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Duplex Study of Carotid Artery in Patient With Ischemic Stroke at European Modern Hospital Sana'a. Yemen

دراسة الاضطرابات بالأشعة التلفزيونية (السونار) في الشريان السباتي لمرضى الجلطة الدماغية بسبب نقص التروية في المستشفى الأوروبي الحديث بصنعاء

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Abstract.

Background: Cerebral ischemic stroke is life-threatening and debilitating neurological disease. Studies have shown that there is a close relationship between carotid artery stenosis and ischemic cerebral vascular disease. This study was done to assess the carotid artery abnormality with the help of color Doppler sonography and to correlate cerebrovascular accidents.

Patients and Methods: retrospective study was carried out on 151 patients with ischemic stroke. Risk factors such as hypertension, diabetes mellitus,smoking, ischemic heart disease(IHD) ,dyslipidemia and age were documented. The data gathered from color Doppler examination consisted of any carotid artery abnormalities as intimal thickening ,stenosis, and plaque .

Statistical Analysis Used: The collected data were analyzed and presented in the form of tables ,figures, wherever necessary.

Results: There are 103 patient have abnormality in carotid artery which is common in male{ 69 patient (67%)} . The abnormalities are :(65%) plaque, (36%) stenosis, (15%) intimal thickening & (2%) complete occlusion), 59% of the stenosis are significant (i.e. >50% stenosis) .The abnormality is common in the age group of (60 – 69) which has a significant association, 76.5 % of Hypertension & 59.5% of IHD has abnormal carotid artery with significant association also .

Conclusion: The duplex abnormality of carotid artery detected by carotid Doppler in the form of plaque ,stenosis, & intimal thickening is common in ischemic stroke and associated significantly with hypertension , old age and IHD as risk factors, and may help in guide of the management of patient.

Key words: carotid artery stenosis , ischemic stroke ,carotid intima-medial thickening (CIMT) ,duplex abnormality

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ملخص البحث :

تعتبر الجلطة الدماغية بسبب نقص التروية أحد أمراض الجهاز العصبي وقد يؤدي إلى إعاقة مستديمة .وقد أثبتت دراسات علمية العلاقة بين تضيق الشريان السباتي مع هذا النوع من الجلطة الدماغية ولذلك أجري هذا البحث هنا من أجل دراسة هذه العلاقة بواسطة الأشعة التلفزيونية للشريان السباتي لفهم هذه العلاقة أكثر بين هذا النوع من الجلطة مع التغيرات التي تحدث في هذا الشريان وخاصة مع شحة الأبحاث في اليمن في هذا المجال.

تم إجراء البحث على 151 مريض مصاب بجلطة دماغية ممن ترقدوا في المستشفى الأوروبي الحديث بصنعاء للفترة بين يناير 2018 إلى يناير 2020ميلادي وتم تجميع المعلومات من ملفات الكترونية لأشعة التلفزيون للشريان السباتي والاضطرابات (الاختلالات) فيه مثل التضيق و تغيرات التصلب بدرجات متفاوتة لهؤلاء المرضى مع تجميع بعض العوامل الخطيرة التي تؤدي لذلك المرض كارتفاع ضغط الدم والسكري وتقدم السن واضطرابات الدهون والتدخين.

وتم تحليل هذه المعلومات حسب نظم التحليل وكانت النتيجة كالتالي:

أن (103) من المرضى بالجلطة لديهم تغيرات غير طبيعية في الشريان السباتي معظمهم ذكور بنسبة 67%.هذه التغيرات تتراوح من تصلب أو تضيق أو تضخم للطبقة الوسطى في الشريان أو تضيق كامل بنسب(65 %) (36 %) (15 %) (2 %) حسب الترتيب .(59 %) من هذه التضيق تعتبر كبيرة (يعني بنسبة أكثر من 50 ٪ من قطر الشريان). أكثر تلك الاضطرابات في الشريان كانت متعلقة بالتقدم في السن (60- 69) يليه مرضى ارتفاع ضغط الدم ثم مرضى الشريان التاجي بعلاقة سببية معتبرة من الناحية الإحصائية.

وباختصار فإن هناك نسبة كبيرة من مرضى الجلطة الدماغية الانسدادية لديهم اضطرابات أو اعتلالات في الشريان السباتي وهذا سيسهم في العلاجات والتدخلات في هذا الشريان لمنع هذا المرض والوفيات والإعاقات المستديمة التي يسببها وخاصة أن هناك تدخلات علاجية مباشرة في هذا الشريان كالدعمة وإزالة التضيق والتي لا زالت غير متوفرة حاليا باليمن إلا أنها ستكون مهمة وضرورية مستقبلا.

