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Odontogenic tumors: a study of 340 cases in a Brazilian population

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BACKGROUND: The aim of this study was to determinate the relative frequency of odontogenic tumors (OTs) in a Brazilian population and to compare this data with previous reports.
METHODS: We reviewed the achieves of 19 123 specimens from oral pathology laboratory of Universidade Federal de Minas Gerais, from 1954 to 2004. Using the criteria of histologic typification published by the World Health Organization in 1992, we classified the OTs.
RESULTS: A total of 340 OTs were found. The frequency of OTs comprises 1.78% of all pathologic specimens in our laboratory. The most frequent tumor was ameloblastoma (45.2%), followed by odontomas (24.91%), and myxomas (9.1%).
CONCLUSIONS: Odontogenic tumors are uncommon lesions in this Brazilian population and malignant OTs are very rare. The relative frequency of various types of OTs, age, and gender distribution are similar to those reported in African, Asian but not to Chilean and North American series.
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Keywords: adenomatoid odontogenic tumor; ameloblastoma; myxoma; odontogenic tumors; odontoma

Introduction

Odontogenic tumors (OTs) are a group of lesions arising from the tooth-producing apparatus or its remnants. They may originate from the epithelial and/or ectomesenchymal odontogenic tissues, and they show many different degrees of tissue interactions (1, 2). Although some of them represent hamartomas, there are many others that are true benign and malignant neoplasms with different degrees of aggressiveness (3). OTs are rare lesions of the mandible and maxilla that must be considered as a differential diagnosis of lesions that occur in the jaws (4). In humans, OTs comprise about 1% of all jaw tumors (5).

Studies with different ethnic groups from various parts of the world showed differences in relative frequency of histologic types of OT (3, 4, 6–13). The terminology and classification controversies of theses lesions were partially responsible for this variation, although World Health Organization (WHO) published the first and the second editions of the 'Histological Typing of Odontogenic Tumors', in 1971 (1) and in 1992 (14), respectively.

This study was carried out to establish the relative frequency of various histologic types of OTs at Oral Pathology Service, School of Dentistry, Universidade Federal de Minas Gerais, Brazil, over a period of 51 years (1954–2004), as well as their frequency in both genders and in different age groups. We also attempted to compare our findings with those reported from elsewhere in the world.

Material and methods

We retrieved 19 123 samples of oral biopsies from the files of the Oral Pathology Service, School of Dentistry, Universidade Federal Minas Gerais, Brazil. This service is one of the referral centers in oral and maxillofacial pathology in our country and the main center in Minas Gerais State. Case records of patients with OTs over a 51-year period (1954–2004) were used. The records were analyzed for age, gender, tumor site, and clinical history.

The hematoxylin and eosin-stained slides were studied by two observers and were re-evaluated according to the 1992 WHO histologic classification (14). Recurring tumors were considered once. With regard to the site of occurrence, the jaws were divided into three areas: anterior, premolar, and molar. In the case of the mandible, the molar area included the ascending ramus.

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Table 1 Frequency and gender distribution of odontogenic tumors listed by diagnostic type

	Total		*Female*		*Male*	
	n	*%*	*n*	*%*	*n*	*%*
Benign						
Ameloblastoma	154	45.3	84	54.5	70	45.5
Clear cell odontogenic tumor	2[a]	0.6	1	50.0	–	–
Squamous odontogenic tumor	5	1.5	3	60.0	2	40.0
Calcifying epithelial odontogenic tumor	4	1.2	2	50.0	2	50.0
Ameloblastic fibroma	6	1.8	5	83.0	1	17.0
Ameloblastic fibro-odontoma	1	0.3	1	100.0	–	–
Odontoameloblastoma	6	1.8	5	83.3	1	16.7
Adenomatoid odontogenic tumor	13	3.8	8	61.5	5	38.5
Calcifying odontogenic cyst	12	3.5	7	58.3	5	41.7
Complex odontoma	52	15.3	24	46.2	28	53.8
Compound odontoma	33	9.7	14	42.4	19	57.6
Odontogenic fibroma	11	3.2	8	72.7	3	27.3
Myxoma	31	9.1	17	54.8	14	45.2
Cementoblastoma	8	2.3	6	75.0	2	25.0
Malignant						
Ameloblastic carcinoma	1	0.3	1	100.0	–	–
Clear cell odontogenic carcinoma	1	0.3	1	100.0	–	–
Total	340	100	187	55.0	152	45.0

[a]Gender not specified in one of the tumors.

