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CASE REPORT

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Three-dimensional radiographic assessment of central giant cell granuloma using CBCT: A case report

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ABSTRACT

Central Giant Cell Granuloma (CGCG) is a benign, but locally aggressive, osteolytic lesion that commonly affects the mandible, particularly in the posterior region. Accurate diagnosis and effective treatment planning are essential for optimal outcomes. While conventional 2D radiographs provide limited information, Cone Beam Computed Tomography (CBCT) offers superior diagnostic capabilities due to its high resolution, 3D visualization, and ability to assess bone integrity and lesion extent. In this case report, CBCT was instrumental in evaluating the size, location, and impact on surrounding structures, guiding surgical intervention of Central Giant Cell Granuloma at Left Posterior Mandible in a young female.

KEYWORDS

Central giant cell granuloma; Cone Beam Computed Tomography; Advanced imaging; Image interpretation

ARTICLE HISTORY

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Introduction

Central giant cell granuloma (CGCG) is an idiopathic non-neoplastic proliferative disease that was first characterized by Jaffe in 1953 [1]. It is an intraosseous lesion composed of cellular fibrous tissue that occasionally has trabeculae of woven bone, aggregations of multinucleated giant cells, and several haemorrhage foci [2].

The WHO defines it as "an intraosseous lesion consisting of cellular fibrous tissue that contains aggregations of multinucleated giant cells, multiple foci of haemorrhage, and occasionally trabeculae of woven bone [1]."

Uncertain and idiopathic, the CGCG lesion was thought to be predominantly a local reparative reaction of bone, presumably caused by intramedullary bleeding, but other potential causes include local trauma, intraosseous haemorrhage, and genetic anomalies. It accounts for as much as 7% of tumors found in the maxilla and mandible [3]. Females are more often than males to have CGCG, and individuals between the ages of 10 and 25 are more likely to have it in the anterior mandible, which typically crosses the midline, than in the maxilla [4].

Cone-Beam Computed Tomography (CBCT) has become a key imaging modality in maxillofacial radiology because of its isotropic voxel reconstruction, greater spatial resolution, and relatively low radiation exposure when compared to traditional CT [3]. Because of its three-dimensional volumetric imaging capability, it can accurately evaluate craniofacial features, which makes it easier to locate, define, and describe abnormal entities [5].

Multiplanar reformation (MPR) and volumetric rendering are made possible by CBCT and are essential for assessing the degree of lesions, the integrity of the cortical bone, the patterns of trabecular bone, and the anatomical closeness to important neurovascular systems [4]. Pre-operative planning, directing minimally invasive procedures, and customizing patient-specific treatment plans in oral and maxillofacial surgery all depend on this kind of thorough visualization [5]. Here, we present a case of CGCG in the left posterior mandible with emphasis on the radiological findings using CBCT as imaging modality.

Case Report

A 24-year-old female presented with a chief complaint of a gradually enlarging, painless swelling localized to the anterior mandible, with onset approximately one year prior to consultation. Her medical history was unremarkable, with no prior surgical interventions, systemic illnesses, or ongoing pharmacologic therapy. Vital signs were within normal physiological limits.

Clinical intraoral examination revealed a well-demarcated swelling in the anterior mandibular region, resulting in obliteration of the labial vestibule. On palpation, the lesion was predominantly firm in consistency, with focal areas exhibiting a softer, compressible texture.

The patient was then asked to undergo a Cone Beam Computed Tomographic evaluation to check for the extent. The Carestream Select 9300 CBCT system (Carestream Dental LLC, Atlanta, GA, USA) was used for the imaging. It is a cutting-edge device made for low-dose, high-resolution 3D imaging.

The scan was carried out using the following imaging protocol: an 8-mA current, a 90 kVp tube voltage, and an 11–12 second scan length. The CBCT system reduces radiation exposure and maximizes image quality by automatically adjusting the milliampere (mA) setting according to the patient's anatomical features. With an 8x8 cm field of view

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(FOV) to provide thorough coverage of the target areas, the scan was taken at a voxel size of 0.2 mm, offering remarkable spatial resolution.

