

# Investigating the Frequency of Symptomatic Extracranial Artery Stenosis in Patients with Ischemic Stroke Admitted to Imam Khomeini Hospital of Urmia in 2011–2012 and Its Relationship with Cardiovascular Risk Factors

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## Abstract

**Background and Objective:** Stroke is one of the two leading causes of mortality worldwide and leads to 9.7% of the world's total deaths. Identifying risk factors that increase the likelihood of stroke or the factors that are associated with its occurrence may have an important role in reducing this disease. The aim of this study was to determine the frequency of symptomatic extracranial artery stenosis in patients with ischemic stroke (IS) admitted in Imam Khomeini Hospital of Urmia in 2011–2012 and its relationship with cardiovascular risk factors. **Materials and Methods:** This is a descriptive-analytic study in which 149 patients admitted in the neurology department of Imam Khomeini Hospital in Urmia, who had been diagnosed with ischemic cerebrovascular accident (CVA), were examined by a neurologist and the findings of disease record, examination, computed tomography scan, and color Doppler ultrasonography were compared, and the patients with symptomatic extracranial stenosis were entered into this study and a pre-prepared questionnaire was completed about their condition. Data were analyzed using SPSS software version 16. **Results:** The results of this study showed that the prevalence of carotid artery stenosis in patients with stroke is 40.3% and having a history of myocardial infarction (MI) is the only factor associated with an increase in the incidence of carotid artery stenosis in patients with ischemic CVA, and there is no relationship between different risk factors for cardiovascular diseases such as diabetes, hypertension, ischemic heart disease, cigarette smoking, previous CVA, previous transient ischemic attack, and hyperlipidemia and carotid artery stenosis. **Conclusion:** Patients with a history of MI have a higher incidence of carotid artery stenosis and heart attack as a risk factor for stroke.

**Key words:** Cardiovascular risk factors, extracranial arteries, ischemic stroke

## INTRODUCTION

The incidence of stroke and deaths caused by stroke has been declined in developing countries during recent years, but it is a major cause of mortality in the world.<sup>[1,2]</sup> Identifying the factors involved in stroke, as well as progress in acute stroke care, improves stroke statistics, and among

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the significant risk factors is that Causing stroke, one can mention high blood pressure, hyperlipidemia (HLP), diabetes, cigarette smoking, physical inactivity, and inappropriate diet, which together account for about 90% of the risk of stroke.<sup>[3,4]</sup> In the low- and middle-income countries, the incidence of stroke is still rising.<sup>[5-7]</sup> Ischemic stroke (IS), which is described as the death of neurons due to the prevention of regional cerebral blood flow by the intra-arterial thrombus, is the second most common cause of death and the first major cause of disability worldwide.<sup>[8]</sup> In terms of the division of the cerebrovascular, they are divided into two large and small vessels that large vessels consist of two extracranial and intracranial groups. Extracranial vessels include common carotid, internal and external carotid. About 15% of IS s occur due to extracranial carotid artery stenosis.<sup>[9]</sup> The cause of artery stenosis in most cases has been reported as atherosclerosis, endothelial damage, fat accumulation, inflammation, plaque formation, fibrin, platelet, and thrombin.<sup>[10]</sup> Angiography is a gold standard diagnostic tool for carotid stenosis, but it is an expensive and invasive method with potentially serious side effects. While Doppler ultrasonography is a non-invasive and inexpensive method and it can provide information on vascular function and anatomy and provide atherosclerotic plaques; therefore, ultrasonography is widely used as a method without side effects for monitoring extracranial cerebrovascular. The sensitivity and specificity of the ultrasound of the carotid artery are about 90% and 95%, and it also has the ability to detect very small plaques.<sup>[11]</sup> The most effective treatment for stroke is prevention. By the means of prevention, especially in high-risk populations, we can significantly reduce mortality and disability.<sup>[12]</sup> Therefore, identifying risk factors that increase the likelihood of stroke or the factors that are associated with it has an important role in reducing the disease. For this reason, we intend to determine the frequency of stenosis of the extracranial carotid artery in patients with stroke and to investigate the possible relationship between risk factors of stroke and stenosis of extracranial arteries to predict the carotid stenosis to determine the probability of stroke.