Results

In this study, we found 340 OTs, which constituted 1.78% of oral cavity and jaw lesions examined at oral pathology laboratory of the School of Dentistry, Universidade Federal de Minas Gerais, during this 51-year period. Table 1 shows the frequency and gender distribution for different pathologic types of tumors listed according to WHO International Classification of Odontogenic Tumors. There were 338 (99.4%) benign lesions and only two (0.6%) malignant lesions. The most frequent benign tumor was ameloblastoma (45.2%), followed by odontomas (24.91%), and myxoma (9.1%). The malignant lesions were an ameloblastic carcinoma and a clear cell odontogenic carcinoma (CCOT).

Ameloblastomas occurred in three different clinical presentation. These were: solid or multicystic (81.6%), unicystic (17%) extraosseous or peripheral (1.4%). All cases of ameloblastomas were histologically classified. There were 55.3% plexiform, 37.6% were folicular, 3.5% were basaloid, 1.4% were acantomatosous, 1.4% were granular cells, and 0.8% were desmoplastic.

Of the 340 OTs, the gender distribution was 187 females, 152 males and one not related. Benign tumors presented a male–female ratio of 1:1.2 and all malignant tumors were found in female.

The mean age (Table 2) of this patient population is 25.5, with a wide range (1–82 years). About 250 cases (73.5%) were found in the second, third and forth decades, with a peak in the second decade (32.9%). The most prevalent OT in the second decade of live was ameloblastoma (42%), following by complex odontoma (17.6%), compound odontoma (10.7%), and myxoma (9.8%).

Table 3 shows that the exact location of the tumor was known in 319 cases. There were 110 (34.5%) cases in the maxilla and 209 (65.5%) cases in the mandible. The most frequently affected areas were the posterior aspect of the mandible and anterior region of the maxilla, with 56.9% and 60% of all tumor found in each location, respectively. The ameloblastic fibroma was only found in the mandible. About 85% of the ameloblastoma were observed in the mandible, most frequently in molar zone. Calcifying epithelial OT and CCOT were only in the maxilla. The odontoma (complex and compound) were found principally in the

Table 2 Age distribution of 340 odontogenic tumors

		Age (years)									
Tumors	*Total*	*0–9*	*10–19*	*20–29*	*30–39*	*40–49*	*50–59*	*60–69*	*70+*	*NS*	*Mean age ± SD*
AME	154	5	47	40	27	15	8	5	1	6	27.7 ± 14.2
CCOT	2	–	–	–	–	–	–	–	1	1	82
SOT	5	–	1	2	1	–	–	–	1	–	35.6 ± 24.1
CEOT	4	–	1	1	2	–	–	–	–	–	27.6 ± 9.8
AF	6	1	2	2	–	–	–	–	–	1	16.8 ± 6.5
AFO	1	–	–	1	–	–	–	–	–	–	21
OAM	6	2	2	2	–	–	–	–	–	–	13.0 ± 7.8
AOT	13	1	6	4	1	–	1	–	–	–	21 ± 11.4
COC	12	1	7	2	–	1	–	–	–	1	18 ± 9.6
ODTx	52	7	20	11	5	4	1	2	–	2	22.2 ± 14.7
ODTp	33	5	12	9	4	1	–	1	–	1	20.5 ± 12.3
OF	11	1	1	2	3	2	1	–	1	–	35.2 ± 19
MYX	31	–	11	9	6	4	–	–	–	1	25.8 ± 10.9
BC	8	–	2	2	1	2	–	–	–	1	28.9 ± 10.3
AMC	1	–	–	–	1	–	–	–	–	–	35
CCOC	1	–	–	–	–	–	–	–	–	1	–
Total	340	23	112	87	51	29	11	8	4	15	25.5 ± 14.4

NS, not specified; AME, ameloblastoma; CCOT, clear cell odontogenic tumor; SOT, squamous cell odontogenic tumor; CEOT, calcifying epithelial odontogenic tumor; AF, ameloblastic fibroma; AFO, ameloblastic fibro-odontoma; OAM, odontoameloblastoma; AOT, adenomatoid odontogenic tumor; COC, calcifying odontogenic cyst; ODTx, complex odontoma; ODTp, compound odontoma; OF, odontogenic fibroma; MYX, mixoma; BC, benign cementoblastoma; AMC, ameloblastic carcinoma; CCOC, clear cell odontogenic carcinoma.

