

BENIGN LESIONS OF MANDIBLE ON ORTHOPANTOMOGRAM- OUR EXPERIENCE

Raseshkumar Rasiklal Vyas¹, Himanshu Champaklal Soni², Adarsh Chhaganbhai Bhalodia³, Dolubha Jilubha Sisodiya⁴

¹Associate Professor, Department of Radio-diagnosis, C.U. Shah Medical College and Hospital Surendranagar, Gujrat.

²Associate Professor, Department of Radio-diagnosis, Gujrat Cancer and Research Institute, Civil Hospital, Ahmedabad, Gujrat.

³2nd Year Resident, Department of Radio-diagnosis, C.U. Shah Medical College and Hospital Surendranagar, Gujrat.

⁴3rd Year Resident, Department of Radio-diagnosis, C.U. Shah Medical College and Hospital Surendranagar, Gujrat.

ABSTRACT**BACKGROUND**

Orthopantomography plays a vital role to diagnose mandibular lesions. Odontogenic benign tumours may occur at any period of odontogenesis. Those who develop during first stage of teeth formation do not contain calcified tissue and are therefore referred to as soft. When they develop during second stage (formation of enamel and cementum) they may contain calcified tissue so known as hard lesion. Orthopantomography help in such a way that tissue biopsy is necessary only to confirm the diagnosis and in some case its need may be altogether eliminated.

MATERIALS AND METHODS

Patients included in the study were from all age groups and under following clinical findings like pain, difficulty to open mouth, swelling, local tenderness, discharge from mouth etc. The machine use for the study is D B Troniks and the duration of the study is one year from jan-2016 to dec-2016.

RESULTS

A study carried out of 50 patient, after orthopantomogram found that incidence of male are more affected compare to females and most of them lying in third decade. The density of lesions were lytic followed by mixed and then sclerotic, while the margins of most of the lesions was smooth and well define. Most common lesion was dentigerous cyst followed by radicular cyst.

CONCLUSION

Many lesions involving the jaw produce characteristic radiographic appearances while many lesions produce protean characteristic with resultant overlap in radiographic features. With the combine help of history, clinical examination and orthopantomographical examination one can have accurate diagnosis of the lesions.

KEYWORDS

Benign lesions, Mandible, Orthopantomogram.

HOW TO CITE THIS ARTICLE: Vyas RR, Soni HC, Bhalodia AC, et al. Benign lesions of mandible on orthopantomogram- our experience. J. Evid. Based Med. Healthc. 2017; 4(25), 1451-1459. DOI: 10.18410/jebmh/2017/282

BACKGROUND

Mandible houses half of the total teeth and any lesion of mandible will give rise to teeth problem and cosmetic problems as well. Orthopantomogram produces a single image of facial structures, including both maxillary & mandibular arches and their supporting structure, is primarily used as a first step investigation for mandibular lesions.¹ It is important for radiologists to recognize pathologic changes in the jaw to ensure appropriate, timely patient care.² Apart from tumours of mandible radiography of mandible is very helpful in certain systemic disorders, endocrine disorders, and congenital disorders.

Financial or Other, Competing Interest: None.

Submission 01-03-2017, Peer Review 07-03-2017,

Acceptance 21-03-2017, Published 24-03-2017.

Corresponding Author:

Dr. Raseshkumar Rasiklal Vyas,

No. 3, Devkutir, Bunglows-1,

Iscon Ambli Road, Ambli,

Ahmedabad, Gujrat-380058.

E-mail: dr_rasesh_rad@yahoo.com

DOI: 10.18410/jebmh/2017/282

**Aims and Objectives**

- Role of orthopantomogram in diagnosis of benign mandibular lesions.
- Study the morphological characteristics of benign mandibular lesions with the help of orthopantomogram.

MATERIALS AND METHODS

Patients with specific complain pertaining to lower jaw are included in our study, although some cases were found on orthopantomological study for other complains rather than pertaining to lower jaw. Patients included in the study were from all age groups and both sex.

The machine use for the study is D B Troniks and the duration of the study is one year from January 2016 to December 2016.

Inclusion Criteria

Patients included in the study are of following

- All age groups.
- Both male and females.
- Clinical findings like pain, difficulty to open mouth, swelling, local tenderness, discharge from mouth etc.

- Past history like trauma, extraction of tooth or any operation.

Exclusion Criteria

- Patient not willing to participate.
- Female with pregnancy.
- Patient with known case of malignant aetiology.

