Int J Clin Exp Pathol 2022;15(12):467-475
www.ijcep.com /ISSN:1936-2625/IJCEP0136051

Original Article

Histopathologic spectrum and clinical correlation of lesions of jaw - a series of 60 cases

Garima Vijayvergiya[1], Ashwani Tandon[2], Anshul Rai[3], Ujjawal Khurana[2], Deepti Joshi[2], Jai Chaurasia[2], Tanya Sharma[2], Garima Goel[2], Hemlata Panwar[2], Neelkamal Kapoor[2]

[1]Pathology Bhopal Memorial Hospital and Research Centre, Bhopal, MP, India; [2]Department of Pathology and Lab Medicine, All India Institute of Medical Science, Bhopal, MP, India; [3]Department of Dentistry, All India Institute of Medical Science, Bhopal, MP, India

Received June 6, 2021; Accepted July 12, 2022; Epub December 15, 2022; Published December 30, 2022

Abstract: Odontogenic tumors have the potential for the development of malformations of the teeth as well as the surrounding tissue. Sound knowledge of various types of jaw lesions and their characteristics will help the clinician with timely measures and management. Our main aim was to study the histopathological nature of various jaw lesions retrieved from biopsies and resected specimens. Consecutive 60 cases of jaw lesions were analyzed. Odontogenic cyst, odontogenic tumor, fibro-osseous lesions, and giant cell lesions were included in this study. Lesions of the oral cavity, soft tissue lesions, secondary and inflammatory lesions of the jaw were excluded. H&E stained slides were examined by light microscopy. A total of 60 jaw lesions were analyzed for histologic type. Odontogenic cysts (55%) were found to be most common followed by odontogenic tumors (25%), fibro-osseous lesions (10%), giant cell lesions (05%), and non-odontogenic cysts (05%). The most commonly affected age groups were between 20-40 years. The mandible was more commonly involved bone. To conclude, based only on histology, the distinction between odontogenic cysts is difficult and almost impossible when they are secondarily infected. For definitive diagnosis clinical-radiological correlation is needed.

Keywords: Jaw lesion, odontogenic tumors, odontogenic cyst

Introduction

The jaw tissues are involved in tooth formation. Jawbones harbor a wide variety of cystic and neoplastic lesions. The origin of these cystic and neoplastic lesions is from the nests of odontogenic epithelium with mesenchyme or without their associated mesenchymal counterparts. These odontogenic epithelial and mesenchymal elements are normally found in the jaw, and may develop into cysts or tumors [1, 2].

The breakdown of ectodermal lining cells during the union or fusion of various embryonic processes of the region, through the formation of entrapped epithelium-lined nests, also leads to the development of cystic lesions [1, 2]. Lesions of the jaw have a wide variety of pathologic features, but almost similar clinical presentations including painful swelling, loosening of teeth, facial deformity, and sinus malformations. Radiologic findings are similar in many jaw lesions. Although microscopy is classic in many cases, it is difficult to differentiate fibro-osseous lesions of the jaw and giant cell tumors of the jaw on histology alone [3].

Odontogenic tumors and cysts include a range of disorders. They may lead to malformations of the teeth and surrounding tissues [4-6]. Such odontogenic tumors arise from ectomesenchyme and/or epithelial tissue which is involved in the tooth forming apparatus. Odontogenic tumors are divided preliminarily into two categories, malignant and benign, of unknown etiology [7]. Interaction of odontogenic ectomesenchyme and epithelium is the basis of the classification of odontogenic tumors. Odontogenic cysts are divided into developmental and inflammatory cysts.

Newer entities are regularly added into the classification making it a dynamic one. Incorporation of odontogenic cysts, newer entities, re-classification of tumors, and rapid discovery of genetic

Table 1. Histologic types of jaw lesions

Odontogenic cyst (33)	Odontogenic tumor (15)	Fibro-osseous lesion (6)	Non-odontogenic cyst (3)	Giant cell lesion (3)
Dentigerous cyst (11)	Ameloblastoma (11)	Benign fibro-osseous lesion with plasmacytosis (1)	Benign cystic lesion (1)	Giant cell reparative granuloma (3)
Odontogenic keratocyst (11)	Odontoma (3)	Cemento-ossiying fibroma (3)	Cyst of epidermal origin (1)	
Radicular cyst (10)	Adenomatoid odontogenic tumor (1)	Fibrous dysplasia (1)	Epidermal inclusion cyst (1)	
Benign odontogenic cyst (1)		Osteofibrous dysplasia (1)		

Table 2. Histologic types of jaw lesions and its gender frequency

Histologic types	Frequency		
	N (60)	Male (32)	Female (28)
Odontogenic cysts	33	19	14
Odontogenic tumors	15	6	9
Fibro-osseous lesions	6	2	4
Giant cell lesions	3	2	1
Non-odontogenic cysts	3	3	0

and molecular alteration is critical in the field of odontogenic tumors and cysts [8]. Recently, odontogenic tumors have been divided into two broad categories-- malignant and benign-- which are further divided into epithelial, mesenchymal, and mixed tumors [9].

