

Evaluation of Periapical Granuloma and Radicular Cyst Regarding the Age, Gender and The Lesion Size

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KEYWORDS

Periapical, Granuloma, Gender

ABSTRACT

Background: Apical periodontitis (AP) is a common infectious disease characterized by inflammation and bone destruction in the periapical tissues due to microbial infection in the dental pulp. AP is the most frequent inflammatory lesion related to teeth, distinguished by a direct pathway to the bone marrow without epithelial barriers if the dental pulp becomes necrotic and infected. Materials and methods: Thirty paraffin embedded tissue blocks of radicular neck resected samples of 18 preapical granulomas and 12 radicular cysts were processed histopathologically. Results: the mean patients' age was 34.37 ± 2.95 years; fifteen patients were aged below 30 years and 15 patients were equal or above 30 years. The mean lesions size was significantly higher among patients with radicular cysts than preapical granuloma (5.07 ± 1.35 vs. 0.94 ± 0.21 ; $p=0.048$). granulomas lesions were slightly higher among females in age group 30-39 years (25% vs. 10%), and the radicular cysts lesions were higher among females in all age group as compare to male patients. Conclusions: Lesions size was significantly higher among patients with radicular cysts than that of preapical granuloma. A peak incidence between the third and fourth decades of life and predominance among female

1. Introduction

The pyogenic granuloma is a reactive overgrowth of granulation tissue resulting from irritation (1). It may occur anywhere on the mucocutaneous surfaces but most commonly on the gingiva. The lesion is sessile or pedunculated, usually ulcerated, hemorrhagic, and compressible. Pyogenic granuloma grows rapidly in the initial stages, after which it becomes static and seldom grows larger than 1cm. in diameter (1). Periapical lesions resulting from necrotic dental pulp are among the most frequently occurring pathologies found in the alveolar bone, exposure of the dental pulp to bacteria and their by-products, acting as antigens, may elicit non specific inflammatory responses as well as specific immunological reactions in the periradicular tissues, and cause the formation of periapical lesion (2). It is believed that RC formation involves the proliferation of Malassez's epithelial rests and the formation of epithelial chains that grow and fuse into a three-dimensional spherical mass. The tissues trapped within this epithelial mass gradually degenerate due to the loss of blood and oxygen supply (hypoxia condition) and lead to the formation of the cystic cavity (3)

The etiopathogenic mechanisms of these lesions are still not well understood; however, the interaction between inflamed tissue and cellular components indicates the relevance of molecular pathways in their origin/development(4). The bone destruction in AP results from both microbial infection and the immune response (5). Factors like caries or coronal fracture expose dental pulp to microorganisms, inducing an inflammatory response leading to pulp necrosis. This spread of toxic products causes periapical lesions, characterized by inflammatory cell infiltration and cytokine production (5,6). Radicular cysts and periapical granulomas are common inflammatory lesions, particularly in the anterior maxilla (7,8).

Granulomas are aggregates of macrophages and other immune cells forming in response to persistent stimuli that cannot be eradicated by individual macrophages. They evolved as protective responses but are often pathological in infections and inflammatory diseases (9). Periapical granuloma (PG) comprises chronically inflamed granulation tissue and is the most common periapical lesion (10,11). Histologically, it includes granulation tissue with mixed inflammatory infiltrates, newly developed blood vessels, and nerve fibers (12). Bacterial toxins from necrotic pulp initiate local inflammatory responses, leading to the release of cytokines and bone destruction (13,14). Jaw bone cysts were initially described by Fauchard in 1728 as intra-osseous pathological cavities filled by fluids, semi-solid, or gaseous material, partially or completely covered with epithelial cells, and surrounded by a

capsule of connective tissue. When a cyst develops from odontogenic epithelial remnants, it is referred to as an odontogenic cyst (15). Histologically, these cysts are lined by nonkeratinized stratified squamous epithelium, often infiltrated with inflammatory cells (16). Macrophages play crucial roles in the immune response against chronic periapical lesions, participating in phagocytosis, inflammatory mediator production, and lesion repair. (17).

