Medicine & Clinical Science

Case Report

Surgical Management of Inflammatory Radicular Cyst in Maxillary Anterior Teeth: A Clinical Case Report

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Abstract

Inflammatory Radicular Cysts (IRCs) are odontogenic cysts resulting from chronic dental infections, typically due to pulp necrosis secondary to conditions like dental caries or trauma. They develop from epithelial remnants in periapical tissues stimulated by inflammation or immunological reactions. The cysts manifest as well-defined radiolucent lesions on radiographs, commonly in the posterior maxilla, particularly affecting lateral incisors and canines. Clinical symptoms vary from asymptomatic to mild pain and swelling, often associated with non-responsive teeth on vitality tests. Treatment options include surgical techniques like enucleation and root-end resection with retrograde filling. This case report presents the successful surgical management of a large infected radicular cyst associated with a maxillary anterior tooth, for a 39-year-old male patient reported to the Department of Conservative Dentistry, EIU Dental College and Republican Hospital, Sana'a, with a chief complaint of swelling in the upper front region. This case report aims to elucidate pathogenesis, clinical aspects, and management strategies, emphasizing the role of cone-beam computed tomography in diagnosis and treatment planning.

Keywords

Inflammatory radicular cyst, MTA, Enucleation.

Introduction

Radicular cysts, also known as periapical cysts, are the most common type of odontogenic cyst. They arise because of chronic periapical infection, typically due to untreated dental caries or trauma. Prevalence rates are highest in adults aged 20-40 years, with a slight male predominance. Risk factors include untreated dental caries, dental trauma, previous endodontic treatment, and poor oral hygiene. While radicular cysts can be asymptomatic, they may also cause pain, swelling, tooth sensitivity, and mobility. Diagnosis involves radiographs and cone-beam computed tomography (CBCT). Treatment options include endodontic therapy, surgical enucleation, and root-end resection. The epidemiology of radicular cysts can vary depending on population demographics, access to dental care, and cultural practices.

Inflammatory radicular cysts (IRCs) are prevalent odontogenic cysts that are caused by long-standing dental infections and triggered by inflammation of the pulp. IRCs are considered to be "true cysts" as they possess a cystic lining [1,2]. These cysts originate from epithelial residues within the periapical tissues of a tooth with pulp necrosis, which is commonly secondary to dental caries, trauma, or maybe a reaction to bacteria or physical, chemical, or iatrogenic factors [1,3,4], and they get stimulated via necrosis or immunological stimulation that is caused due to chronic periapical infection [2].

Its development is associated with the intensity of the immune inflammatory reaction induced by the microorganisms and their byproducts within the root canal [4]. Cytokines and growth factors that promote the proliferation of Malassez epithelial rests are released by the inflammatory cells associated with chronic apical periodontitis. Radicular cysts arise as a result of a proliferation of Malassez's epithelial rests [5]. An apical granuloma grows progressively due to bacterial infection from exposed dental pulp or marginal

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periodontitis. The teeth of patients with moderate-to-severe chronic periodontitis have a higher likelihood of being diagnosed with radicular cysts, but the association is limited to teeth with pulp necrosis. The major causative factor in the development of radicular cysts appears to be the presence of bacterial plaque and the type of bacteria involved in the periradicular region [6,7]. Also, infection can occur with the accessory or lateral canals when substandard root canal treatments have been performed. Dentin allows and facilitates the penetration of the organism when the tooth structure is damaged or cannot protect the root canal completely [8-10].

Despite being considered the most common odontogenic cyst, it does not occur at a high frequency [4]. IRC is commonly observed in the permanent posterior maxillary region with a predilection for maxillary lateral incisors and canines [11], tends to be slightly more prevalent in men, and is mostly found in the third and sixth decades [12,13].

Patients with IRC have discrete symptoms or are asymptomatic. The affected people have occasional swelling and mild pain. A history of swelling or pain is there for a long duration. The larger the lesion, the more risks there are, including swelling and tooth mobility [2,11], as well as the affected tooth does not respond to pulp vitality tests [14]. On radiographs, the lesion presents as a well-circumscribed, unilocular radiolucency, expansile, corticated borders that appear hydraulic located at the root apex of a nonvital tooth [15].

