DENTINO
JURNAL KEDOKTERAN GIGI
Vol IV. No 1. Maret 2019

RADIOGRAPHIC FEATURES OF INTERNAL STRUCTURE IN JAW LESIONS

(Review article)

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ABSTRACT

Background*: The internal structure of jaw lesions demonstrates different characteristics and distinctions. They may be varied in features such as the four variations of internal structure presented in ameloblastoma. Each type represents distinctive characteristics which depict the natures of respective lesion. Unquestionably required for lesion identification, internal structure becomes an essential radiographic aspect to differentiate the characteristic of a lesion. Several specific attributes of internal structure are utilized to distinguish each diagnosis. Thus, it is necessary to conduct specific assessment to discover the features of internal structure.* ***Objective****: To identify different radiographic features of internal structure in jaw lesions.* ***Discussion****: This article scrutinizes the internal structure of jaw lesions such as Pattern of Bones Destruction and Septation in Bone Lesions from several article reviews. A number of variances exist in the features of internal structure which later separate them from other lesions. The identification of cyst, benign and malignant tumor lesions may eventually be performed by using specific radiographic features of the lesions.* ***Conclusion****: Radiographic features of internal structure in jaw lesions illustrate particular hallmarks and traits which assist the identification of a lesion.*

Keyword*: Internal structure, jaw lesion, radiograph*

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INTRODUCTION

Lesions of the jaw can be classified into benign and malignant lesion. Aside from clinical and histopathological examination, radiographic assessment has been one of essential method to establish a diagnosis. Radiographic image of a lesion displays specific attribute which enable them to be easily distinguished with other lesions. One method used to identify this trait is by interpreting the internal structure of a lesion.[1]

Internal structure in radiograph assists the assessment of a diagnosis by identifying specific feature of internal structure. Radiographic features of internal structure, such as *Pattern of Bone Destruction* and *Septation in Bone Lesions*, will be discussed in this article as a specific combination to

define benignity and malignancy of a disease based on the radiographic feature review.[2,3]

This article aims to distinguish specific radiographic features of internal structure observed in radiographic examination. Hereby we discuss about the characteristics of radiographic feature, especially in scrutinizing lesion internal structure. This method may aid dental practitioner to comprehend the distinctions between benign and malignant lesions using radiographic traits.

Systematic Review

Internal structure of a lesion is divided into three radiographic features which later can be analyzed in the presentation of total radiolucent, total radiopaque and a combination of radiopaque and radiolucent. Total radiolucent can be observed in cyst lesion while total radiopaque can be found in osteoma lesion. Radiopaque radiolucent combination can be identified in ameloblastoma where calcified structure (radiopaque image) is imposing radiolucent structure and resulted in mixed density appearance.[3,4]

All malignant lesions are not promoting new bone formation thus radiolucency will be a general depiction to be observed. Although there is a radiopaque appearance from inflammation and bone formation induced by inflammatory healing reaction, almost all malignancies exhibit bone destruction in their internal structure validating this feature as a guide to diagnose diseases. In accordance with geographical pattern of bone destruction, the characteristic of a lesion can be evaluated. Specific destructive pattern of the bone can be illustrated radiographically and manifested in different radiographic images according to the stages of progression. Destructive pattern demonstrates the intensity and aggression of diseases development.[2]

The features of internal structure based on bone destruction pattern are comprised of: Geographic pattern which divided into three types namely type IA with sclerotic margin, type IB without sclerotic margin and type IC with unclear margin. Meanwhile, type 2 is Moth-Eaten Pattern and type 3 presents Permeative Pattern.[2,5,6]

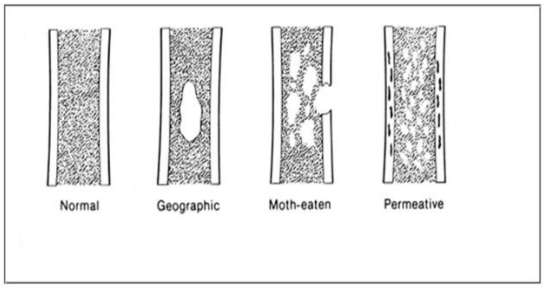

Figure 1. Radiographic features based on the *Pattern of Bone Destruction* types in jaw lesions[6]