2. Methodology

The study performed on thirty formalin- fixed, paraffin-embedded blocks of 18 periapical granuloma and 12 radicular cyst which were retrieved from the archives of Oral Pathology laboratory, College of Dentistry-Baghdad University which were dated from the period 2012 to 2019. The clinicopathological information regarding age, gender, lesion size, were obtained from the case sheets presented with the lesions specimens. All tissue specimens, samples were fixed in 10% neutral formalin and processed in a routine paraffin blocks. Each formalin-fixed paraffin-embedded specimen had serial sections One section of four um thickness was mounted on clean glass slides for routine Hematoxylin and Eosin staining (H&E), from each block of the studied sample and the control group for histopathological re-examination. Other 3 sections of 4mm thickness were mounted on positively charged microscopic slides (AFCO), for immunohistochemical staining. Immunohistochemical specificity is consider positive when only immunohistochemical brown stain present in selective positive control tissue slides according to manufactures datasheets and absent in negative control tissue slides. For each tissue section, five fields selected to visualized and scored microscopically at 400X objective, then recorded the mean positive percentage for each case. All slides were scanned blindly by two pathologist.

Statistical analysis

The data analyzed using Statistical Package for Social Sciences (SPSS) version 25. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Independent t-test and Analysis of Variance (ANOVA) (two tailed) were used to compare the continuous variables accordingly. Receiver operating characteristic (ROC) curve analysis was used for prediction of differentiation preapical granuloma. A level of P - value less than 0.05 was considered significant.

Results and Discussion

Thirty patients were enrolled in the present cross sectional study; the results were expressed in mean plus minus standard error of the mean (Mean \pm SE). Seventeen patients (56.7%) were males and 13 patients (43.3%) were females, the mean patients' age was 34.37 ± 2.95 years; fifteen patients were aged bellow 30 years and 15 patients were equal or above 30 years. The mean lesions size was 2.67 ± 1.11 cm (Table 1).

Table 1: Baseline characteristics of patients enrolled in the present study

Parameters		Range	Mean \pm SE
Age (years)		16.0 – 75.0	34.37 ± 2.95
Lesions size (cm)		0.13 – 32.0	2.67 ± 1.11
Gender N. (%)	Males	17 (56.7 %)	
	females	13 (43.3 %)	

Age groups N. (%)	< 30 years	15 (50.0 %)
	≥ 30 years	15 (50.0 %)

SE: Standard Error; N: Number of patient

There were no significant differences between patients with granulomas and radicular cysts concerning mean ages (35.78 ± 3.93 vs. 32.25 ± 4.58 ; $p=0.567$) and their gender ($p=0.880$) as demonstrated in table 2

Table 2: Comparison of demographic features between patients with granulomas and radicular cysts

Demographic features		Granulomas lesion N.=18	Radicular cysts lesion N.=12	p value
Age (years) (Mean±SE)		35.78 ± 3.93	32.25 ± 4.58	0.567 T NS
Gender N. (%)	Male	10 (58.8 %)	7 (41.2 %)	0.880 C NS
	Female	8 (61.5 %)	5 (38.5 %)	

