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Radiographic evaluation of Stafne Bone Cyst in patients referred to a radiology center in Mashhad, Iran: A 3-year survey

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ABSTRACT

Introduction: The aim of this study was to evaluate the radiographic features of stafne bone defects in patients referred to a private radiology center from March 2013 to 2016 in Mashhad, Iran.

Materials and Methods: In this retrospective cross-sectional study 5000 CBCTs were evaluated with the definitive diagnosis of SBD. Radiolucencies between the molar region and angle of mandible were considered as SBD and if no increase in the size of the depressions was observed in the second panoramic view, the diagnosis of SBD was made. After selecting the radiographs with SBD, all their radiographic characteristics were recorded.

Results: Among the 5000 CBCT radiographs, 10 (0.2%) SBD cases were diagnosed, 9 in males and only 1 case in a female. All SBDs were between the molar regions and the angle of mandible and were categorized as the posterior variant of SBD. In our studied cases SBD was near the inferior border of mandible and in 3 cases the depressions disrupted the continuity of the inferior mandibular border. The lesion's shape was oval in 7 cases and round in the others. In total 5 cases were categorized as type I, 4 as type II and one case as type III of SBD.

Conclusion: According to our findings, SBD is an uncommon lesion in the mandible and CBCT can be used as a non-invasive method to detect this defect.

Keywords: Stafne bone defect (SBD), Cone beam computed tomography (CBCT), Panoramic radiography.

Introduction

Edward Stafne in 1942 explained 35 radiolucent lesions in the angle of mandible in intraoral radiographs [1], and introduced them as monolateral, asymptomatic, well defined radiolucencies at the posterior side of the mandible, behind the inferior alveolar canal [2]. These radiolucencies are known as Stafne Bone Defects (SBD) [3]. SBD is defined as an idiopathic depression in the lingual region of the mandible, considered as a developmental anomaly [4]. The posterior lingual variant has an incidence of 0.10% to 0.48% when diagnosed radiologically; however, some cadaver studies have revealed that its incidence maybe as high as 6.06% [5]. The anterior lingual variant is seven times less frequent than the posterior one and is usually located between the incisor and premolar areas, above the insertion of the mylohyoid muscle [6,7]. It is usually an accidental radiographic finding which mostly appears as a unilateral defect with cortical border beneath the inferior alveolar canal between the first molar and

mandibular angle [8]. SBD's shape is commonly round or oval with a diameter of approximately 1-3 cm [9]. SBD is often unilacunar and multilacunar cases are rarely seen [10]. To date, different terms have been used to describe these lesions in various articles as stafne bone cavity, developmental bone defect, latent bone cyst, static bone defect, aberrant salivary gland defect and lingual mandibular bone depression [11-12].

SBD is an anatomical variation which does not need any treatment, but a wrong diagnosis as a periapical lesion, odontogenic cyst or tumor may lead to several unnecessary treatments such as root canal therapies and surgical interventions. This lesion is a non neoplastic bony lesion, but its radiographic features and clinical manifestations can resemble other intra bony neoplastic lesions [13]. Therefore, its differential diagnosis from other similar lesions is important to avoid irrelevant treatments. Since the radiographic features of this anatomical lesion are relatively spectacular, SBD, especially its posterior variant, is commonly diagnosed via conventional two-dimensional radiographs [12]. Complementary diagnostic methods such as MRI, Cone beam computed tomography (CBCT) and sialography are recommended only in atypical cases in which clinical examination and conventional radiographies are not sufficient [10,13]. The objective of this study was to evaluate SBD lesions in clinical and radiological aspects among patients of a private radiological center in Mashhad, Iran.

