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Research Article

A Narrative Review on the Most Important Management of Keratocystic Odontogenic Tumor

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ABSTRACT

Keratocystic odontogenic tumor (KCOT) is a benign neoplasm with a keratinized epithelial outline with a high recurrence rate. The treatment methods in KCOT are still debated. The aim of all treatment methods is to eradicate the cyst and to reduce recurrence and surgical complications. This review article was conducted to assess the findings of studies on the diagnosis, management and recurrence of KCOT.

Methods: Information were gathered by searching keywords such as management, treatment, pharmacology, surgery and keratocystic odontogenic tumor in International databases such as Web of Science, PubMed and Scopus. The search period was between 2010 -2020.

Results: The study showed that the site of KCOT was mostly affected in the mandible. Techniques used for treatment include decompression, marsupialization, enucleating with or without adjunct, Caldwell-LUC surgery and resection. Of the 40 studies, recurrence was observed in 13 studies and the recurrence ranged from 0 to 48% in different treatment methods.

Conclusion: Due to the high recurrence of this disease, it is suggested that long term follow up be considered after treatment to reduce recurrence. Also it is recommended that the treatment method be selected carefully. Decision on the treatment should be made considering age, tumor size, and the site of involvement in order to reduce the economic and psychological burden of the disease.

Keywords: Odontogenic Tumor; Management; Treatment, Pharmacology; Surgery; Keratocystic

INTRODUCTION

The term odontogenic keratocyst' (OKC) was first described by Philipsen in 1956 [1]. The World Health Organization (WHO) used the term keratocystic odontogenic tumor (KCOT) as benign but aggressive tumor of odontogenic origin in 2005. Histologically, KOT is characterized by a thin parakeratinized stratified epithelium. KCOT is a benign neoplasm with a keratinized epithelial outline with a high recurrence rate [2]. KOT is a relatively common developmental odontogenic cyst and represents approximately 10-14% of all jaw cysts [3]. The reason for the high recurrence rate in KCOT is due to its neoplastic characteristics including high proliferation rate, angiogenesis, presence of daughter cysts and epithelial islands [4, 5]. Incomplete resection of epithelial structure of KCOT due to the fragility of the tumor tissue is another reason for recurrence [4, 6]. In radiographic imaging, KCOT is seen as aunilocular or multilocular well-circumscribed radiolucent lesion with scalloped and corticated margins. Involvement of affected tooth is reported in 25-40% of cases [7, 8]. In case of suspicious lesions in mandible or maxilla, computerized tomography (CT) scan, radionucleide imaging or magnetic resonance imaging (MRI) are used as conjunctive diagnostic methods. CT scan is a better method in identifying bone resorption, osteoporosis, periosteal swelling, destruction and calcification [9].

It is believed that keratocysts are originated from dental layer remnants with the following features such as a thin, bandlike lining of strati?ed squamous epithelium, a corrugated keratinized lining and a spinous cell layer 8 to 10 cells in thicknes, a thin,

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in?ammation-free connective tissue capsule, and a lumen-containing varying amounts of desquamated keratin. A predominant parakeratin lining predominates in majority (83-97%) of KCOT tumors [10, 11].

Various treatment options exist for KCOT ranging from conservative managements, including enucleation (with or without curettage), decompression and marsupialization, to aggressive treatments, including enucleation or cryotherapy with liquid nitrogen, and application of Carnoy's and jaw resection. No universal approach has yet been proposed for KCOT and the treatment methods in KCOT are still debated. The aim of all treatment methods is to eradicate the cyst and to reduce recurrence and surgical complications [12, 13].

KCOT is commonly asymptomatic and is mainly identified in routine radiographic assessments or panoramic radiographic examinations. Early diagnosis and correct treatment of KCOT is of great importance as surgery and treatment of KCOT is complicated and due to its high recurrence rate. Furthermore, there is no comprehensive assessment regarding the superiority of aggressive over conservative management in reducing recurrence. Therefore, this review article was conducted to assess the findings of studies on management and recurrence of KCOT.

METHODS

This study was conducted as narrative review. Information were gathered by searching keywords such as management, treatment, pharmacology, surgery and keratocystic odontogenic tumor in International databases such as Web of Science, PubMed and Scopus. The search period was between 2010 -2020.

RESULTS AND DISCUSSION

In the initial search, 1500 articles were found. After deleting the duplicate, unrelated, incomplete information and studies performed *in vitro* as well as studies without full text, 40 studies were eventually classified as the main study.

In these studies, the sample size varied from one to 181 people. The study showed that the site of KCOT was mostly in the mandible. Techniques used for treatment include decompression, marsupilization, enucleation with or without adjunct (Carnoy's solution, 5-fluorouracil (5-FU)), caldwell-LUC surgery and resection, for example madibletomy, antrostomy, endoscopic modified medial maxillectomy (EMMM) and etc. Of the 40 studies, recurrence was observed in 13 studies and the recurrence ranged from 0 to 48% in different treatment methods.

The aim of this review article was to assess the effective management methods in KCOT. A total of 40 original articles were reviewed. Majority of the articles were case reports. The most common affected site was mandible. The sample size varied from one to 181 subjects in different studies. The difference in sample size made the interpretation of the findings difficult.

