Case Report

Calcifying epithelial odontogenic tumors (Pindborg tumor) of maxilla in pediatric patients

ABSTRACT

The calcifying epithelial odontogenic tumor (CEOT) was first described by Pindborg as a distinct entity in 1955. Odontogenic tumors are derived from epithelial, ectomesenchymal, and/or mesenchymal elements that are or have been a part of the tooth-forming apparatus. Of all the odontogenic tumors, CEOT accounts for 1% of the cases. There is no sex predilection, with a 2:1 predilection for the mandible, mostly in the premolar/molar region. The CEOT typically presents clinically as an intraosseous, expansile, and painless mass that exhibits slow growth. It is often locally invasive. Most often, it is associated with an impacted tooth, is asymptomatic, and requires biopsy for diagnosis. Although most of these cases are primarily intraosseous, an extraosseous tumor is also known to occur, first observed by Pindborg in 1966. The lesions were surgically enucleated, and histopathological examination confirmed CEOT. The purpose of this article is to describe one additional case of both variants of CEOT.

Keywords: Calcifying epithelial odontogenic tumor, odontogenic tumors, Pindborg tumor, surgical pedodontics

INTRODUCTION

Odontogenic tumors comprise a diverse group of exceptional lesions derived from epithelial elements of the tooth-forming apparatus that account for about 1% of all jaw tumors.[1] According to Mosqueda-Taylor, some of these are hamartromas that present a variable degree of differentiation, whereas the remaining ones are benign or malignant neoplasms of variable aggressiveness characterized by a metastatic potential.[2] The calcifying epithelial odontogenic tumor (CEOT) was first described by Pindborg as a distinct entity in 1955.[3] The eponym Pindborg Tumor was first introduced into the literature in 1967 to further describe this interesting and unique odontogenic tumor.[4] CEOT is an asymptomatic, benign, slow-expanding, and a locally invasive tumor of jaws that account for approximately 1% prevalence rate of all odontogenic tumors.[5,6] Different terminologies have been used for this tumor, such as ameloblastoma of unusual type with calcification, calcifying ameloblastoma, malignant odontoma, and cystic complex odontoma.[7]

It is most often encountered between the ages of 8 and 92 years with the peak occurrence of the 40 years without significant difference in occurrence based on sex.[8] It may be classified as intraosseous or extraosseous. The extraosseous variant has a predilection for anterior gingiva where it appears as a sessile mass capable of destroying the underlying bone. Intraosseous type is more commonly found in the mandible and more so, in the posterior region. More than half of these are associated with an impacted tooth.[9] On radiographic evaluation, this lesion usually presents as unilocular or multilocular radiolucent area. In some cases, this neoplasm may exhibit calcified structures of variable density and size.[10] The CEOT is composed microscopically of polyhedral epithelial cells that exhibit a granular eosinophilic cytoplasm

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and are believed to originate from the stratum intermedium. Other characteristic microscopic features include the presence of an amorphous, homogeneous, eosinophilic, amyloid-like material, and foci of calcification, sometimes in large amounts and in the form of lamellar, concentric structures (Liesegang's rings). Occasionally, the lesional cells may exhibit a clear, vacuolated cytoplasm (clear cell variant).[11] The differential diagnosis includes adenomatoid odontogenic tumor (AOT), calcifying odontogenic cyst, dentigerous cyst, ameloblastic fibro-odontoma, and odontoma.[7,12] The purpose of this article is to describe one additional case of each variant of CEOT.

CASE REPORTS

Case 1: Intraosseous variant

A 14-year-old girl referred to the department of oral surgery with the chief complaint of swelling over the left side of the nose, the nasal twang in voice, and malaligned teeth. The patient came to have orthodontic treatment.

An extra-oral examination showed a hard swelling of about 3 cm diameter over the left side of the nose. Swelling was asymptomatic. The intra-oral examination showed a hard swelling of about 3 cm diameter in relation to the left maxillary canine-premolar region. Permanent canine was missing. The first premolar was medially tilted to close the space for the canine. The patient was advised for an orthopantomogram.

An orthopantomograph revealed an impacted left maxillary canine and was enclosed in a unilocular cystic space with well-defined margins. Cystic space was mixed that is radiopaque – radiolucent in nature. Maxillary sinus was pushed in the posterior and distal direction. The roots of premolars were pushed distally [Figure 1] that causes mesially tilted permanent premolars. Radiologically, the lesion resembled a compound odontoma or a dentigerous cyst. Computed tomography (CT) scans showed well-defined cyst, encroaching sinus cavity, and enclosing canine along with some radiopaque mass [Figure 1].