We discuss here the histopathologic spectrum of various jaw lesions in our institute.

Material and methods

60 consecutive cases of jaw lesions received in the pathology laboratory at our institute were analyzed. Cases of all age groups were included.

Received samples were in the form of excisional biopsies which mostly contained soft tissues along with bony particles as well as enucleated cysts, hemimandibulectomy, and hemimaxillectomy.

Pathologies of odontogenic cyst, odontogenic tumor, fibro-osseous lesion, and giant cell lesion were included in this study. The lesions of the oral cavity, soft tissue lesions, secondary lesions, and inflammatory lesions of the jaw were excluded.

For ease of understanding, lesions were grouped as odontogenic cyst, odontogenic tumor, giant cell lesions, fibro-osseous lesions, and non-odontogenic cysts based on histologic features.

Demographic details of the patients like age, gender, and location of the lesions along with the clinical details and radiological findings of the jaw lesions were recorded. H&E stained slides were examined under light microscopy. Consent was taken for surgical procedure and implied consent for histopathological analysis.

Results

A total of 60 jaw lesions were analyzed for histopathologic type. Odontogenic cysts (55%) were most common followed by odontogenic tumors (25%), fibro-osseous lesions (10%), giant cell lesions (5%), and non-odontogenic cysts (5%). We found that dentigerous cyst and odontogenic keratocyst was the most common odontogenic cysts, while ameloblastoma was the most common odontogenic tumor.

The distribution of histologic types of jaw lesions according to their relative number is presented in **Table 1**.

Of all lesions, 32 (53.3%) occurred in males and 28 (46.6%) in females (**Table 2**).

The mandible (n=36) was the most frequently affected jaw bone as compared to the maxilla (n=20). No information regarding the site was provided in 2 cases. In two cases the lesion was located in both the mandible and maxilla. The anatomic locations of all cases are presented in **Table 3**.

The peak age of incidence was the second decade followed by the third decade of life. The ages of the patients ranged from 8 years to 80 years (**Figure 1** and **Table 4**).

Radiologic findings were available in only 43 cases. We did a comparison of radiological

Table 3. Distribution of various types of lesions according to their anatomic location

Histologic types	Maxilla (20)	Mandible (36)	Maxilla + mandible (02)	No info (02)	Total
Odontogenic cysts	13	18	2	0	33
Odontogenic tumor	1	13	-	1	15
Fibro-osseous lesion	4	2	-	0	6
Giant cell lesion	1	2	-	0	3
Non-odontogenic cyst	1	1	-	1	3

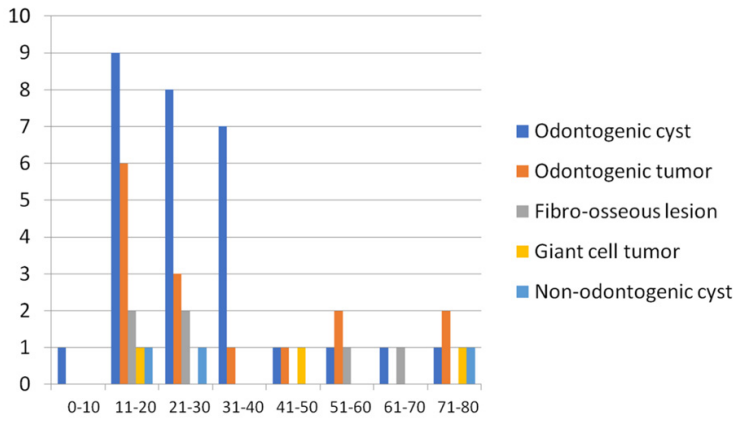

Figure 1. Age wise distribution of jaw lesion.

appearance in those 43 cases (**Table 5**). We observed that odontogenic cysts were unilocular as well as multilocular radiolucent lesions. There was a presence of impacted teeth in many cases. Ameloblastoma consisted of unilocular and multilocular cystic lesions along with radiolucency in a few of the cases. Odontomas were radiopaque radiologically. Some cases of giant cell tumor were observed to be radiolucent with granulomatous lesions.

Fibro-osseous lesions of the jaw were unilocular as well as multilocular in appearance. These lesions were irregularly radioopaque with a moth-eaten appearance radiologically.

Out of 60 cases, 50 cases showed a clinical-histological correlation (83%, n=50/60).

Discussion

The World Health Organization classified odontogenic tumors in 1992 based on the consistency of the tumor - solid and cystic [10]. Odontogenic cysts were divided into developmental and inflammatory cysts. They are tumors of odontogenic epithelium with or without odontogenic ectomesenchyme. Unicystic ameloblastoma, odontogenic keratocyst, dentigerous cyst, and radicular cyst show a considerable overlap of their diagnostic histopathologic features in the presence of inflammation [11]. The use of proliferative and antiapoptotic indices in these lesions might help in understanding and differentiating these lesions from others [12]. Assessment of p63 in odontogenic cyst and tumors help in a better understanding of odontogenic lesions' pathogenesis and biological behavior [13]. Ki67 also helps in differentiating these lesions [14].