RESULTS

Out of total 50 patients, results are as below Age Wise Distribution-

Age	Number of Cases
1-10	2
11-20	5
21-30	11
31-40	17
41-50	6
51-60	4
>60	5
Total	50

Table 1. Age Wise Distribution

Sex	Number of Cases
Male	32
Female	18
Total	50

Table 2. Sex Wise Distribution

Margin	Number of Cases
Smooth well defined	38
Indeterminate	12
Total	50

Table 3. Distribution as per Margin of the Lesion

Density	Number of Cases
Lytic	28
Sclerotic	7
Normal	2
Mixed	13
Total	50

Table 4. Distribution as Per Density of the Lesion

Cystic Tumours		
Odontogenic Origine	Radicular CYST	6
	Dentigerous CYST	7
	Odontogenic Keratocyst	4
Non Odontogenic Origine	Simple Bone CYST	1
	Aneurysmal Bone CYST	2
Solid Tumours		
Odontogenic Origine	Odontoma	3
	Ameloblastoma	3
	Cementoma	2
	Calcifying epithelial odontogenic tumour	1
Non Odontogenic Origine	Ossifying fibroma	2
	Central giant cell granuloma	1
	Osteoma	2
	Giant cell tumour	2
	Haemangioma	2

Others	
Acute osteomyelitis	2
Chronic osteomyelitis	3
Periapical abscess	2
Osteoradionecrosis	1
Fracture	3
Developmental disorders	1

Table 5. Total Number of Cases of Each Pathologies

Tumours

Note- Above results are confirmed by correlated with histological and laboratory findings however this correlation is not documented here.



Figure 1. Radicular Cyst- OPG is Showing Well defined Radiolucent Lesion at the Root of Right Lower 2nd Premolar Tooth with Mild Root Resorption



Figure 2. Dentigerous Cyst- OPG Shows Interrupted Left 3rd Molar Tooth with Well Defined Lucent Lesion having Sclerotic Margin and attached to the Cervical Region of the Tooth. Radicular Cyst at the Left Lower 1st molar Tooth as Incidental finding



Figure 3. Dentigerous Cyst- OPG Shows Interrupted Right Lower 3rd Molar Tooth with Well Defined Lucent Cystic Lesion Involving the Body and Ramus of Right Hemimandible, associated with its Mild Expansion, However, no Evidence of Cortical Break

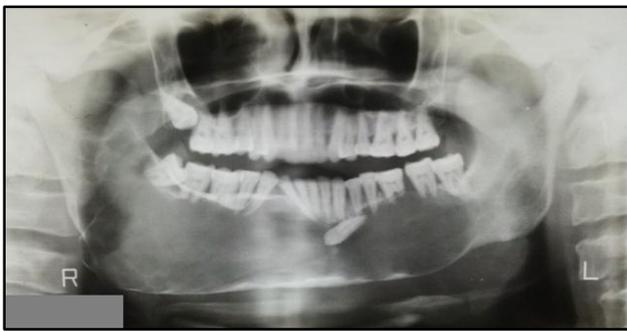


Figure 4. Odontogenic Keratocyst- A Lucent Cystic Lesion with Smooth Margins Involving most of the Body and Right Sided Ramus of Mandible, Significant Expansion of Mandible and Displacement of Teeth, Associated Impacted Tooth and Suspicious Cortical Erosion at the Right Lower Margin of the Lesion



Figure 5. Simple Bone Cyst- OPG Shows a Unilocular Radiolucent Lesion with Well Defined Margin Along Long Axis of Ramus of Right Hemimandible



Figure 6. Aneurysmal Bone Cyst- OPG Showing Multilocular Expansile Well Defined Radiolucent Lesion with fine Internal Septations, causing Splaying of Adjacent Molar Teeth in Left Hemimandible



Figure 7. Compound Odontoma- OPG is Showing well Defined Lobulated Radiodense Lesion with Surrounding Lucent Rim in Body of Left Hemimandible



Figure 8. Complex Odontoma- Multiple Masses of Dental Tissue with Amorphous Calcification in Mandible



Figure 9. Ameloblastoma- Expansile Multilocular Radiolucent Lesion, giving "Soap Bubble Appearance", Involving Ramus and adjacent Body of Left Hemimandible associated with Cortical Breach. On incidental Finding, there is well defined Radiolucent Lesion Involving root of right lower 1st and 2nd Premolar Teeth, diagnosed as Radicular Cyst



