular cysts are the most common odontogenic cystic lesions of inflammatory origin affecting the jaws. They are most commonly found at the apices of the involved teeth; however, they may also be found on the lateral aspect of the roots in relation to lateral accessory root canals.^{1,2} Most of the radicular cyst are symptomless and are discovered when periapical radiograph is taken of teeth with non-vital pulps. Patient often complains of slowly enlarging swellings.³

Radiographically most radicular cyst appears as round or pear shaped unilocular radiolucent lesion in the periapical region. The cyst may displace adjacent teeth or cause mild root resorption.⁴

Quite often a radicular cyst remains behind in the jaws after removal of the offending tooth and this is referred to as a residual cyst.² They are most commonly associated with permanent teeth and are rare in the primary teeth.⁵

EPIDEMIOLOGY

Radicular cysts are the most common of all jaw cysts and comprise about 52% to 68% of all the cysts affecting the human jaws.⁶ Actual prevalence of cysts is only about 15% of all apical periodontitis lesions. Their prevalence is highest among patients in their third decade of life, and higher among men than women.⁷

PATHOGENESIS

A radicular cyst is an odontogenic cyst of inflammatory origin preceded by a chronic periapical granuloma and stimulation of cell rests of Malassez found in the periodontal membrane. Rests of Malassez are remnants of Hertwigs' root sheath. Although the source of the epithelium is usually a rest of Malassez, other sources, such as crevicular epithelium, sinus lining, or epithelium lining of fistulous tracts, have been suggested.⁸ These cysts usually arise from the epithelial residues in the periodontal ligament as a result of inflammation. They generally result due to pulpal infection following dental caries. Bacteria from the gingival sulci or periodontal pockets have been suggested to reach the root canals of these teeth through severed periodontal blood vessels.⁹ Radicular cysts are inflammatory lesions leading to bone resorption and can reach great dimensions and become symptomatic when infected or with great size due to nerve compression.^{10,11} Pulpal infection can also occur through exposed dentinal tubules at the cervical root surface, due to gaps in the cemental coating. Microbes have also been claimed to 'seed' in the necrotic pulp via the blood circulation (anachoresis). Initially, the tooth pulp becomes infected and necrotic by an autogenous oral microflora. The endodontic environment provides a selective habitat for the establishment of a mixed, predominantly anaerobic flora. Collectively, this habitat adapted polymicrobial community residing in the root canal has several biological and pathogenic properties, such as antigenicity, mitogenic activity, chemotaxis, enzymatic histolysis, and activation of host cells. The microbial invaders in the root canal can advance, or their products can egress, into the periapex. In response, the host mounts an array of defences consisting of several classes of cells, intercellular messengers, antibodies, and effector molecules. The microbial factors and host defence forces encounter, clash with, and destroy much of the periapical tissue, resulting in the formation of various categories of apical periodontitis lesions. Periapical cysts are a direct sequel to chronic apical periodontitis, but not every chronic lesion develops into a cyst. There are two distinct categories of periapical cysts, namely, those containing cavities completely enclosed in epithelial lining, and those containing epithelium-lined cavities that are open to the root canals. The latter was originally described as 'bay cysts' and has been newly designated as 'periapical pocket cysts'. More than half of the cystic lesions are true apical cysts, and the remainder are apical pocket cysts.

PERIAPICAL TRUE CYST

The periapical true cyst may be defined as a chronic inflammatory lesion at the periapex that contains an epithelium lined, closed pathological cavity. The pathogenesis of radicular cysts, presumably the true cysts, has been discussed by various authors. An apical cyst is considered to be a direct sequel to apical granuloma, although a granuloma need not always develop into

a cyst. Due to still unexplainable reasons only a small fraction (< 10%) of the periapical lesions advances into true radicular cysts. The process of the true cyst formation has been discussed in three stages. During the first phase the dormant cell-rests of Malassez begin to proliferate, probably under the influence of growth factors, cell mediators and metabolites that are released by various cells residing in the periapical lesion. During the second phase an epithelium-lined cavity comes into existence. There are two main theories regarding the formation of the cyst cavity

