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Research Paper

Comparative Analysis Of Sphenoid Sinus Dimension In Adults And Adolescents:- A Retrospective Analysis Of Prospective Studies In The Sphenoid Sinus Of Adults And Adolescents In Nigeria.

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ABSTRACT
Background
The dimension of the sphenoid sinus (SS) has been grossly associated with the extent of the sinus pneumatisation[1] This is due to the variations in the extent of its pneumatization, ranging from absence of SS pneumatization to extensive pneumatization of the sphenoid sinus. This may have a major impact on the rate of complication during surgical access to the SS[2]. The surgical complications are often encountered during neuro-endoscopic procedures to the sellar/parasellar region. Endoscopic trans-nasal trans-sphenoid surgery (ETTS) is increasingly utilized in neurosurgery as first line treatment for most pituitary lesions. These lesions are also present in the adolescent age group requiring the same line of surgical treatment as in the adult population. Thus this study aims to compare the average SS dimension in the adolescent and that of the adult SSD. It is hoped that the outcome of this study will form a guide in the decision to access the sellar region in the adolescent likewise the adult black population in Nigeria. This study considers sphenoid sinus dimension as it affects the widest anterior-posterior dimension (APD), transverse dimension (TD). The widest dimensions are considered because of the irregular shape of the sphenoid sinus cavity caused by varying degree of the sinus pneumatization and septation[6]. These parameters: APD, TD and age, are essential in calculating the adequatecy of the sphenoid sinus. It is this adequacy that is used to determine the corridor to the sellar region. An in-depth analysis of the role of factors such as age, sex and race in the dimension of SS has been considered in many series and noted to be important contributory factors to the SS dimension. In all the studies CT scan was the image modality of choice.
In most publications there is appreciable consensus that SS maturity (sellar type/adult size SS) occurs at the age of puberty i.e. between 12 to 14 years and that pnuematization of the various parts of the SS continues up to the third decade of life before declining. In our environment, Studies have been performed on the anatomy of sphenoid sinus and its dimension in the black adolescent and adult population but none has been done to compare the two different age groups. This disparity in the knowledge of the dimension of SS may affect the extent of neurosurgical intervention using this approach in this age groups especially endoscopic procedure of the sphenoid sinus. This may be the reason why trans-cranial approaches to this region of the skull base in adolescents have been highly favoured.

MATERIALS AND METHOD
This is a comparative analysis of the outcomes of the prospective study of the sphenoid sinus dimension of randomly selected asymptomatic adults in Nigerians by Idowu et al, and the outcome of the prospective study of the sphenoid sinus dimension of randomly selected asymptomatic adolescent Nigerians by Orji et al. The studies were CT scan based clinical anatomical study that were conducted at various hospitals for Neurosurgery in Nigeria. All selected samples had normal sphenoid sinus morphometary with sellar/postsella type pneumatization. The data was obtained from the results of already concluded measurements in the above respective research works and analysis was with Pearson's correlation coefficient using measurements taken from CT scan of the sphenoid sinus by the researchers. The statistical analyses was conducted using descriptive and inferential statistics using statistical package for scientific students version.17 (SPSS v.17). Independent T test was used to compare the results of the adolescent and adult studies while Ethical approval was obtained for this study.This is a retrospective, cross sectional, descriptive study that was designed to measure the anterior-

posterior, lateral (APD, LD) of the sphenoid sinuses in the asymptomatic adolescent Nigerians aged between 13 to 18 years and adults above 18 years who are Nigerians. The calculated volume of their sphenoid sinus (SSV) was determined and used as a control for that age. The mean of the individual values of the sphenoid sinus MSSV were obtained.

The study was carried out in Enugu metropolis using CT scan facilities at Memfys Hospital for neurosurgery for the adolescent population while the measured data from the adults was CT scan base study in Lagos. Inclusion and exclusion criteria were considered

The statistical analysis were conducted using descriptive and inferential statistics under the guidance of a qualified statistician. Descriptive analysis involved the use of tables, cross-tables. Inferential statistics was employed in testing the hypothesis by comparing the mean of the dimensions using the Student's t-test. The mean, median, and standard deviation (SD) of each dimension will be computed of the Right and left SS, and gender differences analyzed. The association between continuous variables (age and corresponding mean SSD) were investigated by means of Pearson's correlation coefficient. A probability (p) test of less than 0.05 was used to ascertain the statistical significance of the results. Data analysis were performed with Statistical Package for Social Sciences (version 17 SPSS Inc., Chicago, IL).