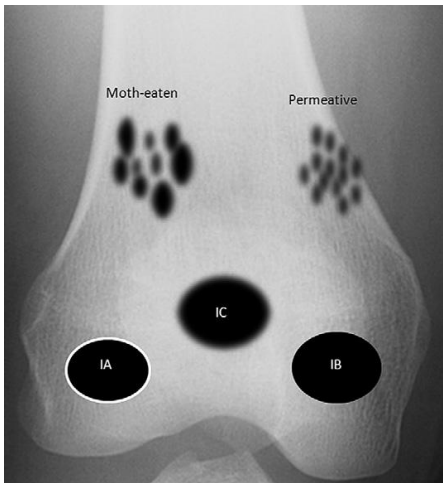

Figure 2. *Tumor-bone* margin. Type IA (Geographic with sclerotic margin), type IB (Geographic without sclerotic margin), type IC (Geographic with unclear margin), Moth-eaten (Type II) and Permeative (Type III)[5]

Jaw lesions can be identified by the presence of septa. Thin wall or cortical bone septa may appears to separate the internal structure especially in several particular lesions. Nonappearance of internal septa is known as *non septated* lesion which is a specific characteristic for unicamera bone cyst, while the presence of multiple septas are recognized as *multi septated* lesion. In a number of cases, lesions behold true septa appearance in the whole internal structure where endosteal surface erosion or scalloping formation may also resembles this condition illustrating septated feature or what is generally pronounced as *false septa*.[5]

There are several types of internal structure associated with *Septation in Bone Lesions*. Comprised of unicameral non septated, honeycomb multi septated, soap bubble, true septation and ridging feature[5], these radiographic patterns can be used to differentiate specific internal structure and simplify the identification of benign or malignant lesions. Unicameral non septated lesion is commonly found in unilocular lesion, while honeycomb and soap bubble can be easily found in ameloblastoma which is a benign yet invasive lesion.[5]

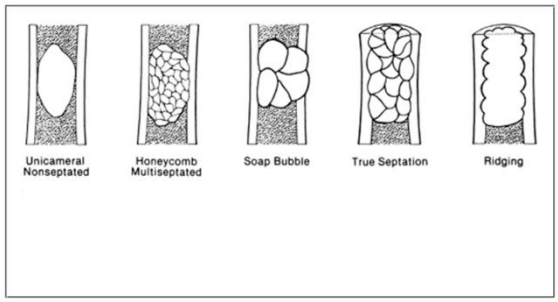

Figure 3. Radiographic features based on the types of *Septation in Bone Lesion*.[6]

DISCUSSION

Pattern of Medullary Destruction

Geographic Pattern

Geographic pattern of bone destruction is the least aggressive bone destruction pattern which generally demonstrates a gradual growth inside the lesion. It displays a well-defined margin which can be easily distinguished from surrounding normal bone. This border may be thin or irregular, but usually confined by sharp border. A border from sclerotic tissue layer may indicate the aggression of a lesion. The sharper the layer presents, the more aggressive the progress will be.[2]

The radiographic features are categorized into less aggressive lesion, slow progressive lesion, big sized lesion with lytic internal structure, and well-defined margin. In figure 4, there is a type IA geographic pattern found in ossifying fibroma lesion with irregular sclerotic margin. This lesion is more frequent in mandibula especially in posterior region of the jaw.[5,7,8]

Figure 4. Panoramic radiograph section showing radiolucent lesion with irregular sclerotic margin.[7]

Moth Eaten Pattern

Moth-eaten pattern represents more aggressive bone destruction as the characteristic for fast progressive lesions compared to jaw lesions with geographic pattern. This pattern is always associated with ill-defined margin, characterized as hollow appearance in trabecular bone with spreading pattern and gradual expanse. This is also a manifestation of soft tissue infiltration followed by ulcer formation in between.[2]

Initial radiographic feature of osteomyelitis lesion exhibits reduction in affected bone density such as the sharpness of trabecular bone structure. Bone resorption becomes more critical as it progressed to produce lytic area with irregular margin. This pattern sometimes illustrates moth eaten structure resembling a piece of cloth devoured by moth. This lesion tend to be more aggressive with multiple small radiolucent appearances (2-5 mm in size).[9-11]

Figure 5. Panoramic radiograph depicting *mouth-eaten pattern type* of bone destruction.[9]

