Title: Calcifying Odontogenic Cyst: A case report

Authors: Mulvihill Ciara, Ni Mhaolcatha Sarah, Brady Paul, McKenna Joe, Sleeman Duncan, Fitzgibbon James.

Institution: Oral and Maxillofacial Surgery, Cork University Dental School and Hospital, University College Cork, Ireland

Abstract

A calcifying odontogenic cyst (COC) is a rare odontogenic lesion with a vast variety of clinical, radiological, histopathological features and biological behaviours. In this paper, we illustrate a case of an 18-year-old male patient with a complaint of an 18-month history of swelling in his right maxilla. The lesion was diagnosed as a COC associated with an impacted 18 using radiological, cytological and histopathological investigations. The present study examines and considers the case.

Introduction

A calcifying odontogenic cyst (COC) is a benign developmental cystic lesion with rare malignant transformation documented in the literature[1]. COC is a hybrid lesion of the jaw exhibiting a diverse variety of clinical behaviours and histopathological features including cystic, solid (neoplastic) and aggressive variations. It consists of a proliferation of ameloblastoma-like odontogenic epithelium and scattered nests of ghost cells that may calcify.

Medical and dental literature often states that the COC was first recognized as a distinct clinicopathological entity by Gorlin et al., in 1962[2]. This is a misconception. In fact, the COC was originally reported five decades earlier by Thoma in the United States[3]. Subsequently, it was described by Rywkind in Russia and almost concurrently by Bloodgood in the United States and Sato in Japan[3].

Although the lesion has been commonly regarded as a benign odontogenic cyst, according to the WHO Classification in 2005, the COC was reclassified as the calcifying cystic odontogenic tumour (CCOT) under the tumour classification, with the term dentinogenic ghost cell tumour (DGCT) retained for the neoplastic variant. The most recent edition (4th) of the WHO Classification of Head and Neck tumours reinstates the COC to the classification of an odontogenic cyst and discards the preceding terminology

It is estimated that COC accounts for less than 1% of all odontogenic cysts of the jaw [4]. Primary clinical presentations vary from loosening of teeth to increasing swelling. This lesion can occur at any age with incidence most commonly in the second decade of life[5,6]. Incidence is almost equally distributed between the maxilla and the mandible. Reports on gender prevalence vary in the literature but, the occurrence of COCs is approximately equal in males and females[6]. There appears to be a slight predilection for Caucasians[6]. The incidence of root resorption is 75% to 77% of cases [7.] COCs are often associated with impacted teeth. However, the displacement of an adjacent tooth is rarely reported[6] and is observed in the case discussed.

The purpose of this report is to present an interesting and rare case of a COC associated with a displaced tooth and to highlight the importance of including COCs in differentials diagnoses, even when the lesion is seemingly non-pathological.

Case Presentation

An 18-year-old dental phobic male patient reported to the emergency oral surgery department with a complaint of an 18 month persistent asymptomatic swelling in the right maxilla region. It had gradually increased to the present size [Figure 1]. His medical and family history were unremarkable and there was no history of pain or trauma. On extraoral examination, facial asymmetry was apparent with a diffuse non-tender swelling involving the right buccal and malar areas. Intraoral examination revealed a firm, well-circumscribed solitary swelling extending from the distal aspect of the right upper second molar to the mesial aspect of the upper right canine with vestibular obliteration. There was an expansion of buccal bone with normal mucosal colour. Grade III mobility was present in tooth 17 16 15. On aspiration, straw-coloured fluid was obtained and electrical pulp testing showed that the involved teeth were nonvital.

The upper periapical radiograph showed an extensive well-defined radiolucency with radioopaque flecks and resorption of the roots of the upper right molars and premolars. A panoramic radiograph revealed a large well-defined unilocular radiolucency present in the maxilla, extending from the right maxillary tuberosity to the root of the upper right canine and radicular resorption of involved teeth [Figure 2]. On careful inspection, an ectopic third molar tooth was seen on the right lateral orbit.

Figure 1: Image at initial clinical examination.

Figure 2: Panoramic radiograph revealing a large well-defined unilocular radiolucency with an ectopic third molar tooth lateral to the right orbit.

The upper right molar teeth were extracted, surgical enucleation of the lesion and bone curettage was performed under general anaesthesia [Figure 3 and Figure 4]. Primary closure was obtained. An aspirate and the specimen was sent for histopathologic evaluation. The surgical specimen was fixed in formalin and routinely processed, with representative tissue sections embedded in paraffin and stained with hematoxylin and eosin.

