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Evaluation of Patients Diagnosed as Having Acute Stroke in the Emergency Department: Two-year Analysis

Acil Serviste Akut İnme Tanısı Alan Hastaların Değerlendirilmesi: İki Yıllık Analiz

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Abstract

Objective: To investigate the etiologic, demographic, and clinical features of patients who were diagnosed as having acute stroke in the emergency department and thus, we aimed to contribute to the stroke data of our country, primarily to the data of our region.

Materials and Methods: This study was retrospectively conducted on the data of 236 patients who were diagnosed as having acute stroke and admitted to the emergency department between January 1st, 2017, and December 31st, 2018.

Results: Of the patients, 210 (88.9%) were diagnosed as having ischemic stroke and 26 were diagnosed as having hemorrhagic stroke (11.1%). One hundred six (44.9%) of the patients were admitted to the hospital within the first 4.5 hours, 130 (55.1%) - arrived to the hospital after 4.5 hours. Two hundred five (86.9%) patients were discharged from the hospital, and 31 (13.1%) patients died. Hypertension was found to be the most common risk factor among patients, followed by smoking. The highest number of patients was admitted during summer with a rate of 29.7%. Atrial fibrillation was found to be an independent risk factor of mortality in patients with acute stroke and increased the odds of mortality by 3.18 (p=0.008).

Conclusion: Although our study reflects a large part of the stroke data of the Bolu province, it gives valuable results for the Western Black Sea region.

Keywords: Bolu, stroke, emergency department

Öz

Amaç: Çalışmamızda, acil serviste akut inme tanısı alan hastaların etiyolojik, demografik ve klinik özelliklerini araştırmayı ve bu sayede öncelikle bölgemiz verileri olmak üzere ülkemizin inme verilerine katkıda bulunmayı amaçladık.

Gereç ve Yöntem: Çalışma, 01.01.2017-31.12.2018 tarihleri arasında acil servise başvuran ve inme tanısı alan toplam 236 hastanın verileri üzerinden retrospektif olarak yapıldı.

Bulgular: Hastaların 210'u (%88,9) iskemik inme ve 26'sı hemorajik inme (%11,1) tanısı aldı. Yüz altı (%44,9) hasta ilk 4,5 saat içerisinde başvururken, 130 (%55,1) hasta 4,5 saatin üzerindeki bir süre de başvurdu. İki yüz beş (%86,9) hasta hastaneden taburcu edilirken, 31 (%13,1) hasta öldü. Hastalarda hipertansiyon en sık tespit edilen risk faktörü iken, ikinci sıklıkta sigara kullanımının olduğu görüldü. En sık hasta başvurusunun %29,7 oranıyla yaz aylarında olduğu görüldü. Atriyal fibrilasyon akut inmeli hastalarda mortalite için bağımsız bir risk faktörü olarak belirlendi ve atriyal fibrilasyonun mortalite riskini 3,18 kat artırdığı görüldü (p=0,008).

Sonuç: Çalışmamız Bolu ilinin inme verilerinin büyük bir kısmını yansıtmakla beraber, Batı Karadeniz Bölgesi açısından kıymetli sonuçlar vermiştir.

Anahtar Kelimeler: Bolu, inme, acil servis

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Introduction

According to the World Health Organization, stroke is a clinical picture characterized by rapid development of symptoms of loss of brain function without any cause other than vascular causes (1). It is the third greatest cause of death in the world, especially in the United States and Western countries, after coronary artery diseases and cancers. It is also a social and economic problem because the majority of patients who survive stroke need constant help to sustain their lives (2,3). When we look at stroke types, the American Stroke Association states that 87% of patients have ischemic stroke (IS) and 13% have hemorrhagic stroke (HS) (4). When we look at the risk factors that contribute to the development of acute stroke, they are divided into modifiable and non-modifiable factors. Hypertension, hyperlipidemia, coronary artery disease, and Diabetes mellitus are modifiable factors, and age, sex, and race are non-modifiable risk factors (5). Many studies in the literature have shown that seasonal changes have an effect on stroke incidence and mortality and morbidity (6,7).

