

A Review Of Treatment Of Keratocystic Odontogenic Tumor: A Review Article

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Abstract: Philipsen in 1956 first described a cyst of the jaws lined by keratinizing epithelium. This was known as odontogenic keratocyst. It is now more appropriately named as Keratocystic Odontogenic Tumor (KCOT) because of its tumor like behaviour. This article aims to throw light on the various treatment modalities of KCOT, along with an analysis of their success rates, as well as rates of recurrence, and morbidity. The goals of treatment should involve eliminating the potential for recurrence while minimizing the surgical morbidity. Enucleation followed by chemical cauterization using Carnoy's solution, followed by excision of overlying attached mucosa has been used for the successful treatment of KCOT. Marsupialization is also considered to be a successful method of treatment of smaller lesions. In this article, the clinical, radiographic and histopathologic features of KCOT are discussed, along with various treatment modalities including enucleation, marsupialization as well as resection. In the light of recent literature, it may be concluded that an aggressive treatment modality like enucleation with application of Carnoy's solution might be considered as the most appropriate treatment modality for the KCOT.

INTRODUCTION

Philipsen in 1956 first described a cyst of the jaws lined by keratinizing epithelium. This was known as odontogenic keratocyst, surgeons have been toiling to find an ideal treatment for it. The various options available for the treatment of the odontogenic keratocyst has been expanding over the past few decades. Despite this, the issue is still debateable in Oral and Maxillofacial surgery. Various treatment modalities have been employed for the successful treatment of the KCOT, from simple enucleation to resection.

Tumor Like Nature Of KCOT

KCOT behaves like a tumor in many ways:

1. Involvement of large areas of the bone
2. High recurrence rate
3. Distinctive histopathological features of the lesion
4. Disregulation of the PTCH (patched) gene in both Nevoid basal cell carcinoma syndrome associated and sporadic odontogenic keratocysts.

On the other hand, the successful treatment of KCOT by marsupialization essentially denies its tumor-like characteristics. However, cases of carcinoma arising in KCOT have been reported^[1,2]. The recurrence of the lesion has even been reported in a bone graft^[3]. In this article, we present a review of the various treatment modalities of KCOT.

Clinical Features

The lesion may occur at any age, from the very young to the elderly. However, it is extremely rare under the age of 10 years. The peak incidence is seen around the second and third decades of life. There is a male predilection seen. The mandible is more commonly affected than the maxilla, with majority cases occurring in the Ramus of the mandible, followed by the body. In the maxilla, the most commonly affected region is the third molar region, followed by the cuspid region. The lesions found in children are often reflective of multiple odontogenic keratocysts as a component of nevoid basal cell carcinoma syndrome, but not always. There are no characteristic clinical manifestations of the cyst, although about 50% of the patients are symptomatic prior to seeking treatment. Common features include pain, soft tissue swelling, and expansion of the bone. Drainage and various neurologic manifestations like lip or teeth parasthesia may be seen. In the maxillary lesions, there tends to be secondary infection due to its vicinity to the maxillary sinus. Aspirated material from this cyst usually contains a cheesy material, suggestive of keratin; sometimes, the aspirated material may also contain a straw coloured fluid.

Radiographic features

Radiographically, KCOTs present as a unilocular radiolucency with a well defined peripheral rim. Scalloping of the border is also a frequent finding and this represents variations in the growth pattern of the cyst. Multilocular radiolucent KCOT is also observed but generally represents a central cavity having satellite cysts. Occasionally, the lesion may mimic a dentigerous cyst

and contain the crown of a retained tooth within its lumen. The gold standard for confirmation of a diagnosis is considered to be biopsy.

Histopathology

The wall of OKC is usually thin, unless there has been superimposed inflammation. The lining epithelium is highly characteristic, composing a parakeratinized surface which is typically corrugated, wrinkled or rippled. A remarkable uniformity of thickness of the epithelium, ranging from 6-10 cells thick. A prominent palisaded, polarized basal layer of cells, described as having a 'picket fence' or a 'tombstone' appearance. Histologically, these cysts are formed with stratified squamous epithelium that produces orthokeratin, parakeratin or both. The highly characteristic nature of KCOT is its parakeratinized lining epithelium with surface corrugations and a palisaded basal layer. The epithelium is thin and mitotic activity is frequent. In cases where there is presence of an intense inflammatory process, the adjacent epithelium loses its keratinized surface, thickens and may develop rete ridges or ulcerate. The connective tissue wall often shows small islands of epithelium similar to the lining epithelium. The lumen of the keratocyst may be filled with a thin straw coloured fluid, or a thicker creamy material. Cholesterol, as well as hyaline bodies at the site of inflammation, may also be present. Dysplastic and neoplastic transformation of the lining epithelium is an uncommon occurrence but has been reported, careful microscopic examination must be done to rule out epidermoid carcinoma developing from a KCOT.

