Normative Optic Chiasm Measurements Using Magnetic Resonance Imaging

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Abstract: The study aimed to characterize the optic chiasm Measurements in normal MRI brain using coronal cuts. Concerning the subjects ages and gender. This study was done at Sudan University of science and Technology college of medical radiologic sciences - and Khartoum state hospitals, Khartoum Sudan, during the period from November 2015 to July 2018. A total of 172 images were included in this study Measurements of the height and width of the optic chiasm were obtained, on coronal T2 weighted MR images using commercially available region-of-interest software, were obtained in healthy subjects with normal MRI findings. All analyses were performed using SPSS and excel. the results of this study revealed that the mean of width of the optic chiasm was 13.04 mm, with a standard deviation of 1.21mm, The mean of height was 2.46 mm, with a standard deviation of 0.14mm, it concluded that the width and height of the optic chiasm can be measured with the use of commercially available software, which allows an objective estimate of the chiasm's size. Knowledge of the normal size range of the optic chiasm can be helpful in the early detection of some disorders.
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1. Introduction

The optic chiasm is an important landmark when interpreting magnetic resonance (MR) examinations of the brain. A small chiasm can be an indication of several disorders, the most common of which is septooptic dysplasia [(1)], and a large chiasm can be the result of glioma, meningioma, lymphoma, or hemorrhage [(2)].

The study aimed to characterize the optic chiasm Measurements in normal MRI brain using coronal cuts. Concerning the subjects ages and gender.

2. Material and Methods

2.1Subjects

The present study was carried out at radiology departments of Royal care hospital & Antalya medical center in Sudan. during the period from November2015to July 2018. All the patients went under MRI brain, diagnosis by experienced radiologists as a normal used for immobilization. T1 weighted imaging was performed in the axial plane fallowed by coronal & sagittal plane. all images were 5mm in thick with a0.5 mm space MRI brain. patients with pathological changes were excluded such as: astrocytoma, brain atrophy mastoiditis, metastasis brain, optic atrophy, sinusitis The sample of this study included172 Sudanese patients, 41.9% (72) were female, 58.1% (100) were male their ages ranged (between 16-76 years old.

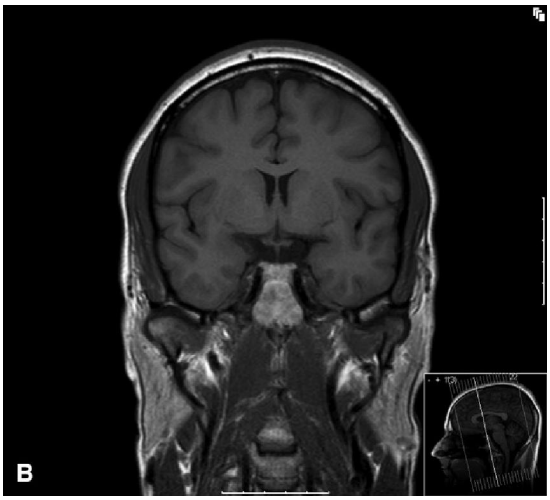

Figure (1) coronal magnetic resonance images showing the position and immediate relationship of the chiasm to adjacent anatomical structures.

All MRI examinations were performed using a1.5 Tesla system (Toshiba+ general electric). The patient lies supine on the examination couch. examined general brain. Used head coil, The patients are positioned so that the longitudinal alignment light

lies in the midline, and the horizontal alignment light passes through the nasion Straps and foam pads are between slices.

2.2 Data acquisition and measurement protocol

The data were transferred to a workstation, at which the width & height of the optic chiasm were measured on the coronal section For purposes of standardization of positioning, the coronal section passing through the optic chiasm 3mm anterior to the pituitary fossa, the width of the optic chiasm was measured horizontally at the centering point of chiasm, the height of the optic chiasm was measured in the midline and were taken in mm. Using region interest (ROI) Figures (1,2).

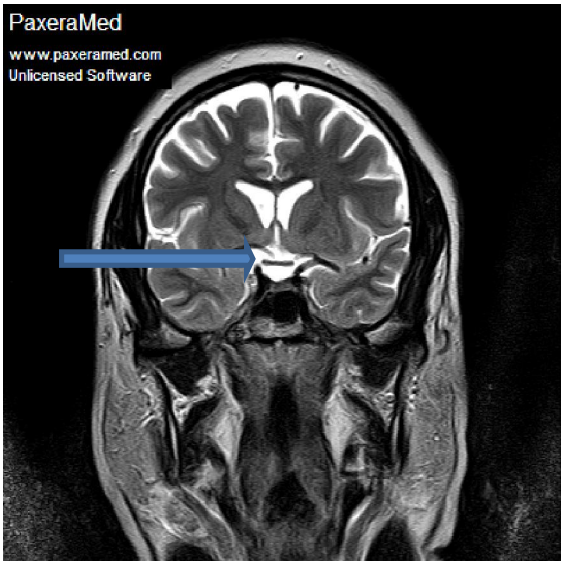

Figure (2) shows T2-weightedcoronal image demonstrate where chiasm measurement (arrow) were obtained.

