

The Predictive Value of Intima-Media Thickness of the Common Carotid Artery in the Prevention of Stroke

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ABSTRACT:

BACKGROUND:

Non invasive measurement of intima-media thickness(IMT) of the common carotid artery by high resolution ultrasonography and its importance in stroke patient.

OBJECTIVE:

The study was designed to study this relation in our locality.

PATIENTS AND METHODS:

Thirty patients with ischemic stroke that were admitted in the medical department of Al Yarmook teaching hospital were tested by the aid of echocardiography department to measure intima-media thickness of the common carotid artery and they were compared with 30 persons(matching age and sex) without history of stroke or transient ischemic attack.

RESULTS:

The mean of IMT of common carotid artery in stroke patients was 1.25 mm while in control group the mean was 0.76 mm.

CONCLUSION:

There is a significant relation between the increased IMT of common carotid artery and stroke.

KEY WORD: intima-media thickness, primary prevention of stroke.

INTRODUCTION:

Stroke is a syndrome characterized by the acute onset of a neurological deficit that persists for at least 24 hours, reflects focal involvement of the central nervous system and it is a result of disturbance of the cerebral circulation⁽¹⁾. Stroke is the third leading cause of mortality world wide(first 3 are cardiovascular & malignancies)⁽¹⁾Stroke is caused either by ischemic-infarction or intracranial hemorrhage. Ischemia and infarction constitute about 80% while the remaining 20% are intracranial hemorrhage⁽¹⁾. Cerebrovascular disease is caused in about half of patients by the obstruction in the extra cranial cerebral arteries, in the other half, stroke is due to roughly equal percentages of intracranial arteries, cardiac emboli, or intra cerebral hemorrhage^(1,2). The risk of the stroke increases with the age and doubles in each successive decade after the age of 60 years of age^(3,4). Men have about a 20% higher incidence of stroke than women. Circumstances

such as oral contraceptive and pregnancies uniquely contribute to the risk of stroke in women^(1,5,6,7). Race & Ethnicity, blacks have high stroke incidence compared with whites^(1,8,9,10). Family history, both paternal and maternal history of stroke may be associated with increase stroke risk^(11,12). Modifiable risk factors includes hypertension which is a major risk factor for both cerebral infarction and intra cerebral hemorrhage. Hypertensions increase the risk of stroke by four folds^(13,14). Smoking, is a recognized risk factor of stroke (nearly doubles the risk)^(15,16). Haematocrit⁽¹⁷⁾. Diabetes increase the risk of stroke 2-3 folds⁽¹⁸⁾. Hyperlipidemia: high LDL and low HDL are associated with increased risk of stroke⁽¹⁹⁾. Atrial fibrillation, responsible for about 20% of the thrombo-embolic strokes⁽²⁰⁾. Cardiac problems, anterior myocardial infarction, valvular heart disease, endocarditis, heart failure and cardioomyopathy are associated with increased risk of thrombo-embolic stroke⁽²¹⁾. Asymptomatic carotid stenosis, patient with stenosis of more than 60% are more liable to develop stroke than those with stenosis less than 60%⁽²²⁾. Other risk factors, such as sickle cell disease, obesity, physical inactivity, alcohol abuse, drugs(contraceptive pills)^(23,24).

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In our study we are going to concentrate on thickness of intima and media of the common carotid artery to see whether it got an important value in stroke patients. Recent studies in which ultrasonography measured intima-media thickness was compared with histologically determined intima media thickness showed that ultrasound is capable of accurately measuring intima-media thickness^(1,2,3,4). Atherosclerosis is a disorder of the intima, and ultrasound imaging cannot discriminate between the intimal and medial layers of the vessel wall⁽⁵⁾.