## MATERIALS AND METHODS

This descriptive, analytic study was conducted with 149 patients admitted to the Neurology Department of Imam Khomeini Hospital in Urmia who had been diagnosed with ischemic CVA and they were investigated by a neuroscientist, and the findings of disease record, examination, computed tomography scan, and color Doppler ultrasound were compared; patients with extracranial stenosis were included in the study and a prepared questionnaire was completed about these patients. It should be noted that the patient's consent was taken

before any action. Then, all the data were analyzed using SPSS version 16 software (IBM).

## RESULTS

In this study, 149 admitted patients with mean age of  $63.47 \pm 14.920$  years old and minimum age of 18 years and maximum age of 103 years after stroke were studied in which 60 patients (40.3%) had internal carotid artery stenosis and 89 subjects (59.7%) did not show this symptom. Of the sixty patients with internal carotid artery stenosis, 33 were male and 27 were female, and of 89 patients without internal carotid artery stenosis, 40 were male and 48 were female. Of the 60 patients with arterial stenosis, 48 did not have diabetes and 12 were diabetic patients, and 89 patients who had no stenosis, 79 had no diabetes and 10 had diabetes, and in a total number of patients, 127 patients did not have diabetes and 22 cases had diabetes [Table 1]. Chi-square test on the relationship between variables of diabetes and artery stenosis in the studied patients showed that the relationship between these two variables was not statistically significant. In fact, there is no relationship between these two variables ( $P = 0.139$ ).

Furthermore, of sixty patients with arterial stenosis, fifty patients had no ischemic heart disease (IHD) and ten had IHD, and of 89 patients without arterial stenosis, 79 patients were without IHD and 10 were with IHD; of whole the studied population, 129 patients had no IHD and 20 had IHD [Table 2]. The Chi-square test on the relationship between

**Table 1: The prevalence of internal carotid artery stenosis in diabetic and non-diabetic patients**

DM	Stenosis		Total
	Negative	Positive	
No	79	48	127
Yes	10	12	22
Total	89	60	149

DM: Diabetes mellitus

**Table 2: The prevalence of internal carotid artery stenosis in the studied patients with a history of ischemic heart disease and without it**

IHD	Stenosis		Total
	Negative	Positive	
No	79	50	129
Yes	10	10	20
Total	89	60	149

IHD: Ischemic heart disease

variables of IHD and artery stenosis in the studied patients showed that the relationship between these two variables was not statistically significant, and in fact, there is no relationship between these two variables ( $P = 0.34$ ).

Of sixty patients with arterial stenosis, 51 patients had no history of myocardial infarction (MI) and 9 had a history of MI, and of 89 patients without stenosis, 87 cases had no history of MI and two patients had a history of MI; among total number of participants, 138 patients had a history of MI and 11 patients had a history of MI [Table 3]. Chi-square test with regard to the relationship between the history of MI and artery stenosis in the studied patients showed that the relationship between these two variables is statistically significant, and in fact, there is a relationship between these two variables. This means that the rate of stroke in patients with a history of MI is more than that of other patients and heart attack is a risk factor for stroke ( $P = 0.004$ ).

Of sixty patients with arterial stenosis, 57 had no HLP and 3 had HLP, and of 89 patients without arterial stenosis, 83 did not have HLP and 6 had HLP; from the total number of patients, 140 had no HLP and 9 had HLP [Table 4]. Chi-square test with regard to the relationship between HLP variables and arterial stenosis in the studied patients showed that the relationship between these two variables was not statistically significant, and in fact, there is no relationship between these two variables ( $P = 0.662$ ).

