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Spontaneous Intracerebral Hemorrhage: Etiology and Yearly Prognostic Factors

Spontan İntraserebral Hemoraji: Etyoloji ve Bir Yıllık Prognozu Etkileyen Faktörler

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Summary

Objective: To assess the risk factors in patients with a history of spontaneous intracerebral hematoma, to determine the effects of these risk factors on mortality and morbidity and recurrence rate during the 12-month follow up period.

Material and Method: Two hundred and fifteen patients with spontaneous intracerebral hemorrhage treated between January 2008 and June 2010 in Trakya University Faculty of Medicine, Department of Neurology were included in this study. Patients who suffered from a stroke due to arteriovenous malformation, subarachnoidal, epidural and subdural hemorrhage and subdural hematoma were excluded.

Results: It was determined that male gender, age and hypertension are risk factors for intracerebral hemorrhage, whereas diabetes mellitus, smoking and alcohol usage are not. Due to the small number of patients using anti-aggregant and anti-coagulant medication, a statistically significant association to intracerebral hemorrhage could not be defined. Age over 65, hypertension, presence of hyperglycemia at the time of admission, size of hematoma, presence of intraventricular hemorrhage and National Health Institute Stroke Scale score at the time of admission are important prognostic factors. The influence of age 65 and older was seen to be an independent risk factor, whereas presence of hypertension was analyzed to increase the recurrence rate.

Discussion: It is vital to be aware of the risk factors of intracerebral hemorrhage in order to take preventive measures. Prognostic factors in intracerebral hemorrhage must be recognized to relieve the economical burden of the healthcare system. *(Turkish Journal of Neurology 2012; 18:88-95)*

Key Words: Spontaneous intracerebral hemorrhage, etiology, prognosis

Özet

Amaç: Spontan intraserebral hematom gelişen hastalardaki risk faktörlerini belirlemek ve bu risk faktörlerinin 12 aylık takipte morbidite, mortalite ve tekrarlama sıklığı üzerindeki etkilerini araştırmaktır.

Gereç ve Yöntem: Ocak 2008-Haziran 2010 arasında Trakya Üniversitesi Tıp Fakültesi Nöroloji kliniğinde spontan intraserebral kanama tanısıyla izlenen 215 hasta çalışmaya dahil edilmiştir. Subaraknoid, epidural, ve subdural hematom, ve arteriyovenöz malformasyona bağlı inme gelişen hastalar dahil edilmemiştir.

Bulgular: Erkek cinsiyet, yaş ve hipertansiyonun intraserebral hemoraji için risk faktörü olduğu belirlendi. Diabetes mellitus, sigara, alkol kullanımının risk faktörü olmadığı tespit edildi. Antiagregan ve antikoagülan kullanan hasta sayısının azlığı dolayısıyla intraserebral hemoraji ile aralarında istatistiksel anlamlı ilişki saptanmadı. Yaşın 65'in üzerinde olması, hipertansiyon, başvuru sırasında hiperglisemi varlığı, hematom hacmi ve intraventriküler hemoraji varlığı, başvuru anında hesaplanan National Institutes of Health inme skoru önemli prognostik faktörler olarak saptandı. Rekürrens açısından 65 yaş üzerinde olmak bağımsız risk faktörü olarak bulunurken hipertansiyon varlığının rekürrens oranını arttırdığı saptandı.

Sonuç: İntraserebral hemoraji risk faktörlerinin bilinmesi alınacak koruyucu önlemler açısından oldukça önemlidir. İntraserebral hemoraji geçiren hastalarda prognozu etkileyebilecek faktörler bilinmelidir. Böylelikle tedavi edilebilir olanların tedavisiyle morbidite oranının azaltılması ve bunun da sağlık sistemi üzerinde gittikçe artan yükün hafifletilmesini sağlayacağı düşünülmektedir. *(Türk Nöroloji Dergisi 2012; 18:88-95)*

