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Dimension and morphological variation of the sella turcica in Libyan adults in Benghazi using CT scan

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Original Research Article

Abstract

Background: The sella turcica is a significant anatomical structure used to assess sellar and parasellar pathologies, as well as in orthodontic procedures.

Normal sellar anatomy varies significantly between different populations. Currently, there is insufficient knowledge about the sella turcica among the Libyan community.

Aim: The aim of this study is to evaluate and assess the correlation between sellar dimensions and morphological variants with gender.

Results: Data from computed tomography of 146 Libyan adults (66 females and 80 males) aged from 18 to 70 years was analyzed using SPSS. The mean length, depth, and anteroposterior diameter were 9.924±2.001mm, 8.575±1.651mm, and 12.502±1.912mm, respectively. The round shape was the most common, found in 54.8% of subjects, followed by oval (32.2%) and flattened (13%). When assessing whether gender plays a role in the size and shape of the sella turcica, there was no statistically significant difference between males and females in relation to all sellar measurements and shapes.

Conclusion: The results of this study can be used as a reference standard for the Libyan population in various medical specialties, including radiology, neurosurgery, forensic medicine, and orthodontics. This can aid in the early diagnosis of pathologies, leading to better management and follow-up. Additionally, the findings can serve as a basis for further international research investigations.

Keywords: sella turcica, variation, hypophysial fossa, pituitary gland.

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Introduction:

Sella turcica (ST) is a concavity in the body of the sphenoid bone, that composed of the anterior wall (tuberculum sellae) and the posterior wall (dorsum sellae), both contains two lateral rounded projections (anterior and posterior clinoid processes) respectively. As well as the hypophysial fossa which is the central deep area that hosts and protects the pituitary gland.[1] The pituitary gland is the master gland of the body, which have about 1g of weight and 1cm in diameter. It is responsible for secretion of important hormones for example: growth hormone, follicle-stimulating hormone, and luteinizing hormone, all are essential in growth and various physiological functions.[2]

Pathologies in the pituitary could be reflected as alterations in the dimensions of the ST as their development is clearly related. [3] In addition, the ST has significant anatomical relations with various structures, including sphenoid air sinus, cavernous sinus, optic chiasm, and hypothalamus which make it crucial for neurosurgeons in order to conduct a safe surgical intervention.[4]

Furthermore, as the ST size increases during childhood, it is beneficial in forensic medical investigations for post mortem age determination.[4] Moreover, by its location in the middle cranial fossa the ST considered as a fixed landmark in cephalometric analysis, which is extremely important in orthodontic field in order to help them to decide about the most appropriate plane of management and follow up. [3,5-7]

Depending on the literature, this area has great alterations among different people,[7,8] and all established as normal variants, hence, knowledge about the normal structure of ST will help the doctors in different specialties to diagnose and manage many associated diseases involving the pituitary gland and related structures.

Advanced imaging methods has been recently used to define the morphology of ST; in the current study we used computed tomography (CT) depending on its ability to define the ST as a bony structure other than the surrounding tissues.

However, up to the time of writing this study information about ST among Libyan subjects remains unidentified. Accordingly, this study is focusing on demonstrating the different shapes and measurements of ST in Libyan adults. Moreover, as sella variants appear among different genders, races, and geographic areas hence the results of this study will be useful as additional information to the published researches in the global data.

Aim: Evolution of dimensions and morphological variants of ST among Libyan adult using CT scan in relation to gender.

Materials and Methods:

This cross-sectional study involved retrospectively collecting data from head CT radiographs obtained from various healthcare centers in Benghazi over a 10-month period from May 2020 to March 2021. The images were obtained using conventional CT and GE Optima 128-slice scans. A total of 174 patients were initially included, but 28 were excluded, only146 patients were included in the study (66 females and 80 males) aged 18 to 70 years old. All patients did not have any evidence of pituitary gland anomaly or systemic disease related to the sella turcica. Exclusion criteria included subjects below 18 years old, images of inadequate quality, and individuals with pathological features in the area of study or who had undergone surgical intervention in the craniofacial

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area.

