Pindborg Tumor: Review of Literature and Case Reports

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ABSTRACT

Pindborg or calcifying epithelial odontogenic tumor (CEOT) is a benign and noninvasive tumor that presents poor clinical features, a typical radiological picture and a characteristic histomorphology. CEOT is an uncommon odontogenic neoplasm, representing only 1% of all odontogenic tumors. The average age of occurrence is around 40 years with almost 1:1 gender ratio. It shows a mandible: maxilla site ratio of 2:1 and is mainly located in the molar: premolar (3:1) region. The tumor usually appears as a radiolucent area containing radiopaque masses scattered throughout. Histologically, it is characterized by densely eosinophilic cells, which tend to calcify, homogeneous eosinophilic substance believed to be amyloid and calcifications in concentric layers (Liesegang rings). Two case reports are presented here in patients aged 30 years and 14 years.

Keywords: Oral surgery, Odontogenic tumors, Mandibular neoplasms, Calcifying epithelial odontogenic tumor, Pindborg tumor.

INTRODUCTION

JJ Pindborg, a Danish pathologist, who reported three cases in 1955, first described calcifying epithelial odontogenic tumor (CEOT) or Pindborg tumor. Lucas1 suggests that CEOT makes up 1% of all odontogenic tumors.

CEOT is a benign but locally aggressive tumor. The clinical feature is most commonly a slow-growing painless swelling. The tumor may show considerable radiographic variation. Usually, this tumor shows characteristic histologic features. Surgical treatment varies from simple enucleation to more or less partial resection of the affected bone.

CASE REPORTS

Case 1

A 30-year-old male had a complaint of a painless swelling in relation to the left mandibular region since 2 years, which had been gradually increasing in size. The patient stated that a tooth in that region had fallen off (which was later found out to be a retained deciduous molar), following which the patient started noticing the development of the swelling.

Extraoral examination revealed an asymmetrical face with fullness in relation to the left mandibular parasympysis region. Bilateral nontender submandibular lymphadenopathy was noted. Intraoral examination showed an oval swelling measuring approximately 4 × 5 cm, extending from the distal aspect of tooth no. 31 to distal aspect of 37. The swelling had caused an enlargement of both the buccal and lingual cortical plates. The surface of the swelling was pinkish-red in color with a smooth texture and had variable consistency. Clinically, there was a missing tooth no. 36. Teeth nos. 33, 34 and 35 had grade-I mobility.

Radiographic examination showed a mixed radiopaque-radiolucent lesion, with islands or masses of radiopacities distributed throughout. One striking finding was the presence of an impacted tooth no. 36 in relation to the lesion (Fig. 1).

Fig. 1: Case 2—Radiographic picture showing mixed radiopaque-radiolucent lesion
The histologic picture revealed sheets of polyhedral epithelial cells with multiple calcific bodies with a laminated appearance—Liesegang rings (Fig. 2).

**Case 2**

The second case, a 14-year-old male had a complaint of a painless swelling in the right side of the mandibular body region, extending under the tongue, since 3 months, which had been increasing in size. The increase in size of the swelling was moderately rapid. This patient stated that the swelling originated in relation to the lingual aspect of tooth no. 45, which then spread toward the anterior region.

Extraoral condition was similar to the first case. Intraoral examination revealed an oval swelling measuring around 3 × 4 cm with ulcerated superficial mucosa, due to trauma during occlusion. The swelling extended from the mesial surface of tooth no. 41 to the distal surface of 47, anteroposteriorly. The lingual extension of the swelling was marked and was more than the buccal extension (Fig. 3). This had resulted in raising of the right half of the tongue leading to slurred speech. The color, texture and consistency were similar to the first case. However, clinically there were no missing teeth. There was a separation of teeth nos. 44 and 45 along with grade-II mobility of teeth nos. 44, 45 and 46.

Radiographs showed a mixed radiopaque-radiolucent lesion, not well-demarcated from the surrounding normal bone, with radiopaque specks scattered throughout. The radiographs showed no evidence of any impacted or embedded tooth (Fig. 4).

