



A clinicopathological study and management of odontogenic keratocyst

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ABSTRACT

Odontogenic Keratocyst is an aggressive odontogenic cyst with a high recurrence rate. After radicular and follicular cysts, odontogenic keratocysts are the third most common cyst of the jaws and approximately 12-14% of all odontogenic cysts. It has been retermed to Keratocystic odontogenic tumour (KCOT) as it better reflects its neoplastic nature but recently it has been re classified and retermed into the cystic category. Various surgical methods have been proposed but comparatively, conservative treatment options such as Dredging methods might be the treatment of choice due to preservation of anatomical structure.

Objective: The aim of this study was to analyse the clinical, radiological and histopathological characteristics of Odontogenic Keratocyst and provide a proper management system affected by this type of lesions.

Materials and methods: The prospective study was performed in Dhaka Dental College and Hospital from a period of January 2014 to January 2018. A total number of 75 patients were selected for this study based on clinical, radiological and histopathological confirmation of odontogenic keratocysts. The treatment options were enucleation, enucleation with curettage, enucleation with peripheral ostectomy, Dredging method and surgical resection. After treatment patients were followed up /months, 3 months and 6 months in every year at least for 5 years.

Results: Among 75 patient of odontogenic keratocyst; the mean age was 27.69±13.35 and age range was 11 to 66 years. Male were 53(71%) and 22 (29%) were female patients. 53 (70.67%) cases were found in the mandible, 15(20%) cases in the maxilla and in 7(9.33%) cases were involved in both maxilla and mandible; mandibular posterior region was the most specific region involved 37(69.81%).The most common clinical features revealed pain and swelling. Radiologically, 70.66% unilocular, 96% well defined and 94.66% radiolucent area were prominent. Bone expansion 37.38%, root resorption 30.00% and 36% were associated with an impacted tooth. Regarding treatment options enucleation with curatage 12%, enucleation, curettage & peripheral ostectomy 29.33%, Dredging 52% and surgical resection 6.6% was done. Recurrence occurred in 18 patients with recurrence rate of 24%.

Conclusion: Odontogenic keratocyst is an aggressive cyst, male predominant, posterior mandible is the commonest site and well defined unilocular radiolucency are commonest radiological feature. Radical treatment options such as resection reduced the recurrences of the tumour but higher morbidity and jaw deformity. Comparatively, conservative treatment options such as Dredging methods might be the treatment of choice due to preservation of anatomical structure. A long term follow up is paramount importance for the research and understanding the clinical pattern, behavior, treatment and recurrence of the lesion.

KEY WORDS:

Odontogenic Keratocyst, Clinicopathological study, Treatment modalities, Recurrences



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Introduction

Odontogenic Keratocyst (OKC) is an aggressive odontogenic cyst arising from dental lamina and is unique for its innate growth potential like tumours with an aggressive clinical patterns and association with high recurrence rate.¹ After radicular and follicular cysts, odontogenic keratocysts are the third most common cyst² and approximately 12-14% of all odontogenic cysts of jaws.³ It has been retermed to Keratocystic odontogenic tumour (KCOT) as it better reflects its aggressive behavior, high recurrence rate and neoplastic nature but recently it has been re classified and retermed into the cystic category by WHO 2017 classification.⁴

Two histologic variants has been classified - orthokeratinized or parakeratinized. The orthokeratinized variant not only lacks of the typical characteristics of the parakeratinized one but also has different biological characteristics and consequently a much lower recurrence rate.²

Various treatment modalities have been published in literature for odontogenic keratocyst but the universally accepted approach remains undecided. Treatment generally includes from conservative methods such as marsupialization, enucleation, curettage, chemical cauterization, peripheral ostectomy to much aggressive treatments such as marginal or segmental resection.⁵ However, no good evidence is currently available regarding the best treatment option.

In this article, we analysis and share our experience in the clinical, radiological and histopathological characteristics of odontogenic keratocyst and provide a proper management system affected by this type of lesions.

Materials and methods

The prospective study was performed in Department of Oral & Maxillofacial Surgery, Dhaka Dental College and Hospital, Dhaka, Bangladesh from a period of January 2014 to January 2018.