Figure 10. Recurrent Ameloblastoma- Post Left Segmental Hemimandibulectomy Patient for ameloblastoma, present with well-defined Radiolucent Lesion with Lobular Cortical Margin at the Surgical Margin of Residual Mandible Diagnosed as Recurrent Ameloblastoma



Figure 11. Cementoma- well defined Radiodense Lesion Perilesional Radiolucent Rim Involving Body of Mandible with its Expansion and Displacement of Overlying Teeth



Figure 12. Calcifying Epithelial Odontogenic Tumor- well defined Expansile Lucent Lesion, with internal Scattered Calcifications and associated impacted Tooth, in right Hemimandible



Figure 13. Recurrent ossifying fibroma- Post Left Lower Alveolectomy Status for Ossifying Fibroma Present with Multiple Radiolucent Lesion with Variable Internal Calcifications, in Left Hemimandible as Well as Body of Right Hemimandible Diagnosed as Recurrent Ossifying Fibroma



Figure 14. Central Giant Cell Granuloma- OPG Showing well defined Multiloculated Radiolucent Lesion, with Irregular Margins and Internal Bony septations, involving body of mandible and causing displacement of adjacent teeth

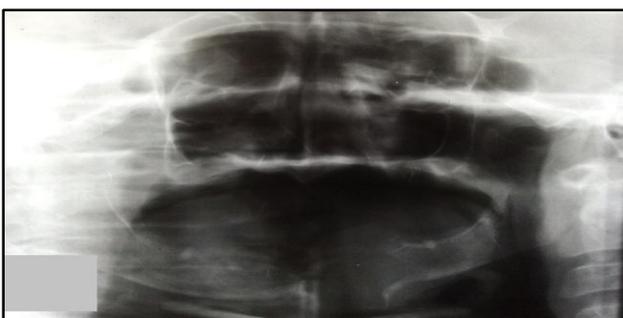


Figure 15. Osteoma- well defined radiodense lesion at the symphysis menti with the mild exophytic component

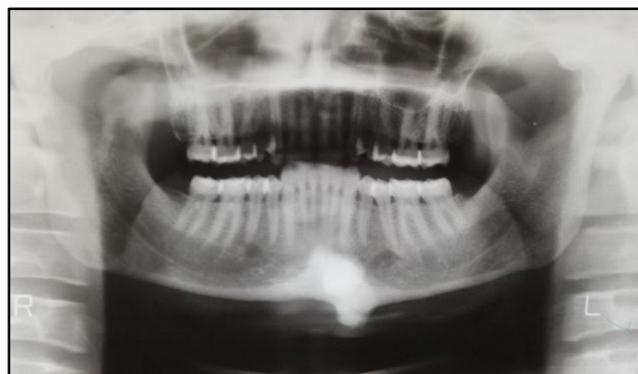


Figure 16. Giant Cell Tumor- Expansile Lytic Lesion Involving Body of mandible in left Paramedian Location associated with Cortical break and Soft Tissue Component

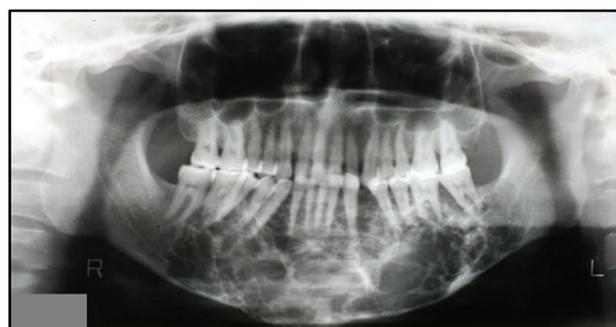


Figure 17. Cavernous Haemangioma- well defined Dense Opacity with Internal Coarse Trabeculation at the Root of Right Lower Canine and Premolar Teeth with their Splaying and Displacement



Figure 18. Haemangioma- Homogenous Soft Tissue Haziness at the Angle of Right Hemimandible with Internal Multiple Calcified Opacities (Phleboliths)



Figure 19. Acute Osteomyelitis- OPG Shows Supernumerary Teeth with Decreased Trabecular density in left hemimandible with multiple small, ill-defined radiolucent lesions in left hemimandible and body of right hemimandible with suspicious cortical erosion at inferior aspect of cortex at right paramedian location



