



THE RADIOLOGIC DIMENSIONS OF THE SELLA TURCICA IN NIGERIAN ADULTS USING A COMPUTED TOMOGRAPHY SCAN: An Essential Guide in planning Pituitary and Sella Surgeries

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Abstract

Sella turcica is a saddle shaped concavity in the body of sphenoid bone situated in the middle cranial fossa of the skull. This study describes the normal dimensions of Sella turcica of both genders of adults in a Nigerian population using computed tomography head scan of the subjects. It can be a useful tool during surgeries in pituitary and around the sella region. This is a prospective cross-sectional research design which involves measurement of the length; depth and diameter of the sella turcica using computed tomography. The data was collected from 150 individuals who underwent CT head Scan and met the selection criteria at EzeNdiEze Diagnostic Centre, Trans-Ekulu, Enugu, between October, 2017 to October, 2019. A total of 150 subjects were studied, 77 (51.3%) were males and 73 (48.7%) were females. The mean age of the participants was 55.0 ± 17.8 years. The age of the female was higher than that of male, however, it was not significant. The mean length, depth and anteroposterior diameter obtained were 15.4 ± 1.2 , 11.7 ± 0.7 and 13.5 ± 0.8 respectively. Both depth and diameter of the sella turcica was also higher in male. There was no significant difference in size of the sella turcica across the age ranges and sex. The size of the pituitary gland can roughly be estimated from the dimensions of sella turcica obtained from radiological method. This can be a handy and useful tool in the hands of Neurosurgeons who operate on certain pathologies originating within the sella. Examples of such conditions include: pituitary adenomas, empty sella syndrome, pituitary abscesses, craniopharyngiomas etc.

Keywords: sella, turcica, computed, pituitary, adenomas

Introduction

Sella turcica is a saddle shaped concavity in the body of sphenoid bone situated in the middle cranial fossa of the skull, clearly seen on lateral cephalometric radiograph. (Tejavathin et al., 2015). As early as 1693, the Latin term; Sella turcica has been coined in Blacard's dictionary as the Turkish saddle, (Tejavathin et al., 2015). A structural change from normal dimensions of sella turcica could be an indication of a pathological condition of the structure itself, the pituitary gland or the extra-sella structures. (Ejike et al., 2017)

Sella turcica is bounded by two anterior and posterior clinoid processes. It is composed of three parts; the tuberculum sellae, pituitary or hypophyseal fossa which lodges the pituitary gland and dorsum sellae. Sella turcica houses the pituitary gland and this gland can be measured indirectly by measuring the Sella turcica.

The pituitary gland is covered on its superior surface by the diaphragm sellae, which is a fold of dura mater attached to the anterior and posterior clinoid process. (Ashraf et al., 2015).

The Sella turcica is a fossa that houses the pituitary gland which is also known as the master gland and because the hormone it produces control so many different processes in the body, it senses the body's need and sends signal to different organs and glands throughout the body to regulate their function and maintain an appropriate environment. (Tejavanthan et al., 2015).

Sella turcica on cephalometric radiographs can be observed clearly and constructively traced during cephalometric analysis. It is an important structure in radiographic analysis of the neurocranial and craniofacial complex, therefore an important anatomic and radiologic entity.

Sella turcica vary greatly in normal individuals and are influenced by genetic and local factors. A larger size may be an indication of pituitary tumour over producing hormones such as an adrenocorticotrophic hormone, prolactin, growth hormone, thyroid stimulating hormone, antidiuretic hormone. The enlarged sella turcica on radiograph has been found to be associated

with adenomas, meningioma, primary hypothyroidism, prolactinoma, gigantism, acromegaly, empty sella syndrome, and Nelson syndrome. (Tejavanthan et al., 2015). Measurements of the Sella turcica have been described as early as 1923. Great variations have been reported in the measurement of length, depth, and diameter in both sexes. (Tejavanthan et al., 2015). Therefore, clinicians need a baseline for normal radiographic anatomy of the sella owing to its variability to be able to better recognize and effectively investigate changes that may reflect pathological conditions even prior to the onset of symptoms of pituitary or craniofacial syndromes (Andredaki et al., 2007). To date, there is paucity of data in the literature showing the dimensions of sella turcica among Nigerian subjects.

The aim of this study therefore, was to establish the normative values of the dimensions of sella turcica of Nigerian adults using a computed tomography scan.

Materials and Methods

This is a prospective non-experimental cross-sectional research design that involves measurement of the length, depth and diameter of the Sella turcica of the skull using computed tomography scan. A convenient sampling method was used to select the subjects that met the inclusion criteria. The sample size was 150 subjects; 77 (51.3%) males and 73 (48.7%) females.