Materials and Methods

In this retrospective cross-sectional study, 30000 panoramic radiographs and 5000 CBCTs of patients referred to a private radiologic center in Mashhad between 2013 and 2016 were analyzed. In panoramic radiographs, according to a previous study, unilateral radiolucencies between the first molar and mandibular angle which were beneath the alveolar canal were considered as suspicious SBD cases. For some of these suspicious cases, their related CBCT was also available in the archive, so definite diagnose of SBD was made if the depression opened in the lingual side in the axial view in CBCTs (Fig 1). The other group of patients with suspicious SBD lesions in panoramic radiographs which did not have a CBCT were also recalled and based on the clinician's judgment and patient's consent, another panoramic view was taken from them. If no increase in the lesion's size was seen in this second panoramic view (which was taken 3-6 months after the first one), due to the static nature of the lesion, the diagnosis of SBD was confirmed and the radiographic features were recorded from the panoramic radiographs. The definite criteria for SBD diagnosis in CBCT was opening of the bone depression to the lingual side in the axial view (fig 1) Panoramic radiographs were prepared by Planmeca XC (Helsinki, Finland) and digitalized with CR konica 210. CBCTs were prepared by Planmeca 3D Max (Helsinki, Finland) and the pictures were presented in 0.2mm voxel and gray scale of 15 bit. All measurements were done by Planmeca Reomix viewer software version 2.8.1. All radiographs were also assessed by the same specialist.

The panoramic radiographs were calibrated before measurements and the width and height of lesions were recorded in sagittal and coronal views; the maximum size being recorded in each dimension. In the CBCTs the size of the lesions were measured in three dimensions; depression depth on axial view, mesiodistal width on sagittal view (Fig 2) and vertical height on coronal view (Fig 3) and in each dimension the maximum size of the lesion was recorded. Moreover, in both the panoramic view and CBCT the measurements included the distance between the superior border of SBD and inferior border of the inferior alveolar canal (Fig 4), and the distance between the lesion's inferior border and the inferior border of mandible (Fig 5). The lesion's influence on the mandibular canal such as resorption was also assessed.

The antero-posterior location of the SBD was recorded due to the tooth in parallel with the anterior border of the lesion; anterior borders of SBDs were recorded as parallel to mesial of the second molar, mesial of the third molar or more posterior. In the superior-inferior view, the lesion's location was reported as the distance between its lower border to the lower border of the mandible. The SBDs' shapes were reported as round or oval and the lesions' border were reported as clear and not cortical, cortical or sclerotic.

Types of anomalies in CBCTs were reported based on the Ariji's classification (14); type I for cases in which depression depth did not reach the buccal cortical plate, type II for cases in which depression depth had reached the buccal cortical plate but had not yet expanded and the deeper lesions which caused an expansion or deformation in the buccal cortical plate were reported as type III.

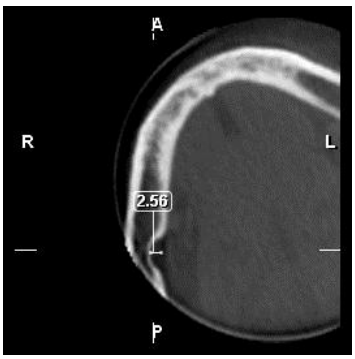

Fig 1. The depth of the SBD in CBCT.

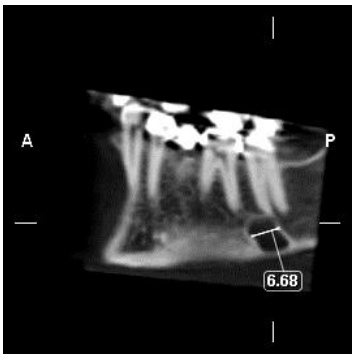

Fig 2. The size of the SBD in the mesiodistal dimention in CBCT.

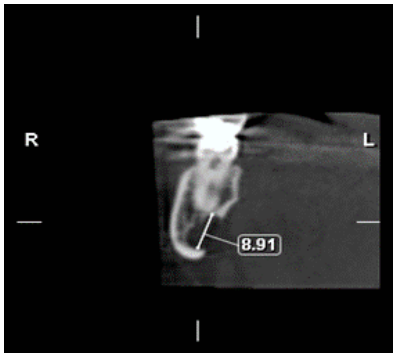

Fig 3. The size of the SBD in the vertical dimention in CBCT.

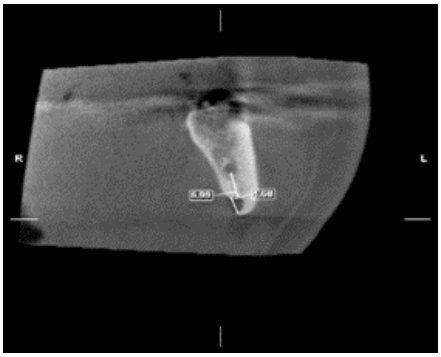

Fig 4. Distance between upper border of SBD to inferior alveolar nerve canal.

