

Original Article

Sex Differences in Acute Stroke Patients -Clinical Features, Stroke Subtypes, and *Sasang* Constitutions-

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Objectives : This study investigated stroke types, ischemic stroke subtypes, risk factors for stroke, stroke complications and *Sasang* constitutions in both sexes.

Methods : 307 patients with acute stroke within 14 days onset were included, who were admitted to Kyunghee Oriental Medical Center from October 2005 to May 2007. Stroke types, ischemic stroke subtypes, risk factors for stroke, stroke complications and *Sasang* constitutions in both sexes were examined.

Results : Mean age was higher among women than men (64.82 ± 10.21 years versus 62.18 ± 11.52 years for the 137 female and 170 male patients, respectively, $p=0.037$). There were no significant differences in stroke type, ischemic stroke subtypes, or stroke risk factors except smoking and *Sasang* constitutions. Current smoking was more frequent in male patients ($p < 0.001$). Stroke complications, especially urinary tract infection (UTI), were significantly more common in women ($p=0.002$).

Conclusion : Sex does not seem to influence stroke types, ischemic stroke subtypes, or stroke risk factors except current smoking and *Sasang* constitutions. UTI should be taken into consideration to manage female stroke patients. Smoking cessation is indicated to prevent stroke in men.

Key Words : Stroke, sex, urinary tract infection, smoking

Introduction

Stroke is the second leading cause of death (after cancer) in Korea¹. The greater prevalence of stroke in men is well known, but recent reports have emphasized the importance of stroke in women².

The death rate from stroke in women has been about 10 percent more than in men since 2000. It was estimated that 67.3 per 1,000,000 women died of stroke, whereas 6.5 died of breast cancer per 100,000 females in Korea.1 Moreover, stroke severity is greater in women than in men³.

Gender differences in stroke risk factors, stroke subtypes, and medical management have also been described^{4,5}, but there is little data on sex differences of stroke risk factors and stroke subtypes in patients with acute stroke in Korea.

The objective of this study was to examine whether there are differences between male and female stroke patients in stroke subtypes, ischemic stroke subtypes, risk factors, stroke

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complications and *Sasang* constitution.

Subjects and Methods

From October 2005 to May 2007, 307 consecutive patients with first-ever stroke within 14 days of onset were admitted to Kyunghee Oriental Medical Center. The diagnosis of stroke was based on clinical features and neuroradiologic images (brain computed tomography (CT) scan and/or magnetic resonance imaging (MRI)), confirmed by at least two or more neurologists. All patients fulfilled the clinical protocol, which included stroke risk factors, stroke types, ischemic stroke subtypes, stroke complications and *Sasang* constitution.

For each patient, separated by sex, the following data were analyzed. (1) age; (2) *Sasang* constitution (*soyeumin*, *soyangin*, *taeyeumin*, *taeyangin*, and unidentified), which was diagnosed using the Questionnaire for *Sasang* Constitution Classification II (QSCC II) (3) stroke risk factors, which included diabetes mellitus (DM) if they had a past history of DM with current treatment, hyperlipidemia if they had a past history of hyperlipidemia with current treatment, hypertension (HTN) if they had a past history of HTN with antihypertensive medication, smokers if they were current smokers, ischemic heart disease (IHD) if they had a past history of IHD with current treatment, and atrial fibrillation (Af) if they had a past history of Af with current treatment; (4) stroke complications, which included urinary tract infection(UTI) if bacteria was observed on urine analysis with current treatment, pneumonia if radiologists confirmed it on chest PA X-ray, upper respiratory infection (URI) if patients complained of cough without pneumonia, gastrointestinal (GI)

bleeding if gastroenterologist confirmed it on the gastroscopy, re-attack if patients had new neurologic deficits, and seizure if patients had focal and/or general seizure; (5) stroke subtype classifications, based on the modified TOAST classification^{6,7}: large-artery atherosclerosis (LAA), small-vessel occlusion (SVO), cardiac embolism (CE), stroke of other determined etiologies (SOD), and stroke of undetermined etiologies (SUE) (6) stroke subtypes: cerebral infarction, cerebral hemorrhage, and subarachnoid hemorrhage (SAH). For statistical analysis, Windows SPSS package was used. Independent t-test was used for the comparison of continuous variables. The chi-square test was used for analysis of noncontinuous variables. A p value less than 0.05 was the threshold of statistical significance.

Results

During the 19-month period, 307 consecutive patients with first ever stroke were enrolled in Kyunghee Oriental Medical Center, 170 male (55.4 %) and 137 female (44.6 %). The mean age of the 137 women was greater than that of the men (64.82 ± 10.21 versus 62.18 ± 11.52 years; $p = 0.037$). *Sasang* constitutions, stroke risk factors, and stroke complications are summarized in Table 1.