Odontogenic infections have potentially severe consequences for systemic and patient prognosis and demand immediate attention to minimize the possibility of complications [2,4]. Treatment options for IRC include conventional enucleation, chemical cauterization, and modified decompression [11]. The most frequent surgical treatment is root-end resection and elimination of the cystic cavity with retrograde placement of root-end filling.

This report aims to demonstrate the data and describe the pathogenesis, clinical concepts, and surgical management of IRC and the importance of cone-beam computed tomography in diagnosing IRC, to provide the main reparative and therapeutic strategies of IRC.

Figure 1. *Palatal swelling.*

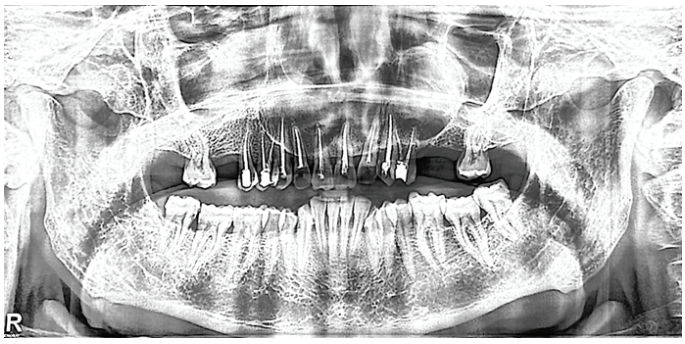


Figure 2. *OPG showing large unilocular radiolucency involving the anterior region of the maxilla.*

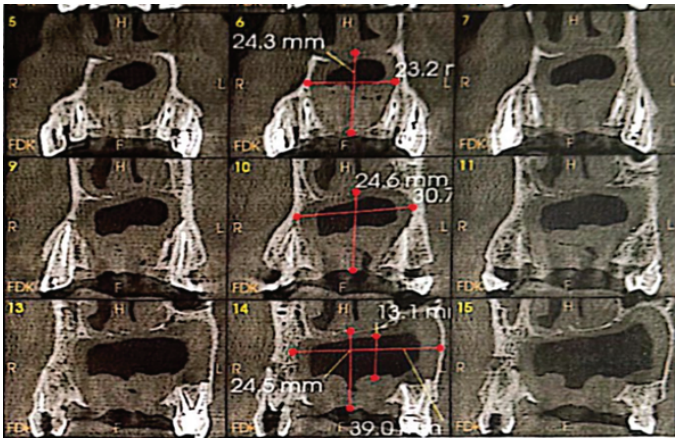
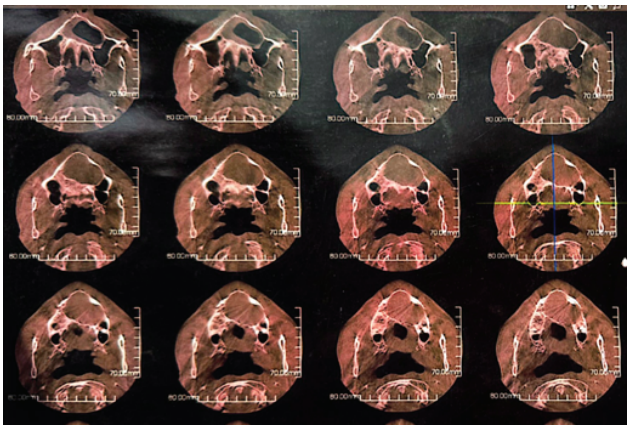


