Original Study

AN INSTITUTIONAL RETROSPECTIVE STUDY TO ASSESS THE CHANGE IN PREVALENCE OF ODONTOGENIC CYSTS ANS TUMORS BASED ON *WHO* 2005 CLASSIFICATION

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ABSTRACT

Aim: - Classification of odontogenic cysts (OC) and tumors (OT) have been improved over the years owing to the better understanding of its molecular pathogenesis. This institutional based study was designed to note the change in prevalence of the same, following redefinition of certain entities in WHO 2005 classification.

Materials and Method: - Retrospective analysis of cyst and tumor from departmental records were evaluated against literature based on WHO 2005 classification. Furthermore relative frequencies were compared against studies based on WHO1992 criteria to assess the change in prevalence.

Result: - OT comprised 2.64 % of cases with keratocystic odontogenic tumor (34.25%), ameloblastoma (33%) and odontomas (10.18%) as prevalent tumors. OC formed 6.22% cases with radicular cysts (70.86%), dentigerous cyst (16.93%) and orthokeratinising odontogenic cysts (5.51%) as frequent ones. There was an obvious disparity in prevalence of these compared to literature.

Conclusion: - Keratocystic odontogenic tumor emerged as the most prevalent tumor, whereas Radicular cyst is persisting as commonest cyst. Moreover, rise in prevalence of OT and decrease in percentage of OC is suggestive of the consequence of new classification.

Key Words: - Odontogenic cyst, Odontogenic tumors, WHO classification

Introduction

Odontogenic cysts and tumors are entities that specifically develop in the jaw bones. These represent a unique group of lesions because of their discrete clinical behavior and histological characteristics. Classification of tumors and tumour-like lesions of the odontogenic origin have been improved over the years based on its origin and histological criteria and has been internationally accepted as well.[1] Surgeons, radiologists and pathologists should be awakened to this situation, in order to develop a uniform treatment protocol.

Odontogenic cysts (OC) are frequently encountered in dental practice than odontogenic tumors (OT) and constitute an important aspect of oral and maxillofacial pathology. Developmental and inflammatory OC are epithelial in origin, exhibiting signs of slow growth and a tendency towards expansion. Nevertheless, these lesions can attain a marked size, despite their benign biological behaviour.[2] OT are derived from tooth forming apparatus, either epithelial or ectomesenchymal or both. These heterogeneous tumors are rare; however the complexity lies in its varied clinical behavior from hamartomatous or non neoplastic tissue proliferations to malignant neoplasm with metastatic capacity.[3] Therefore, understanding the frequency of occurrence and demographic profiles of these lesions will be of great use in the study and clinical management of the same.

Numerous studies are present in the literature regarding odontogenic cysts and tumors based on the 1971 and 1992 WHO histological classification. There exists a difference in overall and relative frequency of individual odontogenic tumors from region to region. Besides, more recent WHO 2005 classification brought some substantial changes, which included parakeratinized odontogenic keratocyst as a benign odontogenic tumor and orthokeratinized as odontogenic cyst.[4] These redefinition and reclassification of odontogenic cysts and tumors have changed the impact of prevalence and epidemiological profiles of the same.

Assessing the records of oral pathology diagnostics are excellent sources to provide information regarding the same and represent the only source of such data available. Therefore, the present institutional based research was designed to analyze the frequency and distribution of odontogenic tumors and cysts based on WHO 2005 criteria and to compare it with other published data from India as well as from other geographic areas, and furthermore to assess the changing prevalence on the same attributable to reclassification.

Materials and Methods

After obtaining the institutional ethical clearance, data regarding the cases were collected from the records of the department of Oral Pathology, KLE VK institute of dental sciences Belgaum. A retrospective analysis of records for odontogenic tumors, and odontogenic cysts were carried out from 1993-2012 (4080 cases) which is reported till date. Information including the histopathological type, patient's age, gender, site of tumour and frequency were also obtained.