Histopathological examination of the excisional biopsy of our patient supports the diagnosis of a COC with an odontome. Histological examination shows a lesion with an outer layer of odontogenic epithelium and a basal layer of columnar pallisading hyperchromatic cells of variable thickness (Figure 5 A-B) with ameloblastic differentiation[8]. The suprabasal epithelial cells, resembling the stellate reticulum of the enamel organ, become pale, eosinophilic, anucleate and form ghost cells (Figure 5 C). These ghost cells undergo keratinisation forming sheets of dense homogenous eosonophilic matter, dentin[9] (Figure 5 D). This haphazard arrangement of dentin is in keeping with a complex odontoma. Immunohistochemistry has shown this dense substance to be cytokeratin positive[10.] There was a positive expression of cytokeratin AE1/AE3 in the basal cells, suprabasal cells and ghost cells of our reported COC (Figure 5 E). Mutations of the beta-catenin gene and others in the WNT pathway[11] and remnants of odontogenic epithelium in the mandible or maxilla are thought to be the precursors of COCs. In this case, there was immunohistochemical expression for

the beta-catenin gene mutation with cytoplasmic and nuclear staining of peripheral pallisading cells and cells surrounding the ghost cells (Figure 5 F).

Figure 3: Intraoperative image demonstrating buccal cortical bone obliteration and cyst lining

Figure 4: Intraoperative image demonstrating ectopic third molar tooth

Discussion

A COC is an uncommon lesion in the oral cavity with a cystic cavity, lined by odontogenic epithelium of variable thickness containing focal ghost cells[6]. The COC can arise at any site in the oral cavity with cases occurring most frequently in the anterior maxilla, followed by the posterior mandible[6]. The COC is thought to evolve from odontogenic epithelial remnants confined within the maxillary and mandibular bones or gingival tissues[12]. Consequently, COCs can emerge either centrally (intraosseous) or peripherally (extraosseous)

Asymptomatic swelling is a common presentation in both extraosseous and intraosseous locations with an expansion of the buccal and/or lingual cortical plates frequently appearing with the latter[5.] However, the majority of COCs are asymptomatic, often an incidental finding revealed on radiographic examination. Radiographically, COCs are well-circumscribed and present as a unilocular radiolucency[7] with calcifications of varying density reported in one-third of cases[6.] Since the lesion appears in tooth-bearing areas of the jaws or gingiva, COCs are frequently situated in the periapical or lateral periodontal area of the dentition[12.] Resultantly, root resorption and root divergence are frequent radiographic findings with an incidence of root resorption 75-77% of cases [13.]

Association with an impacted tooth appears in approximately one-third of cases [5.] COCs can occur within the dental follicle of impacted third molars and can present as a radiolucency of less than 2.5mm[14]. This highlights the importance of routine histopathological analysis of all tissues associated with the crowns of impacted teeth, even where follicular lesions are not suspected radiographically.

Due to the diverse radiographic presentation of COC the differential diagnosis in the early stages of formation, includes dentigerous cyst, odontogenic keratocyst (OKC), and ameloblastoma as they have little or no mineralization and therefore may present as radiolucencies. In later stages, once a mixed radiolucent-radiopaque presentation is seen on radiograph, the differential diagnosis would include dentigerous cyst, adenomatoid odontogenic tumour, a partially mineralized odontoma, calcifying epithelial odontogenic tumour, ossifying fibroma, fibrous dysplasia and ameloblastic fibro-odontoma.

The unique feature of COCs is ghost cell keratinisation, similar to its cutaneous variant, a pilomatrixoma[11]. It is this unique feature that also differentiates it from an ameloblastoma. However, the synchronous occurrence of COC with ameloblastomas and other odontogenic pathologies including dentigerous cysts [15 ,] ameloblastic fibromas, and odontomas[16] has been reported. COC's are complex lesions and can have substantial variation in the morphology of the epithelium, with several different lesions incorporated, including other odontogenic cysts and/or tumours[3]. Various literature has sub-classified COCs, however, their behaviour remains the same despite a difference in classification. The 4th edition of the WHO classification of Head and

Neck Tumours reclassified a COC as an odontogenic cyst having previously been classified as a neoplasm[17]. However, the solid variant, a dentigerous ghost cell tumour, considered to be neoplastic has been classified separately as an odontogenic tumour[17].

Figure 5 A-C A, COC showing odontogenic epithelium: ameloblastoma-like basal layer; inner layer resembling stellate reticulum; ghost cell formation and calcification (H&E x200).
B, COC showing numerous ghost cells and calcifications (H&E x100).
C, β-catenin Immunohistochemical expression with cytoplasmic and nuclear staining of palisading cells and cells surrounding the ghost cells (x400).

Finally, enucleation is the treatment of choice for intraosseous COCs. The extraosseous COC is treated with surgical excision. The reoccurrence rate for both intraosseous and extraosseous COCs is low and the long term prognosis is good [4].

Conclusion

In conclusion, the COC is an uncommon odontogenic lesion. The diverse range of clinical and radiological presentations of COC render it problematic to diagnose clinically. COCs can occur within the follicle of impacted teeth and this highlights the importance of histopathological examination of all dental follicles. Although rare, the COC should be included in the differential diagnosis of jaw lesions and treated promptly due to its' destructive nature and the high rate of root resorption.

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