The study population was divided into two groups, according to the clinical and diagnostic criteria. The first group comprised symptomatic cases with clinical findings like pain, swelling. The second group included asymptomatic cases, with the diagnosis made incidentally by radiographic findings or during routine dental examination.

The location of the cyst was divided into mandible and maxilla. In the maxilla either in anterior (incisor and canine) or posterior (premolar and molar) regions and in the mandible it was divided into anterior (symphysis, para symphysis) and posterior regions (body, angle, ramus, condyle and coronoid process). Radiographical findings were recorded as well defined, ill defined, unilocular or multilocular, radiolucent or radioopaque lesions with single or multiple location. Information was also recorded about whether a tooth was related with the lesion, displacement of adjacent teeth with or without root resorption, impacted tooth, expansion of cortical

plates with or without perforation. Histological findings were also recorded either it was orthokeratinised, parakeratinised or both type of lesions.

The treatment options in this study were enucleation, enucleation of the cyst with curettage and peripheral ostectomy, Dredging method and surgical resection and reconstruction in all cases. The specimen was sent for histopathological examination and a diagnosis of odontogenic keratocyst was confirmed. Patients were regular follow up after 1months, 3 months and 6 months in every year at least for 5 years. Any complication during the treatment or the follow-up period, the incidence and the time of recurrence and management were also recorded.

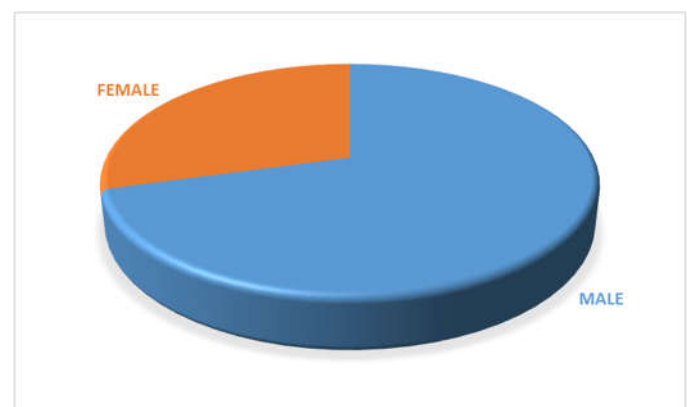
Result:

Table 1: Age distribution of the patients. (n – 75)

Age	Frequency	Percentage
0 - 10	00	00
11 - 20	26	34.7
21 - 30	25	33.3
31 - 40	11	14.7
41 - 50	07	9.3
51 - 60	04	5.3
61 - 70	02	2.7
Total	75	100.0
Mean (±SD)	27.69±13.35	
Range	(11 – 66) years	

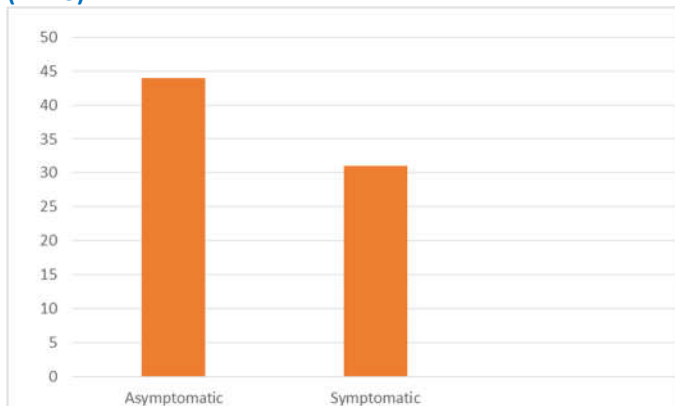
The study included a total of 75 patients. The age of the patients ranged from 11 to 66 years, with a peak incidence in the second and third decade of life (26) cases (34.7%) and (25) cases (33.3%). The mean age was (29.2%) 27.69±13.35 years.

Figure 1: Sex distribution of the patients. (n – 75)



The males were affected more than the females and the maximum male predominance was observed. Among 75 patients 53 (71%) were male and 22 (29%) were female.

