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Assessment of Optic Chiasm Measurements in Abnormal MRI Brain

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Abstract: *The study aimed to characterize the optic chiasm Measurements in abnormal MRI brain using coronal cuts Concerning the subjects ages and gender in Sudan, which could help in the early detection of some disorders. 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 November2015to July 2018, Measurements of the height and width of the optic chiasm, made on coronal T2 weighted MR images with the use of commercially available region-of-interest software, were obtained in 33 subjects with abnormal MRI finding. A normal range and standard deviation were calculated; study variables included age, gender, symptoms, optic chiasm Measurements and MRI findings. The mean of width of the optic chiasm was 13.32mm, with a standard deviation of 1.28. The mean of height was 2.53 mm, with a standard deviation of 0.18.The range of optic chiasm width on coronal MR images were between 11.11 mm and 15.09 mm (1.2 SD from the mean) and a height between 2.11 mm and 2.89 mm (0.18 SD from the mean).*

The study conclude that the calculated measurement of the abnormal optic chiasm using magnetic resonance image can detect relatively smaller or larger chiasms, regardless of whether the measurements are in exact ratio to the actual nerve. the measurements of optic chiasm can be done on general protocol of brain magnetic resonance imaging, also we can add a new protocol for the chiasm make its measurements clear and accurate. Knowledge of the normal size range of the optic chiasm can be helpful in the early detection of some disorders.

the Optic chiasm and the visual pathway following disease and dysfunction has revealed a rich pattern of results allowing for better characterization of disease.

Keywords - *Optic chiasm; abnormal MRI brain , Measurements*

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I. Introduction

Several important structures are located adjacent to the optic chiasm. The supraclinoid branches of the internal carotid artery flank the chiasm. The optic chiasm occupies a central place in the suprasellar cistern and is frequently involved in processes affecting this area. Its position with respect to the sella in cadaver specimens has been described as normal, prefixed, or postfixed [1 , 2]. The intention of the present study was to characterize the optic chiasm Measurements in abnormal MRI brain using coronal cuts Concerning the subjects ages and gender in Sudan, which could help in the early detection of some disorders.

II. Material And Methods

Subjects

The study has been carried out in radiology departments of Royal care hospital & Antalya medical center in Sudan .during the period from January 2015 up to 2018 . All the patients underwent MRI brain.**.** diagnosis by experienced radiologists . ,the patients having pathological changes were diagnoses such as: astrocytoma, brain atrophy mastoiditis ,metastasis brain, optic atrophy, sinusitis .15 of them had visual impairments,17 of them had headache, and 9 of them had optic atrophy The sample comprise of 33 Sudanese patients ,51.5%(17)were female,48.5%(16)were male. with different ages ranges (between 16-78 years).

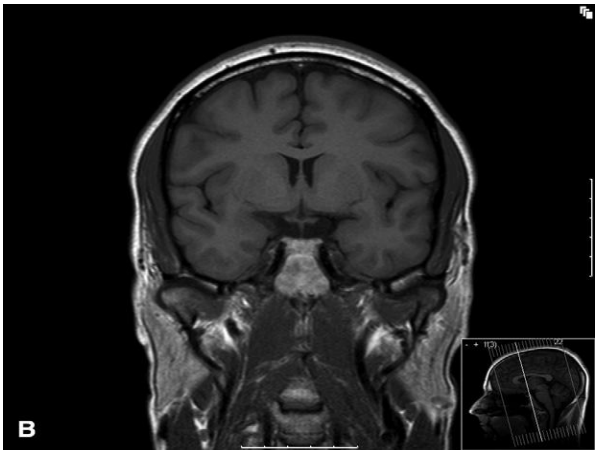
All MRI examinations were performed using a1.5 Tesla system (Toshiba+ general electric) . The patient lies supine on the examination couch .examined general brain. Used head coil,(these a replaced over-head but should not touch the patient). The patients are positioned so that the longitudinal alignment light lies in the midline , and the horizontal alignment light passes through the nasion Straps and foam pads are 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 between slices.