The Kodak Dental CS 3D Imaging Software V3.5.7.0 (Carestream Health Inc., Rochester, NY, USA) was used to process and analyze the images after they were acquired. By viewing them in the axial, sagittal, and coronal planes, multiplanar reconstruction was accomplished. The radiographic interpretation of the CBCT scan was performed by the authors.

While examining the 3-D sections [Figure 1A & B], an osteolytic lesion was noted at left posterior mandible extending from 35 to 36 region. There was marked destruction of bone in the concerned region. The pathology was approximately 24.4 mm ×16.7 mm in its greatest dimensions [Figure 2].

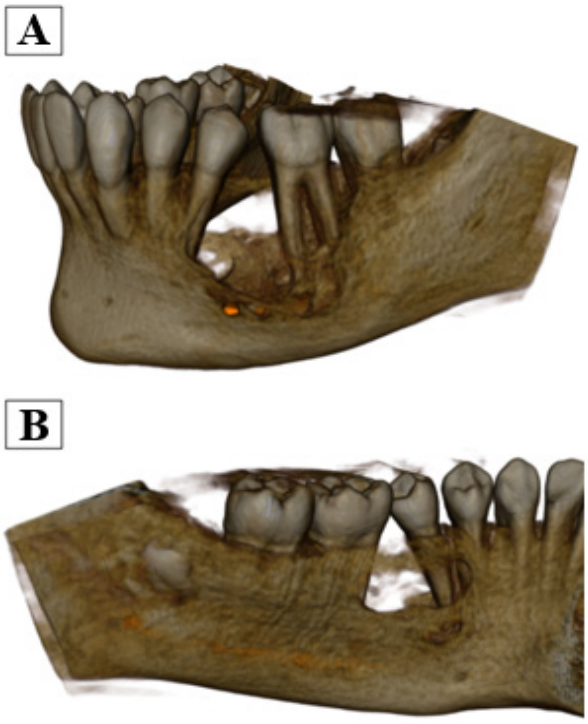

Figure 1(A). Three- Dimensional view from Buccal side. (B): Three-Dimensional view from Lingual side.

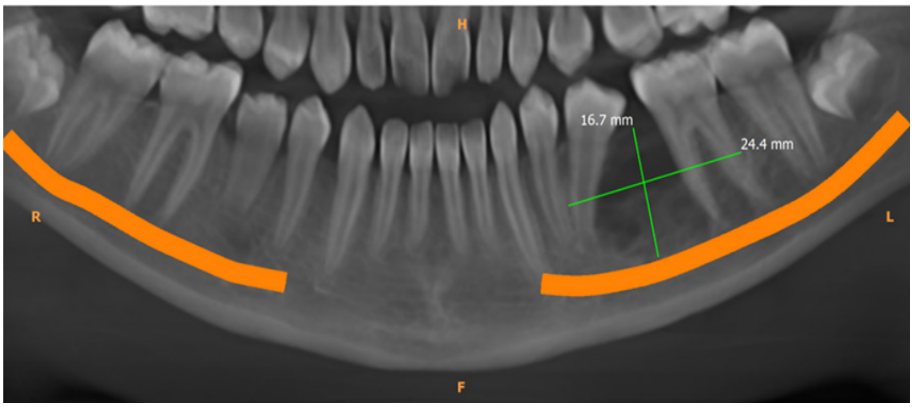

Figure 2. Dimensions of the pathology.

In the axial sections [Figure 3] and cross- sectional images [Figure 4], a well- defined mixed radiolucent radiopaque lesion was noted with a well- defined periphery and non- corticated borders. The internal structure was mixed radiolucent-radiopaque with presence of septations. Buccal & Palatal cortical plate thinning and perforation was noted. The pathology was also involving the Left Mandibular nerve. There was evidence of displacement of teeth i.e. second premolar and first molar on left side. The lower border of mandible was intact suggesting a diagnosis of Central Giant Cell Granuloma irt Left Posterior Mandible.