Anahtar Kelimeler: Spontan intraserebral hemoraji, etyoloji, prognoz

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Introduction

Cerebrovascular disease (CVD) is the leading cause of high mortality and long-term disability in the acute term. World Health Organization data report that CVD is the third most common cause of death following cardiovascular disease and cancer in developed countries, and second cause of death throughout the world (1). Intracerebral hemorrhage (IH) is the clinical condition resulting from the sudden passage of arterial of venous blood into brain tissue (2). Ischemic stroke, intracerebral hemorrhage (IH) and subarachnoidal hemorrhage (SAH) are seen at rates of 80% (75-80%), 15% (10-15%), and 5% (5-10%) among all stroke cases, respectively (3). Data from the Turkish Multicentered Stroke Study of the Turkish Cerebrovascular Disease Association showed that the rates of ischemic stroke and IH in our country are 71.2% and 28.8%, respectively (4). The incidence of spontaneous IH is approximately 12-15 per 100,000, whereas the incidence of IH is reported to be 15-19/100,000 in the general population and 15-19/100,000 among the elderly population (5). Although IH is seen less frequently than ischemic stroke, it is one of the leading causes of stroke related mortality and morbidity.

There is inadequate information on mortality and morbidity rates, distribution of risk factors and their relation to clinical stroke subtypes due to lack of regular health insurance records and death data, and also lack of studies in epidemiology. It is of vital importance for preventive measures to conduct large epidemiyology studies to identify common risk factors, characterize modifiable and reduceable or yet unknown risk factors in a population. Recognizing how risk factors may determine mortality will give clues to predict the course and prognosis of treatment.

The objective of this study is to assess the risk factors in patients with a history of spontaneous intracerebral hematoma, to determine the effects of these risk factors on mortality and morbidity and recurrence rate during the 12-month follow up period

Material and Method

The 215 patients enrolled in this study were diagnosed with spontaneous intracerebral hemorrhage and followed at the Trakya University Medical School Neurology Clinic between January 2008 and June 2010. The study was approved by the Trakya University Medical School Ethics Committee with the approval letter (no 07/05) dated 04.10.2010. Patients with IH due to SAH, epidural and subdural hematoma, and arteriovenous malformation (AVM) were excluded from the study. In addition, patients with stroke resulting from conditions that may cause hemorhagic stroke (including vasculitis, trauma, coagulopathy, tumor) were also excluded from the study.

Medical files of enrolled patients were reviewed and information on age, sex, hypertension (HT) history, diabetes mellitus (DM) history, presence of chronic renal failure (CRF), antiaggregant and/or anticoagulant use, tobacco use, alcohol use, detailed medical history and neurological examination was recorded. In addition, National Institutes of Health (NIH) stroke score, sistolic and diastolic blood pressure values, average blood pressure (ABP) values, blood glucose and LDL cholesterol at presentation were also recorded. Lesions were identified with computerized brain tomography (CT) and localization and sides, volumes and whether the lesion opened into a ventricule was assessed and recorded. Hemorrhages were evaluated in 5 sections based on localization: basal ganglionic, thalamic, lobar, localized in the brain stem and cerebellar. Volume of the hematoma mass was estimated by multiplying the width (A) and length (B) of the hematoma mass and height determined based on the number of sections seen in CT and dividing the resulting number in two (A x B x C / 2). Based on the estimated volumes, hemorrhages below 10 cm^3, between 10 and 30 cm^3, between 30 and 60 cm^3, and above 60 cm^3 were classified as small, medium, big and very big hemorrhages, respectively. Patients still alive 1 year after hospitalization, and who could return to the hospital were assessed for prognosis on an outpatient basis. Information on those who couldn't come to the hospital and who had died was obtained from family members via telephone. The modified Rankin Scale (mRS) was used to determine functional dependence and to assess improvement; a score of ≤3 on the mRS was considered as good prognosis, while >3 was considered to show bad prognosis.

Statistical Analysis

NCSS (Number Cruncher Statistical System) 2007&PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) was used for statistical analysis. Numerical values were expressed as mean ± SD for questions evaluating study data. The concordance of data to normal distribution was reviewed using the single sample Kolmogorov Smirnov test. Student's t test was used for inter-group comparisons of parameters showing normal distribution, and Mann Whitney U test was used to for inter-group comparisons of parameters not showing normal distribution. Chi square test was used to compare qualitative data. Kaplan Meier Survival analysis was used to evaluate survival. Significance was assessed as $p < 0.05$.

Findings

A total of 215 patients were included in this study; 82 (38.1%) of the patients were female, and 133 (61.9%) were male. Patients' age varied between 23 and 105, and mean age was found to be 65.39±13.43. Patients were divided into 4 groups based on age (<55 years, 55-64 years, 65-74 years, and ≥75 years) and distribution among these groups was as follows: 23.7% of patients (n=51) below age 55, 20.5% (n=44) between 55 and 64 years, 26.5% (n=57) between 65

and 74 years, and 29.3% (n=63) 75 years and above. Cigarette use and alcohol use was found in 34.4% (n=74) and 19.1% (n=41) of patients, respectively.