RESULT

***Result of SSD in adult population**: In the black population, especially in Nigeria, Idowu OE, 'et al, did a prospective study of the sphenoid sinus morphology using the cranial tomographic (CT) scan images of 60 Nigerian adult patients. The CTs were reviewed regarding the different anatomical variations of the sphenoid sinus: dimensions, septation, and pattern of pneumatization.*

However, with respect to this study, the SSD shows that out of the 68 patients studied, 37 were males and 23 females. The patients' ages ranged from 18 years to 85 years, with a mean of 47.2 years. There was no gender difference with respect to the attachment of the main sphenoid sinus septum. The sphenoid anterior-posterior, and transverse dimensions were not significantly dependent on age, but they were longer in males than in females with average total of 23.8 mm and 26.0 mm for right, then 18.6 mm and 20.1 mm for left respectively. They concluded that the study provides anatomical information about the sphenoid sinus dimensions and morphology that is essential for avoiding complications in performing an endoscopic sphenoidotomy in adult black.

***Result of SSD in adolescent population:** In the adolescent population, the study boy Orji BI et al, shows that the study consisted of one hundred and four randomly selected asymptomatic male and females between the ages of thirteen and eighteen years whose parents or caregivers consented to the study. There were fifty-two males and fifty-two females recruited into the study. The mean age for male and females were 15.90 and 16.21 respectively, with average mean age for both gender being 16.08 years. Eliminating gender bias, the right MSSD was revealed to be 19.06 mm in the APD, 16.57 mm in the TD. While the left MSSD was likewise shown to be 19.81 mm for APD, 16.82 mm for TD.*

CONCLUSION

This study has shown the adolescent black in Nigeria, does not have adequate SSD comparable to that of the adult and require more detailed CT guided imaging to access the adequacy of the SSD for ETS. The APD was noted to be wider than the other dimensions.

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I. INTRODUCTION

The dimension of the sphenoid sinus (SS) has been grossly associated with the extent of the sinus pneumatisation[1] There are variations in the extent of sphenoid sinus pneumatization, ranging from absence of SS pneumotization to extensive pneumatization of the sphenoid sinus. This may have a major impact on the rate of complication during surgical access to the SS[2]. The surgical complications are often encountered during neuro-endoscopic procedures to the sellar/parasellar region. Neuro-endoscopy has grown rapidly in the last 25 years as a diagnostic and therapeutic modality for investigating and treating respectively a variety of brain and spinal disorders[3-5]. Endoscopic trans-nasal trans-sphenoid surgery (ETTS) is increasingly utilized in neurosurgery as first line treatment for most pituitary lesions. These lesions are also present in the adolescent age group requiring the same line of surgical treatment as in the adult population. Thus this study aims to compare the average SS dimension in the adolescent and that of the adult SSD. It is hoped that the outcome of this study will form a guide in the decision to access the sellar region in the adolescent likewise the adult black population in Nigeria. The study of the pre-operative CT and MRI scans and perioperative endoscopic visualization can provide useful anatomical information as indicated in sellar, suprasellar, intraventricular (third ventricle), retro-infundibula, and invasive tumors. Recurrent and residual lesions, pituitary apoplexy and empty sellar syndrome can be managed by endoscopic approaches. This study considers sphenoid sinus dimension as it affects the widest anterior-posterior dimension (APD), transverse dimension (TD). The widest dimensions are considered because of the irregular shape of the sphenoid sinus cavity caused by varying degree of the sinus pneumatization and septation[6]. These parameters: APD, TD and age, are essential in calculating the adequatecy of the sphenoid sinus. It is this adequacy that is used to determine the corridor to the sellar region. An in-depth analysis of the role of factors such as age, sex and race in the dimension of SS has been considered in many series and noted to be important contributory factors to the SS dimension. In all the studies, CT scan was the image modality of choice.

