REVIEW ARTICLE

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# Differences in characteristics of Central Giant Cell Granuloma with Ameloblastoma, Odontogenic Myxoma and Aneurysmal Bone Cyst through radiographic approach

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## ABSTRACT

**Objectives:** This study aims to determine the differences in the characteristics of Central Giant Cell Granuloma with Ameloblastoma, Odontogenic Myxoma, and Aneurysmal Bone Cyst through a radiographic approach so as to expand understanding of the characteristics of Central Giant Cell Granuloma with benign lesions of the oral cavity that have similar characteristics.

**Review:** The data used in this study are research journals published on PubMed and Google Scholar search engines. Selecting keywords namely Radiology, Central Gaint Cell Granuloma, Differential Diagnosis by formulating research questions to provide an operational framework using the PICO framework (P: Patient, Population, or Problem; I: Intervention or Exposure; C: Comparison; Outcome). Data collection procedures were carried out through journal identification, then data reduction was carried out, namely selecting journals that were in accordance with the research concept, so that inclusion and exclusion criteria were determined and tested for eligibility and completeness of journals.

**Conclusion:** In this literature review, it was found that Central Giant Cell Granuloma can be diagnosed in comparison with Ameloblastoma, Odontogenic Myxoma, and Aneurysmal Bone Cyst. A total of 41.6% compared with Ameloblastoma, so Ameloblastoma has a higher percentage. 19.4% compared with Odontogenic Myxoma and 38.8% compared with Aneurysmal Bone Cyst.

***Keywords:*** *Central Giant Cell Granuloma, Ameloblastoma, Odontogenic Myxoma, Aneurysmal Bone Cyst*
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## INTRODUCTION

The prevalence of Central Giant Cell Granuloma (CGCG) can reach up to 1.1 per million population per year. Based on clinical findings, CGCG is more common in women. These lesions are also more common in the mandible (condyle, ramus and coronoid) than in the maxilla. Location in the condyle region has a low frequency compared to other posterior regions of the mandible. The first case of CGCG occurred in a 44-year-old woman with lesions located in the condyles.[1] Approximately 60% of cases are found in individuals under the age of 20 years. The sign of CGCG is swelling without pain.[2]

Two-dimensional radiographs can provide an overview of the lesion in terms of location, expansion, and internal structure. The limitations of periapical radiographs are that they cannot show the extent of the lesion, the expansion of the cortical bone, and the effect on the surrounding tissue in depth. Panoramic examination is the gold standard in CGCG examination because it provides a comprehensive picture of the condition of the oral cavity.[3] Cone Beam Computed Tomography (CBCT) examination can help determine lesion expansion with low radiation dose and high resolution. The radiographic picture of CGCG varies greatly, in general, imaging features of CGCG has a multilocular or unilocular shape, predominantly occurs in the mandible and has clear boundaries.[2]

The etiology of this lesion is still controversial, but based on three theories, first; the presence of local irritants, second; developmental anomalies, third; neoplastic implications.[4] CGCG, which has septa, is radiologically similar to aneurysmal bone cyst (ABC), odontogenic myxoma (OM) and ameloblastoma. ABC, OM and ameloblastoma because of their radiographic similarities are considered as differential diagnoses of CGCG. OM occurs in the age range of 20 to 40 years. OM is rare in children and generally occurs in the mandibular region, especially the posterior region.[5] OM can be found as unilocular or multilocular, radiolucent or mixed radiolucent - radiopaque. When the lesion is coronal to the tooth, it will cause tooth impaction.[6]

Ameloblastoma is a benign odontogenic tumour and the second most common odontogenic tumour after odontoma. It often occurs in the mandibular region in two-thirds of the ramus.[7] Radiographs reveal a totally radiolucent or mixed radiolucent-

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radiopaque internal structure with septa. The effect on the surrounding tissue can cause tooth root resorption, apical tooth migration and cortical bone thinning.[2]

Aneurismal Bone Cyst is a benign bone lesion that accounts for approximately 1.5% of reactive lesions of bone. It is often found in the mandible compared to the maxilla in a ratio of (3:2), especially in the ramus, corpus, and mandibular angulus.[8] Radiographically, the lesion has clear boundaries and is circular in shape. The internal structure of the lesion is multilocular with septa. Expansion to the cortical bone, tooth migration and tooth root resorption may occur.[2]

