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Review Article

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RADIOGRAPHIC INTERPRETATION OF SHADOWGRAPH

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ABSTRACT

The radiographic recognition of a disease requires superior radiographic appearance of normal anatomy. The art of interpreting a radiograph for exhibiting the final diagnosis of jaw lesions become difficult due to their ability to mimic each other in a vague fashion. A clinician should have thorough knowledge not only on the principles of radiographic interpretation such as location, periphery and shape, internal structure, effect on surrounding structures and periosteal reactions, but also on its clinical implications. This is a review on principles of radiographic interpretation which will help a clinician in narrowing his differential diagnosis on reading a radiograph of head and neck region.

KEYWORDS: Radiograph, radiographic interpretation, principles, clinical diagnosis, periosteal reactions.

INTRODUCTION

A radiograph mainly consists of two shadows, one of which is black (radiolucent) and the other white (radiopaque).[1] Radiolucency is a result of resorption of mineralized tissue or decrease in thickness where as radiopacity is due to an increase in mineralization, increase in thickness, superimposition on some other structures or a result of calcification in soft tissues.[2] The interpretation of these shadows on a radiograph has been explained on a clinical basis constituted by the following criteria: (1) location (2) periphery and shape (3) internal structure (4) effect on surrounding structures and (5) periosteal reactions.[3, 4]

INTERPRETATION

Radiolucent and radiopaque lesions can occur in periapical, inter-radicular, edentulous, or pericoronal location. A radiolucent lesion can even occur as alveolar bone loss.[5] The location of the epicenter of periapical inflammatory lesions is at the apex of the tooth and periodontal lesions at the alveolar crest.[6]

The most common bilateral lesions are cherubism, Paget's disease [PD], odontogenic keratocyst [OKC] and florid osseous dysplasia [FOD]. Whereas fibrous dysplasia [FD] is the most common unilateral lesion found in maxillary posterior region. The lesions crossing midline include central giant cell granuloma [CGG], periapical abscess, radicular cyst, and OKC. The lesions most commonly occurring in the maxillary anterior region are radicular cyst and glandular odontogenic cyst [GOC], and are mostly associated with incisors and canines. The dentigerous cyst, compound odontome and adenomatoid odontogenic tumor [AOT] are mostly associated with unerupted maxillary canine. Mandibular anterior region bears lateral periodontal cyst [LPC], periapical cemental dysplasia [PCD], Gorlin cyst and CGG as the most common ones. The lesions common in posterior mandible are osteomyelitis, OKC (body of mandible); dentigerous cyst (unerupted third molar); Pindborg tumor (unerupted or impacted premolar, molar); residual cyst (molars); traumatic bone cyst [TBC] (ramus); ameloblastoma and aneurismal bone cyst [ABC] (molar and ramus); complex odontomas (first and second molar); odontogenic myxoma and cemento ossifying fibroma [COF] (premolar and molar); central hemangioma [CH] (posterior body, ramus, within inferior alveolar canal).[2, 3, 4, 5]

Periphery or the boundary of lesion constitute a broad classification as ill-defined, well-defined with corticated margins and well-defined with sclerotic margins. An ill-defined (diffuse, irregular, moth-eaten, ragged) periphery is suggestive of a lesion enlarging by invading the surrounding bone. A well-defined (circumscribed) periphery with corticated margins is suggestive of a self-contained lesion enlarging by expansion. A well-defined periphery with a hyperostotic (sclerotic) radiopaque margin is suggestive of an extremely slow-growing self-contained lesion enlarging by expansion. Apart from this vivid classification, the punched-out periphery is a characteristic feature of multiple myeloma seen only when tumor destruction extends to the surface of the bone and there is often no new bone laid down. And another example is fibrous healing defect, where the bone surrounding a lesion does not show any change with the clinical interpretation of static lesion.[7, 8]