2.3 Statistical analyses

All data obtained in the study were documented and analyzed using SPSS program version16. Descriptive statistics,, ANOVA test, Independent samples T-test, mean and Standard deviation were used.

3. Results

Table (1) shows participants age

Age /years		
N	Valid	172
	Missing	0
Mean		38.78
Median		34.00
Std. Deviation		16.422
Range		60
Minimum		16
Maximum		76

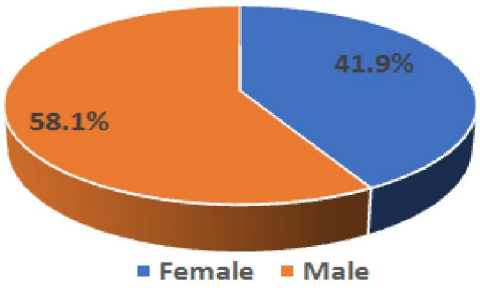

Figure (3) shows Distribution of gender among study participants (n = 172)

Table (2) shows study participants OC width

Statistics		OC width
N	Valid	172
	Missing	0
Mean		13.0429
Median		13.0050
Std. Deviation		1.21003
Range		4.94
Minimum		10.18
Maximum		15.12

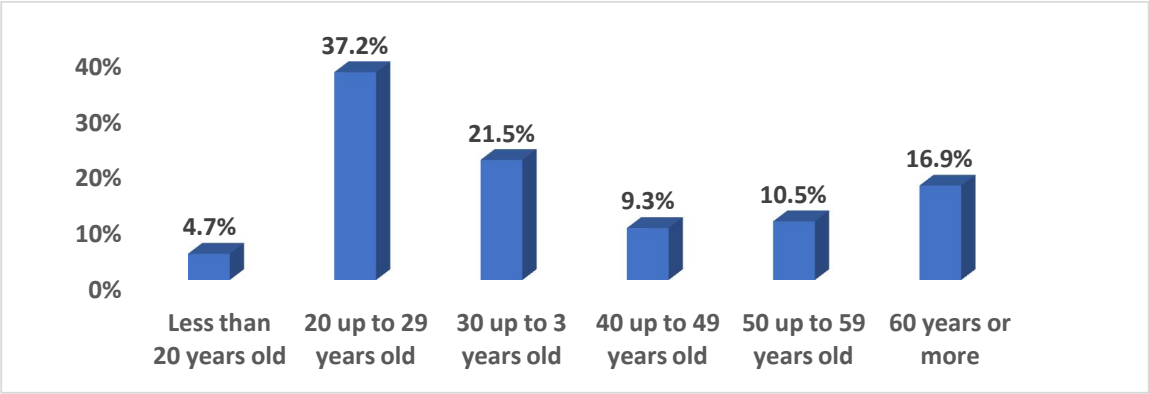

Figure (4) shows Distribution of age group for study population (n=172)

Table (3) shows ANOVA test for relationship between age group with OC width and OC height: -

Age group / years		OC width	OC height
Less than 20 years old	Mean	14.0013	2.4263
	N	8	8
	Std. Deviation	.85738	.06523
20 up to 29 years old	Mean	13.1295	2.4672
	N	64	64
	Std. Deviation	1.24680	.14273
30 up to 3 years old	Mean	12.9941	2.4457
	N	37	37
	Std. Deviation	1.30575	.15181
40 up to 49 years old	Mean	13.2769	2.4888
	N	16	16
	Std. Deviation	1.40653	.18319
50 up to 59 years old	Mean	12.7756	2.4550
	N	18	18
	Std. Deviation	.87268	.14501
60 years or more	Mean	12.6866	2.4703
	N	29	29
	Std. Deviation	1.02703	.14780
Total	Mean	13.0429	2.4619
	N	172	172
	Std. Deviation	1.21003	.14613

Table (4) shows Distribution of participants OC width

OC width		Frequency
	Less than 12	40
	12 up to 15	129
	More than 15	3
	Total	172

Table (5) shows participants OC height

Statistics	OC height
N	172
Mean	2.4619
Median	2.4450
Std. Deviation	.14613
Range	.86
Minimum	2.18
Maximum	3.04

Table (6) shows ANOVA test for relationship between gender with OC width and OC height: -