## REVIEW

The type of research used is qualitative research with a literature study approach. The literature study approach is related to systematic research, data collection based on events and time sequences that aim to describe the state of events systematically and theoretically.[9] The literature study approach will describe the characteristics of the event under study. The event is the reason for the research. The case study approach requires systematic data collection to facilitate analysis and compile in detail.[10]

The population in this study uses the same research journal as the selected search engine. Selecting keywords by formulating research questions to provide an operational framework using the PICO framework (P: Patient, Population, or Problem; I: Intervention or Exposure; C: Comparison; Outcome).[11] PubMed search engine using the keywords Radiology, Central Gaint Cell Granuloma, Differential Diagnosis obtained 49 journals. Google Scholar using the keywords Radiology, Central Giant Cell Granuloma, Differential Diagnosis obtained 26,600 journals.

Data was retrieved by selecting journals through PubMed and Google Scholar and determining keywords that match the research title. Then perform data reduction, namely selecting journals that are in accordance with the research concept, so that the inclusion and exclusion criteria are determined. Qualitative data collection was carried out by identifying the year of publication, screening journals and suitable topics and testing the feasibility and completeness of research data so that journals were obtained that met the inclusion criteria.[7]

Central Giant Cell Granuloma has a dominant sexual predilection in women, this is supported by 21 journals out of 36 journals with a percentage of 58.3% stating the same thing in this study. In the results of research by Tenore, et al (2014), CGCG also often occurs in women. CGCG lesions are often found at ages under 30 years or in the second decade and life shows as much as 58.3% (21 journals). This is also in accordance with the theoretical statement by (White and Pharoah, 2014) that CGCG occurs at an age below 20 years.

CGCG predominantly occurs in the mandible compared to the maxilla with a percentage of 52.77% (19 journals). In the mandible, lesions can occur anteriorly or posteriorly. The posterior part

