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Original Research Article

Frequency and Patterns of Presentation of Common Types of Odontogenic Tumor at a Tertiary Care Dental Hospital

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Abstract: *Odontogenic tumors, which originate in tissues involved in tooth formation and often develop in the jaw, can be benign or malignant.* ***Objective:*** *To determine the Frequency and Patterns of Presentation of Common Types of Odontogenic tumors at a Tertiary Care Dental Hospital.* ***Methodology:*** *The study, conducted at the Nishtar Institute of Dentistry in Multan, Pakistan, involved 97 patients diagnosed with odontogenic tumors. The research was conducted from September 2023 to September 2024 using a non-probability sequential sampling method. Patients were categorised based on age, gender, and medical reporting. Demographic information was collected, and patients with swellings were assessed through a comprehensive history, clinical examination, and radiographic evaluation. Incisional biopsy was performed for each case.* ***Results:*** *This study assessed 97 participants, comprising 53 males (54.6%) and 44 females (45.4%), revealing a slightly higher prevalence of males in the cohort. The most common odontogenic tumor was ameloblastoma, accounting for 52 cases (53.6%) with a male predominance (30 males vs. 22 females). The regression analysis shows that the presence of fluid on aspiration is associated with a negative correlation (B = -0.351, p = 0.081), suggesting that fluid presence may be linked to a lower occurrence of certain tumors; however, this result was marginally non-significant. Overall, the model does not provide strong predictive value, suggesting that additional factors may contribute to the occurrence of odontogenic tumors.* ***Conclusions:*** *The findings underscore the predominance of ameloblastoma as the most frequently diagnosed odontogenic tumor, particularly in males. The study highlights the varying presentations of different odontogenic tumors, with most being benign and having low metastatic potential, except for a small proportion of ameloblastomas that exhibit aggressive characteristics.*

Keywords: Classification, Epidemiology, Odontogenic tumors, Oral Pathology, World Health Organization

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Introduction

Odontogenic tumors are uncommon neoplasms that develop from the tissues involved in tooth development and can present in the jawbones, particularly within the maxilla and mandible (1). Benign to malignant, these are classified according to the tissue of origin and biological behavior. These can be further classified into epithelial, mesenchymal, and mixed tumors. According to a multicenter study, the most common types of tumors were ameloblastoma and odontoma (2). The World Health Organization (WHO) first introduced a classification of odontogenic tumors in 1971 with subsequent modifications. In 2017, an additional update included genetic and immunohistological data (3). Odontogenic tumors have an incidence of around 1 to 9%. However, regional variations in the frequency of odontogenic tumors have been reported in studies conducted in Asia, Europe, North America, South America, and Africa (4). Odontogenic tumors are uncommon oral lesions, with prevalence influenced by geographic location, access to dental care, and the target population examined (5). They are primarily observed in adults, with the highest incidence occurring between the second and fifth decades of life. Certain tumors, such as odontomas, have a higher incidence in the younger population (6). Ecological factors, genetic susceptibility, and cultural behaviors can explain geographic variation. The incidence and manifestation of odontogenic tumors can also be influenced by genetic syndromes (7).

These tumors are located in the mandible, maxilla, and occasionally in the gingiva, and they share two common properties: they originate from tissue with the potential to differentiate into tooth or periodontal structures, and they produce tooth-related extracellular substances that can calcify and demonstrate radiographic opacity (8). These include hamartomata or non-neoplastic tissue proliferation that can progress to malignant neoplasms with metastatic ability (9). Based on differences in the neoplastic tissues, tumors are sub-classified into lesions derived from odontogenic epithelium only, tumors derived from odontogenic mesenchyme only, and those arising from both (10).

Ameloblastoma and odontoma are some good examples of benign odontogenic tumors. Ameloblastoma is a slow-growing tumor, whereas odontoma is a common benign tumor composed of dental tissues. Malignant odontogenic tumors comprise odontogenic carcinoma, a rare malignant tumor, and odontogenic sarcoma (11). Other odontogenic lesions include dentigerous cysts, which cause jaw expansion and should be surgically removed, and keratocystic odontogenic tumor (KCOT), a developmental cyst with aggressive behavior associated with nevoid basal cell carcinoma syndrome (Gorlin syndrome) (12).

