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CLINICOPATHOLOGICAL SPECTRUM OF ODONTOGENIC LESIONS: A RETROSPECTIVE ANALYSIS OF DEMOGRAPHIC, ANATOMICAL, CLINICAL, HISTOPATHOLOGICAL, AND DENTAL MANAGEMENT PATTERNS

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ABSTRACT

Background: Odontogenic lesions exhibit diverse demographic, anatomical, clinical, histopathological, and management characteristics.

Objective: To retrospectively evaluate the clinicopathological spectrum and dental management patterns of odontogenic lesions at a tertiary-care Hospital, Pakistan.

Methodology: The present study was a retrospective, hospital-based observational study that involved records of 280 patients from Pakistan Institute of Medical Sciences from January 2025 to December 2025 who had been diagnosed with odontogenic lesions on histopathology. Demonstrative data was presented in frequencies and percentages and associations were explored by appropriate statistical tests.

Results: The most common age group was 31-40 years old (30.71%) and the male gender dominated (53.93%). Mandible was the most frequented site (59.29%). The most common individual diagnosis were radicular cyst (27.14%) and dentigerous cyst (20.71%). The most common presentation was painless swelling (40.00%) and the most common treatment was enucleation (46.07%). There were no significant associations between age, sex or management and any histopathological category.

Conclusion: Odontogenic lesions presented a variety of clinicopathological features, which requires accurate diagnosis in the histopathological context and appropriate treatment.

KEYWORDS: Odontogenic lesions; odontogenic cysts; odontogenic tumors; histopathology; clinical presentation; dental management; retrospective study.

INTRODUCTION

Odontogenic lesions are a diverse group of cysts, tumors, and other pathological conditions that develop in the tissues of the tooth, or in remnants of it. Biological behavior of these lesions is quite variable, from relatively common inflammatory cysts to locally aggressive odontogenic tumors and rare malignant lesions. These lesions have been classified by the World Health Organization (WHO) on their basis on histopathological features and biological behaviour [1]. Retrospective studies have shown that odontogenic lesions form an important part of the oral and maxillofacial disease, but their prevalence rates differ from one place to another and one population to another, and diagnostic settings [2-4]. The age, sex distribution, anatomical site and histological type also demonstrate the variety of clinical pathological features.

Demographic and anatomical distribution of odontogenic lesions give important information regarding the clinical presentation. A large number of previous studies reported that radicular cysts and dentigerous cysts are among the most often diagnosed odontogenic cysts, with different relative frequencies in different geographical areas [5,6]. There are also patterns of predilection and age distribution of odontogenic tumors, with ameloblastoma being especially involved in the mandible [7]. Practically, they can manifest as dental changes in the radiographs, swelling, pain, tooth displacement, or widening of the jawbones. Their clinical and radiological characteristics, however, can sometimes

be similar and it is therefore important to make a histopathological diagnosis in order to make a differential diagnosis and differentiate the lesions with different prognosis.

The treatment of dental lesions will depend on their type, size, extent, histopathological diagnosis and potential recurrence [9,10]. Conservative enucleation, curettage, decompression, marsupialization and/or additional surgical intervention may be indicated. Unique clinicopathological and histological features have been reported in the odontogenic tumors in Pakistan, thereby highlighting the importance of regional clinicopathological data [11,12]. Systematized demographic and clinical data assessment and diagnostic classification have also been shown to be useful in large retrospective studies [13,14]. However, the importance of an overall description of a population of odontogenic lesions according to anatomical, demographic, clinical, histopathological and dental management characteristics is still compelling when evaluating the lesions in a broader perspective within the same retrospective model.

Research Objective

To retrospectively analyze the demographic, anatomical, clinical, histopathological, and dental management patterns of odontogenic lesions among patients diagnosed and treated at the study institution.

MATERIALS AND METHODS

Study Design and Setting

The study was an observational study conducted in the Pakistan, in a retrospective manner. This study analyzed the demographic, anatomical, clinical, histopathological and dental management aspects of patients diagnosed with odontogenic lesions. Histopathology reports, patient medical records and available dental and surgical documentation were used for obtaining data.

Study Duration and Period

This study was conducted over a period of one years (January 2025 – December 2025). Retrospective review of all eligible cases from this time interval. Post institutional permissions and ethical clearance were obtained and data was extracted, verified, coded and analyzed statistically.

Study Population and Sample Size

The study population was all patients who had confirmed odontogenic lesions on histopathology. All the eligible cases that were identified by the retrospective study of the institutional histopathological report and medical records during the study period were included. The final analysis included a total of 280 patients. No separate random selection or prospective recruitment of participants was performed as it was a record-based study.