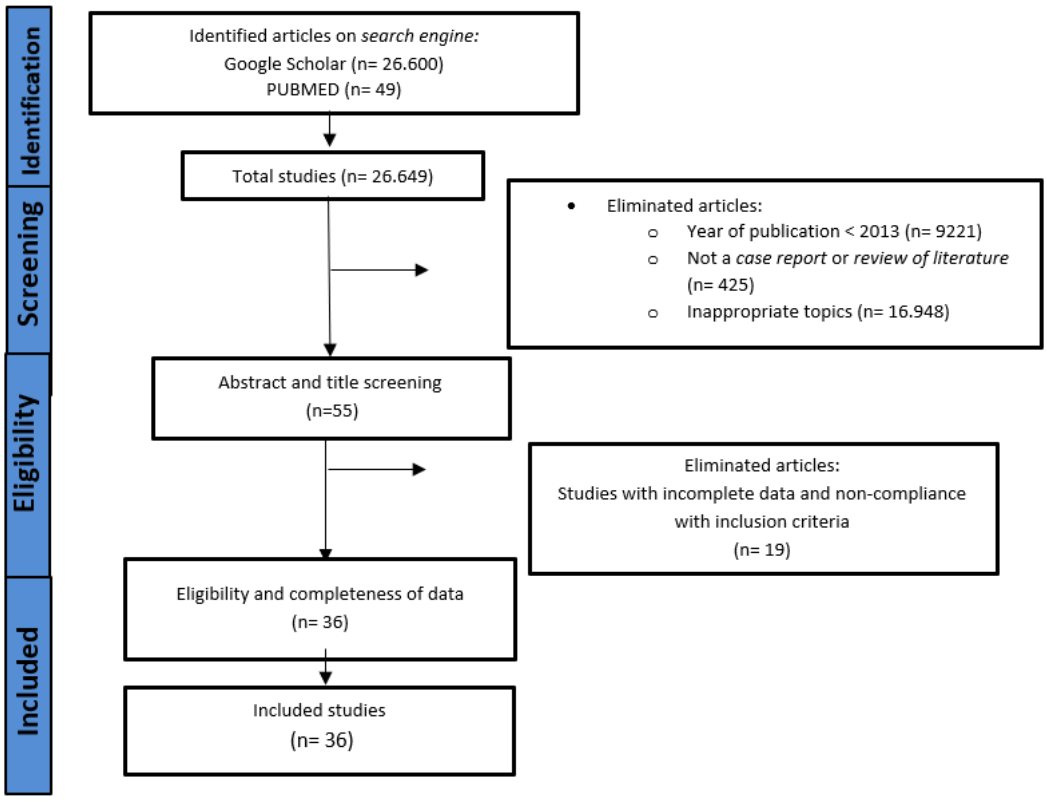


**Figure 1.** Research flow

of the mandible often occurs in the corpus to ramus with a percentage of 38.88% (14 journals), and condyles with a percentage of 5.55% (2 journals). The anterior part of the mandible can occur up to crossing the mandibular midline with a percentage of 27.77% (10 journals).

CGCG can be multilocular with a percentage of 58.33% (21 journals) and unilocular with a percentage of 44.44% (16 journals). If CGCG is multilocular, it has a larger size than unilocular. It has clear or unclear boundaries with a percentage of 38.88% (14 journals). The internal structure of CGCG is dominantly in the form of radiolucent with a percentage of 50% (18 journals) but can be found in a mixed radiolucent - radiopaque form with a percentage of 5.55% (2 journals). CGCG can also be found with a radiopaque internal structure (ground glass) as in the results of a study by Imanimoghaddam, et al (2021). Typical features can be found in the form of fine granules with thin septa. Thin septa were found with a percentage of 13.88% (5 journals).

The size of CGCG varies but if the lesion is aggressive it can reach more than 5cm in size. CGCG can cause cortical bone perforation with a percentage of 58.33% (21 journals), tooth root resorption with a percentage of 41.66% (15 journals), cortical bone expansion with a percentage of 36.11% (13 journals), tooth migration with a percentage of 33.33% (12 journals), mandibular border resorption with a percentage of 5.55% (2 journals), tooth unsteadiness, inferior canaliculus alveolaris urgency, and maxillary sinus lateral wall damage with a percentage of 2.77% (1 journal). The results of this study found that out of 36 journals, 25 journals determined the radiodiagnosis of CGCG with various differential radiodiagnoses. 15 journals stated differential radiodiagnosis with Ameloblastoma, 14 journals stated differential radiodiagnosis with ABC, and 7 journals stated differential radiodiagnosis with OM.

## DISCUSSION

CGCG has a dominant sex predilection in women. This is in accordance with the results of research by Tenore, et al (2014) that the dominant occurrence in women is due to hormonal influences such as the hormones estrogen and progesterone which affect the development of CGCG.[12] This lesion occurs in the age range below 30 years but does not rule out the possibility of occurring in old age.[13] CGCG is mostly found at a young age based on Pharoah (2014) who also stated that these lesions can occur at an age below 20 years.[2]

CGCG is generally found in the mandibular region anterior to the extension of the molar region and can also be found in the posterior region. CGCG is also able to cross the mandibular midline, this is a characteristic of CGCG.[2] The difference in location can occur because it is influenced by age. At a young age the lesion has the ability to extend to the anterior region while at an older age the tendency is to extend to the posterior region. The internal structure of CGCG is generally radiolucent with thin septa.[14] Other internal structures can be mixed (radiolucent-radiopaque) with thin septa. The results of a literature search by Imanimoghaddam, et al (2021), other internal structures that can be found are ground glass appearance. Ground glass appearance is found when CGCG accompanied by thin septa is found in the maxillary sinus and adjoins Fibro-osseous lesion.[15] The characteristic feature of this lesion is that it has a fine granular calcification pattern composed of thin and indistinct septa. The effects on the surrounding tissue of CGCG lesions are mostly capable of causing cortical bone perforation.[2]

CGCG has a variable size that can be influenced by the aggressiveness of the lesion. The more aggressive the lesion can reach larger size, this is also following the results of literature by Eziagu, et al (2022) lesions can reach more than 5 centimeters.[16,17] CGCG with a multilocular shape that can be distinguished from Ameloblastoma,