The Radiant DICOM Viewer 2022 software was used to visualize the CT images in different anatomical planes to obtain the precise linear dimensions and shape of the sella turcica. The data was analyzed using the IBM SPSS statistical package version 25.0, with statistical descriptions including mean, minimum, maximum, and standard deviation (SD). The association between gender and sella turcica classification was estimated using the Chi-square test. The variables were normally distributed, and an independent T-test was utilized to analyze the differences in sella turcica measurements with respect to sex.

Size of ST

The linear dimensions were used according to the approved methods described by Silverman FN (1957).[9] All reference lines were measured in the midsaggital plane (Fig. 1) as the following:

- Length: a straight line from the tip of the tuberculum sellae to the tip of the dorsum sellae.
- Depth: a perpendicular line from the line drown above to the floor of the sella.
- Anteroposterior diameter: a line from the posterior part of the tuberculum sellae to the deepest point in the floor of the fossa.

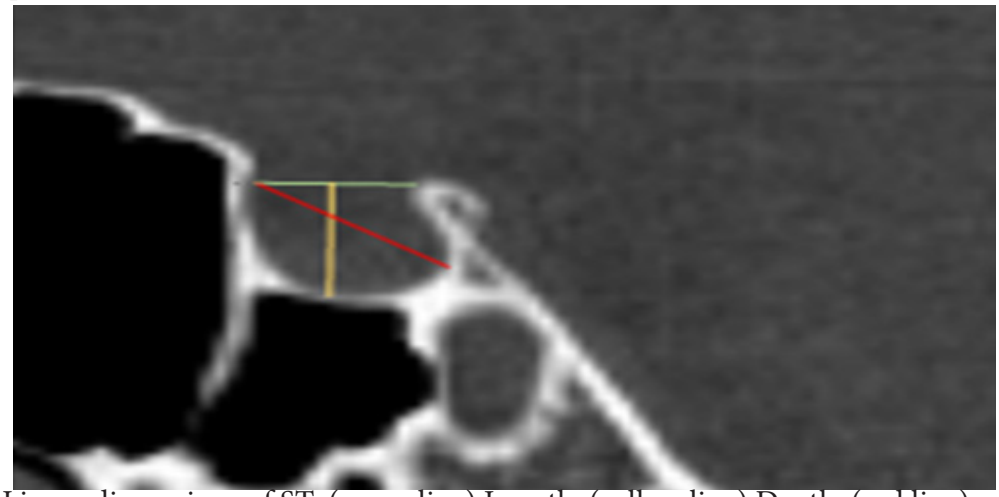

Fig. 1: Linear dimensions of ST: (green line) Length; (yellow line) Depth; (red line) anteroposterior diameter

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Shape of ST

Morphological appearance of ST has been classified depending on the floor of the sella turcica as declared by Camp JD,[10] into three types: round, oval, and flattened (Fig-2).

