Comparison of components of odontogenic cyst fluids: A review
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Abstract
The cystic lesions that affect the oral and maxillofacial region are predominantly odontogenic in origin. The odontogenic cell rests entangled within tissue of the jaws such as cell rests of Malassez, cell rests of serre, and enamel organ leads to its formation. The factors leading to the enlargement of these jaw cysts are increased the permeability of cyst wall, increased the protein content of the cyst fluid, and when the intracystic fluid pressure on the jaw bone is increased. This review is an attempt to analyze and compare the components of cystic fluids such as albumin, prealbumin, globulin, and total protein content among various odontogenic cysts.

Keywords:
Albumin, prealbumin, odontogenic cysts, odontogenic cyst fluid, total protein content

Introduction
The odontogenic cystic lesions include inflammatory cysts such as radicular cyst; developmental cysts such as dentigerous cysts; and benign tumors such as a keratocystic odontogenic tumor which was previously called odontogenic keratocyst. Clinical and radiologic indices are often inadequate to discriminate reliably among these possibilities. The majority of these cysts are detected incidentally when radiologic imaging is performed for unrelated indications. Analysis of contents of cystic fluids may aid in an accurate diagnosis whenever a cyst is detected before surgical excision or conservative management. This review is an attempt to provide an overview of various odontogenic cysts and to discuss the values of albumin, globulin, and total protein content among various odontogenic cysts.

Review of Literature
The odontogenic keratocyst (OKC) was first introduced as a separate pathologic entity by Philipson in 1956. Various studies have reported that 11.25% of all odontogenic cysts are OKC and are considered to be developmental in origin.² Their pathognomonic microscopic features, potentially aggressive clinical behavior, and high recurrence rate make them a unique entity among odontogenic cysts. The WHO (2005) reclassified the lesion as a tumor and included it in the group of benign odontogenic tumors derived from odontogenic epithelium with mature fibrous stroma without odontogenic ectomesenchyme.³ The immunohistochemical expression of P53, Ki 67, proliferating cell nuclear antigen is higher in keratocystic odontogenic tumors than in other types of odontogenic cysts.⁴ The cystic lining is comprised the parakeratinized stratified squamous epithelium. In some cysts, corrugated surface epithelium can be seen.

The most common developmental odontogenic cyst is the dentigerous cyst. The cyst encloses the crown of an unerupted tooth by the expansion of its follicle due to a collection of cystic fluid. The exact pathogenesis of dentigerous cyst is unknown; however, most authors favor a developmental origin. It occupies the crown of an unerupted or supernumerary tooth by the expansion of its follicle and is attached to its neck. Microscopically, the dentigerous cyst lining resembles the reduced enamel epithelium and consists of flat, cuboidal cells 3-5 cell layer thickness. Mucous-producing cells may be present in the epithelium.⁵

The most common odontogenic cyst reported is the radicular cyst. Radicular cysts make around 52-68% of all cysts affecting the human jaws.⁶ The cystic lining of radicular cyst is comprised non-keratinized stratified squamous epithelium which of several layers in thickness. The epithelial linings may be proliferating and show arcading pattern with an intense inflammatory cell infiltrate. The inflammatory cell infiltrates in the proliferating...
epithelial linings is predominantly polymorphonuclear neutrophils leukocytes, whereas the adjacent fibrous capsule is infiltrated mainly by chronic inflammatory cells. Rushton bodies are characterized by a glassy pink (hyalized appearance) in approximately 10% of the radicular cysts. These hyaline bodies are believed to be due to the previous hemorrhage within the inflamed cyst wall.[4]

**Biochemical analysis**

The cystic fluid in radicular cysts is usually brown in color. The presence of cholesterol crystals imparts a shimmering gold or straw color. Yellow mural nodules of cholesterol may project into the cavity. Total protein content is usually between 5 and 11 g/100 ml.[6-8] The cystic fluid of dentigerous cyst is straw colored fluid. The total protein content in the dentigerous cyst is usually 4-8 g/100 ml.[3] Dirty white cheesy material was found on aspiration in all the cases of OKC. Keratin squames are usually found in the aspirated cystic fluid. Electrophoretic analysis revealed that the ratio of soluble protein to total protein content was lower than that in serum. Total protein content is <5 g/100 ml [Table 1].[6-8]

