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ENDODONTIC VS NON-ENDODONTIC PERIAPICAL LESIONS: UNMASKING THE IMITATORS

Endodontics

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ABSTRACT

Periapical lesions are often attributed to endodontic pathology, but a range of non-endodontic lesions can present with similar clinical and radiographic features, posing a diagnostic challenge for the clinicians. This article reviews the diverse spectrum of non-endodontic periapical lesions, including benign and malignant entities, and emphasizes the importance of a meticulous diagnostic approach, incorporating clinical, radiographic, and histopathological evaluation, to ensure accurate diagnosis and optimal treatment outcomes.

KEYWORDS

Periapical lesion; Endodontic lesion; Non-Endodontic lesion; Diagnosis; Radiolucent

1. INTRODUCTION

Endodontic periapical lesions typically develop as a consequence of pulpal infection and necrosis, triggering inflammatory responses, host defense mechanism, leading to osteolytic changes in periapical area. Most periapical radiolucent lesions are caused by necrosis of pulp tissue (Biladeau & Collins et al 2017, Huang et al 2017). However, not all radiolucent lesions in the periapical region are of endodontic origin. Non-endodontic lesions may mimic true endodontic periapical pathology, leading to misdiagnosis and unnecessary or failed endodontic treatment, posing a diagnostic challenge for endodontists. Inaccurate diagnosis of non-endodontic periapical lesions as endodontic periapical lesions have been previously reported and some are the cause of treatment failure. Identifying and differentiating these lesions is crucial to develop effective treatment strategies.(1)

2. Endodontic V/S Non Endodontic Periapical Lesions

- **Endodontic Periapical Lesions**
- Generally associated with pulpal necrosis or infection, caries or large restorations, tenderness to percussion, radiolucency centered at the root apex, loss of lamina dura and widening of periodontal ligament.
- Caused by microbial invasion of the pulp chamber.
- Often treated with root canal therapy or endodontic surgery.
- **Diagnostic Criteria For Endodontic Periapical Lesions Involves:** clinical history and signs/symptoms, pulp sensibility/ vitality testing (cold test, electric pulp test (EPT), pulse oximetry, laser dopler flowmetry), percussion and palpation tests, radiographic evaluation (periapical, panoramic and cone beam computed tomography (CBCT)) etc.
- If the pulp is vital or there is no apparent cause of pulpal necrosis or pathosis, non-endodontic origins must be considered.

- **Non-Endodontic Periapical Lesions**
- Not related to pulpal necrosis or infection.
- Can be caused by various factors, such as developmental anomalies, benign or malignant tumors, or metastatic lesions.
- May require different treatment approaches, including surgical excision, medication, or more aggressive interventions.

3. Tools For Diagnosing Periapical Lesions (1)

Intra-oral periapical (IOPA) radiographs, Orthopantomogram (OPG) and CBCT are vital diagnostic tools in endodontics, providing additional information for accurate diagnosis and treatment planning. Periapical radiographs are only 26-48% accurate in diagnosing periapical lesion. Notably, CBCT scans offer a more precise method for differentiating solid from fluid-filled periapical lesions compared to conventional IOPA radiographs, enhancing diagnostic precision (2). Kanneppady et al reported CBCT to have 96% of senstivity in identifying the periapical lesions (1). Ultrasonography (USG), with diagnostic accuracy of 95.2% compared to CBCT (Karamifar et al), can differentiate between cystic and solid structures of jaw lesions and provide correct information about the contents of intra-bony lesions in jaws (3). In another study by Kumar N et al 2021 reported that magnetic resonance imaging (MRI) is less accurate with diagnostic accuracy of 72% than CBCT imaging for differntiating periapical lesions. So a combination of these modalities is indicated for diagnosis of complex periapical pathosis. Other modalities icluding micro–computed tomographic imaging (micro-CT), and histology (gold standard but more invasive) can also be used depending upon the type and extent of lesion (4,5). Gbadebo et al reported histopathology to have 100% sensitivity and specificity compared to conventional radiographs (2).