Figure 20. Chronic Osteomyelitis- OPG Shows Irregular moth Eaten Lyric Area, with surrounding Sclerotic Bone, Involving Ramus and Adjacent Body of Right Hemimandible associated with few small Radiolucent Foci in Right Hemimandible

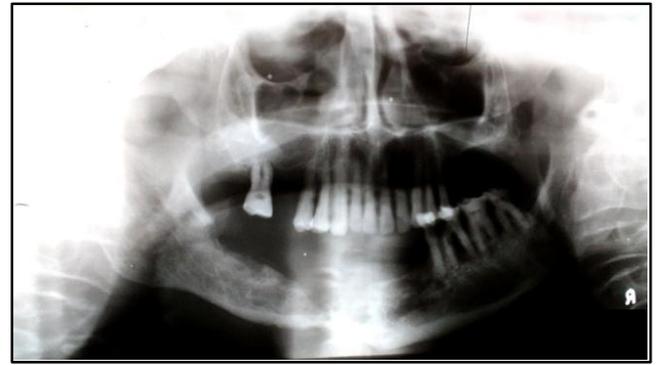


Figure 24. Fracture- linear horizontal fracture through body and ramus of predominantly involving right sided mandible with an inferior displacement of fractured segment



Figure 21. Periapical Abscess- OPG Showing Well defined area of Radiolucency at the Root of Right Lower 1st Premolar Tooth and Left Lower 1st Molar Tooth



Figure 25. Congenital Hypoplasia of Ramus of Right Sided Mandible



Figure 22. Osteoradionecrosis- Post Right Lower Alveolectomy Post Radiotherapy Patient, Showing Ill-defined Multifocal Radiolucency Involving Right Hemimandible



Figure 23. Fracture- Linear Undisplaced fracture Through Body of Left Hemimandible and Right condylar fracture with normal right temporomandibular joint

DISCUSSION

Mandibular lesions are classified into benign and malignant, with further subdivided into odontogenic and non-odontogenic tissue according to their predominant tissue of origin. These lesions present with varying clinical signs and symptoms, the most common presentation is swelling and pain. Swelling may be intraoral or outside resulting in facial asymmetry. Other symptoms are teeth displacement & mobility, bleeding, secondary signs and symptoms of infection. Paraesthesia of lower lip indicates mandibular canal involvement.

On panoramic radiography, these lesions primarily can be either solid or cystic in appearance. The mandibular lesions can be classified as cystic odontogenic or non-odontogenic lesions, solid odontogenic or non-odontogenic tumours, infectious lesions, developmental disturbances and fractures.

Mandibular Cysts

A true mandibular cyst develops as result of stimulation of either developmental and inflammatory factors with resultant proliferation of epithelial cells surrounding a tooth. Cysts are classified as: odontogenic or non-odontogenic.

Odontogenic Mandibular Cysts

Radicular Cyst-

The radicular cyst is the most common odontogenic cyst of the mandible.³ The radicular cyst is seen in all ages, more often between 30-60 years of age group. It is also known as "periapical cyst" or "apical periodontal cyst", as it occurs at

the apex of the nonvital tooth. The radicular cyst is an inflammatory cyst, results from spread of infection to the root of the tooth, leading to secondary apical periodontitis, granuloma, or abscess and finally cyst formation.⁴ It most often presents as an asymptomatic lesion.

On OPG, the radicular cyst appears as a well-defined unilocular periapical lucent lesion with smooth margins at the apical region of root of nonvital tooth (Figure 1). The cyst may cause mild root resorption and may displace adjacent teeth. The radicular cyst and periapical granulomas have a similar radiographic appearance, although radicular cysts are less common and often larger.⁵

Dentigerous Cyst

Dentigerous cyst is also known as "Follicular cyst" or "pericoronal cyst". It is the second most common odontogenic mandibular cyst after radicular cyst. Dentigerous cysts are mainly seen in adolescents and young adults as a painless cyst around the crown of the unerupted tooth. The dentigerous cysts result from accumulation of fluid between enamel organ remnant and tooth crown, with cyst formation around the crown of the unerupted tooth.

On OPG, follicular cysts appear as a unilocular, well-defined radiolucent lesion with smooth margins around an unerupted tooth crown. The cyst is most often attached to the cervical area of the unerupted tooth at an acute angle and the crown generally protrudes into the cyst while the roots remain outside the lesion. Identifying the crown of a tooth projecting into the cystic cavity is pathognomonic.⁶ (Figure 2).