الكلمات المفتاحية: الجلطة الدماغية بسبب نقص التروية ,تضيق الشريان السباتي , سماكة الطبقة الوسطى للشريان السباتي , الاضطرابات بالأشعة التلفزيونية.

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INTRODUCTION

Stroke is the second leading cause of death worldwide, and the leading cause of acquired disability in adults in most regions.[1,2] Countries of low- and middle-income have the largest burden of stroke, accounting for more than 85% of stroke mortality worldwide. Few reliable data are available to identify risk factors for stroke in most of these regions.[1-4] Stroke has many risk factors such as age, male sex, hypertension, diabetes, cardiac diseases, transient ischemic attacks (TIA) smoking, hyperlipidemia and previous attacks of stroke.[5] Although ischemic stroke (IS) is more common than hemorrhagic stroke(HS).[6-8] The latter is the most devastating pathological type of stroke and accounting for 9%–22% of total strokes among Western populations.[9,10] In some developing countries, HS recorded higher frequencies.[11-14] Insufficient data about stroke in Yemen, Sallam *et al*.[15] was published and available study about the clinical profile of stroke in Sana'a ,also there is published comparative study [16] between IS. and HS.but there is no published study knock the relation between carotid artery stenosis and ischemic stroke in Yemen in spite the vascular intervention of stroke now is needed in management of stroke. So , this work provides study of this relation to improve outcome of a patients with carotid stenosis .

Aim of the Work

This study was conducted to contribute in basic data about duplex study of carotid artery in patient with ischemic stroke at European Modern Hospital in Sana'a.

SPECIFIC OBJECTIVES:

- To study the prevalence of the abnormality in carotid artery detected by duplex study in patient with ischemic stroke.
- To determine the significant and character of carotid artery abnormality in patient with ischemic stroke.
- To find out the relation of carotid abnormality with the risk factors (age, sex, HTN, DM, IHD, smoking).
- To study percentage of carotid stenosis and correlation with symptoms in patient with ischemic stroke .

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Methodology:

1-Study design:

Retrospective descriptive study.

2-Study population:

151 patients who diagnosed as ischemic stroke or TIAs at Modern European hospital in Sana'a, capital of Yemen for a period of 2 year from January 2018 to January 2020

3-Inclusion criteria:

Cases with history, clinical and CT scan findings consistent with cerebral ischemic stroke diagnoses who underwent Doppler sonography of carotid arteries.

4- *Exclusion criteria*

Patients with following conditions were excluded: (neurosis, hypertensive encephalopathy, sepsis, head injuries, & primary and metastatic brain tumors).

5- Data collection techniques and tools:

The data was collected from the records of the patient ,through questionnaire which is prepared after reading the literature and according the objectives . This questionnaire include 4 parts:

First part : included the personal data characteristics of the participants as file no. , age, sex, and smoker habit .

The second part : include complaining presentation of the patients which is with left or right side body weakness and dysphasia .

The third part : was about the past history of patient about DM, I.H.D, and HTN.

The fourth part : include brain CT scan , carotid duplex study

6-Data analysis and management:

Data were collected, summarized, tabulated& properly analyzed with statistical package for social sciences [SPSS version 20].The obtained result was be represented by using [histogram, tables and pie -chart] finally according to the results, The findings are discussed in the light of findings of other similar studies. conclusions and recommendations was be stated.

7 - Definitions & characters :

The data gathered from the color Doppler examination consisted of : Peak systolic velocity (PSV) of common carotid artery (CCA) and internal carotid artery (ICA); ICA/CCA velocity ratios ; Plaque characteristics is either calcified or not calcified ; The presence of intimal thickening ; Detection of any thrombus and detection and grading of carotid artery stenosis. The duplex examinations were performed by different operator.

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Criteria used for measuring percentage of stenosis in our study:
Carotid intima-media thickness (CIMT) is anechoic zone between two echogenic li nes, first echo is lumen-intima surface, and the second echo is caused by media-adv entitia interface .The intima-media thickness(IMT) measurement of internal carotid arteries was taken. The mean value of above four sites was used for analysis. A CI MT more than 1 mm was regarding as abnormality of carotid artery & almost indicative of atherosclerosis.

The diameter of the residual lumen and the external diameter of the artery at th e same level were measured and the degree of stenosis was calculated using the foll owing relationship: Percent stenosis = D-d.100/D, where D is vessel wall-to-wall di ameter and d is patent vessel diameter. All carotid stenosis were included in the ana lysis, irrespective of the laterality to the symptomatic hemisphere or its unilateral or bilateral presence, or the presence of solitary or multiple stenosis in one or more vessels.

