Prevalence and localization of the posterior superior alveolar artery in relation to the floor of the maxillary sinus and alveolar crest among sample of Iraqis using computed tomography

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ABSTRACT

Background: Posterior superior alveolar artery (PSAA) is branch of the maxillary artery. It usually supplies the lateral wall of the sinus and overlying membrane. Evaluation and awareness of the anatomy of maxillary sinus before surgery is crucial to avoid surgical complications. The aim of this study is to examine the prevalence, location of the (PSAA) in relation to the floor of the maxillary sinus and alveolar crest using computerized tomography (CT) scans.

Materials and Methods: This study included 180 Iraqi subjects (99 males and 81 females) with age more than 16 years old. CT scans for (right and left) Maxillary sinuses were done for each patient. The information obtained was assessed in a coronal multi planar reconstructions images (MPRs) in order to obtain the following parameters: prevalence rate of PSAA, distance from the lower border of the artery to the: alveolar crest, the floor of the sinus and the medial sinus wall.

Results: The prevalence of PSAA on CT images was 73.61% among total sample. Distance from the lower border of the artery to the alveolar crest was (18.42± 4.07) mm, and to the sinus floor was (8.99 ±3.86) mm and to the medial sinus wall was (12.68 ± 2.81) mm.

Conclusions: CT scan is valuable tool in evaluation and localization of the PSAA before maxillary sinus surgery.

Keywords: PSAA, Maxillary sinus, Maxillary artery, Computed tomography. **(J Bagh Coll Dentistry 2017; 29(3):54-58)**

INTRODUCTION

The posterior superior alveolar artery and infraorbital artery (IOA) are branches of the maxillary artery. They supply the lateral wall of the maxillary sinus and the Schneiderian membrane [1,2]. These arteries should be taken into concern during sinus augmentation procedures because of the possibility of bleeding during the surgery due to injure to the vascular supply of the lateral sinus wall [3].

Surgical intervention in the maxillary sinus needs a good knowing of its anatomy. The maxillary sinus is the largest sinus of the paranasal sinuses [4]. Placing dental implants required the presence of enough thickness of the bone. In the posterior maxillary areas, where there is atrophy of the bone and pneumatization of maxillary sinuses which occur as a results of teeth extraction in this area. As any other surgical intervention, a large number of complications whether it was intraoperative or postoperative may occur during the surgery of sinus floor elevation. One common complication is the blood vessel trauma [5,6].

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Computerized tomography (CT) is a digital imaging tool that allows the quantification and differentiation of hard and soft tissues. CT can examine the arteries, anatomical structures, is also can calculate bone dimension, identify specific anatomical landmarks and detect sinus pathologies [7]. Hence, this study was undertaken in order to show variations in the vascular morphology of the posterior superior alveolar artery in a sample of Iraqi subjects using CT scans.

MATERIALS AND METHODS

The sample

The sample in this study composed of 180 Iraqi patients (99 males and 81 females) with an age not less than 16 years old.

They attended the Radiology Department at Neuro Science Hospital in Baghdad to take Spiral CT scan of the brain and paranasal sinuses from November 2015 till February 2016.

All participants were informed well about the aim and the method of the study and asked them if they agree to participate and they were free to withdrawal at any time they decide. A special consent form was to be signed by each one.

The patients were divided according to dental status into dentate partially edentulous patients and then CT scans for (right and left) maxillary sinuses were taken for each patient using Siemens Somatom definition AS (Germany). The parameters of the acquisition were 1 mm thickness slice, kV=120, mAs=370 and exposure time was 20 seconds. The patients were

positioned in supine on the CT examination table with the head on the head rest.

The information obtained was the measurements parameters which were done using the calibration function of the syngo software program on syngo acquisition workplace in coronal multi planar reconstructions (MPRs), axial and coronal images were evaluated to reconfirm that the examined area contain artery canal.

