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Morphometric Dimensions of the Maximum Length of Maxillary Air Sinus in Adult Bangladeshi Population

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Abstract

A cross-sectional, analytical type of study was carried out in the Department of Anatomy, Sir Salimullah Medical College, Dhaka, Bangladesh, from July 2019 to June 2020, to determine the maximum length of maxillary air sinus in a Bangladeshi population. Our study samples were 90 Bangladeshi nationals who were attending the Radiology & Imaging Department of the same institution. We adopted convenient sampling method. The maximum length of the right and left maxillary air sinus were measured by the longest distance from the most anterior point of the anterior wall to the most posterior point of the posterior wall by using MB-Ruler for Windows software. The maximum length of right maxillary air sinus in male was significantly higher than that of female (p=0.014). However, no such difference was observed in the maximum length of left maxillary air sinuses between male and female (p=0.137). The maximum length of right maxillary air sinus was significantly higher than that of the left maxillary air sinus in males (p=0.001). However, no difference was observed in the maximum length between the right and the left maxillary air sinuses in females (p=0.099).

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Introduction

Paranasal air sinuses are complex anatomical structures situated within the frontal, maxilla, ethmoid and sphenoid bone. There are four paired paranasal air sinuses, among them maxillary air sinus is the largest one.[1]

According to their location these sinuses are known as paranasal air sinuses. There are four paired paranasal air sinuses, among them maxillary air sinus is the largest one. The maxillary air sinus or antrum of Highmore (Greek; antron means 'a cave') was first discovered and illustrated by Leonardo da Vinci, but the earliest attribution of it's significance was given by Nathaniel Highmore in the 17th century.[2]

It is pyramidal in shape. The base is medial and forms much of the lateral wall of the nasal cavity. The floor, which often lies below the nasal floor, is formed by the alveolar process and part of the palatine process of the maxilla. The roof of the sinus forms the major part of the floor of the orbit. The lateral truncated apex of the pyramid extends into the zygomatic process of the maxilla and may reach the zygomatic bone. The facial surface of the maxilla forms its anterior wall. The posterior wall is formed by the infratemporal surface of the maxilla.[3] After birth maxillary sinus continues to extend both laterally and inferiorly during the rapid growth period from birth to 3

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years of age and from 7 to 12 years of age.[4] They reach their mature sizes at the age of about 20 years, when the permanent teeth fully develop.[5] During adulthood, the shape and size of the maxillary sinus change especially due to loss of teeth. After the maximum growth period, the volume of the maxillary sinus decrease in both gender.[6] The size and shape of the maxillary sinus varies amongst individuals, between genders and in various populations.[7]

A broad spectrum of disease process may involve in this region like acute and chronic sinusitis, rhinosinusitis, polyposis, mucocoele, allergic fungal sinusitis, mycetoma, mucosal thickening, retention cyst formation etc. Precise knowledge and comprehensive understanding of the anatomy of the maxillary air sinus as well as it's relation with different important structures of the face are important to the clinicians and radiologists for definite and confident diagnosis of various diseases in this regions. Antral lavage, inferior meatal antrostomy, Caldwell-luc operation, transantral ethmoidectomy, Functional endoscopic sinus surgery (FESS) are commonly performed by the ENT surgeons to treat a variety of diseases in this area.[8]

Different morphometric dimensions of the maxillary air sinuses can be measured by different radiological methods. Since radiological studies are carried out on living subjects, radiographic measurement of maxillary air sinuses gives more precise result compared to the measurement from dry ossified sinuses or sinuses measured from the cadaver. Living subjects provide the opportunity to record a large amount of information regarding the subject directly such as age, sex, and stature. Therefore the advantage of the radiographic technique is, image of the sinus can be obtained directly and non-invasively.[9]

Anatomical and developmental descriptions of the maxillary sinus may be of great clinical importance. An understanding of age and sex related changes in the dimensions and volume of the normal maxillary sinus may help in the evaluation of radiographs and identification of sinus abnormalities.[10]

With the above perspective, this radiological study of the maxillary sinus was carried out in Bangladesh. The values of different morphometric dimensions of maxillary air sinus of adult Bangladeshi population may be helpful to the anatomists for a normative reference. For the radiologists and the head and neck surgeon the normative values may be helpful in their diagnosis of diseases.

