

*Original Article***Difference between risk factors of anterior and posterior circulation strokes***Seyed Ali Mousavi\*, Tahereh Hoseini\****Abstract**

**BACKGROUND:** The cerebrovascular diseases rank first in frequency and importance among all the neurological diseases of adult life. It is important to understand the risk factors associated with stroke subtypes in order to improve primary and secondary preventative strategies. There is currently no information on the relationship of these stroke subtypes with cerebrovascular risk factors. Clinicians have tended to view strokes occurring in the anterior circulation (AC) and the posterior circulation (PC) as separate entities because the most common ischemic strokes occur in the AC, while strokes occurring in the PC are the most severe. Furthermore, AC and PC strokes have different underlying pathogenesis, natural histories and potential responsiveness to interventions such as anticoagulation and risk factors. We sought to explore differences between AC and PC strokes concerning their risk factors.

**METHODS:** In this prospective descriptive study, we evaluated 250 patients; 125 had AC involvement and 125 had PC involvement, and were referred to Alzahra and Noor University Hospitals and private clinics between January 2000 and December 2004. Strokes in AC and PC were diagnosed by clinical and neuroimaging findings including brain CT Scanning and MRI. Pre-stroke cerebrovascular risk factors for each patient recorded from previous and present evaluations included hypertension, diabetes mellitus, hyperlipidemia and smoking.

**RESULTS:** The average age of patients with AC stroke was  $73 \pm 19.15$  and the average age of patients with PC stroke was  $70 \pm 19.7$ . Of 125 patients with AC stroke, 57 (45.6%) were male and 68 (54.4%) were female. Of 125 patients with PC stroke, 54 (43.2%) were male and 71 (56.8%) were female. The prevalence of hypertension as a major risk factor of stroke was higher in patients with PC stroke in comparison to patients with AC stroke (60 % vs. 40.8%) and the odds ratio for PC stroke was 2.8 (95% CI; 1.27 – 3.73). The prevalence of smoking in patients with PC stroke was higher than in those with AC stroke (32.8% vs. 15.2%) and this difference was statistically significant ( $P = 0.001$ ).

**CONCLUSIONS:** The prevalence of hypertension as a major risk factor of stroke was higher in patients with PC strokes. However, there was no increased prevalence of stroke associated with diabetes mellitus between AC and PC strokes. Our results also showed that hyperlipidemia was a risk factor for AC and PC strokes and the prevalence was equal in both types, while the prevalence of smoking in PC strokes was higher compared to AC strokes.

**KEY WORDS:** Stroke, anterior circulation stroke, posterior circulation stroke, hypertension, diabetes mellitus, hyperlipidemia.

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The cerebrovascular diseases rank first in frequency and importance among all the neurological diseases of adult life. At least 50% of the neurologic disorders in a general hospital are of this type <sup>1</sup>. In addition, stroke is the second most common cause of death globally, although, paradoxically, the problem tends to receive less attention from healthcare providers than many other diseases <sup>2</sup>.

Cerebrovascular risk represents a progressive and evolving concept owing to the particular distribution of risk factors in patients with ischemic stroke and in light of the newest stroke subtype classifications that account for pathophysiological, instrumental and clinical criteria. It is important to understand the risk factors associated with stroke subtypes in order to improve primary and secondary preven

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tative strategies<sup>3</sup>. Age represents the strongest non-modifiable risk factor associated with ischemic stroke, while hypertension constitutes the most important modifiable cerebrovascular risk factor. Diabetes mellitus, hyperlipidemia and smoking are the other major modifiable risk factors for ischemic stroke<sup>2</sup>. Studies that have examined cerebrovascular risk factor profiles have focused on comparisons between hemorrhagic and ischemic stroke<sup>4</sup>, categorizing ischemic stroke broadly into lacunar and non-lacunar infarcts<sup>5-7</sup> or into etiologic subtypes<sup>8,9</sup>. A widely used classification system, the Bamford classification<sup>10</sup>, classifies cerebral infarction according to the vascular territory involved. This system uses clinical features to forecast the size and site of the ischemic lesion in the brain. Lesions are categorized as total anterior circulation infarcts (TACI), partial anterior circulation infarcts (PACI), posterior circulation infarcts (POCI), and lacunar infarcts (LACI). Although this classification system is useful for predicting the outcome and recurrence of stroke<sup>9</sup>, there is virtually no information on the relationship of these stroke subtypes with cerebrovascular risk factors. Because, ischemic strokes occurring in the anterior circulation (AC) are the most common of all ischemic strokes, and strokes occurring in posterior circulation (PC) are more severe, clinicians have tended to view AC and PC strokes as separate entities, with different underlying pathogenesis, natural histories and potential responsiveness to interventions such as anticoagulation and risk factors<sup>10</sup>. We sought to explore the differences between AC and PC strokes with regards to their risk factors.

## Methods

In this prospective descriptive study, we evaluated 250 patients; 125 had AC involvement and 125 had PC involvement and were referred with ischemic thrombotic stroke to Alzahra and Noor University Hospitals and private clinics between January 2000 and December 2004. Strokes in AC and PC were diagnosed by clinical and neuroimaging findings

by Brain CT Scanning and MRI. Pre-stroke cerebrovascular risk factors for each patient recorded from previous and present evaluations included hypertension, diabetes mellitus, hyperlipidemia and smoking. Hypertension was diagnosed by a blood pressure reading of >140/90 mm Hg based on National Institute of Health (NIH) classification. Diabetes mellitus was diagnosed by two FBS>140mg/dl based on NIH classification. High blood cholesterol was diagnosed by checking levels of cholesterol in the blood after 9 to 12 hours of fasting before taking the test. Total cholesterol level >240 mg/dl and LDL>130 mg/dl were considered as hyperlipidemia, based on NIH classification.