**Discussion**

The contents of odontogenic cysts are variable from clear yellow liquid to a semisolid cheese-like mass.[6-10] The odontogenic cystic fluid can be studied for their color, consistency, presence of cholesterol crystals, keratin flecks, and different protein fractions such as albumin, alpha and beta globulin, total protein content, and inorganic phosphates.[11-13]

Electrophoresis separates proteins based on their physical properties. The movement of charged particles through an electrolyte subjected to an electric field is called electrophoresis. The surface charge for various plasma proteins vary. They migrate at different rates from the point of application of the protein mixture to the other end of the cellulose acetate membrane (CAM) strip. They can be studied qualitatively and quantitatively.[14,15]

Scanning of the stained CAM strips by densitometer or elution can be done for the quantitative estimation of protein fractions. The areas below each section of the curve can be measured during scanning by an integrator. Each fraction can be calculated as a percent of the total by simple proportion.

The cystic content is centrifuged at 2000 rev/min for 5 min to remove cell debris and deposits. The supernatant cystic fluid thus collected can be analyzed for their protein contents by CAM electrophoresis. Qualitative estimation of prealbumin and albumin is done using sodium dodecyl sulfate polyacrylamide gel electrophoresis and visualization of prealbumin and albumin bands can be made under standardized conditions of the intensity of coomassie brilliant blue staining in transilluminated light in a scale.

The protein content and its different fractions can also be quantitated by scanning the CAM strips in a densitometer at 590 mm (green filter) and the relative percentage, and absolute value of different protein fractions such as albumin, globulin content along with different globular fractions can be estimated. Toller has suggested that these proteins are transported to the cystic fluid by immunoglobulin (Ig) producing cells. IgA, IgG, and IgM levels in cystic fluid can be assessed quantitatively.[16]

Cystic fluid accumulation causes the expansion of the cysts. Syringe aspiration is positive for almost all odontogenic cysts. Pre-operative diagnosis is important for all odontogenic cysts to obtain good results. Fine-needle aspiration cytology is the technique commonly used for pre-operative diagnosis. The aspirates taken from cystic lesions are poorly cellular.[16]

Smith et al. in their study showed that most cysts showed the presence of higher molecular weight proteins. The increased epithelial permeability together with discontinuities in the epithelial lining and intraepithelial channels facilitates the passage of lactoferrin into the cystic lumen.[17] Toller et al. suggested that clinically uninfected cyst walls of various types may produce Igs that may enter the cyst cavities by an active cellular transport mechanism. However, the finding of small amounts of “secretory” IgA in the cyst fluids suggested that a small proportion of cyst fluid Ig arrived by simple diffusion through the epithelial cyst wall.[18]

**Conclusion**

In this review, we have discussed the composition and components of various odontogenic cyst fluids including OKC, dentigerous cyst, and radicular cyst. Since odontogenic cysts incorporate an important part of the oral and maxillofacial lesions, diagnosing them before surgery will help us to determine surgical procedures, conservative or radical for preventing the future recurrence of the cyst. The recurrence rate of cysts can be reduced by diagnosing cysts before surgery and thereby formulating the surgical procedure. In OKC, the mean value of the total soluble protein content in a cystic fluid, albumin, and globulin levels were notably lower compared to dentigerous and radicular cyst. Thus, we conclude that it is necessary to evaluate and validate the clinical, radiological, and biochemical findings with histopathological features of odontogenic cystic lesions for proper diagnosis and treatment planning.

**Table 1:** Comparison of components of cystic fluid in odontogenic keratocyst, dentigerous cyst, and radicular cyst

<table>
<thead>
<tr>
<th>Type of cyst</th>
<th>Albumin</th>
<th>Globulin</th>
<th>Total protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odontogenic keratocyst</td>
<td>Between 2 and 4 g/dl</td>
<td>Between 0.5 and 2.5 g/dl</td>
<td>&lt;5 g/dl</td>
</tr>
<tr>
<td>Dentigerous cyst</td>
<td>Between 2 and 5 g/dl</td>
<td>Between 0.5 and 3.5 g/dl</td>
<td>Between 4 and 8 g/dl</td>
</tr>
<tr>
<td>Radicular cyst</td>
<td>Between 2.5 and 5 g/dl</td>
<td>Between 2 and 5 g/dl</td>
<td>Between 5 and 11 g/dl</td>
</tr>
</tbody>
</table>

inorganic phosphorus level, and total protein estimation can be done by Biuret method.
References