Anatomic site distribution was considered based on the radiographic extension method used by Sriram and Shetty (2008).[5] Maxillary lesions were divided into 3 categories; Class I as lesions limited to the anterior segment of maxilla (distal aspect of right canine to distal aspect of left canine). Class II as lesions limited to the posterior segment of maxilla (from mesial aspect of first premolar distally).

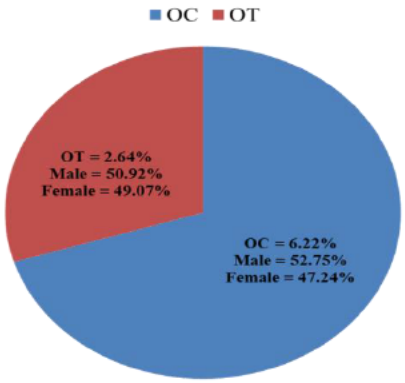
Class III as lesions extended to the anterior and posterior segment of the maxilla.

Likewise, mandibular lesions were divided into 4 categories. Class I as lesions limited to the anterior segment of mandible (distal aspect of right canine to distal aspect of left canine). Class II as lesions limited to the posterior segment of mandible (mesial aspect of first premolar to distal aspect of third molar). Class III as lesions limited to ramus and angle of the mandible (distal aspect of second molar to condyle). Class IV as lesions that extended into anterior, posterior, and ramus segments of the mandible, i.e., along 2 or all 3 segments.

The diagnoses were re-evaluated according to the criteria of WHO histological classification 2005. Results were analysed based on the percentage of cases. In addition, Pubmed / Medline search of literature were done with keywords of incidence of odontogenic cysts and tumors. Series of studies based on 2005 classification were only included for comparison purposes and to assess the impact on prevalence, previous studies based on WHO 1992 were used.

Results

On analysis of 4080 registered biopsies over a period of 19 years (1993 to 2012), we found 254 cases (6.22%) of OC and 108 cases (2.64%) of OT. Regarding gender distribution, these lesions overall showed slight male predominance. Out of 254 cases of OC, 134 cases were males (52.75%) and females 120 (47.24%); out of 108 cases of OT, male constituted 55 cases (50.92%) and female 53 (49.07%) cases. (Pie Chart)



Pie Chart: - Relative frequency and gender distribution of odontogenic cysts and tumours.
OT = Odontogenic Tumor; OC = Odontogenic Cysts; M = Male; F = Female

Odontogenic Tumor

Based on 2005 WHO classification, the relative frequency of odontogenic tumor in the present series was 2.64%. (Table 1)

Overall benign tumors constituted around (98.15%) and malignant (1.85%). On individual analysis KCOT (34.25%) was the most prevalent OT followed by AME (33.3%); OC (10.18%), AOT (9.25%), and CCOT (5.55%). Though the difference between KCOT and AME were not statistically significant, gender wise distribution of OT revealed KCOT as most prevalent OT in male patients and AME in female subjects.

Tumor	Abbr.	n (%)	M n (%)	F n(%)
Benign, 106 cases				
Ameloblastoma	AME	36 (33)	15 (27.3)	21 (39.7)
Unicystic	AME-U	14	5 (9.1)	9 (17)
Solid	AME-S	21	10 (18.2)	11 (20.8)
Peripheral	AME-P	1	0	1 (1.9)
Keratocystic Odontogenic Tumor	KCOT	37 (34.25)	24 (43.6)	13 (24.5)
Adenomatoid odontogenic tumor	AOT	10(9.25)	3 (5.5)	7 (13.2)
Calcifying Epithelial odontogenic tumour	CEOT	2 (1.85)	0	2 (3.8)
Squamous odontogenic tumor	SOT	-	-	-
Ameloblastic Fibroma	AF	-	-	-
Ameloblastic fibro odontoma	AFO	1 (0.92)	0	1 (1.9)
Odontoma	OC	11 (10.18)	5 (9.1)	6 (11.3)
Odontoameloblastoma	OA	-	-	-
Calcifying cystic odontogenic tumor	CCOT	6 (5.55)	5 (9.1)	1 (1.9)
Dentinogenic ghost cell tumour	DGCT	1 (0.92)	1 (1.8)	0
Odontogenic Fibroma	OF	-	-	-
Odontogenic myxomas	OM	1 (0.92)	0	1 (1.9)
Cementoblastoma	CB	1 (0.92)	0	1 (1.9)
Malignant, 2 cases		2 (1.85)	2 (3.6)	0

Table 1: - Frequency and gender distribution of odontogenic tumors by diagnostic type.