Methods

This cross-sectional, analytical type of study was carried out in the Department of Anatomy, Sir Salimullah Medical College, Dhaka, Bangladesh, from July 2019 to June 2020. The study population were 90 Bangladeshi nationals including 45 male and 45 female attending the Radiology & Imaging Department of the same institution and the sample was collected using convenient sampling method.

Digital radiographs of maxillary air sinus in occipito-mental and lateral view were taken in the Radiology & Imaging Department. The softcopies of images of digital radiograph of maxillary air sinus were collected by pandrive and transferred to a computer. From these images the maximum length of the right and left maxillary air sinus were measured by the longest distance from the most anterior point of the anterior wall to the most posterior point of the posterior wall (Fig. 1) by using MB-Ruler for Windows software. Comparison between different dimensions of maxillary air sinuses between right and left as well as male and female were done by using unpaired

Student's 't' test. A p-value <0.05 was considered statistically significant.

The study was approved by the Ethical Committee of Sir Salimullah Medical College, Dhaka, Bangladesh.

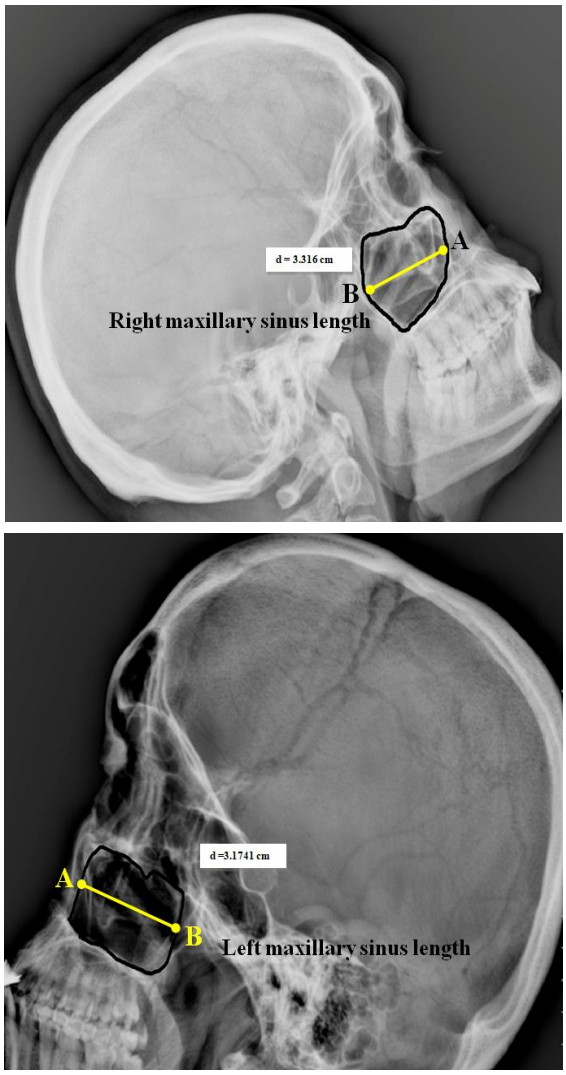

Fig. 1: Photograph of digital radiograph of PNS lateral view showing maxillary sinus length (A: the most anterior point of the anterior wall of right and left maxillary air sinus, B: the most posterior point of the posterior wall of right and left maxillary air sinus).

Results

In male, the maximum length of right maxillary air sinus was ranged from 2.5 cm to 3.6 cm and the mean maximum length of right maxillary air sinus was 3.08±0.21 cm. In female the maximum length of right maxillary air sinus ranged from 2.3 cm to 3.8 cm and the mean maximum length of right maxillary air sinus was 2.94±0.28 cm. The maximum length of right maxillary air sinuses of male was significantly higher (p=0.014) than the maximum length of right maxillary air sinuses of female.

