Normal Anatomical Variations of Maxillary Sinus Septa using Computerized Tomography from Sokoto Northwestern Nigeria

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ABSTRACT

Background/Aim: The maxillary sinus is the largest paranasal sinus and represents a complex anatomical structure with significant inter-individual variation. Computerized Tomography (CT) in the assessment of the maxillary sinus yields much more information. The aim of this study is to determine the prevalence, number and location of maxillary sinus septa using CT. **Materials and Methods:** One hundred and thirty subjects (79 males and 51 females), between 20–80 years, with normal maxillary sinus CT anatomy, from head CT scans carried out at the Radiology Department of the Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto, over a period of 5 years, were studied. Head CT scans were obtained from the local data base of the CT machine and back up compact disc from the CT library. Images were taken with Neusoft Dual Slide Helical CT machine, and films were viewed on the computer monitor. Septa were identified as bony projections from the sinus walls into its cavity on axial and coronal slides. **Results:** In this study, septa were present in 14.23% (37 septa out of 158) males sinuses, while in females, 10.34% (27 out of 102) had septa. The overall prevalence of maxillary sinus septa was 24.62%. **Conclusion:** Maxillary sinus septa appear common and are capable of complicating sinus membrane surgeries. CT may be useful in surgical evaluation and planning.

Key words: Anatomical variations; computerized tomography; maxillary sinus; Nigeria; septa; prevalence; Sokoto

Introduction

Maxillary sinus septa are bony crests within the sinuses and are referred to as Underwood's septa, because they were first described in detailed anatomy of the maxillary sinus by Underwood in 1910.[1] They may give rise to multiple posterior recesses or extend from the base to the roof, producing two separate sinuses.[1-3] Etiologically, according to Underwood,[3] they arise from an area between two adjacent teeth and are usually found in three specific sections (anterior, middle, or posterior) that correspond to the three defined periods of tooth activity, separated by intervals of time. However, Neivert[4] proposed that septa were derived from finger-like projections produced by the embryonic out-pouching of the ethmoidal infundibulum.

Krenmair[5] classified sinus septa into primary and secondary; the primary septa occur along with the development of the maxilla, while the secondary arises as a result of irregular pneumatization of the sinus floor after tooth loss. The presence of anatomic variations within the maxillary sinus, such as septa, may increase the risk of schneiderian membrane perforation during sinus operations and this represents the most common complication.[6-8] It may also limit the creation of a window in the anterior-lateral wall and the reflection of a hinged door when elevating the sinus membrane from an alveolar recess.[8,9] As such, a detailed knowledge of the anatomy of the sinuses is critical in performing procedures such as functional endoscopic sinus surgery.[10]

According to Donal,[11] from the University of British Columbia, Vancouver, Canada, 50% of cadaveric models had septa, whose position, number, and depth were extremely

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variable. Ulm[7] reported 18.3% prevalence from School of Dentistry, University of Vienna, Austria, while in two separate studies, Krenmair[5,12] reported a prevalence of 26.8% and 14.3%, respectively using sinus computerized tomographys (CTs) of Austrians in Wels. Velasquez-Plata[13] found 24% prevalence at the University of Detroit, Michigan, USA, and from the College of Dentistry, Yonsei University, Seoul; among Koreans, Kim[14] reported a prevalence of 31.7% and 22.6% in edentulous and dentate maxillas, respectively by CT scan imaging. Maryam[15] at Leuven, Belgium, found prevalence of 47%. There is dearth of data on the prevalence, and locations of maxillary sinus septa using CT among Nigerians (Africans), and most of these results were obtained from Caucasian subjects. The aim of this study is therefore to compliment their findings and to establish a baseline data for values in our environment.

Materials and Methods

This study involved 130 subjects (79 males and 51 females), between 20–80 years, with normal maxillary sinus CT anatomy, from head CT scans carried out at the Radiology Department of the Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto, over a period of 5 years. Head CT scans were obtained from the local data base of the CT machine and back up compact disc from the CT library. Images were taken with Neusoft Dual Slide Helical CT machine, (2005 model, 15 cm FOV, 200 mA, 120 kV, scanning at high resolution bone algorithm at 1 second and slice thickness of 5 mm). Films were viewed on the computer monitor. Septa were identified as bony projections from the sinus walls into its cavity on axial and coronal slides while the number and location of septa per sinus was noted. Data was manually sorted out, tabulated, entered into computer using Microsoft word, and Excel, and comparison was done using Chi-square with Yates correction.

Results

All observed septa were located on the anterior and anterolateral walls of the maxillary sinus [Figure 1]. Among males, septa was present in 14.23% of maxillary sinus, [Table 1] while of the 19 male right maxillary septa, had each maxillary sinus being completely divided into two halves [Figure 2] and the other had a doubled septum [Figure 3]. Double septa were not seen in any left maxillary sinus of either males or females in the studied population. However, in females, 10.34% had sinus septa. Two of the 13 right septa were doubled. Th e overall prevalence of maxillary sinus septa was 24.62%.