Analysis of age distribution of OT exhibit patient's age at diagnosis ranged from 4 to 80 years and peaked at the 2nd and 3rd decade of life with a mean age of 29.8 years. Site distribution of tumor type exhibits a striking prevalence for posterior mandible representing Class III. Evaluation of prevalence and commonest tumor type in 1992 and 2005 WHO criteria revealed an overall increase in frequency of OT; moreover KCOT has emerged as one of the prevalent tumor type (Table 2).

Country	WHO 1992				WHO 2005			
	Author	n	%		Author	n	%	
Indian	Ponniah et al.[7]	489	4.13%	AME, AOT	Tupkari et al	120	5.78%	AME, KCOT
China	Luo et al.[8]	802	2.4%	AME, OD	Luo et al.[8]	1309	3.92%	KCOT, AME
S America	Ochsenius et al.[11]	362	1.29%	OD, AME	Alver et al.[14]	239	4.76%	KCOT, AME
Africa	Ladeinde et al.[9]	319	9.6	AME, AOT	Tawfik et al[16]	82	-	AME, KCOT

Table 2: - Changing prevalence and common odontogenic tumors type country wise

Odontogenic Cyst

The prevalence of OC distributed by histological finding and gender distribution shows maximum cases of RC 70.86%, followed by 16.93% of DC, and 5.51% of OOC and 1.18% of glandular odontogenic cysts and 14 cases of other cysts included residual cysts, lateral periodontal cysts and gingival cysts (Table 3).

Cyst	Abbre.	N	%	Male	Female
Radicular Cyst	RC	180	70.86	96(71.64%)	84(70%)
Dentigerous Cyst	DC	43	16.93	21(15.7%)	22(18.3%)
Ortho keratinizing Cyst	OOC	14	5.51	7(5.2%)	7(5.8%)
Glandular odontogenic Cyst	GC	3	1.18	3(2.2%)	0
Others		14	5.51	-	-
Total		254		134	120

Table 3: - Frequency and distribution of odontogenic cysts

Age of the patients varied from 7 to 80 years with a peak incidence in 3 rd and 4 the decade and a mean age of 32.35. The site distribution of OC, illustrated a predilection for maxilla, (128 cases) especially anterior region i.e. Class 1.

Discussion

Recognizing the most prevalent and rare OC and OT in different group of population will be of great significance as it aids in their diagnosis and clinical management. In spite of the apparent need to discern the relative frequency of these lesions, there are unexpectedly few such studies. Moreover there still exists a lack of uniform nomenclature among clinicians and pathologists; as the WHO classification has not entirely been adapted.[1] Many studies exist on prevalence of cysts and tumors; however they are too old to draw valid assessments as there are changes in interpretation of entities.

Odontogenic Tumors

Odontogenic tumors are rare lesions; representing 0.7-2.7% of oral lesions according to reports.[6] Retrospective studies carried out in different parts of the world are mainly based on 1992 WHO classification and exhibit disparity in frequencies. Literature search of OT based on same displays a varied prevalence such as in Indians[7] 4.13%, in Chinese[8] 2.4%, in Africans[9] 9.6%, where as it was comparatively lower in North American[10] 1.55 %, South American[11] 1.29% and European series[12] 0.74%. Information on OT based on WHO 2005 classification is very limited in literature; thus difficult for comparisons between countries. However, Pubmed search disclosed few such studies and show evidence of relative frequencies such as, 5.78% in Indian population;[13] 3.2% in Chinese population;[9] 4.76% in South American population.[14] (Table 4) These results show a slight increase in existing prevalence, which may be owing to the reclassification and inclusion of KCOT and CCOT into OT and is not associated with real increment in cases of OT.