Computerized Tomography Scan (CT) has been found to be very important tool in assessing dimensions of bony structures, and for preoperative planning of the skull base surgery. This is because of the role of CT scan in identifying bone related lesions in the skull base better than other conventional imaging modalities like magnetic resonant imaging (MRI). After CT image acquisition, 3D reconstruction in sagittal, coronal and axial plane is done and measurements taken accordingly.

In most publications there is appreciable consensus that SS maturity (sellar type/adult size SS) occurs at the age of puberty i.e. between 12 to 14 years and that pnuemotization of the various parts of the SS continues up to the third decade of life before declining. In our environment, Studies have been performed on the anatomy of sphenoid sinus and its dimension in the black adolescent and adult population but none has been done to compare the two different age groups. This disparity in the knowledge of the dimension of SS may affect the extent of neurosurgical intervention using this approach in this age groups especially endoscopic procedure of the sphenoid sinus. This may be the reason why trans-cranial approaches to this region of the skull base in adolescents have been highly favoured. Examples are pituitary adenomas; craniopharyngiomas; fronto-ethmoidal and sphenoid sinus mucoceles provided wide marsupialization could be achieved[7].

Research hypothesis:

Ho > 1. There is no age difference in the derived values of SSD in adolescents and adult in Nigeria
Ha >1. There is age difference in the derived values of SSD in adolescents and adult in Nigeria
Ho > 2. There is no difference in the average SSD between adult and adolescents right and left SS in Enugu.
Ha > 2. There is a difference in the average SSD between adult and adolescents right and left SS in Enugu.

General objectives of the study:

This study is aimed at comparing the dimensions of the sphenoid sinus in adolescents (13 to 18 years) and adults (>18 yrs) in Nigeria

Specific objectives of the study: To compare between the adolescents and adults, the mean values of SSDs in males and females. The data obtained from these measurements may provide reference values for SSDs of adolescents adult population in Nigeria and if the dimensions are comparably similarity, it will be useful for pre-operative evaluation of adolescents for endoscopic access to the anterior skull base as is done in the Nigerian adult population.

II. LITERATURE REVIEW

Studies have been done on the dimensions of sphenoid sinus in surgical practice especially in adults by neurosurgeons, ear nose and throat (ENT) surgeons and anatomists[8]. Most of these studies were done outside Nigeria with obvious dearth of information on the sphenoid sinus dimensions in adolescents as well as its compared value with the adults SSD.

Anatomical consideration

Detailed knowledge of the anatomy of the sphenoid sinus is very important in understanding the morphometric changes affecting the sphenoid sinus dimensions. The sphenoid sinuses are formed in the body of the sphenoid bone as a pair of unequal air cavities in the skull base[9]. This sinus develops differently from the other paranasal sinuses. At birth, it arises as a recess between the sphenoid concha and the presphenoid body. Then it starts to develop inferiorly and posteriorly. Part of the sphenoid concha fusses with the presphenoid thus forming the sphenoid sinus cavity in the second or third year of life. The presphenoid recess becomes the sphenoethmoidal recess. After this stage, pneumatization occurs in the presphenoid and the basisphenoid of the sphenoid bone. By the age of 8–10 years, the real sinus cavity is visible, although the definitive cavity will be formed at puberty and the origin of the sphenoid sinus on the posterior nasal wall can be clearly identified from the location of its osmium· This pneumatization continues until adulthood when it reaches the maximum size[10]. Pneumatization of the sphenoid can extend in all its components, like the greater and lesser wings, the pterygoid plates, and the basiocciput. The sinus spreads more often anteriorly and laterally then posteriorly and inferiorly[11]. These extensions of the sinus bring it in close relations to vessels and nerves of the skull base.