NS: Not significant ($p > 0.05$); T: Independent sample t test; C: Chi square

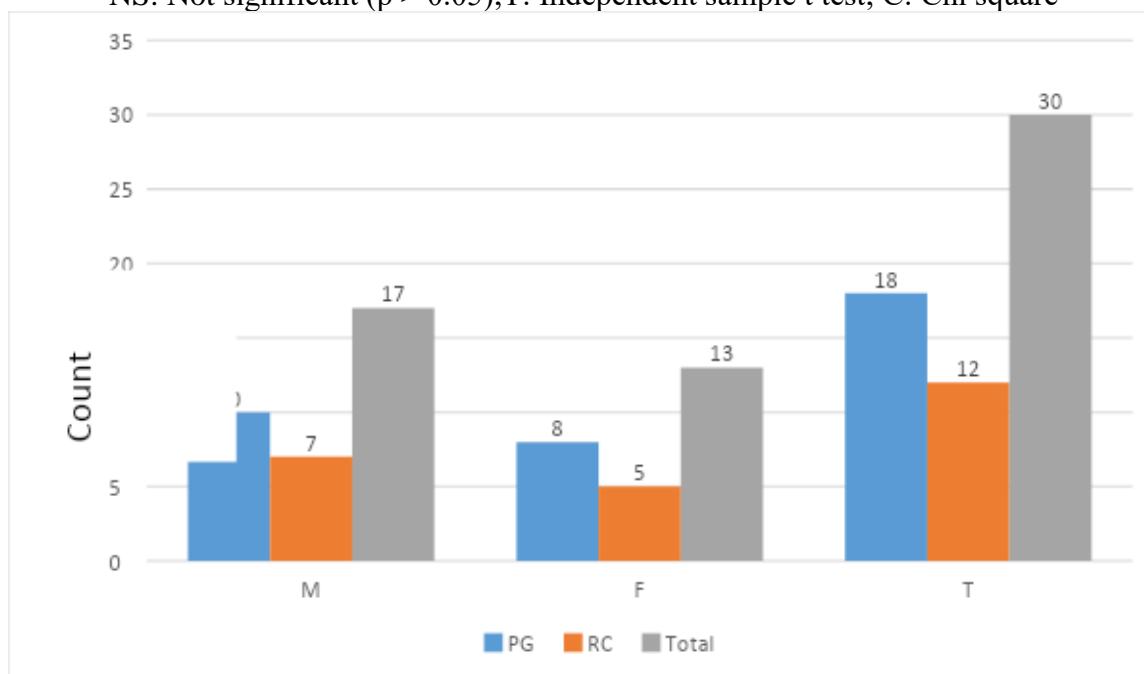


Figure 1: Comparison of demographic features between patients with granulomas and radicular cysts

Comparison of lesions size between granulomas and radicular cyst lesions

Lesions size was significantly higher among patients with radicular cysts (5.07 ± 1.35 vs. 0.94 ± 0.21 ; $p=0.048$) as presented in table 3.

Table 3: Comparison of lesion size between granulomas and radicular cyst lesions

Parameters (Mean \pm SE)	Granulomas lesion N.=18	Radicular cyst lesion N.=12	p value
Lesions size	0.94 ± 0.21	5.07 ± 1.35	0.048 F S

SE: Standard error; NS: Not significant ($p > 0.05$); S: Significant ($p \leq 0.05$); F: Independent sample t test

