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Incidence and Clinicopathological Correlation of Periapical Granulomas Associated with Extracted Teeth in Jeddah, Saudi Arabia

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Abstract

Objectives: study the incidence and clinicopathological correlation, focusing on the histologic diagnosis of periapical granulomas associated with extracted teeth. **Methods:** Over the course of one year, a prospective study was conducted involving the routine biopsy of retrievable periapical tissues from patients undergoing tooth extraction. Additionally, routine histopathologic examinations were performed on recoverable Periapical tissues from the extracted teeth. The study involved the participation of 120 patients, of whom 52 (43.33%) were diagnosed with histopathological peri-radicular lesions. **Findings:** The male-to-female incidence ratio was 2:1, and most of the patients with lesions identified by histopathology were in their first, second, or third decades of life, comprising 41 (34%) cases. Among the 52 (43.33%) cases with histopathologically diagnosed periradicular lesions, the most common types were periapical abscess 8 (15.38%) and inflammatory (periapical) granuloma 27 (92%). Remarkably, clinically confirmed acute apical periodontitis was shown to be associated with periapical granuloma, which is primarily characterized by foamy cells and macrophages. Several clinical and radiologic features exhibited significant associations with the histopathologic diagnosis of specific periradicular lesions ($P < 0.05$). Furthermore, a significant correlation was observed between clinical diagnosis and histopathologic diagnosis, specifically for inflammatory (periapical) granuloma and periapical abscess. **Novelty:** The study strengthens the link between clinical presentation and histopathological characteristics of periapical granulomas. The study uncovers several clinical signs that could help predict the histopathological diagnosis of periapical granulomas. This is an important finding, as it could improve the accuracy of

diagnosis and help dental professionals identify these lesions earlier, which may lead to more effective and timely interventions.

Keywords: Periapical lesion; Extracted tooth; Periapical granuloma; Histopathology; Clinical diagnosis; Biopsy

1 Introduction

Peri-radicular lesions are a set of chronic inflammatory processes generally caused by microorganisms or their by-products.⁽¹⁾ There have been significant disputes over the importance of routine biopsy of peri radicular lesions. Few specimens of peri-radicular tissues undergo histopathological investigation.⁽²⁾ Examination is only required when the clinical diagnosis is uncertain, rather than as a routine biopsy to confirm the diagnosis.^(3,4) The most frequent periapical lesions are granulomas, cysts, and abscesses.^(4,5) Periapical granuloma (PG) is a chronic inflammatory lesion located near the apex of a non-vital tooth. It is composed of up of granulation tissue and scar tissue that is invaded by a variety of chronic inflammatory cells. This lesion differs from granulomatous inflammation in that it contains more macrophages (histiocytes) and multinucleated giant cells. During an acute flare of a periapical granuloma, there is extensive neutrophilic infiltration, as well as granulation tissue and chronic inflammatory cells.⁽⁶⁾ Histologically, clinically confirmed acute apical periodontitis can be classified as an acutely aggravated periapical granuloma, whereas a periapical abscess in the quiescent phase can evolve into a periapical granuloma.^(7–10)

The aim of the present study was to determine the incidence and clinicopathological correlation, focusing on the histologic diagnosis of periapical granulomas associated with extracted teeth, as well as to identify potential clinical indicators for histopathologic examination of peri radicular lesions to confirm clinical diagnosis.

2 Methodology

This was a one-year prospective study involving patients who had single tooth extractions with routine histopathological examination of recoverable peri-radicular tissues from the extracted teeth at the Department of Oral and Maxillofacial Surgery, Ibn Sina College of Medical Science, Jeddah, Saudi Arabia, as well as other private dental clinics and hospitals.

We received approval from the institute's ethics committee (H-21-11072019) to conduct the study and acquired written informed consent from the patients for the biopsy of the samples. The study included individuals with clinically apparent or suspected periapical lesions involving non-vital teeth (measured with an electric pulp tester) and preoperative periapical radiological abnormalities. Patients who underwent endodontic surgical therapy, had periapical tissues removed during a histological investigation, and had teeth removed from their sockets without any recoverable soft tissue following curettage were not included in the study. Based on a tentative diagnosis established during a history, clinical examination, and radiographic examinations, teeth were extracted.