In sellar or post sellar pneumatization of the sphenoid sinus, the dorsum sellae that lies posterior to the pituitary gland at the summit of the clivus could be the most posterior part of the roof of the sinus. Many authors have assessed the relationship of optic nerve in the superior part (roof) of the sphenoid sinus. The most commonly used description pattern of the various anatomical relations of the SS and the optic nerve is the classification system by Delano et al viz:

Type 0: Does not border sphenoid sinus
Type 1: Adjacent to sphenoid sinus
Type 2: Indentation on sphenoid sinus
Type 3: Less than 50% exposure of optic nerve in sphenoid sinus
Type 4: Optic nerve traversing sphenoid sinus

Factors affecting SSD

Extent of pneumatization

The role of pneumotization on the anatomy of the SS especially as it concerns the neurovascular structures in relation to the SS has been adequately studied. One of such study by Fasunla et al, was based on the relationship of optic nerves and internal carotid in a well-pneumatized SS. This study shows how important the degree of pneumatization of SS is, as it can affect the effective volume (volume adequate for endoscopic trans-spheniodal access to the sellar region) of the SS in the black population. Given that the protrusion and dehiscence of the wall of the SS by OP and ICA could be as high as quoted above and could limit the endoscopic approach to the sellar region, as a direct effect of pneumatization of the SS, it does show that in the presence of large volume or dimension of the SS the SSD could still be regarded as ineffective or inadequate as a corridor to the sellar region. Also Sinuses with sellar/postsellar pneumatization have been considered to be technically less demanding for a trans-sphenoidal hypophysectomy as compared to the presellar pneumatization because they have adequate dimension.

Role of age, sex, race and onodi cells on SSD

The role of age, sex, race and other morphometric variables such as Onodi air cells as they affect the dimension of the SS have been widely discussed in the literatures. the SSD has been unequivocally noticed to be variable among various age groups, sex and race. The role of Onodi cells as a factor influencing the dimension of SS has been evaluated in details[12]. While the longest horizontal distance from the anterior wall to the posterior wall of sphenoid sinus was 22.0 ± 7.7 mm. This study provides anatomical information about sphenoid sinus of the Chinese in Asia with some surgical distance measured between the sphenoid ostium and the surrounding structures. This study shows that the presence of Onodi air cells compromised the dimension of the SS in the Chinese population whereas in Nigeria, sex, though not very significantly, was the main factor in the black population as noted by Idowu et al. However it must be pointed out that the study by Wu BH ‘et al, has shown that even in the presence of Onodi air cells, the measurement of the dimension of the SS can still be done with the dimension not being affected provided the measurement is taken from a certain anatomical land mark. First they noted that there was a reduction in the mean horizontal distance from anterior wall to posterior wall of sphenoid sinus by 4.9 mm in the Onodi air cell type of SS, the second point they noted was that the length of mean vertical line from the center of sphenoid ostium to the roof of sphenoid sinus of Onodi cell type was reduced by 7.3 mm but the dimension was not affected when the measurement was taken from the center of the ostium to the lowest point of the bottom of the SS. This means that in considering the effect of Onodi air cells on the SS anatomy, for accurate measurement of the SSD especially in Asians, certain anatomical landmarks have to be chosen to obviate this limitation. This is more so since the SS is not a uniformly formed cavity. The study by Wu BH ‘et al shows that such anatomical landmarks may include the following: The length of vertical line from the center of sphenoid ostium to the lowest level of the bottom of sphenoid sinus, the length of mean horizontal line from the center of sphenoid ostium to the posterior wall of sphenoid sinus, the mean horizontal line from the lowest point of the sella to the anterior wall of sphenoid sinus, the transverse diameter of the SS cavity and the longest horizontal distance from the anterior wall to the posterior wall of sphenoid sinus.

Racial variation may not directly affect the dimension of the SS. However the presence of various degree of dehiscence and protrusion of the lateral wall of the SS by optic nerve and the carotid artery may suggest an indirect effect. The same view may be extended to the presence of Onodi air cells. While the later has not been proven, the former has. Sareen D ‘et al, suggest strong possibilities of racial variations in terms of relationship of the internal carotid artery and optic nerve to the sphenoid sinus in the Indian population. Senja T ‘et al, did a study on the anatomic variations in sphenoid sinus pneumotization between Asians and Caucasians and concluded that there exists, a statistically higher prevalence of internal carotid artery protrusion in Caucasians compared with Africans Americans and Hispanics, as well as statistically higher prevalence of optic nerve protrusion in Caucasians and Asians when compared with African Americans and Hispanics[12]. These findings may have interesting implications when considering the ease of assess to the SS in endoscopic trans-sphenoidal procedures and complication rates among different ethnic groups, and by extension the effective SSD.