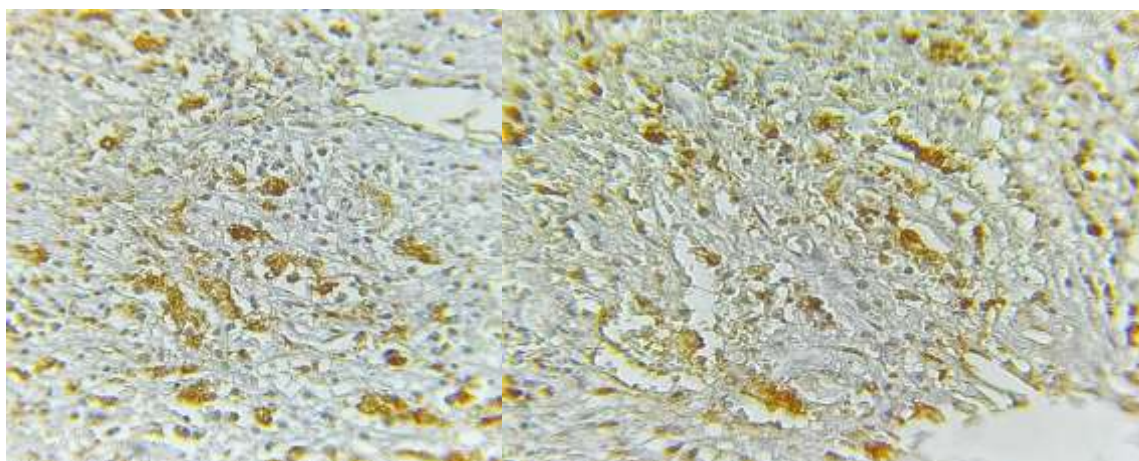


Figure 2: Histopathological (H&E) photomicrograph of radicular cyst (200x) with mobile zoom

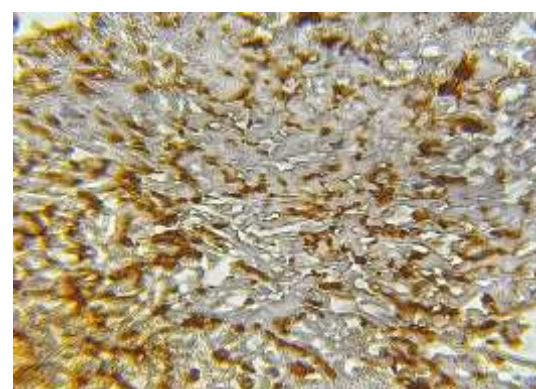
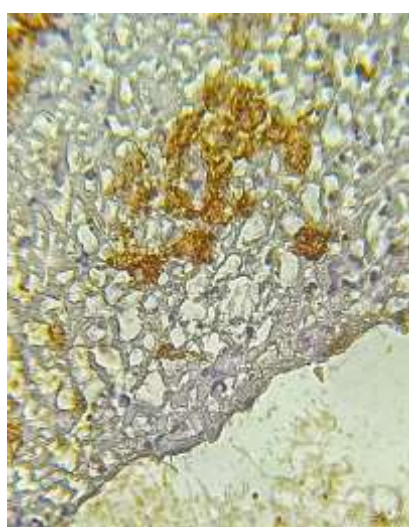


Figure 3 Histopathological (H&E) photomicrograph of periapical granuloma (200x) with mobile zoom

Correlations between patient's age and lesions size among patients with granulomas lesions

There is no significant correlations between patient's age and lesions size among patients with granulomas were demonstrated in table 4

Table 4: Correlations between patient's age& lesion size among patients with granulomas lesions

Parameters	Statistics	Age	Lesions size
Age	r	1	-0.329
	p value		0.182 NS
Lesions size	r	-0.329	1
	p value	0.182 NS	

r: Pearson's correlation coefficient; NS: Not significant ($p>0.05$); S: Significant ($p\leq 0.05$)

Correlations between patient's age& lesions size among patients with radicular cyst lesions

Patients with radicular cysts revealed there were no significant correlations between patient's age and lesion sizes with markers expression as illustrated in table 5

Table5: Correlations between patient's age& lesions size among patients with radicular cysts lesions

Parameters	Statistics	Age	Lesions size
Age	r	1	0.572
	p value		0.052 NS
Lesions size	r	0.572	1
	p value	0.052 NS	

r: Pearson's correlation coefficient; NS: Not significant ($p>0.05$); S: Significant ($p\leq 0.05$)

Distributions of granulomas and radicular cyst lesions according to age and gender

Although there were no significant differences of both granulomas ($p=0.516$) and radical cysts ($p=0.827$) distributions among males and females according to age groups, granulomas lesions were slightly higher among females in age group 30-39 years (25% vs. 10%), and the radicular cysts lesions were higher among females in all age group as compare to male patients as demonstrated in table 6, table 7, figure 4and figure 5.