Intraorally, crevicular incision along with mesial- and distal-releasing incisions was given to expose the site. Then, overlying buccal cortical plate was removed, and the cyst was enucleated along with its lining and the canine and attached hard tissue [Figure 2]. It was then sent for histopathological examination. Healing was completely uneventful.

Histopathological examination showed nests of polygonal to clear epithelial cells with extensive psammomatous calcifications in the form of Liesegang rings [Figure 2]. The diagnosis confirmed CEOT.

Case-2: Extraosseous variant

A 16-year-old girl came to the oral surgery department with the chief complaint of swelling over the left side of the maxillary buccal vestibule. History of treatment of the lesion for 8 months was also given.

An extra-oral examination showed no significant swelling or any other findings. The intra-oral examination showed a hard swelling of about 1.5 cm diameter in relation to the left maxillary premolar-molar region. Swelling was asymptomatic. Overlying mucosa was normal in color and texture. The patient already had an orthopantomogram that revealed an inverted drop-shaped radiolucency between the upper left second premolar and first molar.[Figure 3] The margins of the radiolucent area were well defined. Radiologically, the lesion resembled a peripheral giant cell granuloma or lateral periodontal cyst. CT scans showed a well-defined cyst separated from the sinus cavity with a thin lining. Buccal cortex was eroded and expanded, and the palatal cortex was intact [Figure 3].

Intraorally, crevicular incision along with mesial- and distal-releasing incisions was given to expose the site. Then, the overlying buccal cortical plate was removed, and the cyst was enucleated along with its lining and the second premolar and attached hard tissue [Figure 4]. It was sent for histopathological examination. Healing was completely uneventful.

Histopathological examination shows nests of clear epithelial cells in a fibrous stroma with acellular eosinophilic material. The nuclei were round and central. Eosinophilic material is a congophilic and shows birefringence with polarized light (amyloid-like material). Focal calcification was also present [Figure 4].

DISCUSSION

CEOT was first described by Pindborg in 1955 as a separate entity among epithelial tumors, and the eponym Pindborg tumor has also been used for this pathologic condition.[3,13] Most cases (94%) are intraosseous, and only 6% are extraosseous.[7] The first reports of the extraosseous CEOT date back to 1966 when Pindborg published two cases of gingival growth in the anterior jaw region of young patients.[14] Some other studies reported the prevalence of extraosseous CEOT ranges from 0.6% to 1.7% of all odontogenic tumors.[3,11,14] Al-Ru *et al*. calculated one in