On the *Sasang* constitution classification, 14 male and 15 female patients could not get a QSCC II test. *Soyangin* (30.3 %) was the most common *Sasang* constitution of the 307 patients; next were *taeyeumin* (18.6 %) and *soyeumin* (11.1 %). 30.3 % could not be identified. No major sex difference was observed in *Sasang* constitutions (Table 1).

Current smoking was the most important risk

factor in 54.7 % of 170 male patients, which was followed by HTN (45.9 %), DM (28.2 %), IHD (4.7 %), hyperlipidemia (3.5 %), and Af (5.2 %). HTN was the most major risk factor in 54.0 % of 137 female patients, which was followed by DM (24.8 %), current smoking (9.5 %), IHD (4.4 %), Af (2.9 %) and hyperlipidemia (2.9 %). Current smoking was significantly more frequent in male patients ($p < 0.001$). There was no significant difference in the stroke risk factors except current smoking between sexes (Table 1).

A significant difference in the stroke complications was observed in female patients. UTI

was a common stroke complication in female patients, which was much more frequent in women than in men (12.4 % versus 2.9 %; $p = 0.002$) (Table 1).

As shown in Table 2, stroke types and ischemic stroke types were similar between sexes. 160 male patients had cerebral infarction and 10 male patients had cerebral hemorrhage. 126 female patients had cerebral infarction and 11 female patients had cerebral hemorrhage. SAH was not found in either sex. There was no significant difference in the stroke types between sexes. In terms of ischemic stroke

Table 1. General Characteristics in Men and Women

	Sex group, n (%)			p-value
	Men (n=170)	Women (n=137)	All (n=307)	
Age, mean \pm standard deviation	62.18 \pm 11.52	64.82 \pm 10.21		0.037
<i>Sasang</i> constitution				
<i>Soyeumin</i>	17(10.0)	17(12.4)	34(11.1)	N.S
<i>Taeyeumin</i>	24(14.1)	33(24.1)	57(18.6)	N.S
<i>Soyangin</i>	59(34.7)	34(24.8)	93(30.3)	N.S
<i>Taeyangin</i>	0(0)	1(0.7)	0(0)	N.S
unidentified	56(32.9)	37(27.0)	93(30.3)	N.S
Risk factors				
Hypertension	78.(45.9)	74(54.0)	152(49.5)	N.S
Diabetes mellitus	48(28.2)	32(24.8)	82(26.7)	N.S
Atrial fibrillation	4(2.4)	4(2.9)	8(2.6)	N.S
Hyperlipidemia	6(3.5)	4(2.9)	10(3.3)	N.S
Ischemic heart disease	8(4.7)	6(4.4)	14(4.6)	N.S
Current smoking	93(54.7)	13(9.5)	106(34.5)	< 0.01
Stroke complication	13(7.6)	23(16.8)	36(11.7)	0.013
Urinary tract infection	5(2.9)	17(12.4)	22(7.2)	0.002
Upper respiratory infection	2(1.2)	3(2.2)	5(1.6)	N.S
Pneumonia	1(0.6)	1(0.7)	2(0.7)	N.S
Re-attack	2(1.2)	2(1.5)	4(1.3)	N.S
Seizure	1(0.6)	0(0)	1(0.3)	N.S
Gastrointestinal bleeding	1(0.6)	0(0)	1(0.3)	N.S

Table 2. Stroke Subtype in Men and Women

	Sex group, n (%)			p-value
	Men (n=170)	Women (n=137)	All (n=165)	
Stroke type				
Cerebral infarction	160(94.1)	126(92.0)	286(93.2)	N.S
Cerebral hemorrhage	10(5.9)	11(8.0)	21(6.8)	N.S
Subarachnoid hemorrhage	0(0)	0(0)	0(0)	N.S
Ischemic stroke type				
Large artery atherosclerosis	26(15.3)	21(15.3)	47(15.3)	N.S
Cardioembolism	4(2.4)	2(1.5)	6(2.0)	N.S
Small vessel occlusion	125(73.5)	100(73.0)	225(73.3)	N.S
Stroke of other determined etiology	0(0)	1(0.7)	1(0.3)	N.S
Stroke of undetermined etiology	5(2.9)	2(1.5)	7(2.3)	N.S

subtypes, SVO was the most common type, as it comprised 73.5 % and 73.0 % for the male and female patients, respectively. The next common types were LAA (15.3 %), SUE (2.9 %), and CE (2.4 %) in male patients, LAA (15.3 %), CE (1.5 %), SUE (1.5 %), and SOD (0.7 %) in female patients. Distribution of subtypes was not significantly different between sexes (Table 2).