Gender		OC width	OC height
Female	Mean	13.0619	2.4860
	N	72	72
	Std. Deviation	1.21664	.15946
Male	Mean	13.0292	2.4446
	N	100	100
	Std. Deviation	1.21121	.13389
Total	Mean	13.0429	2.4619
	N	172	172
	Std. Deviation	1.21003	.14613

4. Discussions

The optic chiasm is an important landmark when interpreting magnetic resonance (MR) examinations of the brain. A small chiasm can be an indication of several disorders, the most common of which is septooptic dysplasia, and a large chiasm can be the result of glioma, meningioma, lymphoma, or hemorrhage. The diagnosis of atrophy or enlargement of the chiasm has largely been made by "gestalt" interpretation, and is therefore highly subjective and variable among observers. We retrospectively reviewed 172 coronal MR images of the normal brain and measured the width and height of the optic chiasm to determine a range of normal values. These references can potentially aid in the early detection of infiltrating processes of the chiasm and can be used in cases in which the diagnosis of optic chiasm atrophy is uncertain.

We retrospectively reviewed 172 cranial MR studies that had been obtained at Sudan University of science and Technology college of medical radiologic sciences - and Khartoum state hospitals, Khartoum Sudan during the period from November2015to July 2018. and that had been interpreted as normal. No patient had suspected visual or endocrine abnormalities. All the examinations had been performed with a 1.5-T MR system using routine imaging protocols, with additional 3-mm T1-weighted contiguous coronal sections used for measurements. The 123 studies were obtained in 100 men and 72 women, 16-76 years old; all images adequately showed the optic chiasm. Values from these patients were averaged and put into the study as one set of measurements. The studies were transferred to workstation, at which the width, and height, of the optic chiasm were measured using region-of-interest (ROI) software.

The measurements of the optic chiasm (OC) as calculated in this study revealed that In table (2) Mean of OC width was 13.04 ± 1.21 mm standard deviation, median 13.005 mm, minimum 10.18 mm while maximum 15.12 mm, In table (4) Shows distribution of participants OC width, About three quarters 129 (75%) had OC width range between 12 up to 15 mm, while slightly less than one quarter 40 (23.3%) had OC width less than 12 mm and those who had OC width more than 15 mm were 3(1.7%), In table (5) Mean of OC height was 2.46 ± 0.146 mm standard deviation, median 2.44 mm, minimum 2.18 mm while maximum 3.04 mm, In table (6) for gender and OC width not significant P value 0.862, for gender and OC height not significant P value 0.067, In table (3) for age group and OC width not significant P value 0.092, for age group and OC height not significant P value 0.893.

Breakdown by age and gender showed an expected no significant in the measurement of the chiasm as patients got older, as well a small decrease in the area in women. Comparison of the measurements with previous studies. However, because of the lack of MR criteria, it can be difficult to distinguish between mild to moderate hypoplasia of the optic chiasm and a chiasm that is at the lower limits of normal. Studies of the normal optic anatomy have been performed using both computed tomography (CT) and MR imaging [3–6], and MR imaging has proved to be the method of choice for examining the optic chiasm, especially coronal high-field T1-weighted imaging, which seems to depict the anatomy to the best advantage. Brodsky et al [7] reported that identification of optic nerve hypoplasia on MR images significantly matched clinical diagnosis on both coronal and sagittal studies; however, they relied on subjective grading to determine whether the nerves were normal or small. Parravano et al [8] described optic chiasm and nerve sizes in normal and abnormal brains but relied on measurements of the height and width made with handheld digital calipers. We think that computers offer a more accurate measurement. We believe that the most accurate measurements can be made on T1-weighted MR images. In addition, coronal T1-weighted images of the brain are a standard sequence in imaging the chiasm and sella. Use of a selected image from a coronal MR study of the chiasm allows this structure to be seen and measured without having to determine reproducible anterior and posterior cut-off points, which would be necessary on axial images. Although there may be some variation due to differences in sections among studies, we think that use of the section on which the chiasm is largest will minimize error. Our intention was to measure the optic chiasm on a presumed standard T1-weighted coronal MR image, The calculated measurement of the normal optic chiasm on MR sections can be used as a comparative standard by which to detect relatively smaller or larger chiasms, regardless of whether the measurements are in exact ratio to the actual nerve. For the above-mentioned the number of adult patients in this study was relatively high compared to previous studies in this age group, it should be noted, however, that these studies refer to patients data., so as in table (5, 6) both the P value and QC not affected by age and gender.

5. Conclusion:

The study concluded that the Sudanese population morphology is slightly different from other populations mentioned in the previous studies. Coronal MRI may prove beneficial for demonstration

of optic chiasm anatomy. The width and height of the optic chiasm can be measured with the use of commercially available software, which allows an objective estimate of the chiasm's size. Knowledge of the normal size range of the optic chiasm can be helpful in the early detection of some disorders.

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