The materials and accessories used in the data collection include; patient's record book to obtain the biodata of the subjects and the Computed Tomography Scan to obtain and record the dimensions.

Inclusion Criteria: Included individuals without any history of systemic diseases or base of skull fracture who are age of 18 years and above.

Exclusion Criteria: Included individuals with history of craniofacial or base of the skull fracture, those suffering from systemic diseases,

individuals with congenital craniofacial defects as well as individuals below the age of 18 years.

Data Collection

The Sella turcica on the computed tomography of the skull images were evaluated through the use of measuring tools installed in the software of the PAC System in the computed tomography.

Measuring Techniques

The method of measurement used in this research is that of Silverman. According to Silverman, the lines were measured to determine the size of the Sella turcica and the reference lines used were situated in the midsagittal plane.

The normal size of Sella turcica was measured by tracing the contour of the dorsum Sellae to the tuberculum Sellae and then following a straight line from the tuberculum Sellae back to the origin. The length of the Sella turcica was measured as the distance from tuberculum sellae (TS) to the tip of the dorsum sellae (DS). The depth of the Sella turcica was measured perpendicular to the line, the deepest perpendicular to the line that is the deepest point on the floor. Anteroposterior diameter of

the sella is measured to a point on the posterior inner wall of the pituitary fossa farthest from tuberculum sellae.

TS-DS= Length of Sella turcica (L); TS-APD= Anterior-Posterior diameter (APD); L-BPF=Depth of Sella turcica; Area of Sella turcica = length x Depth

(TS- DS X L- BPF (Base of pituitary fossa).

Data Analysis

Data were analysed using SPSS Window version 20.0S (SPSS Inc, IBIM, UK). Descriptive statistics of mean \pm standard deviation was used to summarize the data obtained. One-way analyses of variance (ANOVA) were used to test the significance in different sexes and ages. $P < 0.05$ was considered statistically significant.

Results

A total of (150) subjects were studied, 77 (51.3%) of them were males while 73(48.7%) were females. The mean age of the participant is 55.0 ± 17.8 years.

Table 1: Dimensions of Sella turcica

Dimension	(mm) Length	Depth (mm)	AP(mm) Diameter	Area mm ²
N	150	150	150	150
Mean \pm SD	15.4 \pm 1.2	11.7 \pm 0.7	13.5 \pm 0.8	180.5 \pm 19.4

The Sella turcica dimensions are expressed as mean \pm standard deviation.

N = number of patients

Table 1 shows the mean length of 15.4 ± 1.2 , mean depth of 11.7 ± 0.7 and mean anteroposterior diameter of 13.5 ± 0.8 .

Table 2: Dimensions of Sella turcica by sex

	Male	Female	P-Value
Age (yrs)	52.9 \pm 19.0	57.2 \pm 16.4	0.14
Depth	11.8 \pm 0.8	11.4 \pm 0.7	0.36
Diameter	13.6 \pm 0.9	13.4 \pm 0.8	0.32
Length	15.6 \pm 1.0	15.6 \pm 1.2	0.05
Area	183.6 \pm 20.2	177.3 \pm 18.2	0.05

The age of the females is higher than that of the males, this was however not significant. ($P > 0.05$; ANOVA)

The depth of the Sella turcica was higher in the males than in the females. This was not significant as well ($P > 0.05$ ANOVA).

The diameter of the Sella turcica is higher in the males than in the females as well; this was also not significant ($P > 0.05$ ANOVA).

There is no significant difference in the length of Sella turcica in the males and the female's subjects.

Discussion

Morphometric knowledge about the Sella turcica is essential to neurosurgeons in order to choose the best operative corridor and approach in sella surgeries. This may seem to be more useful in endoscopic surgeries such as Trans-sphenoidal approaches to the sella lesions. Enlargement of the Sella turcica is the most frequent pathological findings although usually, it is not accompanied by bone erosion. On the other hand, small Sella turcica although less likely to occur can also be seen and may lead to decreased function causing symptoms like short stature and retarded skeletal growth (Meyer-Marcotty *et al.*, 2010).

Accepted normal maximum dimensions of the sella turcica are 16mm for anteroposterior diameter and 12mm for the depth. (Ghaida *et al.* ; 2016).

Many researchers agree that growth of the sella turcica decreases rapidly after the first years of life and increases during puberty and slows down and ceases at early adulthood. The growth of Sella turcica affects the dimensions, size and area of the Sella turcica and appears to follow the somatic growth pattern possibly related to the function of the anterior lobe of the pituitary gland irrespective of the sex and skeletal type. (Ghaida *et al.* ;2016).