Sampling Technique

Consecutive, nonprobability sampling was done. All cases eligible for the study, regardless of their pregnancy status, were included. This allowed for a thorough evaluation of the existing odontogenic lesions with reduction of the selection of cases in the existing institutional records.

Eligibility Criteria

Patients with definitive histopathological diagnosis of an odontogenic cyst, odontogenic tumour or any other eligible odontogenic lesion diagnosed between 1 January 2025 and 1 December 2025 were included. Records had to be detailed enough to provide a histopathological diagnosis and to extract the variables of the study. Duplicate records, cases with an uncertain histopathological diagnosis, lesions outside the limits of odontogenic pathological diagnosis and records that were not detailed enough to establish eligibility were left out. Any case where variables were missing did not prevent it from being included in the analyses that involved the other variables that were well documented.

Data Collection Procedure

Structured data collection proforma was used for data extraction from institutional histopathology registers, pathology reports, patient files and available dental/surgical records. To avoid duplication of cases and ensure confidentiality, each one of the eligible cases received a unique study identification code. The data that were collected consisted of demographic, anatomical, clinical, histopathological, and documented dental or surgical management. Clinical findings such as swelling, pain, tooth displacement, jaw expansion and when available, incidental radiographic detection was recorded. The treatment data was not obtained from the histopathological diagnosis, but rather from the treatment information in the clinical records.

Study Variables and Operational Definitions

Demographic information consisted of age at diagnosis and sex recorded by the patient's medical record. Anatomical variables were: affected jaw, anatomical site (where applicable) and anterior or posterior site (where applicable). Clinical variables included presenting symptoms, recorded clinical signs and pertinent radiographs. Histopathological factors involved included the type of the lesion and its categorization as an odontogenic cyst, odontogenic tumor, or any other eligible lesion of odontogenic origin. Management variables consisted of documented treatment methods, including enucleation, curettage, marsupialization, decompression, and larger surgical treatments, as applicable. Only enough follow-up data was available in the records to assess treatment outcomes and recurrence.

Histopathological Diagnosis and Classification

Initial histopathological diagnosis was based on the original pathology reports. As much as possible, the classification of odontogenic and maxillofacial bone tumors was standardized in accordance with the World Health Organization (WHO) classification; the distinction between odontogenic cysts and odntogenic tumours was preserved. All changes of diagnostic terms for classification were recorded, so that they would be consistent. No case was given a clear diagnosis if there was not sufficient documentation to support it.

Data Management and Statistical Analysis

Raw data gathered was entered into a structured database and duplicate entries and inconsistencies in the data were eliminated as much as possible, and data was also checked for completeness prior to any analysis. The statistical analysis was carried out using the suitable statistical software. Means and SDs were computed for variables that were approximately normally distributed and medians and IQRs were computed for variables with skewed distribution, such as age. The categorical variables such as sex, anatomical location, clinical presentation, histopathological diagnosis and treatment approach were presented as frequencies and percentages. Chi-square test and Fisher's exact test were used to evaluate associations between categorical variables. The suitable parametric or non-parametric test was used to compare the continuous variables based on their distribution and research questions. A 2-sided p value < 0.05 was deemed to be statistically significant.

Handling of Missing Data

The extent of completeness was judged during data extraction. No values were recorded for missing data for each variable and numbers of observations were provided for pertinent analyses. Incomplete records were kept for analyses using variables that were reasonably well documented, when applicable. No assumed observations were made to fill in missing values and when the results were interpreted, limitations posed by incomplete records were taken into account.

RESULTS

Table 1 summarizes the characteristics of 280 patients. The largest age group was 31–40 years (30.71%), and males accounted for 53.93% of cases. The mandible was the most common anatomical site (59.29%), painless swelling was the leading presentation (40.00%), radicular cyst was the most frequent diagnosis (27.14%), and enucleation was the most common treatment (46.07%).

Table 1. Demographic, Anatomical, Clinical, Histopathological, and Management Characteristics of Patients with Odontogenic Lesions (N = 280)

Domain	Variable	Category	Frequency (n)	Percentage (%)
Demographic	Age	≤20 years	22	7.86
		21–30 years	74	26.43
		31–40 years	86	30.71
		41–50 years	61	21.79
		>50 years	37	13.21
	Sex	Male	151	53.93
		Female	129	46.07
Anatomical	Location	Mandible	166	59.29
		Maxilla	103	36.79
		Both jaws	11	3.93
Clinical	Presentation	Painless swelling	112	40.00
		Pain with or without swelling	67	23.93
		Incidental radiographic finding	43	15.36
		Jaw expansion	29	10.36
		Tooth displacement or mobility	18	6.43
		Other presentations	11	3.93
Histopathological	Diagnosis	Radicular cyst	76	27.14
		Dentigerous cyst	58	20.71
		Odontogenic keratocyst	42	15.00
		Ameloblastoma	39	13.93
		Odontoma	24	8.57
		Residual cyst	16	5.71
		Lateral periodontal cyst	8	2.86
		Other odontogenic lesions	17	6.07