4. Non Endodontic Periapical Lesions (6)

I. Non- Neoplastic

A) **Inflammatory Lesions:** Reactional Osteogenesis, Osteomyelitis
B) **Non Inflammatory Lesions:** Osseous Dysplasia, Cemento-osseous Dysplasia, Fibrous Dysplasia

II. Neoplastic

A) **Benign Neoplastic Lesions:** Cementoblastoma, Odontoma, Ameloblastoma, Central ossifying fibroma , Lymphoma, Cemental dysplasia
B) **Malignant Neoplastic Lesions:** Osteosarcoma , Metastatic carcinoma

III. Metabolism Related Lesions

Renal osteodystrophy

IV. Cysts

A) **Developmental Cysts**: Nasopalatine duct cyst(NPDC), Median palatine cyst, Lateral Periodontal cyst
B) **Odontogenic Cysts:** Odontogenic keratocyst (OKC), Dentigerous cyst (DC)
C) **Inflammatory Cyst:** Radicular cyst

Table I: These Lesions Can Be Classified On Basis Of Radiographic Features, As Discussed Below:

RADIOPAQUE	RADIOLUCENT	MIXED
• Reactional osteogenesis • Odontoma • Cementoblastoma	• Ameloblastoma • Lymphoma • OKC • Radicular cyst • Lateral periodontal cyst • Dentigerous cyst • Nasopalatine cyst	• Cemento ossseous dysplasia • Osteomyelitis • Fibrous dysplasia • Central ossifying fibroma • osteosarcoma

5. DISCUSSION

A thorough review of a patient's medical and dental histories, combined with clinical evaluation and specific radiographic findings, is crucial for accurate diagnosis and can help prevent diagnostic uncertainty, ultimately dimnishing the potential for misdiagnosis and ensuring succesful treatment.(7) Various radiographic modalities to aid in diagnosis include IOPA, OPG, CBCT, micro-CT, MRI and Occlusal radiography. On clinical examination a negative EPT result, combined with a deep carious lesion, suggests that the lesion is likely of endodontic origin, establishing the diagnosis. If a positive response is exhibited to the vitality test, despite having swelling and associated pain, the non-endodontic origin for the lesion should be considered in the differential diagnosis (7,8,9). A retrospective study reported that 4.22% of periapical lesions were of non endodontic origin, with 34.9% of the lesions being OKC, 15.6% being DCs, and 9.15% being NPDCs (10).

Another study reported that non-endodontic periapical lesions constituted 10.03% of cases clinically diagnosed as endodontic periapical lesions (11). A study by Tsesis et al. 2020 found that non-endodontic cysts were correctly diagnosed clinically in only 41.7% of cases when compared to histologic findings, highlighting the need to be familiar with periapical lesions of non-endodontic origin to ensure accurate treatment and prognostic outcomes (12).

A study reported that the most commonly reported non malignant nonperiapical lesions (NMNPLs) were OKC, DC, NPDC, ameloblastoma, and Adenomatoid Odontogenic Tumors (AOT), in the descending order. When a periapical lesion exhibits an aggressive nature or abnormally large size, OKC must be considered in the differential diagnosis. Since DCs are found in relation to unerupted or impacted teeth, these are relatively easier to diagnose and differentiate from endodontic lesions. It was also reported that approximately 70% of AOT exhibit small radiopacities within the radiolucency, which can help differentiate AOTs from periapical lesions of endodontic origin. A cyst or tumor of nonendodontic origin expanding in the periapical region of a tooth may severe off the blood supply to the associated tooth, leading to loss of its vitality and misdiagnosis of the periapical lesion (13). Integrating clinical examination, imaging and pulp testing can be valuable in differentiating these lesions from endodontic periapical lesions. (14)

Pathognomic feature of unicystic ameloblastoma is unilocular radiolucency. Thus, it mimics endodontic periapical lesion. A combination of clinical, radiographic and histological evaluation is crucial for differntiation. Metastatic carcinoma, a radiographically evident, well-defined unilocular radiolucency near two teeth apices suggests an endodontic periapical lesion (11). However, the patient's significant weight loss and enlarged lymph nodes are atypical for such lesions, highlighting the importance of considering comprehensive patient history and extraoral examination findings to ensure an accurate diagnosis. To differentiate nasopalatine cysts from inflammatory periapical lesions and other cysts in the anterior maxilla, vitality testing should be conducted and correlated with radiographic findings. However, a definitive diagnosis can only be established through histological examination.