Different studies on the dimensions of sella turcica have been performed in different population around the globe. Silverman (2000) showed that males exhibit larger sellae than females except during puberty. This is partially similar to the findings in this current study which showed that dimension of the sella turcica is higher in males. However, no significant difference was found between men and women with respect to the length, diameter, and depth of the sella turcica. This finding is in line with the studies by Farhad S *et al* (2018); Shah AM *et al* (2011) and Alkofide EA (2007). The dimensions of Sella turcica in Saudi Arabia were on the average of 1-3mm larger than other studies (Alkofide, 2007).Norwegians showed smaller dimensions by 0.2-1mm. However, Sella turcica

dimensions in African were reported to be similar to that of Caucasians.

This study describes the normal dimensions of Sella turcica of both genders in Nigerian adult's population residing in Enugu state metropolis using computed tomography of patients who undergone CT head examination at EzeNdiEze Diagnostic Centre.

The values in this study showed an increase in the dimensions of Sella turcica compared to the values reported in Ogunaike *et al.* (2016), but similar to that of Zegga *et al* (1990). Ogunaike reported in his work the values of mean diameter as 11.37mm, mean length of 9.81mm and depth of 8.49mm. The differences may be due to his measurement methods and possibly radiographic enlargement. He measured the oblique diameter as the longest distance between the tuberculum sellae and the floor of the pituitary fossa while we measured anteroposterior diameter as the longest distance dividing the pituitary fossa into two. Zegga *et al.*(1990), in his work reported values of the anteroposterior diameter of 14.0mm which is similar to this study. However, showed slight difference in the length of 11.4mm and the depth of 9.3mm. These differences could be due to shortfall of radiographic methods and differences in races.

Similar patterns were noted by (Asad & Hamid, 2005), who reported that the mean length of Sella turcica in subjects of the DeMontmorency College is 14.9mm. Axelsson *et al.*(2014), also reported a value in his work, an anteroposterior diameter that is larger than the values reported by Zegga *et al.* (1990).The observed discrepancy in Sella turcica values of Caucasian population and that of Nigerian population can be partly attributed to the shortfall of radiographic method. This study used the computed tomography which gives a more exact impression of anatomical features and the differences in values obtained between the Nigerian and the Caucasian populations could be attributed to racial differences.

Table 2 shows relationship between Sella turcica and sex. Though it was noted that there were no

statistically significant differences between those values, it was noted that the males have higher values than that of the females across the three dimensions. This result is in keeping with studies done by Yassir *et al.*, (2010) in the Iraqi population, Shah *et al.*(2011) in the Pakistanian population, Chavan *et al* ; (2012) in Maharashtra population, Osunwoke *et al*; (2014) in the Nigerian population, where between genders no significance was found in terms of length, depth and diameter. There could be a form of sexual dimorphism in the form of thicker bones and prominent bony markings in the males compared to that of the females and anatomical features of the human skull which tend to be larger in males than in females. This is similar to the findings of Stefan (2004), who reported in his research work that the length of Sella turcica was larger in males while the depth and diameter was almost similar for both sexes. Ogunaike *et al.* (2016), also reported in his work that the dimensions of Sella turcica are slightly larger in males than in females, but this contradicts the work done by Burchat. S. Pruet in 1928. He reported that the diameter and length of Sella turcica was larger in females. This discrepancy in Burchat SP (1928), may be due to racial variation and/or the methodology of the research

In the relationship between the dimensions of the Sella turcica across the age groups, it was observed that there was no statistically significant relationship between the Sella turcica values and the age ranges, but there was a slight change noted across all the three dimensions as the age range increases.

Therefore, age group of patients is not a major determinant of the dimensions of sella turcica. This is in conformity with the study by the Axelsson *et al.*, (2004) but contradicts the study done by Valizadeh *et al.*, (2015), which demonstrated in their work that patients' age had a direct and significant correlation with the anteroposterior diameter of the Sella turcica.

In another sella turcica study carried out by Ogunaike *et al.*, (2016), on adults Lagos

population, the same observation was also reported, this could be attributed to the fact that most individual in this age group are at the peak of their lifetime both in the physical and structural growth.

In the study done by Axelsson *et al.*, (2004), it was found that there were significant differences in the length of sella turcica in the gender in favour of the males. Similar findings were documented in a study done in the South Indian population.

Conclusion

Sella turcica is one of the most commonly used landmarks for cephalometric tracing which helps in the evaluation of craniofacial morphology, hence the importance of morphology and size of Sella turcica.

There is no significant difference in size of the Sella turcica among the age ranges and sex, and the size of the pituitary gland can be roughly estimated from the dimensions of Sella turcica obtained from radiological methods in pathological conditions, since disease conditions of the master gland ultimately affects the size of the Sella turcica. CT scan and MRI give more accurate values than other radiographical method. However, the CT will have advantage over MRI in a study of this sort.

Sella turcica has a largely constant dimension except perhaps in pathological conditions.

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