Figure 3A. *Palatal swelling.*



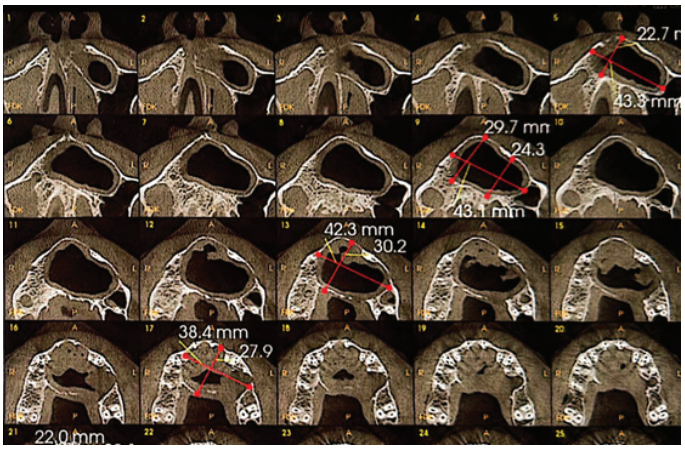


Figure 3B. *Horizontal plane of lesion.*

Case presentation

A 39-year-old male patient attended the Department of Conservative Dentistry, EIU Dental College and Republican Hospital, Sana'a - Yemen, with a chief complaint of swelling in the front region of the upper jaw, which had persisted for three years. The patient gave a history of past endodontic therapy for upper anterior and premolar teeth more than eight years back. The patient had visited a private clinic one year prior for a similar complaint and pus from around the teeth (15, 14, 13, 12, 11, 21, 22, 23, and 24).

Intraoral clinical examination revealed a round to oval swelling which was located over the palatal of maxillary in association with (15 - 24) (Figure 1). The swelling was soft, localized, fluctuant, inflamed, and non-tender. Spontaneous pus discharge was seen from the gingival sulcus.

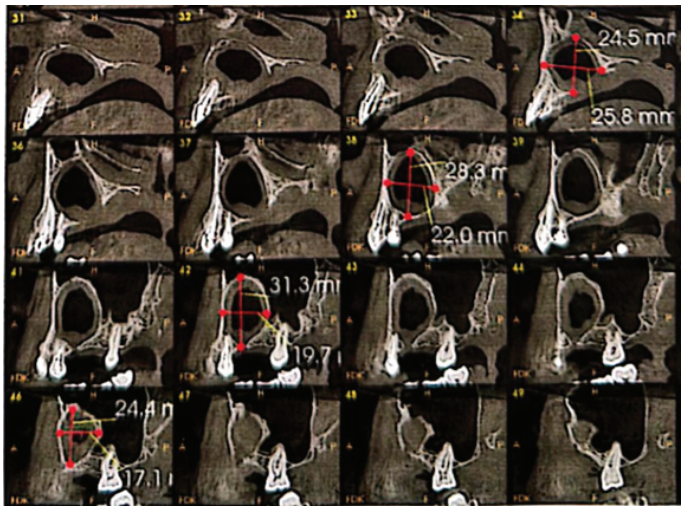


Figure 3C. *Sagittal plane of lesion.*

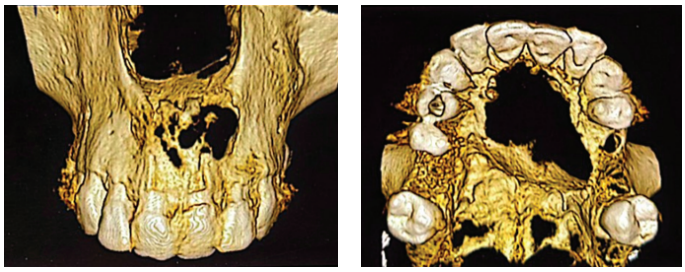


Figure 3D. *3D images of the lesion.*

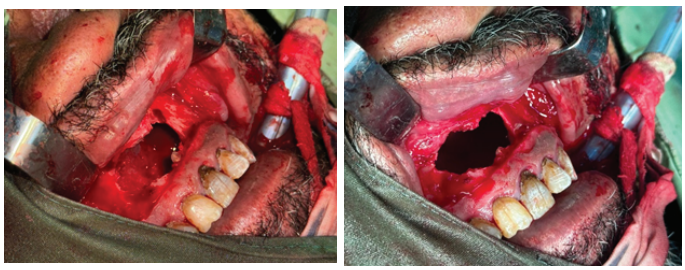


Figure 4A. *Complete curettage, along with granulation tissue removal.*

Panoramic radiograph illustrates all the anterior teeth (15 - 24) have root canal treatment and a large unilocular radiolucent lesion which involved periapical regions of teeth (15 - 24) and extended into the floor of the nasal cavity, hard, and soft palate (Figure 2).

The patient was subjected to a CT scan for further exploration of the finding, and to check for proximity or any involvement of lesion with the nasal floor, since the lesion was extensive. CT showed that the nasal floor was intact and the radiolucency was seen in the apex of (12, 11 - 21, 22) teeth in coronal, horizontal, and sagittal planes (Figures 3a, b, and c]. Based on these, a 3D construction image was plotted (Figure 3d) and the dimension of the lesion was (31 x 21 x 39 mm) which was measured using a measurement scale.

