

Original Research Article

Relation between transcranial doppler findings, neuroimaging and functional state in the first days of acute cerebrovascular accidents-hemorrhagic and ischemic in patients admitted to the Ardabil city hospital during 2015-2016

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ABSTRACT

Background: Cerebrovascular accident (CVA) is the third leading cause of death in the United States. Considering the diagnostic and clinical value of sonography of extra cranial vessels of the brain, identifying findings obtained from patients suspected of having CVA and Transient Ischemic Attack (TIA) and their prevalence is of great importance. The aim of this study was to investigate the relation between TCD finding, neuroimaging and functional state of ischemic and hemorrhagic CVA patients.

Methods: This was a cross-sectional study that has been done on 100 stroke patients admitted to Ardabil city hospital from March 2015 to March 2016. Patients underwent to CT-scan, doppler sonography, and TCD. The obtained data were analyzed by statistical methods in SPSS version 21.

Results: The mean age of the patients was 66.3 ± 11 years and 53% were women. High blood pressure, history of heart disease, smoking, and diabetes were the major risk factors in the present study. Fifty eight percent of the patients had moderate to severe disability in their functional status. Atheroma plaques, intima-media thickening, and the change of speed in the external carotid artery were most frequent in doppler sonography investigations. There was no significant correlation between the obtained results from TCD and the functional status of the patients.

Conclusions: Considering the non-significant correlation between TCD results and the functional state of the patients in this study, for exactly study of this topic, study the TCD of patients on several different days and after starting treatment is essential.

Keywords: Cerebrovascular accident, Functional state, Transcranial doppler

INTRODUCTION

Cerebrovascular disease (CVA) is the third cause of death in the United States which responsible for most of deaths in 2012.¹ The occurrence of CVA has risen to over 100%

in low to middle income countries over the past four decades and has reached to an epidemic level.²

Carotid arterial ultrasound (US) is a selective method for detecting and monitoring individuals with atheromatous

disease.³ Carotid US is generally performed on symptomatic patients with suspected CVA or TIA, but in economic status it can be used to screen for asymptomatic patients.⁴ In many ultrasound centers, elective carotid examination included carotid artery (CCA), the site of the CCA, the internal carotid artery (ICA), the external carotid artery (ECA), vertebral and subclavian artery that it has been done by using both B-mode and doppler ultrasound.⁵

The ultrasound diagnosis of atherosclerotic carotid disease is done by helping study the thickness of the intima-media layers, plaque morphology and ICA and CCA stenosis.³ The thickness of the intima-media of extracranial layers of the carotid artery is a measurable indicator of the presence of atherosclerosis.^{6,7} In addition to US, other modalities such as catheter angiography or CT angiography can be used to differentiate between full and partial vascular obstruction.^{8,9} Considering the diagnostic and clinical value of TCD, the identify of findings in CVA and TIA suspected patients and determine their prevalence is important. The aim of this study was to investigate the relation between TCD findings, neuroimaging and functional state in the first days of acute cerebrovascular accidents (hemorrhagic and ischemic) in patients admitted to the Ardabil city hospital, 2015-2016.

METHODS

This study was a descriptive cross-sectional study that has been done on 100 patients with stroke (ischemic and hemorrhagic) referred from March 2015 to March 2016 to Alavi hospital in Ardabil city who were undergo carotid doppler sonography and imaging.

Patient information including demographic characteristics, patient's lifestyle and symptoms were recorded in the checklist.

Inclusion criteria

- Patients with ischemic and hemorrhagic CVA patients who referred in the first 24 hours and candidate for imaging and colored doppler ultrasonography were included in the study.

Exclusion criteria

- Patients with a change in the final diagnosis that did not refer on the first day and did not have the satisfaction to enter the study were excluded from the study.

Statistical analysis

Collected Data were analyzed using statistical methods in SPSS version 20. Chi-square test was used for analysis relation between variables and p <0.05 was considered as significant.

