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ORIGINAL RESEARCH

ODONTOGENIC CYSTS AND TUMOURS: CLINICOPATHOLOGICAL DATA OF 13 YEARS FROM TERTIARY ORAL HEALTH CARE CENTER OF SOUTH INDIA

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ABSTRACT

Background: Odontogenic cysts and tumors arise from remnants of the tooth-forming apparatus and exhibit diverse biological behaviors. Accurate diagnosis is essential for effective management, especially with updates in the WHO 2024 classification. To retrospectively analyze the demographic, clinical, radiological, and histopathological features of odontogenic cysts and tumors diagnosed over 13 years at a tertiary oral health center in South India.

Material and Methods: This study reviewed 433 histopathologically confirmed cases from 6,739 oral biopsies recorded between 2010 and 2023. Data were analyzed for age, gender, lesion site, radiographic appearance, and pathological type. Classification was done according to the WHO 2024 guidelines.

Results: A total of 433 cases (6.42%) were identified, with a male predominance (1.6:1) and peak incidence in the 20–29 years age group. The mandible was more frequently affected, particularly on the left side. Odontogenic keratocyst was the most common cyst (121 cases), while ameloblastoma was the most common tumor (97 cases). Most lesions presented as unilocular radiolucencies.

Conclusion: Odontogenic lesions in this population showed trends consistent with global data. The study underscores the value of histopathology and the relevance of the updated WHO classification in guiding diagnosis and management of these diverse lesions.

Keywords: Odontogenic cysts, Odontogenic tumours, Ameloblastoma, Odontogenic keratocyst cyst, Radicular cyst

INTRODUCTION

Odontogenic cysts and tumors are lesions that originate from the epithelial and/or mesenchymal remnants of the tooth-forming apparatus and are predominantly found in the maxillofacial region. These lesions can occur across a wide demographic range, affecting individuals of all ages, sexes, races, and socioeconomic backgrounds [1]. The development of odontogenic cysts and tumors is closely linked to disturbances in normal odontogenesis and alterations in dental development, often influenced by genetic ,environmental, and systemic factors [2]. Odontogenic lesions are broadly classified into two categories: odontogenic and non-odontogenic. Odontogenic cysts, in particular, arise from epithelial remnants associated with the tooth-forming apparatus, including the dental lamina and enamel organ, whereas odontogenic tumors originate from either epithelial or mesenchymal components of the odontogenic tissues [2,3]. Non-odontogenic lesions, on the other hand, have origins unrelated to tooth development. They display a wide

spectrum of biological behaviors, ranging from benign cysts with minimal growth potential to aggressive tumors capable of causing significant destruction of surrounding bone and tissues [3]. Odontogenic cysts are more commonly encountered than tumors, and although many are innocuous, certain types like the odontogenic keratocyst (OKC) exhibit locally aggressive behavior and a tendency for recurrence. The biological classification of these lesions has evolved considerably over the past decades, with significant refinements introduced in the 2024 World Health Organization (WHO) Classification of Head and Neck Tumors [4]. Notably, the WHO 2024 edition continues to recognize the odontogenic keratocyst as a cyst rather than a tumor, reinforcing the 2017 decision based on molecular and clinical evidence, particularly PTCH1 mutations and their association with nevoid basal cell carcinoma syndrome [4,5].

One major revision in the WHO 2024 classification is the more detailed molecular categorization of ameloblastomas, distinguishing between BRAF V600E-mutated conventional ameloblastomas and non-mutated variants, which has therapeutic implications [5]. Furthermore, the 2024 classification introduces clearer diagnostic criteria for rare lesions such as sclerosing odontogenic carcinoma and primordial odontogenic tumor, highlighting their distinct histopathological and molecular profiles [6].

Epidemiologically, odontogenic cysts and tumors show considerable geographic and racial variation. Studies indicate a higher prevalence of ameloblastomas in African and Asian populations compared to Western countries, where odontomas predominate [7]. In particular, odontogenic keratocysts are consistently reported as one of the most common developmental cysts across global populations, noted for their parakeratinized epithelial lining and aggressive potential [8]. The demographic profile often reveals a peak incidence in the second to fourth decades of life, with a slight male predilection and a higher frequency in the mandible compared to the maxilla [9].