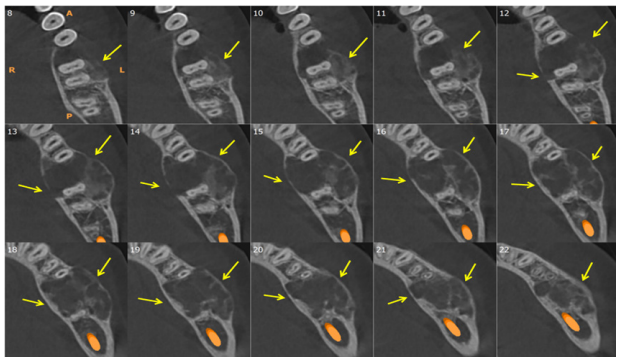

Figure 3. Axial views of Left Posterior Mandible.

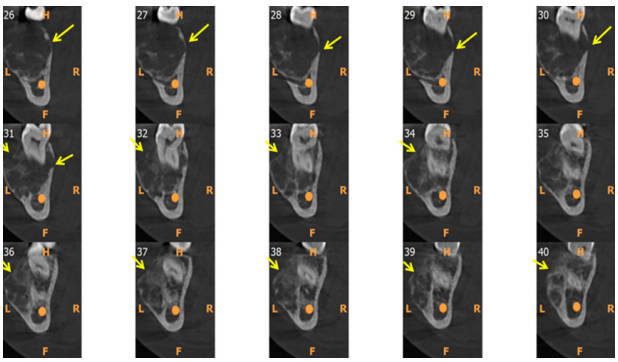

Figure 4. Cross- sectional images of Left Posterior Mandible.

The patient was further referred for a histopathological examination and referral to Department of Oral Surgery for further interventions and treatment.

Discussion

Central giant cell granuloma is a proliferative, non-neoplastic lesion with an unclear cause. The maxilla is most frequently affected, then the mandible. Despite being harmless, it can cause impact locally [6].

A lot of mandibular lesions cross the midline and usually appear before the first molars. It is remarkably more prevalent on the right side than the left.4 Additionally, central giant cell

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granuloma can develop in additional cranial vault and facial skeleton bones [5]. It has been observed in the small tubular bones of the hands and feet, but it is uncommon outside the cranial bones [7]. The jaw bones may have central or peripheral giant cell granulomas. On the gingiva, peripheral lesions manifest as pedunculated or sessile lesions, whereas central lesions are endosteal [8].

In the majority of cases, the ratio of female to male predilection is 2:1.1 Young adults or children are most likely to experience it. A key etiologic element in the development of this lesion has been thought to be trauma [7]. Trauma and some capillary defects cause slow, minute, persistent haemorrhages of a multicentric type, which lead to the deposition of tissue and the growth of lesions [8]. CGCG exhibits a range of clinical behaviour. It might be anything from a slow-growing, asymmetrical swelling to an aggressive lesion that hurts. A prominent facial asymmetry accompanied by a painless swelling is the most prevalent presenting indication of CGCG [3].

Alternatively, the abnormality may be disclosed as a purely incidental finding during radiographic examination of the jaws made for an unrelated purpose. In only about 25% of the cases, the lesion is accompanied by pain [6]. Palpation of the suspect bone area may elicit tenderness. The lesions develop without paraesthesia. Teeth in association with the lesion may become mobile but maintain their vitality. 7The lesions develop without paraesthesia. Teeth in association with the lesion may become mobile but maintain their vitality [8].

