Original Article

Relative Frequencies of Odontogenic Cysts and their Protein and Glucose Content

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ABSTRACT

Background: Odontogenic cysts are derived from remnants of odontogenic apparatus entrapped within jawbones. The diagnosis of cysts is based on histology features; however, these features are not clear-cut in many cases, except for a few like OKC and Calcifying Odontogenic cyst. The knowledge of the content of these cysts may assist in the differentiation and diagnosis of the cysts. This study reviewed the pattern of jaw cysts presentation and further analyzed the glucose and protein contents of some odontogenic cysts among them. The findings from our local environment were compared with findings globally as regards jaw cysts.

Methods: A retrospective search of the departmental records of Oral and Maxillofacial Surgery and Oral Pathology of the University College Hospital Ibadan was done from the year 2010 to 2017 for jaw cysts. The cystic content of odontogenic cysts was analyzed prospectively from 2016 to 2017 for total protein, albumin and glucose. Some cases of unicystic ameloblastoma were included because as at the time of obtaining the aspirate the working diagnosis was jaw cyst. Total protein, albumin and glucose estimations of the cysts were done by Biuret, Bromocresol Green and Glucose Oxidase methods respectively. The literature search was done on PubMed, using the keywords cysts, jaw cysts, odontogenic cysts, protein, albumin, glucose content.

Results: 1,156 lesions were diagnosed within the study period of 7 years, among which 45 lesions (3.9%) were jaw cysts of odontogenic origin. Collectively the mean age at presentation was 30.8 (SD ± 17.2) years while it was 32.7 (SD±14.4), 21.6 (SD±14.6) and 40.1 (SD±24.0) years for radicular cyst, dentigerous cyst and OKC respectively. The mean concentration of total protein was highest in radicular cysts (6.2g/dL) compared with the dentigerous cysts.

Conclusion: Radicular cyst is the most common odontogenic cyst followed by the dentigerous cyst. The radicular cyst favours the anterior maxilla while the dentigerous cyst favours the posterior mandible. Caution should be exercised when interpreting the results of protein estimation of odontogenic cystic fluids.

INTRODUCTION

In 1974 Kramer defined a cyst as a pathological cavity filled with fluid or semi-solid and is not formed by the accumulation of pus, but not necessarily lined by epithelium[1]. Since then several classification schemes of cysts of the maxillofacial region have come into existence. The most comprehensive of these is the WHO classification of 2005, which categorized jaw cysts as epithelial and non-epithelial, with a sub-classification of the epithelial as odontogenic and non-odontogenic[2].

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Odontogenic cysts are derived from remnants of odontogenic apparatus entrapped within jawbones. Several reports have described the distribution of odontogenic cysts in the maxillofacial region, with deferring cysts assigned the highest prevalence[3,4,5]. This title is shared between the radicular cysts, dentigerous cyst and odontogenic keratocyst (OKC).

The diagnosis of cysts is based on histology features; however, these features are not clear-cut in many cases, except for a few like OKC and Calcifying Odontogenic cyst. Based on this, the knowledge of the content of these cysts may assist in the differentiation and diagnosis of the cysts [6]. However, information on the content of cysts is sparse and none was found from a Nigerian population. This study reviewed the pattern of jaw cysts presentation and further analysed the glucose and protein contents of some odontogenic cysts among them. The findings from our local environment were compared with findings globally as regards jaw cysts.

METHODS

A retrospective search of the Departmental records of Oral and Maxillofacial Surgery and Oral Pathology was done from the year 2010 to 2017 for jaw cysts. Information was collected on the biodata and clinical features of cases with odontogenic cysts. In addition the cystic content of odontogenic cysts was analyzed prospectively from 2016 to 2017 for total protein, albumin and glucose. Some cases of unicystic ameloblastoma were included because as at the time of obtaining the aspirate the working diagnosis was jaw cyst. Total protein, albumin and glucose estimations of the cysts were done by Biuret[7], Bromocresol Green[8] and Glucose Oxidase[9]methods respectively.