While the mean NIH stroke score was found to be 10.36±7.10 (minimum 0, maximum 29), mRS score varied between 0 and 6, with a mean score of 3.59±2.56. When patients were evaluated at the end of 1 year for mRS score (as ≤ 3 good prognosis, and >3 bad prognosis), prognosis was found to be bad in 55.3% (n=119) and good in 44.7% (n=96). While 49 (41.2%) of the 119 bad prognosis patients were female and 70 (58.8%) were male, 33 (34.4%) of the 96 good prognosis patients were female, and 63 (65.6%) were male. There was no significant difference between female and male patients for prognosis (p=0.307). When demographic information was reviewed, neither sex nor cigarette or alcohol use was found to have a significant impact on prognosis (p>0.05). Mean age was found to be 69.70±12.23 in the bad prognosis group and 60.06±12.99 in the good prognosis group. There was a significant difference between the two groups for mean age (p<0.001), and there was also a significant difference between age group distribution for prognosis (p<0.001). Bad prognosis was seen most frequently in the above 65 age groups.

Hypertension was detected in 157 (73%) of the patients. While systolic blood pressure (SBP) values varied between 90 and 290 mmHg, and mean value was 166.51±37.77 mmHg, diastolic blood pressure (DBP) values were between 60 and 160 mmHg and mean value was 96.07±19.76 mmHg. Average blood pressure (ABP) values varied between 70 and 193 mmHg, and mean value was 119.38±24.17 mmHg. Thirty-two (14.9%) patients had diabetes mellitus. Blood glucose measurements at presenting were between 65 and 522 mg/dl, with a mean value of 125.98±43.95 mg/dl. Blood glucose was 185 mg/dl and above in 25.1% (n=54) of the patients. Only 10 (4.7%) patients had chronic renal failure. Forty-six (21.4%) patients used antiaggregant drugs, and 14 (6.5%) patients used oral anticoagulant (OAC) drugs. INR value varied between 1.3 and 10.9, with a mean value of 4.30 ± 3.10. LDL values were between 15 and 269 mg/dl, and the mean LDL value was found to be 125.98±43.95 mg/dl; LDL level was found to be below 160 mg/dl in 172 (80%) patients.

When findings for chronic conditions were reviewed, there was a significant difference between good and bad prognosis groups for presence of HT (p=0.005). Patients in the bad prognosis group had a significantly higher rate of HT than the patients in the good prognosis group. There was also a significant difference between groups for the presence of DM (p=0.042); on the other hand, there was no significant difference for the presence of CRF (p>0.05). There was also no significant difference between prognosis groups for antiaggregant and anticoagulant drug use (p>0.05), which was interpreted as being due to the small number of of patients using antiaggregants and anticoagulants.

When localization of hematoma was assessed, it was found that 101 patients (47%) had hematomas in the left hemisphere, 88 patients (40.9%) in the right hemisphere and 26 patients (12.1%) in the brain stem. These hematoma were localized in the basal ganglia in 84 patients (39.1%), thalamus in 57 patients (26.5%), lobes in 48 patients (22.3%), brain stem in 11 patients (5.1%) and cerebellum in 15 (7%) patients. The mean volume of hematoma was found to be 35.87±41.91 cm^3 (minimum 1 cm^3, maximum 220 cm^3), with 31.2% of patients (n=67) having a hematoma of 10 cm^3, 29.3% of patients (n=63) a hematoma of 10-30 cm^3, 20.5% of patients (n=44) a hematoma of 30-60 cm3 and 19.1% of patients (n=41) a hematoma of >60 cm^3. Intraventricular hemorrhage (IVH) was detected in 101 (47%) patients. Six patients (2.8%) were seen to have a recurrence; mean age of these cases was 68±11.08, whereas mean age of the 209 patients without a recurrence was 65.32±13.50. There was no statistically significant difference between two subgroups for mean age (p=0.631).