Furthermore, of sixty patients with arterial stenosis, 34 patients had no hypertension (HTN) and 26 patients had HTN, and of 89 patients without stenosis of the arteries, 56 had no diabetes and 33 had HTN; from the total number of patients, ninety patients had no HTN and 59 cases had HTN [Table 5]. The Chi-square test for the relationship between HTN and arterial stenosis in the patients showed that the relationship between these two variables was not statistically significant, and in fact, there was no relationship between these two variables ( $P = 0.444$ ).

Of the sixty patients with artery stenosis, 48 were non-smokers and 12 were smokers, and of 89 patients without stenosis, 75 cases were non-smokers and 14 were smokers; from the total number of patients, 123 subjects were non-smokers and 26 were smokers [Table 6]. Chi-square test on the relationship between variables of smoking and artery stenosis in the patients showed that the relationship between these two variables was not statistically significant. In fact, there is no relationship between these two variables ( $P = 0.501$ ).

**Table 3:** The prevalence of internal carotid artery stenosis in patients with a history of myocardial infarction without a history

MI	Stenosis		Total
	Negative	Positive	
No	87	51	138
Yes	2	9	11
Total	89	60	149

MI: Myocardial infarction

**Table 4:** The prevalence of internal carotid artery stenosis in patients with and without hyperlipidemia

HLP	Stenosis		Total
	Negative	Positive	
No	83	57	140
Yes	6	3	9
Total	89	60	149

HLP: Hyperlipidemia

**Table 5:** The prevalence of internal carotid artery stenosis in patients with hypertension and without hypertension

HTN	Stenosis		Total
	Negative	Positive	
No	56	34	90
Yes	33	26	59
Total	89	60	149

HTN: Hypertension

**Table 6:** Prevalence of internal carotid artery stenosis in smokers and non-smokers

Smoking	Stenosis		Total
	Negative	Positive	
No	75	48	123
Yes	14	12	26
Total	89	60	149

**Table 7:** The prevalence of internal carotid artery stenosis in patients with and without prior transient ischemic attack

Pre-TIA	Stenosis		Total
	Negative	Positive	
No	87	58	145
Yes	2	2	4
Total	89	60	149

TIA: Transient ischemic attack

Furthermore, of sixty patients with arterial stenosis, 58 had no previous transient ischemic attacks and 2 had previous transient ischemic attacks, and of 89 patients who had no stenosis, 87 had no previous transient ischemic attack and 2 had previous transient ischemic attacks; from the total number of patients, 145 patients had no transient ischemic attacks and 4 had transient ischemic attacks [Table 7]. Chi-square test on the relationship between the variables of previous transient ischemic attacks and artery stenosis in the patients showed that the relationship between these two variables was not statistically significant. In fact, there is no relationship between these two variables ( $P = 0.687$ ).

## DISCUSSION

Stroke is one of the two leading causes of mortality worldwide and leads to 9.7% of the world's total deaths.<sup>[13]</sup> The incidence of stroke is higher in underdeveloped countries than in developed countries.<sup>[14]</sup> IS is the most common type of stroke around the world and the intracranial atherosclerotic artery is the most commonly reported mechanism.<sup>[15]</sup> The current study was conducted on 149 patients admitted to the Neurology Department of Imam Khomeini Hospital in Urmia. The results of the Doppler ultrasonography on these patients revealed that 60 (40.3%) of them had internal carotid artery stenosis. In a study done by Lehtola *et al.*, it was found that the rate of recurrence of IS in patients with carotid artery stenosis was significantly higher than those who did not have carotid artery stenosis. By analyzing several variables involved in IS, it was found that carotid artery stenosis is an independent risk factor for the recurrence of stroke and those who have carotid artery stenosis are more likely to suffer from stroke again.<sup>[16]</sup> The findings of this study showed that the rate of carotid artery stenosis was higher than Wolff *et al.* study result. In a study by Wolff *et al.*,<sup>[17]</sup> on 159 patients aged 45–45 years with IS attack, 49 patients (31%) had cranial carotid artery stenosis. The frequency of internal carotid artery stenosis according to the gender of the patients is consistent with the study by Mousavi *et al.*<sup>[18]</sup> Our findings showed that, of sixty patients with artery stenosis, 33 were men and 27 were women, and in Mousavi *et al.* study, there were 50 men and 40 women. The statistical analysis of the present study using Chi-square test to measure the relationship between the two variables and between the patients' gender and the amount of stenosis of the internal carotid artery showed that there was no significant relationship, and this means that the gender of the patients did not affect the incidence of internal carotid artery stenosis ( $P = 0.254$ ).