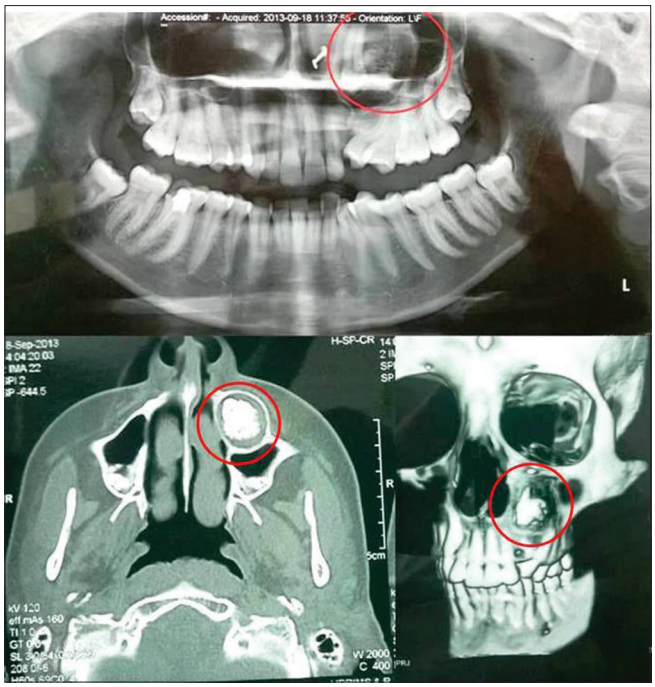

Figure 1: Optic pathway gliomas and computed tomography of Case 1

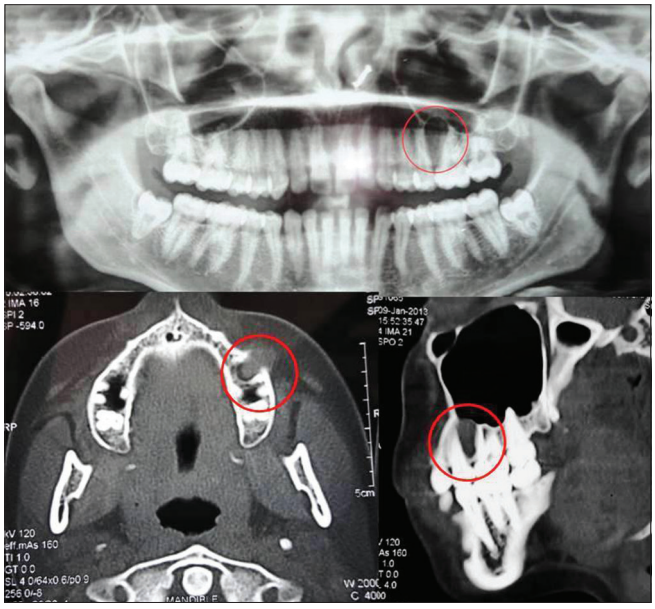

Figure 3: Optic pathway gliomas and computed tomography of Case 2

20 cases of CEOT were extraosseous in location in their case study of 181 patients.[15]

There is a predilection for occurrence anatomically, a maxilla to mandible ratio of 1:2 has been reported for the intraosseous variant of CEOT which are more common, accounting for 87.8% as compared extraosseous tumors 6.1% with the former presenting most often in the premolar-molar area, while the latter in the anterior part of the jaws.[7,13,15,16] Kaplan *et al*. reported 41 cases of one or more impacted

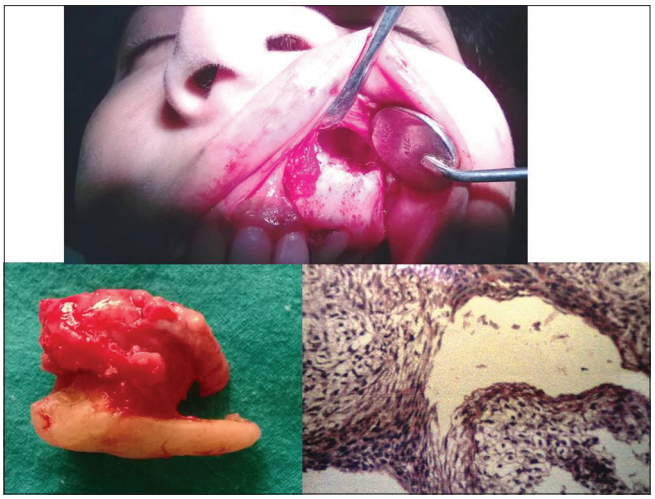

Figure 2: Intraoperative photograph with excised lesion and histopathological photographs of Case 1

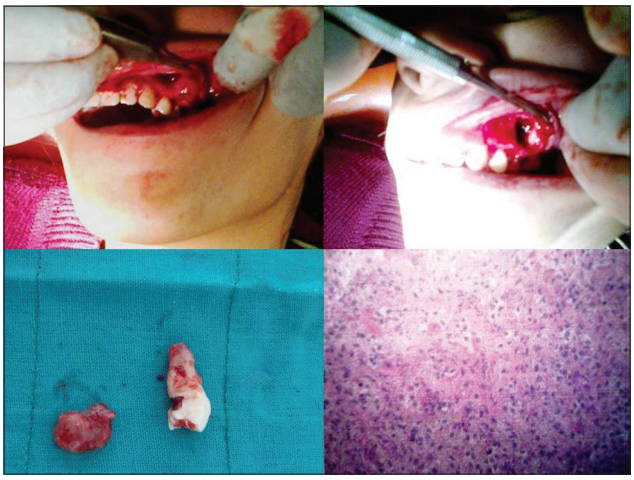

Figure 4: Intraoperative photograph with excised lesion and histopathological photographs of Case 2

teeth (60%) associated with a total of 67 cases of CEOT. Of these, the most prevalent was molars (62%) followed by premolars, canines, incisors, and the least was the supernumerary or unidentified teeth (4%).[17]

The initial consensus regarding the pathogenesis of CEOT was attributed to Pindborg in 1955. He stated that the CEOT was indeed of odontogenic origin, that is, reduced enamel organ-related, as the previous cases have been associated with unerupted teeth.[14] However, according to Philipsen and Reichart, with the reports of central cases not presenting with unerupted tooth, and the gingival variants, other sources of origin were debated.[7] The soft-tissue location of this tumor strongly suggests that these tumors may arise from rests of dental lamina or basal cells of the oral epithelium. After the disintegration of the dental lamina complex, numerous epithelial remnants (rests of Serres) persist in the jaw bones and supraperiosteally in the gingiva when odontogenesis is

completed. Furthermore, the focal proliferation of the basal layer of the gingiva epithelium has also been proposed as a possible origin.[7,18] Wertheimer *et al*. 1977 state that the intraosseous CEOT is derived from the stratum intermedium of the enamel organ. In contrast, the extraosseous form arises from the dental lamina, epithelial rests in the gingiva, and/or basal cells of the gingival surface epithelium. With the hybrid tumor between CEOT/AOT, the AOT portion arises from all three components of the enamel organ (preameloblasts, stellate reticulum, and stratum intermedium).[8,19]

