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Clinicopathologic Study on Odontogenic Tumors-A 10-Year Single Institute Experience

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ABSTRACT

Introduction: Odontogenic tumors are the expansile group of jaw neoplasm that originates from the tooth-forming tissues. WHO, revised classification several times due to their discrete histological and biological behavior. They were broadly classified as benign and malignant tumors, the former being the most common. Benign tumors are classified into epithelial, mixed (epithelial and mesenchymal), and mesenchymal lesions based on their histogenetic origin.

Materials and Methods: 1. To evaluate the various types of odontogenic tumors diagnosed in the Department of Oral Pathology. 2. To correlate the clinical data and histological features of odontogenic tumors diagnosed. Clinical data of all the odontogenic tumors were collected retrospectively from the 10-year archives of the Oral Pathology Department, GITAM Dental College and Hospital, Visakhapatnam. The tumors were classified according to the WHO classification. Clinical and histopathological evaluations wasere doneperformed for all the odontogenic tumors. Different histological characteristics were compared; tabulated and analyzed.

Results: A total of 105 cases of odontogenic tumors were recorded. 82% account for benign tumors, and 18% for malignant tumors. Epithelial origins comprise the majority of benign tumors (48%), followed by mesenchymal and mixed odontogenic tumors (20% and 14%, respectively). Unicystic ameloblastoma is the most common odontogenic tumor, accounting for 18 (17%) cases, followed by conventional ameloblastoma, odontogenic fibroma, ameloblastic carcinoma, and odontoma. Odontogenic tumors were reported mostly during the second, third, and fourth decades of life. Male predilection was observed over females in all the odontogenic tumors. All forms of OT were detected in the posterior mandible. Epithelial odontogenic tumors predominate in all four anatomical sites, except the posterior maxilla, where mesenchymal OT was somewhat more common and no malignant odontogenic tumor was seen.

Conclusion: The variability in data from this study can be ascribed to a variety of demographic factors. Hence, the need to incorporate specific lesion histopathology and diagnostic molecular interventions would make results more sensitive catering to research needs.

Keywords: WHO Classification; Odontogenic; Tumors; Ameloblastoma; Odontoma.

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Introduction

The tumor is a swelling that does not elicit a neoplastic reaction. Neoplasia is the formation of new, abnormal growth of tissue. Odontogenic tumors are an expansile group of jaw neoplasms that originate from the tooth-bearing tissues. The pathogenesis involves inductive interactions between the odontogenic epithelium and ectomesenchyme. These are the regions of interest for oral pathologists due to their diverse clinical and histopathological presentations, which range from hamartomatous to benign to malignant lesions. In rare cases, extreme malignancy may lead to metastasis. This diversification has led the World Health Organisation to revise its classification several times.

1971 WHO classification (Figure. 1):

• Odontogenic tumors were broadly classified as benign and malignant tumors based on their biological behavior.

• Malignant tumors were further classified as odontogenic carcinomas and odontogenic sarcomas.

1992 WHO classification:

• Benign tumors were again classified based on histiogenic origin as epithelial, mixed epithelial and mesenchymal, and mesenchymal.

2005 WHO classification:

1. Ameloblastoma was further classified as:

a. Solid/multicystic.

b. Unicystic.

c. Desmoplastic.

d. Extraosseous/peripheral.

2. An adenomatoid odontogenic tumor (AOT) was added to benign epithelial tumors (in 1992, AOT was in mixed benign tumors).

3. Odontogenic keratocyst (OKC) was eliminated from the odontogenic cysts classification and added to epithelial benign odontogenic tumors and named a Keratocystic odontogenic tumor (KCOT).

4. A calcifying odontogenic cyst (COC) in the 1992 classification was renamed as calcifying cystic odontogenic tumor (CCOT).

5. A dentinogenic ghost cell tumor was added.

6. Malignant ameloblastoma was renamed as metastasizing ameloblastoma.

7. Ameloblastic carcinoma was reclassified into:

a. Primary type.

b. Secondary type, intraosseous.

c. Secondary type, peripheral.

8. Primary intraosseous squamous cell carcinoma was reclassified as:

a. Solid type.

b. Derived from KCOT.

c. Derived from the odontogenic cyst.