In patients with IS, different neurologic presentations may develop due to impaired cerebral blood flow and consequent loss of function of the affected brain region. In a detailed bedside neurologic examination, it may be possible to estimate the location, extent and prognosis of the infarction by evaluating some basic findings. The classification used in the Oxfordshire Community Stroke Project study included small and large infarctions in the territory of anterior carotid artery, partial anterior circulation infarction, total anterior circulation infarction (TACI), posterior (vertebrobasilary arteries) circulation infarction (POCI), and lacunar infarction (LACI) (8).

Although the mortality-morbidity rates of acute stroke are very high in our country, the number of adequate studies on patients with stroke is limited. With this study, we aimed to investigate the etiologic, demographic, and clinical characteristics of patients admitted to our emergency department with acute stroke, and to contribute to stroke data in our region and country.

Materials and Methods

After our study was approved by the Ethics Committee of Bolu Abant İzzet Baysal University, Faculty of Medicine, data of adult patients aged 18 years or older who were diagnosed as having acute stroke in the emergency department of our hospital between January 1st, 2017, and December 31st, 2018, were examined. In order to access the data of the patients admitted to the emergency department due to acute IS and HS, the protocol numbers of patients who received IS and HS diagnosis codes according to the ICD-10 diagnostic coding system were taken from the hospital automation system. With the protocol numbers obtained, the patient's files were accessed from our hospital archive. Patients diagnosed as having IS and HS with radiologic imaging were included in the study. Patients diagnosed as having subarachnoid hemorrhage, epidural-subdural hemorrhage, and transient ischemic attack were excluded from the study. The patients with IS were divided into three groups: ACI, POCI, and LACI according to their clinical and radiologic characteristics. Patients with HS were grouped as basal ganglia, lobar, thalamic, brainstem, and cerebellar hemorrhages according to the localization of the hemorrhage in imaging. The clinical and demographic characteristics of the patients were recorded through the hospital's automation system.

A standard data collection form was created for our study. The patient's age, sex, time of admission, symptom, accompanying risk factors, time of imaging, duration of hospitalization, blood pressure (BP) value at the time of admission, and prognosis were recorded on the patient form. The resulting data were grouped for analysis. Three groups were created by admission time: 08:00-16:00, 16:00-24:00, and 24:00-08:00. According to the admission season, four groups were created: spring, summer, autumn, and winter. Two groups were created according to the time of transportation from symptom onset to the hospital including patients who arrived at hospital before 4.5 hours and those who arrived after 4.5 hours. Patients were divided into three groups as hypotensive (systolic BP <90 mm Hg, diastolic BP <60 mmHg), normotensive (systolic BP: 90-140 mm Hg, diastolic BP: 60-90 mm Hg) and hypertensive (systolic BP >140 mm Hg, diastolic BP >90 mm Hg) according to the BP value at the time of admission.

Statistical Analysis

For descriptive statistics, median (minimum - maximum) values are given for numeric variables that did not have normal distribution. For categorical variables, number (n) and % (percentage) values are given. The differences between etiologic, demographic, and clinical characteristics between the hemorrhagic and IS groups were compared using the Mann-Whitney U test for numeric variables. Pearson's chi-square test or Fisher's exact chi-square test was used to compare categorical variables. Multiple logistic regression analyses were performed to assess independent risk factors of mortality after stroke and odds ratios and 95% confidence intervals were calculated for each risk factor after controlling for the effects of other variables. P<0.05 was accepted as the level of statistical significance in all tests. Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS) for Windows 21.0 package program.

Results

Our study was completed with 236 patients who were admitted to the emergency department over a two-year period, whose data could be accessed. Of the patients, 210 (88.9%) were diagnosed as having IS and 26 as having HS (11.1%). The median age of patients with IS was 73 (range, 25-92) years, and the median age of patients with HS was 74.5 (range, 34-90) years. By sex, 129 (54.7%) patients were male and 107 (45.3%) were female. Of the patients who had IS, 117 (55.7%) were male, and 14 (53.8%) patients who had HS were female. From the onset of symptoms to the time of hospital admission, 106 (44.9%) patients arrived within the first 4.5 hours, and 130 (55.1%) patients arrived after 4.5 hours. Within the first 4.5 hours, 90 (42.9%) patients with IS were admitted to the hospital emergency department. Of these patients, 32 (36%) who were eligible received thrombolytic therapy. According to the BP values of the patients at the time of admission, 130 (55.1%) patients were hypertensive, and 8 (3.4%) patients were hypotensive. One hundred nine (51.9%) patients with IS were hypertensive and 21 (80.8%) with HS were