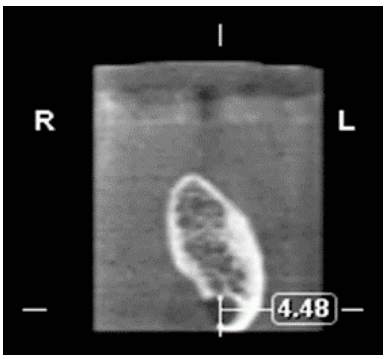

Fig 5. Distance between the upper border of SBD to the inferior border of mandible in CBCT.

Results

Among the 30000 panoramic and 5000 CBCT radiographs available in the archive, 20 panoramic and 10 CBCT radiographs were diagnosed with SBD that revealed a prevalence of 0.085% for SBD in Mashhad. Out of these 30 samples, 26 (0.07%) cases were male and 4(0.01%) cases female. The age of the SBD cases varied from 22 to 80 yrs with a mean age of 45.39 yars. All cases were posterior variants of SBD. Unexpectedly, in one case, the SBD had extended upwards to over the canal. Detailed demographic characteristics and lesions' distribution features in the CBCT and panoramic radiographs are presented in Table 1 and 2.

Gender	Male	Female		
	9	1		
Anterior posterior location	Mesial of second molar	Mesial of third molar	Distal of third molar	
	4	4	2	
Superior –inferior location	Separate from the lower border of mandible	Adherent to the lower border of mandible	Caused resorption in the lower border of mandible	Mean distance to the lower border of mandible(mm)
	2	8	3	1.66mm
Shape	Round	Oval		
	3	7		
Lesion›s type	Type I	Type II	Type III	
Relation to the inferior border of mandibular canal	Separate from inferior border of mandibular canal	Adherent to the inferior border of mandibular canal	Caused resorption in inferior border of mandibular canal	Mean distance to the inferior border of mandibular canal(mm)
	2	8	4	1.12
Mean size of lesions(mm)	Depressions depth	Anterior posterior	Superior inferior	
	4.98	11.5	6.32	

Table 1. Distribution and radiographic features of 10 SBD cases in CBCT.

Gender	Male	Female		
	17	3		
Anterior posterior location	Mesial of second molar	Mesial of third molar	Distal of third molar	
	4	6	10	
Superior –inferior location	Separate from the lower border of mandible	Adherent to the lower border of mandible	Caused resorption in the lower border of mandible	Mean distance to the lower border of mandible(mm)
	6	14	3	1.69mm
Shape	Round	Oval		
	5	15		
Border	Not cortical	Cortical	Sclerotic	
	4	14	2	Mean distance to the inferior border of mandibular canal(mm)
	2	8	4	
Relation to the inferior border of mandibular canal	Separate from inferior border of mandibular canal	Adherent to the inferior border of mandibular canal	Mandibular canal was not found	Mean distance to the inferior border of mandibular canal(mm)
	10	9	1	3.15
Mean size of lesions(mm)	Anterior posterior	Superior inferior		
	16.96	8.46		

Table 2. Distribution and radiographic features of 20 SBD cases in the panoramic view.

Discussion

According to a previously published series, the prevalence of posterior variants of SBD varies between 0.1% and 0.48% [15]. In the current study the prevalence of this lesion was 0.085% that is consistent with previous reports and is similar to its prevalence reported by Sisman et al. in Turkey [16]. Since in the current study there were some suspicious lesions in panoramic radiographs which were not evaluated clinically or the recall radiography was not taken, there might be a few missed cases and therefore the prevalence of this lesion may be even higher.

SBD mostly occurs in middle-aged patients and is more common in men. Despite some reports of 11 to 87-year-old patients, it most commonly occurs in the 5th and 6th decades of life [4]. Similarly, the mean age of our SBD patients was 45.3 yrs. Moreover, a number of researches have reported SBD occurrence in the 7th decade of life [17]. In the present study the oldest patient with SBD was 80 years old. SBD is more prevalent among the male population and a previous study reported a male to female ratio of 25:6 for this lesion [18]. In our study its prevalence was 6.5 times more common in males compared to females.