Under local anesthesia, teeth were extracted by either the trans alveolar approach or a forceps delivery. Soft tissue samples obtained attached to the teeth, along with those excised and then preserved in 10% formalin, were sent to our pathology department for histopathologic analysis. Each patient provided pertinent information that was recorded using a standardized questionnaire.

A microscopical histological examination at low ($\times 10$) and high power ($\times 40$) magnifications led to the diagnosis of periapical granuloma. Using Pearson's correlation coefficient, statistical testing was done to determine how strongly the clinical diagnoses, and the histological appearance of the periapical granuloma correlated. 95% was the

threshold for significance in terms of confidence, and $P < 0.05$ was the threshold for probability values (P-values).

3 Results and Discussion

The study offers significant insights into the clinical, radiological, and histological features of periradicular lesions, with particular emphasis on the incidence of periapical granulomas and abscesses. The study included 120 patients, with 52 (43.33%) having histopathologically identified peri radicular lesions. There were 27 (51.92%) cases of periapical granuloma, with 34 males and 18 females, resulting in a male to female ratio of 2:1. The lesion appeared predominantly during the second, third, and fourth decades of life, 41 (78.86%) (Table 1). The most prevalent clinical symptoms were tooth pain and face swelling with lymphadenopathy, 75 (62.5%) (Table 2). Molar teeth were primarily affected with periapical lesion (Table 3). The histopathologic diagnoses of periapical abscess and inflammatory granuloma ($P < 0.05$) were the only ones exclusively related with carious tooth and submandibular lymphadenopathy, as well as fractured or loose teeth, according to the association of clinical and radiologic features with histopathologic diagnosis. The correlation between the histopathologic diagnosis of periapical granuloma, which is an inflammatory condition, and acute apical periodontitis was found to be significantly linked. ($P < 0.05$). The histopathologic diagnosis of periapical abscess was significantly correlated with the clinically diagnosed dentoalveolar abscess (Table 4). The most prevalent histological appearance of a periapical granuloma lesion is macrophages and lymphocytes 19 (15.83%) (Figure 1).

Table 1. Age and gender distribution of patients with histopathologically diagnosed Periradicular lesions

Age	Female	Male	Total	Percentage (n=120)
10-20	0	1	1	0.83
21-30	5	16	21	17.5
31-40	9	10	19	15.83
41-50	3	6	9	7.50
51-60	1	1	2	1.66
	18	34	52	43.33

Table 2. Clinical features of the Periradicular lesions

Clinical features	Frequency	Percentage
Tooth pain and facial swelling	75	62.5
Discoloration of tooth	2	1.66
Fractured tooth	5	4.16
Mobile tooth	2	1.66
Retained root	8	6.66
Carious tooth	28	23.33
Total Cases	120	100

Table 3. Types of teeth associated with the periradicular lesions

Tooth	Frequency	Percentage
Permanent first molar	32	26.66
Permanent second molar	21	17.5
Permanent third molar	11	9.16
Permanent central incisor	5	4.16
Permanent lateral incisor	2	1.66
Permanent canine incisor	1	0.83
	72	60

⁽⁵⁻⁷⁾ Histopathology revealed a link between acute apical periodontitis and periapical granuloma, primarily composed of foamy macrophages and lymphocytes ($P < 0.05$). Prior research has also indicated that periapical granulomas predominantly occur in young people, with a small male predominance, reflecting the gender pattern seen in this study.^(7,8)

Table 4. Clinocopathological co-relation of Periradicular lesion

Clinical Diagnosis	Associated Presenting Complaint	Associated Sign/Radiologic Findings	Clinical	Histopathologic	Diagnosis
Dentoalveolar abscess	Toothache Facial swelling	Carious tooth		Periapical abscess	
Acute apical periodontitis	Fractured and mobile tooth, Facial swelling, Toothache	Nonspecific Periapical radiolucency		Inflammatory granu- loma	
Periapical lesion	Carious tooth	Anterior teeth Radiolucency around the apex		Periapical cyst	
Non-specific lesion	Mobile tooth and retained root	-		Non-specific Inflammatory lesion	