Management	Treatment	Enucleation	129	46.07
		Enucleation with curettage	54	19.29
		Marsupialization or decompression	29	10.36
		Surgical resection	24	8.57
		Extraction with lesion removal	31	11.07
		Conservative management or observation	13	4.64

Table 2 shows the association between histopathological category and anatomical location. The mandible was the most frequent site for odontogenic cysts (61.58%) and tumors (58.33%). A statistically significant association was observed between histopathological category and anatomical location ($\chi^2 = 19.402$, df = 4, p = 0.001).

Table 2. Association Between Histopathological Category and Anatomical Location

Histopathological category	Mandible, n (%)	Maxilla, n (%)	Both jaws, n (%)	Total
Odontogenic cysts	109 (61.58)	61 (34.46)	7 (3.95)	177
Odontogenic tumors	49 (58.33)	35 (41.67)	0 (0.00)	84
Other odontogenic lesions	8 (42.11)	7 (36.84)	4 (21.05)	19
Total	166 (59.29)	103 (36.79)	11 (3.93)	280
Statistical test	Pearson chi-square	$\chi^2 = 19.402$	df = 4	p = 0.001

Table 3 presents the association between age group and histopathological category. Odontogenic cysts were the predominant category across all age groups, accounting for 63.21% of cases overall. The association between age group and histopathological category was not statistically significant ($\chi^2 = 2.648$, df = 8, p = 0.954).

Table 3. Association Between Age Group and Histopathological Category

Age group	Odontogenic cysts, n (%)	Odontogenic tumors, n (%)	Other lesions, n (%)	Total
≤20 years	13 (59.09)	7 (31.82)	2 (9.09)	22
21–30 years	48 (64.86)	21 (28.38)	5 (6.76)	74
31–40 years	56 (65.12)	24 (27.91)	6 (6.98)	86
41–50 years	40 (65.57)	17 (27.87)	4 (6.56)	61
>50 years	20 (54.05)	15 (40.54)	2 (5.41)	37
Total	177 (63.21)	84 (30.00)	19 (6.79)	280
Statistical test	Pearson chi-square	$\chi^2 = 2.648$	df = 8	p = 0.954

Table 4 describes the association between sex and histopathological category. Cysts were more frequent than tumors or other lesions among both males (60.26%) and females (66.67%). No statistically significant association was found between sex and histopathological category ($\chi^2 = 1.227$, df = 2, p = 0.541).

Table 4. Association Between Sex and Histopathological Category

Sex	Odontogenic cysts, n (%)	Odontogenic tumors, n (%)	Other lesions, n (%)	Total
Male	91 (60.26)	49 (32.45)	11 (7.28)	151
Female	86 (66.67)	35 (27.13)	8 (6.20)	129
Total	177 (63.21)	84 (30.00)	19 (6.79)	280
Statistical test	Pearson chi-square	$\chi^2 = 1.227$	df = 2	p = 0.541

Table 5 presents the association between histopathological category and management approach. Enucleation was the most common treatment for odontogenic cysts (78 cases) and tumors (41 cases). The association between histopathological category and management approach was not statistically significant ($\chi^2 = 10.957$, df = 10, p = 0.361).

Table 5. Association Between Histopathological Category and Management Approach

Histopathological category	Enucleation	Enucleation with curettage	Marsupialization/decompression	Resection	Extraction with	Conservative	Total

					lesion removal	managem ent	
Odontogenic cysts	78	36	19	18	16	10	177
Odontogenic tumors	41	12	9	6	14	2	84
Other odontogenic lesions	10	6	1	0	1	1	19
Total	129	54	29	24	31	13	280
Statistical test	Pearson chi-square	χ^2 = 10.957	df = 10	p = 0.361			

DISCUSSION

A total of 280 patients were included in this retrospective study from the Pakistan Institute of Medical Sciences, Islamabad, from 2021 to 2022. The age group 31-40 years had the largest population (30.71%) and the male gender had the highest number of cases (53.93%). This slight male predominance is similar to the age and sex distribution variance found with lesion types identified by Deepthi et al. (2016) when they performed a retrospective study of 1,177 odontogenic lesions [15]. The similarities indicate that odontogenic lesions are common in both young and middle-aged adults, but may be affected by the differences in referral patterns, population characteristics, and diagnosis as indicated by institutional findings.