Radiographically, the intraosseous lesion presents as radiolucency. Later, as the lesion ages, calcium salts are deposited, and it becomes increasingly radio-opaque. It also simultaneously erodes bone and thus, the lesion is often mixed radiolucent/radio-opaque giving a characteristic "driven-snow" appearance on the radiograph. Further, the lesion may be unilocular or more commonly, multilocular in appearance. Thoma and Goldman reported that 65% lesions out of his 67 cases of Pindborg tumor were radiographically mixed (radiolucent/radio-opaque) type followed by 32% complete radiolucent and 3% radio-opaque.[20] The peripheral variant of CEOT can display a range of radiographic features with regard to lesion size and bone pattern as compared to the intraosseous forms. It presents with no radiographic changes to a superficial erosive pattern.[14,21] to a radiolucency with scattered radiopaque foci.[7]

Pathological reports of CEOT exhibit considerable variations. It is characterized by a fibrous tissue stroma with sheets or islands of polyhedral epithelial cells with intercellular bridges. Nuclei are often pleomorphic, and giant nuclei may be visible. Eosinophilic, amorphous hyaline-rich material, which stains positive for amyloid, may be present. Calcifications in the form of concentric rings, called Liesegang rings, may develop within the amyloid-like material. This material stains with Congo red and exhibits an apple-green birefringence under polarized light. It also fluoresces under ultraviolet light with thioflavin T. This amyloid-like material may contain either basement membrane components (Type IV collagen)[22] or a mixture of cytokeratins.[23] The origin of amyloid is unclear. It could either be an active secretion product or a degeneration product of keratin filaments which originate from tumor epithelium due to developmental or aging processes.[23]

Some of these tumors may be epithelium predominant with minimal amyloid, whereas others may be amyloid predominant with small islands of the epithelium. Still, others may have abundant clear cells.[24] A mixed lesion along with AOT has also been reported.[25] The given section in our case revealed islands and strands of polyhedral epithelial cells in a fibrous stroma. The fibrous stroma revealed the presence of numerous calcifications, suggestive of lesion progression and a lesion of long standing. Some of these were in the form of concentric rings, also called Liesegang rings. Congo red testing for amyloid was negative in the present case, as the amyloid had become calcified.

Al-Ru *et al*.[15] subclassified this tumor into four distinct microscopic patterns, two or more types may be present in the same tumor. Type-1: Sheets, nests, and masses of polyhedral epithelial cells exhibiting prominent intercellular bridges, marked nuclear size variation, regular nuclear pleomorphism, scarce mitotic figures, and calcified corpuscles in the fibrous stroma. Type-2: It is characterized by a cribriform arrangement of tumor cells, less nuclear cell pleomorphism, absence of prominent intercellular bridges, and masses of calcified tissue showing Liesegang rings. Type-3: It consists of scattered or densely populated tumor cells accompanied by marked cellular pleomorphism in a myxoid stroma and frequent multinucleated giant cells. Type-4: Is characterized by small nests and cords of epithelial cells, some of them containing abundant cytoplasm separated by fibrous stromal tissue. In addition, several cellular variants such as clear cells, pigmented, Langerhans cell containing, bone and cementum forming, myoepithelial cell, and noncalcifying subtypes have been reported.[7,26]

CEOT is less aggressive than ameloblastoma although cases of malignant transformation have been reported.[27] The aggressiveness is a prominent finding in the posterior maxilla. In addition, root resorption is reported as a rare finding in CEOT (4%), unlike solid ameloblastoma (81%).[17] Kaplan *et al*. reported 28 cases out of 67 cases (41%) of CEOT which had caused the displacement of teeth.[17]

CONCLUSION

Treatment of CEOT involves the enucleation of smaller lesions and resection of large ones.[9] The resection should include a rim of the surrounding bone. A long follow-up is recommended, as a recurrence rate of 14% has been observed, particularly for those who have been curetted.[28] The lesions in the presented case report were enucleated. Follow-up revealed uneventful healing, and no recurrence was noticed. Literature search, however, arbitrarily states a minimal follow-up of 5 years.[5,8] The patients are, therefore, on frequent recall visits.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other

clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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