We analyzed consecutive 60 cases of jaw lesions. We observed that jaw lesions were more common in the 2nd to 4th decade which is similar to Ayaz et al. [15] and Prashant et al. [3]. We observed that odontogenic cysts (55%) were the commonest jaw lesion followed by odontogenic tumor (25%) which was similar to Ayaz et al. [15] and Prashant et al. [3]. When comparing the sex distribution among the cases of jaw lesion, it was observed that the ratios of male vs. female were around 1.14:1. A study by Prashant et al. [3] showed slight female predominance, with M:F ratio being 1:1.13.

Various authors have reported the incidence of odontogenic tumors from 19%-30% among tumors of the mouth and jaw. We found the frequency of odontogenic tumors among the jaw lesions was 25%. We found that the mandible was most affected jaw bone as compared to the maxilla which is similar to Ayaz et al. [15] [mandible (n=83) & maxilla (n=70)].

Odontogenic cyst: It was the commonest jaw lesion (55%). Baghaei et al. reported the peak incidence of odontogenic cysts to be in the third and fourth decades of life [16]. In the study done by Cabrini et al. highest prevalence of oral

Table 4. Agewise distribution of jaw lesions

	Odontogenic cyst	Odontogenic tumor	Fibro-osseous lesion	Giant cell tumor	Non-odontogenic cyst
0-10	01	00	00	00	00
11-20	09	06	02	01	01
21-30	08	03	02	00	01
31-40	07	01	00	00	00
41-50	01	01	00	01	00
51-60	01	02	01	00	00
61-70	01	00	01	00	00
71-80	01	02	00	01	01

Table 5. Radiologic findings of jaw lesions

Radiologic Findings	Odontogenic cyst	Odontogenic tumor	Giant cell lesion	Fibro-osseous lesion	Non-odontogenic cyst	Total
Unilocular cystic lesion	7	1	-	-		8
Multilocular cystic lesion	4	1		-		5
Radioopaque	-	3	-	3		6
Moth eaten appearance	-	-	-	1	-	1
Radiolucent lesion	10	4	2	-	-	15
Impacted tooth	12	2	-	-	-	14
Granulomatous lesion			1			1

cysts was at the age of 30-50 years [17]. Bataineh et al. reported the third to fifth decades of life as the most common age range [18]. We observed that the common age group for the occurrence of the odontogenic cyst was 11-40 years. The mandible was the commonest site for odontogenic cyst similar to Ayaz et al. [15]. Among the odontogenic cysts, dentigerous cyst (n=11) and odontogenic keratocyst (n=11) were the commonest cystic lesions followed by radicular cyst (n=10). Baghaei et al. [16] reported that dentigerous cyst was the commonest cyst (27.2%) followed by radicular cyst (18.6%). In a study done by Prashant et al. [3], a dentigerous cyst was the commonest cyst. In a study done by Ayaz et al. radicular cyst was the commonest [12].

A dentigerous cyst is a developmental cyst. It is usually associated with an impacted tooth. Radiograph of dentigerous cyst shows a cystic lesion with an impacted tooth in the angle region (**Figure 2A**). Grossly the cyst was usually associated with an impacted tooth (**Figure 2B**). Histopathologically they were lined by thin non-keratinizing stratified squamous epithelium (**Figure 2C**, **2D**). Three cases of inflamed dentigerous cyst were reported.

A radicular cyst is an inflammatory cyst that arises as a result of inflammation from the epithelial residues (cell rests of Malassez) in the periodontal ligament causing the death of the dental pulp. Cysts arising in this way is found mostly in the apices of involved teeth [3]. Histologically, radicular cyst is lined by proliferated stratified squamous epithelium with arcading of basal cells. The fibrous capsule was infiltrated by chronic inflammatory cells. Plasma cells were also seen (**Figure 3A**, **3B**). Hyaline bodies referred to as Rushton's bodies were not found.

Odontogenic keratocyst (OKC) is a commonly encountered developmental cyst. It has a potential for aggressive clinical behavior and recurrence [18]. Microscopic examination shows uniform epithelial lining 6-10 cell layers thick lacking rete ridges. The epithelium is characterized by palisaded basal cell layer and a thin refractile corrugated parakeratinized lining layer (**Figure 3C**, **3D**). Budding of the basal layer and "daughter cyst" formation are frequent findings. If the cyst wall becomes secondarily inflamed, the characteristic microscopic pattern usually disappears. A sampling of large cysts is important for identifying secondarily inflamed OKC [19].