Histologic section showed the lesion lined by stratified squamous epithelium with foci of ulceration and moderate acanthosis. No loss of polarity or hyperchromasia was evident in these cells. Deeper tissue exhibited collagenization with fibroblast proliferation and focal metaplastic new bone. There were multiple clusters or islands of squamous cells with deeply eosinophilic cytoplasm. Many of these cells also exhibited calcification (small bony spicule formation was seen all around the cells). The squamoid islands contained foci of spherical calcification. The squamous cells showed mild hyperchromasia and anisonucleosis. Nuclear morphology showed moderate variation (Fig. 5).

**DISCUSSION**

**Clinical Appearance**

The CEOT is a benign neoplasm occurring either intraosseously or extraosseously. The intraosseous CEOT (ICEOT) commonly manifests as a painless swelling with slow growth, expanding the surrounding bone. Nasal stuffiness, epistaxis and headache are the symptoms when the maxilla is involved.

The peripheral soft tissue or extraosseous CEOT (ECEOT) manifests as a painless, firm gingival mass with a clinical provisional diagnosis of fibrous dysplasia, peripheral giant cell granuloma and epulis. Surgical removal reveals an underlying bony depression or saucerization, in some cases.

In the cases reported here, both showed a painless swelling with variable consistency. Whereas the swelling in case 1 showed slow growth, the increase in size of the swelling in case 2 was moderately rapid.

**Age:** The age in case-1 was 30 years, in accordance with the common age of occurrence of ICEOT. However, the age in case 2 was only 14 years, which is a deviation from the common as mentioned in Table 1.

**Gender:** Although no sexual predilection is seen, JJ Pindborg suggests a slight male preponderance. More commonly the peak incidence for male is reached a decade earlier (3rd decade) than that for females (4th decade). The gender ratio of ECEOT is similar to ICEOT (M:F = 6:5).

Both the cases reported here were male.

**Site:** Of the two variants, the ICEOT is the most common (93.6% of all tumors). It is found to occur more frequently in mandible than maxilla (2:1). The tumor is more common in the premolar-molar region with more chances of occurrence in the molar region than the premolar region (3:1). Nearly half of
the cases of ICEOT are associated with an unerupted tooth (or odontoma) (Table 2). Fifty-two percent of the tumors were associated with unerupted mandibular molars. The ECEOT is believed to occur more commonly in the anterior segment of the gingiva.

In case 1, the tumor occurred in the mandibular molar region and was associated with an unerupted tooth no. 36. However, in case 2, the tumor occurred in the mandibular premolar region and there was no association with any unerupted tooth (or odontoma). The patient had no missing teeth and all four quadrants had normally erupted teeth from central incisors to the 2nd molars. The developing crowns of all the four 3rd molars were visible in the OPG and they were in no way associated with the lesion.

RADIOLOGICAL FEATURES

- Some cases show a diffuse or well-circumscribed unilocular radiolucency
- Some cases show a mixed radiolucency and radiopacity with many small irregular trabeculae traversing the radiolucent area
- A multilocular appearance resembling a ‘honeycomb pattern’ can also be seen, particularly in the larger lesions
- Some cases give a ‘driven snow’ appearance due to scattered flecks of calcification
- Some cases show a total radiolucency associated with an impacted tooth

Both the cases reported here showed a mixed radiopaque-radiolucent lesion with scattered masses or specks of radiopacities. There was an evidence of an impacted molar in relation to the lesion in case 1, whereas case 2 showed only a separation of teeth no. 44 and 45 with no impacted tooth in association with the lesion.

PATHOGENESIS

Pindborg was of the opinion that, CEOT originates from the reduced enamel epithelium of an unerupted tooth. Most authors in the recent past believe that, the tumor cells originate from the stratum intermedium, because of the morphological similarity of the tumor cells to the normal cells of this layer. However, this belief is not in favor of ECEOT cases. Following the occurrence of ECEOT and ICEOT without an associated unerupted tooth, it becomes evident that other sources may play a role in the tumor pathogenesis. The ECEOT suggests the possibility of rests of the dental lamina, or the basal cells of the oral epithelium, in the histogenesis.