The major aspect of the previous studies on SBD is the use of panoramic and intraoral radiographs which are adequate for the diagnosis of typical SBD cases, whereas additional testsare required only for atypical cases [11,12]. Although a number of sources have proposed the probable size increase of SBD in the 2nd and 3rd decades due to its developmental nature [13], there is a published case report of SBD's growth in an 11-year-old child [19]; yet SBD is still considered as a static lesion that is not expected to grow in size. Accordingly, in the present study, patients with suspicious SBD in the panoramic radiograph were recalled to take another panoramic view and if the size of the depression had not changed compared to the primary radiograph, SBD diagnosis was confirmed. Nevertheless, CBCT radiographs were prescribed for other purposes such as implant surgeries in which SBDs were detected accidentally.

The anterior boundaries of SBDs varied in these radiographs from mesial of second molar to distal of third molar and adjacent to the mandibular angle; consequently, all of our SBD cases were posterior variants. The anterior variant of SBD has an incident ratio of less than 0.009% [20]. To the authors' knowledge only 42 anterior variants and 17 mandibular ramus cases have been reported in the English literature. In spite of the publication of some reports of bilateral SBD cases, it is still a rare phenomenon [13] and in our study all cases were unilateral.

In general, SBDs' location is commonly beneath the mandibular canal and adjacent to the angle of mandible. In some cases the bone defect interferes with the mandibular lower border uniformity in a way that a touchable notch might be observed [14]. Similarly, in the current study, the mean distance of SBDs lower border to the inferior border of mandible in CBCT and panoramic radiographs were 1.66mm and 1.69mm respectively. In 8 CBCTs and 14 panoramic views it was adhered to the inferior border of the mandible. Moreover, it also caused a resorption in the mandibular lower border in 3 CBCTs and 2 panoramic views.

The lesion's shape is mostly round or oval and in oval depressions the longer longitudinal axis is usually parallel to the mandibular angle [2,3]. In CBCT and panoramic radiographs 3 and 5 cases had a round shape, respectively while the rest were oval. Unexpectedly, in one of the oval cases the longer longitudinal axis was in the vertical dimension.

The mean depth of the depression in the current study was 4.9mm which was reported as 6.4mm in Munevveroglu et al. study [21]. One of the advantages of CBCT is its ability to reveal the depression's effect on the buccal cortical plate of mandible. In our study there were 5 SBDs of type 1, 4 of type 2 and one case of type 3 in which the cortical plate was perforated. So far, there has been only one case report of a perforated cortical plate due to SBD presence in the literature [21].

The exclusive location and radiological manifestation of SBD, make it distinguishable from its' other differential diagnosis. Most of the odontogenic lesions are located above the mandibular canal while the SBD posterior variant is located exclusively beneath the canal, anterior to the angle of mandible [1]. In the anterior part of mandible, due to the lack of mandibular canal as an anatomical landmark, SBD anterior variants are observed without any spatial correlation with the canal and make it difficult to be differentiated from various odontogenic lesions such as periapical cysts, traumatic bone cysts, residual cysts and giant cell granulomas [22]. However, since SBD is a static lesion, there would be no increase in size in contrast to most of the above listed lesions [23].

Furthermore, sialography may provide a definitive diagnosis by showing the salivary ducts in the bone

defect [24]. It is a very aggressive method [25] and consists of ionizing radiation [23]. This technique is also very difficult in anterior variants because of the multiple ducts of the sublingual salivary gland.

Although most articles support the idea of SBD diagnosis with CT scan which can show lingual depression of bone defects [26], but for cases with defect enlargement or suspicious of other lesions, surgical intervention and atomicopathological evaluation is indicated [8,27,28]. Dikbas et al. reported a case of a salivary gland neoplasm in the stafne bone defect; it showed that superimposed pathologies such as pleomorphic adenoma could develop in the glandular tissues of bone defects [28]. However, this report cannot justify the routine prescription of surgery for screening such defects and therefore SBDs should only be followed up by panoramic radiographs [26].

Conclusion

Because of the similarity of SBD with pathological mandibular lesions, clinical dentistry should be able to detect this lesion through panoramic radiographs and/or CBCT. It can be distinguished from other lesions with the same radiological appearance by the patient's precise examination. Such examinations can avoid unnecessary surgical intervention in these patients.

Conflict of Interest

There is no conflict of Interest to declare.

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