When types of hematoma were reviewed, 52 of the 84 basal ganglionic hematoma (61.9%) were found to be in the bad prognosis group and 32 (38.1%) in the good prognosis group; 31 of the 57 thalamic hematoma (54.4%) in the bad prognosis group, and 26 (45.6%) in the good prognosis group; 18 of the 48 lobar hematoma (39.6%) in the bad prognosis

Table 1. Distribution of hematoma types by prognosis

	mRS Bad prognosis (n=119) (55.3%)		mRS Good prognosis (n=96) (44.7%)		Total	
	n	%	n	%	n	%
Basal ganglionic	52	61.9	32	38.1	84	100
Thalamic hematoma	31	54.4	26	45.6	57	100
Lobar hematoma	19	39.6	29	60.4	48	100
Brain stem hematoma	9	81.8	2	18.2	11	100
Cerebellar hematoma	8	53.3	7	46.7	15	100

mRS: Modified Rankin Scale

group, and 29 (60.4%) in the good prognosis group; and 9 of the 11 hematoma localized in the brain stem (81.8%) were found to be in the bad prognosis group, whereas 2 (18.2%) were in the good prognosis group. Seven of the cerebellar hematoma (46.7%) were in the good prognosis group, and 8 (53.3%) were in the bad prognosis group. As a result, the highest rate of bad prognosis hematoma was found in the brain stem localization group, and this was followed by the basal ganglionic hematoma, thalamic hematoma, cerebellar hematoma, and lobar hematoma (Table 1).

The average hematoma volume in the bad prognosis group patients was found to be significantly higher than that of the good prognosis group patients (p=0.001). Based on the groups by hematoma volume, prognosis was found to worsen as volume increases (p=0.001) (Table 2).

Intraventricular hemorrhage (IVH) was seen in a total of 101 (47%) patients. IVH rates were statistically significantly different in prognosis groups (p<0.001). Compared to 59.7% (n=71) of the patients in the bad prognosis group, only 31.2% (n=30) of the patients in the good prognosis group had IVH (Table 3).

There was no significant difference between prognosis groups for mean SBP, mean DBP and ABP. Moreover, when patients were grouped for SBP ≥180 mmHg and <180 mmHg, DBP ≥105 mmHg and <105 mmHg, there was still no significant difference for good and bad prognosis.

There was no significant difference between good and bad prognosis groups for the mean LDL levels of patients (p>0.05). On the other hand, there was a significant difference between bad and good prognosis groups for blood glucose values at presentation (p=0.001). The mean blood glucose values of the bad prognosis group at presentation was found to be significantly higher than that of the good prognosis group. There was also a significant difference between prognosis groups for NIH stroke score estimated in the patients' initial evaluation (p=0.001). The NIH stroke scores for the good prognosis group patients were found to be significantly lower than those of the bad prognosis patients (Table 4).

Recurrence was observed in 6 of the 215 patients (2.8%) enrolled in the study (Table 5); 4 of these patients were male, and 2 were female. There was no significant difference between male and female patients for recurrence (p>0.05). One of the cases was below 55 years, one was above 75 years and the other four were between 65 and 74 years old; the mean age of the six cases was 68.00±11.08. On the other hand, the mean age for the 208 patients without recurrence was 65.32±13.50, and there was no significant difference between the two groups for mean age (p>0.05). Five of the six patients with recurrence had a history of hypertension, but none of them had a history of DM or chronic renal failure (CRF). One patient was a smoker, and none of them consumed alcohol. There was no

Table 2. Hematom hacim gruplarına göre prognoz değerlendirmesi

	mRS Bad prognosis (n=119) (55.3%) Mean±SD	mRS Good prognosis (n=96) (44.7%) Mean±SD	p
Volume (cm^3)	48.93 ± 48.84	19.69 ± 22.74	0.001
	n (%)	n (%)	
< 10 cm^3	24 (20.2%)	43 (44.8%)	0.001
10-30 cm^3	33 (27.7%)	30 (31.3%)	
31-60 cm^3	28 (23.5%)	16 (16.7%)	
>60 cm^3	34 (28.6%)	7 (7.3%)	

mRS: Modified Rankin scale

Table 3. Inraventricular hemorrhage rates by prognosis groups

		mRS Bad prognosis (n=119) (55.3%)	mRS Good prognosis (n=96) (44.7%)	Total n (%)	p
IVH	Yes	71 (59.7%)	30 (31.2%)	101 (47%)	0.001
	No	48 (40.3%)	66 (68.8%)	114 (53%)	0.001

mRS: Modified Rankin scale; IVH: Intraventricular hemorrhage

Table 4. Prognoz gruplarına göre ortalama kolesterol, başvuru kan şekeri ve inme skoru değerleri