Clinical presentation and diagnosis encompass clinical examination, aspiration, radiographic imaging, and definitive identification through biopsy. However, the approach to treatment will depend on the specific tumor type and its nature, and surgical removal is often the first step in treatment. Odontogenic tumors are managed through a multidisciplinary effort involving oral and maxillofacial surgeons, pathologists, and, in some cases, oncologists. Regular follow-up is crucial to assess recurrence, especially in the case of aggressive lesions. Patients should seek professional help for an accurate diagnosis and management (13).

Odontogenic tumors are a diverse group, and their frequency and presentation vary across different geographical regions; therefore, it is essential to understand the frequency and patterns of these tumors for accurate diagnosis and management. Together with ameloblastoma, which accounts for 10% of all jaw tumors, and odontomas, which are the most common (ranging from 22% to 67%), these collectively account for all odontogenic tumors (14). Odontogenic keratocysts (OKCs) are infrequent lesions, but aggressive, and often appear in the posterior

mandible, inducing jaw expansion. Ameloblastic carcinoma is a rare malignant neoplasm that belongs to the odontogenic carcinomas, which are relatively infrequent malignant tumors characterized by aggressive behavior and aggressive radiolucency (15).

Knowledge of the frequency and patterns of presentation of these tumors is important for dental and medical professionals involved in their diagnosis and treatment. The aim of this study was to analyze the frequency and clinical presentation of the most common types of odontogenic tumors in the population of Pakistan to assess the possible guidelines for treatment and prognosis.

Methodology

A cross-sectional study was conducted at the Nishtar Institute of Dentistry in Multan, Pakistan, from September 2023 to September 2024, involving 97 subjects diagnosed with odontogenic tumors. We employed a non-probability sequential sampling approach, whereby patients were admitted for treatment as they presented during the study period. All patients, regardless of age or sex, were eligible for inclusion, comprising both medicolegal and non-medical legal cases. Patients who have non-odontogenic tumors or syndromes associated with multiple odontogenic tumors, such as Gorlin syndrome, are excluded from this protocol. Moreover, patients with infectious pathologies that could be similar to odontogenic tumors would be excluded. Ethical approval was a crucial issue: Informed consent was obtained from the participants' custodians after a thorough explanation of the study process, data use, and the risks and benefits of participation was provided to them. Demographic details such as age and sex, were recorded. Patients with swellings received a detailed clinical evaluation and radiographic investigations, as these were considered most important for diagnosis. Incisional biopsy was done on each patient diagnosed withan odontogenic tumor to confirm the histological diagnosis and classify the type of tumors. Hospital records data were analysedstatistically to determine the frequency and trends of odontogenic tumors by sex, age, and clinical presentation during the study period.

Results

Table 1 presents the gender distribution of common odontogenic tumors among the study participants. Ameloblastoma was the most frequently observed tumor, with 30 males (30.92%) and 22 females (22.68%), indicating a higher prevalence in males. Odontoma showed a relatively balanced distribution, affecting 14 males (14.43%) and 16 females (16.49%). Keratocystic odontogenic tumors were less frequent, with 8 cases in males (8.24%) and 6 in females (6.18%), while calcifying epithelial odontogenic tumors were observed in only one male (1.03%), with no female cases reported. The mean values and standard deviations suggest a moderate variation in tumor occurrence, emphasising potential gender-related differences in odontogenic tumor distribution.

Table 2 presents the frequency and patterns of presentation of common odontogenic tumors, categorised by their nature, location, and associated pathological features. Ameloblastoma was the most frequently observed tumor, with 50 benign cases and two malignant cases, primarily affecting the posterior mandible (25 cases) and anterior mandible (20 cases). Odontoma, which is entirely benign, was observed in 30 cases, with the highest occurrence in the anterior maxilla (12 cases) and the anterior mandible (10 cases). Keratocystic odontogenic tumors were reported in 12 benign and two malignant cases, predominantly in the posterior mandible (7 cases). The calcifying epithelial odontogenic tumor was the least common, with only one benign case reported in the posterior mandible. Root resorption and fluid presence varied among tumors, with ameloblastoma showing the highest occurrence of root resorption (40 cases) and fluid presence (25 cases), indicating their aggressive behavior.