Findings were compared with documentations of these cysts in the English literature. The literature search was done on PubMed, using the keywords cysts, jaw cysts, odontogenic cysts, protein, albumin, glucose content. Articles that considered at least three odontogenic cysts in the adult population were selected and analyzed for relative frequencies of the cysts, gender and jaw distribution of the cysts and cystic content. The relative frequencies were described according to the continent of study, type of cyst, gender distribution, site (jaw distribution) and location (anterior or posterior) of the odontogenic cysts. Data was summarized and analyzed with SPSS version 22. Comparison of categorical variables was tested with Chi Square while comparison of means was tested with student T-test. Statistical significance was set at p £0.05.

RESULTS

1,156 lesions were diagnosed within the study period of 7 years, among which 45 lesions (3.9%) were jaw cysts of odontogenic origin. Collectively the mean age at presentation was 30.8 (SD±17.2) years while it was 32.7 (SD±14.4), 21.6 (SD±14.6) and 40.1 (SD±24.0) years for radicular cyst, dentigerous cyst and OKC respectively.

There were 28 (62.2%) males and 17 (37.8%) females. The mandible was the commonest site with 25 (55.6%) cases and radicular cyst was the commonest with 22 (48.9%) cases, followed by dentigerous cyst with 13 cases (28.9%). There was no difference in the pattern of distribution of these cysts according to gender and site (Table 1). The colour of the cystic fluids was documented for 36 (80.0%) cases and straw colour was observed in 58.3% of the cases (Table 1). Of note were two aspirates that were without colour and appeared watery (Figure 1).

Total protein, albumin and glucose estimations were done for 19 cystic lesions. The mean concentration of total protein was highest in radicular cysts (6.2g/dL) compared with the dentigerous cysts (Table 2). No OKC was captured in the cystic fluid analysis during the period of estimation.

For the literature search, 53 studies met the selection criteria and were reviewed. Forty-four articles were original articles and data for 17 additional studies were retrieved from 5 of the original articles constituting data from 53 studies. A total number of

Table 1: Distribution of cysts according to type of cysts from this study

		Radicular Cyst (22)	Dentigerous Cyst (13)	OKC (8)	Periodontal Cyst (2)	Total (45)	p-value
Gender	Male	14	7	5	2	28	0.655
	Female	8	6	3	0	17	
Site	Maxilla	12	4	1	1	18	0.404
	Mandible	9	8	7	1	25	
	Not specified	1	1	0	0	2	
Colour	Straw coloured	13	5	3	0	21	0.079
	Brownish	5	5	2	1	13	
	Colourless	1	0	0	1	2	
	NOS	3	3	3	0	9	

Table 2: Mean protein and glucose content of odontogenic cysts.

This study (Number of cases)	Radicular Cyst (8)	Dentigerous Cyst (3)	Periodontal Cyst (2)	Unicystic Ameloblastoma (6)
Total Protein (g/dL)	6.2 (1.14)	2.3 (2.8)	1.0	4.7 (2.4)
Albumin (g/dL)	2.7 (0.8)	1.0 (1.3)	2.2	2.3 (1.1)
Glucose (mg/dL)	53.1 (17.2)	24.3 (18.3)	34.5	50 (18.8)
In literature (Number of studies)	Radicular Cyst (4)	Dentigerous Cyst (4)	OKC (3)	Unicystic Ameloblastoma (1)
Total Protein (g/dL)	_	6.0 (SD±0.9)	3.7 (SD±1.5)	4.9
Albumin (g/dL)	2.7 (SD±2.6)	3.0 (SD±3.1)	2.8 (SD±4.3)	6.7
Glucose (mg/dL)	109.5 (SD±65.02)	65.02 (SD±3.37)	-	-