hypertensive. Of the patients, 148 (62.7%) were admitted to the ward, and 88 (37.3%) were admitted to the intensive care unit (ICU). Sixty-eight (32.4%) patients with IS were admitted to the ICU, and 20 (76.9%) patients with HS were admitted to ICU. The HS and IS groups were statistically significantly different in terms of BP values (p=0.003) and hospitalization services (p<0.001). The mean duration of hospitalization of patients with IS was 7 (range, 1-240) days, whereasit was 10 (range 3-70) days in the HS group (p=0.019). Two hundred five (86.9%) patients were discharged from the hospital, and 31 (13.1%) patients died (p=0.002) (Table 1).

When examined according to the symptomsof the patients, 150 (63.6%) of 236 patients had unilateral muscle weakness,

which was the most common cause of admission, and speech impairment was the second most common cause of admission. Of the patients with IS, 140 (66.7%) had unilateral muscle weakness and 110 (47.6%) had speech impairment, and 10 (38.5%) patients had unilateral muscle weakness and 17 (65.4%) had speech impairment in the HS group. There was a statistically significant difference in terms of having unilateral muscle weakness between the two groups (p=0.005) (Table 2).

In our study, when the risk factors of the patients were examined, 163 (69.1%) patients had hypertension, 99 (41.9%) patients smoked, and 74 (31.4%) patients had Diabetes mellitus. Hypertension was the most common risk factor in patients with IS and HS, followed by smoking (Table 3).

Table 1. The relationship between demographics and clinical characteristics of patients and stroke groups				
	Total n (%)	Ischemic stroke n (%)	Hemorrhagic stroke n (%)	p
Age	73 (25-92)	73 (25-92)	74.5 (34-90)	0.379
Sex				
Female	107 (45.3)	93 (44.3)	14 (53.8)	0.356
Male	129 (54.7)	117 (55.7)	12 (46.2)	
Admission time				
<4.5 hours	106 (44.9)	90 (42.9)	16 (61.5)	0.071
>4.5 hours	130 (55.1)	120 (57.1)	10 (38.5)	
Blood pressure				
Hypertensive	130 (55.1)	109 (51.9)	21 (80.8)	
Normotansive	98 (41.5)	95 (45.2)	3 (11.5)	0.003
Hypotensive	8 (3.4)	6 (2.9)	2 (7.7)	
Hospitalization service				
Ward	148 (62.7)	142 (67.6)	6 (23.1)	<0.001
Intensive care unit	88 (37.3)	68 (32.4)	20 (76.9)	
Duration of hospitalization (day)	7 (1-240)	7 (1-240)	10 (3-70)	0.019
Outcome				
Discharged	205 (86.9)	188 (89.5)	17 (65.4)	0.002
Death	31 (13.1)	22 (10.5)	9 (34.6)	
n: Number				

Table 2. The relationship between patient symptomsand stroke groups				
	Total n (%)	Ischemic stroke n (%)	Hemorrhagic stroke n (%)	p
Unilateral muscle weakness	150 (63.6)	140 (66.7)	10 (38.5)	0.005
Speech impairment	119 (50.4)	110 (47.6)	17 (65.4)	0.087
Loss of consciousness	67 (28.4)	54 (25.7)	13 (50.0)	0.010
Epileptic seizure	7 (3.0)	6 (2.9)	1 (3.8)	0.779
Vertigo	26 (11.0)	24 (11.4)	2 (7.7)	0.566
Headache	12 (5.1)	6 (2.9)	6 (23.1)	<0.001
Visual impairment	9 (3.8)	7 (3.3)	2 (7.7)	0.274
n: Number				

According to the magnetic resonance diffusion-weighted imaging findings, 143 (68%) patients had ACI, 41 (19.5%) had POCI, and 24 (11%) had LACI. Two (1%) patients had ACI + POCI. Of the patients who died, 65.3% were in the ACI group and 26.1% were in the POCI group. One (4.3%) of the patients in the LACI group died, and one of the two patients with ACI + POCI died.