Discussion

Maxillary sinus septa appear common, they are capable of precipitating and complicating sinus membrane perforation during sinus operations, and this may be minimized by complete CT evaluation and adequate

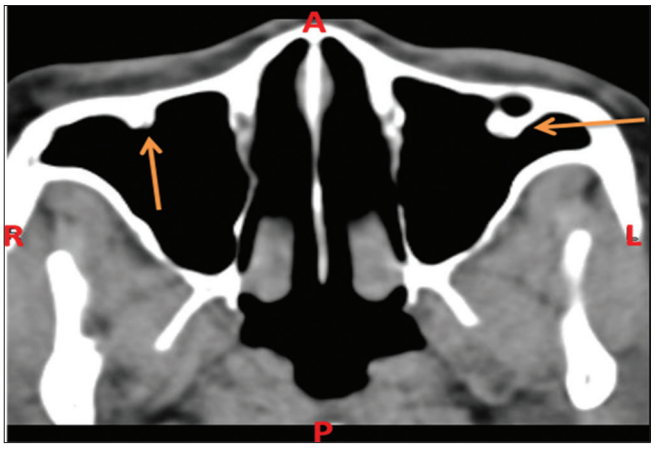

Figure 1: Axial computerized tomography (CT) of a 45-year-old male showing arrows pointing toward septa on the anterior and anterolateral sinus walls. A = anterior, P = posterior, R = right side, L = left side

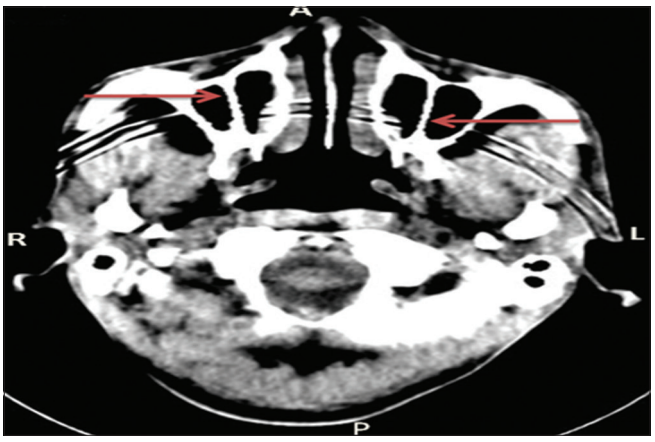

Figure 2: Axial computerized tomography (CT) slide of a 55-year-old male showing bilateral septa (arrows) completely dividing each maxillary sinus anteroposteriorly into two compartments. R = right side, L = left side, A = anterior, P = posterior

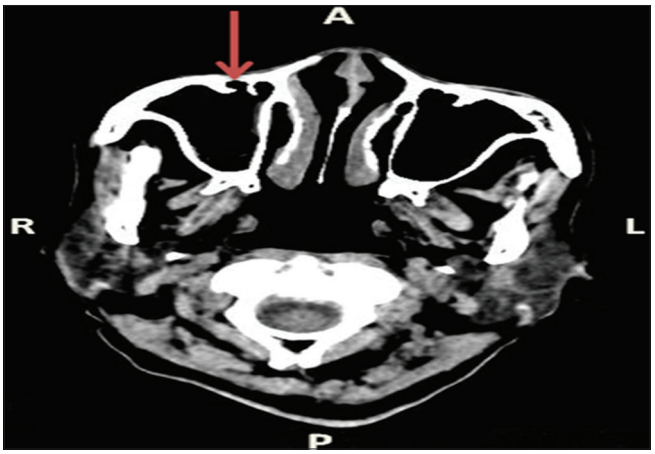

Figure 3: Axial computerized tomography (CT) slide of a 70-year-old female showing doubled septa (arrow) on the anterior wall of the right maxillary sinus. R = right side, L = left side, A = anterior, P = posterior

Table 1: The frequency of maxillary sinus septa in the studied population

Maxillary sinus	Males		Females	
	Septa present	Absent septa	Septa present	Absent septa
Right maxillary sinus	19	60	13	38
Left maxillary sinus	18	61	14	37
Summary: Prevalence in total population (%)	37 (14.23)	121 (46.53)	27 (10.34)	75 (28.84)
	Overall prevalence of sinus septa=24.62%. 64 septa in 260 sinuses			

X^2 with Yates correction. Absolute value for males is 79, while for females, its 51. Level of significance ≥0.25

pre-operative planning for sinus surgery. The range of normal anatomical variations of the maxillary sinus in different studies is a reflection of the influential effects of human variability and the different degrees of pneumatisation.[16,17] In this study, the prevalence of maxillary sinus septa was 24.62%; of these, 1.15% were doubled septa, and all septa were located on the anterior and anterolateral walls of the maxillary sinus. The incidence of septa from this study was lower than the estimated prevalence of antral septa among Canadians by Donal,[11] where 50% of cadaveric models had septa, by Ella,[18] in France with 38.6% prevalence; by Maryam,[15] in Leuven, Belgium, with prevalence of 47%; and among Italians by Gabriele,[1] who reported a prevalence of 40% in a cadaveric study of the maxillary sinus septa. However, the results of this study compared favorably with the works of Krenmair,[5] in Austria, and Kim,[14] in Seoul, Korea, where the prevalence of maxillary sinus septa were 26.8% and 22.6%, respectively.

Our results were essentially the same with the report of Velasquez-Plata,[13] from the University of Detroit, Michigan, USA, who found 24% prevalence of antral septa on CT scan analysis of maxillary sinuses, and Won-Jin,[19] who reported a prevalence of 24.6%, among Koreans in Jeonju. However, our results were higher than the septal prevalence reported by Ulm,[7] (18.3%), from the University of Vienna, Austria, and Krenmair,[12] (14.3%), from the University of Vienna, Austria, while Amusa,[20] who worked on south-western Nigerians at the Obafemi Awolowo University Teaching Hospital, Ile Ife, recorded no antral septa in 24 dried human skulls.

Concerning double septa, our results were lower and different from the findings by Won-Jin,[19] from Chonbuk National University School of Dentistry, Jeonju, Korea, that, 8 out of 236 sinuses had double septa, and that no sinus had septa completely dividing it into two or more compartments. In agreement with most studies on the location of sinus septa,[1-3,20-22] this study found that, the maxillary sinus septa were located on the anterior and anterolateral walls of the maxillary sinus.

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