RESULTS

The average age of the patients in this study was 66.1±11.1, the average age of patients with hemorrhagic CVA was 65.1±11.2 and patients with ischemic CVA was 67.6±11.1 and there was no significant difference between three groups.

Table 1: Frequency of risk factors by type of CVA.

Type of CVA risk factors	Ischemic		Hemorrhage		p-value
	n	%	n	%	
History of heart disease	30	15	10	20	0.1
Diabetes	11	22	8	16	0.12
HTN	22	44	33	66	0.003
Total	50	100	50	100	

Table 2: MRS of patients by type of CVA.

Type of CVA MRS	Ischemic		Hemorrhage		Total
	n	%	n	%	
No symptoms at all (0)	2	4	2	4	4
No significant disability despite symptoms; able to carry out all usual duties and activities (+1)	3	6	4	8	7
Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance (+2)	4	8	0	0	4
Moderate disability; requiring some help, but able to walk without assistance (+3)	15	30	10	20	25
Moderately severe disability; unable to walk and attend to bodily needs without assistance (+4)	17	34	16	32	33
Severe disability; bedridden, incontinent and requiring constant nursing care and attention (+5)	5	10	10	20	15
Dead (+6)	4	8	8	16	12
Total	50	100	50	100	100

Most of patients were in age group 70 to 80 years and 53% were female. 36% of patients had smoking and the average rate of smoking among them was 14.8±25.6 PY. The average of smoking in patients with hemorrhagic CVA was significantly higher than patients with ischemic CVA. 19% of patients had diabetes, 35% heart disease and 55% high blood pressure and there was no significant difference in the type of CVA and the incidence of diabetes and the history of heart disease (Table 1). In this study, 33% of all patients with the highest frequency of grade 4 got the highest MRS (Table 2).

Table 3: Finding of CT-Scan in patients by type of CVA.

Type of CVA	Involved area	n	%
Hemorrhage	Putamen	22	44
	Talamus	12	24
	Lober	8	16
	Other	8	16
Total		50	100
Ischemic	MCA	31	62
	Anterior cerebral artery	4	8
	Posterior cerebral artery	7	14
	Other	8	16
Total		50	100

In CT-scan of 50 patients with hemorrhagic CVA, 44% had putamen hemorrhage and of 50 patients with ischemic CVA, 31 (62%) had middle cerebral artery ischemia (Table 3).

In 16 patients (32%) with ischemic CVA and 13(26%) patients with hemorrhagic CVA the intima media thickness has been increased (Table 4). 40% of patients with ischemic CVA and 26% of patients with CVA were hemorrhagic in carotid arterial plaque atheroma and there is a significant difference between the type of CVA and the presence of atheromatous plaque. Of 9 patients with velocity changes in the carotid, 7 patients had ischemic CVA and 2 patients had hemorrhagic CVA. This value indicates a significant difference between patients in two types of CVA. There was no significant relation between the increase in the intima-media thickness, the presence of atheromatous plaque and velocity changes and the MRS.

There was no significant difference between the performance level of the patients and the SFV (systolic flow velocity), DFV (diastolic flow velocity), MFV (mean flow velocity) and PI (pulsatility index) in patients with ischemic and hemorrhagic CVA in the involved and noninvolved cerebral hemisphere. So, based on results of the TCD, we cannot judge about performance level of patients.

Table 4: Relation between US results by CVA and MRS.

Type of CVA MRS	Ischemic			Hemorrhage		
	IMT increased	Atheromatous plaque	Velocity change	IMT increased	Atheromatous plaque	Velocity change
0	0	1	1	0	1	0
1	2	0	0	2	0	0
2	2	0	1	0	0	0
3	5	7	2	3	2	0
4	3	9	3	4	3	0
5	3	2	0	2	3	0
6	1	1	0	2	4	2
Total	16	20	7	13	13	2