The shape of a lesion should never be confused with periphery as the shape is only the form in which lesion occurs. Most of malignant lesions show cupped-out shape where as TBC and primordial cyst had got unique scalloped shape or the outline.[3, 4]

Relative to the surrounding tissues, the radiodensity of the lesion could be uniformly radiolucent, radiolucent with patchy opacities within (mixed) and radiopaque.[2] [Figure 1, 2, 3, 4]. Some benign lesions like ameloblastoma occurs in many forms such as unilocular radiolucency resembling a cyst, spider-web pattern, soap-bubble pattern , or a 'multi-chambered' or 'multi-cystic bunch of grapes' appearance. Other examples with similar pattern are OKC, CGG, CH and Botryoid odontogenic cyst. 'Honeycomb' or 'solid pattern' or 'beehive pattern' are seen in tumors that have not undergone cystic degeneration such as OKC, ameloblastoma, Pindborg tumor, CH and CGG. [4, 9] Angular compartments resulting from development of straight septa of bony trabeculae in radiolucent region gives rise to 'tennis racket appearance', a pathognomonic feature of odontogenic myxoma. [3] Mixed radiolucent-radiopaque lesions can be due to inflammation, metabolic anomalies, fibro-osseous conditions, or less commonly, malignant processes. [1,10, 11] The examples include, 'spoke-wheel', 'wagon-wheel', 'corduroy' or 'sunburst' appearance of CH , 'wind-driven snow appearance' of Pindborg tumor, typical 'target appearance' of AOT, 'cotton wool appearance' of FD, FCOD and PD, 'peud-orange or orange-peel appearance' or 'ground glass or granular appearance' of FD. [1] Even developmental anomalies can mimic distinct radiographic appearance such as 'heart shaped appearance' of Nasopalatine cyst and 'Inverted tear or pear shaped radiolucent appearance' of intra-alveolar cyst.[3]

Evaluating the effect of a lesion on the surrounding structure helps in inferring behavior of the lesion. Slow-growing lesions often cause expansion with cortical bowing, while cortical destruction denotes aggressive inflammatory or neoplastic lesions.[11] In periapical inflammatory lesions the lamina dura around the apex of the tooth is lost. Apical region of the root undergo external resorption. Cysts cause displacement and sharp, curved shape resorption of teeth. Cysts may displace the inferior alveolar nerve canal in an inferior direction. A benign tumor exerts pressure on neighboring structures, resulting in the slow displacement of teeth or bony cortices as it grows. Benign tumors tend to resorb the adjacent root surfaces in a smooth fashion where as malignant tumors results in thinning of the root into a 'spiked' shape. Bone dysplasias do not cause root resorption. When the hemangioma involves soft tissue, the formation of phlebolith may occur within surrounding soft tissues. Rapidly growing malignant lesions generally destroy supporting alveolar bone so that teeth appear to be floating in space as in osteomyelitis. In FD, inferior dental canal is displaced in superior direction.[3]

Periosteal reaction [PR] observed radiologically represents either periosteal new bone formation or periosteal elevation secondary to cortical extension of tumor or infection. PR can be broadly classified based on radiographic appearances as lamellated (linear-single or multiple), solid, spiculated, Codman's triangle and expanded shell. [Table 1][12, 13, 14] Although the presence of PR is non-specific, the spectrum of appearances relates to the degree of intensity, aggression and duration of the underlying insult.[14]

Table 1: Periosteal reactions.