Permeative Pattern

This feature is commonly found in malignant cases, such as Ewing's Sarcoma. Ewing's Sarcoma is a neoplasm which is rarely progressed in jaw region but it may occur more frequent in mandibula rather than maxila with 2:1 ratio. Mostly found bilateral in posterior region of the jaw, this lesion will initially develop in marrow space and gradually progress to cortical bone layer. The margin and shape of Ewing's Sarcoma are presented as radiolucent lesion with uncorticated margin. Rough cortical margin is often resulted from the lesion attribute to promote irregular bone destruction. This lesion is generally solitaire and may triggered pathological fracture with the appearance of soft tissue mass in radiographic image. The lesion may be presented in round or oval shape but mostly indicates no particular pattern. Ewing's Sarcoma generates bone destruction with less induction in bone formation. Initiated in the internal aspect of the bone, the lesion will appear as total radiolucent which include endosteal and periosteum surface in the later progression. It is characterized by an oval-shaped radiolucent lesion (less than one milimeter in size) in a nearly uniform appearance.[4,12,13]

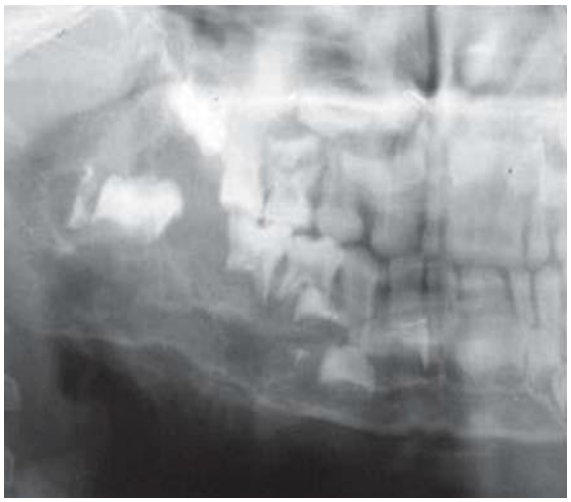

Figure 6. Panoramic radiograph presenting *Permeative Pattern*, radiolucent lesion with unclear and irregular margin.[12]

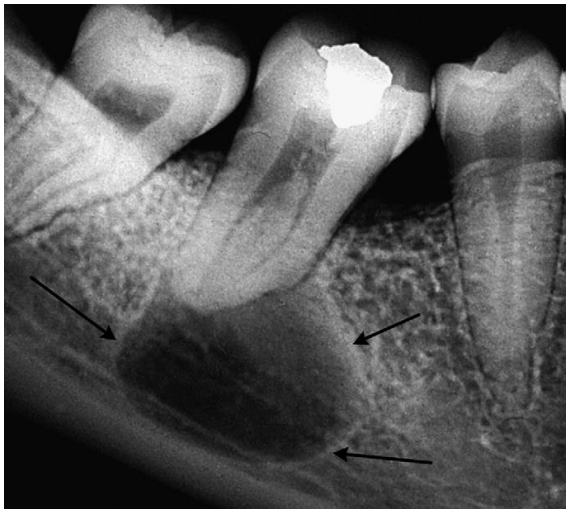

Figure 7. Radiograph of radicular cyst with corticated unilocular radiolucent lesion in dental apex.[16]

Septation in Bone Lesions

Unicameral Nonseptated

Also known as simple bone cyst, this condition commonly occurs in mandibula and rarely in maxilla affecting mostly women as the target population. This lesion manifests as radiolucent image with clear and sharp margin around dental apex. When located between the teeth, it appears in scallop form and resembles

multilocular lesion as the result of endosteal scalloping. Lamina dura and periodontal tissues display no abnormality and the teeth are presented in vital condition. Internal structure of this lesion depicts unilocular radiolucent, usually more than one centimetre in size, with corticated and well-defined margin.[14-16]

Honeycomb

Radiographically, ameloblastoma exhibits various features in its internal structure from total radiolucent lesion to bone septa formation producing internal compartement within the lesion. This septa is generally irregular and quite curved, originating from normal bone which is trapped inside the tumor mass. This tumor frequently possesses internal cystic component where the septa can be remodeled in other particular pattern such as honeycomb with small compartements or loculations. This is often detected in ameloblastoma case with *mixed type* internal structure formed by small radiolucent and multiple septa inside the lesion.[4,5,9,11,17,18]

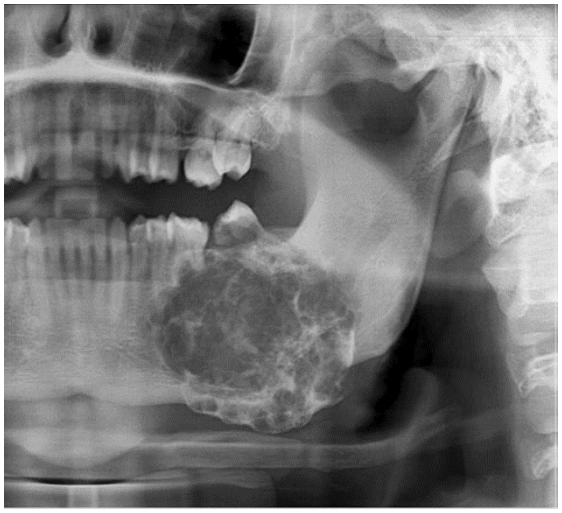

Figure 8. Ameloblastoma in the left region of mandible. *Honeycomb pattern type* is presented in panoramic radiograph.[9]