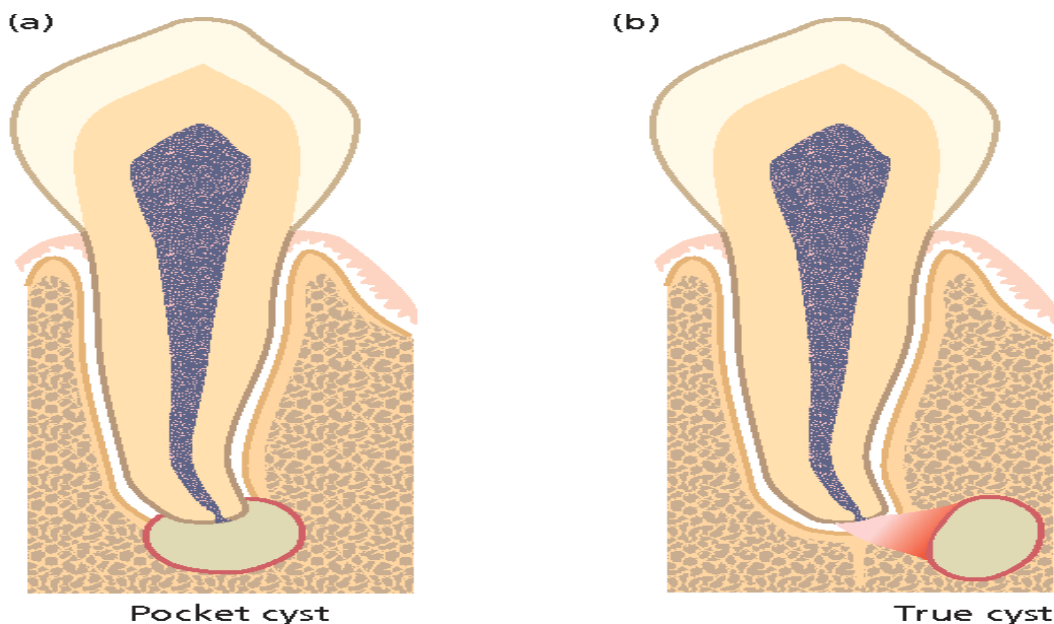
- (i) The 'nutritional deficiency theory' is based on the assumption that the central cells of the epithelial strands get removed from their source of nutrition and undergo necrosis and liquefactive degeneration. The accumulating products in turn attract neutrophilic granulocytes into the necrotic area. Such microcavities containing degenerating epithelial cells, infiltrating mobile cells and tissue fluid coalesce to form the cyst cavity lined by stratified epithelium,
- (ii) The 'abscess theory' postulates that the proliferating epithelium lines an abscess cavity formed by tissue necrosis and lysis because of the inherent nature of the epithelial cells to cover exposed connective tissue surfaces.

During the third phase the cyst grows the exact mechanism of which is still unknown. It is generally believed to be by osmosis. The presence of necrotic tissue in the cyst lumen attracts neutrophilic granulocytes, which extravasate and transmigrate through the epithelial lining into the cyst cavity where they perish. The lytic products of the dying cells in the cyst-lumen release a greater number of molecules. As a result, the osmotic pressure of the cyst fluid rises to a level higher than that of the tissue fluid. The latter diffuses into the cyst cavity so as to raise the intraluminal hydrostatic pressure well above the capillary pressure. The increased intracyst pressure may lead to bone resorption and expansion of the cyst. However, the fact that an apical pocket cyst with lumen open to the necrotic root canal can become larger would eliminate osmotic pressure as a potential factor in the development of radicular cysts. On the other hand, there is increasing evidence in support of a molecular mechanism for cyst expansion. The macrophages and T-lymphocytes in the cyst wall may provide a continuous source of bone resorptive metabolites and cytokines. The presence of effector molecules such as matrix metalloproteinase-1&2 have also been reported in the cyst walls

PERIAPICAL POCKET CYST

The periapical pocket cyst is a radicular cyst containing an epithelium-lined pathological cavity which is open to the root canal of the affected tooth. As has been mentioned previously such lesions were originally described as 'bay cysts' and has been recently investigated in detail and renamed as the 'periapical pocket cysts'. It is postulated that a pocket cyst is initiated by a small bubble-like extension of the infected root canal space into the periapex. The micro luminal space is enclosed in a stratified squamous epithelium which grows and forms an epithelial collar around the root tip. The epithelial collar forms an 'epithelial attachment' to the root surface so as to seal off the infected root canal and the microcystic lumen from the periapical milieu. The presence of micro-organisms in the apical root canal attracts neutrophilic granulocytes by chemotaxis into the microlumen. However, the pouch-like lumen biologically outside the body milieu acts as a 'death trap' and 'garbage bag' to the externalized and dying neutrophils. As the necrotic tissue and microbial products accumulate,