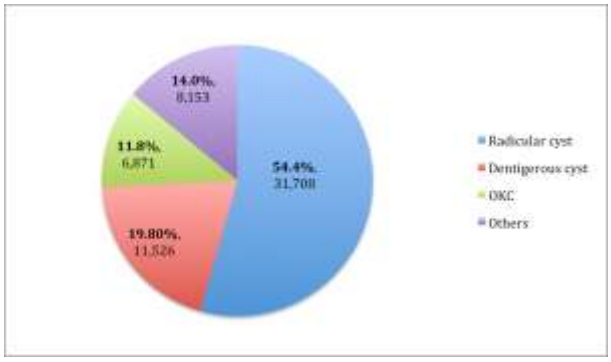

Figure 1: Frequencies of common odontogenic cysts

58,258 odontogenic cysts from the six continents were documented in these articles. The three most frequent odontogenic cysts were the radicular, dentigerous and the odontogenic keratocysts. The combined frequency of these cysts accounted for 86.0% of all odontogenic cysts. Radicular cyst was the most frequent accounting for 54.4% of all the odontogenic cysts (Figure 1 and Table 1). Radicular cyst was reported as the most frequent of the odontogenic cysts in 84.9% of the articles while dentigerous cyst and OKC were reported as the most frequent in 7.5% of the articles. The second most frequent was dentigerous cyst in 52.8% of the articles while OKC was the second most frequent in 18.9% of the articles. The male gender was represented in 55.8% of the cases while the mandible was the commonest site in 65.4% of the articles. However, 50.6% of the cases were reported in the maxilla. The dentigerous and OKC had higher frequencies reported for the mandible than the maxilla (Table 3). Location of the cysts was generally more in the posterior region (52.4%) of the jaws but for radicular cyst a higher anterior location (60.2%) was reported (Table 3).

Table 3: Pattern of distribution of the common odontogenic cysts

		Number of studies	Total number of cysts	Radicular Cyst	Dentigerous Cyst	OKC	Others
Continent	Asia	22	10,979	5,027 (45.8%)	2,101 (19.1%)	1,519 (13.8%)	2,332 (21.2%)
	Europe	10	11,494	6,445 (56.1%)	1,916 (16.7%)	1,254 (10.9%)	1,879 (16.3%)
	Africa	9	541	116 (21.4%)	156 (28.8%)	46 (8,5%)	223 (41.2%)
	South America	8	9,200	5,282 (57.4%)	2,241 (24.4%)	787 (8.6%)	890 (9.7%)
	North America	3	7,747	4,816 (62.2%)	1,662 (21.5%)	538 (6.9%)	731 (9.4%)
	Australasia	1	18,297	9,982 (54.6%)	3,772 (20.6%)	2,145 (11.7%)	2,398 (13.1%)
Gender	Male	33	13,851	7,089 (51.2%)	2,836 (20.5%)	1,940 (14.0%)	1,986 (14.3%)
	Female		10,950	6,283 (57.4%)	1,722 (15.2%)	1,353 (12.4%)	1,592 (14.5%)
Site	Maxilla	26	8,620	5,863 (60.1%)	1,115 (36.8%)	711 (31.7%)	931 (10.8%)
	Mandible		8,414	3,889 (39.9%)	1,914 (63.2%)	1,529 (68.3%)	1,082 (12.6%)
Position	Anterior	17	6,393	4,722 (60.2%)	711 (31.9%)	372 (23.0%)	588 (9.2%)
	Posterior		7,041	3,127 (39.8%)	1,520 (68.1%)	1,242 (77.0%)	1,152 (16.3%)

DISCUSSION

This study described the relative distribution of the three most frequently reported odontogenic cysts as well as their protein and glucose contents. The reported relative prevalence of odontogenic cysts ranged from 1.6% to 9.4% from other studies; thus 3.9% found in this study corresponds with the findings in literature[10, 11, 12, 13]. The mean age of occurrence in literature was between the second and third decades of life[3,5,14,15], as was similarly noted in this study. In accordance with reported literature the frequency of reported jaw cysts was higher in males than female [13,16,17,18,19,20,21]. The reason for higher prevalence in the male gender was suggested by some authors as poor oral hygiene and higher incidence of trauma with the male gender[13, 21, 2].

In this study radicular cyst was the most common of the odontogenic cysts, followed by the dentigerous and thirdly the OKC. This order of frequencies has been similarly reported by several studies in literature[23,24,25,26,27,28,29] . The second commonest odontogenic cyst appears to be shared between dentigerous cyst and OKC but more often the dentigerous cyst. However, some studies from Africa reported relatively higher prevalence of dentigerous cyst compared to radicular cyst [3,30,31]. The observed differences in the distribution of odontogenic cysts may be due to geographical differences, variations in sample size and the previous categorization of OKC as an odontogenic tumour by the WHO[14].