The systolic and diastolic velocity of blood flow, presence of atheromatous pla que and thrombus were looked for and then the percentage of stenosis of the affecte d patients was assessed.

Carotid Doppler study was graded as follow(SRU criteria) (17) :

Normal; ICA/CCA PSV ratio<2 and ICA EDV<40,

Mild stenosis <50%; ICA/CCA PSV ratio<2 and ICA EDV<40 with presence of at heromatous plaques,

Moderate stenosis 50-70%; ICA/CCA PSV ratio= 2-4 and ICA EDV=40- 100,

Sever stenosis >70%; ICA/CCA PSV ratio>4 and ICA EDV> 100.

All findings were included in the carotid Doppler study of common carotid arteries and internal carotid arteries of both sides.

The diameter of the residual lumen and the external diameter of the artery at the same level were measured and the degree of stenosis was calculated.

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Defining Risk Factors:

The risk factors include:

Hypertension (receiving medications for hypertension or systolic blood pressure ≥130 or diastolic ≥ 80 mmHg (as suggested in 2017 by American college of cardiology and American Heart Association (ACC/AHA).{18 }

Diabetes mellitus (receiving medications for diabetes mellitus, fasting blood sugar ≥126 mg/dL or HbA1c ≥ 6.5%, or a random plasma glucose ≥ 200 mg/dL with symptoms or 2 hour plasma glucose ≥ 200 mg /dl during an OGTT ,as the criteria of DM diagnosis in American Diabetic Association(ADA) of 2018.{18}

Hypercholesterolemia (receiving cholesterol-reducing agents or an overnight fasting cholesterol level ≥240 mg/dL, ≥200 mg/dL

triglycerides, or Low density lipoprotein (LDL) cholesterol ≥160mg/dL.), {18}

A "current smoker" was defined as a person who self reported smoking within the calendar year prior to the year of diagnosis.

Results:

This study of 151 cases of ischemic stroke is done to determine the carotid artery abnormality detected by duplex ultrasonography , we found that ischemic stroke is common in male where about 102 case (68%) is male, and mean age is 56 (± 4.5) as show in table (1).

Table No. (1) distribution of ischemic stroke according the sex:

Sex	No.	%
Male	102	68%
Female	49	32%
TOTAL	**151**	**100**

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About 134 cases (89%) are thrombotic , 17cases(11%) are cardio embolic, and 9 cases (6%) of them are lacunar as showed in table (2) .

Table No.(2):distribution of ischemic stroke types:

	no	%
Thrombotic	134	88.7
Cardio Embolic	17	11.3
Lacunar	9	5.96

About 103 case (68%) have abnormal carotid artery as showed in table No (3),67 cases (65%) of them have plaque,19 cases (18%) of them is non-calcified, while 37 cases(36%) with stenosis as showed in table (4).

Table No.(3) Distribution of ischemic stroke according abnormality of carotid artery.

	No.	%
Abnormal carotid artery	103	68%
Normal carotid artery	48	32%
	151	100

Table No.(4) Distribution of carotid abnormality according character of abnormality:

Abnormal character	No.	%
Stenosis	37	36%
Calcified plaque	48	47%
Non calcified plaque	19	18%
Minimal intimal thickness	15	15%
Thrombus	2	2%
Complete occlusion	2	2%

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About 28 cases (76%) of the Stenosis cases are Ipsilateral to the symptoms of the side weakness as showed in table (5) , with different grades as showed in table (6) ,where 8 cases (22%)of them heave sever stenosis.

Table No.(5) distribution of stenosis with stroke side:

Correlation	No .	%
Ipsilateral (going with)	28	76%
contra lateral	9	24%
Total	**37**	**100**

Table No.(6) :Grads of carotid stenosis

Grad of carotid stenosis	No.	%
Mild (<50%)	15	40.5%
Moderate(50-70%)	14	37.8%
Severe (>70%)	8	21.6%
Total	**37**	**100**

Regarding the risk factors we found that,the abnormal carotid is common in male 69 case(67%) with insignificant relation statistically{p-value(0.83)} as showed in Table (7).

Table No.(7) relation between sex & carotid abnormality.

Sex * carotid abnormality Cross tabulation		Carotid Abnormality		Chi-square	p-value
		Freq.	%	0.046	0.830
Sex	female	34	33%		
	male	69	67%		
Total		**103**	**100**		

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The mean age of abnormal carotid is 60.5 (±25.5), and (60-79)year group are more effect 66 patient (64. %) with significant relation statistically, p-value (.025) as showed in table (8).