Through the history, clinical examination, and investigation, a provisional diagnosis of infected radicular cyst in (15 - 24) teeth was made. The treatment plan was formulated and after explaining it to the patient, his informed consent was taken (preserved the patient's anonymity, as well as preserving

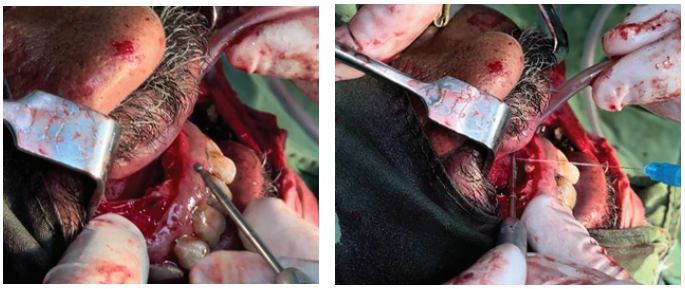


Figure 4B. *Surgical enucleation of the cyst and root's apex apicoectomy.*

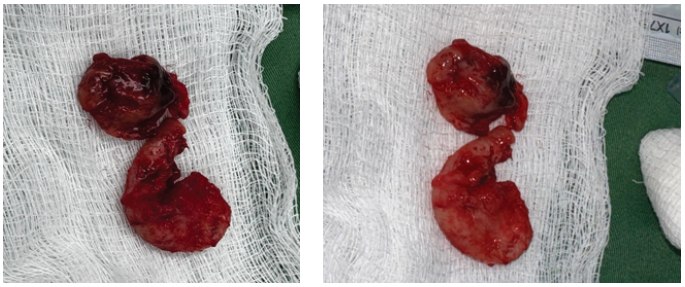


Figure 4C. *The flap was closed with 3-0 silk ligature.*

Figure 4D. *The flap was closed with 3-0 silk ligature.*

the rights and care of the patient and his information as recommended by the Declaration of Helsinki of 1964). Make an opening, remove the pus, and repeat the irritation for 60 days to relieve the infection using surgical tape and normal saline. Then root canal retreatment was performed, teeth were isolated using a rapper dam, and root canals were filled using MTA and single cone gutta-percha.

The patient was prepared for surgical operation after two months, which included surgical enucleation of the cyst, apicoectomy, and retrograde filling of the involved teeth. After the administration of general anesthesia, a crevicular incision in the labial region at the apex of the teeth (15 to 24) was made. A full-thickness mucoperiosteal flap was reflected, and a large bony defect was seen clinically. Complete curettage, along with granulation tissue removal (Figures 4a and b), the cystic lesion was enucleated and sent for histopathological evaluation (Figure 4c), and the flap was closed with 3-0 silk ligature (Figure 4d).