In the Indian context, relatively few large, multicenter studies have been conducted, despite India's ethnic diversity and significant patient volume. Recent studies from South India have emphasized the dominance of ameloblastomas and OKCs among odontogenic lesions, mirroring global trends but also highlighting regional peculiarities [10].

Understanding the clinical, radiographic, and histopathological features of odontogenic cysts and tumors, particularly in light of the latest WHO 2024 classification, is critical for accurate diagnosis and effective management. Therefore, this study was undertaken to retrospectively analyze the demographic distribution, clinical presentation, radiological characteristics, and pathological features of odontogenic cysts and tumors over a 13-year period in a tertiary dental hospital in South India effective management. Therefore, this study was undertaken to retrospectively analyze the demographic distribution, clinical presentation, radiological characteristics, and pathological features of odontogenic cysts and tumors over a 13-year period in a tertiary dental hospital in South India.

MATERIALS AND METHODS

This retrospective observational study was conducted in the Department of Oral Pathology and Microbiology at a tertiary care dental hospital in South India, after obtaining approval from the Institutional Ethics Committee. The study evaluated cases diagnosed histopathologically as odontogenic cysts and tumors between January 2010 and December 2023, spanning a 13-year period. Inclusion criteria comprised all cases with a definitive diagnosis of odontogenic cysts or tumors confirmed by histopathological examination, irrespective of patient age, gender, or lesion location. Exclusion criteria included cases with incomplete clinical, radiographic, or histopathological records, cases diagnosed as non-odontogenic cysts or tumors, and recurrent cases where the primary histopathological report was unavailable. Patient demographic data, including age and gender, along with clinical details such as site of lesion (maxilla or mandible, anterior or posterior region), and radiographic findings (unilocular or multilocular radiolucency) were retrieved from hospital archives and case records. Histopathological diagnosis was based on examination of hematoxylin and eosin-stained sections prepared from formalin-fixed, paraffin-embedded tissue blocks. Each case was independently reviewed by two oral pathologists to minimize diagnostic variability, with discrepancies resolved by consensus. Classification of cysts and tumors was done according to the latest WHO 2024 Classification of Head and Neck Tumours (Barnes et al., 2024), incorporating updated molecular and histopathological criteria. Developmental cysts, such as dentigerous cysts and odontogenic keratocysts, were distinguished from inflammatory cysts like radicular and residual cysts based on clinical and histopathological features. Tumors were categorized as benign or malignant odontogenic tumors, with subclassification according to epithelial, mesenchymal, or mixed tissue origin. Where necessary, immunohistochemical staining was performed to assist in differentiating ambiguous cases.

Data were entered into Microsoft Excel 2019 and statistically analyzed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to calculate frequency distributions and percentages for categorical variables such as lesion type, site, and gender. Mean and standard deviation were computed for continuous variables like age.

RESULTS

This retrospective study analyzed odontogenic cysts and tumors over a period of 13 years (2009–2022) from a tertiary oral health care center in South India, with a sample size derived from 6739 oral biopsy records. Among these, 433 cases were diagnosed as odontogenic cysts and tumors, reflecting a relative frequency of 6.42%. The age distribution of the cases revealed that odontogenic cysts and tumors occurred across a wide range of age groups, from children to elderly individuals.However, the peak incidence was observed in the 20–29 years age group, suggesting that young adults are the most commonly affected. A significant male predominance was observed, with 268 males and 164 females affected, resulting in a male to female ratio of approximately 1.6:1.(Figure 1)