The regression analysis aimed to determine the relationship between various predictors and the occurrence of common odontogenic tumors. The results indicate that none of the independent variables significantly contribute to the prediction of tumor occurrence, as all p-values are greater than 0.05. The pattern of presentation by location ($B = 0.017$, $p = 0.876$), pattern of presentation by nature of lesion ($B = 0.306$, $p = 0.471$), and pattern of presentation by lymph distant metastasis ($B = 0.225$, $p = 0.583$) all show weak relationships with the dependent variable, suggesting that these factors do not strongly influence the frequency or distribution of odontogenic tumors. Similarly, the presence of root resorption ($B = 0.273$, $p = 0.199$) demonstrates a moderate positive effect but remains statistically insignificant. Interestingly, the presence of fluid on aspiration ($B = -0.351$, $p = 0.081$) indicates a negative trend, suggesting that the presence of fluid may be associated with a lower occurrence of certain odontogenic tumors. However, this finding is only marginally non-significant. Overall, the model does not provide strong evidence that these predictors play a significant role in determining the occurrence of odontogenic tumors. Future research should consider a larger sample size or alternative predictors, such as genetic or environmental factors, to understand the determinants of these tumors better.

Table 1: Gender Distribution of Common Odontogenic Tumors among Participants

Odontogenic Tumor	Male		Female		Mean	Standard Dev.
	Frequency	Percentage	Frequency	Percentage		
Ameloblastoma	30	30.92	22	22.68	0.53	0.501
Odontoma	14	14.43	16	16.49	0.30	0.466
Keratocystic Odontogenic Tumor	8	8.24	6	6.18	0.14	0.352
Calcifying Epithelial Odontogenic Tumor	1	1.03	0		1.00	0.00
Total	53		44			

Table 2: Frequency and Patterns of Presentation of Common Types of Odontogenic Tumor

Odontogenic Tumor	Nature of Lesion	Frequency	Anterior Mandible	Anterior Maxilla	Posterior Mandible	Posterior Maxilla	Lymph Node Metastasis	Distant Metastasis	Root Resorption	Fluid Presence
Ameloblastoma	Benign	50	20	5	25	2	Positive (3)	Positive (3)	Positive (40)	Positive (25)
	Malignant	2	-	-	-	-	Negative (49)	Negative (49)	Negative (12)	Negative (27)
Odontoma	Benign	30	10	12	6	2	Positive (0)	Positive (0)	Positive (15)	Positive (2)

	Malignant	0	-	-	-	-	Negative (30)	Negative (30)	Negative (15)	Negative (28)
Keratocystic Odontogenic Tumor	Benign	12	5	1	7	1	Positive (1)	Positive (1)	Positive (10)	Positive (12)
	Malignant	2	-	-	-	-	Negative (13)	Negative (13)	Negative (4)	Negative (2)
Calcifying Epithelial Odontogenic Tumor	Benign	1	0	0	1	0	Positive (1)	Positive (0)	Positive (1)	Positive (1)
	Malignant	0	-	-	-	-	-	-	Negative (0)	Negative (0)
Total		97	35	18	39	5				

Table 3: Regression Coefficients

Model	**Unstandardised Coefficients**		**Standardised Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	1.030	.880		1.170	.245
Pattern of Presentation by Location	.017	.109	.022	.156	.876
Pattern of Presentation by Nature of Lesion	.306	.423	.080	.725	.471
Pattern of Presentation of Lymph Distant Metastasis	.225	.409	.059	.551	.583
Presence of root resorption	.273	.211	.167	1.295	.199
Presence of fluid on aspiration	-.351	.199	-.226	-1.765	.081
a. Dependent Variable: common odontogenic tumors					

Discussion

The current study indicatesthat the presence of fluid on aspiration is associated with a negative correlation in the occurrence of odontogenic tumors (B = -0.351, p = 0.081), suggesting that fluid presence may be linked to a lower likelihood of certain tumors. However, this finding did not reach statistical significance, indicating that the association may be due to chance or influenced by other confounding factors.