Similarly, the comparative study of the SSD between the Chinese and the Caucasians by Yuntao, L 'et al, showed that extended pneumotization of the sphenoid sinus SS which inadvertently increased the SSD is an indispensable element for the extended trans-sphenoidal (ETS) approach[13].

One of the important parameters in measuring SSD is the volume of the SS though it is difficult to decide the best way of accurately measuring the SS volume (SSV), considering the irregular shape of the deeply sited sinus and the various extent of its pneumatization. It has been recognized that aeration of the SS expands with the development of the sphenoid bone, but there is existence of scant detailed volumetric data regarding this process, as it evolves from childhood to old age. However, Yonetsu 'et al have associated age of an individual with his or her SSV without gender or racial bias by noting that the sphenoid sinus volume (Vcm3) at a particular age (A = years), could be estimated by the following formula: ($V = - 2.23 + (0.77\ A – 0.018\ A^2 + 0.00012\ A^3)(r = 0.69)$)). They used a paired t-test to analyze the difference in the volume of sphenoid aeration between female and male patients in each of the age groups. Then using a polynomial regression analysis for age-related changes in the sphenoid aeration volume, they fitted the obtained data into an equation of third degree as noted above. Their analyses were performed with Stat View 4.0 software (Abacus Concepts, Berkeley, CA). Their study has shown that sinus aeration on both sides seemed to manifest independently throughout development and, at maturation, the volumes of bilateral aeration differed markedly in many cases. Their work also shows that irrespective of the sphenoid sinus APD, VD and TD at any particular age, the SSV could be calculated using only the value of the patient's age.

The effective SSD is very important when measuring the SSD because it is the dimension that guarantees safety during clinical assessment of the SSD for ETT. This is very true because the course of the neurovascular structures surrounding the SS may limit the corridor to the sellar/parasellar lesions even when the measured SSD is capacious enough. This means that a balance has to be struck between the measurement of SSD obtained without considering their neurovascular relationship and the measured SSD with consideration of the neurovascular surroundings (effective SDD).

Role of SSD in Endoscopic transnasal-transphenoidal Approach

The endoscopic trans nasal trans-sphenoidal approach to sphenoid sinus is a technique, which has established itself in the recent years and demands a thorough knowledge of the surgical anatomy and a huge amount of anatomical variations (especially with the dimensions) involving the sphenoid sinus is adequate in dimension to allow passage of endoscopic instruments.

III. MATERIALS AND METHOD

This is a comparative analysis of the outcomes of the prospective study of the sphenoid sinus dimension of randomly selected asymptomatic adults in Nigerians by Idowu 'et al, and the outcome of the prospective study of the sphenoid sinus dimension of randomly selected asymptomatic adolescent Nigerians by Orji et al. The studies were CT scan based clinical anatomical study that were conducted at various hospitals for Neurosurgery in Nigeria. All selected samples had normal sphenoid sinus morphometary with sellar/postsella type pneumotization. The data was obtained from the results of already concluded measurements in the above respective research works and analysis was with Pearson's correlation coefficient using measurements taken from CT scan of the sphenoid sinus by the researchers. The statistical analyses was conducted using descriptive and inferential statistics using statistical package for scientific students version.17 (SPSS v.17). Independent T test was used to compare the results of the adolescent and adult studies while Ethical approval was obtained for this study.

Study design:

This is a retrospective, cross sectional, descriptive study that was designed to measure the anterior-posterior, lateral dimensions (APD, LD) respectively of the sphenoid sinuses in the asymptomatic adolescent Nigerians aged between 13 to 18 years and adults above 18 years who are Nigerians. There mean value represents the MSSD value for the adolescents.

The study was carried out in Enugu metropolis using CT scan facilities at Memfys Hospital for neurosurgery for the adolescent population while the measured data from the adults was CT scan base study in Lagos.