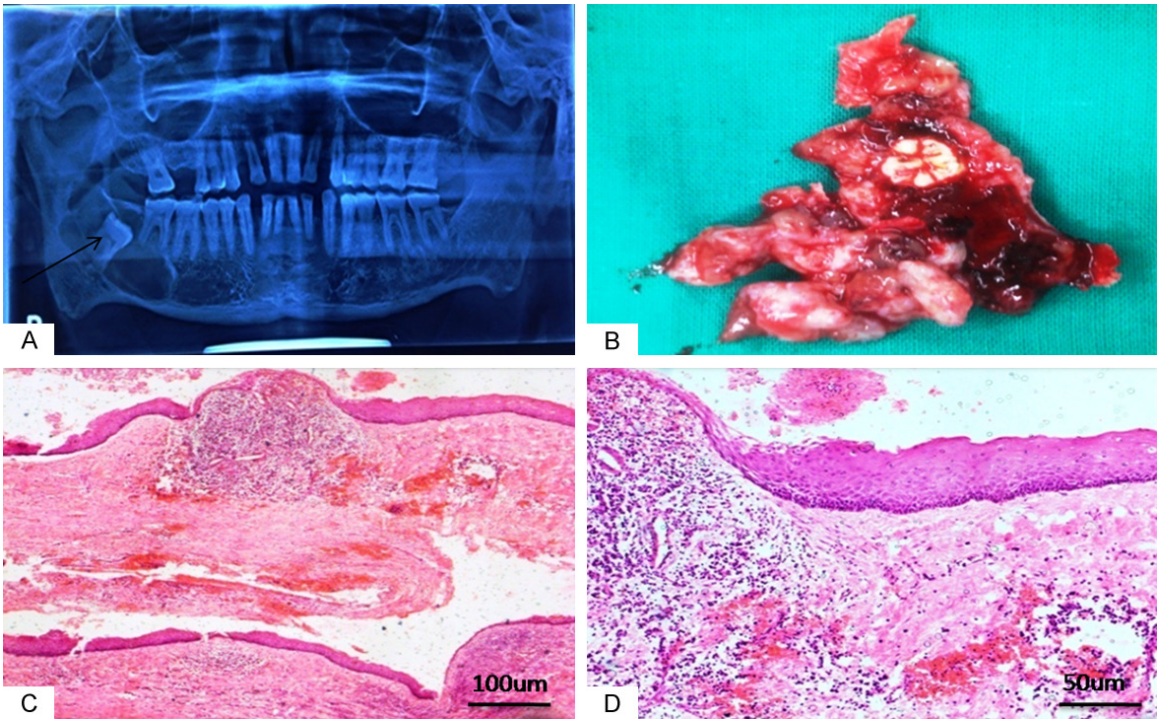

Figure 2. Dentigerous cyst (A) Dental radiograph shows cystic lesion with impacted tooth in the angle region (Arrow), (B) Gross specimen shows cyst with impacted tooth, (C, D) Photomicrograph shows inflamed dentigerous cyst (H&E 100×, 400×).