Knowledge of the normal size range of the optic chiasm can be helpful in the early detection of some disorders, these measurements can be calculated with any of the multitude of commercial software currently available, and most MR units now in use have the capabilities to furnish the ROI measurements

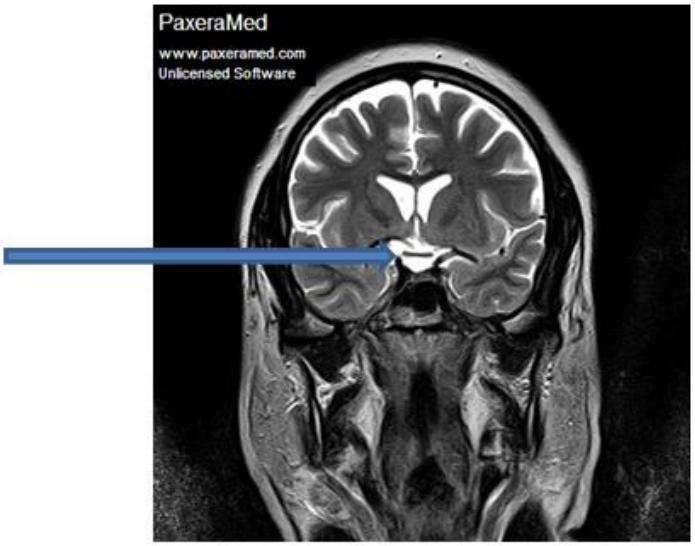
The calculated measurement of the normal optic chiasm on MR sections can be used as a comparative standard by which to detect relatively smaller or larger chiasms, regardless of whether the measurements are in exact ratio to the actual nerve.

III. Data Acquisition And Measurement Protocol

The data were transferred to a workstation, at which the width & height of the optic chiasm were measured on T2 coronal section. there was one image in which the optic chiasm was clearly seen as a horizontally aligned dumbbell-shaped object, and this image was used for the measurements 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).



F i g u r e (1) coronal magnetic resonance images showing the position and immediate relationship of the chiasm to adjacent anatomical structures.



Figure(2) showsT2-weightedcoronal image demonstrate where chiasm measurement (arrow)were obtained

IV. Statistical Analysis

All data obtained in the study were documented and analyzed using SPSS program version 21.Continuous data are presented as mean ± standard deviation (SD) and compared using the t test. Categorical data were expressed as percent frequencies, and differences between proportions were compared using ANOVA test. Statistical correlation between continuous variables was tested using the Pearson's product-moment coefficient of correlation (r). All tests of significance were two tailed and a p-value < 0.05 was considered statistically significant. All analyses were performed using SPSS version21.

V. Results

The results of this study revealed that In Table(1) Mean age of the participants was 39.76 ± 18.62 years, while median was 35years, minimum age 16 years while maximum 78 years. In Table(2) female were slightly half study population 17(51.5%) , while male were 16(48.5%.In Table(3) Age group less than 20 years was5 (15.2%) , while next age group 20 year up to 29 years old was highest age group 9 (27.3%) , 30 up to 39 years old were 5(15.2%), 40 up to 49 years were 5 (15.2%) , 50 up to 59 years was lowest percent among study population 5 (12.1%) and 60 years and above were 5 (15.2%) .In Figure (3) Visual disturbance affected 15 (45.5%) , while 18 (54.5%) didn't affected by visual disturbance. In Figure (4) Majority of participants 16 (48.5%) not suffer headache, while about one fifth 17(51.5%) suffered headache.In Figure (5) Majority of participants 24 (72.7%) not suffer optic atrophy, while about one fifth 9(27.3%) suffered optic atrophy. In Table(4) Mean of OC width was 13.32 ± 1.28 standard deviation , median 13.69, minimum 11.11 while maximum 15.09.In Figure (6) About less than three quarters 3 (69.7%) had OC width range between 12 up to 15 mm , while slightly less than one quarter 8 (24.2%) had OC width less than 12 mm and those who had OC width more than 15 mm were 2(6.1%).In Table(5) Mean of OC height was 2.53 ± 0.184 standard deviation , median 2.47, minimum 2.11 while maximum 2.89.In Table(6) Majority of study population were affected by sinusitis and mastoiditis 13 (39.4%).In Table(7) gender and OC width not significant P value 0.273. gender and OC height not significant P value 0.204.Table(8) age group and OC width not significant P value 0.224. age group and OC height not significant P value 0.504.