Follicular cysts can expand the mandible asymptotically, with preservation of cortical bone (Figure 3). These cases are more prone to develop pathological fracture or infection. Occasionally, ameloblastoma, squamous cell carcinoma and mucoepidermoid carcinoma may arise within the wall of the dentigerous cysts. Multiple follicular cysts are very rare and may be seen in the Gorlin-Goltz syndrome, mucopolysaccharidosis type 4 and cleidocranial dysplasia.²

Odontogenic Keratocyst

Odontogenic keratocysts are also known as "keratinising cysts", "primordial cysts" or "keratocystic odontogenic tumours (KCOTs)". Odontogenic keratocysts are benign tumours, arise from the dental lamina, which is found throughout the mandible and overlying alveolar mucosa, thus the cyst can occur throughout the apical and primordial region.⁴ Daughter cysts and nests of cystic epithelia are found outside the primary lesion; therefore, odontogenic keratocysts shows the highest recurrence rate when treated conservatively with curettage.⁷ They are often associated with an impacted tooth. Odontogenic keratocysts are often asymptomatic and misdiagnosed as follicular cysts, periapical cysts or ameloblastoma on imaging.⁸ Though, they can occur at any age, they are most commonly found in 2nd to 4th decade.

On OPG, the odontogenic keratocysts appear as a unilocular lucent lesion with smooth margin; while, the

larger lesions appear as well defined multilocular lucent lesion with undulating cortical borders (Figure 4). This appearance makes it indistinguishable from ameloblastoma. Unlike follicular cysts, odontogenic keratocysts can expand cortical bone and erode the cortex.⁶ and their malignant transformation is very rare. Multiple odontogenic keratocysts are seen in the nevoid basal cell carcinoma syndrome (Gorlin-Goltz syndrome), the oral-facial-digital syndrome, the Ehlers Danlos syndrome and in the Noonan syndrome.²

Non-odontogenic Mandibular Cysts- Simple Bone Cyst-

The simple bone cysts (SBC) are also known as "traumatic bone cyst", "solitary bone cyst" or "haemorrhagic cyst". They result from trauma, typically with tooth extraction, which leads to intramedullary haemorrhage and subsequent resorption and cyst formation. They are characterized by absence of epithelial lining, thus considered to be pseudocyst instead of true cyst. Most SBCs occur before the age of 20 years with more frequently seen in females.⁹ Most lesions are asymptomatic. In most cases SBC is located in posterior marrow space of mandible.

On OPG, most SBCs appear as unilocular, well-defined lucent lesions (Figure 5), often have characteristic scalloped superior margin extending between the roots of the teeth. Rarely, it shows poorly defined borders. It causes osseous expansion with cortical thinning. The differential diagnoses are other unilocular radiolucent lesions, such as keratocysts.

Aneurysmal Bone Cyst

Aneurysmal bone cysts are very rare in mandible. They are mainly seen in older children and adolescents.

On OPG, they appear as expansile multilocular radiolucent lesion with invariable faint septa, coursing through the lesion in random pattern, producing "soap bubble" appearance (Figure 6). Margins appear well demarcated somewhat less regular and distinct than those of an odontogenic cyst.

Solid Benign Lesions Odontogenic Solid Tumours- Odontoma-

Odontoma is the most common odontogenic tumor of the mandible.¹⁰ It is a hamartomatous lesion containing various abnormally developed tooth components, including dentin and enamel. Nearly 50% of odontomas are associated with an impacted tooth and discovered during 2nd decade of life.⁴ On OPG, there appear as calcified lesion, not fused with surrounding bone, as evident by radiolucent line which separate them. Most are 1-3 cm in diameter. They are subclassified into two types: compound and complex. Compound odontomas have radiographically identifiable tooth components (abortive teeth) (Figure 7), whereas complex odontomas contain multiple masses of dental tissue with amorphous calcifications (Figure 8).