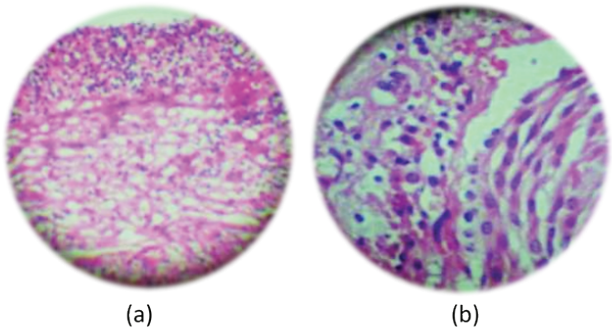


Figure 5. *Histopathological picture.*

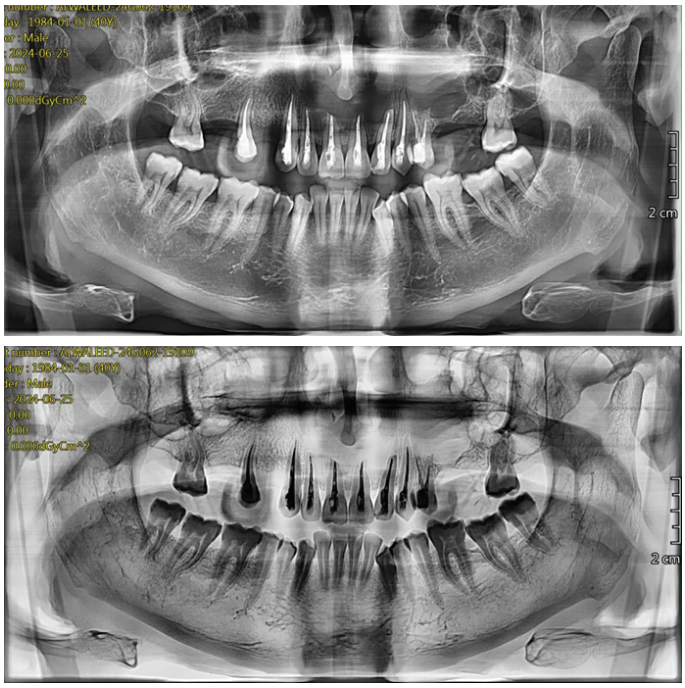


Figure 6. *Six months follow-up (OPG) showing appreciable healing.*

The primary diagnosis of an infected radicular cyst was confirmed by the histopathology report (Figures 5a and b) that shows the cystic cavity was lined with non-keratinized stratified squamous epithelium and mixed inflammatory infiltration.

Post-operative instructions were given to the patient and the patient was kept on antibiotics and analgesics for ten days. Currently, the patient is asymptomatic and is under follow-up for six months, where the recent radiograph showed appreciable healing (Figure 6).

The timing of the CT scan

The CT scan was performed after the initial presentation and panoramic radiograph. This suggests that the initial radiograph revealed a large lesion, but the extent of the cyst, particularly its relationship to the nasal floor, was uncertain. The CT scan was ordered to provide a more detailed three-dimensional image of the lesion and help determine the best course of treatment.

By performing the CT scan after the initial presentation, the clinician was able to obtain a more accurate assessment of the cyst's size, location, and potential complications before planning the surgical procedure.

Surgical Procedure: Enucleation and Retrograde Filling

The surgical procedure in this case involved the following steps:

1. Incision and Flap Elevation: A crevicular incision was made in the labial region at the apex of the affected teeth (15-24). A full thickness mucoperiosteal flap was reflected to expose the underlying bone.
2. Bone Removal: A large bony defect was observed, and a portion of the bone was removed to access the cyst.
3. Enucleation: The cystic lesion was carefully enucleated, taking care to avoid rupturing the fibrous capsule to minimize the risk of recurrence.
4. Curettage: The cystic cavity was curetted to remove any residual tissue and epithelial cells.
5. Root-End Resection: The root apices of the affected teeth were resected to remove any infected or necrotic tissue.
6. Retrograde Filling: The root canals were filled with a biocompatible material, such as mineral trioxide aggregate (MTA), to seal the root apex and prevent future infection.
7. Closure: The flap was closed with sutures, and the surgical site was dressed.

This procedure is a common approach for the treatment of radicular cysts, and it aims to remove the cyst, eliminate the source of infection, and prevent recurrence.

Postoperative Care for Radicular Cyst Surgery

To ensure proper healing and minimize complications, we have followed these guidelines:

- Managed pain with over the counter or prescribed medications.
- Taken antibiotics as directed to prevent infection.
- Reduced swelling by applying cold compresses.
- Maintained good oral hygiene by brushing gently and using mouthwash.
- Avoided irritating foods like hot, spicy, or acidic dishes.
- Attended all follow-up appointments with your dentist.

Potential complications: "We informed the patient about potential complications, including infection, bleeding, nerve damage, and recurrence. If you experience any concerning symptoms, please contact your dentist immediately."

Discussion

Radicular cysts are inflammatory odontogenic cysts arising from epithelial residues within periapical tissues of teeth with pulp necrosis. The World Health Organization (WHO) classifies radicular cysts into two categories: developing cysts and inflammatory origin cysts [16]. They develop in response to chronic periapical infection, triggered by bacterial byproducts and immunological reactions. The case highlights the typical clinical features of radicular cysts, including long-standing swelling, occasional pain, and non-responsiveness to pulp vitality tests.