Scope of the study:

This study was conducted in a sample population of asymptomatic male and female adolescents aged between 13 and 18 years, and their adult counterpart resident in Enugu and Lagos respectively, who have no pathology involving the sphenoid sinus. The following anatomical dimensions of the sphenoid sinus measured are:

- The widest anterior-posterior dimension from the sphenoid ostium to the posterior wall of the sinus ostium (APD)
- The maximum transverse diameter (TD)

Inclusion criteria
Data from the results of the respective studies as earlier described , who met the inclusion criteria for measuring the dimension of the sphenoid sinus in the respective age groups**.**
Exclusion criteria
Non-Nigerians and Nigerian adults as well as adolescents who were already having symptoms related to sphenoid sinus pathology (example: SS mucoceole, osteosarcoma of the SS bone, pituitary tumor, fracture, etc.). Also patients with a previous sphenoid sinus surgery, and asymptomatic patients whose CT scan reveal sphenoid sinus lesions were excluded from the sample size.

Statistical presentation and analyses:
All statistical analysis were conducted using descriptive and inferential statistics under the guidance of a qualified statistician. Descriptive analysis involved the use of tables, cross-tables. Inferential statistics was employed in testing the hypothesis by comparing the mean of the dimensions using the Student's t-test. The mean, median, and standard deviation (SD) of each dimension will be computed of the Right and left SS, and gender differences analyzed. The association between continuous variables (age and corresponding mean SSD) were investigated by means of Pearson's correlation coefficient. A probability (p) test of less than 0.05 was used to ascertain the statistical significance of the results. Data analysis were performed with Statistical Package for Social Sciences (version 17 SPSS Inc., Chicago, IL).

IV. RESULT

Result of SSD in adult population: In the black population, especially in Nigeria, Idowu OE, 'et al, did a prospective study of the sphenoid sinus morphology using the cranial tomographic (CT) scan images of 60 Nigerian adult patients. The CTs were reviewed regarding the different anatomical variations of the sphenoid sinus: dimensions, septation, and pattern of pneumatization.
However, with respect to this study, the SSD shows that out of the 68 patients studied, 37 were males and 23 females. The patients' ages ranged from 18 years to 85 years, with a mean of 47.2 years. There was no gender difference with respect to the attachment of the main sphenoid sinus septum. The sphenoid anterior-posterior, and transverse dimensions were not significantly dependent on age, but they were longer in males than in females with average total of 23.8 mm and 26.0 mm for right, then 18.6 mm and 20.1 mm for left respectively. They concluded that the study provides anatomical information about the sphenoid sinus dimensions and morphology that is essential for avoiding complications in performing an endoscopic sphenoidotomy in adult black.

Result of SSD in adolescent population: In the adolescent population, the study by Orji BI et al, which consisted of one hundred and four randomly selected asymptomatic male and females was between the ages of thirteen and eighteen years, whose parents or caregivers consented to the study. There were fifty-two males and fifty-two females recruited into the study. The mean age for male and females were 15.90 and 16.21 respectively, with average mean age for both gender being 16.08 years. Eliminating gender bias, the right MSSD was revealed to be 19.06 mm in the APD, 16.57 mm in the TD. While the left MSSD was likewise shown to be 19.81 mm for APD, 16.82 mm for TD.

The variables studied were the mean, median, minimum, maximum, standard deviation and standard error of the adolescent and adult age, anteropostero diameter right, anteropostero diameter left, transverse diameter right, and transverse diameter left. The tables below define the corresponding statistics.

Table 1:

Statistics	ADL	AP-ADLR	AP-ADLL	TADLR	TADLL	ADT	AP-ADTR	AP-ADTL	T-ADTR	T-ADTL
Mean	16.06	19.07	19.81	16.5	16.82	47.20	23.80	26.00	18.60	20.10
Median	16.50	8.87	19.90	16.27	16.20	45.00	23.00	25.00	17.80	19.00
Minimum	13.00	8.90	6.35	7.95	8.43	18.00	9.00	12.00	7.00	11.00
Maximum	18.00	32.63	31.55	28.78	33.60	85.00	41.00	50.00	35.00	40.00
S.D	1.79	5.20	5.92	4.45	5.05	17.16	.70	.80	.67	.58

S.E .25 .72 .82 .62 .70 2.22
.09 .10 .09 .08

Correlations

AP Diameter Adolescent Right
AP Diameter Adult Right

Adolescent Right
Pearson Correlation
1
.993**

Sig. (2-tailed)

.000

N
6
6
AP Diameter_Adult Right
Pearson Correlation
.993**
1

Sig. (2-tailed)
.000

N
6
6
Table 2: This is the outcome of the test of association between the adolescent and the adult variables.