Figure 2: Clinical manifestation of odontogenic keratocyst (n - 75)



The duration of the symptoms ranged from two months to three years (median = 8 months). The initial presenting symptom for all 31(41%) patients was expansion of the jaw bone, associated with pain in 22 cases and clinically, though 44(59%) of the lesions were diagnosed incidentally during routine dental examination.

Figure 3: Anatomical distribution of odontogenic keratocyst (n - 75)

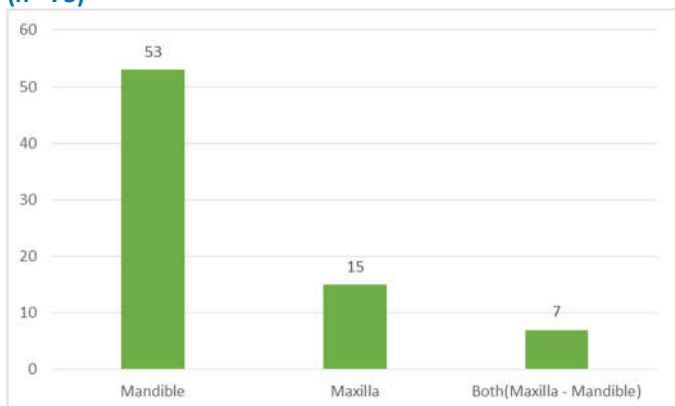


Table 2: Anatomical location and distribution of odontogenic keratocyst (n - 75)

	Mandible	Anterior	Posterior	Total
		16(30.19%)	37(69.81%)	53(70.67%)
	Maxilla			
		3(20%)	12(80%)	15(20.00%)
	Both			7(9.33%)
	Total			75(100%)

The overall mandibular to maxilla ratio of tumors occurrence with 70.67 % of the lesions located in the mandible, most frequently in the posterior region which included body angle ramus 69.81% and 30.19% in the anterior region. Only 20% of the lesions occurred in the maxilla, most in the posterior region 80% maxillary sinuses, pterygopalatine fossa or floor of the nose. In 9.33% cases the tumors involved more than one anatomical area, both maxilla and mandible. However, some lesion crossed the midline from right lower second molar or premolar to left lower second molar or premolar of mandible.

Table 3: Radiological features of odontogenic keratocyst (n - 75)

Radiological features	Patients	Percentages
General appearance		
Unilocular	53	70.66%
Multilocular	22	29.33%
Effects on adjacent structure		
Well defined	72	96%
Ill defined	03	04%
Radiological features		
Radiolucent	71	94.66%
Radio Opaque	00	00%
Mixed type	04	5.33%
Effects on adjacent structure		
Bone expansion	28	37.38%
Root resorption	23	30.00%
Tooth displacement		
Tooth within the lesion / Impacted tooth	27	36%

Radiologically, 70.66% of the tumours were identified as unilocular lesions whereas 29.33% had a multilocular appearance. 96% were well defined and 04% were ill defined borders and 94.66% tumours were radiolucent area and 5.33% are mixed type lesions. Bone expansion were seen on 37.38%, root resorption were seen on 30.00% and 36% were associated with an impacted or semi-impacted tooth. The majority of the lesions 82% were located in tooth-bearing areas, most commonly in a periapical zone 74%.

All of the pathological reports reveals a similar histological features. The lesion consist of a fibrous connective tissue wall which contain islands of epithelium shows a small cystic lesion - Daughter cyst. The epithelial lining is highly characteristic and is composed of a parakeratin surface which is usually corrugated, a uniformity of thickness, generally between 4 to 10 cells in depth without rete peg and a palisaded basal layer of cells. The lumen of the cyst may be filled a thin straw-colored fluid or with a thicker creamy material. Sometimes, the lumen contains a great deal of keratin. Cholesterol and hyaline bodies at the site of inflammation may also be present. In our study most of the histopathological varities were orthokeratocyst and parakeratocyst, sometimes both were present.