9. Clear cell odontogenic carcinoma and ghost cell odontogenic carcinoma were added.

2017 WHO classification:

1. Solid/multicystic ameloblastoma was named as ameloblastoma.

2. A desmoplastic type of ameloblastoma, odontoameloblastoma, was removed.

3. Metastasizing ameloblastoma was removed from odontogenic carcinomas and added to benign epithelial odontogenic tumors.

4. Ameloblastic fibroma in the 2005 classification was reclassified as:

a. Ameloblastic fibroma.

b. Ameloblastic fibro-dentinoma.

c. Ameloblastic fibro-odontoma.

5. KCOT and CCOT were eliminated and reclassified as OKC and COC, respectively, and were added to the category of odontogenic cysts.

6. Primordial odontogenic tumor (mixed), Cemento-ossifying fibroma (mesenchymal), sclerosing odontogenic carcinoma, and odontogenic carcinosarcoma were added.

7. Ameloblastic carcinoma types and primary intraosseous carcinoma types were removed and simplified to “ameloblastic carcinoma” and “primary intraosseous carcinoma, NOS” (not otherwise specified). 2022 WHO classification: Adenoid ameloblastoma was the only new entity added to benign epithelial odontogenic tumors [1-5].

DOI:

The study aims to assess the frequency of various types of odontogenic tumors that were diagnosed and to evaluate them according to age, gender, and anatomical site.

Materials and Methods

This retrospective study was conducted at GITAM Dental College and Hospital, Visakhapatnam. We reviewed the clinical data of all odontogenic tumors diagnosed histopathologically between 2014 and 2023, extracted from the clinical data records. A master chart was prepared by recording the clinical data, including gender, age, and anatomical site, for all odontogenic tumor cases. Age grouping was performed in 10-year intervals. Anatomical sites were noted as anterior (incisors and canine region), posterior (premolars and molars regions), maxilla, and mandible. Location of soft tissue tumors, tumors in the ascending ramus, maxillary sinus, and zygoma are recorded as others. Tumors are classified based on the 2022 WHO classification of Head and Neck tumors. The data was tabulated separately for the frequency of different types of odontogenic tumors, frequency based on age, gender, and anatomical location. The data was analyzed, and graphs were created.

Results

Frequency of occurrence of odontogenic tumors: (Table 1; Charts 1, 2).

A total of 105 cases of odontogenic tumors were recorded—82% account for benign tumors, and 18% for malignant tumors. Epithelial origins make up the majority of benign tumors (48%), followed by mesenchymal and mixed odontogenic tumors (20% and 14%), respectively. Unicystic ameloblastoma was the most common odontogenic tumor among epithelial odontogenic tumors, accounting for 18 cases (17.1%), followed by conventional ameloblastoma, which accounted for 16 cases (15.2%). Within the odontogenic tumors that originated from mixed epithelial-mesenchymal and mesenchymal tissue, more cases of odontoma (12 cases, 11.45%) and odontogenic fibroma (14 cases, 13.3%) were recorded, respectively. A maximum of 13 cases (12.3%) of ameloblastic carcinomas were found in malignant odontogenic tumors. From this data, it was clear that the most frequently observed odontogenic tumors were unicystic ameloblastoma, conventional ameloblastoma, odontogenic fibroma, ameloblastic carcinoma, and odontoma, in descending order of the number of cases. No single case of extraosseous/ peripheral ameloblastoma, primordial odontogenic tumor, odontogenic myxoma, sclerosing odontogenic carcinoma, or primary intraosseous carcinoma was observed. This indicated the rarity of these cases.

Frequency based on gender: (Table 2, Graph 1)

Among 105 subjects, 64.7% (68 subjects) are males and 35.2% (37 subjects) are females. A very slight male predilection was observed over females in all the odontogenic tumors. Overall, the male-to-female ratio was found to be 1.8:1. In both male and female subjects, the most commonly occurring odontogenic tumor was unicystic ameloblastoma.