Table 3 Distribution of 340 benign and malignant odontogenic tumors by location

	Maxilla				*Mandible*					
Tumors	*Anterior*	*Premolar*	*Molars*	*Total, n (%)*	*Anterior*	*Premolar*	*Molars*	*Total, n (%)*	*NS, n (%)*	*Total*
AME	6	4	3	13 (8.5)	22	30	79	131 (85)	10 (6.5)	154
CCOT	1	–	–	1 (50)	–	–	–	–	1 (50)	2
SOT	–	–	2	2 (40)	1	–	2	3 (60)	–	5
CEOT	–	1	–	1 (25)	1	1	1	3 (75)	–	4
AF	–	–	–	–	–	–	6	6 (100)	–	6
AFO	–	–	–	–	–	–	1	1 (100)	–	1
OAM	3	1	1	5 (83.3)	1	–	–	1 (16.7)	–	6
AOT	5	1	–	6 (46)	3	4	–	7 (54)	–	13
COC	4	2	–	6 (50)	3	1	2	6 (50)	–	12
ODTx	21	7	4	32 (61.5)	9	2	5	16 (30.8)	4 (7.7)	52
ODTp	16	4	1	21 (63.6)	4	3	2	9 (27.2)	3 (9.2)	33
OF	6	–	1	7 (63.6)	–	1	3	4 (36.4)	–	11
MYX	3	3	8	14 (45.1)	2	2	11	15 (48.4)	2 (6.5)	31
BC	–	–	1	1 (12.5)	–	–	7	7 (87.5)	–	8
AMC	–	–	–	–	–	–	–	–	1 (100)	1
CCOC	1	–	–	1 (100)	–	–	–	–	–	1
Total	66	23	21	110	46	44	119	209	21	340

NS, not specified; AME, ameloblastoma; CCOT, clear cell odontogenic tumor; SOT, squamous cell odontogenic tumor; CEOT, calcifying epithelial odontogenic tumor; AF, ameloblastic fibroma; AFO, ameloblastic fibro-odontoma; OAM, odontoameloblastoma; AOT, adenomatoid odontogenic tumor; COC, calcifying odontogenic cyst; ODTx, complex odontoma; ODTp, compound odontoma; OF, odontogenic fibroma; MYX, mixoma; BC, benign cementoblastoma; AMC, ameloblastic carcinoma; CCOC, clear cell odontogenic carcinoma.

anterior of maxilla zone, with 61.5 and 63.6% respectively. Table 4 compares the relative frequency of OTs from select references of different studies and our study. In this table, we have grouped together the two types of odontomas in order to compare the series.

Discussion

The frequency of OTs has few published studies carried out after the 1992 WHO classification of the OTs. Because of this, newer studies are necessary to comparisons with

Table 4 Comparison of the relative frequency of odontogenic tumors from selected references of different countries and this study

	Fernandes et al. (Brazil)		*Ochsenius et al. (12) (Chile)*		*Mosqueta-Taylor et al. (3) (Mexico)*		*Daley et al. (9) (Canada)*		*Lu et al. (11) (China)*		*Odukoya (10) (Nigeria)*	
	Cases	*%*	*Cases*	*%*	*Cases*	*%*	*Cases*	*%*	*Cases*	*%*	*Cases*	*%*
Benign												
Ameloblastoma	154	45.2	74	20.4	83	23.7	79	17.8	445	58.6	169	58.5
Clear cell odontogenic tumor	2	0.6	2	0.6	–	–	–	–	2	0.3	–	–
Squamous odontogenic tumor	5	1.47	2	0.6	–	–	1	0.2	3	0.4	3	1.0
Calcifying epithelial odontogenic	4	1.17	2	0.6	3	0.8	8	1.8	7	0.9	1	0.4
Ameloblastic fibroma	6	1.76	2	0.6	5	1.4	7	1.6	14	1.8	13	4.5
Ameloblastic fibrodentinoma	–	–	2	0.6	–	–	–	–	–	–	–	–
Ameloblastic fibro-odontoma	1	0.3	6	1.7	3	0.8	14	3.1	2	0.3	–	–
Odontoameloblastoma	6	2.0	–	–	–	–	–	–	2	0.2	2	0.7
Adenomatoid odontogenic tumor	13	3.8	24	6.6	25	7.1	14	3.1	63	8.3	18	6.2
Calcifying odontogenic cyst	12	3.52	26	7.2	24	6.8	18	4.0	35	4.6	7	2.4
Odontomas	85	24.91	162	44.7	121	34.6	204	45.8	51	6.7	12	4.2
Odontogenic fibroma	11	3.22	20	5.5	16	4.5	61	13.7	5	0.7	13	4.5
Myxoma	31	9.1	32	8.8	62	17.7	24	5.4	64	8.4	34	11.8
Benign cementoblastoma	8	2.35	6	1.7	3	0.8	7	1.6	20	2.6	2	0.7
Odontogenic tumor (non-classified)	–	–	–	–	–	–	1	0.2	–	–	–	–
Malignant												
Primary intraosseous carcinoma	–	–	–	–	–	–	–	–	11	1.4	–	–
Malignant ameloblastoma	–	–	–	–	–	–	–	–	24	3.2	–	–
Malignant calcifying odontogenic Cyst	–	–	–	–	–	–	–	–	3	0.4	–	–
Ameloblastic carcinoma	1	0.3	–	–	–	–	–	–	–	–	–	–
Odontogenic carcinosarcoma	–	–	1	0.3	–	–	–	–	–	–	–	–
Ameloblastic fibrosarcoma	–	–	–	–	–	–	–	–	2	0.3	–	–
Ameloblastic fibro-odontosarcoma	–	–	1	0.3	–	–	–	–	–	–	–	–
Odontogenic sarcoma	–	–	–	–	–	–	–	–	–	–	1	0.4
Odontogenic carcinoma	–	–	–	–	4	1.1	7	1.6	6	0.8	14	4.8
Clear cell odontogenic carcinoma	1	0.3	–	–	–	–	–	–	–	–	–	–
Total	340	100.0	362	100.0	349	100.0	445	100.0	759	100.0	289	100.0