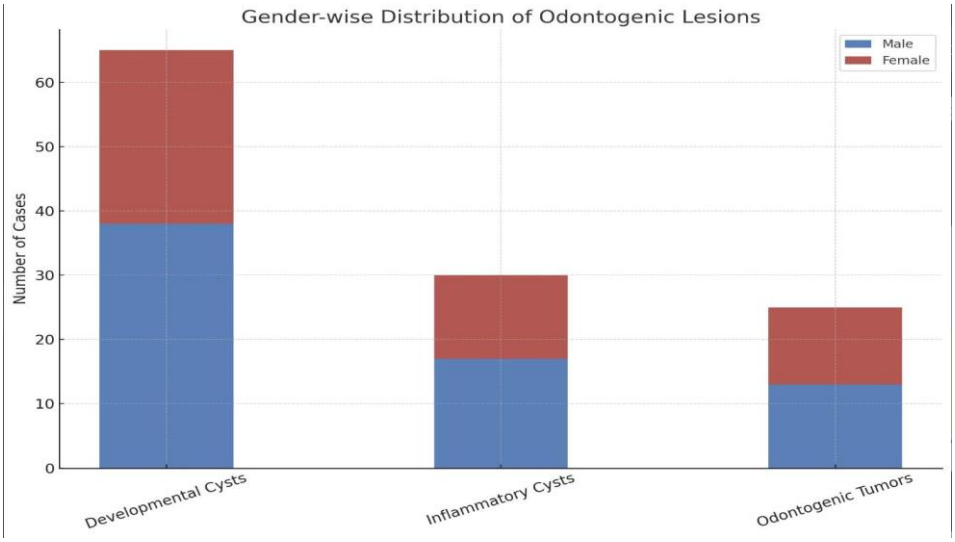

Figure 1 shows Gender-wise distribution of odontogenic lesions categorized into developmental cysts, inflammatory cysts, and odontogenic tumors.

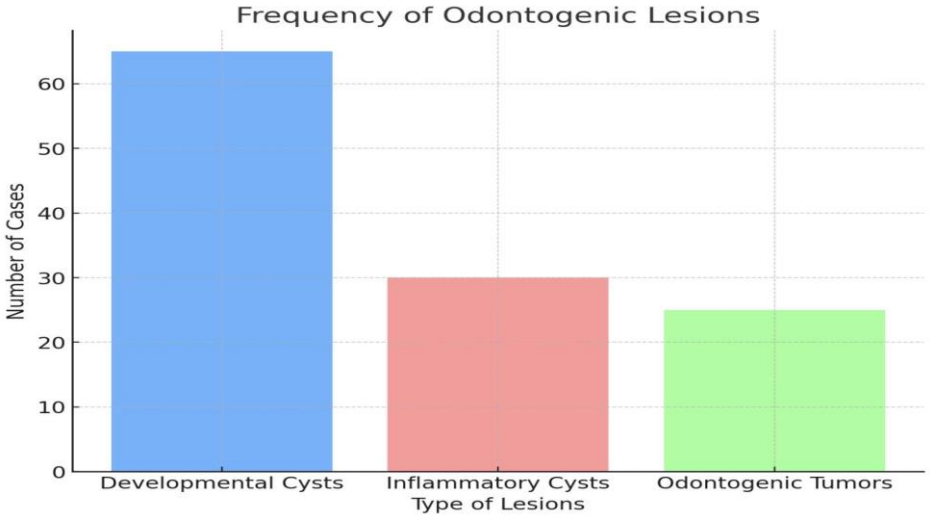

Figure 2 shows Frequency of Odontogenic Lesions.The bar chart displays the distribution of odontogenic lesions into three main categories: developmental cysts, inflammatory cysts, and odontogenic tumors. Developmental cysts are the most frequent, followed by inflammatory cysts and tumors.