Table No.(8) Relation of carotid abnormality with age groups:

Age*Carotid abnormality		carotid abnormality		Chi - squar	P-value
		Freq.	%		
Age	20-39	4	3.9%	14.405	.025
	40-59	26	25.2%		
	60-79	66	64.1%		
	80-89	7	6.8%		
Total		**103**	**100.0%**		

There was significant relation between HTN and IHD with carotid abnormality as p-value (0.003) &(0.001) respectively ,but insignificant relation between DM and dyslipidemia with carotid abnormality as p-value (0.303) and (0.816)respectively as showed in table(9). Smoking history reveal only 7 patients are smoker .

Table No.(9) relation between risk Factors & carotid abnormality

Risk Factors * carotid abnormality		carotid abnormality		p-value
Risk Factors	HTN	75	51.0%	0.003
	DM	50	34.0%	0.303
	IHD	22	15.0%	0.001
	Dyslipidemia	33	70%	0.816

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DISCUSSION:

Ischemic stroke is poly etiologic disease with the risk factors includes modifiable and non-modifiable risk factors. Well documented risk factors that can be controlled include hypertension ,DM ,dyslipidemia ,smoking , and asymptomatic carotid stenosis. Many study researches the relation between extra cranial vessels and ischemic stroke. The risk of ischemic stroke increases with the degree of carotid stenosis.

This study of 151 case of ischemic stroke, presents the data of carotid duplex abnormality relation .We found that ischemic stroke is common in male about 102 cases (68%) , and mean age of the cases is 56 (± 4.5) , this is same as SALLAM study, where male predominant 63%, and mean age is 60, also Bamekhlah study reveal male predominant (58%) of stroke . and mean age is 68, the different that our study was for ischemic type. In Sibiu study no predominant in gender, and the mean age was slight higher (71) in which ,the study was of ischemic stroke as our study. About 134 cases (89. %) are thrombotic, 17case(11. %) are cardio embolic, and 9 (6%) of them are lacunar . About 103 case (68. %) in our study have abnormal carotid artery, the mean age of them is 60.5 (±25.5) ,67 cases (65%) of them have plaque ,this result near the result of Suoth Indian study where plaque was 78% ,19 case of them (18.4%) is non-calcified. In our study 37 cases (36%) have stenosis,60% of them have significant stenosis (i.e. >60 % stenosis) ,and 40% has insignificant stenosis, this result is same as Daka study 60% ,but in Indian study was less (24%). Regarding the ipsilateral abnormality with side of weakness was 76% in our study ,which is near the result of Daka study which is 81%.In our study ,28 cases (76%) of the stenosis cases are ipsilatrael with symptoms of the side weakness ,22 cases have significant stenosis, 8 cases of them with sever stenosis, 2 cases of them are totally occluded and other two with thrombus .

Regarding risk factor we found that the carotid abnormality is common in male 69 cases(67%) with insignificant association statistically (p-value 0.830).The mean age of abnormal carotid is 60.5 (±25.5), the age group of(60-79)years are more effect { 66 patient (64. %)} with statistic significant association with carotid abnormalities (p –value 0.025) this result resembles Daka study .HTN is most risk factor related to abnormal carotid, where 75 cases (77%) of abnormal carotid artery have HTN with significant association (p,0.003) ,.IHD also have significant association (p<0.001) with abnormal carotid, while DM has insignificant association ,p-value (0.303).About 46 cases of abnormal carotid have lipid profile,32(68%) of them have dyslipidemia , also dyslipidemia has insignificant association with abnormal carotid p-value (0.816) .Smoking history reveal only 7 patient are smoker tow cases (2%) have abnormal carotid artery .

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CONCLUSION

The carotid artery abnormality (atherosclerosis) is a well-known risk factor for the development of the ischemic stroke and a significant number of patients in our study were found to have abnormality , (stenosis with grading from mild to totally occluded, plaque (calcified & non calcified) and intimal thickness , & thrombus, . The present study shows that the presence of risk factors like, age, hypertension, and ischemic heart disease is strongly associated with carotid artery atherosclerosis.

LIMITATION OF THE STUDY

The present study has some limitations. As this study was a single hospital-based study conducted on patients having a different clinical and risk factor profile .also less than half of the patient has no lab. investigation of lipid profile,& the past history of the smoker patients only taken from recommendation of discharge paper ,where there are no risk factor other than smoking is present.

RECOMMENDATIONS

High risk patients should be screened by Doppler ultrasonography for the presence of carotid atherosclerosis specially stenosis in order to plan out medical and surgical intervention for the primary

as well as secondary prevention of cerebrovascular events. Also the vascular interventions for ischemic stroke is not done in Yemen, so more researches and more concentration on carotid imaging wither by duplex or by the gold standard carotid angiography to trend us toward vascular management of acute ischemic stroke to improve the outcome and the prognosis and handicapped from the ischemic stroke.

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