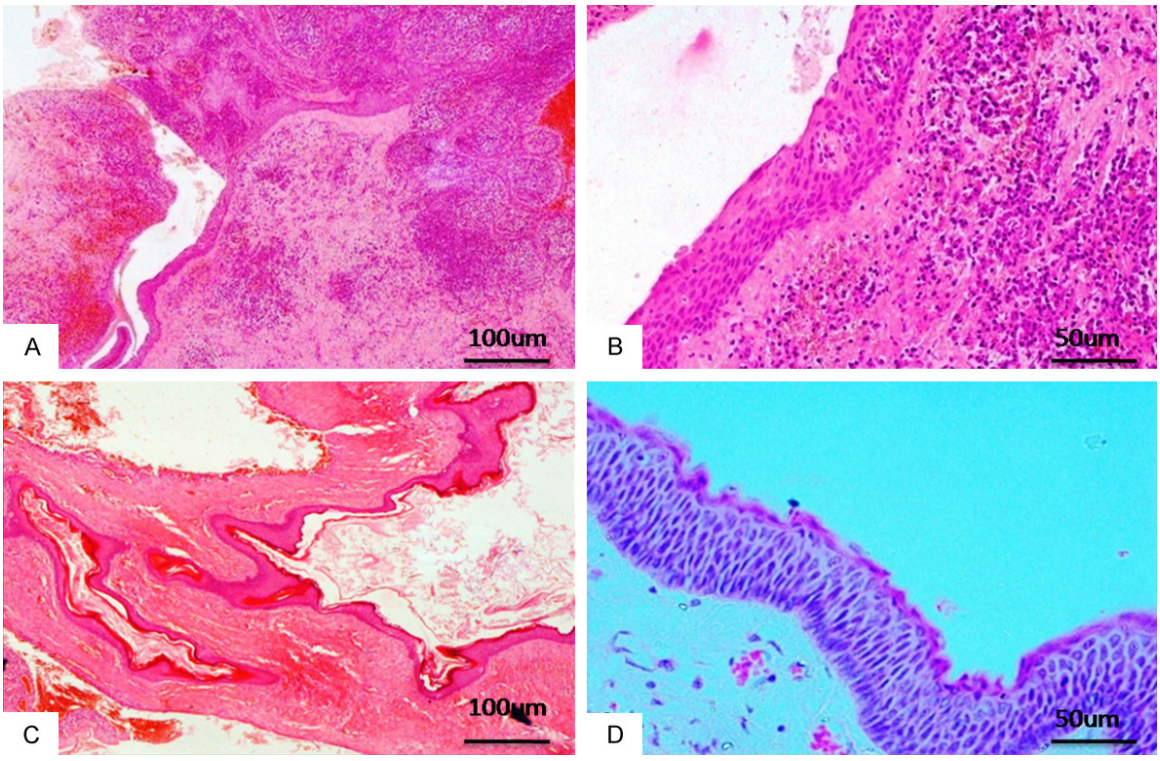

Figure 3. Radicular cyst (A, B) Photomicrograph shows radicular cyst. Chronically inflamed stratified squamous cyst lining (H&E 100×, 400×), Odontogenic keratocyst (C) Photomicrograph showing odontogenic keratocyst. Daughter cyst is located within the wall of the main cyst (H&E 100×), (D) Cyst lined with a corrugated, parakeratinized surface with palisaded columnar basal cells (H&E 400×).

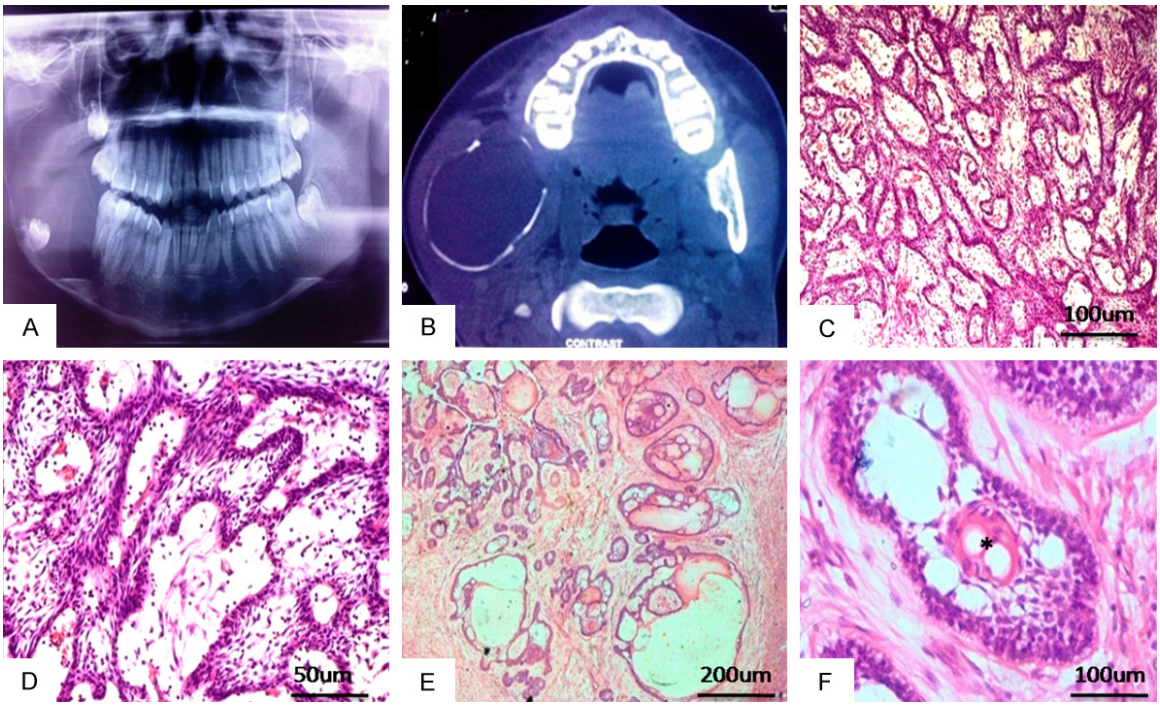

Figure 4. Ameloblastoma (A) Orthopantomogram (OPG) representing cystic lesion involving mandibular body, ramus and angle region, (B) CT scan showing cystic lesion in the mandible with thinning of the cortical plates, (C, D) Plexiform ameloblastoma (H&E 100×, 400×), (E) Follicular ameloblastoma (H&E 40×), (F) Photomicrograph show reverse polarization of columnar cells with central stellate reticulum cells. A focus of keratinization (highlighted by star*) (H&E 400×).

Odontogenic tumor: Verkhede et al. reported odontogenic tumors without odontogenic ectomesenchyme to be the most commonly encountered (76.6%) lesion in their study [20]. The authors also observed odontogenic tumors to be more common in patients more than 5 years of age which was again similar to our findings. Ameloblastoma (n=11) was the commonest similar to the Ayaz et al. [15] and Baghaei et al. [16]. The site of origin of ameloblastoma was different in various studies. In all studies including our findings, mandibular lesions were predominantly seen when compared to the maxillary region. Radiologically, ameloblastoma presented as a unilocular and multilocular cystic lesion (**Figure 4A**, **4B**). Microscopically ameloblastoma can exhibit various patterns like follicular, plexiform, desmoplastic and spindle cell. Peripheral palisading and stellate reticulum cells are common findings in all variants (**Figure 4C-F**).

We found three cases of odontoma (**Figure 5A**, **5B**). An adenomatoid odontogenic tumor (**Figure 5C**, **5D**) was seen in 1 case.

