Original Article

Prevalence of odontogenic cysts and its associated factors in South Indian population

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Abstract

Background: Odontogenic cysts (OCs) constitute a major part of oral pathological lesions, but little is known about their distribution patterns in various populations.

Aims: The aim was to determine the prevalence and factors associated with the cases of histopathologically diagnosed OCs that report to our institution and to analyze the factors associated with the presence of OCs and to study the biologic behavior of different types of cysts.

Materials and Methods: A cross-sectional study was performed on 596 oral and maxillofacial specimens during 2013–2017. Out of these, the cases which were histopathologically proven as OCs were separated and data were collected and analyzed regarding the age, gender, primary symptom, site, radiographic feature, histopathologic diagnosis, treatment given, recurrences and associated conditions if any.

Results: Of the 596 cases included in the study, 67 (11.2%) had a histopathological diagnosis of OCs. 41 cases were inflammatory cysts and 26 developmental cysts. 28 cases (41.8%) were reported as periapical cysts, 10 cases (14.9%) were odontogenic keratocysts (OKCs), 9 cases (13.4%) were dentigerous cysts, 8 cases (11.9%) were inflamed cyst wall, 5 cases (7.5%) each of residual cyst and developmental OCs and one case (1.5%) each of orthokeratinized OC and calcifying OC.

Conclusion: This study showed that the prevalence of OCs was similar to other reported studies. Periapical cysts were the most common cysts reported, followed by OKCs showing that the latter were more frequent than dentigerous cysts.

Keywords: Dentigerous cyst, odontogenic cysts, odontogenic keratocyst, radicular cyst

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INTRODUCTION

Cysts are pathologic cavities filled with fluid, semisolid or gaseous material. Those cysts which develop from the remnants of the odontogenic apparatus within the jaws are known as odontogenic cysts (OCs). The WHO has broadly divided the OCs into developmental and inflammatory cysts based on their pathogenesis. Inflammatory cysts are radicular cysts, residual cysts and paradental cysts, whereas dentigerous cyst, odontogenic keratocyst (OKC), calcifying OCs, gingival cysts of newborn and adults and glandular OCs are developmental in nature. These cysts may cause significant jaw swelling associated with pain and

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pus discharge. Sometimes they can result in significant jaw destruction without any obvious jaw swelling and may be discovered accidentally. Some of the developmental cysts show aggressive behavior and high recurrence rate which mandates regular follow-up.

Several studies have been carried out on the prevalence of OCs in various countries. Kambalimath *et al*.[1] reported a prevalence of 15.31% for OCs and they found that radicular cyst was the most prevalent histological type (48.67%). Manor *et al*.[2] found that that 44% of cases in their study were developmental in origin, whereas 48% were inflammatory. A systematic review done by Johnson *et al*.[3] reported that the frequency of radicular cysts is 54.6%, followed by dentigerous cyst (20.6%) and OKC (11.7%). A study conducted by Baghaei *et al*.[4] concluded that 16.9% of cases were OCs and among them, dentigerous cyst had the highest prevalence rates (27.2%), followed by radicular cyst (18.6%), OKC (18.6%) and calcifying OC (11.4%). Selvamani *et al*.[5] in their study analyzed 2275 biopsy reports and found that 8.5% of these were jaw cyst, of which 6.7% were odontogenic in nature. Sharifian and Khalili[6] have reported a prevalence rate of 14.4% for OCs in their study. Demirkol *et al*.[7] in their study analyzed 149 cysts of the jaws and observed that out of these, 63% were radicular cysts, 26.9% were dentigerous cysts, 6.1% OKC, 3.4% residual cysts and 0.6% nasopalatine cysts. In another study by Kahnamouii and Yazdani,[8] 39% of the cysts were developmental OCs, 44% of which were dentigerous, 36% were keratocysts and 9% were primordial.

A large number of OCs report to our center annually. Information regarding the factors associated with OCs is lacking in our institution. Thus, the aim of our study was to determine the prevalence and factors associated with the cases of histopathologically diagnosed OCs that reported to our institution. Our objective was to analyze the factors associated with the presence of OCs and to study the biologic behavior of different types of cysts. This study attempts to compile the information on the prevalence and biologic behavior of OCs.