DISCUSSION

Mikulicz in 1876 first described the KCOT as a condition affecting the jaws. However, the term odontogenic keratocyst was first introduced by Philipsen in 1956. In 1960, Shear ^[4] stated that, 'in most respects, the diagnosis of primordial cysts is of academic importance only. They are entirely simple in nature and will not recur if enucleated.' Since then, a wide range of treatment modalities have been put forward for its treatment.

Treatment modalities

Eyre and Zakrzewska ^[5] in 1985, stated the following treatment options for the KCOT –

1. Enucleation:

- with primary closure
- with packing
- with chemical fixation
- with cryosurgery

2. Marsupialization:

- only
- followed by enucleation

3. Resection

Bramley ^[6], in 1971, proposed a treatment plan for the keratinising cystic odontogenic tumor due to its tendency to recur. He suggested:

1. Unilocular cysts to be treated by intraoral resection.
2. In areas of difficult access, decompression and secondary enucleation is advocated.
3. Large multilocular cysts should be treated by resection and primary bone graft.

Use of Carnoy's solution

Carnoy's solution is the most commonly used chemical cauterizing agent used in treatment of KCOT. It is made using 1 part Glacial Acetic Acid, 3 parts of Chloroform, 6 parts of 95%/100% Ethanol. In a systematic review of the treatment and prognosis, Blanas et al. ^[7] in 2000, have concluded that simple enucleation results in an unnecessarily high recurrence rate when treating the KCOT. For a routine KCOT in a person who is likely to return for a follow-up treatment, Carnoy's solution seems to be the minimally invasive procedure with the lowest recurrence rate. If the lesion is very large, decompression of the cyst may be done, which is followed by enucleation. This sequence of procedures also have a low recurrence rate. The use of Carnoy's solution can also be considered at the enucleation stage of the procedure.. If the patient is not likely to return for follow-up, the lesion should be resected.

Enucleation with Cryosurgical Treatment

Bradley and Fischer ^[8], in 1975, have described a combined enucleation and cryosurgical treatment for KCOT. Webb and Brockbank ^[9] in 1984, have also presented the treatment of the KCOT of the mandible using a combination of enucleation and cryosurgery. They followed up the case for 5 years and found no recurrence. This suggests that cryosurgery, as an adjunct to enucleation, may prove to be a conservative and reliable method of treatment of KCOT with a low recurrence rate.

Recurrence of KCOT

The recurrence of the KCOT ranges from 2.5% to 62%. While different studies have shown difference in recurrence rates, the possible mechanisms of recurrence have been described by Voorsmit et al. [11] in 1981. These state that any lining epithelium left behind in the oral cavity may give rise to the formation of a new lesion. Daughter cysts, microcysts or epithelial islands can be found in the walls of the original cysts. New KCOTs may develop from epithelial offshoots of the basal layer of oral epithelium [12]. Both conservative approach and aggressive approach have been advocated for the treatment of the KCOT. Conservative approach, however, has not gained much popularity. This is due to the difficulty in the complete removal of the KCOT, due to its thin friable lining, the limited surgical access, skill and experience of the surgeon. Most importantly, the desire to preserve adjacent vital structures renders the conservative approach as not very popular.

Goals for treatment of KCOT

The goals of treatment should involve eliminating the potential for recurrence while minimizing the surgical morbidity. Enucleation followed by chemical cauterization using Carnoy's solution, followed by excision of overlying attached mucosa has been used for the successful treatment of KCOT. Stoelinga [16] in 2001 concluded in a long term follow up study that this method gave rise to a fairly low number of recurrences. Peripheral ostectomy combined with chemical cauterization using Carnoy's solution may give nil recurrence rate [15]. A strict follow up protocol, which allows for early surgical intervention in case of recurrence, limits the extent of second surgery, therefore, giving rise to less morbidity. It seems very likely that offshoots of the basal layer of the epithelium of the oral mucosa are a major cause for the development of some KCOT and some recurrences.