Table 5: Treatment options of odontogenic keratocyst (n-75)

Treatment	Patients	Percentages
Enucleation & curatage	09	12%
Enucleation, curettage & peripheral ostectomy	22	29.33%
Dreaging method	39	52%
Resection & reconstruction	05	6.67%
Total	75	100%

All these lesions were treated with varying surgical modalities. These includes enucleation, enucleation, curettage and peripheral ostectomy to aggressive treatments such as resection. 09 (12%) patients were treated with enucleation and curettage, 22(29.33%) cases received enucleation, curettage & peripheral ostectomy, 39(52%) patients were treated with Dredging method and 05 (6.67%) cases were treated with segmental resection and autologous bone was used to reconstruct bone defects; in 1 cases with an iliac crest bone graft and 04 patient a micro vascularized fibula flap was employed to reconstruct an important tumours defect.

The average follow-up period was 5 years. The recurrences were usually diagnosed during the first 5 years postoperatively. Recurrence was found in 18 cases (24%). Recurrences were observed in the posterior maxilla and mandible (40% and 21.4% respectively) as compared to anterior maxilla and mandible (16.7% and 15.4% respectively). The age distribution at recurrence was similar to the primary cases - showing a peak in the 2nd decade to 3rd decade.

Treatment of recurrence in our study were enucleation with curettage or peripheral ostectomy (6/18), surgical resection and reconstruction with reconstruction plate (4/18) and microvascular fibula graft (8/18).

Discussion

The odontogenic keratocyst was first described by Philipsen in 1956 and designate an odontogenic keratocyst with a parakeratinized epithelial surface² but its characteristics features was first described by Pindborg and Hansen in 1963. In 1967, Toller suggested that odontogenic keratocyst may be regarded as a benign neoplasm rather than a conventional cyst based on its clinical behaviour.⁴

The odontogenic keratocyst is now designated by the World Health Organization (WHO) as a keratocystic odontogenic tumour (KCOT) and is defined as a benign unicystic or multicystic, intraosseous tumour of odontogenic origin with a characteristic lining of parakeratinized stratified squamous epithelium and potential for aggressive, infiltrative behaviour.⁶ WHO proposed the terminology as keratocystic odontogenic tumor (KCOT) as it shows neoplastic nature. However In 2017, the new WHO classification of Head and Neck pathology retermed into the cystic category.⁴

Odontogenic keratocyst is so named because keratin is produced by the cystic lining. It is a Parakeratin lined cyst like lesion within bone. Odontogenic keratocyst is the one of the rare and distinctive developmental odontogenic cyst which from the dental lamina, containing clear fluid and a cheesy material resembling keratin debris.⁴

The age of distribution of odontogenic keratocyst in this study was 27.69 ± 13.35 years which ranged from 11 to 66 years and peak incidence 2nd to 4th decade; which is comparable with international literature, with a peak incidence in 3rd and 4th decade. Blanas and colleagues⁷ demonstrated the peak incidence in 4th and 5th decade. Odontogenic keratocysts are rare in extremes of age, under 10 and above 70 in our study.

However, Neville et al.⁸ reported in study conducted on 18 cases of odontogenic keratocyst a mean age of 69.9 years, which is much higher than for odontogenic keratocyst.

The distribution between sexes varies from equality to a male to female ratio of 1.6:1, except in children⁹ concerning the sex distribution, the present investigation showed that males were affected more than females. A similar male predominance also reported by Nohl and Gulabivala¹⁰ and Neville et al.⁸ Odontogenic keratocysts may occur in any part of the maxilla and mandible.⁸ Its predominantly affect the mandible especially posterior mandible including body, angle and ramus region (60-80%).¹¹ Regarding the site distribution, odontogenic keratocyst in our study occurs predominantly in the mandibular posterior region 37(69.81%). These finding confirmed by previous studies.^{12, 13} Odontogenic keratocysts although tends to grow in medullary spaces without significant bony expansion but it can cause extensive bone destruction.¹⁴ This lesion can be associated, although not in all cases, with an impacted third molar.⁸ In our study bone expansion were seen on 37.38%, root resorption were seen on 30.00% and 36% were associated with an impacted or semi-impacted tooth.