MATERIALS AND METHODS

This cross-sectional study was conducted in the department of oral pathology and microbiology of our institution from the month of March to October 2018. The study population were the patients who had undergone biopsy procedures from 2013 to 2017. The biopsy specimens were examined in our department in the same period. All histopathologically examined cases from 2013 to 2017 were included in the study and those cases without conclusive diagnosis or inadequate specimens were excluded. As per the study done by Kambalimath *et al*.,[1] the prevalence was calculated to be 15.3% and using the formula 4pq/d,[2] the minimum sample size was calculated as 553. Accordingly, data were collected from 600 cases. These cases were selected by simple random sampling. The 600 cases were proportionally divided among the total cases per year as per our records. Then, random numbers were generated with the help of the Internet. The biopsy samples with these random numbers were selected as our samples.

Data were collected from the electronic medical records of these samples using a semistructured questionnaire. Four cases were excluded from the study due to inadequate records. The age, gender and diagnosis of all the cases were noted. In addition, from the histopathologically proven cases of OCs among these, additional information regarding family history, primary symptom, history of trauma, number of cysts, site, side, radiographic presentation, presence of impacted teeth, final histopathologic diagnosis, treatment given, recurrences and associated conditions if any were collected. The classification followed for OCs was the WHO classification of 2017.[9] To analyze the behavior of the OC, they were broadly grouped as inflammatory and developmental cysts.

Data collected were entered into Microsoft Excel and analyzed using SPSS version 20. To test the statistical significance of the association of various factors with the presence of OCs, the Chi-square test was done.

RESULTS

Of the 596 cases included in the study, 67 (11.2%) had a histopathological diagnosis of OCs. Of these, 33 (11.0%) were male and 34 (11.5%) were female. The overall percentage of males and females were 50.3% and 49.7%, respectively. 16 cases (25.4%) in the age group of 1–20 years, 24 cases (16.2%) in the age group of 21–40 years, 20 cases (8.2%) were in the age group of 41–60 years and 7 cases (5.0%) above 61 years had OC's among the total sample of 596 cases. The age predilection was found to be statistically significant with $P < 0.05$ [Table 1].

Table 1: Age and gender distribution of cases

	Cyst (yes) (%)	Cyst (no) (%)	*P*
Age			
0-20	16 (25.5)	47 (74.6)	0.000
21-40	24 (16.2)	124 (83.8)	
41-60	20 (8.2)	225 (91.8)	
≥61	7 (5.0)	133 (95.0)	
Gender			
Male	33 (11.0)	267 (89.0)	0.851
Female	34 (11.5)	262 (88.5)	

There was no family history for OC in any of the cases. Swelling was the main complaint in 35 cases (52.2%), followed by pain and swelling in 15 cases (22.4%), pain in 8 cases (11.9%) and 6 cases (9.0%) were asymptomatic. There was a history of trauma in 8 cases (11.9%). 66 of the cases (98.5%) had only a single cyst, whereas one case (15%) had multiple cysts. OC was located in the mandible in 41 cases (61.2%) and maxilla in 25 cases (37.3%). The case with multiple cysts was located in both the maxilla and mandible (1.5%). In the jaws, 33 cases (49.3%) were seen in the posterior region, 26 cases (38.8%) in the anterior and 8 cases (11.9%) had an anteroposterior extension. 29 cases (43.3%) were located in the right side while 27 cases (40.3%) were in the left side and 10 cases (14.9%) presented in the midline. The radiographic presentation varied from unilocular in 40 cases (59.7%), periapical in 25 cases (37.3%) and multilocular in 2 cases (3.0%). 16 cases (23.9%) had an associated impacted tooth. Out of the total 67 cases of OC, 41 cases were inflammatory cysts and 26 developmental cysts. The different types of cysts and their distribution are given in Table 2.

Enucleation was done as treatment for 55 cases (82.1%), marsupialization was done in 7 cases (10.4%), resection in 4 cases (6.0%) and a combination of marsupialization and resection was done in one case (1.5%). None of the cases reported with a recurrence. Other associated oral conditions were reported in 15 cases (22.4%), of which 8 cases (11.9%) had caries, 4 (6.0%) had both caries and periodontitis and 2 (3.0%) had periodontitis. Associated systemic conditions such as diabetes, hypertension, cardiovascular disorders and respiratory disorders were seen in 7 cases (104%) of cases.