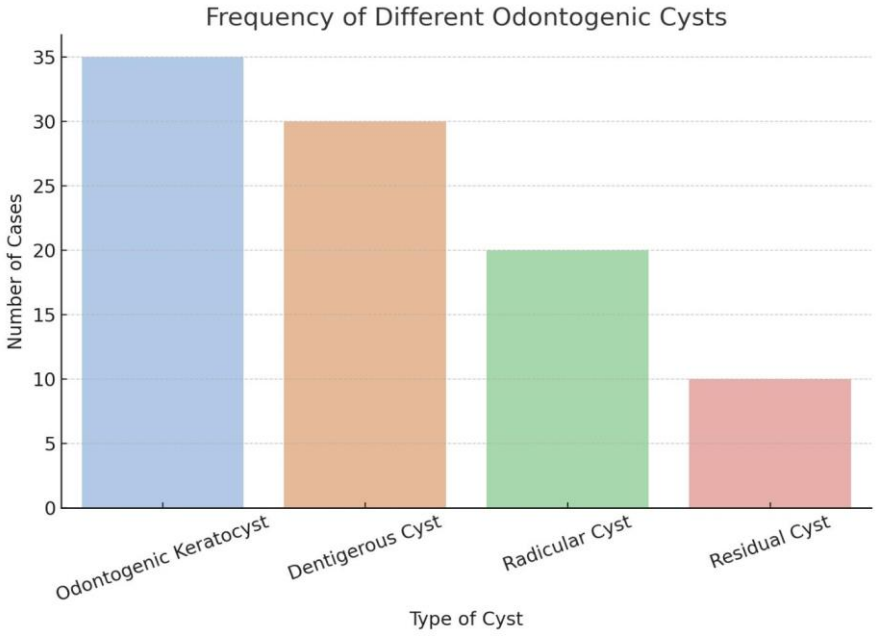

Figure 3 shows frequency of Different Odontogenic Cysts, This chart illustrates the distribution of specific types of odontogenic cysts. Odontogenic keratocysts were the most common, followed by dentigerous cysts, radicular cysts, and residual cysts.

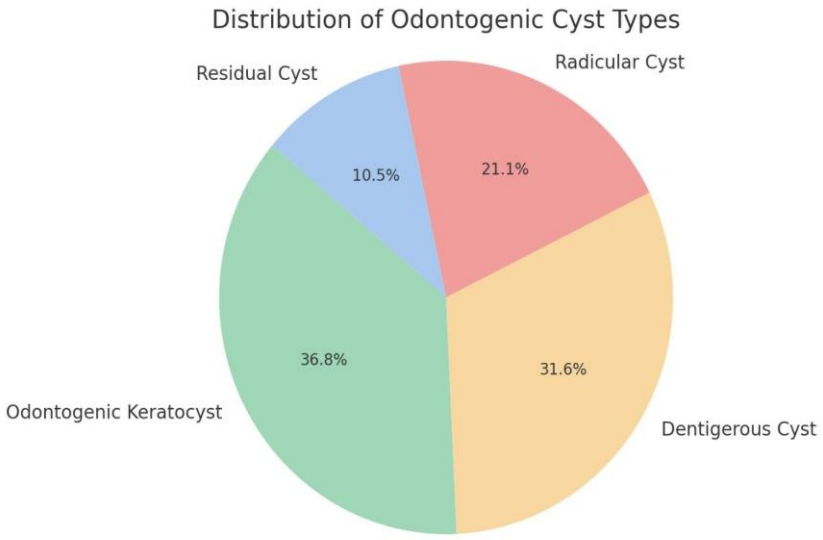

Figure 4 shows the distribution of Odontogenic Cyst Types, the pie chart illustrates the proportional distribution of various odontogenic cysts. Odontogenic keratocyst accounts for the largest share (36.8%), followed by dentigerous cyst (31.6%), radicular cyst (21.1%), and residual cyst (10.5%), reflecting their relative frequencies in the study population.

DISCUSSION

Odontogenic cysts and tumors represent a complex and heterogeneous group of lesions arising from the epithelial and mesenchymal elements involved in tooth development. Their biological behavior ranges from indolent cystic lesions to aggressive neoplasms, necessitating accurate diagnosis and management. The present study, conducted over a 13-year period, revealed that odontogenic cysts were more prevalent than tumors, with a predominance of developmental cysts, particularly odontogenic keratocysts (OKCs). This finding aligns with several contemporary studies indicating the high frequency of OKCs among jaw lesions globally **8,11**. The WHO 2024 Classification of Head and Neck Tumors reinforces the classification of OKCs as cysts rather than tumors, emphasizing their benign nature despite their locally aggressive potential and their association with PTCH1 gene mutations. In our study, OKCs exhibited a strong predilection for the posterior mandible and were most common in the second to fourth