Neville et al.⁸ reports 18 cases of odontogenic keratocyst occur in anterior midline of the maxilla, Moreover, in our study, some cases of odontogenic keratocyst crossed the midline and only in 1 case the lesion involved the maxillary antrum. High incidence of maxillary antrum involvement was reported by Meara et al.¹³ which was not seen in our study. Clinically, an odontogenic keratocyst is characterized by aggressive, local growth. The lesion may manifest with pain, swelling, discharge, and occasionally parasthesia or displacement of teeth.¹⁵ Our finding is the same, in which the majority of the cases were seen in advanced stages, pain reported in 22 cases (29.33%), and clinically 44(59%) of the lesions were diagnosed incidentally during routine dental examination while tooth displacement and parasthesia were observed in some cases. The expansion of the cyst is very minimal in the initial stage and it is due to the classical characteristic of the cyst to grow in anteroposterior direction in the medullary space of the bone. Expansion of buccal cortex in 30% of maxillary and 50% of mandibular regions.^{16,17,18} which was comparable to our study.



Figure – 1 & 2: Facial asymmetry and swelling was not seen on both side of face.



Figure – 3 & 4: Facial asymmetry and swelling was seen on left side of mandible (Fig 3) and right side of mandible (Fig 4)

Radiographically odontogenic keratocyst presents as well defined unilocular or multilocular (25-40%) radiolucent lesion with smooth margin (corticated margin in secondarily infected cases), displacement of adjacent teeth without root resorption, lesion may contain impacted tooth (25-40%), Expansion of cortical plates (buccal > lingual) with or without perforation. Cyst grows in medullary spaces of bone in antero-posterior direction, so bony expansion is minimal in initial stages.^{11,16, 19}

This finding is supported by our series, in which the lesion shows 70.66% were identified as unilocular lesions whereas 29.33% had a multilocular appearance. 96% were well defined and 04% were ill defined borders and 94.66% were radiolucent area and 5.33% are mixed type lesions. However, the prevalence of association with an unerupted tooth were 36%, and root resorption in 30% and bone expansion was 37.38%. Moreover, Struthers and Shear²⁰ reported that the root resorption by odontogenic keratocyst appears to be very rare in comparison with that associated with dentigerous cyst which was comparable to our study. (Fig: 5 - 11)



Figure 5: Panoramic view of the OKC located at the right mandibular ascending ramus with a multilocular appearance. Mandibular third molar tooth within the lesion.



Figure 6: Panoramic view of the OKC located at the left mandibular ascending ramus with a unilocular appearance.



Figure 7: Panoramic view of the OKC located at the anterior mandibular region with a unilocular well defined appearance. Root resorption are also marked.



Figure 8: Panoramic view of the OKC located at the right mandibular ascending ramus anterior mandibular region with a multilocular appearance and scalloped border. Mandibular canine tooth within the lesion.



Figure 9: Panoramic view of the OKC in multiple site - located at the right mandibular ascending ramus region and right maxilla with a unilocular appearance.



Figure 10: Panoramic view of the OKC located on both side of mandibular ascending ramus with a multilocular appearance and impacted third molar seen on the both side within the lesion.

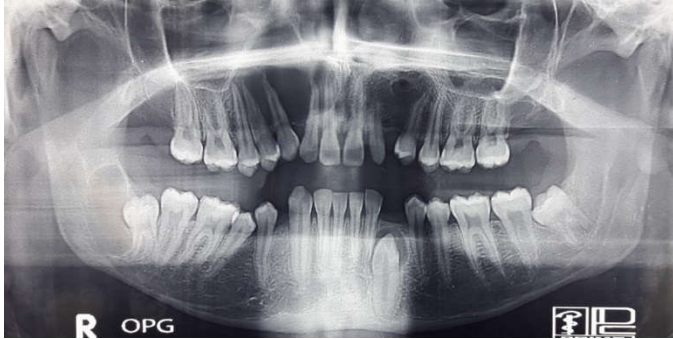


Figure 11: Panoramic view of the OKC located on both side of mandible – right ascending ramus and left canine region with a unilocular appearance and impacted third molar seen on the right side and impacted canine in the left side within the lesion.