Fibro-osseous lesion: Fibro-osseous lesions constituted 10% of the lesions (n=6/60). Most commonly they were seen in females. Maxilla was the most common site. Among these lesions, the cemento-ossifying fibroma (**Figure 6A**, **6B**) constituted the commonest lesion (50%; 3/6). Fibrous dysplasia constitutes 16.6% of lesions (1/6). We found one case of osteo-fibrous dysplasia (**Figure 6C**, **6D**) and benign fibro-osseous lesion each.

Giant cell lesions: These constitute only 5% of cases. We found only cases of giant cell reparative granuloma (**Figure 7A**, **7B**). Male patients were commonly affected. The mandible was the commonest site.

We analyzed a very small number of cases. IHC was a limitation in our study. There is a great possibility of missing diagnosis of tumors. We believe that more awareness should be encouraged among patients for regular clinical as well as radiologic examination for timely diagnosis and treatment of oral lesions.

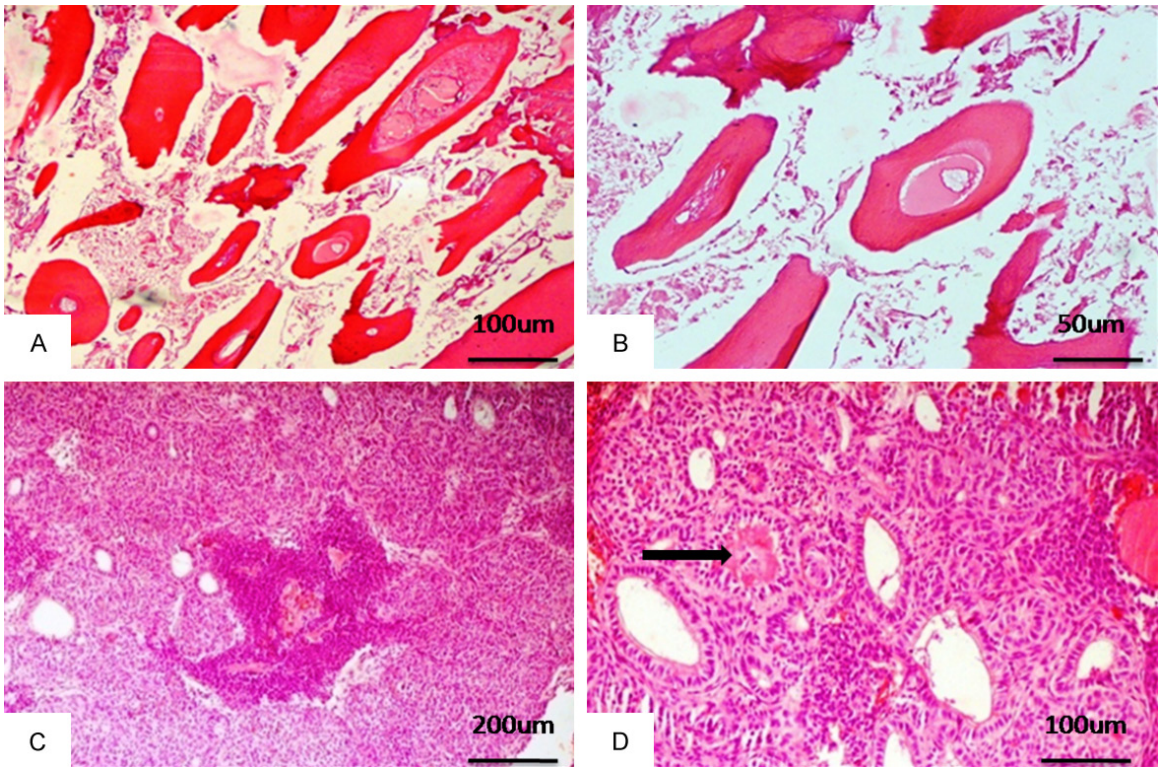

Figure 5. Odontoma (A, B) Numerous disorganized profiles of dentin, enamel, and pulpal tissue (H&E 100× and 400×), Adenomatoid odontogenic tumor (C, D) Nodular and duct-like island of odontogenic epithelium (H&E 40×, and 100×). Eosinophilc fibrillar structure in duct lumen (Highlighted by arrow).