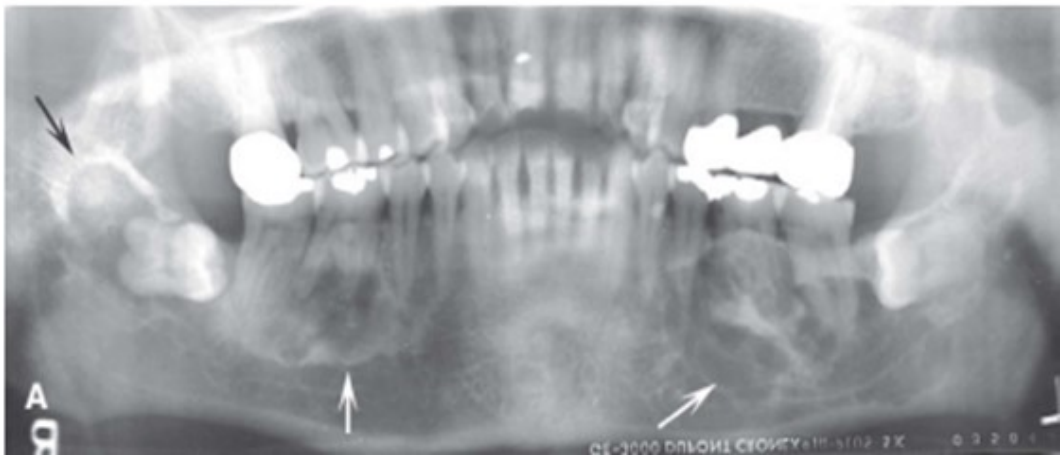

**Figure 2.** Panoramic radiograph of CGCG lesion showing granular edges[10]

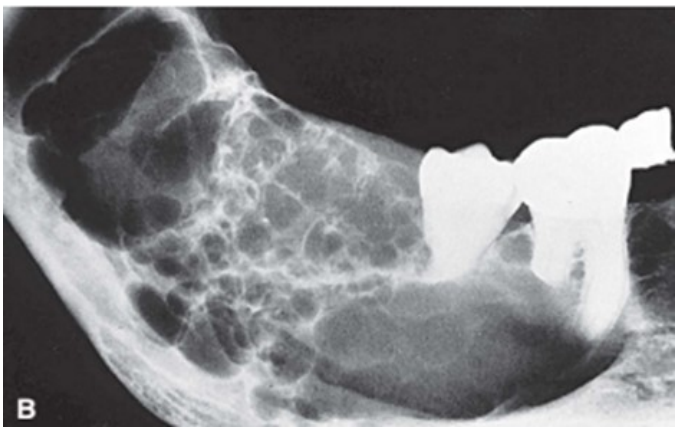


**Figure 3.** Radiograph of multilocular ameloblastoma with soap bubble appearance[10]

Odontogenic Myxoma, and Aneurysmal Bone Cyst.

Ameloblastoma has a predominantly male sex predilection, in contrast to CGCG which is predominantly female. These lesions occur between the ages of 20 - 50 years with an average age of 40 years.[18] In contrast to CGCG which predominantly occurs at a younger age. This is in accordance with the statement by Pharoah (2014) that Ameloblastoma predominantly occurs in males with an age range of 20 - 50 years (average age 40 years).[2]

Ameloblastoma is commonly found in the posterior mandibular region (i.e. corpus, angulus and ramus). The location of Ameloblastoma is different from CGGC which can be found in the anterior region to cross the mandibular midline.[2] Ameloblastoma has unilocular and multilocular forms with a characteristic soap bubble appearance when the lobe of the lesion is large and honey comb appearance when the lobe of the lesion is small.[7] Generally, the lobes are large when located posterior to the mandible and smaller when located anterior to the mandible. Several studies and searches by Ragunathan, et al (2022) and Merbold, et al (2023) revealed that Ameloblastoma has a predominantly radiolucent internal structure and can be mixed radiolucent - radiopaque with septa.[19,20] Effects on the surrounding tissue can be in the form of tooth root resorption, buccal cortical bone expansion, lingual cortical bone expansion, mandibular border thinning, and tooth displacement towards the apical causing tooth impaction.[18] This statement is also supported by the statement by Pharoah (2014) that tooth displacement occurs because Ameloblastoma can originate from the occlusal teeth so that the teeth will point more apically. Expansion and perforation of the cortical bone produces an "eggshell" appearance.[2] Ameloblastoma has a larger size than CGCG, Ameloblastoma has a volume of about 250.044 $mm^3$, while CGCG volume is about 10.31 $cm^3$.[20]