decades of life, consistent with previous epidemiological reports by Speight et al (2024) and Mosqueda-Taylor et al (2023). Radiographically, most OKCs appeared as unilocular or multilocular radiolucencies, often associated with cortical expansion and occasional root resorption, underscoring their potentially aggressive behavior if left untreated.Among odontogenic tumors, ameloblastomas were the most frequently diagnosed, a finding that corroborates previous reports from India and other developing regions [10]. The WHO 2024 edition now emphasizes the importance of molecular diagnostics in ameloblastomas, particularly the detection of BRAF V600E mutations, which may influence therapeutic decisions, especially in cases considered for targeted therapy [5]. Conventional solid/multicystic ameloblastoma accounted for the majority of cases in our study, typically presenting as multilocular radiolucencies in the posterior mandible. This classic presentation has been widely documented and remains a critical radiographic feature aiding preliminary diagnosis [12]. The lower incidence of unicystic ameloblastomas and peripheral ameloblastomas observed may reflect either true epidemiological patterns or possible underreporting due to misdiagnosis as simple cystic lesions.

Inflammatory cysts, particularly radicular and residual cysts, also constituted a significant proportion of cases, consistent with the high prevalence of dental caries and pulpitis in the Indian subcontinent [10]. The WHO 2024 classification continues to categorize radicular cysts under inflammatory odontogenic cysts, highlighting their origin secondary to pulp necrosis and apical periodontitis [13]. The presence of residual cysts reflects delayed or incomplete dental treatment and points towards the need for improved oral healthcare access and preventive strategies. In this study, residual cysts were predominantly found in the posterior regions of the jaws, likely due to higher rates of tooth extraction in these areas following chronic infection. Interestingly, odontomas, which are the most common odontogenic tumors in many Western populations, were relatively rare in this study, similar to findings reported by Mosqueda-Taylor et al. (2023) in non-Western cohorts. Odontomas often remain asymptomatic and are incidentally detected on routine radiographs, which are less frequently utilized in developing countries for preventive care, possibly contributing to their lower recorded incidence. Demographically, our data showed a slight male predilection and a dominant mandibular involvement, findings that are consistent with broader global trends 8,9,14. Notably, the new WHO 2024 classification introduced updated descriptions for rare entities such as sclerosing odontogenic carcinoma and primordial odontogenic tumor, though none were identified in the present series, emphasizing their extreme rarity. Nonetheless, the awareness and recognition of these rare lesions are critical for practicing pathologists to ensure appropriate diagnosis and management 15,16. The current study underscores the indispensable role of histopathological evaluation, often supplemented by immunohistochemical markers where necessary, for definitive diagnosis of odontogenic lesions [17,18]. Given the evolving understanding of the molecular underpinnings of these lesions, future studies should incorporate genetic and immunohistochemical profiling to refine classification and explore potential targeted therapies, particularly for aggressive tumors like ameloblastoma [19,20].

CONCLUSION

The present study highlights the predominance of developmental odontogenic cysts, particularly odontogenic keratocysts, and benign odontogenic tumors such as ameloblastomas, in a South Indian population over a 13-year period. The findings emphasize the necessity for clinicians and pathologists to remain updated with the latest WHO 2024 classification, which integrates molecular and histopathological advancements to refine diagnosis and management. Accurate diagnosis, grounded in a combination of clinical, radiological, and histopathological evaluations, remains critical for appropriate treatment planning. Future studies incorporating molecular profiling and larger multicenter cohorts are essential to better understand the biological behavior and optimize therapeutic strategies for odontogenic lesions. Strengthening preventive oral healthcare programs can further reduce the incidence of inflammatory cysts, thereby improving overall oral health outcomes in the population.

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Consent for publication

Informed consent was obtained from every participant for documentation and examination.

Competing interests

The authors declare no competing interests.

Ethical approval

Ethical approval was granted by the Institutional Human Ethical Committee

Informed patient consent

All patients' clinical records were obtained with informed consent.

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