Radiographically, slow-growing lesions often exhibit well-defined borders, though a corticated margin may be absent. In some cases, the periphery appears ill-defined, mimicking more aggressive or malignant processes due to a potentially infiltrative growth pattern [9]. Some central giant cell (CGC) lesions appear entirely radiolucent, particularly when small, lacking any discernible internal architecture [10]. Others may exhibit a faint granular pattern of calcification, which can be subtle and only visible with adjusted image contrast. In certain cases, this internal structure may organize into delicate wispy striations or septa, aiding in lesion characterization [3]. Unlike typical septa, those in CGC lesions are not remnants of normal bone but are actively formed by the lesion's cellular components [5].

When present, the newly formed septa in CGC lesions are characteristic—especially when they extend at right angles from the lesion's periphery, often accompanied by cortical indentation [2]. In some cases, well-defined septa create a multilocular appearance by dividing the lesion into compartments [6].

CGC lesions often cause uneven or undulating expansion of bone, frequently displacing nearby structures. On occlusal images, this can resemble a double boundary [7]. The expanded bone border typically appears more granular than normal cortex. In the maxilla, cortical destruction without expansion may occur, sometimes mimicking malignancy [2]. CGC lesions may displace the inferior alveolar canal inferiorly and often cause displacement or resorption of adjacent tooth roots. While root resorption is not consistent, it can be extensive and irregular when present. The lamina dura of involved teeth is typically lost [8].

Conventional 2D radiography is often the first imaging choice but offers limited details on cortical integrity, lesion size, and extension [9]. For more comprehensive evaluation, 3D imaging, like CBCT, is preferred due to its ability to assess cortical disruption and soft tissue involvement with a lower radiation dose compared to CT, making it ideal for maxillofacial imaging [10].

Surgical curettage has traditionally been the treatment for CGCG but often causes jaw and tooth damage, increasing the risk of recurrence [12]. For aggressive cases, resection is required for a better prognosis [10]. Alternative therapies, such as corticosteroids, calcitonin, and interferon-alpha, have shown variable success in reducing giant cell numbers, lesion size, and osteoclastic activity, while promoting lamellar bone formation [13].

The literature also highlights similar cases using CBCT as a superior modality and aiding in proper interpretation along with a proper treatment plan. According to a case report, a 21-year-old woman arrived at the clinic with a of mandibular swelling on the right side that had begun a year earlier without any pain [1]. A distinct, multilocular, radiolucent lesion on the right side of the jaw that stretched from the molar region to the ramus with wispy septations were visible on a CBCT scan. Radiographic characteristics of a central giant cell granuloma included wispy septations and undulating boundaries. The patient's biopsy was excisional. Multinucleated large cells in a fibrous stroma were seen during the biopsy, supporting our radiographic diagnosis of a central giant cell lesion.

Similarly, a 39-year-old healthy male was referred to the oral and maxillofacial surgery department with a progressively enlarging, asymptomatic intraoral swelling in the left parasymphysis region of the mandible [14]. Radiographic evaluation revealed a unilocular radiolucent lesion involving teeth 33 and 34. An incisional biopsy indicated a giant cell lesion, and surgical curettage was subsequently performed. Histopathological analysis confirmed the diagnosis of Central Giant Cell Granuloma (CGCG).

Likewise, Garg P et.al presented a case of CGCG in the maxilla of a patient with a diffuse swelling on the left side of the face, causing mild obliteration of the nasolabial fold and resulting in facial asymmetry [15]. Intraoral examination revealed a purple, expansile mass in the edentulous region of teeth 26, 27, and 28. Surgical management was planned under general anesthesia. Using an intraoral approach, the lesion was accessed from the 22 to 28 regions, followed by enucleation and thorough curettage.

Conclusion

Central Giant Cell Granuloma (CGCG) requires thorough evaluation for accurate diagnosis and treatment planning. While 2D radiographs offer limited information, CBCT provides superior diagnostic capabilities with high resolution and 3D visualization. CBCT allows for detailed assessment of bone integrity, lesion extent, and involvement of surrounding structures aiding in formulating an appropriate treatment plan.

Disclosure statement

No potential conflict of interest was reported by the author.

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