INTRICATE PATHOGENESIS OF RADICULAR CYST
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INTRODUCTION

According to Kramer (1974) “Cyst is a pathological cavity
filled with fluid, semisolid or gaseous content which is not
created by the accumulation of the pus. Most of the cyst but not
all are lined by the epithelium” (Shear & Speight, 2007) (Figure 1).

World health organization (WHO) has classified cysts as
developmental, neoplastic and inflammatory origin(Kramer et
al, 1992). Odontogenic cysts are derived from-tooth germ,
epithelial cell rests of Malassez, reduced enamel epithelium,
remnants of dental lamina and basal layer of oral
epithelium(Shafer, 2016). Radicular cysts are the most
common developmental inflammatory odontogenic cysts with
an incidence between 50-60% as described by Tay 50.7% (Tay et al,
2004), Shear et al 52.3% (Shear, 1961), Jones et al 52.3% (Jones et al,
2006), Silvia et al 87.5% (Silvia et al, 2008) while Sharifian et al reported incidence of 37.9% (Sharifian et al,
2011). Most frequently found in the apices of the teeth but can
also be seen along with lateral and accessory canals of the tooth
(Narula H et al, 2011). The cyst is formed by hydropic
degeneration of epithelial cell rests of Malassez due to
inflammatory reaction in periapical region of the tooth (Rees,
1997). Epithelial cell rest of Malassez were first described by
Augustin Serres in 1817 (Serres, 1817)and Louis Charles
Malassez in 1888 established that these epithelial cells persist
form part of periodontal ligament (Malassez, 1885).

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ABSTRACT

Radicular cyst is an inflammatory odontogenic cyst of the jaws which is most commonly seen along
with necrotic pulp of the tooth following inflammatory reaction due to physical, bacterial or
chemical injury. They are most commonly seen in maxillary anterior region. Proliferation of cell
rests of Malassez which are remnants of Hertwig’s epithelial root sheath (HERS) plays the prime
role in its pathogenesis. In this article the various phases of pathogenesis have been explained in an
unpretentious manner.

Fig 1 Cystic Components

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etiological factor in pathogenesis of radicular cyst are bacterial endotoxins which further leads to proliferation of epithelial cells (Kiss, 2004).

**Pathogenesis**

The pathogenesis of radicular cyst is divided in three phases – Phase of initiation, Phase of cyst formation and phase of cyst expansion

**Role of HERS & Epithelial Cell Rest of Malassez**

Epithelial cell rests of Malassez are the result of fragmentation of Hertwig’s epithelial root sheath (which is formed by combination of inner and outer enamel epithelium) which further stimulates the differentiation of ectomesenchymal cells into odontoblasts to secrete root dentin along with differentiation of periodontium. After this HERS undergoes disintegration and persists as dispersed islands of epithelial cells known as epithelial cell rests of Malassez in periodontal ligament and pulp (Xiong et al., 2012). It is considered that these epithelial cell rests of Malassez proliferate to form epithelial linings of various odontogenic cysts such as radicular cyst under the influence of various stimuli (Rincon, 2006) (Flowchart 1).

**Flowchart 1 Role of HERS**

**Phases of Cyst Initiation**

The epithelial lining of radicular cyst is derived from cell rest of Malassez in the periodontal ligament but sometimes it is derived from respiratory epithelium from the maxillary sinus when periapical lesion communicates with the sinus wall, oral epithelium from the fistulous tract and from the oral epithelium proliferating from the periodontal pocket (Shafer, 2016). Themain etiological factor in the development of radicular cyst is the pulpal infection as a result of dental caries, as a result bacterium will reach to the root canals of the tooth from the periodontal pocket or gingival sulci through severed periodontal blood vessels (Shear & Speight, 2007). As a result of pulpal infection, the host shows defensive mechanism by presenting various intercellular messengers, effector molecules, antibodies and several classes of cells (Flowchart 2).

**Flowchart 2 cyst initiation**

Due to this confrontation between bacterial action and the host defensive mechanism there is destruction of periapical tissue causing apical periodontitis (Grossman, 1967). And this will further result in formation of radicular cyst (Figure 2).