The relationship between the risk factors for acute stroke with the risk of death was examined usiing multiple logistic regression analysis. The mortality odds ratio was 3.18 (95% CI: 1.349-7.498; p=0.008) times higher in patients with atrial fibrillation when other factors were controlled. Furthermore, the mortality odds ratio of patients with HS was 4.29 times higher (95% CI: 1.579-11.647; p=0.004) than in those with IS (Table 4).

According to the hospital admission hours of the patients, 110 (46.6%) patients were admitted between 16:00 and 24:00, and 28 (11.9%) patients were admitted between 24:00 and 08:00. The distribution of patients according to admission hours is presented in Chart 1. According to the hospital admission months of the patients, 6.7% of the patients with IS were admitted in June, 10% in July, and 11.4% in August; 34.6% of the patients with HS were admitted in June. The distribution of patients by month is shown in Chart 2. According to the hospital admission seasons of the patients, the most frequent admissions were in the summer months with a rate of 29.7%. Of the 26 patients who had HS, 11 (42.3%) were admitted in the summer. The distribution of patients by season is shown in Chart 3.

Discussion

When we look at the causes of death in our country, stroke-related deaths come in second place after cardiovascular disease-related deaths. Due to dependency, disability, and labor loss in surviving patients, both individual and social material-spiritual

Table 3. The relationship between risk factors and stroke groups

	Total n (%)	Ischemic stroke n (%)	Hemorrhagic stroke n (%)	p
Hypertension	163 (69.1)	143 (68.1)	20 (76.9)	0.358
Diabetes	74 (31.4)	70 (33.3)	4 (15.4)	0.063
Hyperlipidemia	16 (6.8)	13 (6.2)	3 (11.5)	0.306
Smoking	99 (41.9)	87 (41.4)	12 (46.2)	0.645
Coronary artery disease	76 (32.2)	67 (31.9)	9 (34.6)	0.780
History of a stroke	72 (30.5)	62 (29.5)	10 (38.5)	0.350
Atrial fibrillation	50 (21.2)	42 (20.0)	8 (30.8)	0.205
n: Number				

Table 4. The risk factors of mortality after stroke in patients admitted to hospital

Risk Factors	Odds ratio (95% CI)	p
Age	1.013 (0.979-1.048)	0.462
Sex, male	1.324 (0.488-3.911)	0.612
Hypertension	1.109 (0.414-2.972)	0.837
Diabetes	1.008 (0.391-2.599)	0.986
Smoking	0.758 (0.240-2.389)	0.636
Coronary artery disease	0.440 (0.167-1.162)	0.098
History of stroke	1.265 (0.532-3.007)	0.594
Atrial fibrillation	3.181 (1.349-7.498)	**0.008**
Admission time, <4.5 hours	1.712 (0.730-4.016)	0.216
Diagnosis, hemorrhagic stroke	4.289 (1.579-11.647)	**0.004**

The goodness of fit of the multiple logistic regression model was confirmed using the Hosmer-Lemeshow test (p=0.399), CI: Confidence interval
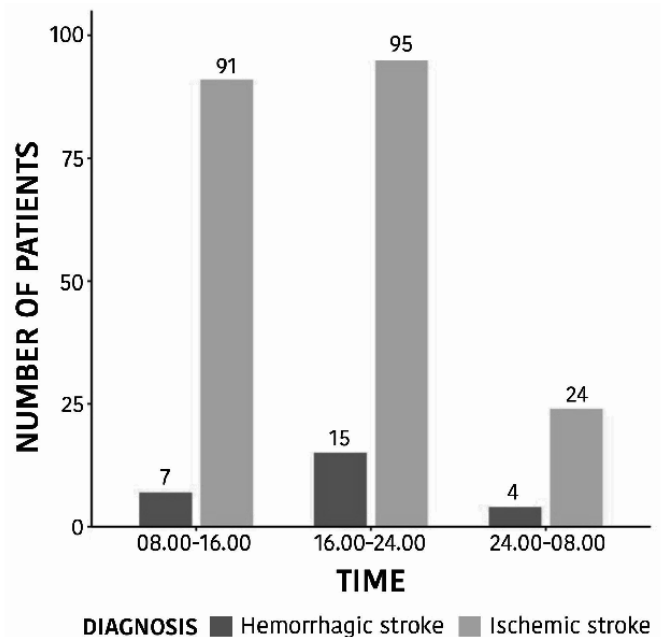Significant p values are shown in bold.