Table (1) shows study participants age

Age /years		
N	Valid	33
	Missing	0
Mean		39.76
Median		35.00
Std. Deviation		18.626
Range		62
Minimum		16
Maximum		78

Table (2) Distribution of gender among study participants

Gender	Frequency	Percent
Female	17	51.5
Male	16	48.5
Total	33	100.0

Table (3) Distribution of age group for study population

Age group / years	Frequency	Percent
Less than 20 years old	5	15.2
20 up to 29 years old	9	27.3
30 up to 3 years old	5	15.2
40 up to 49 years old	5	15.2
50 up to 59 years old	4	12.1
60 years or more	5	15.2
Total	33	100.0

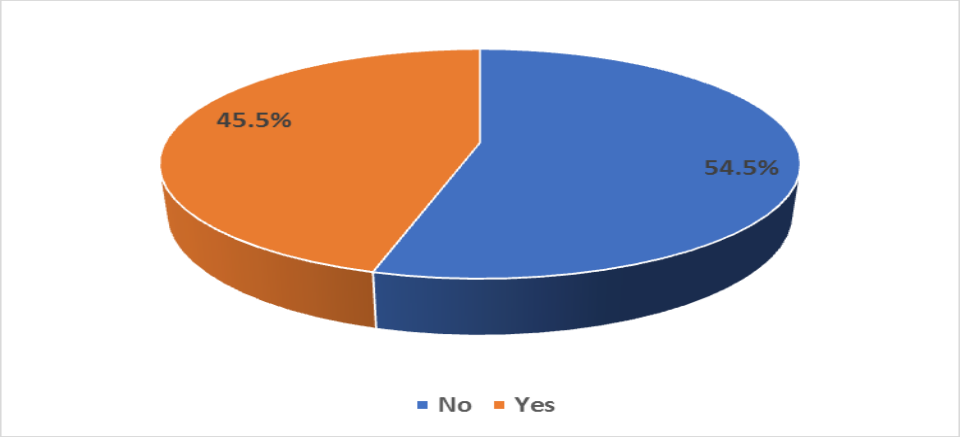


Figure (3) Shows distribution of visual disturbance among study population

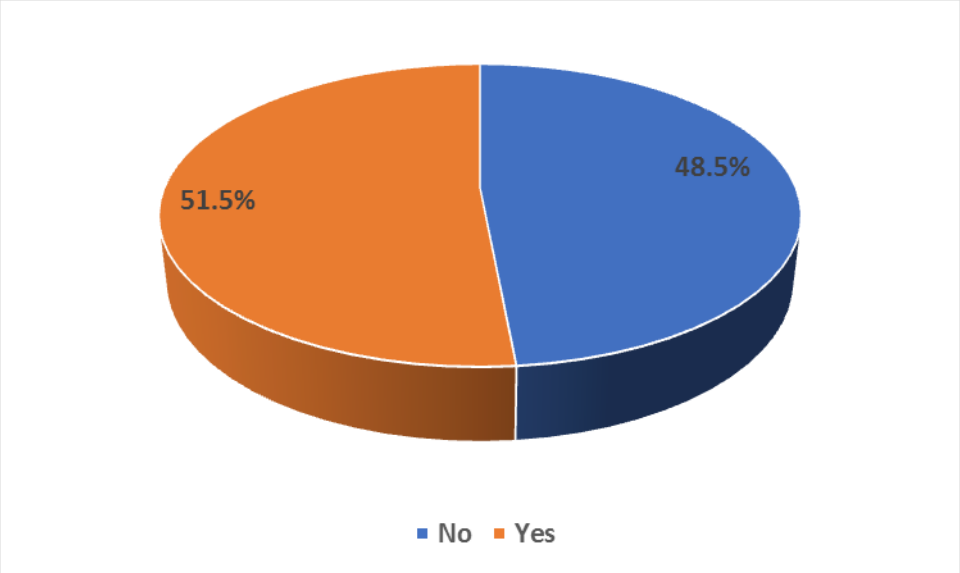
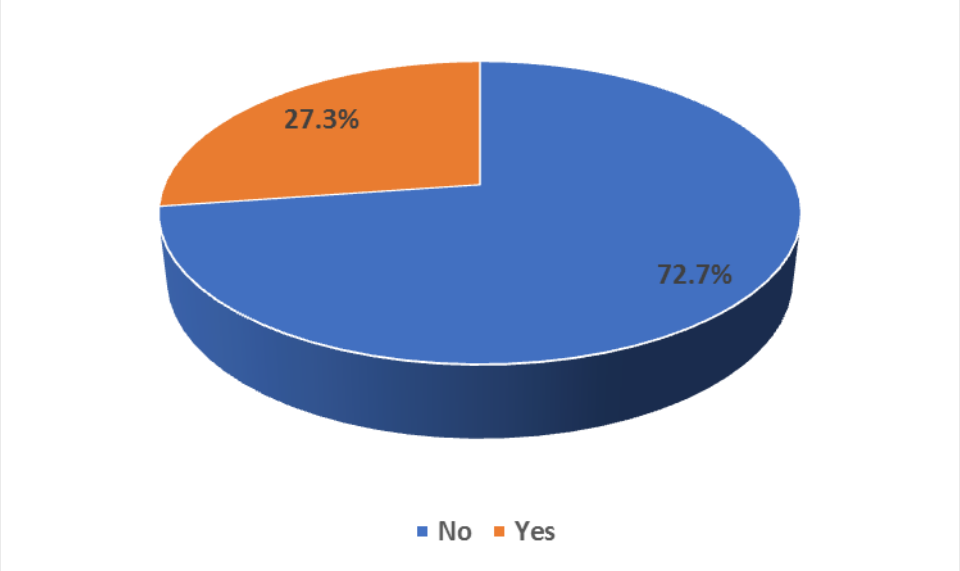