The present series demonstrate a relative frequency of 2.64% of OT of the total biopsied specimens recorded. This incidence is lower on comparison with other Indian studies[3,13] probable reason may be disparity of inhabitants rate in various part of the country. Rarity of the malignant tumor in literature, is yet again proven with our result by malignant tumor forming only 1.85% and benign tumors constituting the rest i.e. 98.15%.[3,4,6] More than 99% of cases of OT in the present series were found in patients older than 5 years and a peak incidence was accounted in 2nd and 3rd decade of life, which is in concordance with previous results.[3-9] High prevalence of OT in younger age group and in particular its occurrence after crown completion of permanent teeth, yet again emphasize the impression that these lesions occur from remnants of tooth germ.[5]

Distribution of OT among the gender is variable, with a male predilection in Asian and African series; whereas female predilection exists in South Americans.[7] In our study we found a slight male predominance which is in concordance with many studies.[3,5,7] Regarding the site distribution of OT, Asians and Africans show a higher figure for mandible than in maxilla as compared to Americans and Europeans.[7] The site predilection varies in relation to occurrence of the particular neoplasm, the marked preference for mandible could be explained by the increased prevalence of AME and KCOT in the lower jaw. In our research too the most frequently affected location was molar region of the mandible, which was in accordance with earlier reports.[3,5,7]

In our series, KCOT was the most prevalent tumour, which accounted for 34.25% of cases, with a slight male predominance, peak incidence in 3rd decade, mean age of 37 years and prevalence for mandibular posterior region. (Table 4) Reports from China,[8] Brazil[14] and Mexico[15] demonstrated KCOT as the most frequent OT, whereas study from India by Tupkari *et al* and Gill *et al* noticed AME as the most common tumor followed by KCOT. The relative frequency of KCOT in Asian and American series is almost analogous except African series which is showing relatively less (Table 4).[3,4,8,13,15,16] Age and gender distribution of KCOT in our series was comparable with many other studies as well.[8,14,15] In our opinion, clinicians and pathologists should be awakened to this situation and must take this changing prevalence seriously.

AME was the second most prevalent tumor, out of 36 cases of AME (33.3%), AME-S constituted 21 cases and AME-U

	Indian Studies				China		South America		Africa	Iran
	Present study	Tupkari et al[13] 2011	Gill et al[3] 2011	Ebenezer et al[1] 2010	Luo et al[8] 2009	Jing et al[4] 2007	Alver et al [4] 2008	Gaitan Cepeda et al[15] 2010	Tawfik et al[16] 2010	Rezvani et al[17] 2011
Cases(n)	108 (2.64)	120 (5.78)	209 -	102 -	1309 (3.92)	1642 -	238 (4.76)	136 (5)	82	118
AME	33.3	40.83	47.4	14.71	36.52	40.3	23.7	19.3	41.5	30.5
KCOT	34.25	37.5	23.4	12.75	38.73	35.8	30	38.9	19.5	42.3
AOT	9.25	5.83	7.7	2.94	2.06	4.1	5.4	1.4	3.7	2.5
CEOT	1.85	0.83	1.4	1.96	0.46	0.6	2	1.4	3.7	6.7
SOT	-	0.83	-	-	-	0.2	0.4	-	-	
AF	-	0.83	1	0.98	0.99	1.2	1.7	-	2.4	
AFO	0.92	-		0.98	0.92	0.2	0.4	-	-	
OC	10.18	11.67	5.3	58.82	6.11	4.7	22.1	30.8	13.4	9.7
OA	-	-	-	-	-	0.1	-	-	-	
CCOT	5.55	0.83	6.7	1.96	1.99	2.2	6.3	-	-	
DGCT	0.92	-	-	-	0.38	0.5	-	-	-	
OF	-	-	1	0.98	1.60	0.3	-	1.4	-	
OM	0.92	-	3.3	1.96	2.60	4.6	6.3	5.8	8.5	2.5
CB	0.92	0.83	2.9	0.98	1.68	2	1.7	-	3.7	
Malignant	1.85	-	-	0.98	5.96	3	-	-	3.6	-