In this study, the commonest site for the odontogenic cyst was the mandible while the radicular cyst was more common in the maxilla. Some studies reported the mandible to be the most prevalent site[13,16,21]while others reported the maxilla to be the most prevalent site[20,32,33]. However there was no statistically significant difference in the jaw

distribution of odontogenic cysts, a finding similarly reported by Acikgoz and Koseoglu[11,34]. Furthermore, the jaw distribution of odontogenic cysts appeared not to be consistent in literature. On the other hand, jaw distribution according to the type of odontogenic cyst appears to be consistent; as the anterior maxilla favours radicular cyst while the posterior mandible favors dentigerous cyst and OKC1[10,11]. This distribution may possibly be explained by the higher frequency of the anterior teeth being involved in trauma as an initiating factor and thus may be responsible for the higher number of radicular cyst in this region. Also the late erupting teeth are the ones usually associated with cystic formation therefore may account for the dentigerous having a higher frequency posteriorly. Based on these observations it can be hypothesized that a cyst presenting in the anterior maxilla is most likely a radicular cyst and a cyst presenting in the posterior mandibular region is most likely a dentigerous cyst or an OKC (Figure 2). In the posterior mandibular region a dentigerous cyst is considered first because it is more common than an OKC. However, a systematic review of the literature will be required to confirm this hypothesis.

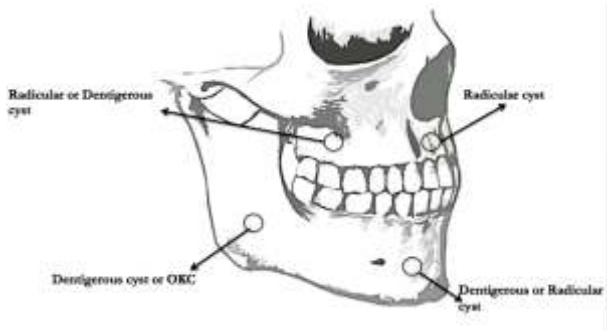

Figure 2: Proposed likely sites and location of common odontogenic cysts

The colour of odontogenic cystic fluid was majorly straw-coloured in this study. Two aspirates however were colourless (3B and 3C in Figure 3) which was interesting but could not be explained. They were cases of radicular and lateral periodontal cysts. One was aspirated from an anterior maxillary lateral periodontal cyst of a male patient and the other from an anterior mandibular radicular cyst of a female patient. Reports on the colour of odontogenic cyst aspirate was sparse in literature. In the few reports found aspirates from radicular cysts were described as straw-coloured while dirty white was described for OKC[35].

In this study the protein estimation were similar to the documentations in literature with respect to the mean total protein of radicular cyst being higher than that of dentigerous cysts and ameloblastoma which in turn was higher than that of the lateral periodontal cyst[36] . The mean total protein concentration of radicular cyst in this study of 6.2g/dL was very similar to the 6.8g/dL recorded by a similar study[35]. However no OKC was captured in our series and the mean total protein of the dentigerous cyst and ameloblastoma were lower than 5g/dL. In the literature, protein and glucose odontogenic cystic fluid estimations were sparsely documented. Toller demonstrated that the protein content of OKC is usually lower than those of other odontogenic cysts and Kramer suggested that a soluble protein content of lower than 4.8g/dL is suggestive of an OKC[37,38]. Browne also reported the mean concentration of protein in unicystic ameloblastoma to be lower than 5g/dL[36]. This was similarly observed in this study. It is therefore suggested that caution should be exercised when interpreting the results of protein estimation of a jaw cyst aspirate as a value lower than 5g/dL may also be suggestive of unicystic ameloblastoma.

Glucose estimation of radicular cyst in our study was higher than that of dentigerous cyst but similar to unicystic ameloblastoma. This higher glucose content of radicular cyst has been previously documented and has been suggested to be a reflection of a lower level of cellular metabolism in dentigerous cyst compared with the radicular cyst[39].

CONCLUSION

Radicular cyst is the most common odontogenic cyst followed by the dentigerous cyst. The radicular cyst

favours the anterior maxilla while the dentigerous cyst favours the posterior mandible. Caution should be exercised when interpreting the results of protein estimation of odontogenic cystic fluids.

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