**. Correlation is significant at the 0.01 level (2-tailed).
The correlation between Adolescent and Adult Right Antero-Posterior Diameter is 0.000 which is significant at the 0.01 level. Since $p<0.05$, it is statistically significant

Correlations

AP_AdolescentLeft
AP_Adult Left

AP_Adolescent Left
Pearson Correlation
1
.976**

Sig. (2-tailed)

.001

N
6
6
AP Adult Left
Pearson Correlation
.976**
1

Sig. (2-tailed)

	.001
N	6
	6

Table 3. **. Correlation is significant at the 0.01 level (2-tailed).

The correlation between Adolescent and Adult Anteroposterior Diameter left is 0.01 which is significant at the 0.01 level. Since $p<0.05$ it is statistically significant.

Correlations

		Transverse Adolescent Right	Transverse Adult Right
Transverse Adolescent Right	Pearson Correlation	1	.994**
	Sig. (2-tailed)		.000
	N	6	6
Transverse Adult Right	Pearson Correlation	.994**	1
	Sig. (2-tailed)	.000	
	N	6	6

Table 4 **. Correlation is significant at the 0.01 level (2-tailed).

The correlation between Transverse Adolescent Right and the Transverse Adult Right was significant at the 0.01 level. It was 0.000. Since $P<0.05$ it is statistically significant.

Correlations

		Transverse Adolescent Left	Transverse Adult Left
Transverse Adolescent Left	Pearson Correlation	1	.990**
	Sig. (2-tailed)		.000
	N	6	

6

Transverse Adult Left

Pearson Correlation

.990**

1

Sig. (2-tailed)

.000

N

6

6

Table 5 **. Correlation is significant at the 0.01 level (2-tailed).

The association between adolescent and adult Left Transverse diameter is 0.000. It is significant at the 0.01 level. Since p<0.000 it is statistically significant.

T-Test

One-Sample Test

Test Value = 23.80

t

df

Sig. (2-tailed)

Mean Difference

95% Confidence Interval of the Difference

Lower

Upper

AP Adolescent Right

-2.016

5

.100

-9.56833

-21.7706

2.6339

Table 6 The difference between Adolescent Right Anteroposterior diameter and the observed mean is 0.100. since p>0.05 it is not statistically significant.

One-Sample Test

Test Value = 26

t

df

Sig. (2-tailed)

Mean Difference

95% Confidence Interval of the Difference

Lower
Upper
AP_Adolescent Left
-2.519
5
.053
-11.94167
-24.1266
.2433

Table 7 The difference between the Left Anteroposterior diameter and the observed adult mean of 26 is 0.53. Since p>0.05, it is not statistically significant

One-Sample Test

Test Value = 18

t
df
Sig. (2-tailed)
Mean Difference
95% Confidence Interval of the Difference

Lower
Upper
Transverse Adolescent Right
-1.332
5
.240
-5.56000
-16.2872
5.1672

Table 8. The association between the Transverse Adolescent Right diameter and the observed mean of 18 is 0.240. Since p>0.05 it is not statistically significant

One-Sample Test

Test Value = 20.10

t
df
Sig. (2-tailed)
Mean Difference
95% Confidence Interval of the Difference

Lower
Upper
Transverse Adolescent Left
-1.390

5
.223
-6.63333
-18.9011
5.6344

Table 9.The association between the Transverse Adolescent Diameter and the observed mean of 20.10 is 0.223. Since p>0.05 it is not statistically significant.

KEY
ADL - Adolescent
AP-ADLR – Anteroposterior Adolescent Right
AP-ADLL - Anteroposterior Adolescent Left
TADLR – Transverse Adolescent Right
TADLL – Transverse Adolescent Left
ADT - Adult
AP-ADTR – Anteroposterior Adult Right
AP-ADTL – Anteroposterior Adult Left
T-ADTR - Transverse Adult Right
T-ADTL - Transverse Adult Left

V. DISCUSSION

Comparing adolescent and adult SSDs means using independent t test, it is discovered that there is significant difference between the two statistics, showing that it may not be safe to practice endoscopic trans-sphenoidectomy (ETS) in patients below 18yrs with mean SSD of 16.06 mm.