Table 4: - Comparison of frequencies of Odontogenic Tumor with studies from India and other geographic areas

formed 14 cases in this series. The relative percentage of AME is less on comparing with other Asian studies whereas it is higher in relation to South American series (Table 4).[3,4,8,13,15] AME-S (19.4%) reveals an almost equal gender distribution and a peak incidence in 4th decade. In case of AME-U (12.96%) there was a significant female predilection and a peak incidence in second and third decade of life. In this series, younger age of occurrence of AME-U as compared to AME-S and location of posterior region of mandible is in concordance with the literature; while significant female predilection of AME-U is in contrast to the previous reports.[8] An overall increased female predilection of AME in our series may be owing to female predominance in AME-U cases.

Odontomas accounted for 10.11% cases, with a slight female predominance, prevalence in 3rd decade of life with a mean age of 19.5 years and tendency to occur in maxillary anterior region (Table 1). Most of the demographic data and clinical data agree with the literature. However, on comparing our result with earlier reports from India, an overall increase in incidence can be seen.[5] This raise may be because of enhanced health care provision and improved hospital management over the years. The relative frequency of Odontomas reveals a geographic variation in incidence as frequency is more in Americans and less in Asians and Africans (Table 4).[3,4,8,13,15,16]

In general with reference to the distribution of OTs, Ameloblastoma's are more common in Asians and Africans, where as Odontomas are more common in Americans and Europeans.[7] OT such as Odontomas exhibit self limited growth throughout the clinical course, and do not cause any clinical symptoms. The possible explanation for high frequency for AME and KCOT is that, these are aggressive tumors and patients visit the hospitals for consultation as there are clinical manifestations. Moreover, genetic and environmental factors will also influence the occurrence and thus results in geographic variation.[5,8,13]

AOT was reclassified into the epithelium without ectomesenchyme from epithelium with ectomesenchyme as researches have proven that this tumor is devoid of any cellular odontogenic ectomesenchyme.[4] In our analysis AOT comprised 9.25% of cases, which has a peak incidence in 2 nd decade of life, mean age of 20 years, female predominance and prevalence in maxillary anterior region is in concordance with the literature. Younger age of incidence of AOT could be explained by its occurrence in association with impacted anterior tooth, which alert the individual at an earlier age and patient may seek consultation pertaining to failure of the associated teeth to erupt.[5]

CCOT depicts diversity in clinical behavior and histopathological features. In 2005 these tumors were reclassified into three categories: CCOT, a benign cystic neoplasm; DGCT and GCOC which is the malignant variant.[4] In this series, there were 6 cases of CCOT and 1 case of DGCT and a male predominance was seen. It is difficult to compare these data with others, as the literature regarding the same based on new classification system is very limited. The rarity of other OT like OM CEOT, SOT, AF and CB were too negligible to draw any meaningful observation.

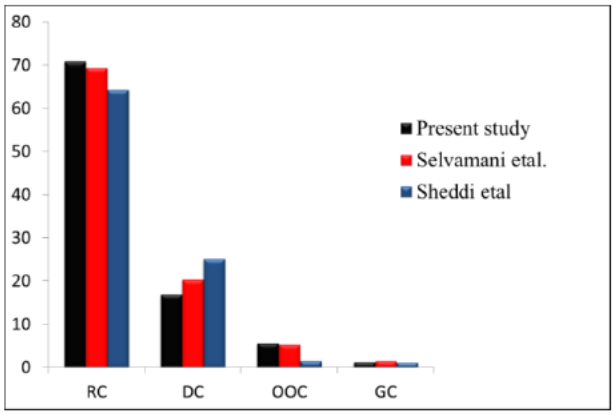
Odontogenic Cysts

Odontogenic Cysts are more common in the maxillofacial region and are categorized conventionally into a developmental group, including keratocyst and dentigerous cysts, and an inflammatory group including Radicular cysts.[18] However according to the new classification system, certain cysts such as OKC and COC have been included in OT. Odontogenic cysts are diagnosed in 7-12% of all oral and maxillofacial biopsies according to