	mRS Bad prognosis (n=119) (55.3%) Mean±SD	mRS Good prognosis (n=96) (44.7%) Mean±SD	p
LDL Cholesterol (mg/dl)	122.56±44.12	130.23±43.59	0.204
Blood glucose (mg/dl)	168.29±69.48	138.06±46.99	0.001
NIH Stroke Score	14.26±6.71	5.54±3.90	0.001

mRS: Modified Rankin scale; LDL: Low-density lipoprotein; NIH: National Institutes of Health

significant difference between groups for DM, CRF, cigarette and alcohol use. LDL values of the patients in the recurrence group were below 160 mg/dl and the mean LDL value was 94.16±17.61 mg/dl, whereas the mean LDL value was 126.89±44.15 mg/dl. Although there was a difference between the two groups for mean LDL values, it was not statistically significant (p=0.072). Localization of the hematomas in the patients with a recurrence was basal ganglionic in 2, cerebellar in 2, thalamic in 1 and lobar in one. Mean hematoma volume was 28.16±35.23 cm3 in the recurrence group, and 36.09±42.14 cm^3 in patients without a recurrence; this difference was not found to be statistically significant. One each of the patients in the recurrence group were using antiaggregants, anticoagulants, respectively, and one patient was using both antiaggregants and anticoagulants. There was a significant difference between patientw with and without recurrence in terms of anticoagulant use (p=0.007), but no statistically significant difference for antiaggregant use. There was no statistically significant difference between the two groups for NIH stroke score at presentation. Two of the patients were in the good prognosis group, and the other four were in the bad prognosis group. Two of the patients in the bad prognosis group were reported to die in the first month, one in the third month, and the other in the 11. month.

When mortality rates were reviewed, 36.8% of patients (n=78) were observed to have died in the first month, and 11.63% (n=25) between month 2 and 12. As a result, rate of mortality at month 12 was found to be 47.91%. Among patients with a hematoma volume of >60 cm3, the frequency of patients who died during month 1 was found to be

Table 5. Distribution of patients characteristics by time of death (month)

		Died during month 1 (n=78)(36.8%)		Died between month 2 and 12 (n=25) (11.6%)		Total		p
		n	%	n	%	n	%	
Sex	Female	32	71.1	13	28.9	45	43.7	0.336
	Male	46	79.3	12	20.7	58	56.3	
Age Group	Below 55 years	12	75	4	25	16	15.5	0.701
	55-64 years	12	85.7	2	14.3	14	13.6	
	65-74 years	25	78.1	7	21.9	32	31.1	
	75 and above	29	70.7	12	29.3	41	39.8	
HT	Yes	63	76.8	19	23.2	82	79.6	0.607
	No	15	71.4	6	28.6	21	20.4	
DM	Yes	15	78.9	4	21.1	19	18.4	0.717
	No	63	75	21	25	84	81.6	
Cigarette	Yes	27	90	3	10	30	29.1	0.300
	No	51	69.9	22	30.1	73	70.9	
Alcohol	Yes	13	81.3	3	18.7	16	15.5	0.575
	No	65	74.7	22	25.3	87	84.5	
Antiaggregant	Yes	21	77.8	6	22.2	27	26.2	0.772
	No	57	75	19	25	76	73.8	
Anticoagulant	Yes	5	55.6	4	44.4	9	8.7	0.140
	No	73	77.7	21	22.3	94	91.3	
Hematoma Volume	< 10 cm^3	15	75	5	25	20	19.4	0.029
	10–30 cm^3	17	65.4	9	34.6	26	25.2	
	31–60 cm^3	16	64	9	36	25	24.3	
	>60 cm^3	30	93.8	2	6.2	32	31.1	
IVH	Yes	51	83.6	10	16.4	61	59.2	0.035
	No	27	64.3	15	35.7	42	40.8	

HT: Hipertension; DM: Diabetes mellitus; IVH: Intraventricular hemorrhage.

significantly higher than those who died between month 2 and 12 ($p<0.05$). Moreover, presence of IVH was found to be significantly higher in patients who died during month 1 than patients who died between month 2 and 12 ($p<0.05$). When blood sugar levels measured at presentation were reviewed, blood sugar values of patients who died during month 1 were found to be significantly higher than those of patients who died between month 2 and 12 (180.79 4.76 – 142.36±55.62; $p=0.02$). There was also a significant difference between the two groups for mean NIH stroke score ($p<0.001$). There was no significant difference for mean age, sex, HT, DM, presence of CRF, cigarette and/or alcohol use, mean SBP and DBP values, and antiaggregant and anticoagulant drug use.