the sac-like lumen enlarges to accommodate the debris to form a voluminous diverticulum of the root canal space into the periapical area. It has been pointed out that from the pathogenic, structural, tissue dynamic and host-beneficial and protective stand points, the epithelium-lined pouch-like extension of the root canal space of such lesions has much in common with a marginal periodontal pocket so as to justify the terminology of ‘periapical pocket cyst’ as against a biologically meaningless nomenclature of ‘bay cyst’.



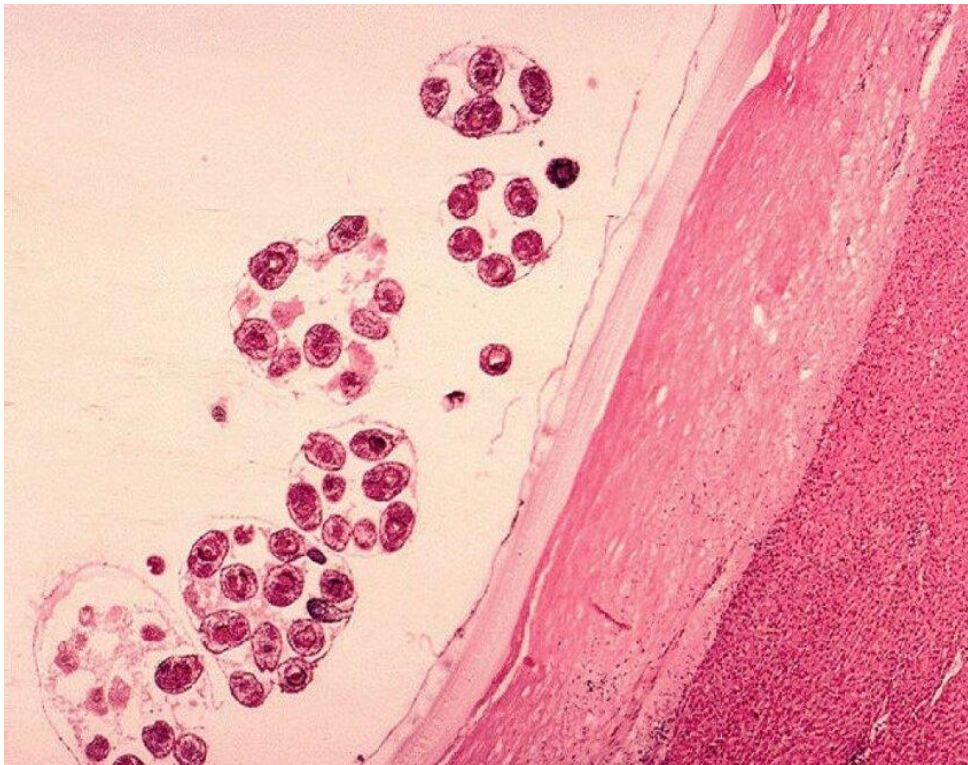
RADIOLOGICAL FEATURES

Radiographically most radicular cysts appear as round or pearshaped unilocular radiolucent lesions in the periapical region. The cysts may displace adjacent teeth or cause mild root resorption. Radiographically, distinguishing between a granuloma and a cyst is impossible, although some say that if the lesion larger than 2 cm is more likely to be a cyst.^{12,13}



PATHOLOGICAL FEATURES

The gross specimens may be spherical or ovoid intact cystic masses, but often they are irregular and collapsed. The walls vary from extremely thin to a thickness of about 5 mm. The inner surface may be smooth or corrugated. Yellow mural nodules of cholesterol may project into the cavity. The fluid contents are usually brown resulting from the breakdown of blood and when cholesterol crystals are present, they impart a shimmering gold or straw colour.⁷ Almost all radicular cysts are histopathologically lined wholly or in part by non-keratinized stratified squamous epithelium. These linings may be, discontinuous in part and range in thickness from one to 50 cell layers. The majority are between six and 20 cell layers thick. The epithelial linings may be proliferating and show arcading with an intense associated inflammatory process or be quiescent and fairly regular with a certain degree of differentiation. The inflammatory cell infiltrate in the proliferating epithelial linings consist predominantly of polymorphonuclear leucocytes whereas the adjacent fibrous capsule is infiltrated mainly by chronic inflammatory cells. In approximately 10 per cent of periapical cysts, hyaline bodies (often referred to as Rushton's hyaline bodies) are found in the epithelial linings. Such bodies within the epithelial lining are characterized by a glassy pink (hyalinized) appearance. The origin of such bodies is believed to be related to previous haemorrhage within the inflamed cyst wall