As shown in Table 3, the number of men was more than that of women in the age groups ≤ 50 years, but the portion of women was higher than that of men in the age groups > 50 years.

Discussion

The importance of stroke in women is increasing owing to a high mortality and morbidity in women. Stroke is more lethal in women than in men, since over an entire lifetime, about 16 % of women but only 8 % of men die of stroke⁸⁾. It also leaves a residual disability in about two thirds of the survivors in both sexes, but the burden is higher in women⁹⁾.

Previous studies have reported sex differences in the management and outcome of patients with cardiovascular disease¹⁰⁾ and in stroke patients

Table 3. Age Distribution in Men and Women

	Sex group, n (%)		
	Men (n=170)	Women (n=137)	All (n=307)
≤ 40 years	5(2.9)	3(2.2)	8(2.6)
41-50 years	23(13.5)	12(8.8)	35(11.4)
51-60 years	42(24.7)	25(18.2)	67(21.8)
61-70 years	62(36.5)	49(35.8)	111(36.2)
71-80 years	30(17.6)	45(32.8)	75(24.4)
> 80 years	8(4.7)	3(2.2)	11(3.6)

¹¹⁻¹³⁾, yet little data clearly differentiates between the sexes. Thus, this study was conducted to investigate whether there is a clear difference between men and women.

In this study, mean age of female patients was greater than that of male patients. This result may be simply because women live about 8 years longer than men and life expectancy will increase even more in women than in men.

This study showed that the number of men was higher than that of women in accordance with other studies¹³⁾. The portion of men in the age groups ≤ 50 years was higher than that of women (16.4 % versus 11.0 %). These data are similar to previous data showing that the risk of stroke is lower in premenopausal women than in men of the same age¹⁴⁾. This may be explained by the fact that atherosclerosis characteristically occurs at an earlier age and is more extensive in men^{15,16)}, and estrogens have a beneficial effect on serum lipids and coagulation profile and on preventing coronary heart disease¹⁷⁾. The frequency of stroke in the age groups > 50 years was higher in women than in men (89 % versus 85.4 %). This finding is in agreement with previous observations showing that after menopause, there is a rapid increase in the frequency and severity of cerebral atherosclerosis and a rapid increase in the incidence of cerebrovascular events in women due to estrogen alteration of lipid metabolism^{17,18)}.

In analyzing the stroke subtypes, no difference was found between ischemic and hemorrhagic stroke according to sex (94.1 % of cerebral infarction in men versus 92 % in women). The proportion of ischemic stroke was higher than other data reported in Korea¹⁹⁻²¹⁾. This may be simply because many patients with hemorrhagic stroke are admitted to western medical centers.

In the diagnosis of ischemic stroke subtypes, TOAST classification was used. SVO was the most frequent ischemic stroke subtype (73.5 % in men versus 73 % in women), though LAA was the most common stroke type in other reports.²⁰⁾ This may be because stroke patients with mild neurological deficits visit oriental medical centers. Low portion of CE may be explained by the lower frequency of Af. Sex does not seem to influence stroke types and ischemic stroke subtypes distribution.

In the diagnosis of *Sasang* constitution, *soyangin* was the most common in both sexes, which was followed by *taeyeumin* and *soyeumin*. These results were similar to other reports^{22,23)}. Sex does not seem to affect *Sasang* constitution.

In the analysis of stroke risk factors, HTN was more frequent among women, whereas smoking was the most important risk factor in male patients. This may be in part because of the higher smoking rate of men. Thus, it is important for men to stop smoking. There was no significant difference except current smoking in both sexes. These results were similar to other reports²⁰⁾.

Medical complications are leading causes of death in stroke patients. Pneumonia, UTI and GI bleeding are the most common medical complications of stroke²⁴⁾.

In our study, UTI was more frequent in female patients. Many factors related to advanced age might increase the susceptibility of elderly female patients to UTI. These factors include physiological changes of the urinary tract that affect its ability to resist infections, acquired pathologies or adverse effects of chronic disease and the use of medications affecting urinary tract function²⁵⁻²⁷⁾.

In this study, there were some limitations. The design of the study was retrospective and some information such as National Institute of Health Stroke Scale (NIHSS) and Barthel Index (BI) were not recorded. Thus stroke severity and functional outcome could not be fully evaluated between sexes and this study was not a population-based study but a hospital-based study.

In conclusion, there was no significant difference in stroke types, ischemic stroke subtypes, *Sasang* constitution, or stroke risk factors except current smoking between the sexes. Stroke complications, especially UTI, were significantly more common in women than in men, and smoking was a markedly more important risk factor in men than in women. Thus, UTI should be taken into consideration when managing female stroke patients. Smoking cessation is indicated to prevent stroke in men.

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