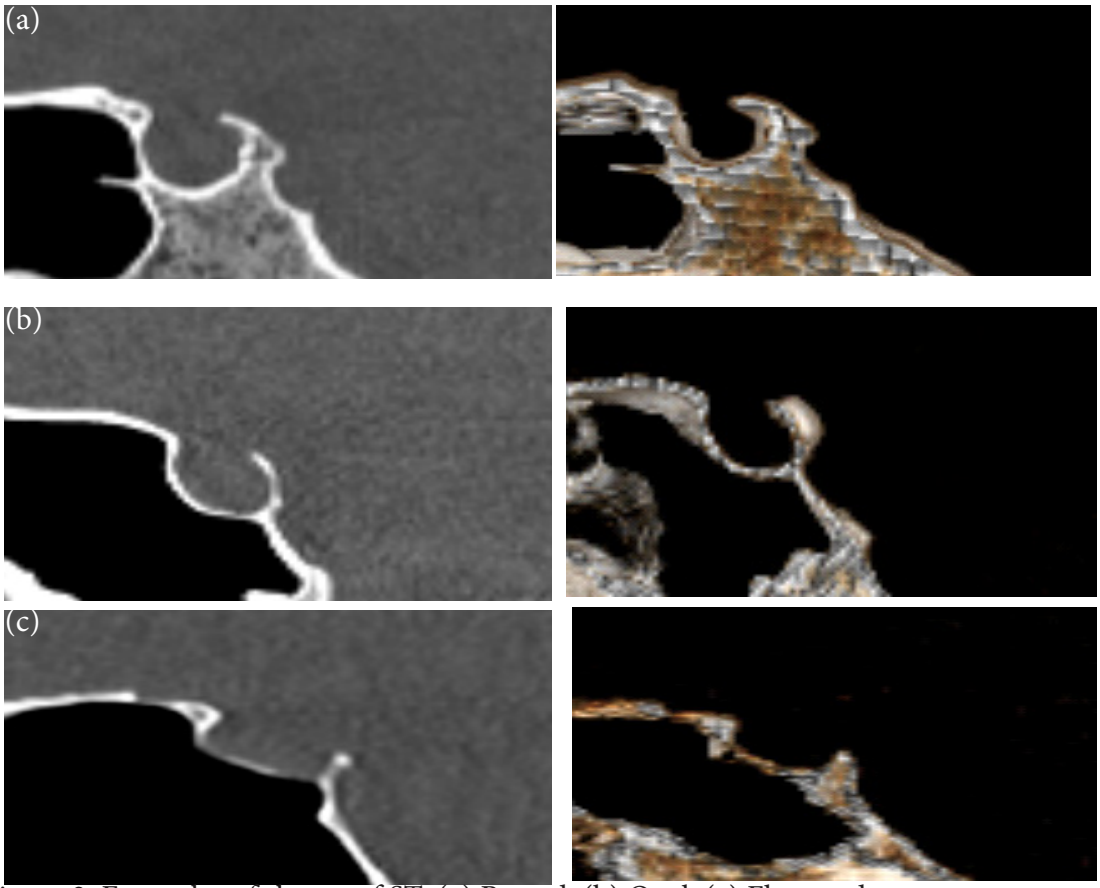

Figure 2. Examples of shapes of ST: (a) Round; (b) Oval; (c) Flattened.

Results:

Size the ST

The dimensions of ST of 146 subjects located in the midsagittal plane are described in table 1. Sellar length, depth, and antero-posterior diameter were 9.924±2.001mm, 8.575±1.651mm, and 12.502±1.912mm respectively. When linear dimensions compared between females and males, there was no statistically significant difference among all three elements (P>0.05).

Shape of ST

The shape of ST was appeared to be round in 54.8% of subjects, which is considered as the most common form, followed by the oval shape which exhibited in 32.2%,

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and the least repeated is flattened in 13% of subjects. On assessing the morphology of ST on each gender; the distribution frequency of different morphological variants in both genders is summarized in table 2, and the correlation between the two factors was not statistically significant.

Table 1. Descriptive Statistics of Dimensions of ST According to Gender.

	Sex	Mean	SD	Min	Max	Average (Female & Male)	P-value
Length	Female	9.937	1.835	6.052	13.917	9.924	0.943
	Male	9.913	2.139	4.582	16.258		
Depth	Female	8.830	1.714	4.422	13.728	8.575	0.090
	Male	8.365	1.578	5.275	15.786		
A/P Diameter	Female	12.694	1.872	8.345	17.900	12.502	0.270
	Male	12.343	1.942	9.199	18.241		
Independent T-test, A/P = Anterior /posterior diameter SD= standard division, Min= Minimum and Max = Maximum							

Table 2. Frequency of distribution of different shapes of ST according to gender.

	Female (n=66)	Male (n=80)	Total	P-value
Round	33	47	80	0.225
Oval	26	21	47	
Flattened	7	12	19	
Chi square, n= number of subjects				

Discussion:

This study establishes and analyzes the linear dimensions of ST and morphological variants in different genders. Sellar dimensions were described by many studies and summarized in table 3.