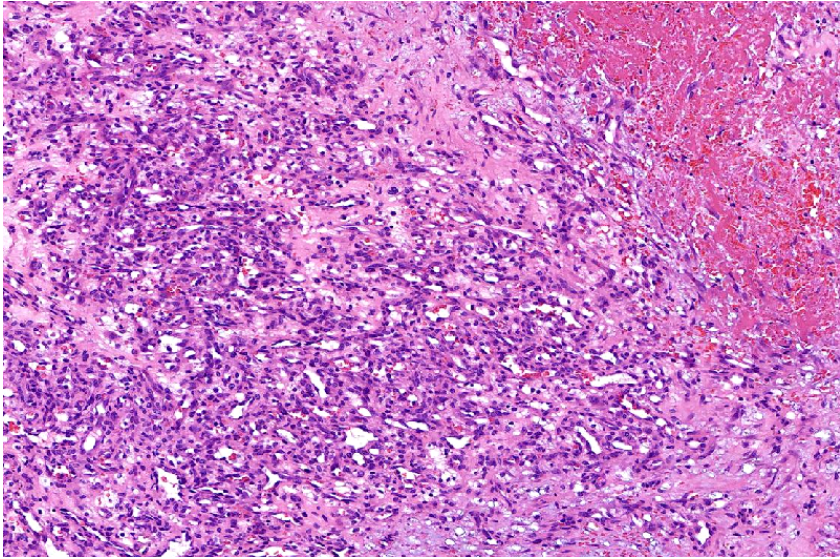


Fig 1. Periapical granuloma with prominent lymphocytes and blood vessels [H and E, ×40]

The study provides a fresh insight into the correlation between the histological diagnosis of periapical granuloma and acute apical periodontitis, which is statistically significant ($P < 0.05$). Previous studies have indicated correlations between these disorders; however, the intricate histopathologic findings, particularly the prevalence of foamy macrophages and lymphocytes (15.83%), offer a more nuanced comprehension of the inflammatory process at the cellular level.^(9–11) The study identified a substantial correlation between clinically diagnosed periapical abscesses and dentoalveolar abscesses, therefore enhancing the understanding of the diagnostic criteria for both disorders. This study underscores the significance of integrating clinical, radiographic, and histopathological characteristics for enhanced diagnostic accuracy and treatment strategy formulation. The emphasis on molar teeth being most impacted aligns with previous research, which has underscored the tendency for posterior teeth to be implicated in periapical lesions due to their anatomical positioning and vulnerability to carious lesions. This study uniquely correlates clinical variables such as tooth pain, facial oedema, and lymphadenopathy with histological findings, highlighting the significance of these symptoms in early diagnosis. This research reinforces the notion that clinical signs, particularly lymphadenopathy, must not be disregarded in diagnosing periapical granulomas and abscesses, despite prior investigations identifying comparable symptoms.^(9,12)

The clinical diagnosis plays a major role in determining the diagnostic standard for peri apical lesions. The Occasionally, a biopsy may be helpful in confirming the diagnosis if the clinical diagnosis is unclear.^(1–5) Current research has attempted to evaluate the occurrence of PG in routinely extracted teeth and to correlate clinicopathological findings with histologic diagnoses. Current research was based on routine biopsy of recovered peri radicular tissue from an extracted tooth, with the exception of patients who had history of endodontic surgery, as these patients have been extensively studied.

In this study, males were more likely to develop peri radicular lesions. The most common lesions were periapical abscess and inflammatory granuloma, which occurred in patients in their first, second, and third decades of life. Also, it was more common in men than in women. This appears to indicate a high rate of diagnosing peri radicular lesions in young adult males.