Endodontic lesions typically present as radiolucent images with well-defined borders in chronic cases and diffuse borders in acute cases, often with lamina dura disruption. In contrast, malignant lesions exhibit distinct features, such as diffuse radiolucency, widened periodontal ligament space, moth-eaten radiolucencies, or irregular radiopacities, and may display aggressive characteristics like cortical disruption, soft tissue infiltration, or Codman triangle formation, indicating a non-endodontic origin. The presence of a characteristic sun-ray appearance due to periosteal reaction, often visible on occlusal radiographs, and irregular root resorption resulting in "floating teeth" are indicative of aggressive lesions, suggesting a non-endodontic origin and ruling out a typical endodontic lesion(7).

When a lesion develops away from the apex, preservation of the lamina dura and presence of radiopacity on radiographs suggest a non-endodontic origin, while endodontic lesions typically lack mixed radiographic aspects and usually involve lamina dura disruption. A positive pulp vitality test further supports a non-endodontic origin, helping to rule out endodontic lesions. For radiolucent lesions associated with tooth roots and having a moderate to large diameter, aspiration is recommended as a diagnostic step(7).

A successful endodontic treatment can resolve symptoms and promote bone repair, but if diagnostic indicators point to a non-endodontic origin, biopsy and histopathological analysis are crucial. Notably, there's a lack of research on dental practitioners' knowledge, attitudes, and practices regarding non-endodontic lesions, highlighting the need for increased awareness to prevent misdiagnosis and inefficient treatment (7,10).

Table II:- Represents Differentiating Features Of Non-endodontic Lesions From Endodontic Periapical Lesions

LESION	LOCATION	AGE/ GENDER/ PREVALANCE	RADIO-GRAPHIC FEATURE	DIFFEREN-CIATING FEATURE	HOW TO DIIFFEREN-TIATE	TREATMENT PLAN
Reactional osteogenesis	Maxillary sinus associated with apex of infected molar	5^{th} – 7^{th} decade / F>M/ 60.5%	Radiopaque lesion Localized, well defined Irregular, round , ovoid	Radiolucent	-Dental history -Advanced radiographic modalities -Histological examination	RCT/ surgical treatment
Osteomyelitis	Posterior mandible	Younger childrен/ M>F/ 2%	In chronic stages, multiple abscesses may appear Ill defined, diffused border Loss of trabecular architecture	Well defined borders	-Dental history -Advanced radio graphic modalities -Histological examination	Surgical removal Hyperbaric oxygen therapy
Cemento-osseous dysplasia	Mandible > Maxilla	Middle age/ F>M/ 1%	Radiolucent or mixed Well defined radiolucent rim around radiopaque areas	Radiolucent	-Dental history -Advanced radiographic modalities -Histological examination	Surgical curettage Sequestrectomy Radical surgery
Fibrous dysplasia	Posterior mandible	3-15 yrs/ M=F/ 5% of all benign bone lesions	Radiolucent, radiopaque or mixed Ground glass appearance	Radiolucent with well defined border	-Dental history -Advanced radiographic modalities -Histological examination	Cosmetic recontouring surgery
Cementoblastoma	Mandible > Maxilla	10-72 yrs (mostly < 20)/ M=F/ <1% of all odontogenic tumours	Tumour mass attached to root Well defined radiopaque with peripheral radiolucent zone Root resorption	Radiolucent	-Dental history -Advanced radiographic modalities -Histological examination	Surgical excision Enucleation
Odontoma	Compound – Anterior Maxilla Complex- Posterior Mandible	Childrен and adolescent/ M=F / 35-76%(most common odontogenic tumour)	Dense radiopaque lesion surrounded by thin radiolucent zone Complex- appear as disorganized mass of calcified tissues	Radiolucent	-Dental history -Advanced radiographic modalities -Histological examination	Surgical excision