The analysis of the biologic behavior of inflammatory and developmental cysts is given in Table 3. Of the 33 males, 17 (51.5%) had developmental cysts and 16 (48.5%) had inflammatory cysts. 25 females of the total 34 had inflammatory cysts, whereas 9 (26.5%) had developmental cysts. This was found to be statistically significant with $P = 0.032$. Anterior jaws were the site of occurrence in a total of 26 cases, of which 22 cases (84.6%) were inflammatory while 4 cases (15.4%) were developmental cysts. This was found to be statistically significant with $P = 0.004$. A total of 33 cases occurred in the posterior jaws, of which 19 (57.6%) were developmental and 14 (42.4%) were inflammatory. Only 8 cases had an anteroposterior presentation and out of these, 5 cases (62.5%) were inflammatory and 3 cases (37.5%) were developmental cysts. 23 cases (57.5%) out of the 40 cases which showed a unilocular radiolucency were developmental cysts and 17 cases (42.5%) were inflammatory cysts. Only 2 cases had a multilocular appearance which one each (50.0%) being inflammatory and developmental cysts. 25 cases presented as a periapical radiolucency, of which 23 cases (92.0%) were inflammatory and 2 cases (8.0%) were developmental cysts. The comparison of radiographic presentation also was found to be statistically significant ($P = 0.000$). A total of 16 cases had an associated impacted tooth. Of these, 14 cases (87.5%) were developmental cysts, whereas 2 cases (12.5%) were inflammatory cysts. This association also showed a statistical significance with $P < 0.05$. Among the other 51 cysts which had no impacted tooth, 39 (76.5%)

Table 2: Frequency of different odontogenic cysts

Type	Frequency (%)
Dentigerous cyst	9 (13.4)
OKC	10 (14.9)
Radicular cyst	28 (41.8)
Residual cyst	5 (7.5)
COC	1 (1.5)
Developmental odontogenic cyst	5 (7.5)
Inflammed odontogenic cyst	8 (11.9)
OOC	1 (1.5)

OKC: Odontogenic keratocyst, COC: Calcifying odontogenic cyst, OOC: Orthokeratinized odontogenic cyst

Table 3: Comparison of behavior of inflammatory and developmental cysts

	Inflammatory cysts (%)	Developmental cysts (%)	*P*
Age			
1-20	43.8	56.2	0.032
21-40	58.3	41.7	
41-60	80	20	
≥61	57.1	42.9	
Presenting symptom			
Asymptomatic	33.3	66.7	0.640
Pain	75	25.0	
Swelling	62.9	37.1	
Others	50	50	
History of trauma			
Yes	87.5	12.5	0.104
No	57.6	42.4	
Site			
Maxilla	76	24	0.88
Mandible	53.7	46.3	
Both	0	100	
Specific site			
Anterior	84.6	15.4	0.004
Posterior	42.4	57.6	
Anteroposterior	62.5	37.5	
Radiographic presentation			
Unilocular	42.5	57.5	0.000
Multilocular	50.0	50.0	
Periapical	92.0	8.0	
Presence of impacted tooth			
Yes	12.5	87.5	0.000
No	76.5	23.5	
Treatment			
Enucleation	60.0	40	0.524
Marsupialization	71.4	28.6	
Resection	75	25	

were inflammatory and 12 (23.5%) were developmental cysts.

DISCUSSION

OCs are common lesions of the oral cavity with distinct histopathologic features. We found a prevalence of 11.2% for OC's in our institution. This is in agreement with previous studies from Brazil (9.94%), Chile (10%), Libya (14.8%) and Iran (16.9%).[4,10-12] Studies from Turkey (36%) and Iran (21.62%) have shown a higher prevalence.[7,13] In India, studies from various parts have been reported. A study from North India reported a prevalence of 13.9%[14] while another from Central India showed a prevalence of 15.3%.[1] Previous studies from South India have reported a prevalence of 8.5%,[5] 9.6%[15] and 12.25%.[16]

There was an equal distribution of OC's in males and females in our study. Most of the studies show a male predominance while one study from Brazil showed results similar to ours.[1,4,5,7,10,17,18] OC's were seen to occur in a wide age range. 35.8% of cases were in the 21 to 40 age group, 29.8% in 41 to 60 age group 23.8% in 1 to 20 age group and 10.4% in people above 61 years with a mean age of presentation of 45.5% years. Other studies have reported a mean age of 32.72 years and 28 years at the time of diagnosis.[5,7]

Swelling was the most common (52.2%) clinical complaint, followed by pain and swelling (22.4%) while 9% of cases were asymptomatic. The presence of swelling with or without pain is one of the common presentations of OC's.[5] Cases which are asymptomatic are usually discovered on routine radiographs.

Location wise, OC's were more common in the mandible (61.2%) than in the maxilla (37.3%). One case had multiple cysts and was located in both the maxilla and mandible. They were more common in the posterior region (49.3%) than in the anterior region (38.8%). This is in accordance with other studies.[1] The radiographic presentation varied from unilocular in 59.7% to multilocular in 3% of cases. 37.3% of cases showed a periapical radiolucency suggestive of inflammatory origin. The presence of impacted tooth was seen in 23.9% of cases and indicated that the cyst was developmental in nature.