DISCUSSION

In the present study, the average age of patients was 66.1±11.1 and there was no significant difference in average age of patients between two sexes. In the studies conducted by Taheriaghdam, et al. the average age of patients was consistent with the results of the present study.¹⁰⁻¹² In the present study, 53% of the patients were women and 47% were men which was consistent with other studies.¹⁰⁻¹² In the present study, 36% of patients were smokers and the average rate of smoking among them was 14.8±25.6 PY. The average of smoking rate was significantly higher in patients with hemorrhagic CVA than patients with ischemic CVA. In

the study of Treger, 23% of the patients were sick persons which was significantly lower than the present study.¹¹ In the current study, 19% of the patients had diabetes. There was no significant difference in the type of CVA and the incidence of diabetes. No similar study was conducted on the incidence of diabetes and CVA. In general, 55% of patients had hypertension, of them 66% were in hemorrhagic CVA group and 44% in ischemic CVA group and there was a significant difference between the two groups. Studies have shown that men were more likely than women suffer to high blood pressure.⁵⁻⁸ Of all people in this study, 35% had a history of heart disease. In generally, there was no significant relationship between type of CVA,

gender of patients and previous cardiac disease. In other places, no study was conducted on hypertension and underlying heart disease in patients with CVA. In the present study, 70% of patients had disability in moderate to severe, severe or deep coma. Due to the use of NIHSS in other studies did not compare this.

In the CT-scan of patients, in hemorrhagic group, 44% had putamen bleeding. Of all ischemic patients, 18% were hospitalized due to intermediate cerebral artery total obstruction, 46% obstruction of the upper horn and 36% obstruction of the lower horn of the middle cerebral artery. In the present study, only patients with ischemia in the MCA artery were included and the reason for this was that in TCD of patients only evaluated MCA arteries. In similar studies CT scans of patients have not been studied. In this study an external carotid artery Doppler ultrasonography was used to examine the association between blood flow disorder in external carotid artery and functional state of patients. In the study of intima-media thickness in patients with CVA, 29% of patients had increase in intima-media thickness and there was no significant relationship between the MRS and the increase in the intima media thickness. In examining the presence of plaque atheroma in patients, 33% had atheroma plaque and there was no significant difference between MRS and presence of atheroma plaque. Significantly atheroma plaque in patients with ischemic CVA was more than hemorrhagic CVA ($p=0.031$). In examining the changes in the speed of external carotid artery 90% of atheroma plaque patients led to rapid speedy changes, in 6 patients the change in speed showed a stenosis of over 70%. Of the 9 patients who had a change in speed in the external carotid artery, 7 patients with ischemic CVA and 2 patients with hemorrhagic CVA ($p=0.002$).

In generally, there was no significant difference between MRS and speed variations in the external carotid artery. In this study, it was shown that there isn't a significant relationship between blood flow in systolic flow velocity (SFV), diastolic flow velocity (DFV), average flow velocity (MFV) and pulse index according to the functional level of patients with ischemic and hemorrhage CVA in the involved and non-involved hemispheres. A similar article was not found in this area. In the Taheraghdam study, there was a significant negative correlation between the TCD results and the functional level of patients in the involved hemisphere. He pointed that regarding the results of TCD in patients we can more careful about their recovery and their functional level and this issue was different from the present study.¹⁰ Because in the present study due to inability to reconsider the TCD of the patients on the 5th day due to lack of cooperation between the patients after discharge.

CONCLUSION

Based on the results of this study, high blood pressure is a major risk factor for CVA and among patients with CVA hemorrhagic was more frequent. After high blood pressure, smoking, history of heart disease and diabetes are the main risk factors for CVA. In the present study the results of

doppler sonography showed that the most finding were presence of atheroma plaque among patients and followed by increasing intima-media thickening and, finally changes in blood flow velocity in the external carotid artery.

In the CT scan of patients it was shown that in CVA with ischemic involvement with MCA artery involvement, upper horn involvement, lower lacrimal involvement and total involvement were the most frequent among patients orderly. In hemorrhagic CVA, respectively, bleeding of putamen, thalamus bleeding, total bleeding and other types of hemorrhage were the most frequent among patients. In the present study there was no significant relationship between the results of TCD and the functional level of the patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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