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## Odontogenic Keratocyst in Children: A Review

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### Abstract:

#### Objective:

Is to highlight the characteristics and management of odontogenic keratocyst in children only

#### Material and Method:

Computerized search in pubmed between (2005-2015) using specific words such as odontogenic keratocyst in children, odontogenic keratocyst association with Gorlin-Goltz syndrome with abstract written in English only.

#### Result:

During computerized literature search 77 articles in the years (2005-2015) were found. All these publications were miscellaneous studies including case series and case reports. Only 35 papers were selected which conform to our criteria. Most of the papers indicate that the histological type of keratocyst prevalent in children was parakeratinized variant, and most of the cases occurred in maxilla rather than mandible.

#### Conclusion:

We recommend that the surgeons who treat keratocysts in children take into consideration the late presentation in addition to the destructive nature and high recurrence rate. General practitioners face difficulty in early detection and referral of children with keratocysts or Gorlin syndrome. Treatment by multidisciplinary team is important if associated with Gorlin's syndrome Postoperative follow up is advised every 6 months.

**Keywords:** Dental lamina, Odontogenic keratocyst in children, Odontogenic keratocyst in children and association with Gorlin-Goltz syndrome, Odontogenic tumors.

## INTRODUCTION

Odontogenic keratocyst (OKC) is a developmental odontogenic cysts, it is thought to originate from the dental lamina. It was first noted in 1956 by Phillipsen [1]. OKC is well recognized by its aggressive behavior, rapid growth and high tendency to invade the adjacent tissues including bone. It tends to recur and occasionally is associated with the basal cell nevus syndrome [2].

Since odontogenic keratocyst (OKC) is characterized by specific histopathologic features and clinical behavior which is more suggestive of tumor rather than cyst. Several investigators believe that it must be classified as a benign cystic neoplasm.

In the latest WHO classification of odontogenic tumors in 2005, these lesions have been given the name

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“Keratocystic Odontogenic Tumors” (KCOTs) [1].

Multiple KCOTs are usually seen with cutaneous, skeletal, ocular and neurologic abnormalities as a component of Gorlin-Goltz syndrome. These features were first described by Gorlin and Goltz in 1960, hence the name Gorlin- Goltz syndrome [2].

#### **ASSOCIATION WITH GORLIN-GOLLTZ SYNDROME**

Gorlin-Goltz syndrome is rare multi-system disease, which is, characterized by neoplasms and other developmental abnormalities [3]. It is a hereditary condition inherited as an autosomal dominant trait and caused by abnormalities in the PTCH1 (Patched1) gene which is traced to the long arm of chromosome 9q22.3-q31 [3, 4]. Different nomenclatures have been given to this syndrome throughout the time such as nevoid basal cell carcinoma syndrome, Gorlin syndrome, fifth phacomatosis, multiple basilioma syndrome, hereditary cutaneomandibular polyoncosis and the most complex one ‘Jaw-cyst-basal-cell-nevus, bifid rib syndrome [3]. Diagnosis of Gorlin-Goltz syndrome is made when two major criteria or one major and two minor criteria are identified. The major criteria includes odontogenic keratocysts of the jaws, more than two sites of basal cell carcinomas or one site of basal cell carcinoma in persons younger than 20 years, three or more palmar or plantar pits, calcification of falx cerebri, bifid or fused ribs, first-degree relative with Gorlin-Goltz syndrome.

The incidence of this disorder lies in the range of 50,000 to 150,000 in the general population, affected by regional distribution [5]. Males and females show equal predilection [5].

The age of diagnosis of NBCCS is usually 13 years while average age for detection of basal cell carcinoma syndrome is 20 years [6]. The clinical presentation of syndrome differs among individuals within the same family or members of different families. Multiple keratocysts should alert the dentist to the possible diagnosis of this syndrome.

#### **THE MANAGEMENT AND PROGNOSIS OF KEARATOCYST IN CHILDREN**

One of the objectives of this current review is to detect if there is specific characteristic features regarding the behavior and prognosis of odontogenic keratocyst in children.

Odontogenic cysts have low prevalence in children. Keratocystic odontogenic tumor (KCOT) usually appears in the second, third and fourth decades of life (54.2%) and rare cases reported as early as the first, and as late as the ninth decade of life [7, 8]. Treatment of KCOTs is still a debatable subject because of their great tendency to recur [7, 9 - 11]. Occasionally decompression or marsupialization are the first surgical manipulations in KCOT and when the volume becomes smaller in size, enucleation has to be performed [5, 8].

Ravi *et al.* revealed a case of 11 years old boy which was diagnosed as Gorlin-Goltz syndrome according to clinical history, radiographic imaging and histopathology. The cyst was surgically enucleated with good prognosis [12].