Ameloblastoma

Ameloblastoma is benign, but locally invasive, slowly growing odontogenic tumor, arises from enamel forming

cells of the odontogenic epithelium, that have failed to regress during embryonic development. It manifests in 3rd to 5th decade, but also seen in younger and older people with no sex predilection. It presents as unilateral painless facial swelling. Because of slow growth, it causes significant expansion of mandible. Most ameloblastoma occur in posterior body and ramus of mandible.¹¹ Classic ameloblastomas do not have distant metastases. However, variants with metastatic behaviour despite histologically benign features are called as "malignant ameloblastoma". While, tumours with histologically malignant features, without metastatic potential are called as "ameloblastic carcinomas".⁵

On OPG, The expansile, radiolucent tumor can be unilocular or multilocular, with a characteristic "soap bubble" or "honeycomb" appearance, with significant expansion of mandible (Figure 9). The lesion can also erode through the cortex with extension into the surrounding oral mucosa. Many cases also show root resorption. It shows high rate of recurrence (Figure 10). Only histopathological findings can help to determine benignity and malignancy of ameloblastoma. Ameloblastomas may be subdivided into four histological types: unicystic, multicystic, extraosseous, and desmoplastic.¹² Most of them cannot be distinguished with radiology alone, with the exception of desmoplastic ameloblastoma showing multiple coarse internal calcifications with significant surrounding cortical destruction.

Cementoma

Cementoma is a rare odontogenic tumor characterized by formation of cementum like tissue in relation to root of a tooth. It is a large bulbous mass of cementum that forms on the root of a tooth. More males are affected and most of the patients are under the age of 25 years. The tumours grow slowly, forming a mass at the roots.

On OPG, The tumor appears as well defined round or irregular radio dense lesion, usually measuring up to 2-3 cm, with thin perilesional radiolucent rim, giving it "golf ball" appearance. The attachment of the lesion to the root of the tooth sometimes obscured. As it is a slow growing tumor, it shows expansion of mandible (Figure 11).

Calcifying epithelial odontogenic tumor:

Calcifying epithelial odontogenic tumor, also known as "pindborg tumor", is a rare odontogenic tumor seen in adults, composed of epithelial cells in fibrous stroma. It occurs frequently between 3rd to 5th decades with no gender predilection.¹³ It is most frequently located in molar/premolar region of the mandible and associated with the crown of an impacted tooth.

On OPG, the lesion typically appears as radiolucent lesion with scattered calcific components, most often associated with an impacted tooth, with radiodensities most evident around the crown (Figure 12).

Non-odontogenic Solid Tumours- Ossifying Fibroma

Ossifying fibroma, also known as cemento-ossifying or cementifying fibroma, contains fibrous tissue with varying amounts of bony trabeculae.⁴ There are two clinicopathological variants of ossifying fibroma noted: conventional slow growing ossifying fibroma and rapidly growing aggressive juvenile ossifying fibroma. They are more frequently discovered in 3rd and 4th decades of life. Majority of the lesion are found to be within the posterior mandible.

On OPG, the ossifying fibroma appears as an encapsulated, well-circumscribed lesion with variable radiodensity. Depending on the degree of calcification and maturation of the lesion, the lesion appears radiolucent, radiopaque, or with mixed opacity (Figure 13). With maturation, the lesion becomes more radiopaque. The differential imaging diagnoses are fibrous dysplasia, benign tumours like odontoma and vascular malformation.

Central Giant Cell Granuloma

Central giant cell granuloma is a benign but occasionally aggressive proliferative intra-osseous lesion with fibrous tissue, haemorrhage, as well as characteristic osteoclast-like giant cells within. There typically occur in adolescents and young adults, more often in young girls or women. They are more often found in the anterior mandible, crossing midline. Patients typically present with painless swelling.¹⁴ Some lesion present with tenderness on palpation.

On OPG, the central giant cell granuloma show variable appearance. Early lesions appear as small well defined radiolucent lesion, mimicking odontogenic cyst. As it grows further it appears multilocular lucent lesion with osseous expansion and tiny bony septations traversing the lesion (Figure 14). There may be root resorption, erosion or remodelling of the cortex noted. The lesion may cross the midline. The differential diagnosis includes brown tumours of hyperparathyroidism, giant cell tumor, ameloblastoma, odontogenic tumours.

Osteoma

Osteoma is a benign osteogenic tumor arising from proliferation of cancellous or compact bone.¹⁵ Mandibular osteoma is a rare tumor, which present with painless very slow growing swelling. In the mandible, the most common sites are the angle and lower border of the body, locations that are more susceptible to trauma.¹⁵

The radiological appearance of osteoma depends on their location. Central osteoma appears as well defined sclerotic lesion with smooth margin. Peripheral osteoma are radiopaque lesion with extensive borders that may be sessile or pedunculated (Figure 15).