These CT scan images were used to identify the PSAA in order to obtain the following parameters:

1. Prevalence rate of the PSAA (Figure 1).
2. Distance from the lower border of the artery to the alveolar crest (the vertical line from the artery to the crest) [8] (Figure 2).
3. Distance from the lower border of the artery to the sinus floor (the vertical line from the artery to the floor) (Figure 3).
4. Distance from the lower border of the artery to the medial sinus wall [9] (Figure 4).

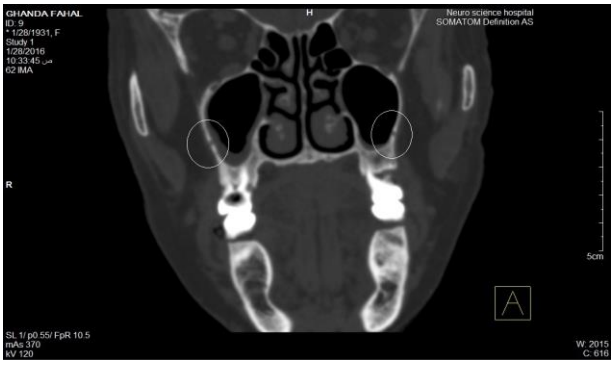

Figure 1: Coronal sections shows the PSAA canal

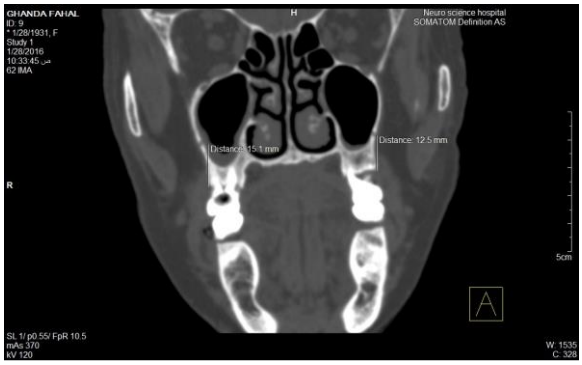

Figure 2: Coronal sections shows distance between lower border of the posterior superior alveolar artery to the alveolar crest

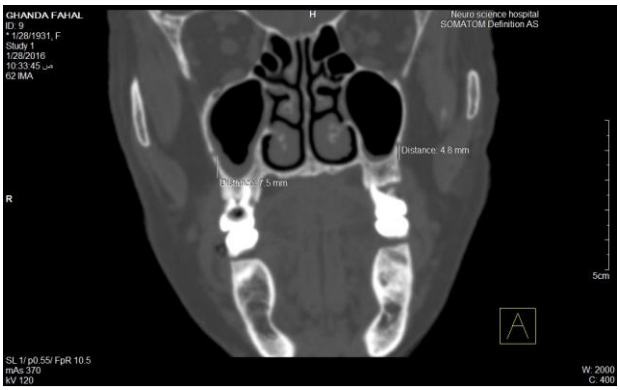

Figure 3: Coronal sections shows distance between lower border of the posterior superior alveolar artery to the floor of the sinus

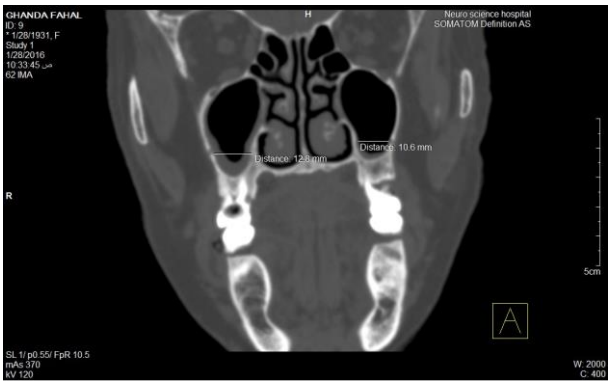

Figure 4: Coronal sections shows distance between lower borders of the posterior superior alveolar artery to the medial sinus wall

Statistical analyses

Data were analyzed using SPSS (statistical package of social science) software version 19. In this study the following statistics were used:

1. Descriptive statistics: including means, standard deviations, frequency (No.), percentages, and statistical tables and figures.
2. Inferential statistics: including: Independent sample t-test: to verify the gender difference for the measured variables.

