Keratocystic odontogenic tumor.

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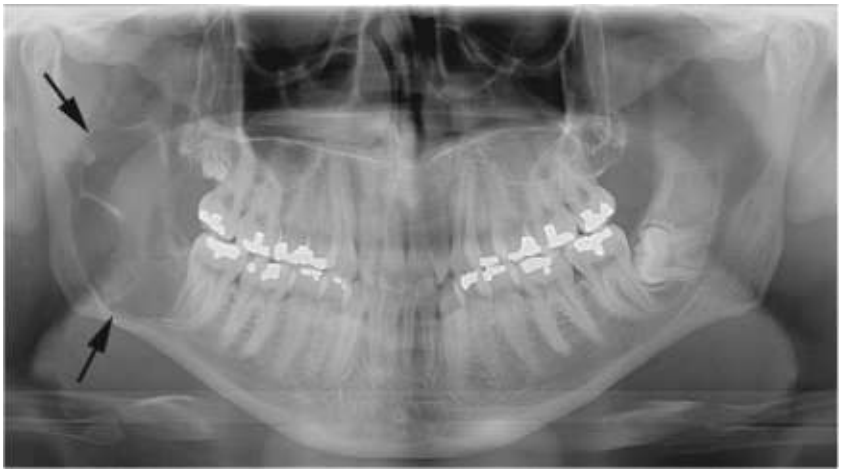
Keratocystic odontogenic tumor (KCOT; formerly known as *odontogenic keratocyst*) is a distinct developmental odontogenic cyst that may be locally aggressive and may be part of the nevoid basal cell carcinoma syndrome (NBCCS, or *Gorlin syndrome*). Inherited as an autosomal dominant trait, there is high penetrance, although with variable expression, associated with loss of function of the *PTCH* gene (chromosome 9q22.3-q31), a tumor suppressor gene.

Accounting for up to 10% of developmental cysts and showing a slight male predilection, KCOT usually presents in young patients (10 to 40 years), although patients with a syndrome-associated tumor present at an even younger age. About one-third of patients are asymptomatic. A cyst in the mandible occurs much more commonly than in the maxilla (3:1). This tumor is usually identified during dental imaging. When symptomatic, swelling, pain, and/or discomfort are noted.

Bite-wing or orthopantomograph images reveal a well-defined, unilocular radiolucency with a smooth border, showing minimal bone expansion and even cortication; it is often associated with an unerupted tooth (figure 1). If the cyst is large, it may be multilocular. In general, teeth tend to be displaced. There is a predilection for the posterior and ascending ramus of the mandible. These tumors are thought to arise from the dental lamina.

Figure 1. An orthopantomograph shows a well-corticated radiolucency (arrows) in the ramus of the right posterior mandible. Note that the teeth roots are displaced.

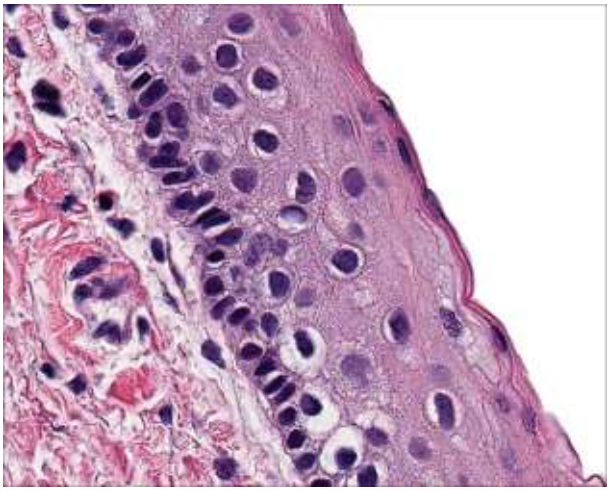


KCOTs are seen in about 75% of patients with NBCCS, many of whom present with multiple cysts. Other findings include basal cell carcinoma (young age at presentation and usually in non-sun-exposed areas), palmar and plantar pits, skeletal anomalies (e.g., bifid ribs, calcified falx cerebri), hypertelorism, epidermal inclusion cysts, and even medulloblastoma or ovarian fibromas.

En bloc resection or enucleation with peripheral ostectomy results in the best outcome. Recurrences can be seen (up to 25% of cases), especially in NBCCS patients or in patients managed with Carnoy solution, enucleation alone, or marsupialization. Malignant transformation is rare.