S. N.	Periosteal reactions	Lesions
1.	Linear-single	Fracture Healing, Osteomyelitis, Langerhans Cell Histiocytosis, Ewing's Sarcoma, and Osteosarcoma.
2.	Multilayered	Ewing's sarcoma, osteosarcoma, and osteomyelitis.
3.	Solid	osteomyelitis, LCH, chondroblastoma and healing fractures
4.	Spiculated	Ewings sarcoma, osteosarcoma, neuroblastoma
5.	Codman's triangle'	Osteo sarcoma, osteomyelitis

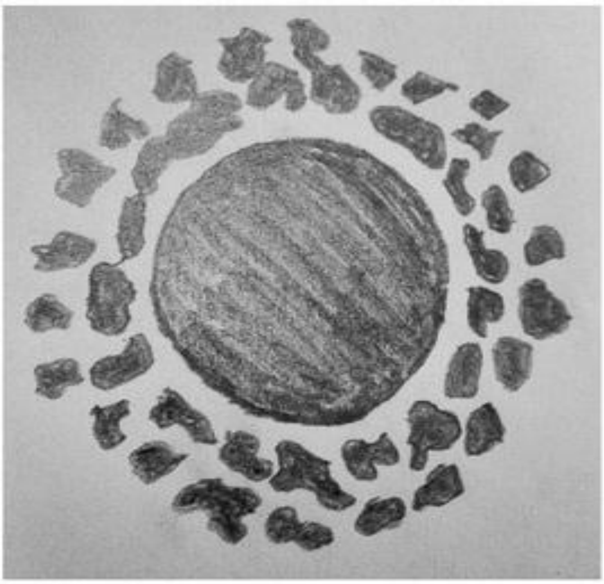

Figure 1: Unilocular radiolucency with corticated margins

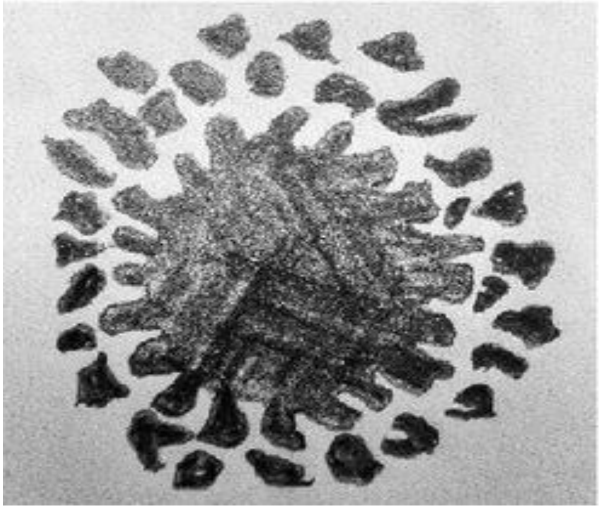

Figure 2: Unilocular radiolucency with non-corticated margins

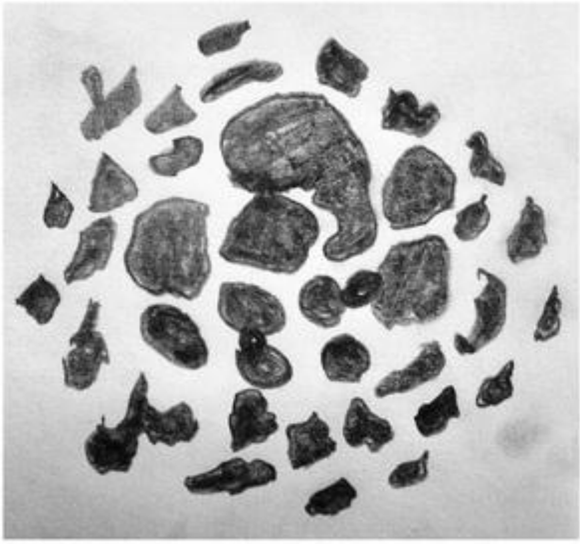

Figure 3: Multilocular radiolucent appearance

Figure 4: Mixed lesions

CONCLUSION

Radiographs are means of communication between a pathology and radio diagnostician. A vivid knowledge on the commonest occurrence sites, outline, nature and behavior of a jaw lesion counts as a sharp diagnostic tool possessed by a dentist. As Aristotle said "the only good is knowledge and the only evil is ignorance".

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