RESULTS

Radiographical Prevalence rate of the Posterior superior alveolar artery (PSAA) on CT images

The radiographical prevalence rate of PSAA was 73.61% among total sample and it was 82.32% in males and was 62.96% in females (Figure 5).

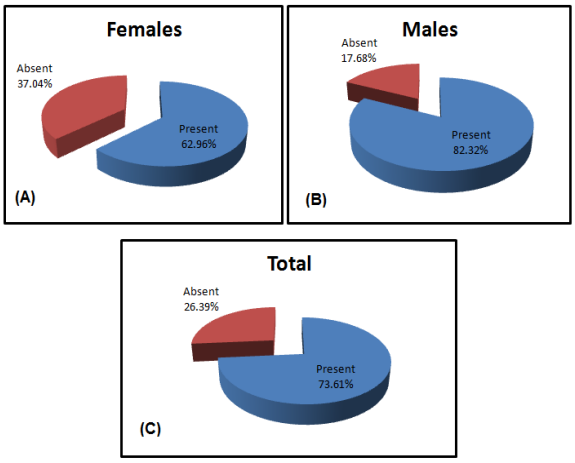

Figure 5: Radiographic prevalence of PSAA in relation to the gender. (A) for females, (B) for males and (C) for total sample.

PSAA measurement parameters (Table 1)

1. The mean distance from the lower border of the artery to the alveolar crest was 18.42± 4.07 mm for the total sample in which it was 18.18 ± 3.70 mm in females and 18.57± 4.29 in males. Statistically there no significant correlation between genders and this distance since the P-value=0.447.
2. The mean distance from the lower border of the artery to the sinus floor was 8.99 ± 3.86 mm for the total sample in which it was 8.41 ± 3.16 mm in females and 9.35 ± 4.21inmales. Statistically there no significant correlation between genders and this distance since the P-value=0.053.
3. The mean distance from the lower border of the artery to the medial sinus wall was 12.68 ± 2.81 mm for the total sample in which it was 13.10 ± 2.61 mm in females and 12.41 ± 2.90inmales. Statistically there no significant correlation between genders and this distance since the P-value=0.053.

Table 1: Descriptive statistics and genders difference of PSAA measurement parameters

Distance from the artery	Genders	Descriptive statistics			Genders difference (d.f.=263)	
		N	Mean	S.D.	t-test	p-value
To the alveolar crest	Total	265	18.42	4.07	-0.762	0.447 (NS)
	Females	102	18.18	3.70		
	Males	163	18.57	4.29		
To the sinus floor	Total	265	8.99	3.86	-1.944	0.053 (NS)
	Females	102	8.41	3.16		
	Males	163	9.35	4.21		
To the medial sinus wall	Total	265	12.68	2.81	1.944	0.053 (NS)
	Females	102	13.10	2.61		
	Males	163	12.41	2.90		

DISCUSSION

The importance of considering the vascular system of the maxillary sinus when employing sinus surgery, particularly lateral approach sinus floor augmentation relates to potential intraoperative complications [1,2,10].

Sinus augmentation is a method with high predictability for placing successful dental implants into atrophic posterior maxilla [11,12]. Blood vessels distribution in this area changes when the alveolar bone is severely atrophied because of increased age and loss of dentition. Moreover, the number and diameter of the blood vessels may decrease in elderly edentulous patients [13], so knowledge of the anatomic structure of the area is important for this procedure.

The prevalence of the PSAA from the examined sinuses using MPR-CT images was found to be 73.6% for the total sample. The success rate for identifying the artery was slightly higher than that reported by Fontana et al. [14] for African-Americans (72.2%) and in the Caucasians (43.2%).