Frequency based on age: (Table 3, Graphs 2, 3, 4, 5)

Epithelial odontogenic tumors were found to be prevalent in individuals aged 21-30 years, mixed odontogenic tumors in those aged 11-20 years, and mesenchymal odontogenic tumors in individuals aged 11-30 years. Malignant odontogenic tumors occurred between 31 and 40 years. Hence, it can be concluded that the incidence of odontogenic tumors was reported mostly during the second, third, and fourth decades of life. A maximum of Unicystic ameloblastoma and conventional ameloblastoma cases were found in the 4th decade of life. More of odontogenic fibroma cases in the 2nd decade, ameloblastic carcinoma in the 4th decade, and odontoma in the 2nd decade. Among all the types of odontogenic tumors, 25.7% (27 cases) are found to occur in the third decade of life. The fewest number of cases are found in the 7th decade (4 cases, 3.8%) and 8th decade (1 case, 0.9%).

Frequency based on anatomical site: (Table 4, Graph 6).

The majority of odontogenic tumors were detected in the posterior mandible. In all four anatomical sites of the jaw, a larger number of epithelial odontogenic tumors were observed, except in the posterior maxilla. In the posterior maxilla, mesenchymal odontogenic tumors were commonly seen among other odontogenic tumors. No malignant odontogenic tumor was recorded in the posterior maxilla. A total number of odontogenic tumors found in the anterior maxilla, posterior maxilla, anterior mandible, posterior mandible, and other sites in the jaw are 10 cases (9.5%), 9 cases (8.5%), 14 cases (13.3%), 66 cases (62.8%) and 6 cases (5.7%) respectively.

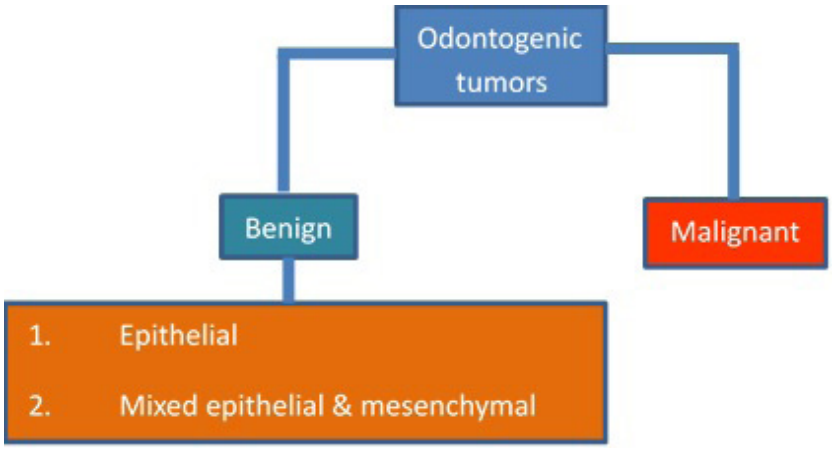
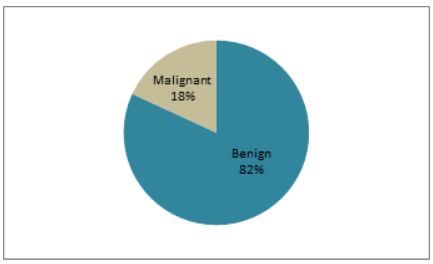
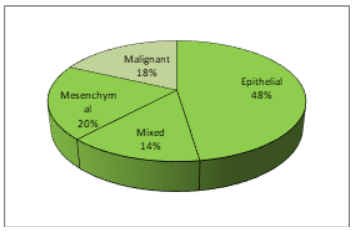


Figure 1. 1992 WHO classification of Odontogenic Tumours.

Table 1. Frequency of occurrence of odontogenic tumors.