HISTOPATHOLOGICAL DEFINITION

According to WHO classification, 1992, CEOT is a ‘locally invasive epithelial neoplasm characterized by the development of intraepithelial structures, probably of an amyloid-like nature, which may be calcified and which may be liberated as the cells breakdown’.7

HISTOPATHOLOGICAL FINDINGS

The tumor consists of polyhedral cells arranged in masses, sheets, islands, cords, rows or strands in a scanty connective tissue stroma. The cells are pleomorphic, with well-outlined cell
border, abundant cytoplasm filled with an eosinophilic material, which has a tendency to calcify. The nuclei are pleomorphic. Multiple giant nuclei, which are dark staining, are seen. Electron microscopic view shows prominent intercellular bridges with desmosomes, intracytoplasmic tonofilaments and well-developed hemidesmosomes. El-Labban et al have mentioned a histologic variant of CEOT with myoepithelial cells.2

One characteristic feature is the homogeneous eosinophilic material, which has been interpreted as amyloid, comparable glycoprotein, basal lamina, keratin or enamel matrix. Vickers et al, Ranlov, Pindborg and Gardner et al have confirmed this homogeneous material as amyloid.3 Mori and Makino suggested that this material appeared to be a distinct protein moiety derived from immune amyloid or amyloid of unknown origin.8

Another characteristic feature is the presence of calcification within the amyloid-like material, known as Liesegang rings. Pindborg noted these rings to have a strong PAS-positive reaction.9 There are a few reports of ICEOT with minimal or no calcification; but, the lack of calcification is more common in the ECEOT, which is the only difference in histology between the ICEOT and ECEOT. Most of the calcified homogeneous masses of CEOT are believed to be dystrophic calcification, but some studies have suggested the presence of cementum-like components.9-11

Ai-Ru et al12 suggested four histological patterns. Pattern 1 shows polyhedral epithelial cells with deeply eosinophilic cytoplasm, one or more prominent nuclei and distinct cell outlines and intercellular bridges. Cellular abnormalities like multinucleated giant cells and nuclear pleomorphism are seen. Calcifications are seen in the fibrous stroma.

Pattern 2 shows distinct cell outlines, less prominent intercellular bridges, less variation in nuclear size and rare multinuclear cells with giant nuclei. Spaces are present in the tumor mass giving rise to a cribriform appearance, filled up with the homogeneous eosinophilic material, which becomes calcified in the form of Liesegang rings.

Pattern 3 shows epithelial cells scattered or arranged in cell-dense areas of varying size. Cell size varies greatly and multinucleated giant cells are prominent. Stroma may contain mucoid material.

Pattern 4 shows epithelial cells in nests or cords, some with abundant eosinophilic cytoplasm, others with a centrally or eccentrically placed nucleus with vacuolated, clear cytoplasm. Stroma may contain the eosinophilic material and dystrophic calcifications. Two or more patterns may be seen in a single case, of which one will be prominent.

Of the two cases reported here, the first appeared to be predominantly pattern 2 and the second, pattern 1, according to the Ai-Ru et al classification.

DIFFERENTIAL DIAGNOSIS

CEOT in general may be confused with the following lesions:

1. Ameloblastoma
2. Adenomatoid odontogenic tumor
3. Calcifying epithelial odontogenic cyst
4. Ameloblastic fibro-odontoma

REFERENCES


SUMMARY

Clinical, radiological, histological features, variants and treatment of CEOT are described. Two cases of CEOT are reported. The first case showed all the classic features of the tumor, whereas the second case deviated from the common in terms of the age and the absence of an unerupted tooth in association with the lesion. A review of literature is also included. Several reports on the various aspects of this tumor have been published in the literature. However, certain doubts about this tumor still needs to be answered, viz the pathogenesis, nature of the homogeneous eosinophilic material, and the different variants of this unique tumor.

TREATMENT AND RECURRENCE RATE

Methods of treatment can range from simple enucleation or curettage to hemimandibulectomy or hemimaxillectomy. Enucleation with a margin of normal tissue is usually recommended for mandibular lesions. CEOT of the maxilla should be treated more aggressively as maxillary tumors grow more rapidly and are usually not well confined. Treatment, however, should be individualized for each case. A minimum follow-up period of 5 years is recommended. Recurrence rate may range from 14 to 20%.5,6

5. Odontogenic fibroma
6. Ossifying fibroma.