Guncu et al. [7] reported a prevalence of 64.5%, Elian et al. [8] 52.9%, Mardinger et al. [9] 55% and Kim et al., [13] 52%. This variation may be related to the methods the other groups used to detect and describe the artery.

PSAA measurements parameters

In the present study, comparison between right and left sides in the same patient was not done but only gender difference was performed due to the anatomical difference in addition to the dental condition on both sides that were not always the same.

Distance from the lower border of the artery to the alveolar crest

The mean distance from the lower border of the artery to the alveolar crest and it was 18.57 ± 4.29 mm for males and 18.18 ± 3.70 mm for females and for the total sample it was 18.42 ± 4.07 mm. This finding is close to that of Guncu et al. [7] and Kim et al. [13] and higher than Elian et al. [8] (16.4 mm) and Mardinger et al. [9] (16.9 mm).

Distance from the lower border of the artery to the sinus floor

The second measurement was the mean distance from the lower border of the artery to the sinus floor which was 8.99 ±3.86 mm for the total sample (9.35 ± 4.21 mm in males and 8.41± 3.16 mm in females). This distance was reported by Guncu et al. [7] as 7.8 ± 0.3 mm and by Mardinger et al. [8] as 7–8 mm.

Distance from the lower border of the artery to the medial sinus wall

The third measurement was the mean distance from the lower border of the artery to the medial sinus wall which was 12.68 ± 2.81 mm for the total sample (12.41± 2.90 mm in males and 13.10± 2.61 mm in females). It is near to that reported by Guncu et al. [7] which was 11 ± 3.8 mm.

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الخلاصة

المقدمة: معرفة وتقييم تشريح الجيب الفكي قبل رفع الجيب ضرورية لتجنب المضاعفات الجراحية. الشريان السنخي العلوي الخلفي هو فرع من فروع الشريان الفكي العلوي الذي يغذي جدار الجيب الوحشي والغشاء المغطي.

الهدف من الدراسة: هو معرفة احتمالية وجود و موقع الشريان السنخي العلوي الخلفي وعلاقته بأرضية الجيب الفكي والعظم السنخي باستخدام التصوير بالأشعة المقطعية.

طرق البحث و المواد المستخدمة: شملت هذه الدراسة (180) فردا (99 من الذكور و 81 من الإناث) الذين كانت اعمارهم أكثر من 16 عاما، و تم اجراء الدراسة في مستشفى العلوم العصبية في بغداد للفترة من تشرين الثاني 2015 إلى شباط 2016.تم اجراء الأشعة المقطعية للجيب الفكي (اليمين واليسار) لكل مريض. المعلومات التي تم الحصول عليها تم تقييمها بواسطة صور مركبة متعددة المستويات من اجل الحصول على القياسات ادناه: معدل احتمالية وجود الشريان السنخي العلوي الخلفي والمسافة من الحد السفلي من الشريان السنخي العلوي الخلفي إلى قمة العظم السنخية و إلى ارضية الجيب الفكي و إلى الجدارالوسطي للجيب الفكي .

النتائج:وكان معدل احتمالية وجود الشريان السنخي العلوي الخلفي عند فحص 360 جيب فكي لكل الافراد ضمن الدراسة هو (73.6٪)، وكانت النسبة أعلى عند الذكور من الإناث.وكانت المسافة من الحد السفلي من الشريان إلى قمة العظم السنخية (18.42 ± 4.07) ملم و إلى ارضية الجيب الفكي (8.99 ± 3.86) ملم و إلى الجدار الوسطي للجيب الفكي (12.68 ± 2.81) ملم .

الاستنتاجات:تشير الدراسة إلى أن التصوير بالاشعة المقطعية هو أداة قيمة في ايجاد وتحديد موقع الشريان السنخي العلوي الخلفي قبل جراحة الجيوب الأنفية العلوية.