Histologically, in 1992 (WHO) designated two different variants of odontogenic keratocyst, an orthokeratinized and a parakeratinized. The parakeratinized form consists in a basal layer made of cubic or cylindrical cells lacking acanthosis and rete ridge proliferation. It is covered by five to eight layers of squamous epithelium lining. The epithelium is characterized by a wavy or corrugated parakeratinized surface layer. Some signs of dysplasia may be observed. The basal layer of the tumour might be budding into the supporting connective tissue, forming daughter cysts at the periphery. If inflammation occurs, the fibrous capsule in the wall of the connective tissue thickens. In addition, it may cause ulceration of the epithelium, which acquires well-developed ridges, whereas the keratinization tends to disappear. This capsule can contain dystrophic calcifications or small fragments of cartilage of unknown origin.²¹ Orthokeratinized odontogenic cyst does not show pallisading of basal cells and is histologically different from parakeratinized form showing less aggressive behavior and destruction.^{22,23} The histopathological features of odontogenic keratocysts in our study were comparable with those seen elsewhere.^{24,25}

Different surgical techniques have been suggested for the treatment of odontogenic keratocysts and the most appropriate treatment remains a subject of controversy. Treatments are generally classified as conservative and aggressive such as surgical resection.⁸ Conservative treatment generally includes decompression or marsupialization, simple enucleation, with or without curettage, Aggressive treatment generally includes peripheral ostectomy, chemical curettage

with carnoy's solution and surgical resection.⁸

Some surgeons believe that the OKC can be properly treated with enucleation if the lesion is removed intact. However, complete removal of the OKC can be difficult because of the thin, friable epithelial lining, limited surgical access, cortical perforation, skill and experience of the surgeon and the desire to preserve adjacent vital structures.⁸

Aggressive treatment, such as ostectomy is necessary in cases associated with soft tissue invasion, a multi recurrent keratocyst, malignant transformation.² Peripheral ostectomy should be used with caution as it may disperse microcysts embedded in peripheral bone to cause recurrence.¹¹ In our study 09 (12%) patients were treated with enucleation and curettage, 22(29.33%) cases received enucleation, curettage & peripheral ostectomy.(Fig 12-18)

Dredging Method is a conservative surgical procedure in which, after deflation and enucleation or only enucleation, repeated dredging is applied to accelerate new bone formation by removing out the scar tissue from the bony cavity. In this study most of the patient were under dredging method 39 (52%) which is comparable to various study.^{26,27,28}

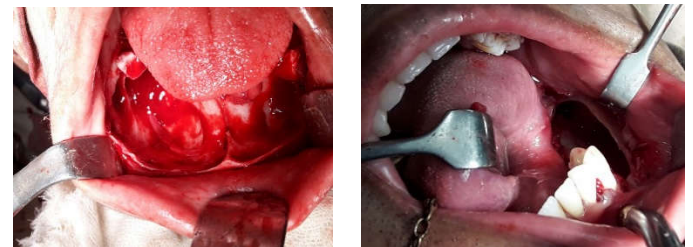


Figure 12: Enucleation of the lesion and peripheral ostectomy was done from right first molar to left first molar. Figure 13: Enucleation of the lesion and peripheral ostectomy was done from body angle and ramus of the left side of mandible

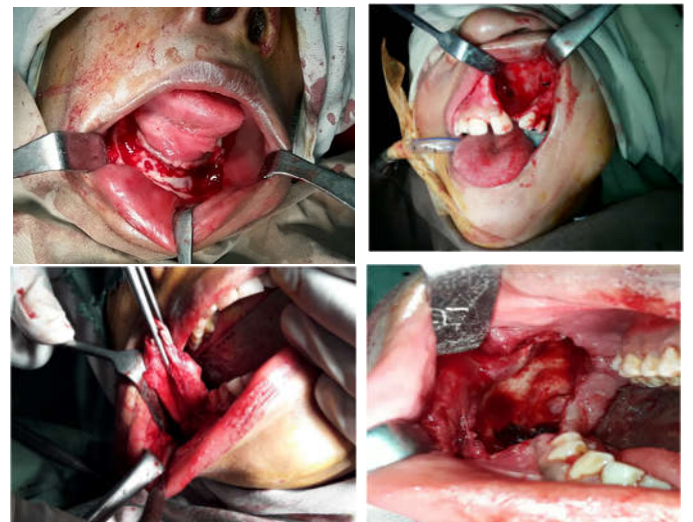


Figure 14: Enucleation of the lesion and peripheral ostectomy was done from right first molar to left first molar. Figure 15: Enucleation of the lesion and peripheral ostectomy was done in left maxilla. Figure 16: Enucleation of the lesion from right mandible involving body angle and ramus region. Figure 17: Perioperative intraoral view of the patient. After enucleation of the lesion from right mandible involving body angle and ramus region.