Giant Cell Tumor

Giant cell tumor, also known as osteoclastoma, is true neoplastic process usually originating from the undifferentiated mesenchymal cells of the bone marrow. It is generally considered benign, but may present with

significantly destructive lesion. Giant cell tumor occurrence in mandible is rare. Patient presents with pain and swelling. On OPG, giant cell tumor appears as well circumscribed radiolucent lesion surrounded by little or no sclerosis, with breach in cortex and associated soft tissue opacity (Figure 16).

The differential diagnosis of GCT includes aneurysmal bone cyst, chondroblastoma, dermoid cyst, chondrosarcoma and giant cell reparative granuloma. When an aggressive growth pattern is evident, the possibility of chondrosarcoma, osteosarcoma, and metastatic lesion cannot be ruled out until confirmation by histological examination.¹⁶

Haemangioma

Haemangioma is a benign tumor characterized by proliferation of blood vessels. It is seen in all age groups with female/male ratio 2:1. The haemangioma is usually not as well defined as in the other bones.

On OPG, it may appear as radiolucency, often multicystic and frequently have a soap bubble or honeycomb appearance that results from fine trabeculation within loculus (Figure 17). Some lesions may also be distinguished by linear trabeculation or be radiolucent. The roots of teeth in the invaded area are frequently resorbed and displaced. The presences of phleboliths are not uncommon (Figure 18).

Other Lesions

Infectious Lesions- Acute Osteomyelitis

The acute osteomyelitis with acute suppurative course usually shows significant clinical signs and symptoms. Intense pain with deep sensation within the bone, general malaise, high grade intermittent fever, fetid oral odour, local swelling and oedema due to abscess formation are the main symptom of acute osteomyelitis. In some cases, paraesthesia or anaesthesia of the lower lip described, indicating inferior alveolar nerve involvement. Pus may exude around gingival sulcus or through mucosal or cutaneous fistula.

On OPG, Mandible shows decreased trabecular density with blurred and fuzzy outline. Subsequent solitary or multiple small radiolucent areas become apparent on the radiograph, representing enlarged trabecular spaces caused by foci of necrosis and frank bone destruction (Figure 19) Sometimes lamellar periosteal reaction may be seen.

Chronic Osteomyelitis

As a sequel of acute osteomyelitis, the clinical presentation of secondary chronic osteomyelitis show great variability in clinical presentation. Pain and swelling become less extensive. Sequester and fistula formation are regarded as classical signs of secondary chronic osteomyelitis. Patient presents with dull pain instead of deep intense pain.

On OPG, there are single or multiple radiolucencies of variable size and irregular outlines and poorly defined borders noted in mandible. As the infection progresses the affected bone becomes moth eaten in appearance. As the radiolucent area enlarges, it become irregular in outline and is separated by islands of sclerotic bone (Figure 20). On

radiograph, sequestra are usually denser and better defined, with a sharper outline, than the surrounding vital bone. Inflammatory reaction is probably stimulating demineralization of the vital bone surrounding sequestra. Suppuration may perforate the cortical bone, periosteum and overlying skin or mucosa forming a fistulous tract to the surface. This tract will show on the radiograph as a radiolucent band traversing the body of the mandible and penetrating cortical plate.

Periapical Abscess

Periapical abscess also known as "dental abscess", is an acute infection of the root of the tooth. They present with pain, oedema and purulent discharge localized to the site of pathology. Damage to the dental enamel allows bacterial access to dental pulp, which spread down to root canal with apical abscess formation.

Early periapical abscess may not have any radiographic findings on OPG. As disease gets older, there is well defined radiolucency noted at the root of the tooth, many times with root resorption (Figure 21). The lesion usually measures less than 1 cm with or without surrounding sclerosis. As the disease progresses, it may develop osteomyelitis. Periapical cyst and periapical granuloma are the main differential diagnosis. However, proper history and clinical examination play vital role for definite diagnosis.

Osteoradionecrosis

Osteoradionecrosis is a severe radiation induced injury, causing bone tissue necrosis and failure in healing. It usually manifest after 5-15 years of radiotherapy. It is thought to occur as a result of alteration in blood supply to the bone from microvascular damage, which limits the ability of the tissues to adjust to normal turnover, resulting in tissue breakdown. Mandible is particularly prone to osteoradionecrosis, due to its superficial location and high dose requirement to treat naso-oropharyngeal tumours.

On OPG, osteoradionecrosis appears as areas of increased density interspersed with osteolytic lucent region and the appearance of late forming sequestra (Figure 22). It may confine to limited area.