Figure (4) Shows distribution of headache among study population



Figure(5)Shows distribution of optic atrophy among study population

Table (4) shows of study participants OC width

OC width		
N	Valid	33
	Missing	0
Mean		13.3206
Median		13.6900
Std. Deviation		1.28733
Range		3.98
Minimum		11.11
Maximum		15.09

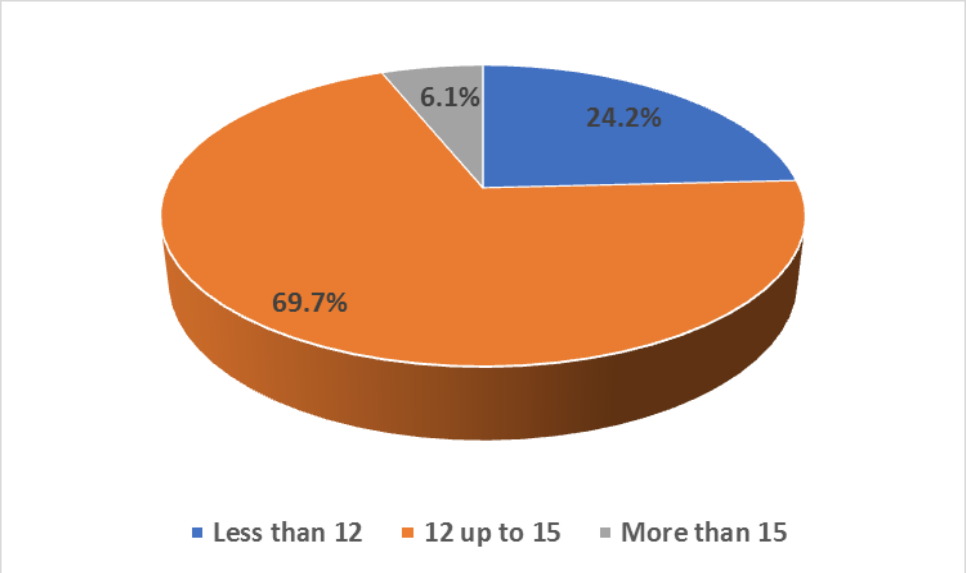


Figure (6) Shows distribution of participants OC width

Table (5) shows study participants OC height

OC height		
N	Valid	33
	Missing	0
Mean		2.5324
Median		2.4700
Std. Deviation		.18490
Range		.78
Minimum		2.11
Maximum		2.89

Table (6) Distribution of finding among participants

Finding	Frequency	Percent
Astrocytoma	1	3.0
Brain atrophy	3	9.1
Mastoiditis	13	39.4
metastasis brain	1	3.0
Optic atrophy	1	3.0
Sinusitis	13	39.4
Sinusitis/mastoiditis	1	3.0
Total	33	100.0

Table (7) Shows relationship between gender with OC width and OC height: -

Gender		OC width	OC height
Female	Mean	13.0788	2.4924
	N	17	17
	Std. Deviation	1.39275	.13899
Male	Mean	13.5775	2.5750
	N	16	16
	Std. Deviation	1.15313	.22039
Total	Mean	13.3206	2.5324
	N	33	33
	Std. Deviation	1.28733	.18490