Type of tumor	*No.of cases*	*Percentage*
Benign Odontogenic Tumors		
Epithelial origin		
Adenomatoid odontogenic tumour Squamous	*6*	*5.7*
odontogenic tumour Calcifying epithelial odonto-	*2*	*1.9*
genic tumour Ameloblastoma, unicystic	*4*	*3.8*
Ameloblastoma, extraosseous/peripheral Amelo-	*18*	*17.1*
blastoma, conventional	*0*	*0.0*
Adenoid ameloblastoma	*16*	*15.2*
Metastasizing ameloblastoma	*3*	*2.8*
	1	*0.9*
Mixed epithelial & mesenchymal origin		
Odontoma	*14*	*13.3*
Primordial odontogenic tumour Ameloblastic	*2*	*1.9*
fibroma	*5*	*4.7*
Dentinogenic ghost cell tumour	*0*	*0.0*
Malignant Odontogenic Tumours		
Sclerosing odontogenic carcinoma Ameloblastic	*0*	*0.0*
carcinoma	*13*	*12.3*
Clear cell odontogenic carcinoma	*1*	*0.9*
Ghost cell odontogenic carcinoma Primary	*1*	*0.9*
intraosseous carcinoma, NOS Odontogenic carci-	*0*	*0.0*
nosarcoma Odontogenic sarcomas	*3*	*2.8*
	1	*0.9*
Total	*105*	*100%*

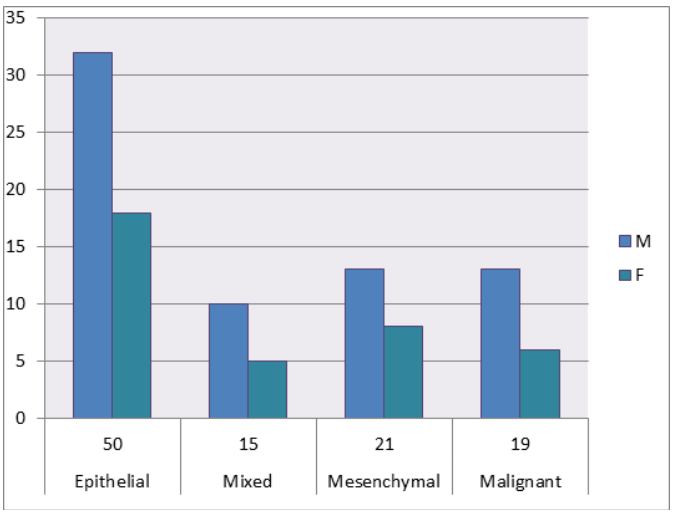




Charts 1,2. Frequency of occurrence of odontogenic tumors.

Table 2. Frequency of occurrence of odontogenic tumors: based on gender.