PATIENTS AND METHODS:

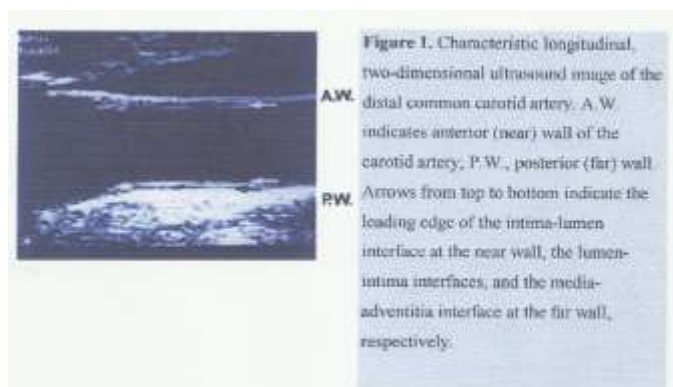
A retrospective study was done in Al Yarmook teaching hospital conducted from April-2006 to December-2006. Thirty patients were selected with stroke, their ages lie between 40-70 years old. Those patients got ischemic cerebral infarction not due to thromboembolic phenomenon. The ischemic infarction was proved by CT-scan while the criteria of exclusion of thromboembolic stroke were as follow⁽⁶⁾:

- 1. No history of previous myocardial infarction.
- 2. No history of atrial fibrillation; permanent or paroxysmal (by history and ECG).
- 3. Exclusion of cardiac myopathy, valvular lesion, ejection fraction less than 40% by echocardiography.

While 30 persons, age and sex matched, were chosen with no history of stroke or transient ischemic attack previously, to make a comparison with the group mentioned above,

After history and physical examination all patients were investigated with blood biochemistry, complete blood picture, ESR, ECG, echocardiography, CT-scan and carotid Doppler ultrasonography. Echocardiography, was 2D mode and M mode type for all our patients to exclude the

possible source of cardiac embolism. CT-scan, The scans were interpreted by a radiologist. In this study the ischemia was included and hemorrhage was excluded. Carotid Doppler, To measure carotid intima, media thickness, ultrasonography of the common left and right carotid arteries was performed with a 7.0-MHz linear-array transducer (Kertz Voluson 70-D). On a longitudinal, two-dimensional ultrasound image of the carotid artery, the anterior (near) and posterior (far) walls of carotid artery are displayed as two bright white lines separated by hypoechogenic space. The distance between the leading edge of the first bright line of the far wall (lumen-intima interface) indicates the intima-media thickness, for the near wall, the distance between the trailing edge of the second bright line at the near wall provides the best estimate of the near-wall intima-media thickness^(1,2,3,4,5,6). When an optimal longitudinal image was obtained, it was frozen on the R wave of the ECG. This procedure was repeated three times for both sides. The actual measurements of intima-media thickness were performed off-line. In short, with a cursor, the interfaces of the distal common carotid artery were marked across a length of 10 mm. The beginning of the dilation of the distal common carotid artery served as a reference point of the start of the measurement. The average of the intima-media thickness of each of the three frozen images was calculated for each individual, the common carotid intima-media thickness was determined as the average near and far wall measurements of both the left and right arteries. In our study we considered the highest reading for the left or right common carotid artery in control group and the site of infarction in stroke patients.



Statistical analysis was carried out using CHI-square.

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RESULTS:

Table 1 shows the number & percentages of cerebrovascular accident patients and control group (gender distribution). The number of cerebrovascular accident patients was thirty, 13 (43,3%) were male while 17 (56,7%) were females. The number of control group was twenty persons 11 (55%) were male while 9 (45%) were females.

Table 2 shows the age distribution for cerebrovascular accident patients (mean of their age \pm SD was 59,0 \pm 4,0) and control group (mean of their ages \pm SD was 58,4 \pm 7,7) and their mean IMT of common carotid artery. The highest reading was in the age group that lies between 56-60 years with a mean of 11,7mm.

Table 3 shows the common carotid intima-media thickness in cerebrovascular accident patients, and control group. The mean intima-media thickness

of control group was 0,960 mm with SD \pm 0,113 and range between 0,7- 0,90mm. For cerebrovascular accident patients the mean intima-media thickness of the common carotid artery was 1,24mm with SD \pm 0,17mm and range between 0,9-1,7mm. The data show significant increase in the intima-media thickness of common carotid artery of cerebrovascular accident patients in comparison with the control group ($p < 0,001$).

Table 4 shows the cholesterol levels in cerebrovascular accident patients and control group. The study showed that 70% of cerebrovascular accident patients and 10% of control group had a cholesterol level more than 200 mg/dl. And data reveal a strong relation between cerebrovascular accident and hyperlipidemia ($p < 0,001$).