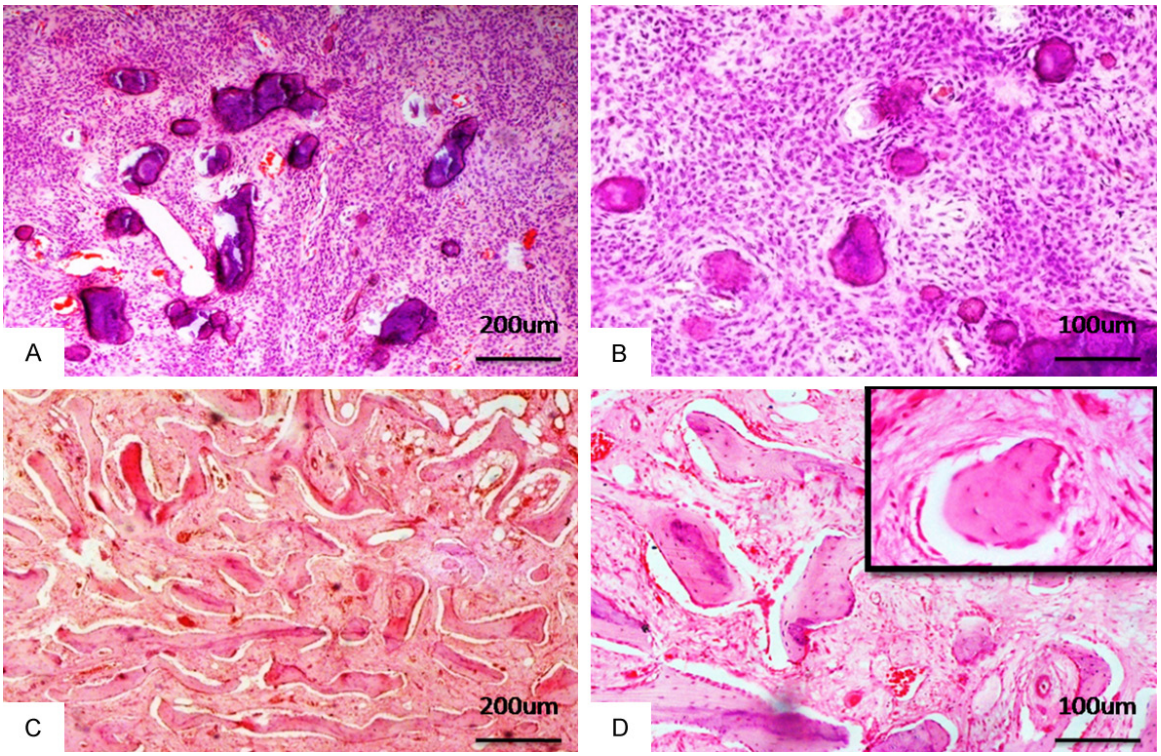

Figure 6. Cemento-Ossifying fibroma (A, B) Plump to spindle cells with immature bone and osteoid deposition (H&E 40× and 100×), Osteofibrous dysplasia (C, D) Spindle cells with woven bone trabeculae lined by osteoblastic rimming (H&E 40× and 100×) (Inset H&E 40×).

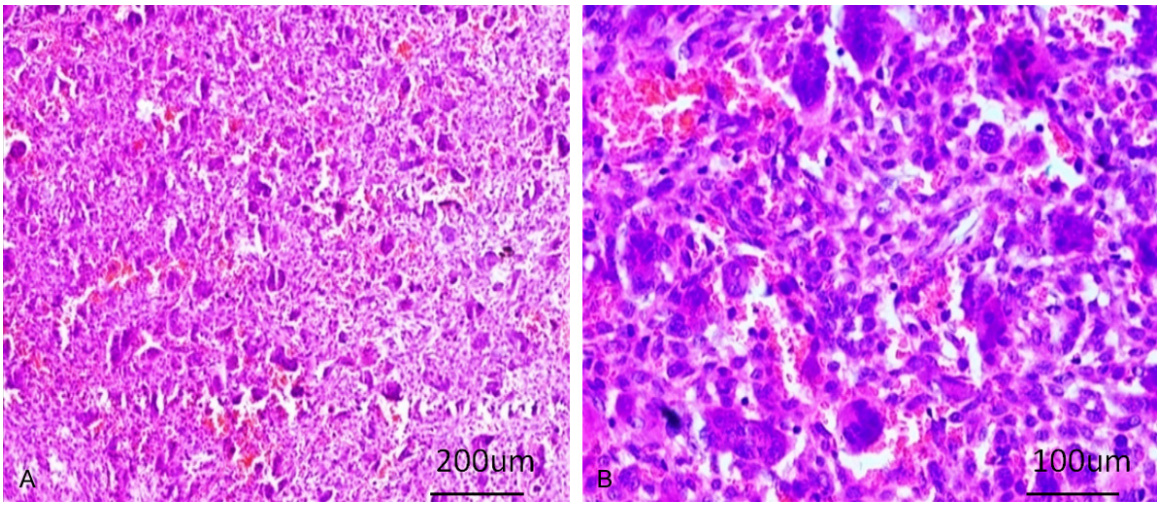

Figure 7. Giant cell tumor (A, B) Oval and spindle mononuclear cells with multinucleated giant cells and hemorrhage (H&E 40×, 100×).

Conclusion

Our main aim was to evaluate and correlate the various clinical and histologic aspects of jaw lesions. Based on histology, the distinction between odontogenic cysts is difficult and almost impossible when they are secondarily infected. For definitive diagnosis clinical-radiological correlation is needed.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Ashwani Tandon, Department of Pathology and Lab Medicine, All India Institute of Medical Science, Saket Nagar, Bhopal 462026, MP, India. Tel: +91-9246149248; E-mail: ashwani.patho@aiimsbhopal.edu.in

References

[1] Surekha MV. Clinicomorphological spectrum of odontogenic cysts and fibro-osseous lesions of jaws: a single institute experience. Oral and Maxillofacial Pathology Journal 2018; 9: 47-50.