Resection

Resection of the lesion is said to give the least recurrence rate out of all treatment modalities. Bataineh and Al Qudah [17] in 1998 advocated for resection without continuity defects as a radical treatment. In this, removal of the cyst, teeth and the overlying soft tissue was followed by packing of the resulting cavity in order to minimize the risk of recurrence.

Marsupialization

Nakamura et al. [18] in 2002 have stated that marsupialization, as well as decompression, have the purpose of relieving the pressure within the cystic cavity. This promotes lower recurrence by allowing the growth of new bone that fills the defect. As a result, it saves the structures like tooth roots, maxillary sinus or the inferior alveolar canal. They can be saved from surgical damage by these treatment modalities. They concluded in their study that marsupialization was a highly successful procedure that helped to reduce the size of the KCOT before surgery. It was found to be more effective in the mandibular body region than in the ramus region. It also did not adversely affect the recurrence tendency of KCOT. Some authors have advocated marsupialization as a viable treatment for the KCOT [19,20]. Pogrel and Jordan [20,21] in 2004, treated 10 cases of KCOT by marsupialization. They found that all the 10 cases of KCOT resolved completely solely with this form of treatment. Their study also suggested that the cyst lining may get replaced by normal epithelium during this treatment.

According to Stoelinga [16,22], complete elimination of recurrences is probably not possible. This is because of two reasons:

1. Some cysts are still treated like ordinary odontogenic cysts. This is because a preoperative diagnosis was not made and the cysts were not treated according to the suggested protocol.
2. Despite excision of the overlying mucosa, there may still be epithelial islands or even microcysts left behind in the mucosa. These may develop into a new KCOT.

Chye CH and Singh B [25] described a case of a large KCOT that had developed rapidly and aggressively over a short period of 2 years and presented with acute symptoms. The KCOT was enucleated and the residual cavity was treated with Carnoy's solution. Kumar M, Bandtopadhyay and Thapliyal GK [26] have reported a case of a KCOT occurring in the anterior mandible which an uncommon site, with the lesion crossing the midline being a unique occurrence. Radical excision has no recurrence but does have the highest morbidity rate and should be reserved for multiple recurrent cysts after conservative means. Tolstunov and Treasure [28] have advocated for a surgical treatment algorithm for KCOT. They reported a combined treatment of KCOT and mandibular defect with marsupialization, enucleation, iliac crest bone graft, and dental implants. Meara et al. [29] have found out an overall recurrence rate of 35%, and the average time to recurrence of 4 years in their clinicopathologic review.

Disadvantages of simple enucleation

Simple enucleation (without curettage) is no longer advocated as an appropriate method for the treatment KCOT. Recurrence rates are highest with this method of treatment and range from 9% to 62.5% [30,31]. Scharfetter et al. [32] in their study on KCOT proliferation, have suggested that a minimum 5-mm bony margin is adequate to ensure satellite cyst removal.

CONCLUSION

Although literature contains many reports regarding management of KCOT, there still is debate as to the most effective treatment for this lesion. Depending on size, location, and behavior, the clinician should decide on an incisional versus excisional biopsy. Prior aspiration cytology may be helpful. In patients with multiple KCOTs, evaluation for the presence of basal cell nevus syndrome should be taken into consideration. Larger KCOTs, with possible cortical perforation, deserve radiographic assessment such as CT in addition to plain films. Treatment of the KCOT varies from enucleation and curettage

to osseous resection. Various factors that should be considered in the selection of the appropriate treatment include size and extent, location, presence of perforation or soft tissue involvement, age of individual, and primary or recurrent nature of lesion. Long-term follow-up is suggested because KCOTs have been known to have late recurrences. Recent factors support emerging molecular evidence that the KCOT is more likely to be a benign cystic neoplasm than a simple odontogenic cyst. This article aims to bring out the importance of clinical awareness about KCOT. It also aims to emphasize the importance of a careful histological examination and the necessity of obtaining biopsy materials from various areas to prevent a misdiagnosis. In the light of recent literature, it may be concluded that an aggressive treatment modality like enucleation with application of Carnoy's solution might be considered as the most appropriate treatment modality for the KCOT.

CONFLICT OF INTEREST

Conflict of interest declared none.

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