TREATMENT

The treatment options for radicular cyst can be conventional nonsurgical root canal therapy when lesion is localized or surgical treatment like enucleation, marsupialization or decompression when lesion is large.¹⁴ The choice of treatment may be determined by the factors such as the extension of the lesion, relation with noble structures, origin, and the clinical characteristics of the lesion, and cooperation and systemic condition of the patient.^{15,16} The treatments of these cysts are still under discussion and many professionals'

options for a conservative treatment by means of endodontic technique.¹⁷ However, in large lesions the endodontic treatment alone is not efficient and it should be associated to a decompression or a marsupialization or even to enucleation.^{18,19}

REFERENCES

1. Narula H, Ahuja B, Yeluri R, Baliga S, Munshi AK. Conservative non-surgical management of an infected radicular cyst. *Contemp Clin Dent* 2011; 2:368-71.
2. Latoo S, Shah AA, Jan SM, Qadir S, Ahmed I, Purra AR, Malik AH. Radicular Cyst. *JK Science*. 2009;11: 187-9.
3. Manwar NU, Agrawal A, Chandak MG. Management of infected radicular cyst by surgical approach. *International Journal of Dental Clinics*. 2011; 3:75-76.
4. Cawson RA, Odell EW, Porter S. Cawson's essentials of oral pathology and oral Medicine. 7th Ed, Churchill Livingstone, Edn2002:102-21.
5. Lustman J, Shear M. Radicular cysts arising from deciduous teeth: Review of the literature and report of 23 cases. *Int J Oral Surg* 1985; 14:153-61.
6. Nair PNR. Non-microbial etiology: periapical cysts sustain post-treatment apical Periodontitis. *Endodontic Topics* 2003; 6:96-113.
7. Shear M. Cysts of the oral region, 3rd edition. Bostan wright. 1992: 136-70.
8. Amos MJ, Dalghous.A, Alkhabuli.J. Massive maxillary radicular cyst resending as facial fracture and abscess a case report. *Libyan J Med* 2007:211-13.
9. Grossman LI. Origin of microorganisms in traumatized, pulpless, sound teeth. *J Dent Res*. 1967; 46: 551-3.
10. Gibson G. M. et al. Case report: A large radicular cyst involving the entire maxillary sinus. *General Dentistry* 2001; 50:80-81.
11. Shafer W. G. A textbook of oral pathology. 5th ed. Philadelphia: WB Saunders 2006:376-378.
12. Cawson RA, Odell EW, Porter S. Cawsons essentials of oral pathology and oral medicine. 7th edition, Churchill Livingstone, Edinburgh. 2002; 15: 139- 150.
13. Ragezi JA, Scubba JJ, Jordan RCK. Oral pathology: clinical pathologic correlations. 4th edition, WB Saunders, St Louis. 2003: 241-54.
14. Ribeiro Paulo Domingos, Gonçalves Eduardo S., Neto Eduardo S. Surgical approaches of extensive periapical cyst. Considerations about surgical technique. *Salusvita Bauru* 2004; 23: 317-328.
15. Michael Mh, Gary LL. Conservative treatment of persistent periradicular lesions using aspiration and irrigation. *J Endod* 1990; 16:182-6.
16. Neaverth EJ, Burg HA. Decompression of large periapical cystic lesions. *J Endod* 1982; 8:175-82.
17. HoenMM. Conservative Treatment of Persistent Periradicular Lesions Using Aspiration and Irrigation. *Journal of Endodontics*1990; 16: 182-6.
18. Danin J. et al. Outcomes of periradicular surgery in cases with apical pathosis and untreated canals. *Oral Surgery and Oral Medicine and Oral Pathology and Oral Radiol. Endodontic* 1999; 87:227-32.
19. Rees. J.S. Conservative Management of a large maxillary cyst. *Int Endod Journal*1997; 30: 64-67.