Soap Bubble

Although known as benign condition, ameloblastoma is an invasive localized lesion with aggressive growth characteristic. This lesion is prompted by dental epithelium residues which may transform into solid, multicystic (85%), unicystic or desmoplastic structure. Rarely emerged in maxilla, the lesion often progresses in the cortical border of mandibula presented with clear and sharp margin. Internal structure of the lesion exhibits unicystic radiolucent and may also displays multiple septa as in multicystic lesion. This lesion usually induces root resorption, tooth migration and jaw expansion. It is one of the most frequent lesions represented with soap bubble appearance.[9,11,17-19]

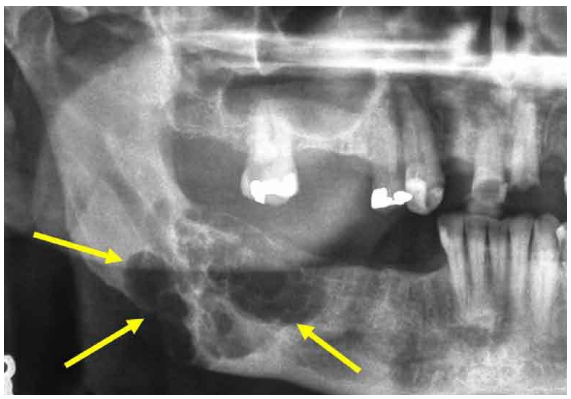

Figure 9. 41 years old male with multicystic ameloblastoma of mandibula.[19]

Figure 10. Cherubism. Panoramic radiograph of *soap bubble* multilocular lesion causing jaw expansion

True septation

Radiographical image demonstrates multilocular lesion with thin and straight internal septa, frequently found in posterior region of mandibula. Small lesion often appears as unilocular structure with well-defined margin while well-

defined or ill-defined margin can also be presented in bigger lesion with cortication or scallop around the lobular edge. Internal septa can be described as *racket tennis pattern* appearance where internal structure disposes thin septa in lesser quantity like manifested in odontogenic myxoma.[4,14,20,21]

Figure 11. Panoramic radiograph showing multilocular lesion in *racket tennis pattern*.[20]

Ridging

Radiograph of *Odontogenic Keratocyst* frequently presents a unilocular radiolucent lesion surrounded by sclerotic border with clear and sharp margin. It may appears as multilocular radiolucent lesion with incomplete septa formation in the internal structure which commonly known as false septa. *Odontogenic Keratocyst* regularly illustrates ridging of internal structure with *scallop appearance* in radiographic image.[16,20,22]

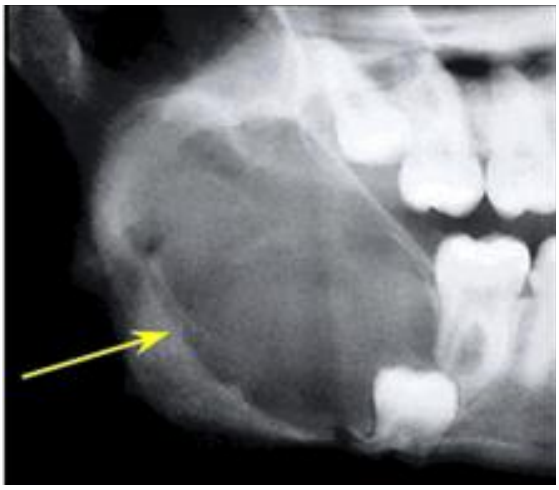

Figure 12. Panoramic radiograph shows a huge OKC lesion involving third molar impaction. It is a unilocular type lesion with scalloped pattern in radiographic image.[20]

Based on the internal structure presentation, particular characteristics can be obtained to identify jaw lesions. Benign conditions are commonly presented as unilocular lesion with narrower zone of bone destruction, while malignant lesion demonstrates wider zone of bone destruction as well as multilocular lesion variations with diverse specific patterns and septas. It can be concluded that internal structure can provide specific radiographic feature of a lesion which can be easily identified to distinguish various lesions of the jaw.