According to Pharoah (2014) the septa in ameloblastoma have curved septa, these septa are derived from normal bone trapped within the lesion.[2] Another study by Figuiredo, et al (2014) Odontogenic Myxoma has the same female sex predilection as CGCG. This lesion occurs at the age of 6-75 years with an average age of 35.5 years.[21] OM can occur in the second and third decades of life. This is in accordance with the statement by Pharoah (2014) that OM lesions occur in the age

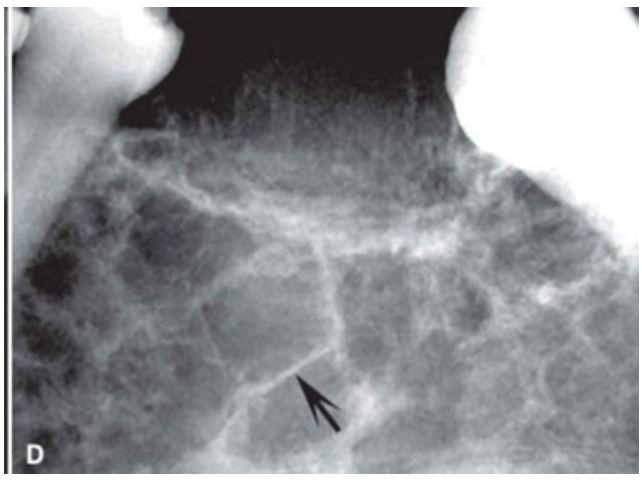


**Figure 4.** Radiograph of OM lesion showing straight septation[10]

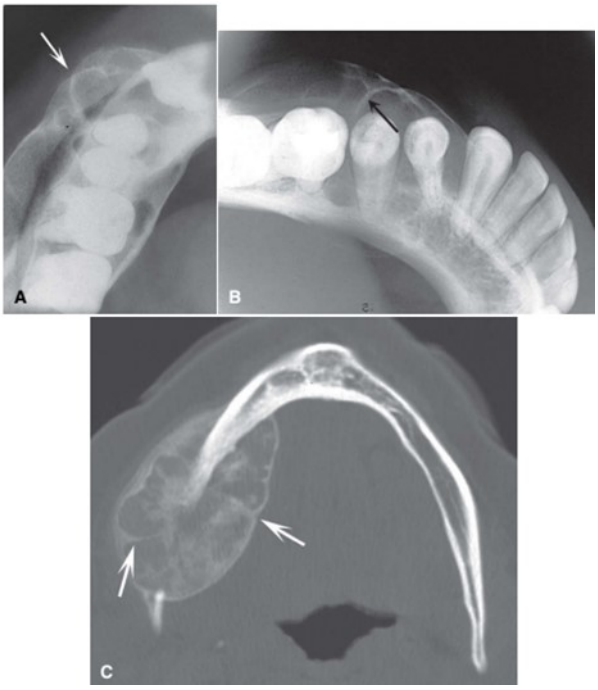


**Figure 5.** (A,B) Occlusal radiographs showing ABC lesion on the mandible with thin septa, (C) CT radiograph showing ABC lesion of cortical bone expansion[10]

range of 10 - 30 years and rarely occur at the age below 10 years or above 50 years.[2]

OM generally occurs in the mandible research by Wang, et al (2017) revealed OM occurs in the posterior mandible involving the ramus and maxilla.[21] This is different from the statement by Pharoah (2014) that OM lesions occur in the mandible of the premolar and molar regions and rarely occur in the ramus and condyle areas because in the ramus and condyle areas there is no dental involvement.[2] The results of the study by Wang, et al (2017) and Goel, et al (2016) were due to the involvement of the third molar. The difference with CGCG is that CGCG lesions are mostly found in the anterior mandible and can cross the mandibular midline.[21,22]

OM can have clear borders, especially in the unilocular form surrounding the crowns of teeth on the posterior mandible. OM with indistinct borders when found in the maxilla but generally has clear borders. The multilocular form of OM has a typical tennis racket appearance (thin straight septa resulting in angular trabeculae and large cusp size).[2] Most septa in OM will appear curved but 1 - 2 straight septa can be found. These septa are derived from residual resorption of trabecular bone and dense fibrous tissue. The internal structure of OM is a mixture of radiolucent and radiopaque with thick septa on the mandibular corpus and thin straight septa on the alveolar crest. The internal structure differs from the CGCG lesion in that it is multilocular with thin septa.[22]