the series published after this time by Daley et al. (9), Odukoya (10), Mosqueta-Taylor et al. (3), Lu et al. (11), Ochsenius et al. (12), and Ladeinde et al. (13).

In the present study, OTs are low frequent, representing 1.78% of all the oral cavity and jaw biopsies, which is similar to many internationally published series (3, 4, 7, 9, 12), but not with studies carried out in Nigeria (10, 13), in which OT were found in 19% and 9.6% of the oral biopsies from University Center of Oral Pathology and a teaching hospital, respectively. Comparing gender, these tumors seems to affect men and woman similarly, according to the male/female ratio observed in this study (1:1.2), in Odukoya's (10) series (1.28:1), in Mosqueta-Taylor et al.'s (3) series (1:1.25), in Lu et al.'s (11) series (1:1.3), in Ochsenius et al.'s (12) series (1:1.16), and in Ladeinde et al.'s (13) series (1:1).

The main localization of benign OTs in this series was generally, the mandible (2:1). In Nigerian (10, 13) and Chinese (11) series, a marked preference for the mandible (5.7:1, 4.1:1 and 3.2:1, respectively) were observed, which could be explained by the greater prevalence of ameloblastoma in these series. Nevertheless, the Mosqueta-Taylor et al.'s series (3) showed a slight preference for the mandible.

The most frequent tumor in the present study was the ameloblastoma (45.2%), with an incidence comparable with the reports of Wu and Chan (7) and Lu et al. (11) and in a Chinese population (59.4% and 58.6, respectively), Komori (15) in Japan (57%), Odukoya (10), and Ladeinde et al. (13) in African patients (58.5% and 63%, respectively). This contrasts with the rates in series involving American (4), Canadian (9), Mexican (3), and Chilean (12) populations, in whom the most frequent lesion was odontoma (73.8%, 45.8%, 34.6% and 44.7%, respectively) and in whom ameloblastomas accounted for 12.2%, 14.8%, 23.7% and 20.4% of tumors, respectively. Furthermore, in the present study, the odontoma was the second most frequent tumor (25%). The incidence of odontomas in the present study was between the rates for the North American/Chilean and Asian/African groups, whereas in Germany (16), the relative incidences of these lesions were similar to that in the North American groups (3, 4, 9). Despite of the suggestion about the incidence of ameloblastoma is higher in blacks than whites (17), the possibility of racial basis of geographic variations observed by these data and other series remains to be proved.

With respect to site of occurrence, the ameloblastoma has a high predilection for the mandible, although the incidence of maxillary lesions varies considerably among reports. In the present series, 8.5% of the ameloblastomas occurred in the maxilla. This value was comparable with the corresponding data from Asia and Africa (2–8%) (7, 10, 11, 13, 15). In contrast, 16–22% of ameloblastoma were maxillary in the American series (4, 8), suggesting another geographic difference (11). The predilection of ameloblastoma for the posterior region of the mandible (51.2%) in this study is also consistent with the reports from elsewhere.

In the present study, the prevalence between male/female was 1.2:1 to myxomas, just as the Lu et al.'s (11) and Ladeinde et al.'s (13) series in which no gender-related differences were found. Other studies of OT observed a female predilection (4, 8, 10, 12).

The frequency of malignant OTs in our study represented 0.6% of the total OT, while in other American series (3, 9, 12) were also very low ($< 1.6\%$), contrasting to the African (10, 13) and Chinese (11) series, which reached a frequency of 5.2%, 3.4% and 6.1%, respectively.

The CCOT tumors in the present study have been classified among the benign OTs, accordingly to WHO (1992), although some authors recognized it as a malignant lesion, because some metastasized and recurred (18, 19). In the present study, it was included one case of clear cell odontogenic carcinoma and one case of CCOT.

A lot of similarities were observed among the studies from the African and Asian series; nevertheless differences with American continents studies were noted. More epidemiologic studies, in different populations, associated with basic research are necessary to provide a better understanding of OT.

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