Table 1 : Gender of patients and control group.

	Cerebrovascular accident patients No.&percentage	Control group No.&Percentage
Male	13 43,3%	11 55%
Female	17 56,7%	9 45%
Total	30	20

Table 2: Age distribution for CVA, Control group mean intima-media thickness.

Age groups	Cerebrovascular accident patients	Control group	Mean IMT
40-50	2	3	0,937mm
51-55	0	3	1,088mm
56-60	9	3	1,117mm
61 & above	18	11	0,990mm
Total	30	20	

Table 3 Common Carotid intima-media thickness(IMT) In patients & control group.

	Control group	Cerebrovascular accident patients
Upper limit of IMT	0,90mm	1,7mm
Lower limit of IMT	0,7mm	0,8mm
Mean	0,960mm	1,24mm
SD	\pm 0,113mm	\pm 0,17mm
Mode	0,8mm	1,1mm

Table 4 : Cholesterol levels in CVA patients & control group.

Cholesterol level	Cerebrovascular accident patients	Control group	Total
>200 mg/dl	21 70%	3 10%	24
<200 mg/dl	9 30%	17 80%	26
Total	30	20	50

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Table 2: Risk factors & their frequencies.

	Number of patients
Hypertension	8
Diabetes mellitus	0
Smokers	1
Hypertension & Diabetes mellitus	0
Hypertension & Smokers	0
Diabetes mellitus	3
Hypertension, Diabetes mellitus & Smokers	3
Total	30

DISCUSSION:

An increase in the intima-media thickness of the common carotid artery is generally considered as an early marker of atherosclerosis and has been associated with high risk of stroke,^(1,2,3,4,5,6,7,8,9) prevalent cardiovascular disease,^(10,11,12) and atherosclerosis elsewhere in the arterial system.^(13,14,15) There is a growing belief that carotid intima-media thickness can be regarded as an indicator of generalized atherosclerosis⁽¹⁶⁾, in our study, which assessed whether noninvasive measurements of intima-media thickness have any significant relation with respect to cerebrovascular events, we were aware that carotid artery intima-media thickness is strongly associated with cerebrovascular risk factors.^(17,18,19,20) It may be difficult for clinicians to identify older patients with subclinical cerebrovascular disease in the basis of classic risk factors. Increased intima-media thickness is an indicator of subclinical disease which might reflect the effects of these risk factors. The addition of measurement of intima-media thickness of common carotid artery to cerebrovascular risk equations may help identify asymptomatic persons who would benefit from aggressive preventive measures, including drugs^(21,22). Measurements of carotid IMT could influence the clinician to intervene with medication and to use more aggressive treatment of risk factors in primary prevention stroke^(23,24,25). For more extensive use of this method in clinical practice a consensus concerning the standardization of methods of measurement and precise definition of the threshold between normal and pathologic intima-media thickness value is urgently needed. In our study we concentrate on the groups lie between 40-70 years old as we thought that this age group might get benefit from primary preventive measures of stroke more than the other age groups^(26,27). The study showed that the control group with negative risk factors got an IMT in

common carotid artery patients is attributed to many factors including difference of age, duration and type(s) of risk factors and the operative accuracy. From this data it was obvious that there is a strong relationship between increased common carotid intimal medial thickness and the risk of stroke and we suggested the intima-media thickness more than 0.9 mm is a pathological value for the occurrence of stroke event in risky patients and this value is nearly matched with values of other studies^(28,29). Previous researches had revealed that cholesterol levels is directly proportional with intima-media thickness^(30,31), so we concentrate on it and the data that has been collected showed that majority of patients with cerebrovascular accident or who got intima-media thickness equal to or more than 0.9 mm are associated with cholesterol level > 200 mg/dl⁽³²⁾.

CONCLUSION:

We conclude that an increase in the intima-media thickness of the common carotid artery is strongly associated with the risk of stroke. Measurement of carotid artery intima-media thickness retain predictive power with respect to new cerebrovascular events even after traditional risk factors have been taken into consideration, moreover, such measurements seem more powerful predictors than these risk factors.

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