Table 3: Comparison between Different Studies in Linear Dimensions of ST.

	Length (mm)	Depth (mm)	Anteroposterior diameter (mm)
Current study	9.92± 2.00	8.58± 1.65	12.50± 1.91
Nigeria [11]	9.8	8.6	11.5
Iraq[12]	8.46	7.44	10.79
Turkey[13]	10.32± 1.75	7.99± 1.33	11.87± 1.66
Ethiopia[14]	10.23± 1.73	7.12± 1.34	11.89± 1.94

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A comparison between males and females in terms of length, depth, and anteroposterior diameter in the current study concludes that there is no significant difference between genders was found, these results are consistent with previewed studies in Nigeria[11], Iraq,[12] Turkey,[13] and Bangladesh[15]. This is also in agreement with study conducted among Libyan population in 2021[16]. On the other hand, Abebe G (2021),[14] conducted study upon 496 subjects, showing the difference between both genders was significant in depth, which the females had higher value than males with 7.48mm and 7.01mm respectively.

The shape of ST is classified based on the contour of the floor, tuberculum sellae, anterior and posterior clinoid prosses, many classifications has developed over time. Ruiz C,[17] classified sella into U, J, and shallow types. Recently, Axelson et al,[18] established six main types including as normal shape, oblique anterior wall, sella turcica bridging, double contour of the floor, irregularity in posterior part of dorsum sellae (notching), pyramidal shape of the dorsum sellae.

The classification used in this study has been established by Camp JD,[17] that categorized the floor of ST into three basic shapes (round, oval, and flattened), and stated that the most common type was the round which is complementary to the results of the current study, in which the round shape occupied 54.8% followed by oval (32.2%) and the flattened was the least frequent (13%), in comparison to study conducted by Yasa Y, in Turkey upon 177 individuals the results were similar, round shape was the most frequent (69.5%), on the other hand flattened was the second most common (16.4%), lastly oval (14.1%).[20]

Alternatively, Mushrath Islam et al, stated that the oval is the most frequent (48.19%) then flattened (28.3%), and then rounded (23.4%) in Bangladeshi population.[15]

When compared to gender; authors in Turkey did not demonstrate a statistically significant difference between males and females in shape distribution, [13] these results are in agreement with our findings. In contrast, another study has been established among Nigerian people and revealed a highly significant aberration.[19] Furthermore, depending on a study has been conducted by Muhammed FK, in purpose of comparison between variations in ST dimensions between three genders (Bosnian, Nepalese, and Chinese); a significant correlation was detected between length of ST and gender of Bosnian individuals, whereas none of sella turcica dimensions and sex of Nepalese and Chinese subjects were affected.[8] although, these researches used the lateral cephalogram as their imaging method which could be responsible to some alterations in the final results.

The noted alterations between ST measurements and morphological types in previous researches may be due to differences in the group of study, methodology, ethnicity, and geographic region.

Recommendations:

In order to establish more extensive information among Libyan population, larger sample size, as well as, individuals from other regions in Libya would give a more comprehensive result. Furthermore, we recommend performing such study on individualized age groups in future researches.

Conclusion:

Anatomy of ST can be investigated using CT effectively; the sellar dimensions provided

from this study are 9.924±2.001, 8.575±1.651, and 12.502±1.912mm for length, depth, and anteroposterior diameter respectively. The most common morphological variant is round (54.2%). No statistically significant difference between females and males was detected in either shape nor linear dimensions. Similar results were illustrated by most of the studies in the literature. The morphology and dimensions of sella turcica vary from person to another, this study provides information about Libyan population for clinicians in varies medical specialties including neurosurgery, radiology, orthodontics, or forensic medicine, in order to detect any deviation in shape and dimensions of ST and estimate pathologies in pituitary gland and surrounding structures, alongside as additional information to the published global data.

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