## Results

The average age of patients with AC stroke was  $73 \pm 19.15$  and average age of patients with PC stroke was  $70 \pm 19.7$ . Applied independent t-test showed non-significant difference of age between the two groups ( $P = 0.83$ ). Of 125 patients with AC stroke, 57 (45.6%) were male and 68 (54.4%) were female. Of 125 patients with PC stroke, 54 (43.2%) were male and 71 (56.8%) were female, Chi-square test showed no statistical significant relationship between sex and kind of stroke ( $X^2 = 0.15$ ,  $P = 0.7$ ). Concerning the prevalence of diabetes mellitus as a risk factor for stroke, there was no significant difference between the two groups (29.6 % vs. 20%) ( $X^2 = 3.09$ ,  $P = 0.08$ ). The prevalence of hypertension as a major risk factor of stroke was higher in patients with PC stroke in comparison to patients with AC stroke (60 % vs. 40.8%) and the OR for PC stroke was 2.8 (95% CI; 1.27 – 3.73). In addition, the prevalence of hyperlipidemia for AC and PC strokes was 12.8% and 20.8%, respectively and the difference between the two groups was not significant ( $P = 0.09$ ). Finally, this study showed that the prevalence of smoking in PC was higher than that in the AC stroke (32.8% vs. 15.2%) which was statistically significant ( $P = 0.001$ ). The summarized results of this study are shown in table 1.

**Table 1.** Frequency distribution of risk factors of stroke for anterior and posterior circulation strokes.

Kind of Stroke		Anterior Circulation		Posterior Circulation		P Value
Risk Factors		n	%	n	%	
Diabetes	Yes	37	29.6	25	20	0.08
	No	88	70.4	100	80	
Hypertension	Yes	51	40.8	75	60	0.002
	No	74	59.2	50	40	
HLP	Yes	16	12.8	26	20.8	0.09
	No	109	87.2	99	79.2	
Smoking	Yes	19	15.2	41	32.8	0.001
	No	106	84.8	84	67.2	
Sex	Yes	57	45.6	54	43.2	0.7
	No	68	54.4	71	56.8	

## Discussion

Many studies of risk factors for stroke have not considered pathological and etiological subtypes separately and often have not even fully differentiated between subarachnoid hemorrhage, intracerebral hemorrhage, and cerebral infarction<sup>10,11</sup>. Of those studies that have categorized strokes as ischemic or hemorrhagic, most have not subdivided ischemic stroke according to the different clinical or etiological subtypes<sup>12,13</sup>. Some studies have compared the prevalence of risk factors between the different subtypes of ischemic stroke and have reported important differences in the frequency of established vascular risk factors<sup>14-16</sup>. Arterial hypertension, the single most frequent stroke risk factor, showed a high prevalence in all stroke subtypes, except for combined other etiologies<sup>17</sup>. Hypertension is more common in microangiopathic stroke than in cardioembolism and its prevalence is also higher in stroke due to large stroke than in cardioembolic stroke<sup>17</sup>. In the Rochester Study<sup>18</sup>, the prevalence of hypertension was not different among stroke subtypes, and diabetes mellitus was less common in atherothrombotic stroke than in lacunar and cardioembolic stroke. The Oxfordshire Com-

munity Stroke Project found no difference between lacunar and cardioembolic stroke regarding hypertension or diabetes mellitus<sup>17</sup>. Fisher<sup>19</sup> originally suggested that lacunar stroke was almost exclusively caused by small-vessel disease related to hypertension. In the NINCDS Stroke Data Bank, hypertension and diabetes mellitus were more common in lacunar and atherothrombotic strokes. In our study, the prevalence of hypertension as a major risk factor of stroke was higher in patients with PC stroke, but concerning the prevalence of diabetes mellitus as a risk factor for stroke, there was no difference between AC and PC strokes. Results for hypercholesterolemia as a stroke risk factor are contradictory<sup>20</sup>. Some studies on stroke subtypes did not include this risk factor, while other studies indicated that hypercholesterolemia plays a role in some but not in other stroke etiologies<sup>17</sup>. The high prevalence in atherothrombotic stroke is in line with a previous study that identified hypercholesterolemia as a risk factor for stroke due to large-artery atherosclerosis<sup>21</sup>. Our results showed, hyperlipidemia was a risk factor for AC and PC strokes and the prevalence was equal for both types. In previous studies,

smoking was mainly associated with stroke due to large-artery atherosclerosis<sup>17</sup>. In addition, smoking might contribute to uncommon etiologies in younger patients but appeared to be less important in other stroke subtypes<sup>17</sup>. This study showed that the prevalence of smoking in PC strokes was higher than that in the AC strokes.

## Conclusions

Evaluation of stroke risk factors in regards to the clinical division of stroke to anterior and posterior circulations showed that hypertension and smoking as major risk factors of stroke had higher prevalence in PC stroke. Strokes occurring in PC are more severe and the control of blood pressure and smoking cessation have more important effects on reducing mortality of stroke.

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