preceding reports.[20] In the present analysis, our result shows a slight decrease (6.22%) in relative frequency of cyst which perhaps have been influenced by the reclassification of certain cyst as tumor.

Survey on studies of OC based on WHO 2005 grading criteria revealed only few such studies. Some studies even though it stated that it is based on the above classification, it has completely excluded OKC from cyst category, which is not acceptable. OOC should be included in the list as orthokeratinising odontogenic cysts is still considered as a cyst. Therefore in the present research we could quote very few studies, as there will be change in interpretation of relative frequencies of entities.

RC are inflammatory in origin; and it is an established fact that they are the most common OC and forms around 70.86% of jaw cysts. In the present study we got 70%, which was in concordance with studies by Selvamani *et al*.[2] 69.3% and Sheddi *et al*[19] 64.3 %..(Graph 1)



Graph 1: - Comparision of odontogenic cysts with other studies

Regarding gender and site distribution, male subject's demonstrated slight extra prevalence than female, and anterior maxilla was the most affected site**.** Literature search have revealed that commonness of this cysts in males and anterior maxilla as site is owing to their increased susceptibility to trauma. And many times patients wish to preserve their anterior teeth in its natural way without adequate restorative treatment.[20] Our result showed a peak occurrence of these cysts in 3 rd decades of life with a gradual decline further, and this finding is in agreement with many other studies.[20,21]

DC the second most common odontogenic cysts in our series, exhibited relative frequency of 16.93% which was slightly lower on comparing with others such as 20.3 % and 25.1%.[3,19] The difference probably reflects the intricacy in diagnosis of small dentigerous cysts which relies largely on operating surgeon, as histologist diagnosis alone is impossible.[23] This lesion showed slight male predominance and increased occurrence in mandibular 3rd molar region. According to literature this site localization can be explained by the fact that lower third molar is the most common impacted teeth and these cysts are mostly associated with the same.[3] Pertaining to age distribution of dentigerous cysts, most of it showed increased incidence in 2nd and 3rd decade of life, which corroborates the findings of previous studies.[3,20,22]

Odontogenic keratocyst is first named by Philipsen in 1956, as a cystic lesion of odontogenic origin with a parakeratinized or orthokeratinized luminal surface. Later in 1967, Toller suggested that it might be a benign cystic neoplasm and in 2005 Philipsen recommended the term keratocystic odontogenic tumor. WHO in 2005 classification accepted OKC with parakeratinized epithelial lining as benign tumor and with orthokeratinized lining as odontogenic cyst. It is important to distinguish between these lesions as OOC does not show aggressive clinical behavior or recurrences as compared with KCOT.[19] In our series OOC is the third most common type of odontogenic cysts with relative frequency 5.51% and a site predilection for mandibular third molar region.

As this study indicates, knowledge of clinical and histological behavior of odontogenic cyst is required for prompt treatment of these noncancerous but likely destructive lesions. A conclusive diagnosis of the cyst type can be prepared on the basis of a delicate balance between the clinical, radiological, and histological findings.

Conclusion

Retrospective analyses of OTs and OCs will be of immense help in enlightening the understanding of the same, for surgeons as well as pathologists. In this geographic region, KCOT is most prevalent OT and RC the most common OC based on the recent WHO classification. Though OT cases are less, the present study threw light on the changing prevalence rate of OT and OC. Appropriate documentation and preservation of case sheet record should be a compulsion in clinical as well as institutional level, which would benefit future researches.

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