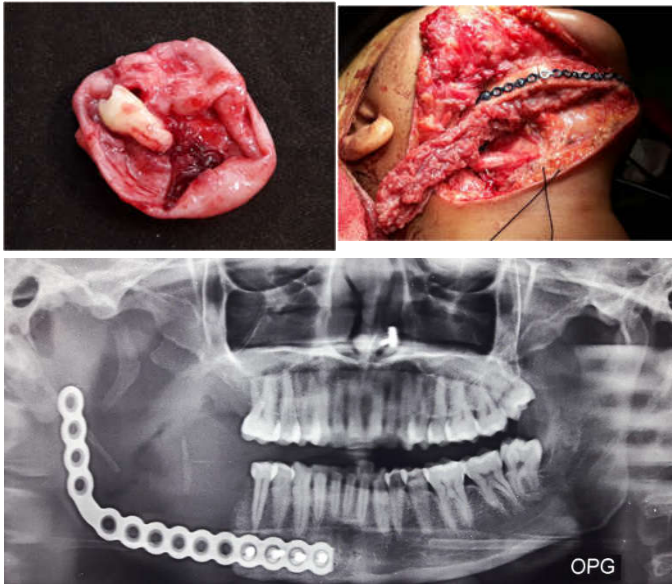


Figure 18. After enucleation of the lesion Figure 19: Reconstruction was done by reconstruction plate after surgical resection. Figure 20: Reconstruction was done by microvascular fibula bone graft after surgical resection.

According to Blanas and colleagues; William and Conner resection was recommended to be the best treatment of choice only in cases of recurrence (3 or more times), in very large and aggressive lesion, in cases of insufficient residual cortical bone or extensive soft tissue involvement.^{7, 29} Segmental resection offers a high cure rate but produces significant morbidity such as loss of jaw continuity, facial disfigurement and need for reconstruction. In this study 05 (6.67%) cases were treated with segmental resection and autologous bone was used to reconstruct bone defects; in 1 cases with an iliac crest bone graft and 04 patient was reconstructed by micro vascularized fibula flap. (Fig 20) Higher recurrence rate has been documented with conservative procedures such as marsupialization and enucleation of the lesion and recurrence rate is relatively low with aggressive treatment.³⁰

The topography of the lesion seems to be a recurrence risk factor. The angle and ramus lesions are more recurrent due to difficulty of access during enucleation, mainly for the multilocular forms³¹ which was comparable to our study. In our series, however, all the lesions with tooth involvement were treated with tooth extraction or apicectomy and this treatment appears to be related with recurrence. Treatment of recurrence in our study were enucleation with curettage or peripheral ostectomy (6/18), surgical resection and reconstruction with reconstruction plate (4/18) and microvascular fibula graft (8/18).

Recurrence rate varies from 2.5 to 62.5% with much literature suggesting approximately 30%.^{1,11,22} Auluck and Pai demonstrated 38% recurrence³ and Brannon depicted 32.5% recurrence.¹ after surgical cure of OKCs. In this study, recurrence occurred in 18 patients with recurrence rate of 24 %. Recurrence has been described up to 10 years after treatment, though it is more common during the first 5-7 years

³² which was comparable to our study.

Conclusion:

Odontogenic keratocyst is an aggressive cyst, male predominant, posterior mandible is the commonest site, welldefined unilocular radiolucency are commonest radiological feature. Treatment options should be decided by the surgeon according to the clinical and histological feature. Radical treatment options such as resection or marginal resection reduced the recurrences of the tumour but higher morbidity and jaw deformity. Comparatively, conservative treatment options such as dredging methods might be the treatment of choice due to preservation of normal anatomical structure like tooth germs and bone. A long term follow up is paramount importance for the research and understanding the clinical pattern, behavior, treatment and recurrence of the lesion.

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