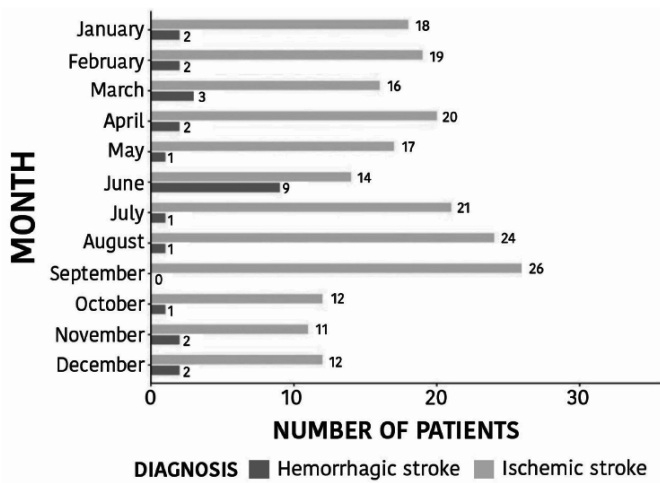**Chart 1.** Distribution of stroke patients by time of admission

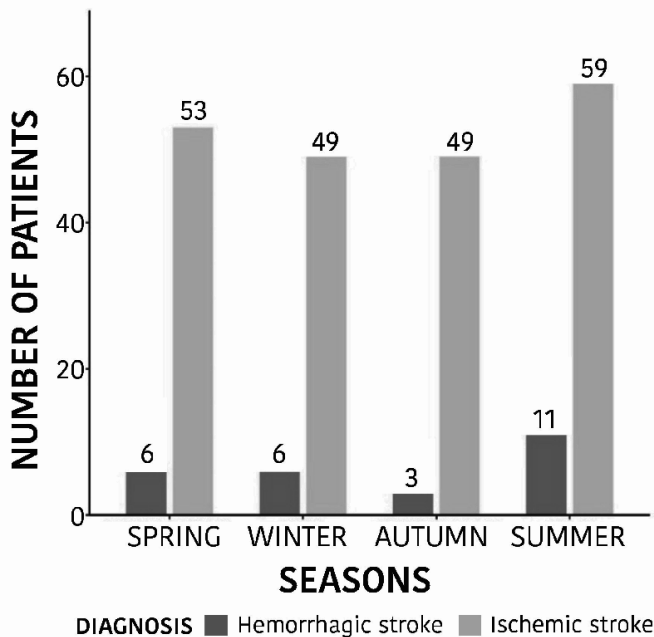**Chart 2.** Distribution of stroke patients by month of admission

Chart 3. Distribution of stroke patients by session of admission

problems arise (9). Although there are non-modifiable risk factors in the development of the disease, the frequency of the disease can be reduced by reducing modifiable factors. Therefore, epidemiologic research on stroke causes will help to identify the priorities in the health policy of society.

One of the most important risk factors of stroke is age. In studies, it was determined that 70% of hospitalized patients with stroke were aged 65 years or older (7,10). The median age of the patients in our study was 73 years (73 years in patients with IS and 74.5 years in patients with HS). These values show that older age is an important risk factor in patients with stroke. In the literature, it

was found that the frequency of stroke with increased age increased in men compared with women, and the incidence of stroke in men between the ages of 55-65 years was twice as high as in women (3, 11). Similar to the literature, the incidence of stroke in men was found to be higher than in women in our study.

The aim of intravenous thrombolytic therapy in patients with IS is to ensure continuity of blood flow to the brain with the dissolution of the thrombus. In the studies and published guidelines, thrombolytic therapy can be given within the first 4.5 hours, but only 21-48% of patients are admitted to the hospital during this period, and it is emphasized that this rate should be increased (12,13). Although the delay in admission of patients with acute stroke to the emergency department develops at different stages, the greatest time lost is in the pre-hospital period (14). Kıyan et al. (3) found that the most important factor causing delay in the pre-hospital period was the length of time takenin seeking medical assistance. Mosley et al. (15) found that the time from the onset of stroke symptoms to the calling of an ambulance accounted for the largest proportion of pre-hospital delay. The most important factors in the delay of admission to the hospital are listed in order of not knowing the symptoms of stroke, not being aware of the severity of the disease, ignoring the disease, symptoms starting during night hours, and the expectation that the symptomswill recover spontaneously (16). Our study found that 42.9% of patients with IS were admitted to our hospital within the first 4.5 hours. Having advanced age, comorbid diseases, living in rural areas of our province, and having the idea that the symptomswill go away on their own were the reasons of delayed emergency admission times. We believe that by informing people using today's mass media, explaining to society that stroke is a disease that has a treatment, admission times can be significantly shortened.