Maria *et al* [13] reported a case of a 10- years old boy with keratocystic odontogenic tumor on the right side of mandible, in an attempt to maintain the permanent teeth, the patient was submitted to decompression procedure by extraction of the primary molars and insertion of iodoform gauze, The permanent teeth went to natural eruption and 2 years after the first visit lesion had healed. Patient was referred to orthodontic treatment and radiographic follow-up of 7 years showed no lesion recurrence. He concluded, the treatment option should consider conservative managements with low morbidity particularly in young patients.

Vijay [14] reported a case of a 6-years old boy keratocystic odontogenic tumor in left posterior side of mandible, where the tumor was surgically enucleated followed by application of Carnoy’s solution for 5 minutes, good healing and bone regeneration was achieved, the lesion showed no evidence of recurrence during the first year of follow up. He concluded that, the first priority is to the preservation of adjacent vital structures, and hence less postoperative complications. Enucleation with or without chemical cautery using Carnoy's solution followed by iodoform dressing can be considered as a more conservative treatment modality with a low tendency to recurrence, and fairly good healing for keratocystic odontogenic tumor. He also recommended a long postoperative observation period due to the high tendency of recurrence of the lesion.

Singh *et al.* [15] reported a keratocystic odontogenic tumour in an 11-years old female which he treated by surgical enucleation of the cyst, according to the principle of Partsch II. The cystic linings were removed and curettage was done with Carnoy's solution. The site was closed with betadine soaked gauze pack and their borders were then sutured to create an open cavity that communicates with the oral cavity.

Rakesh *et al.* [16] reported a case of keratocystic odontogenic tumour associated with Gorlin-Goltz syndrome in a male patient aged 12 years of age, Marsupialization followed by enucleation of upper odontogenic keratocyst and scraping of bony cavity was done with surgical bur and curette.

Chaudhary [17] reported a case of keratocystic odontogenic tumor which was primarily misdiagnosed as dentigerous cyst, the cyst was surgically enucleated followed by application of Carnoy's solution application as chemical cauterization to reduce the recurrence.

## DISCUSSION

In this current review we have tried to find out if there are special features of odontogenic keratocyst in children regarding the behavior and management. During our search it became very conspicuous to us that most of the literature is either case reports or case series or miscellaneous studies. This reflects the dearth of information concerning the behavior and management of odontogenic keratocyst. The odontogenic keratocyst (OKC) is regarded as an aggressive lesion due to its characteristic high tendency to recur, and to invade adjacent tissues [15 - 18]. In 1967, Toller suggested that the OKC should be classified as a benign tumor rather than a cyst based on its characteristic clinical features [19].

The abundance of, research papers supporting the tumorigenic characteristics of odontogenic keratocyst have encouraged the WHO to categorize the lesion as a tumor. This decision was based on several factors:

### Behavior

As stated earlier, the OKC is locally aggressive and highly recurrent.

### Histopathology

Studies executed by Ahlfors and others demonstrated the basal layer of the OKC (KCOT) budding into connective tissue. In addition to that mitotic figures were commonly seen in the suprabasal layers.

### Genetics

PTCH ('patched'), a tumor suppressor gene involved in both nevoid basal cell carcinoma syndrome and sporadic KCOTs, commonly found on chromosome 9q22.3-q31.36-40 normally, PTCH together with the oncogene SMO ('smoothed') forms receptor complex for the SHH ('sonic hedgehog') ligand. PTCH binding to SMO inhibits growth-signal transduction. SHH binding to PTCH releases this inhibition. If the normal function of PTCH is lost, the proliferation-stimulating effects of SMO are allowed to predominate [20, 21].

Management of odontogenic keratocyst particularly in children still remains a subject of debate. The decision on the treatment option should be established on the size and site of the lesion, recurrence status and radiographic evidence of cortical destruction and histologic variety as it is well known that parakeratotic type is more common in young age. Guided by the aforementioned characteristics, there is a general accord in the literature, for aggressive surgical approaches with complete lesion eradication, such as resection with or without reconstruction. These aggressive manipulations may lead to deformities, which may lead to serious psychosocial outcomes, especially in adolescents. Thence, the priority has been given to the reduction of complications as much as possible [22 - 27].

Most of the studies revealed high tendency to recurrence where enucleation is the only surgical manipulation, but this can be considerably decreased when combined with adjunctive procedures [23, 28, 29]. However, adjunctive manipulations, including Peripheral Osteotomy, Carnoy's solution, and Cryotherapy, have their own risks [25]. For instance, Carnoy's solution and other chemical cauterization might cause damage to nearby vital structures such as the IAN and/or permanent tooth buds in mixed dentition. When the cystic lesion lies adjacent to vital structures, marsupialization or decompression is more wise approach in this situation [25, 29]. On the other hand, if lesions are away from these vital structures, then chemical cauterization utilizing Carnoy's solution would be more acceptable given its ability to permeate and fix tissues up to a depth of 1.54 mm into the bone after 5 minutes of application [23, 24, 29, 30]. Cryotherapy is another procedure which can give similar outcomes, but may produce complications such as wound dehiscence noted in most cases [24, 31]. Peripheral Osteotomy is impractical in cases where cysts are large owing to the presence of very thin bony walls, and is not advised in cases with ameloblastoma because it may lead to seeding of ameloblastoma foci deeper in the bone [13, 24]. However, a large cavity following enucleation it is more prudent to allow it to heal by secondary intention rather than primary wound closure to avoid the hazards of postoperative infection [22, 24, 28].