Of the OC's in our study, 61.2% were inflammatory and 38.8% were developmental in nature. All previous studies point that inflammatory cysts are more common than developmental with periapical cysts having the highest prevalence.[5,7,10] Radicular cysts (41.8%) were the most frequent in our study, followed by OKC (14.9%) dentigerous cysts (13.4%), inflamed OC (11.9%), developmental OC and residual cyst (both 7.5%) and orthokeratinized OC and calcifying OC (both 1.5%). Various studies have reported that dentigerous cysts were more prevalent than OKC's while we found a marginally higher prevalence of OKC than dentigerous cysts.[7,10,12] Although the question whether OKC is cystic or neoplastic was a controversy for long, many of the previous studies have included it in their studies. Hence, OKC was included in our study so as to enable comparison. The prevalence rates reported for OKC ranged from 1.8% to 2.5% while for dentigerous cysts is from 15% to 33%.[12]

The association of inflammatory and developmental cysts with age, presenting complaint, history of trauma, site, radiographic presentation, presence of impacted tooth and treatment was compared. About 80% of the inflammatory cysts were seen in the age group of 41–60 age group, whereas only 20% of developmental cysts were seen in this age group. This is understandable as inflammatory cysts develop as a sequela to pulpal inflammatory process over a period of time. 56.25 of developmental cysts were seen in the 1–20 age group, whereas only 43.8% were inflammatory in this group. The odontogenic rests are more active in the younger age and OCs like dentigerous cysts are more commonly seen in young patients.

The inflammatory cysts commonly presented with symptoms like pain (75%) and swelling (62.9%), whereas 66.7% of the developmental cysts were asymptomatic. Developmental cysts like OKC tend to destroy the bone rather than cause expansion unlike inflammatory cysts which produce pain and swelling. Of the cases which had a history of trauma, 87.5% were inflammatory cysts. It is well known that these cysts may arise secondary to trauma leading to pulpal death and subsequent cyst formation, especially in the maxillary anterior region. Common symptoms reported in other studies include swelling, pain, fistulas, tooth mobility and paresthesia.[19]

Seventy-six percent of the cysts in the maxilla were inflammatory while 46.3% of developmental cysts were in the mandible. Inflammatory cysts like radicular cysts are reported to occur more in the anterior maxilla and developmental cysts like OKC and dentigerous cysts occur more in the posterior mandible.[20] 84.6% of cysts in the anterior region were inflammatory while 57.6% of cysts seen in the posterior jaws were developmental cysts. The most common site reported for OKC is the molar area. Extensive cysts were reported in both types of cysts.

Periapical location is one of the prerequisites for periapical cysts and 92% of inflammatory cysts were periapical in location. 8% of developmental cysts were also seen in periapical location. Unilocular and multilocular presentations were seen for both inflammatory and developmental, though unilocular radiolucency was more common among the two. A study from Turkey reported that the most frequent radiological feature was unilocular (93.7%), followed by lobulated (5.0%) and multilocular (1.3%).[21] Impacted teeth are commonly associated with developmental cysts and were seen in 87.5% of cases in our study.

Enucleation, marsupialization and resection were the treatments done for the cysts depending on the size irrespective of its type. Recurrence is commonly reported for OKC. The recurrence rate ranges from 0% to 62%.[22] A study from China showed a recurrence rate of 15.9% and observed that the number of recurrences and the average time (in years) to relapse decreased from the first relapse of OKC to the third relapse and this difference was found to be significant.[23] None of the OKC's in our study reported recurrence. This may be because the maximum follow-up was within 5 years and the time for recurrence may vary from 1 year to even 40 years after the initial surgery.

CONCLUSION

This study has compiled the information regarding the prevalence and biologic behavior of OCs based on the case records. OCs were found to have a prevalence rate comparable with those reported elsewhere. The inflammatory cysts were more common than developmental cysts as reported in previous studies. Radicular cysts were the most common cysts. However, contrary to other studies, OKC's had a slightly higher prevalence than dentigerous cysts. OCs may grow to large sizes and may present with pain and swelling or may be asymptomatic. The early detection of these lesions is necessary to minimize extensive surgery. Furthermore, patients need to be reviewed regularly to monitor possible recurrences, especially OKC. Although rare, OCs can undergo malignant transformation with a reported incidence of <1%.[24] Based on our study, we conclude that the distribution pattern of OC's in our study population is relatively similar to studies from other parts of the world.

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Conflicts of interest
There are no conflicts of interest.

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