Table (8) Shows relationship between age group with OC width and OC height: -

Age group / years		OC width	OC height
Less than 20 years old	Mean	13.5420	2.5280
	N	5	5
	Std. Deviation	1.32965	.15205
20 up to 29 years old	Mean	13.7844	2.6033
	N	9	9
	Std. Deviation	.93210	.15596
30 up to 3 years old	Mean	13.1280	2.5640
	N	5	5
	Std. Deviation	1.52357	.30981
40 up to 49 years old	Mean	12.3320	2.5040
	N	5	5
	Std. Deviation	1.26553	.21161
50 up to 59 years old	Mean	14.1550	2.5500
	N	4	4
	Std. Deviation	.50534	.16713
60 years or more	Mean	12.7780	2.3920
	N	5	5
	Std. Deviation	1.66141	.03834
Total	Mean	13.3206	2.5324
	N	33	33
	Std. Deviation	1.28733	.18490

VI. Discussion

Clinical assessment remains the crucial step in management of disorders of the anterior visual pathways. Once the patient has been examined, or in the majority of cases once the history has been obtained, the clinician should have a clear idea of the site of the disease process and its likely pathogenesis. Only then can appropriate and timely investigations be organized and their results interpreted correctly. Initial assessment by optometrists generally results in such patients being referred to ophthalmologists. In neuroophthalmic practice fundal abnormalities are usually absent or non-specific, such that other clinical features must be relied upon. They may be subtle so requesting repeat examination by an ophthalmologist may be helpful when other clinical features indicate retinal disease.

MRI may be applied to The OC is a commissure formed by converging optic nerves anteriorly and diverging optic tracts posteriorly. The OC is in direct contact with cerebrospinal fluid anteriorly within the subarachnoid space and posteriorly within the third ventricle, features that can be identified on MRI[3,4].However, in MRI studies, these differences in position are not mentioned as impacting on measurement of the width of the OC coronally[5–8].

The OC is an important landmark for interpreting MRI examinations of brain[6]. A small chiasm can be an indicator of several disorders, The diagnosis of atrophy or enlargement of the chiasm has mainly been made by qualitative interpretation on MRI; few studies have published normal range values of OC area and width on coronal MRI images. Wagner et al. [6] reported that, in adults, the width of the OC on MRI ranged between 10.3mm and 18.3 mm. According to this same study, coronal images provide the most accurate OC measurements[6], and coronal images of the brain are a standard sequence for imaging the chiasm . There may be some variation between studies . in our study. We used a 5.0-mm isotropic voxel size, the mean width of optic chiasm was 13.32 ± 1.28 standard deviation while the mean height of the optic chiasm was 2.53 ± 0.184 standard deviation where as in two previous studies the investigators used 3.0-mm thick coronal slices. This larger slice thickness leads to partial volume effects that make the chiasm look wider, The coronal slices measured by Bernd Schmitzr et al. [2003)] are oriented perpendicular to the optic chiasm, which the mean chiasmatic width of alpinism group were 12.9 ± 0.8 mm .while Parravano et al(1993). showed The mean dimensions in the optic atrophy group were chiasm width 2.6 and height 12.6 mm. Breakdown by age and gender showed an expected no significant in the measurement of the chiasm as patients got older 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 T2-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 low compared to previous studies in this age group, while the NO of subjects were slightly high . The three-dimensional shape of the chiasm makes it a difficult organ to measure. We believe that the accurate measurements can be made on T2-weighted MR images, as the chiasm is seen clearly on this sequence in our opinion. 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. Not all studies are suitable for this calculation, such as those with enough motion or noise to make the margins of the chiasm indistinct. However, in alot of our patients, the images had enough detail to make reproducible determination of the borders possible, and no special imaging of the Sella was necessary

VII. Conclusion

Based on our results, measurement s of OC feasible when this structure is seen on coronal MRI so .the study concluded that the Sudanese population morphology is slightly different from other populations mentioned in the previous studies. optic chiasm width ranged from 11.11 mm to 15.09 mm ,the optic chiasm height range from 2.11mm to 2.89 mm, Coronal MRI may prove beneficial for demonstration of optic chiasm anatomy .A detailed knowledge about anatomic variations will help in early detection of some disorders. Establish of normal optic chiasm (OC) size in adult based on high-resolution orbital magnetic resonance imaging (MRI).With high-resolution MRI and 3D reconstruction, Optic tract may be displayed clearly and measured accurately.

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