In contrast to earlier research that suggested a low contributory proportion (0.7% to 5.0%) of histopathologic results from selected periapical biopsies, this study found a much greater contributory percentage (34.16%) of histopathologic diagnoses following routine biopsies.^(1,5)

The presence of periapical pathosis was assessed through direct visualization of the root apices (Linenberg et al., 1964; Simon, 1980; Garrocho & Antonio Neto, 1984; Nair, 1987; Bohne, 1990; Nair et al., 1996). Radiographic examination was not performed prior to tooth extraction. It is important to note that the presence of a periapical radiolucency does not necessarily indicate periapical inflammation, as other factors such as apical scar tissue may also contribute (Nair et al., 1999). Additionally, a periapical inflammatory reaction of endodontic origin may be present without being visible on radiographs (Bender & Seltzer, 1961). Histopathologic investigation proved extremely effective in confirming the diagnosis and reducing the probability of misdiagnosis, especially for malignant peri radicular lesions, which are typically diagnosed histologically. We did not find any malignant lesions during our study.

This investigation also found many potential indicators for predicting the histopathologic diagnosis of various peri radicular lesions. Carious tooth and submandibular lymphadenopathy, as well as a clinical diagnosis of dentoalveolar abscess, indicate a high histological probability of periapical abscess. These findings are consistent with those reported before.^(1,5) fractured tooth, mobile tooth, and clinical diagnosis of acute apical periodontitis suggested a high index of diagnosing inflammatory granuloma histologically. Similarly, a previous report shows that an acute exacerbation of inflammatory (periapical) granuloma could present clinically as acute apical periodontitis.^(5,7) Surprisingly, no significant connection was found between carious tooth and histologic diagnosis of inflammatory granuloma in this investigation. The majority of carious lesions may have rapidly evolved into periapical abscesses, which may form an inflammatory (periapical) granuloma during the quiescent phase.

In this investigation, we found a substantial correlation between the clinical diagnostic of acute apical periodontitis and the histological diagnosis of periapical granuloma, which is composed primarily of foamy macrophages and lymphocytes. The finding contradicts previous reports that correlated an acute flare of periapical granuloma with significant neutrophilic infiltration, as well as chronic inflammatory cell infiltration within the granulation tissue.^(7,10) However, the study suggests that when a periapical lesion presents clinically to the dentist as acute apical periodontitis, the histopathological diagnosis of an acute flare of a periapical granuloma is more probable, whereas a clinical diagnosis of an abscess in the peri radicular region rarely indicates an acute flare of a periapical granuloma.

As a result, if the appropriate clinical signs are recognized, regular histopathologic investigation to confirm clinical diagnosis may not be required for both periapical abscess and inflammatory periapical granuloma, and there is very little risk of misinterpretation. To minimize misdiagnosis, we propose that a histopathologic investigation be performed when clinical indicators suggest malignant peri radicular lesions.

Notwithstanding the significant contributions of this study, various limitations may affect the generalisability and reliability of the results. The study's sample size of 120 patients may be insufficient to draw conclusive inferences about the wider community, and the reported prevalence of periapical granulomas of 51.92% may not accurately reflect different contexts or demographics. Moreover, the male-to-female ratio of 2:1, while aligning with previous research, may add bias, as it represents a sample from a specific cohort that may not be globally representative.

This investigation offers significant new insights into the correlation between histopathological diagnoses, radiological findings, and clinical symptoms in patients with periradicular lesions, with a particular emphasis on periapical granulomas. A significant contribution to the field is the novel identification of significant correlations between histopathological diagnoses and clinical features, such as acute apical periodontitis and dentoalveolar abscess. Nevertheless, it is important to take into account the study's constraints, such as the sample size and potential biases in histopathological analysis, when interpreting these results. Future research should endeavour to overcome these constraints by incorporating a broader, more diverse patient population and taking into account supplementary factors that may affect the development of lesions.

4 Conclusion

This study deals with the histologic diagnosis of periapical granulomas associated with extracted teeth. It found that the awareness of this isolation method is very poor among population in Jeddah city. Also, the majority of patients have no information about rubber dam. Hence, this study reiterates for the need to increase the awareness of importance of this beneficial method in order to accomplish long lasting successful results in all dental treatment. Further studies should be done over larger sample size across the kingdom of Saudi Arabia to increase the validity the study.

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