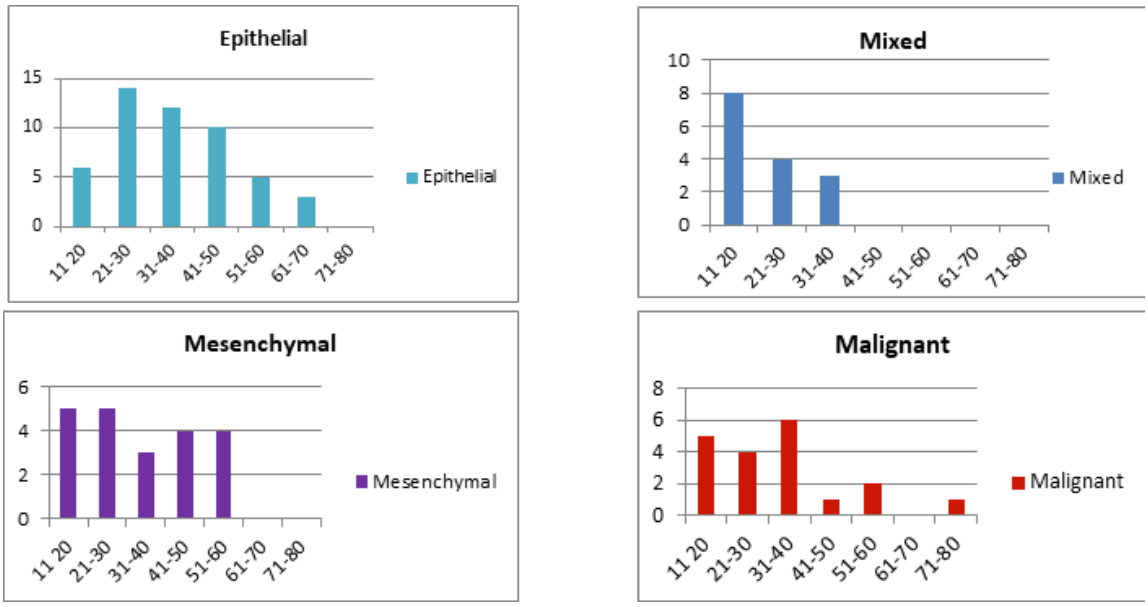
Type of tumor	*Male*	*Female*	*M:F ratio*
Benign Odontogenic Tumors			
Epithelial origin			
Adenomatoid odontogenic tumour	*4*	*2*	*2:1*
Squamous odontogenic tumour	*0*	*2*	-
Calcifying epithelial odontogenic tumour	*4*	*0*	-
Ameloblastoma, unicystic	*11*	*7*	*1.5:1*
Ameloblastoma, extraosseous/peripheral Amelo-	*0*	*0*	-
blastoma, conventional	*10*	*6*	*1.6:1*
Adenoid ameloblastoma	*3*	*0*	-
Metastasizing ameloblastoma	*0*	*1*	-
Mixed epithelial & mesenchymal origin			
Odontoma	*7*	*5*	*1.4:1*
Primordial odontogenic tumour	*0*	*0*	-
Ameloblastic fibroma	*1*	*0*	-
Dentinogenic ghost cell tumour	*2*	*0*	-
Mesenchymal origin			
Odontogenic fibroma	*10*	*4*	*2.5:1*
Cementoblastoma	*1*	*1*	*1:1*
Cemento-ossifying fibroma	*2*	*3*	*0.6:1*
Odontogenic myxoma	*0*	*0*	-
Malignant Odontogenic Tumours			
Sclerosing odontogenic carcinoma Ameloblastic	*0*	*0*	-
carcinoma	*8*	*5*	*1.6:1*
Clear cell odontogenic carcinoma	*1*	*0*	-
Ghost cell odontogenic carcinoma	*0*	*1*	-
Primary intraosseous carcinoma, NOS Odonto-	*0*	*0*	-
genic carcinosarcoma	*3*	*0*	-
Odontogenic sarcomas	*1*	*0*	-
Total	*68*	*37*	*1.8:1*
Percentage	*64.7*	*35.2*	



Graph 1. Frequency of occurrence of odontogenic tumors: based on gender.

Table 3. Frequency of occurrence of odontogenic tumors: based on age.