Effects on surrounding tissues include perforation of the inferior cortex of the mandible to a decrease in cortical bone density which is limited by radiographs to a periosteal sunburst.[22] Other surrounding tissue effects can cause tooth loss or tooth displacement and rarely cause tooth root resorption.[2] OM has a beverage size of 1.2cm and a maximum of 6.5cm, making it larger than CGCG.[23]

ABC has a female sex predilection. This lesion occurs at the age of 10-50 years and predominantly occurs under the age of 20 years.[24] This is also in accordance with the statement by Pharoah (2014) that it occurs at a young age under 30 years and 90% occurs in women. ABC is commonly found in the mandible compared to the maxilla.[25] Based on another literature search by Sonone, et al (2022) ABC is located in the mandible extending anteroposteriorly from the left canine to the ramus.[26] This is also in accordance with the statement by Pharoah (2014) that the mandible is a frequent location compared to the maxilla with a ratio of 3:2 in the molar and ramus regions.[2]

ABC lesions are multilocular or unilocular with clear boundaries. ABC has an oval or "hydraulic" shape with clear boundaries because this lesion is a proliferation of blood vessel.[25] The effect on the surrounding tissue is the same as CGCG, ABC is capable of tooth root resorption, tooth displacement and tends to cortical bone expansion so that it can cause rapid swelling in the buccal or labial area.[2]

Ameloblastoma is a differential radiodiagnosis with a high percentage because Ameloblastoma in multilocular form has similar characteristics to CGCG. This is in accordance with the theory by White and Pharoah where both lesions can occur in the posterior mandible, the internal structure is predominantly radiolucent, and capable of causing tooth root resorption, tooth displacement and cortical bone expansion. OM is a differential

diagnosis with a smaller percentage this can occur due to limitations in samples and search engines in this study.

## CONCLUSION

The results of this literature review found that Central Giant Cell Granuloma occurs in the anterior or posterior mandible and 27.7% stated that it can cross the midline, 13.8% stated that CGCG has a typical picture of fine granules, with a dominant radiolucent internal structure and incomplete thin septa and unclear boundaries. A total of 41.6% compared with Ameloblastoma, so Ameloblastoma had a higher percentage. Ameloblastoma occurs in the posterior mandible (molar to ramus), has a typical soap bubble appearance and honeycomb appearance, with radiolucent/mixed radiolucent - radiopaque internal structure, septa and clear borders. A total of 19.4% compared with Odontogenic Myxoma occurring in the posterior mandibular (premolar - molar), having a typical tennis racket appearance, with internal structure of radiolucent / mixed radiolucent - radiopaque, septa and clear boundaries. A total of 38.8% compared with Aneurysmal Bone Cyst occurred in the posterior mandibular (corpus to ramus), had a typical "hydraulic" appearance, with an internal structure of mixed radiopaque - radiolucent, incomplete septa and clear boundaries.

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## FOOTNOTES

All authors have no potential conflict of interest to declare for this article.

