**Traumatic Bone Cyst of the Mandible Diagnosed Using Contrast-enhanced Magnetic Resonance Imaging**

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**Abstract**

Traumatic bone cyst (TBC) is an uncommon nonepithelial-lined cavity of the jaws. In the clinical diagnosis of TBC, it may be difficult to differentiate TBC from other cysts and tumors. We described a case of TBC of the mandible with magnetic resonance imaging findings, the radiological and clinical characteristics, and the surgical findings. Contrast-enhanced magnetic resonance images provided useful information for distinguishing TBC from other cysts and tumors.

**Introduction**

A traumatic bone cyst (TBC) is an uncommon nonepithelial-lined cavity of the jaws (1–5). In 1929, Lucas and Blum for the first time described TBC as a separate disease entity (6). However, it was not until 1946 that the diagnostic criteria of this cyst were established. These criteria remain valid today and comprise a generally single lesion without an epithelial lining, surrounded by bony walls and either lacking contents or containing liquid and/or connective tissue (7). In the classification of the World Health Organization (WHO), TBCs are included in the group of bone-related tumor-like lesions, together with aneurysmal bone cyst, juxta-articular bone cyst (intraosseous ganglion), metaphyseal fibrous defect (nonossifying fibroma), eosinophilic granuloma, fibrous dysplasia, myositis ossificans, and brown tumor of hyperparathyroidism (8, 9).

Many terms have been used to describe the TBC such as solitary bone cyst (1–3, 7, 10–18), simple bone cyst (4, 19–26), hemorrhagic bone cyst (27–31), progressive bone cyst (32), idiopathic bone cyst (33, 34), and unicameral bone cyst (35–37), in which traumatic bone cyst is the general term that better describes this cystic lesion (5, 38–51).

In the clinical diagnosis of TBC, it may be difficult to differentiate TBC from cysts and tumors, especially when TBC appears with a unilocular shape. Recently, magnetic resonance imaging (MRI) has been used in the diagnosis and definition of cystic lesions in the oral and maxillofacial regions (17, 24, 26).

Thus, we described a case of TBC of the mandible with MRI findings, the radiological and clinical characteristics, and the surgical findings.

**Case**

A 12–year-old girl was referred by a dentist to the Oral Surgery Department for evaluation of a unilocular radiolucency of the anterior mandible accompanied with vague pain that had begun the previous week. Intraoral examination did not show any soft tissue abnormality or bony expansion. The periodontium was noted to be healthy with no evidence of gingivitis or tooth mobility. There were no carious lesions. The anterior mandibular teeth were vital and they responded normally to electrical pulp testing.

Clinical examination was unremarkable with no evidence of lymphadenopathy and the patient
revealed no contributory medical history.

On radiographic examination, a panoramic view revealed an oval unilocular radiolucency extending from the inferior aspect of the apices of the lower right canine to the left canine (Fig. 1). An occlusal view showed a scalloped radiolucency between the teeth in the radiolucent area (Fig. 2). Computed tomography axial scanning demonstrated the presence of a unicystic lesion at the mandibular symphysis, where the lingual cortical plate showed slight expansion and thinning (Fig. 3). Magnetic resonance images further confirmed the details. T1-weighted axial magnetic resonance imaging with gadolinium showed the peripheral area of the lesion rim enhancement and slight enhancement of the inner part of the cyst cavity (Fig. 4). T2-weighted axial magnetic resonance imaging demonstrated a homogenous high signal intensity area, which indicated fluid-like signal intensity (Fig. 4).

A clinical diagnosis of TBC was made and the operation for enucleation and curettage of the cystic lesion was performed under general anesthesia. A mucoperiosteal flap was raised, exposing the labial surface of the alveolar bone overlying the cystic area. None of the surface presented any noticeable bony expansion. A window was made with a surgical bur in order to reach the lesion. The bony cavity was filled with fluid and there was lining on its walls apart from an extremely thin layer of connecting tissue. Following careful curettage, small bone chips with parts of the membrane were submitted for microscopic examination. Because the operative findings were highly suggestive of the diagnosis of TBC, no further treatment was done apart from curettage. The postoperative course was uneventful. A follow-up panoramic radiograph at 6 months has shown good bony filling of the midline region of the mandible (Fig. 5).

Histological examination revealed the thin cystic wall to be a connective tissue membrane with dilated blood vessels with deposits of hemosiderin granules and mucinous degeneration in the inner side and compact bone in the outer side. There was no epithelial lining (Figs. 6 and 7). The final diagnosis of
Fig. 4. T1-weighted axial magnetic resonance imaging with gadolinium demonstrates the peripheral area of the lesion rim enhancement (arrow) (left). T2-weighted axial magnetic resonance imaging demonstrates a homogenous high signal intensity area (arrow) (right).

Fig. 5. Panoramic radiograph at 6 months after surgery showed good bony filling of the midline region of the mandible.

Fig. 6. The cyst wall consists of fibrous connective tissue and compact bone (B, bone; arrows, fibrous connective tissue) (original magnification, ×100).

Fig. 7. Dilated blood vessels and hemosiderin granules in the fibrous connective tissues of the cyst wall (arrows, hemosiderin granules; asterisks, blood vessels) (original magnification ×600).

TBC was made from the histological examination, clinical course, and the operative findings.