Ünivar et al. (17) showed that cardiovascular diseases were the leading causes of death in Turkey with 21.7%, followed by stroke with 15%. One-third of patients who were followed up due to stroke lost their lives and one-third were in need of care. The mortality rate in patients with IS was found to be higher than in patients with HS, but the reason for this was not explained in the study by Altun et al. (7). Çığşar and User (18) found that the mortality rate was 42.9% in HS, whereas it was 6.2% in IS. Türkel et al. (19) evaluated 6-month mortality in IS and they found that the mortality rate was 33%.In our study, 13.1% of the patients who were followed up died. The mortality rates of patients with IS and HS were 10.5% and 34.6%, respectively. Short-term mortality rates were higher in patients with IS than in similar studies in the literature. The average age of the patients enrolled in our study was higher than in these other studies. The literature indicated that TACI was the group with the worst prognosis and resulted in the most severe disability among stroke groups (13). In our study, 65.3% of the patients who died had ACI, and one (4.3%) patient with ACI + POCI coexistence died. We believe that advanced age and having ACI were the main factors affecting mortality in patients with IS. The long-term prognosis of patients was not evaluated in this study. Therefore, more comprehensive studies are needed in our region.

In this study, the most common symptomsof patients were, listed in order, unilateral muscle weakness, speech impairment, and loss of consciousness. Loss of consciousness was observed in 50% of patients with HS. In the literature, hemiplegia and hemiparesis were reported as the most common neurologic examination findings in patients with acute stroke (18,20). Our findings were similar to the literature and we believe that loss of consciousness was among the most common findings in patients with HS.

The risk factors of acute stroke in our study were, listed in order, hypertension, smoking, coronary artery disease, and Diabetes mellitus. Of the patients, 41.9% were smokers. Studies have shown that the most common risk factors are hypertension, diabetes, and hyperlipidemia (3,21). Similar results were found in studies conducted in the Middle East and Asian countries (22). We believe that smoking is a leading cause of stroke among the modifiable risk factors. İnanç et al. (23) showed that the mortality rate was 15.9% in patients with HS and 1.9% in patients with IS. In our study, we found that the mortality rate was 4.29 times higher in patients with HS than in patients with IS. Furthermore, we found that atrial fibrillation was an independent risk factor for mortality in patients with acute stroke and that atrial fibrillation increased the mortality risk by 3.18 times; we concluded that this group of patients should be monitored more closely.

In the literature, the effect of seasonal changes on stroke incidence has been reported in many studies (24,25). İnanç et al. (23) found that 29.5% of admissions for IS were in the summer and 44.3% of admissions for HS were in winter (22). Anlar et al. (26) found that IS and HS were more common in summer. In our study, the incidences of IS and HS were higher in summer than in other seasons, and the incidence of both stroke groups was significantly lower in autumn. It was particularly remarkable that 34.6% of patients with HS were admitted in June in our study. We believe that different results in studies may be the result of genetic differences as well as factors such as regional climate changes, air humidity, pressure, and temperature. In the Western Black Sea region and Bolu Province where our clinic serves, heat differences between the summer and winter seasons are clearly felt. The fact that warm weather triggers hypertension suggests that HS are more common in the summer months. We believe that during periods of increased air temperature, stroke rates will decrease by not being exposed to direct sunlight and protecting patients from hot air.

Being a study conducted in one center, the failure to elaborate stroke subtypes and absence of evaluation of long-term patient prognosis are the main limitations of our study.

Conclusion

We found that non-modifiable risk factors of acute stroke such as age and sex detected in Bolu in our study were similar to different societies, and that seasonal changes might be risk factors for IS and HS. In addition, the early arrival of patients to the emergency department and the removal of risk factors such as smoking would contribute to the reduction of both mortality and morbidity rates.

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