## REFERENCES

1. Cantanhede ALC, Olate S, Assis AF de, Moraes M de. Central Giant Cell Granuloma in the Mandibular Condyle in a Teenager. A Case Report with Literature Review. J Clinical Medicine. 2022;11(14):1–8.
2. White SC, Pharoah MJ. Oral Radiology Principles and Interpretation. 7th ed. St. Louis: Mosby/Elsevier; 2014. p.365-418.
3. Whaites E, Drage N. Essentials of Dental Radiography and Radiology. 6th ed. China: Elsevier; 2021. p.25-50.
4. Alsufyani NA, Aldosary RM, Alrasheed RS, Alsaif RF. A systematic review of the clinical and radiographic features of hybrid central giant cell granuloma lesions of the jaws. Acta Odontol Scand. 2021;79(2):124–131.
5. Ghazali AB, Arayasantiparb R, Juengsomjit R, Lam-Ubol A. Central Odontogenic Myxoma: A Radiographic Analysis. International Journal of Dentistry. 2021;2021;1-8.
6. Kumar N, Kohli M, Pandey S, Agarwal P. Odontogenic Myxoma. Journal of Maxillofacial and Oral Surgery. 2014;13 (2):222–6.
7. Omami G. Honeycomb Jaw Lesion: Ameloblastoma. Ear, Nose Throat Journal 2021;100(7):483–4.
8. Álvarez-Martínez E del C, Posso-Zapata MV, Flórez-Arango VA, Lopera-Valle JS, Ardila CM. Aneurysmal bone cyst of the mandible with conservative surgical management: A case report. Journal Clinical Experimental Dentistry. 2019;11 (6):e561–4.
9. Nurahma GA, Hendriani W. Tinjauan sistematis studi kasus dalam penelitian kualitatif. Mediapsi 2021;7(2):119–29.
10. Assyakurrohim D, Ikhram D, Sirodj RA, Afgani MW. Metode Studi Kasus dalam Penelitian Kualitatif. J Pendidik Sains dan Komput. 2022;3(01):1–9.
11. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ. 2021;372.
12. Tenore G, Palaia G, Capocci M. The central giant cells granuloma of the mandible: a report of two cases and a review of the literature. Senses Sci. 2014;1:30–8.
13. Mohan RPS, Verma S, Agarwal N, Singh U. Central giant cell granuloma: A case report. BMJ Case Reports. 2013;1–4.
14. Abdelkarim AZ, Abu el Sadat SM, Chmieliauskaite M, Syed A. Radiographic Diagnosis of a Central Giant Cell Granuloma Using Advanced Imaging: Cone Beam Computed Tomography. Cureus. 2018;10(6):e2735.
15. Imanimoghaddam M, Mortazavi S, Goudarzi F, Mohtasham N. A literature review of the rare coexistence of central giant cell granuloma with aneurysmal bone cyst: A case report. Iran Jornal Otorhinolaryngology. 2021;33(5):319–25.
16. Shrestha S, Zhang J, Yan J, Zeng X, Peng X, He B. Radiological features of central giant cell granuloma: Comparative study of 7 cases and literature review. Dentomaxillofacial Radiology. 2021;50(5):4–9.
17. Eziagu UB, Arthur N, Kudamnya IJ. Aggressive central giant cell granuloma of the mandible: A case report and review of literature. Ibom Medical Journal. 2022;15(2):183–90.
18. Figueiredo NR, Dinkar AD, Meena M, Satoskar S, Khorate M. Ameloblastoma: A clinicoradiographic and histopathologic correlation of 11 cases seen in Goa during 2008-2012. Contemporary Clinical Dentistry. 2014;5(2):160–5.
19. Ragunathan YT, Kumar SK, Janardhanam D, Ravi A, Santhanam V, Ramdas MN. Prevalence and Epidemiological Profile of Ameloblastoma in India: A Systematic Review and Meta-Analyses. Asian Pacific Journal of Cancer Prevention. 2022;23 (11):3601–10.
20. Merbold LM, Smit CS, Fox JK, Uys AU. The radiologic progression of ameloblastomas. South African J Radiology. 2023;27(1):1–8.
21. Wang K, Guo W, You M, Liu L, Tang B, Zheng G. Characteristic features of the odontogenic myxoma on cone beam computed tomography. Dentomaxillofacial Radiology. 2017;46(2):20160232.
22. Goel S, Goel M, Dinkar AD. Odontogenic myxoma of mandible with unusual (sunburst) appearance: A rare case report. Journal of Clinical Diagnostic Research. 2016;10(5):ZJ05–7.
23. Kauke M, Safi AF, Kreppel M, et al. Size distribution and clinicoradiological signs of aggressiveness in odontogenic myxoma-three-dimensional analysis and systematic review. Dentomaxillofacial Radiology. 2018;47(2):3–5.
24. Urs AB, Augustine J, Chawla H. Aneurysmal Bone Cyst of the Jaws: Clinicopathological Study. Journal of Maxillofacial Oral Surgery. 2014;13(4):458–63.
25. Simsek H, Yildirim D, Gormez O, Yuce E, Kapucuoglu F. Aneurysmal bone cyst of the mandible: Report of a case with a review of the literature. Journal of Oral Maxillofacial Radiology. 2014;2(2):64-7.
26. Sonone A, Hande A, Gawande MN, Patil SK, Pakhale A. Aneurysmal Bone Cyst Plus Lesions: A Case Report and a Literature Review. Cureus. 2022;14(8):e27912.