In male, the maximum of left length maxillary air sinus was ranged from 2.2 cm to 3.4 cm and the mean maximum length of left maxillary air sinus was 2.92±0.21 cm. In female the maximum length of left maxillary air sinus ranged from 2.1 cm to 3.6 cm and the mean maximum length of left maxillary air sinus was 2.84±0.29 cm. No significant difference (p=0.137) was observed in the maximum length of left maxillary air sinuses of male and female (Table-I).

In male, the maximum length of right maxillary air sinus was ranged from 2.5 cm to 3.6 cm and the mean maximum length of right maxillary air sinus was 3.08±0.21 cm. In male, the maximum of left length maxillary air sinus was ranged from 2.2 cm to 3.4 cm and the mean maximum length of left maxillary air sinus was 2.92±0.21 cm. The maximum length of right maxillary air sinus was significantly higher (p=0.001) than the maximum length of left maxillary air sinus in male. In female, the maximum length of right maxillary air sinus ranged from 2.3 cm to 3.8 cm and the mean maximum length of right maxillary air sinus was 2.94±0.28 cm. In female the maximum length of left maxillary air sinus ranged from 2.1 cm to 3.6 cm and the mean maximum length of left maxillary air sinus was 2.84±0.29 cm. No significant difference (p=0.099) was observed in the maximum length of right and left maxillary air sinuses in female (Table-II).

Table-I: Right and left maximum maxillary sinus length in male and female (N=90)

Maximum maxillary sinus length (cm)	Male (n=45) Mean±SD (Range)	Female (n=45) Mean±SD (Range)	p-value
Right	3.78±0.21 (2.5–3.6)	2.94±0.28 (2.3–3.8)	0.014^{S}
Left	2.92±0.21 (2.2–3.4)	2.84±0.29 (2.1–3.6)	0.137^{NS}

Comparison between sex was done by unpaired Student's t-test; S=significant, NS=not significant.

Table-II: Right and left maximum maxillary sinus length in male and female (N=90)

Maximum maxillary sinus length (in cm)	Right Mean±SD (Range)	Left Mean±SD (Range)	p-value
Male (n=45)	3.08±0.21 (2.5–3.6)	2.92±0.21 (2.2–3.4)	0.001^{S}
Female (n=45)	2.94±0.28 (2.3–3.8)	2.84±0.29 (2.1–3.6)	0.099^{NS}

Comparison between right and left was side done by unpaired Student's t-test; S=significant, NS=not significant.

Discussion

It has been widely recognized that maxillary air sinus morphometry is influenced by the racial, gender and age factors. So each population should have their own specific standard baseline to optimize the accuracy of identification. In the present study morphometric dimensions of maxillary air sinus were measured. Results of this study were compared with the results of other studies from different countries like India, Turkey, Egypt, Iraq, Sweden, Japan, Germany, Poland, South Africa, Iran. However, so far it is known, there is no published data on morphometric dimensions of maxillary air sinus in our country. Hence, the findings of the present study could not be compared with the results of any other previous similar studies of our country. The maximum length of right maxillary air sinuses of male were significantly higher ($p<0.05$) than the maximum length of right maxillary air sinuses of female. No significant difference was observed in the maximum length of left maxillary air sinuses of male and female. The mean maximum maxillary sinus length of the present study population was similar with that of the Iranian, Indian and Turkish population.[11-13] In contrast, study findings of present study were lower than that of some other studies done in Karnataka and Madhya Pradesh of India and among Turkish population.[7,14,15]

Conclusion

The present study showed that the maximum length of right maxillary air sinus was significantly higher than the maximum length of left maxillary air sinus in male. The maximum length of right maxillary air sinuses of male was significantly higher than the maximum length of right maxillary air sinuses of female. No significant difference was observed in the maximum length of right and left maxillary air sinuses in female. No significant difference was observed in the maximum length of left maxillary air sinuses of male and female. Maxillary air sinus anatomy may help surgeons during surgical procedures to avoid intra operative and post-operative complications. Measurements of the maxillary sinus can play an important role in the personal identification and gender determination which is important for the forensic experts and anthropologists. The study may also act as a guideline for the anatomists for their future studies.

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