This may not be strictly so as no study has be done to show the minimum SSD adequacy for safe ETS.

The role of age in the dimension of SS has been recognized in many literatures[3, 9,12,]. This has been linked with the effect of pneumatization on the dimension of the SS. Thus pneumatizing effect on the SS finally brings about the developmental change seen in the SS as one advances in age[2]. Though age is an important factor in SSD, several studies have found that the age related SS morphometry is not continues process, thus at a certain age limit the changes recorded in the SSD remains almost the same. In the adult population it has been found that the SSD doesn't vary significantly between one another[9,12]. This knowledge is important when considering ETS to the sella region as the screening procedures will entail ruling out developmental anomalies rather than screening for adequacy of the SSD. However in reviewing this study, attempt was made to find out the MSSD in the adolescent age group and the likely adequacy of the SSD for ETS. The concept of adequacy of the SSD is important because it helps the skull base surgeons to avoiding inadvertent injury to the neurovascular structures around the roof of the SS when accessing the sella[9]. The importance of SSD has been shown in many studies as an important factor that guarantees safety during surgical access to the sella region by preoperative screening. In reviewing this study, it was observed that there is progressive increase in the SSD in the adolescents as the age stratification progresses from 13 years to 18 years, though this did not make a significant statistical difference. However, this isn't in compliance with previous study done in the adult population by WU HB, et al in the Chinese population. This study revealed that though there is no significant statistical difference in the SSD among the age groups in these adolescents, there was consistently statistical difference in the value of the V_A either on the right or left of the SS. This is similar to the finding of Yotnesu K, et al. This may imply that there is need for further evaluation of the volume of the SSD in both adult and in adolescents when considering the adequacy of the SSD for trans-nasal, ETS access to the sella and parasella region. It was noted in this study that using paired t test, the left and right SS showed positive correlation though the TADLR and T-ADTL in adults and TADLR and TADLL in adolescents correlations are positive but weak. Similar findings have been made in other works done in the adult SSD [9]. The explanation to this findings is that the SS septum has a variable insertion points in both adults and adolescent. This implies that the attempt has to be made to identify

preoper-atively the point of insertion of the SS septum because this will lead to a safe access to the sella through the SS. This is because SS septum has been noted as a major guide in avoiding neurovascular injury during exposure of the sellar tursica on the roof of the SS. By following its superior attachment to the roof of the SS gives surgeon early guide in identifying the vital structures . One of the challenges that may affect surgeons during access to the sella is the side of the sinus to be used first as a conduit to the sella. In the adult black, Idowu OE, et al, considered this in their study and noted left side bias in the SSD. Similarly, in Orji BI et al, study, the left SSD was noted to be relatively larger than the right SSD. Anther important factor that affect the SSD is gender. At puberty there is physiological growth sprout in favour of the female sex. This growth pattern is expected to affect all the structures in the body including the SS, though the mechanism is not within the scope of this discuss. However at puberty, the cavity of the SS is said to be already established[11, 12]. This implies that the growth sprout in females may encourage a larger SSD with female bias. This may be the reason for the observation in this study. This information may be a useful guide when considering approach to the sella in these adolescents.

The study of the SSD in the adolescents in this environment by Orji BI et al, showed some significant difference from the already established SSD obtained in the adult from work of Idowu OE, et all. Though the sample size was smaller in the adult study than that of the adolescents and may have contributed to the varying statistics. This may necessitate another structured investigation in the subject matter.

VI. CONCLUSION

This study has shown that in the adolescent black in the southeastern Nigeria, does not have adequate SSD comparable to that of the adult and require more detailed CT guided imaging to access the adequacy of the SSD for ETS. The APD was noted to wider than the other dimensions. The study revealed that the dimension of the SS in the adolescents has female bias with the left sinus having wider dimension in the adolescents whereas the converse was the case in the adults and in adulthood, age played lesser role in the SSD but not so with the adolescents. The study shows that CT scan screening of the adolescent's SS will be a useful neuro-imaging modality in accessing the SSD for trans-sphenoidal procedures.

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