Fracture of Mandible

Mandibular fractures occur through body, ramus and condyle. OPG plays an important role to detect mandibular fracture. The margins of the fracture are usually seen as sharply defined radiolucent lines where the margins of the bone at the fracture site have separated. Most displaced mandibular fractures involve either buccal and lingual cortical plate or only one cortical plate. An incomplete fracture involving only one cortical plate is often seen. (Figure 23, 24)

Developmental Disturbance of the Mandible

Developmental anomalies seen in the mandible are following: hemifacial hypoplasia, hemifacial hypertrophy, hyperplasia of coronoid process and mandibular dysostosis.

Radiographic changes associated with hemifacial hypoplasia are generally revealed as a reduction in the size of bones on the affected side, show a reduction in size of the condyle, coronoid process or overall dimension of the body and ramus of the mandible (Figure 25). The definition on the affected side may show reduction in number or size of the teeth.

In hemifacial hypertrophy, there is enlargement of the mandible on the affected side.

In hyperplasia of coronoid process, there is enlargement of coronoid process may be recognized radiographically.

CONCLUSION

The orthopantomography is a simple, non-traumatic and very useful procedure to diagnosis of various mandibular lesions. Mandibular lesions showing radiographic features like solid-cystic appearance, margins, density, cortical breach etc. play an important role in diagnosis of these lesions. This differentiation would further help in management of these lesions.

REFERENCES

- [1] Avril L, Lombardi T, Ailianou A, et al. Radiolucent lesions of the mandible: a pattern-based approach to diagnosis. *Insights Imaging* 2014;5(1):85-101.
- [2] Meyer KA, Bancroft LW, Dietrich DJ, et al. Imaging characteristics of benign, malignant and infectious jaw lesions. *AJR Am J Roentgenol* 2011;197(3):412-421.
- [3] Goaz PW, White SC. *Oral radiography: principles and interpretation*. 3rd edn. St Louis, Mo: Mosby-Year Book 1994:398-676.
- [4] Dunfee BL, Sakai O, Pistey R, et al. Radiologic and pathologic characteristics of benign and malignant lesions of the mandible. *Radiographics* 2006;26(6):1751-1768.
- [5] Scholl RJ, Kellett HM, Pneumann DP, et al. Cysts and cystic lesions of the mandible: clinical and radiologic-histopathologic review. *Radiographics* 1999;19(5):1107-1124.
- [6] Weber AL, Kaneda T, Scrivani SJ, et al. Cysts, tumors, and non-tumorous lesions of the jaw. In: Som PM, Curtin HD, eds. *Head and neck imaging*. 4th edn. St Louis, Mo: Mosby 2003:930-994.
- [7] Oikarinen VJ. Keratocyst recurrences at intervals of more than 10 year: case reports. *Br J Oral Maxillofac Surg* 1990;28:47-9.
- [8] Ali M, Baughman RA. Maxillary odontogenic keratocyst: misdiagnosis. *J Am Dent Assoc* 2003;134:8770-8883.
- [9] Sabino-Bezerra JR, Santos-Silva AR, Jorge J, et al. Atypical presentations of simple bone cysts of the mandible: a case series and review of literature. *J Craniomaxillofac Surg* 2013;41(5):391-396.
- [10] Regezi JA, Kerr DA, Courtney RM. Odontogenic tumors: analysis of 706 cases. *J Oral Surg* 1978;36(10):771-778.
- [11] Weber AL. Imaging of cysts and odontogenic tumors of the jaw. *Radiol Clin North Am* 1993;31(1):101-120.
- [12] Sham E, Leong J, Maher R, et al. Mandibular ameloblastoma: clinical experience and literature review. *ANZ J Surg* 2009;79(10):739-744.
- [13] Franklin CD, Pindborg JJ. The calcifying epithelial odontogenic tumour: a review and analysis of 113 cases. *Oral Surg Oral Med Oral Pathol* 1976;42(6):753-765.
- [14] Horner K. Central giant cell granuloma of the jaw: a clinico-radiological study. *Clin Radiol* 1989;40(6):622-626.
- [15] Woldenberg Y, Nash M, Bodner L. Peripheral osteoma of the maxillofacial region. Diagnosis and management: a study of 14 cases. *Med Oral Patol Oral Cir Bucal* 2005;10(Suppl 2):E139-E142.
- [16] Park SR, Chung SM, Lim JY, et al. Giant cell tumor of the mandible. *Clinical and Experimental Otorhinolaryngology* 2012;5(1):49-52.