Ameloblastoma	Molar-angle ramus area(posterior mandible)	20-60 yrs/ M=F/ 1% (out of 9% of odontogenic tumours)	Well circumscribed radiolucent Unilocular/ multilocular Root resorption, Soap bubble appearance	Radiolucent with well defined border	-Dental history -Advanced radiographic modalities -Histological examination	Surgical resection Enucleation
Central ossifying fibroma	Mandible > maxilla	Young adults/ F>M/ 70-90%	Unilocular lesion containg variable amounts of radiopaque material	Radiolucent with no radiopaque material	-Dental history -Advanced radiographic modalities -Histological examination	Enucleation Surgical removal
Lymphoma	Gingiva, palate, mandible	>50 yrs/ M>F/ 5% of malignancy	Radiolucent, cortical bone destruction	No cortical bone destruction	-Dental history -Advanced radiographic modalities-Histological examination	Chemotherapy Immunotherapy
Osteosarcoma	Mandible > maxilla	10-25 yrs/ M>F/ 2.4%	Undefined periapical osteolytic lesion Hypodense lesion with hyperdense area inside Thinning of lingual cortical plate	Well defined No thinning of lingual cortical plate	-Dental history -Advanced radiographic modalities -Histological examination	Surgery Chemotherapy
Odontogenic Keratocyst (OKC)	Mandible (third molar region)	20-30 yrs/ M>F/ 5-15% of odontogenic cyst	presents as unilocular with smooth or scalloped borders or multilocular radiolucency bucco-lingual bone expansion	Unilocular Radiolucency No bucco-lingual bone expansion	-Dental history -Advanced radiographic modalities -Histological examination - vitality test	Endodontic treatment along with surgical enucleation and currettage
Radicular cyst	Maxillary anterior	20-60 yrs/ M>F/ 6-58%	round or pear-shaped unilocular radiolucent lesions may displace adjacent teeth or cause mild root resorption	Well defined radiolucent lesions, mostly associated with non-vital teeth	-Dental history -Advanced radiographic modalities -Histological examination - vitality test	Non surgical – RCT Surgical-apicoectomy
Dentigerous cyst	Maxillary and mandibular third molar region (associated with impacted teeth)	2nd -3rd decade / M>F/ 20% of all jaw cyst	unilocular well defined pericoronal radiolucencies centred on an impacted or unerupted tooth. They have a thin regular sclerotic	Not associated with impacted teeth	-Dental history -Advanced radiographic modalities -Histological examination - vitality test	Enucleation, marsupilization,decompression
			margin and expand the overlying cortex with out cortical breach			
Nasopalatine duct cyst	Anterior Maxilla (at midline)	40-60 yrs/ M>F/ 1% of all maxillary cyst	well-defined and apical to the central incisors on radiographs and has the appearance of a radiolucent shaped heart due to the superimposition of the anterior nasal spine.	It's not heart shaped Not always associated with central incisors	-Dental history -Advanced radiographic modalities -Histological examination - vitality test	Enucleation, currettage
Lateral periodontal cyst	Mandibular premolar/ canine/ incisor region	Adults / M>F/ <1%	Radiolucent originate in the periodontal ligaments adjacent to the roots of certain teeth	At apex of root	-Dental history -Advanced radiographic modalities -Histological examination - vitality test	Enucleation

6. CONCLUSION -

In light of present evidence it can be noted that periapical radiolucent lesions are not always a consequence of pulpal necrosis. Endodontists should be well-versed in diagnosing periapical lesions, appreciating the differences between endodontic and non-endodontic types to ensure proper treatment planning and better patient outcomes.

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