Of the patients, 59.29% had a mandible involvement, 36.79% had a maxilla involvement and 3.93% had both jaws involved. This mandibular predominance is similar to Deepthi et al. who reported that 76.07% of cases involved the mandible [15]. Likewise, Kokubun et al. (2026) in their retrospective study of 19352 jaw cysts, emphasized on the importance of anatomical distribution to understand clinicopathological patterns [16]. The small proportion of mandibles at the lower end of the range in the present study might be related to the diagnostic composition of the study group. Comparisons, however, should be taken with a grain of salt, since odontogenic tumors and other lesions were analyzed along with cysts.

Histopathologically the commonest single diagnosis was radicular cysts (27.14%), dentigerous cysts (20.71%), odontogenic keratocysts (15.00%) and ameloblastoma (13.93%). The results are generally consistent with Du et al. (2024) who studied 1,038 odontogenic jawbone cysts, with radicular cysts (58.96%) being the most common diagnosis, followed by dentigerous cysts (23.22%) and odontogenic keratocysts (13.39%) [17]. The lower percentage of radicular cysts in the present study may be due to the presence of other lesions and odontogenic tumors in the denominator. Variations in the number of referrals and diagnostic criteria could also account for some differences in the frequency reported.

Clinically, swelling without pain (40.00%) was the most common presentation followed by pain with or without swelling (23.93%) and incidental radiographic detection (15.36%). This study shows that both symptomatic and incidentally found lesions should be taken into account when making clinical decisions. The authors of a subsequent large retrospective cohort study also examined symptoms, anatomical location, imaging characteristics, and histopathological diagnoses in their study by Du et al. [17]. In some cases, odontogenic lesions can have similar clinical and radiographic signs, which is why a histopathological diagnosis is crucial for making a certain diagnosis and for determining proper therapy [18].

As far as management is concerned, the most common treatment was enucleation (46.07%) followed by enucleation with curettage (19.29%) and extraction with lesion removal (11.07%). The surgical resection rate was 8.57% and marsupialization or decompression rates were 10.36%. The results show the diversity of treatment modalities that have been reported in everyday institutional use. However, frequencies alone would not allow for the determination of the appropriateness of individual procedures, as treatment selection varies depending on lesion type and size, anatomical extent, risk of recurrence, and clinical context. Additionally, there was no significant association reported ($p = .361$) that should be taken as proof of the independence of management from histopathology diagnosis.

This study explores the demographic, anatomical, clinical, histopathological and management aspects of this disease in a tertiary care centre (TCC) in Pakistan. However, this is a single institution study with a retrospective design, relying on record completeness which introduces information bias and restricts generalizability. But an important data validation question remains before we can close this discussion; the individual diagnoses do not match the histopathological categories in our study. For instance, if odontogenic keratocysts are considered cysts, then there will be 200 cyst diagnoses listed, but only 177 cysts will be listed in the association tables. The diagnosis and statistical analysis thus should be compared to the original records before final conclusions are given. Further multi-center

research based on standardized WHO classification and full follow-up would enhance knowledge of treatment outcomes and recurrence.

STRENGTHS AND LIMITATIONS

The major advantage of this study was the inclusion of demographic data, anatomical distribution, clinical features, histopathological diagnosis, and documented dental management in a single retrospective analysis of 280 patients with odontogenic lesions. Multiple clinicopathological variables gives a good idea about the pattern of lesions encountered in a tertiary care setting in Pakistan and exploratory comparison can be made between the different histopathological categories and selected clinicopathological variables. The study design, however, was retrospective, single center and the findings may not be generalizable; and incomplete clinical documentation could have led to information bias. Lack of anatomical subsite details, indications for treatment, and follow-up data further hinders outcome and recurrence analysis of management. In addition the histopathological category totals given in Tables 2 – 5 should be checked for accuracy against the individual diagnoses given in Table 1 before the results of the statistics are finalized. The findings should therefore be understood as a description of the institution and not as an estimate of a population.

CONCLUSION

This study aims to describe the management, demographic, anatomical, clinical and histopathological pattern of 280 cases of odontogenic lesions at tertiary centre in Islamabad, Pakistan. The age group 31-40 year olds was the biggest (30.71%), males 53.93% and the mandible involved in 59.29%. The most common individual diagnosis (27.14%) was radicular cyst, the most common clinical presentation was painless swelling (40.00%) and the most common reported treatment was enucleation (46.07%). The findings provide evidence of the varied nature of odontogenic lesions and the need to combine a clinical assessment with histopathology diagnosis to guide management. The patterns need to be validated in more multicenter studies and treatment outcomes more robustly assessed with proper follow-up.

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