When presence of hypertension was compared, HT was seen to be more frequent in the non-surviving patient group and there was a significant difference between the two groups for HT ($p=0.037$). There was no significant difference between the two groups for DM, but the number of patients diagnosed with DM was higher in the non-surviving patient group. Mean blood sugar level at presentation was 139.45±46.53 mg/dl for surviving patients, and 171.46±72.25 mg/dl for those who had died. There was a significant difference between the two groups for blood sugar level ($p<0.001$). When two groups with blood sugar levels of <185 mg/dl and ≥185 mg/dl were compared, 75.9% of the patients in the blood sugar ≥185 mg/dl group were found to be in the non-surviving patient group ($p<0.001$). Mean LDL level was 130.89±43.74 mg/dl for surviving patients, and 120.65±43.75 mg/dl for non-surviving patients, and there was no statistically significant difference. When NIH stroke score of patients were reviewed, mean NIH stroke score for the non-surviving patient group was found to be significantly higher than the score for the surviving patient group ($p<0.001$).

When hematoma types were assessed, more than half of the patients with basal ganglionic, cerebellar hematomas and hematomas localized in the brain stem were seen to have died within the first year.

Mean hematoma volume for the surviving patient group was found to be significantly higher than that of the non-surviving patient group ($p<0.001$). There was also a significant difference between the surviving and non-surviving patient groups for presence of IVH ($p=0.001$); IVH was found to be more frequent in the non-surviving patient group (60.4%-39.6%).

Discussion

IH has a higher mortality and morbidity than ischemic stroke and subarachnoidal hemorrhage, although its prevalence among all strokes is 10-15% (6). There is inadequate information on mortality and morbidity rates, distribution of risk factors and their relation to clinical stroke subtypes due to lack of regular health insurance records and death data, and also lack of studies in epidemiology. It is of vital importance for preventive measures to conduct large epidemiyology studies to identify common risk factors, characterize modifiable and reduceable or yet unknown risk factors in a population.

Studies found that there is a positive association between male sex and IH. Ariesen et al. (7) found an odds ratio of 1.35 in case-controlled studies, and this ratio was 4.64 in cohort studies. In our study, 82 of the 215 patients (38.1%) were female, and 133 (61.9%) were male. The majority of male patients could be attributed to male sex being a risk factor for IH, as suggested in current studies.

IH risk increases with age and doubles with every decade of life (8). Mean age of the patients in our study was found to be 65.39±13.43. When distribution for age groups was reviewed, patients below 55 years and 75 years and older were found to be 23.7% and 29.3% of the total patient population, respectively. The increase in the prevalence of IH in the older groups can be explained with the increase in the prevalence of HT. When the association of age and prognosis was reviewed, as seen in the study conducted by Nakayama et al. (12), numerous studies have shown the association between patient's age and prognosis. In our study, bad prognosis was seen to be higher in patients above 65 years.

History of HT is present in 72-81% of IH patients (9). The Turkish Multicentered Stroke Study identified HT as a risk factor (79.2%) of IH (4). Consistent with literature, 73% of the patients in our study had a history of HT. When we compared surviving and non-surviving patients at the end of one year for HT, history of HT was seen to have a significant effect on mortality. Willmot et al. (13) found an association between high blood pressure and mortality and morbidity. In our study, there was no significant difference between the good and bad prognosis groups for mean systolic and diastolic blood pressure values, and this was attributed to the fact that patients with impaired consciousness received treatment to lower arterial blood pressure in the emergency room.

Davis et al. (10) did not acknowledge sex as a prognostic factor in their study of 218 acute IH patients. On the other hand, Castellanos et al. (11) associated female sex with good prognosis in their 138-case spontaneous IH study. In our study, sex was not found to be a determining factor for prognosis or mortality.

Hyperglycemia accelerates brain edema and perihematomal cell death following IH. Kimura et al. (14) revealed that hyperglycemia at presentation increases the risk of early death. Fogelholm et al. (15) reported that hyperglycemia at presentation in both diabetic and non-diabetic patients, increased the risk of 28-day mortality. In our

study, there was a statistically significant difference between the good and bad prognosis groups for the presence of DM. The mean blood sugar values of patients who died during month 1 was observed to be significantly higher than the values of patients who died between month 2 and 12. When surviving patients at year 1 and non-surviving patients were compared, 75.9% of the patients in the blood sugar ≥185 mg/dl group were found to be in the non-surviving patient group.