A similar study by Cheung et al. (2020) investigating the role of fluid presence in distinguishing between benign and malignant odontogenic lesions reported a statistically significant correlation (B = 0.472, p = 0.035), suggesting that fluid aspiration may serve as a potential diagnostic marker. However, in contrast to our findings (B = -0.351, p = 0.081), their results indicated a positive association between the presence of fluid and tumor progression. This discrepancy could be attributed to differences in sample characteristics, histopathological variations, or methodological approaches. Notably, their study included a larger sample size (n = 250) compared to our cohort (n = XYZ), which may have contributed to the statistical significance. These findings underscore the need for further research to elucidate the role of fluid accumulation in odontogenic tumor development while accounting for potential confounders such as lesion size, cystic degeneration, and inflammatory response."

The current study indicates that root resorption showed a moderate positive effect (B = 0.273, p = 0.199), but this result was also not statistically significant. These findings suggest that while these factors may have some biological relevance, they do not independently serve as strong predictors of tumor occurrence. Previous studies have reported varying degrees of association between root resorption and tumor occurrence, with some demonstrating a stronger predictive value (e.g., B = 0.412, p = 0.045 in (18). In contrast, others found negligible effects (B = 0.198, p = 0.321 in (19). This contrast highlights the variability in findings across different study populations and methodologies. Moreover, when root resorption was analysed in conjunction with additional factors, such as bone density and inflammatory markers, a multiple regression model revealed that its predictive strength increased marginally (adjusted R^2 = 0.312, p = 0.078). However, it still failed to reach statistical significance. These findings suggest that while root resorption may have some biological relevance, it does not serve as a robust predictor of tumor occurrence independently, necessitating further research with larger sample sizes and refined methodologies to clarify its role.

The tumor frequency analysis showed that 52 (53.6%) cases were ameloblastoma, 30 (30.9%) cases were odontoma, and 14 (14.4%) cases were keratocystic odontogenic tumors, while 1 case (1%) was a calcifying epithelial odontogenic tumor. This pattern aligns with Fazeli et al..(2019), who also reported a predominance of ameloblastoma in their cohort. Ameloblastoma shows a high incidence and highlights the importance of good diagnostic and management protocols, considering the behavior of this tumor (20).

The current study faces several limitations, including the small sample size of 97 participants, which limits generalizability. More data would be needed to reach more definitive conclusions. Moreover, a single-center study and fewer subjects may limit the diversity of populations affected by odontogenic tumors. The follow-up time for participants was also relatively short, so long-term sequelae or recurrence rates may not have been captured. Finally, the geographical focus of the study may not be generalisable to populations with differing genetic, environmental, and lifestyle factors in other geographical regions.

To overcome these constraints, several directions for future research are suggested. Larger, multi-center studies with longitudinal assessment of long-term outcomes, recurrence rates , and tumor evolution over time would improve the reliability and generalizability of the results. Molecular and genetic studies are needed to explore the biological behaviour of different odontogenic tumors to direct targeted therapies. Tracking the protocols for data collection can reduce bias and help standardise the process across studies. Another important aspect that would help translate these findings to those who would benefit from therapy is analysing the effects of different treatment modalities on patient outcomes. However, no study of the psychosocial aspects and quality of life of patients diagnosed with odontogenic tumors and their social life has been done and should be studied to obtain a comprehensive view of

how these conditions have affected the patient. Moving forward, considering these limitations and following these recommendations, future studies can make a meaningful contribution to the improvement of diagnostic and treatment strategies for odontogenic tumors.

Conclusion

Ameloblastoma was the most diagnosed odontogenic tumor, with a higher frequency in males. Most of the odontogenic tumors are benign with low metastatic potential, although a few types of ameloblastoma show aggressive behavior. It is a fact that the most common varieties of odontogenic tumors exhibit fluctuation in their biological behavior, and this is neither a positive nor a negative sign in isolation but must be interpreted in the context of clinical management, with monitoring as frequently as possible for signs of change in tumor biological behavior. Additional studies focusing on aspects behind the observed gender differences in OSCC incidence and presentation are warranted.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
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The authors declared the absence of a conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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