Table 6: Distributions of granulomas according to age and gender

Parameters (Mean \pm SE)	Males N.=10	Females N.=8	p value
< 20 years	2 (20.0 %)	0 (0.0%)	0.516 € NS
20-29 years	4 (40.0 %)	3 (37.5 %)	
30-39 years	1 (10.0 %)	2 (25.0 %)	
\geq 40 years	3 (30.0 %)	3 (37.5 %)	

SE: Standard error; NS: Not significant ($p > 0.05$); €: Chi square

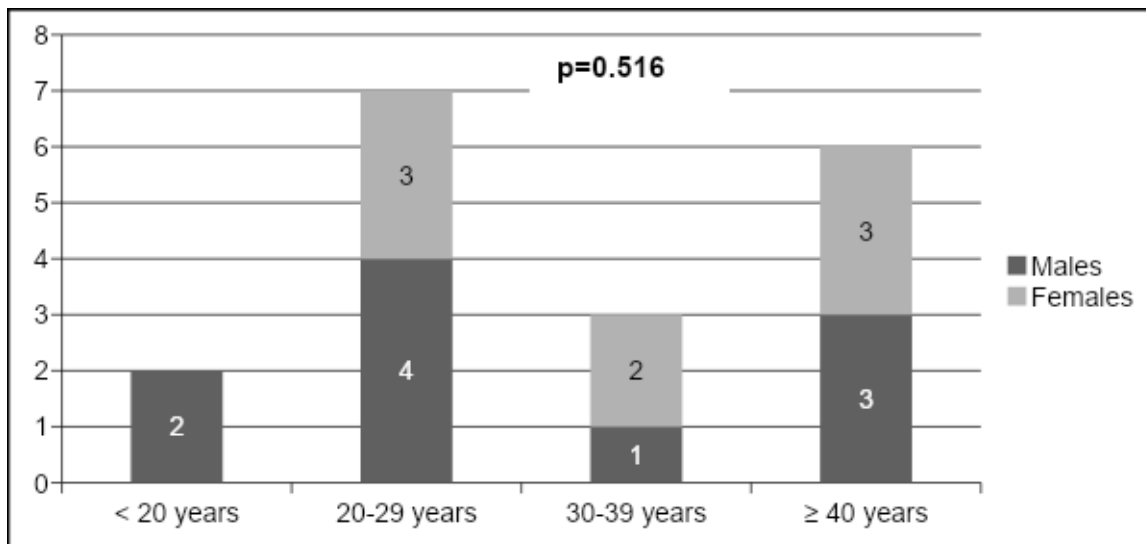


Figure 4: Distributions of granulomas according to age and gender

Table7: Distributions of radicular cysts lesions according to age and gender

Parameters (Mean \pm SE)	Males N.=5	Females N.=7	p value
< 20 years	0 (0.0%)	1 (14.3 %)	0.827 € NS
20-29 years	2 (40.0 %)	3 (42.9 %)	
30-39 years	2 (40.0 %)	2 (28.6 %)	
\geq 40 years	1 (20.0 %)	1 (14.3 %)	