**Fig 2 Phase of Cyst Initiation**

Cysts containing cavities completely enclosed in the epithelium lining are called TRUE radicular cyst and the cysts cavities containing epithelial lining but open to the root canals are called as Bay cyst or the pocket cyst (Nair, 2004).

**Phase of cyst formation**

During the second phase epithelium lined cavity comes into existence. Lin et al summarized three theories for the cyst formation (Latoo et al, 2009) (Figure 3).
Osmosis plays an important role in accumulation of fluid in secretion, transudation/exudation. Pressure exerted by its luminal fluid which rises as a result of pressure exerted by its luminal fluid which rises as a result of Cyst enlargement has been partly attributed to the hydrostatic polarized leading to the infection persists then the epithelial cells will become sheath from gingival epithelium. Hence it becomes clear that if of Malassez are the remnants of Hertwig's epithelial root epithelium to g protective host response there will be bone resorption allowing protective host response there will be bone resorption allowing breached with trauma leading to microbial invasion and as a hem. 2010). Desmosomes connect one cell to the other while i.e. desmosomes and hemidesmosomes (George & Huang, i.e. desmosomes and hemidesmosomes (George & Huang, a contact with the gingival epithelium through macula adherens to tooth appears in the oral cavity from the gingiva but it still has epithelium is formed. As stated by George T& epithelium is formed. As stated by George T& formation of cyst formation but it is unclear that why stratified necrosis is not seen in the center of epithelial strands. Abscess theory states that abscess is the reason for the formation of cyst formation but it is unclear that why stratified epithelium is lined by tissue necrosis and lysis due to intuitive nature of epithelial cells to cover exposed connective tissue surfaces (Takahashi, 1998).

Merging of Epithelial Strand theory: A three-dimensional ball mass is formed by the continued growth of the epithelial strands and the connective tissue trapped inside the ball mass degenerates leading to cyst formation.

Nutritional deficiency theory is unsound as epithelial strands in apical granulomas as frequently infiltrated with PMN’s but cell necrosis is not seen in the center of epithelial strands. Abscess theory states that abscess is the reason for the formation of cyst formation but it is unclear that why stratified epithelium is formed. As stated by George T&J Huang that the tooth appears in the oral cavity from the gingiva but it still has a contact with the gingival epithelium through macula adherens i.e. desmosomes and hemidesmosomes (George & Huang, 2010). Desmosomes connect one cell to the other while hemidesmosomes connect the basal layer of epithelial cells to the underlying basal lamina. But these connections can be breached with trauma leading to microbial invasion and as a protective host response there will be bone resorption allowing epithelium to grow apically. In Radicular cysts also the cell rest of Malassez are the remnants of Hertwig’s epithelial root sheath from gingival epithelium. Hence it becomes clear that if the infection persists then the epithelial cells will become polarized leading to a sack of epithelium lined cyst around the abscess.

Phase of Cyst Enlargement

Cyst enlargement has been partly attributed to the hydrostatic pressure exerted by its luminal fluid which rises as a result of secretion, transudation/exudation and osmosis/dialysis. Osmosis plays an important role in accumulation of fluid in odontogenic cysts (James, 1926). The raised osmolality of cystic fluid compared with the serum has been ascribed to the accumulation of lower molecular weight proteins and products of degenerating epithelial cells from the cyst lining. This volume expansion stretches the epithelial layer and peripheral cells divide further to maintain the epithelial lining intact. The osmolality gradient would be maintained by poor lymphatic drainage in cysts which would limit the normal removal of cyst macromolecular components (Troller, 1970; Main, 1970) (Figure 4 and 5).

CONCLUSION

Pathogenesis of any disease is very important to understand its progression and then the treatment of the same. Radicular cyst is the most common odontogenic cyst of the jaw. The cyst lining is derived from epithelial cell rests of Malassez which further proliferates to form the cyst. This article is explaining each and every step of the pathogenesis of the most common inflammatory odontogenic cyst i.e. Radicular cyst in a streamlined manner.

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