Discussion

Traumatic bone cysts are mainly found in young persons most frequently during the second and third decades of life (16, 20, 37–39, 43, 45). The reported sex distributions vary: even (39, 45), more frequently in men (20, 29, 37, 38), and more frequently in women (21, 47, 50). The majority of TBCs are located in the mandibular body between the canine and the third molar (16, 20, 27, 29). The mandibular symphysis is
the second most common site (13–14.3%) (16, 50). Fewer cases are reported in the ramus, condyle, and the maxilla (11, 12, 15, 22, 23, 29, 32, 39, 41, 49). Clinically, TBC is asymptomatic in most cases and is often accidentally discovered on routine radiological examination (29, 38, 47). Pain is the presenting symptom in 10% to 30% of the patients (27, 29, 39, 47). Other, more unusual symptoms include tooth sensitivity (20, 39), paresthesia (40, 47), fistulas (20), and pathologic fracture of the mandible (28, 32). Often noted is expansion of the cortical plate of the jawbone, usually buccally or labially, resulting in intraoral and extraoral swelling. The teeth adjacent to the lesion are usually vital without mobility, displacement, or resorption of their roots (20, 27, 29, 39, 47). On radiological examination, TBC appears as a unilocular radiolucency with an irregular but well defined (or partly well defined) outline, with or without sclerotic lining around the periphery of the lesion. Characteristic for TBC is the “scalloping effect” extending between the roots of the teeth (16, 39). On MRI examination of TBC cases, the contrast–enhanced T1WI of Gd-DTPA showed marked enhancement of the margin and slight enhancement of the inner part of the cyst cavity. This finding was not observed in the contrast–enhanced MRIs of the true cysts with an epithelial lining, which show no enhancement in the cavity (17, 26). Therefore, contrast–enhanced MRI can provide useful information for distinguishing TBCs from other cysts and tumors. This finding was observed in the present case and a clinical diagnosis of TBC was made.

Several hypotheses for the pathogenesis of TBC have been proposed. The myriad of different proposed mechanisms provides some insight into the lack of understanding of this unusual entity. The most frequently proposed theory for the development of these lesions involves a traumatic event inciting medullary hemorrhage and a subsequent failure of the hematoma to organize and be replaced with tissue (49). Many authors have questioned this mechanism, given that often there is no history of trauma and, furthermore, the incidence of trauma in patients with TBCs is no greater than in the general population (45). Although the mean age at presentation is the second and third decades, when it could be hypothesized that trauma to the jaws is more likely, there is no difference in the prevalence between males and females or the prevalence is higher in females despite a higher incidence of trauma in males. No history of trauma could be elicited from our patient. Cohen proposed that the formation and existence of the traumatic bone cyst are due to a blockage of the normal draining of interstitial fluid. Because the normal hemodynamic pressures of the area are low, the expansion of the cyst would require only a small increase in the hydrodynamic pressure within the cyst (19). Unfortunately, as in our case, many traumatic bone cysts are found to be empty at surgery with no evidence of cyst fluid. This would seem to challenge this proposal. Furthermore, if the cyst developed because of a blockage of draining interstitial fluid, one might expect that these lesions would develop with a more equal frequency in all locations within the facial skeleton rather than occurring with a higher frequency in the posterior mandible as has been documented (45). Mirra et al. (10) proposed that these lesions are synovial cysts arising from a developmental juxtaepiphyseal error with the intraosseous incorporation of synovial tissue. A small nest of synovium becomes trapped intraosseously during fetal or early infant development and that this tissue may retain some secretory function, resulting in the development of a cyst. Furthermore, they hypothesized that the fibrous tissue and osteoid and giant cells often found at the periphery of TBC are from a host bone reaction (10). This theory may explain the greater occurrence in adolescents when developmental anomalies often first present. Similarly, TBCs of the long bones are often discovered at young ages, although this is most often a result of pathologic fracture. However, the etiology of TBCs remains unclear.

Histological presentation is classically a vacant cavity of cancellous bone usually unlined or occasionally lined with a thin connective tissue layer with a scant liquid content. The distinctive characteristic of TBCs is the absence of epithelial lining. Previous
reports have shown that in only 9.52% of the cases could a histological evaluation be made of the material obtained, revealing the presence of vascular connective tissue without evidence of an epithelial component (49, 52). This suggests that the absence of epithelial tissue is one of the most characteristic features of TBCs. This finding was found in the present case. In addition, hemosiderin granules were observed in the cyst wall, suggesting that the episode of hemorrhage was associated with trauma, although she did not recall her antecedent of trauma to the anterior mandible.

Although surgical exploration not only confirms the diagnosis but also is curative as the curettage performed during the procedure induces bleeding and further osseous regeneration (50), a high recurrence rate of 65.4% (17/26) of cases with a scalloped margin, smooth margin (4.8%) was reported. Therefore, a scalloped margin is a sign of possible recurrence, although this should not be confused with the interdental scalloping associated with an intact lamina dura (25). Although careful curettage of the lesion itself favored bone formation and healing in the present case, the treated lesion should be followed up until complete healing has been confirmed radiographically.

In summary, TBC is an uncommon non-epithelial-lined cavity of the jaws. In the clinical diagnosis of TBC, it may be difficult to differentiate TBC from cysts or tumors; however, we obtained the clinical diagnosis of TBC using contrast-enhanced MRI.

References