SE: Standard error; NS: Not significant ($p > 0.05$); €: Chi square

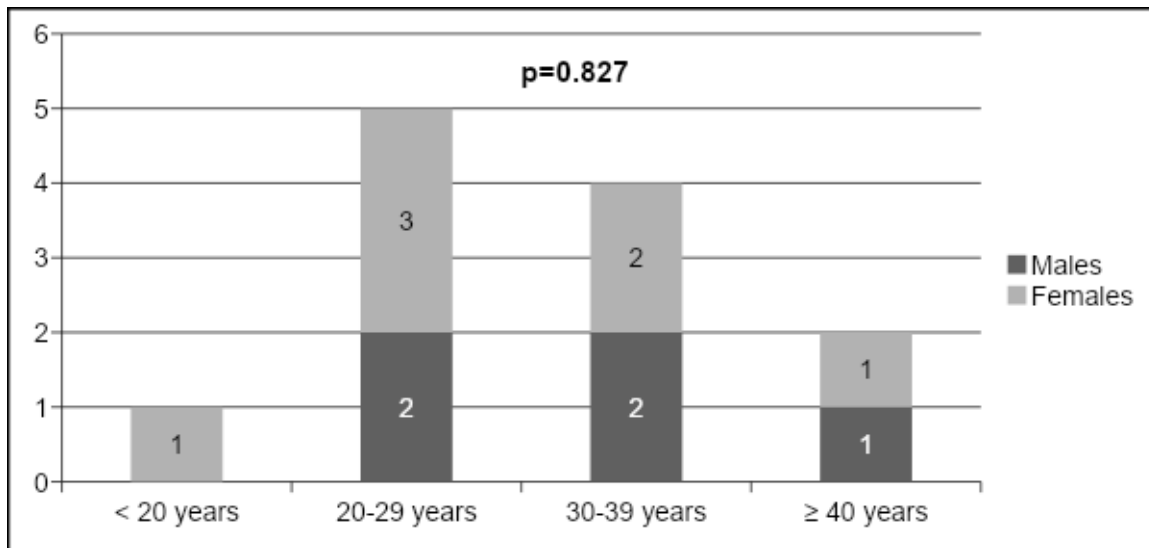


Figure 5: Distributions of radicular cysts lesions according to age and gender

Periapical lesions of endodontic origin are the most common pathological processes in the periapical region. These lesions are eventually diagnosed as periapical granulomas, cysts, abscesses, or scars. The literature shows significant discrepancies regarding the prevalence of each type of lesion. The prevalence of periapical granulomas ranged from 45% to 94%, and the prevalence of cysts ranged from 6% to 44%. (18). Epidemiological studies in different populations show periapical disease as a widespread condition in many countries. However, there is an expressive variability in the results, particularly in relation to the frequency of these lesions of the affected population. In current study the mean age of patients with granulomas 35.78 ± 3.93 and the mean age of patient with radicular cyst 32.25 ± 4.58 . this finding similar to the finding observed by Waheed SA who found the mean age was 30.5 years with a standard deviation of 16.2 years. Male patients were more commonly affected. (19). There is a predominance of cases affecting individuals in their third and fourth decades of life. These findings are possibly associated with the highest prevalence of untreated dental caries in young adults, leading to the development of periapical disease. On the other hand, as observed by other authors, these lesions are rare among adults older than 60 years. This probably occurs because tooth extraction, as an alternative to conventional endodontic treatment, is carried out more frequently in the elderly than in younger patients (19). Odontogenic cysts are one of the most common osseous-destructive lesions affecting the jaws. These cysts arise from the epithelial components of the odontogenic apparatus or its remnants that lie entrapped within bone or in the gingival tissue. Commonly, Odontogenic cysts exhibit slow growth and a tendency towards expansion (20). In current study Lesions size was significantly higher among patients with radicular cysts than that of preapical granuloma (5.07 ± 1.35 vs. 0.94 ± 0.21 ; $p=0.048$). That analogue to the result obtains by Laux, M. who found that radicular cysts could be separated from periapical granulomas based on the high size of radicular cysts (more than 5.9 mm) (21). Periapical lesions of endodontic origin are the most common pathological processes in the periapical region. These lesions are eventually diagnosed as periapical granulomas, cysts, abscesses, or scars. (18)/ In current study granulomas lesions were slightly higher among females in age group 30-39 years (25% vs. 10%), and the radicular cysts lesions were higher among females in all age group as compare to male patients same result found by de Souza who found the Radicular cysts were more frequent in females (62.0%). Other study found the granulomas and cysts were the two most common periapical lesions. Periapical lesions occurred more frequently in female patients and in those in their fourth to fifth decades (21). Alotaibi et al., 2020 found The mean patient age was 35.8 years (SD = 13.03), with a slight female predilection (53.3%) (18)

Conclusions Lesions size was significantly higher among patients with radicular cysts than that of preapical granuloma. A peak incidence between the third and fourth decades of life and predominance among female

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