[2] Rosai J. Mandible and maxilla. In: Rosai J, editor. Rosai and Ackerman's surgical pathology. Edinburgh: Mosby; 2004. p. 279-304.

[3] Kumavat PV, Gadgil NM, Dhusia H, Agarval S, Margam SS and Chaudhari CS. A clinical, radiological and histological study of jaw lesions from pathologist's view. Indian Journal of Pathology and Oncology 2016; 3: 414-420.

[4] El-Naggar AK, Chan JKC, Grandis JR, Takata T and Slootweg PJ (Eds). WHO classification of Head and Neck Tumours. |4th ed|. Lyon: IARC; 2017.

[5] Wright JM and Vered M. Update from the 4th edition of the World Health Organization classification of head and neck tumours: odontogenic and maxillofacial bone tumors. Head Neck Pathol 2017; 11: 68-77.

[6] Barnes L, Eveson JW, Reichart P and Sidransky D. Odontogenic tumors. In: Philipsen HP, Reichart PA, Slootweg PJ, Slater LJ, editors. World Health Organization Classification of Tumours-Pathology and Genetics of Head and Neck Tumours. |3rd ed|. Lyon: IARC Press; 2005. pp. 283-327.

[7] Lei Y, Jaradat JM, Owosho A, Adebiyi KE, Lybrand KS, Nevilleb W, Müller S and Bilodeau EA. Evaluation of SOX2 as a potential marker for ameloblastic carcinoma. Oral Surg Oral Med Oral Pathol Oral Radiol 2014; 117: 608-16.

[8] Moro A, Foresta E, Gasparini G, Pelo S, Forcione M, Cristallinie G, Toraldo M, Iorenzo C, Falchi M and Saponaro G. Ameloblastic carcinoma of the maxilla: a case report and an updated review of the literature. Oncol Lett 2016; 12: 4339-50.

[9] Bonder I, Manor E, Shear M and Vander Waal I. Primary intraosseous squamous cell carcinoma arising in an odontogenic cyst: a clinicopathologic analysis of 116 reported cases. J Oral Pathol Med 2011; 40: 733-8.

[10] Brunner P, Bihl M, Jundt G, Baumhoer D and Hoeller S. BRAF p.V600e mutations are not unique to ameloblastoma and are shared by other odontogenic tumors with ameloblastic morphology. Oral Oncol 2015; 51: 77-8.

[11] Barrett AW, Sneddon KJ, Tighe JV, Gulati A, Newman L, Collyer J, Norris PM, Coombes DM, Shelley MJ, Bisase BS and Liebmann BS. Dentigerous cyst and ameloblastoma of the jaws: correlating the histopathological and

clinicoradiological features avoids a diagnostic pitfall. Int J Surg Pathol 2017; 25: 141-7.
[12] Orikpete EV, Omoregie OF and Ojo MA. Proliferative and anti-apoptotic indices of unicystic ameloblastoma, odontogenic keratocyst, dentigerous cyst and radicular cyst. J Oral Maxillofac Pathol 2020; 24: 399.
[13] Alsaegh MA, Altaie AM and Zhu S. p63 expression and its relation to epithelial cells proliferation in dentigerous cyst, odontogenic keratocyst, and ameloblastoma. Pathol Oncol Res 2020; 26: 1175-1182.
[14] Nafarzadeh S, Seyedmajidi M, Jafari S, Bijani A and Rostami-Sarokolaei A. A comparative study of PCNA and Ki-67 expression in dental follicle, dentigerous cyst, unicystic ameloblastoma and ameloblastoma. Int J Mol Cell Med 2013; 2: 27-33.
[15] Ayaz B, Zaib N, Mushtaq S, Mamoon N, Akhter N, Abbas S, et al. Pathological spectrum of jaw lesions: analysis of 178 cases. J Pak Dent Assoc 2012; 21: 78-84.
[16] Baghaei F, Zargaran M, Najmi H and Moghimbeigi A. A clinicopathological study of odontogenic cysts and tumors in Hamadan, Iran. J Dent (Shiraz) 2014; 15: 167-72.
[17] Cabrini RL, Barros RE and Albano H. Cysts of the jaws: a statistical analysis. J Oral Surg 1970; 28: 485-489.
[18] Bataineh AB, Rawashdeh MA and Al Qudah MA. The prevalence of inflammatory and developmental odontogenic cysts in a Jordanian population: a clinicopathologic study. Quintessence Int 2004; 35: 815-819.
[19] Regezi J. Odontogenic cysts, odontogenic tumors, fibroosseous, and giant cell lesions of the jaws. Mod Pathol 2002; 15: 331-341.
[20] Varkhede A, Tupkari JV, Mandale MS and Sardar M. Odontogenic tumors: a review of 60 cases. J Clin Exp Dent 2010; 2: 183-6.