In the presence of local inflammation, the production of secretions and cytokines is triggered, leading to an increase in the number of dormant Malassez epithelial rests. This initiates a process of periapical inflammatory hyperplasia [14,17]. Radicular cysts are more common in men aged 20 to 40 years [18]; this was agreed with the current report. In terms of ethnicity, there are more cases observed in individuals with lighter skin (leukoderma) than in those with darker skin (melanoderm) [19,20], indicating a higher prevalence in white individuals compared to black individuals. The ratio of males to females in radicular cysts is 1.6:1, which aligns with the findings of our case study involving a male patient [21,22]. These cysts can reach significant sizes, potentially causing the expansion of the bone cortex and resulting in a firm, painless swelling. If the thin cortical bone is broken, the swelling becomes soft but well-defined. At this point, the mucosa covering the cyst may exhibit a bluish coloration, while maintaining a normal consistency [23]. The present situation involves a perforation in the cortex, and the teeth next to the cyst are non-vital. It has been mentioned that as the cyst grows, nearby teeth may lose their vitality [24].

There have been reports in the literature of radicular cysts with dystrophic calcifications in microscopic evaluations; however, radiographic examinations have rarely revealed them to be well-defined calcifications [5]. A typical radiographic appearance of radicular cysts is described as a lesion larger than 2 cm in diameter with a radiolucent, well-defined cortical boundary [13]. The size of this uncommon instance of a calcified radicular cyst is 3.1 x 2.1 x 3.9 cm, similar to that reported by Nilesh et al., [25] and a report by Jagtap R et al., [15] with a difference in their location.

The histopathological examination of the cyst revealed the presence of a cystic cavity lined with non-keratinized squamous epithelium, and there were scattered granular calcifications throughout the specimen, along with signs of granuloma formation and long-term inflammatory changes [5]. In a routine X-ray examination, Krithika et al. documented a case of a lesion with mixed density in the area around a toothless site [26]. Upon microscopic inspection, it was confirmed that the characteristics were consistent with those of a residual radicular cyst displaying dystrophic calcification, similar to the present case, where the submitted lesion exhibited histopathological features that matched the clinical diagnosis of an infected radicular cyst. A nonkeratinized, stratified squamous epithelium lined the cystic cavity, with the presence of mixed inflammatory infiltration.

The size and extent of the lesion may require surgical management to achieve success. Surgical enucleation, with or without extraction of the affected element, is the recommended treatment for periapical cystic lesions. This procedure involves completely removing the cyst without rupturing the fibrous capsule to minimize the risk of recurrence [14]. It is also necessary to perform a curettage of 1 to 2 mm of bone around the affected area to eliminate any present epithelial cells [27].

- CBCT provides superior imaging capabilities compared to traditional radiographs, allowing for more accurate diagnosis and management of radicular cysts. It offers three-dimensional visualization, improved soft tissue contrast, reduced radiation dose, faster image acquisition, and greater accuracy. CBCT plays a crucial role in early detection, accurate diagnosis, treatment planning, monitoring treatment progress, and evaluating surgical outcomes.

The case report provides valuable insights into radicular cysts but has limitations due to its single-case nature, potential selection bias, retrospective design, lack of control group, and limited follow-up. To draw broader conclusions, future studies with larger sample sizes, prospective designs, and control groups are needed.

Conclusion

By utilizing comprehensive clinical data, including pulp vitality testing and CT scan (CBCT), a periapical lesion with or without internal calcifications may be identified as a radicular cyst. Making an accurate diagnosis of the radicular cyst can result in a more conservative treatment approach, such as choosing between endodontic therapy and enucleation, significantly enhancing the patient's comfort and prognosis. Each treatment method for cysts has specific indications, and it is the responsibility of the specialist to assess the type of cyst, its size, location, and the overall condition of the patient in order to determine the most suitable treatment.

The significance of clinical examination in assisting with the interpretation of radiographs is emphasized in this case. Practitioners in Oral and Maxillofacial Radiology and Surgery frequently lack relevant clinical history, which is crucial for making an accurate and targeted differential diagnosis for the patient. In cases where this information is not provided by the practitioner, it should be actively sought for questionable cases.

Authors' contributions

All authors contributed to the report presentation and manuscript writing.

Conflicts of interest

All authors declare that they have no conflict of interest.

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