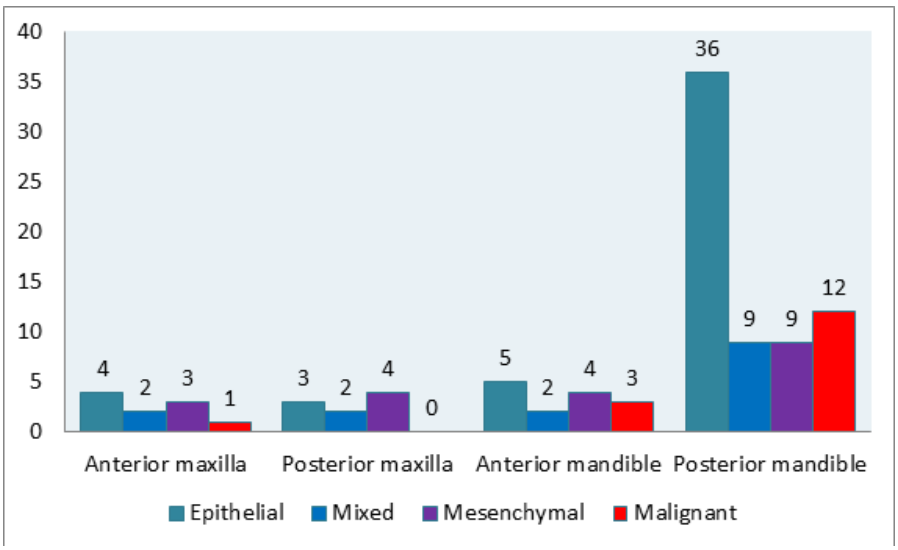
Type of tumor	*Age group*							
	11-20	***21-30***	***31-40***	***41-50***	***51-60***	***61-70***	***71-80***	***81-90***
Benign Odontogenic Tumors								
Epithelial origin								
Adenomatoid odontogenic tumour	*1*	*4*	*0*	*1*	*0*	*0*	*0*	*6*
Squamous odontogenic tumour	*1*	*0*	*0*	*1*	*0*	*0*	*0*	*2*
Calcifying epithelial odontogenic tumour	*0*	*3*	*1*	*0*	*0*	*0*	*0*	*4*
Ameloblastoma, unicystic	*1*	*3*	*6*	*3*	*2*	*3*	*0*	*18*
Ameloblastoma, extraosseous/peripheral Ameloblastoma,	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
conventional	*3*	*3*	*5*	*3*	*2*	*0*	*0*	*16*
Adenoid ameloblastoma	*0*	*1*	*0*	*1*	*1*	*0*	*0*	*3*
Metastasizing ameloblastoma	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*1*
Mixed epithelial & mesenchymal origin								
Odontoma	*7*	*4*	*1*	*0*	*0*	*0*	*0*	*12*
Primordial odontogenic tumour	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ameloblastic fibroma	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*
Dentinogenic ghost cell tumour	*0*	*0*	*2*	*0*	*0*	*0*	*0*	*2*
Mesenchymal origin								
Odontogenic fibroma	*4*	*3*	*2*	*3*	*0*	*1*	*0*	*14*
Cementoblastoma	*1*	*0*	*0*	*1*	*1*	*0*	*0*	*2*
Cemento-ossifying fibroma	*0*	*2*	*1*	*0*	*2*	*0*	*0*	*5*
Odontogenic myxoma	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*
Malignant Odontogenic Tumours								
Sclerosing odontogenic carcinoma	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ameloblastic carcinoma	*4*	*1*	*5*	*1*	*1*	*0*	*1*	*13*
Clear cell odontogenic carcinoma	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*1*
Ghost cell odontogenic carcinoma Primary intraosseous	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*1*
carcinoma, NOS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Odontogenic carcinosarcoma	*0*	*3*	*0*	*0*	*0*	*0*	*0*	*3*
Odontogenic sarcomas	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*
Total	*24*	*27*	*24*	*15*	*10*	*4*	*1*	*105*
Percentage	*22.8*	*25.7*	*22.8*	*9.5*	*9.5*	*3.8*	*0.9*	*100*



Graphs 2,3,4,5. Frequency of occurrence of odontogenic tumors: based on age.

Table 4. Frequency of occurrence of odontogenic tumors: based on anatomical site.

	Anterior	***Posterior***	***Anterior***	***Posterior***		
Benign Odontogenic Tumors						
Epithelial origin						
Adenomatoid odontogenic tumour Squamous odontogenic	*1*	*0*	*1*	*3*	*1*	*6*
tumour	*1*	*0*	*0*	*1*	*0*	*2*
Calcifying epithelial odontogenic tumour	*1*	*0*	*0*	*3*	*0*	*4*
Ameloblastoma, unicystic	*1*	*2*	*0*	*14*	*1*	*18*
Ameloblastoma, extraosseous/peripheral Ameloblastoma, con-	*0*	*0*	*0*	*0*	*0*	*0*
ventional	*0*	*1*	*3*	*12*	*0*	*16*
Adenoid ameloblastoma	*0*	*0*	*1*	*2*	*0*	*3*
Metastasizing ameloblastoma	*0*	*0*	*0*	*1*	*0*	*1*
Mixed epithelial & mesenchymal origin						
Odontoma	*2*	*2*	*2*	*6*	*0*	*12*
Primordial odontogenic tumour Ameloblastic	*0*	*0*	*0*	*0*	*0*	*0*
Fibroma	*0*	*0*	*0*	*1*	*0*	*1*
Dentinogenic ghost cell tumour	*0*	*0*	*0*	*2*	*0*	*2*
Mesenchymal origin						
Odontogenic fibroma	*3*	*3*	*3*	*4*	*1*	*14*
Cementoblastoma	*0*	*0*	*0*	*2*	*0*	*2*
Cemento-ossifying fibroma	*0*	*1*	*1*	*3*	*0*	*5*
Odontogenic myxoma	*0*	*0*	*0*	*0*	*0*	*0*
Malignant Odontogenic Tumours						
Sclerosing odontogenic carcinoma Ameloblastic carcinoma	*0*	*0*	*0*	*0*	*0*	*0*
Clear cell odontogenic carcinoma	*0*	*0*	*2*	*9*	*2*	*13*
Ghost cell odontogenic carcinoma	*1*	*0*	*0*	*0*	*0*	*1*
Primary intraosseous carcinoma, NOS	*0*	*0*	*0*	*1*	*0*	*1*
Odontogenic carcinosarcoma	*0*	*0*	*0*	*0*	*0*	*0*
Odontogenic sarcomas	*0*	*0*	*1*	*2*	*0*	*3*
	0	*0*	*0*	*0*	*1*	*1*
Total	*10*	*9*	*14*	*66*	*6*	*105*
Percentage	*9.5*	*8.5*	*13.3*	*62.8*	*5.7*	*100*