In line with investigating the relationship between cardiovascular risk factors in the understudy patients in line with diabetes, our study results showed that, of sixty patients with carotid artery stenosis, 12 (20%) patients had diabetes, while this value among 89 people without stenosis was 10 (11.23%). Results show that there are more patients in the arterial stenosis group. However, no statistically significant relationship was found between statistical analysis and Chi-square test for diabetes and the incidence of internal carotid artery stenosis ( $P = 0.139$ ). The obtained results are not consistent with the findings of Hadi *et al.*<sup>[11]</sup> study. In their study, the prevalence of diabetes in patients with internal carotid artery stenosis was 44% and in that study, diabetes is an independent risk factor for internal carotid artery stenosis in patients with IS. Furthermore, the obtained results of this study in relation to IHD as an independent risk factor showed that there was no significant relationship between carotid artery stenosis and IHD ( $P = 0.34$ ). In this study, of sixty patients with carotid artery stenosis, 10 had IHD, which was the same in the 89 cases without stenosis. In the study of the history of MI in patients under study, it was found that the incidence of internal carotid artery stenosis was significantly higher in patients with no history of heart attack ( $P = 0.004$ ). The results showed that, of sixty patients with arterial stenosis, 9 had a history of MI, while there were 2 cases among 89 patients without arterial stenosis. The results showed that there is no relationship between HLP and internal carotid artery stenosis ( $P = 0.474$ ). The findings showed that among sixty patients with carotid stenosis, 3 of them had HLP, and this value in patients with no arterial stenosis was 6 patients in 89 patients. There was no relationship between high blood pressure as one of the main risk factors for cardiovascular disease and internal carotid artery stenosis ( $P = 0.111$ ). Of the sixty patients with arterial stenosis, 26 had HTN, of which 33 were in 89 patients without arterial stenosis. These findings are not consistent with the results of Hadi *et al.*<sup>[11]</sup> study. In their study, the prevalence of HTN in patients with carotid artery stenosis was 59%, while this value was 43% in the study, and in their study, HTN has been introduced as an independent risk factor for internal carotid artery stenosis. In this study, there was no relationship between other risk factors for cardiovascular disease such as smoking, pre-Cerebrovascular Accident (CVAT), and pre-transient ischemic attack (TIA). Carotid artery stenosis is one of the main causes of transient ischemic stroke (TIA) and acute IS, and carotid and stent surgery are used to reduce its risk.<sup>[19]</sup> Various factors are involved in carotid artery stenosis and cerebral stroke that, with their prediction and proper treatment, one can improve stroke statistics.<sup>[20]</sup> The aim of this study was to determine the frequency of symptomatic extracranial

artery stenosis in patients with IS admitted to Imam Khomeini Hospital of Urmia in 2011–2012 and its relationship with risk factors for cardiovascular disease.

## CONCLUSION

The results of this study showed that the prevalence of internal carotid artery stenosis in patients who had been attacked by stroke is 40.3% and having a record of MI is the only factor associated with an increase in the incidence of internal carotid artery stenosis in CVA ischemic patients, and there is no relationship between different cardiovascular risk factors such as diabetes, HTN, IHD, cigarette smoking, previous CVA, previous TIA, and HLP and internal carotid artery stenosis.

## Suggestions

This study must be carried out at a wider level, and the impact of other risk factors that were not studied in this study should be studied on the impact of carotid artery stenosis and stroke.

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