Review of the studies indicated that the management methods used for KCOT comprised of various surgical approaches, including decompression, marsupilization, enucleation with or without adjunct (Carnoy's solution, 5-fluorouracil (5-FU)), caldwell-LUC surgery and resection, for example madibletomy, antrostomy, endoscopic modified medial maxillectomy (EMMM) and etc.

Decompression

Decompression is defined as any technique that reduces the pressure inside the cyst. Increased pressure inside the cyst results in the growth and expansion of the cyst [14]. Decompression is considered as an alternative and a more conservative approach that annihilates the predisposing factors for tumor expansion by continues drainage of the cyst [15].

Decompression minimizes adjacent tissue injury. However the effects of decompression on prevention of recurrence is yet to be discussed [16, 17]. The important superiority of marsupialization over decompression is preserving the important anatomical structures including inferior alveolar nerve and preventing following deformities [18].

Marsupialization

Marsupialization was first described by Partch in 1892 [19]. This approach includes incision of a part of the body of KCOT tumor and suturing the borders in adjacent mucus. The resultant surgical window opens the cyst in oral cavity. In decompression technique, a drain is placed inside the lesion that connects the cyst to the oral cavity. This will reduce inrtracystic pressure and causes bone formation [20]. The difference between decompression and marsupialization is in the use of a cylindrical device (drain) for preventing mucosal closure [21]. Based on the findings of the study by Tabrizi et al. the recurrence rate might be lower in decompression compared to marsupialization [22].

Enucleation With and Without Adjuncts

Enucleate means remove whole or clean, as a tumour from its envelope. Curettage is defined as the removal of growths or other material from the wall of a cavity. This technique has been used as a treatment approach for KCOT for many years. Although enucleation or curettage are superior to marsupialization in providing adequate sample for tissue analysis, but the reported recurrence rate (62.5%) is not considered desirable for a treatment approach. Some studies combined enucleation or curettage with adjuvant therapy including chemical solutions (Carnoy's) or cryosurgical agents (liquid nitrogen) for the treatment of KCOT [23, 24]. Similarly, a study reported a significant effect for combined enucleation with 5-fluorouracil (5-FU) in the treatment of KCOT, with fewer post-operative complications and recurrence compared to modified Carnoy's solution.

Enucleation with Carnoy's solution

Carnoy's solution was first used for the treatment of cystic lesions and fistulae by Cutler and Zollinger. Later some studies reported the use of carnoy's solution in the treatment of unicystic ameloblastoma and ossifying fibroma. Actually of the difficulty of enucleating the friable and thin wall of the KCOT

as one piece, and due to the small satellite cysts, consequently, treatment should be targeted to eliminate the possible vital cells left behind in the defect. This is because a not deeply penetrating, mild, cauterizing agent is used such as Carnoy's solution (consists 3 ml of chloroform, 6 ml of absolute ethanol, 1 ml of glacial acetic acid and 1 g of ferric chloride). Furthermore, Carnoy's solution might penetrate cancellous spaces and deviate or fix the remaining tumor. Currently the reformulated Carnoy's solution, without chloroform, is being used as exposure to chloroform may result in cancer or affect fertility. Electro cauterization has been used to prevent recurrence in cases where KCOT invades buccal or lingual cortex.

Various studies and evaluations have pointed out to the high efficacy of the administration of Carnoy's solution in combination with enucleation. The use of carnoy's solution during surgical treatment of invasive cystic lesions reduced the recurrence risk from 60-80% to 6.6%. Furthermore, some studies used Carnoy's solution as an adjuvant therapy after peripheral osteotomy, which reduced recurrence rate.

Resection with or without preservation of the continuity of the jaw: Resection refers to either segmental resection, defined as surgical removal of a segment of the mandible or maxilla without maintaining the continuity of the bone, or marginal resection, defined as surgical removal of a lesion intact, with maintaining the continuity of the bone, a rim of uninvolved bon.

Resection technique is used in KCOT cases with very large lesions with pterygoid muscles involvement, malignant changes or frequent recurrences. Another indication for resection is perforation of bone cortex and involvement of soft tissue with the probability of vital structure involvement including lateral skull base and orbit.

Although some studies reported that the recurrence rate after resection was zero, but resection is considered as an extreme method as it results in significant complications and requires reconstruction measures for the restoration of functional and aesthetic purposes. This will add the psychological and economic burden of the disease and may reduce the quality of life in KCOT patients at all age groups especially in the youth.

KCOT tumors have high recurrence rate. The findings of this review indicated that the recurrence ranged from 0 to 48% in different treatment methods. Therefore, it is suggested that long term follow up be considered after treatment to reduce recurrence. This review also found that the recurrence rate was higher in conservative treatments compared to aggressive treatments; therefore, it is suggested that the treatment method be decides carefully. Decision on the treatment should be made considering age, tumor size, and the site of involvement in order to reduce the economic and psychological burden of the disease.

CONCLUSION

Current developments in genetic and molecular techniques have increased our knowledge about KCOT and resulted in new treatment choices. Due to the high recurrence of this disease, it is suggested that long term follow up be considered after treatment to reduce recurrence. Also it is recommended that the treatment method be selected carefully. We suggest that physicians should consider age, tumor size and other factors in choosing the treatment option in order to prevent recurrence. According to the studies reviewed, the use of enucleation and Carnoy's solution for small lesions, marsupialization and decompressing for larger lesions and resection for very large lesions is suggested. As KCOt is more common in the second decade of life, long term follow up is recommended.

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