Graph 6. Frequency of occurrence of odontogenic tumors: based on anatomical site.

Discussion

In the current study, the most prevalent tumor was unicystic ameloblastoma. Our findings showed a male predisposition in the posterior mandible over the 2nd to 4th decades of life. Soluk et al, 2020 observed about 1231 cases of odontogenic tumors over 47 years from 1971 to 2018 in the Turkish population. The authors followed the 4th edition of the WHO Classification. Ameloblastoma, odontoma, and odontogenic myxoma are the three commonly occurring tumors. After 2017, they observed a decrease in the frequency of odontogenic tumors because of reclassification. They stated that this was not the actual decrease [6]. Kokubun K. et al. conducted a similar study in 2021 among the Japanese population, observing 1089 cases of Odontogenic tumors based on the 2017 WHO classification of Head and neck tumors, in which odontoma and ameloblastoma were found to be the most common. Frequently occurring tumors in males are Ameloblastoma and ameloblastic fibroma; in females, they are odontogenic fibroma and cement-ossifying fibroma. The mean age was 29.5 years. The predominant anatomical site was the posterior mandible [7].

Sudarsan R. et al. (2022) conducted a study similar to the present study and observed that unicystic ameloblastoma was the most commonly occurring odontogenic tumor, without finding any correlation between age and gender [8]. Chandrakala et al. (2023) observed 122 cases of odontogenic tumors over 10 years among the Karnataka population. The cases were categorized based on the 2005 WHO classification of Head and Neck tumors. Ameloblastoma and keratocystic odontogenic tumors are found to be common among other types. The mean age was 32.37 years. Male subjects and posterior mandible sites are predominant. In this study, they have also recorded symptoms and observed that pain and swelling are common [9]. Mehra G et al. (2023) observed 30 cases over a 2-year span from 2021 to 2022. The findings are similar to the current study [10]. Several types of research in the literature produced dissimilar outcomes. Female inclination was discovered in investigations by Jayasingh et al. (2020), Leena et al. (2022), and Molook et al. (2023. Preethi et al. (2020) found that the majority of OT occurred during the first decade. Odontoma and conventional ameloblastoma were the most common OTs in the investigations undertaken by Martin et al. (2020) and Leena et al. (2022) [11-16].

Conclusion

The current study observed 105 cases of odontogenic tumors during 10 years, from 2014 to 2023. And observed that unicystic ameloblastoma and conventional ameloblastoma are the most commonly occurring odontogenic tumors. The majority of the tumors showed a slight male predilection over females. Odontogenic tumors are most likely to occur in the 2nd, 3rd, and 4th decades of life. The posterior maxilla is the anatomical site where most odontogenic tumors occur. The variability in data from this study can be ascribed to a variety of demographic factors, specific lesion histopathology, and diagnostic molecular interventions. Hence, incorporating such tools would make results more sensitive, catering to the research needs. The odontogenic tumors always show diverse presentations both clinically and histopathologically among diverse populations and demographic factors.

DOI:

Conflict of Interest

There is no conflict of interest to declare.

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