The ideal properties of dressing material used for dressin wounds in the oral cavity should consist of following: alleviation of postoperative pain, upgrading of healing and safeguard against infection. Iodoform is regarded as a dressing material owing to its capability to reduce wound fluids by Fibrinolytic activity, exhibits antimicrobial activity after topical application and covers exposed bone surfaces to reduce pain [32, 33]. Recently investigators have shown that decompression and marsupialization change the epithelial lining of keratocystic odontogenic tumor into a less aggressive form, and some tumors have undergone complete resolution with these treatment modalities [22, 24]. Based on the above results, they recommended performing enucleation with or without chemical cauterization utilizing Carnoy's solution followed by iodoform gauze dressing for all cases specially in children.

Yildirim *et al.* [22] and Hadziabdic *et al.* [34] have shown that radiographically complete bone resolution was achieved in about 12 and 16 months in their respective studies.

In children with unerupted teeth, aggressive manipulations endanger the eruption process and the development of the involved jaw, hence conservative approach should be given first priority [10]. Thus, in young patients conservative treatment should be considered rather than aggressive one. On the other hand, en bloc resection is thought of in the following cases:

1. Cases of cyst's recurrence in spite of prior enucleation with an adjunctive procedure.
2. When odontogenic keratocysts recur inspite of prior marsupialization followed by enucleation with an adjunctive procedure.
3. In cases of multiple nonsyndromic or syndromic odontogenic keratocysts of NBCCS.
4. Where diagnosed odontogenic keratocysts show particularly aggressive clinical behavior which require radical resection as the first treatment option [21].

Finally this review reflects very clearly the lack of literature relating to behavior and management of keratocyst in children as most of the papers were case reports or case series.

## CONCLUSION

This study has shown that there is a lack of published literature relating to odontogenic keratocyst in children, as most of the papers were case reports and case series or miscellaneous studies (Table 1).

We recommend surgeons who treat keratocysts in children to take into consideration the late presentation in addition to the destructive nature and high recurrence rate. General practitioners face difficulty in early detection and referral of children with keratocysts or Gorlin syndrome. Treatment by multidisciplinary team is important if associated with Gorlin's syndrome. Postoperative follow up is advised every 6 months.

**Table 1. Table showing the authors, year of publication and type of study of the references in the review.**

Author (Year)	Type of Study
Shear M (2002)	Experimental study
Patil <i>et al.</i> (2005)	Case report
Shin <i>et al.</i> (2005)	Case report
Ramaglia <i>et al.</i> (2006)	Case report
Chirapathomsakul(2006)	Case report
Freitas <i>et al.</i> (2006)	Case report
Maurette <i>et al.</i> (2006)	preliminary study
Giuliani <i>et al.</i> (2006)	Case report
Hellstein <i>et al.</i> (2007)	Case report
Park <i>et al.</i> (2008)	Case report
Tolstunov (2008)	Case rport
Neville <i>et al.</i> (2009)	Book
Hyun <i>et al.</i> (2009)	Case report
Neelampari (2010)	Case report
Singh <i>et al.</i> (2010)	Case report
Mahadesh <i>et al.</i> (2010)	Case report
Yildirim <i>et al.</i> (2010)	Case report

(Table 3) contd.....

Author (Year)	Type of Study
Veena <i>et al.</i> (2011)	Case report
Hemavathy <i>et al.</i> (2011)	Case report
Kalaskar <i>et al.</i> (2011)	Case report
Hadziabdic <i>et al.</i> (2011)	Case report
Maria <i>et al.</i> (2012)	Case report
Chaudhary <i>et al.</i> (2012)	Case report
Zhou <i>et al.</i> (2012)	Case report
Güler <i>et al.</i> (2012)	Case reeport
Carneiro <i>et al.</i> (2012)	Case report
Mizokami <i>et al.</i> (2012)	Case report
Ortega <i>et al.</i> (2013)	Case report
Rosti <i>et al.</i> (2013)	Case report
Ravi <i>et al.</i> (2013)	Case report
Rakesh <i>et al.</i> (2013)	Case report
Chaudhary <i>et al.</i> (2013)	Case report
Freedman <i>et al.</i> (2013)	Case report
Kumar <i>et al.</i> (2015)	Case series

## CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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