At the time of surgery, there is a cyst lumen containing keratinaceous debris with bone fragments and unerupted teeth. Histologically, there is a thin (6 to 8 cells thick) epithelial lining, lacking rete ridges, which results in a separation or clefting artifact from the fibrous stroma of the cyst wall. The basal layer is focally palisaded, with hyperchromatic nuclei. There is a very distinctive and characteristic wavy or corrugated, refractile keratinization at the luminal surface, often associated with parakeratotic epithelial cells (figure 2).

Figure 2. Approximately 6 cell layers comprise the epithelium. The basal nuclei are palisaded, with more hyperchromatic nuclei. The surface epithelium shows a refractile keratinized layer.



Satellite, or daughter, cysts, showing budding off the main cyst (figure 3), are usually seen in patients with NBCCS, and their detection should prompt a clinical evaluation for NBCCS. When the epithelium or fibrous connective tissue stroma becomes inflamed (acute and/or chronic inflammation), the histology is altered with epithelial thickening and the appearance of rete. Rushton bodies (refractile, brightly hypereosinophilic, curvilinear hyaline keratin bodies) may be seen (figure 4), but are not specific to this entity.

Figure 3. The cyst lining shows several daughter cysts, or buds, off the epithelium. There is a concurrent inflammation that has altered the epithelium slightly. This tumor has been removed from a patient with NBCCS.

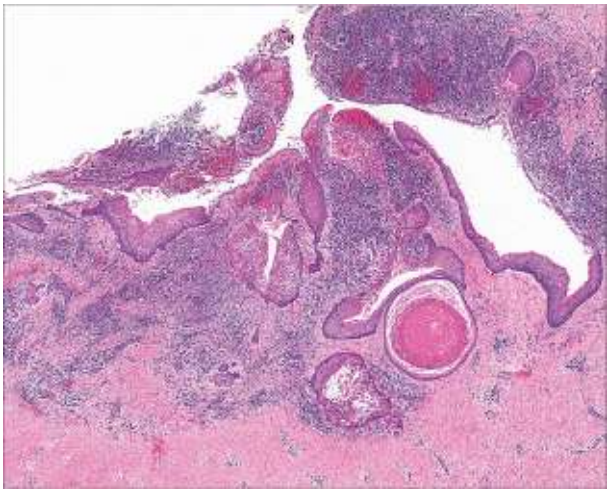
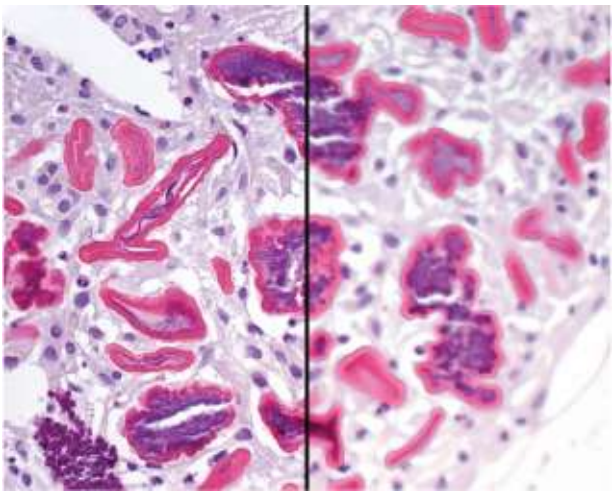


Figure 4. Left: Rushton bodies are abnormal keratin aggregations, often seen in KCOT. Right: The substage condenser of the microscope has been dropped, to demonstrate the refractile nature of these structures.



Although unnecessary for diagnosis, there is a high Ki-67 and p53 expression in the neoplastic cells. It is important to separate KCOTs from dentigerous cysts, orthokeratinized odontogenic cysts, and periapical cysts, as these other entities do not have the same potential for recurrence or syndrome association.

Suggested reading

1. García de Marcos JA, Dean-Ferrer A, Arroyo Rodriguez S ,et al. Basal cell nevus syndrome: Clinical and genetic diagnosis. Oral Maxillofac Surg 2009; 13 (4): 225-30.
2. González-Alva P, Tanaka A, Oku Y ,et al. Keratocystic odontogenic tumor: A retrospective study of 183 cases. J Oral Sci 2008; 50 (2): 205-12.
3. Pogrel MA. The keratocystic odontogenic tumor. Oral Maxillofac Surg Clin North Am 2013; 25 (1): 21-30.

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