Intracerebral hemorrhage resulting from oral anticoagulant (OAC) use is seen in approximately 20% of all IH cases. The risk of IH in patients receiving OAC therapy is 7 to 10 times higher than the risk in patients not receiving OAC and with similar risk factors (16). In our study, rate of IH resulting from OAC use was found to be 6.5%. Moreover, there was no significant difference between good and bad prognosis groups and surviving and non-surviving patients at the end of year 1, which was interpreted as the low rate of OAC use in our patient population.

Tuhrim et al. (17) reported that there is an increase in mortality when the hematoma volume exceeds 30 cm3. On the other hand, Davis et al. (10) found that rate of death increased 1% for each incremental increase of 1 cm3. In our study, we found that the rate of bad prognosis increased in patients with a hematoma volume of >30 cm3. In addition, rate of patients who died during month 1 among patients with a hematoma volume of >60 cm^3 was found to be significantly higher than the rate of patients who died between month 2 and 13.

It is known that intraventricular hemorrhage in intracerebral hemorrhage has a negative impact on prognosis and increases the mortality rate (10,11). The reason of higher mortality may be the development of obstructive hydrocephalus or ventricular blood compressing periventricular structures. In our study, we found that the presence of IVH was a parameter that worsened prognosis and 70.2% of the patients with IVH were in the bad prognosis group. When surviving and non-surviving patients were compared at the end of year 1, the presence of IVH was seen to be higher in the non-surviving group, and the presence of IVH among patients who died during month 1 was found to be significantly higher than that among patients who died between month 2 and 12.

There are reports in literature about an association between statin use and recurring spontaneous intracerebral hemorrhages. Cortico-subcortical microhemorrhages were seen to be more frequent to be in elderly patients using statins. Microhemorrhages were found to recur more frequently in patients using statins, and with lower total cholesterol and LDL cholesterol levels. It has been stressed that statin use in patients experiencing spontaneous intracerebral hemorrhage might be an important indicator for the risk of developing recurring microhemorrhages (18).

Adams et al. (19) report that a NIH stroke score of ≥16 may indicate a high probability of death or severe morbidity, whereas a score of ≤6 may indicate good prognosis. Similarly, in our study, the mean NIH stroke score was 5.54±3.90 in patients in the good prognosis group, and 14.26±6.71 in the bad prognosis group. At the end of year 1, the mean NIH stroke score was seen to be significantly higher in the non-surviving patient group compared to the surviving patient group. In addition, the mean NIH stroke score for patients who died during 1 was found to be significantly higher than the score for patients who died between months 2 and 12.

A study with 474 primary IH cases reported the annual recurrence rate as 2.3%. Age of 65 or above was found to be an independent risk factor for recurrence (20). Qureshi et al. (21) reported that high blood pressure increased recurrence in IH and had a negative impact on prognosis. In our study, 2.8% of the 215 patients (n=6) had recurrent IH; five of these 6 patients had a history of HT. Their mean age was 68 ± 11.08, and one patient was younger than 65 years. We believe that estimating the rate of recurrence after increasing the patient population would be more accurate.

There are numerous studies in the literature reporting 1-month and 3-month death rates for spontaneous IH. In our study, we investigated both the 1-month and 1-year mortality rates in spontaneous IH. We evaluated prognostic factors by comparing surviving and non-surviving patients at the end of year 1. We also compared the good and bad prognosis groups based on mRS score.

In conclusion, while spontaneous IH is less frequent than ischemic stroke, it is one of the leading causes of stroke-related death and disability. Therefore, identifying modifiable, at least controllable risk factors, or yet unknown ones and understanding how risk factors may determine mortality would provide clues for the course of treatment and predicting prognosis. In addition, recognizing risk factors is of vital importance for taking preventive measures in a population. Recognizing prognostic factors in patients with IH, managing those that are treatable, and follow-up will also be important in lowering morbidity rate and decreasing the ever-increasing burden on society and the healthcare system. When the economic conditions of our country are considered, preventive treatment should be the priority in hemorrhagic stroke and many other conditions, specific risk factors for our population should be identified and efforts should be made to eliminate these factors, or at least minimize them.

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