REFERENCES

1. Neyaz Z, Gadodia A, Gamanagatti S, Mukhopadhyay S. Radiographical approach to jaw lesions. singapore med j. 2008;49(2):165.
2. Epsilawati L, Firman R, Pramanik F, Ambarlita Y. Gambaran radiograf dari lesi keganasan maksilofasial : (literature review). Makassar Dent J. 2018;7(2):88–94.
3. Koong B. The basic principles of radiological interpretation. Aust Dent J. 2012;57(1):33–39.
4. White SC, Pharoah MJ. Oral Radiology Principles and Interpretation. 7th ed. Elsevier Mosby, editor. Canada; 2014.p. 271-285.
5. Nichols RE, Dixon LB. Radiographic Analysis of Solitary Bone Lesions. Radiol Clin NA [Internet]. 2011;49(6):1095–114.

Available from: http://dx.doi.org/10.1016/j.rcl.2011.07.012
6. Miller MD TT. Radiology Bone Tumor.Pdf. Radiology. 2008;246(3):662–674.
7. Araki M, Matsumoto K, Matsumoto N, Honda K, Ohki H, Komiyama K. Unusual radiographic appearance of ossifying fibroma in the left mandibular angle. Dentomaxillofacial Radiol. 2010;39(5):314–319.
8. Liu Y, You M, Wang H, Yang Z, Miao J, Shimizutani K, et al. Ossifying fibromas of the jaw bone : 20 cases. Dentomaxillofacial Radiol [Internet]. 2010;39:57–63. Available from: http://dmfr.birjournals.org
9. Omami G. Twenty classic signs in oral and maxillofacial radiology. Oral Radiol [Internet]. 2019;35(1):3–10. Available from: http://dx.doi.org/10.1007/s11282-018-0351-y
10. Whaites E, Drage N. Essentials of Dental Radiography and Radiology. 5th ed. UK: Elsevier; 2013. p.380
11. Phore S, Panchal RS, Baghla P, Nabi N. Dental radiographic signs. Indian J Heal Sci. 2015;8(2):85–90.
12. Thomas V. A Radiological Review of Ewing ' s Sarcoma of Mandible : A Case Report with A Radiological Review of Ewing ' s Sarcoma of Mandible : A Case Report with One Year Follow-up. Int J Clin Pediatr Dent. 2013;6(2):109–114.
13. Baert AL, Knauth M. Imaging of Bone Tumors and Tumor-Like Lesions. Berlin: Springer; 2009. p.337, 637.
14. Lisa J. Koenig, BChD, DDS M. Diagnostic Imaging Oral and Maxillofacial. 2nd Ed. Philadelphia: Elsevier Inc; 2017.p. 425, 436, 470.
15. Imanimoghaddam M, Langaroody AJ, Nemati S, Azimi SA. Simple bone cyst of the mandible: Report of two cases. Iran J Radiol. 2011;8(1):43-46. Available from: http://journals.tums.ac.ir/upload_files/pdf/18534.pdf%5Cnhttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed10&NEWS=N&AN=2011406159
16. Bharatha A, Pharoah MJ, Lee L, Abop D, Tay KY, Glasg M, et al. Pictorial Essay : Cysts and Cyst-like Lesions of the Jaws. Can Assoc Radiol J [Internet]. 2010;61(3):133–43. Available from: http://dx.doi.org/10.1016/j.carj.2010.01.001
17. Avril L, Lombardi T, Ailianou A, Burkhardt K, Varoquaux A, Scolozzi P, et al. Radiolucent lesions of the mandible: A pattern-based approach to diagnosis. Insights Imaging. 2014;5(1):85–101.
18. J. Sean Hubar, DMD M. Fundamentals of Oral and Maxillofacial Radiology. USA: Blackwell; 2017. p.207-212.
19. Constantine S. A Study of Lucent Jaw Lesions - 2nd Edition Benign Lucent Tumours. Dent Insights Mag. 2012.p.11–15.
20. Jawaid M. Odontogenic Myxoma of the Mandible : A Rare Case Report. J Dent Sci Oral Rehabil. 2016;7(3):142–145.
21. Gohel A, Villa A, Sakai O. Benign Jaw Lesions. Dent Clin North Am [Internet]. 2016;60(1):125–141. Available from: http://dx.doi.org/10.1016/j.cden.2015.08.005
22. Gadda RB, Patil N, Salvi R. Multilocular Radiolucency in the Body of Mandible : A Systematic Diagnostic Approach. J Contemp Dent. 2012;2(2):39–42.