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Clinical Manifestation and Factors Associated With Hospital Mortality Rate among Patients with Subarachnoid Hemorrhage

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ABSTRACT

Background: Subarachnoid hemorrhage (SAH) is a devastating neurologic condition with high mortality and long-term neurological morbidity in 50% of survivors. Knowing the risk factor and clinical presentation in patients with SAH is essential. It is critical to prevent the loss of productive life years in addition to significant long-term healthcare costs. This study aimed to investigate the demographic data, clinical presentations, causes, risk factors, radiologic findings, and mortality rate and its associated factors among SAH patients.
Methods: In this cross-sectional study from February 2014 to February 2017, all the patients with a diagnosis of spontaneous SAH admitted to the neurosurgery ward of Namazi hospital affiliated to Shiraz University of Medical Sciences, southern Iran were enrolled. Demographic information, clinical symptoms, radiologic findings, and risk factors were gathered and analyzed.
Results: We investigated 114 patients. The mean age of patients was 52.5 years. Total mortality rate was 28.9 % (33 patients). Headache was the most common clinical presentation (77.2%) followed by unconsciousness (43.9%) and vomiting (37.7%). Multiple logistic regression revealed that a headache (OR=8.80) and unconsciousness (OR=9.82) were associated with mortality of SAH patients.
Conclusion: In this study, SAH has a relatively high mortality rate. Hypertension and smoking were the most critical risk factors for SAH. Headache and unconsciousness were the most associated factors with mortality of SAH patients.
Keywords: subarachnoid hemorrhage, Intracranial Aneurysm, risk factor, Neurosurgery.

INTRODUCTION

Subarachnoid hemorrhage (SAH) is the presence of blood in the subarachnoid space[1]. An Iranian study reported the incidence of SAH to be 1.31 per 100,000 people[2]. SAH represented about 5% of cerebrovascular pathology[3]. Arteriovenous malformation and cerebral aneurysm are responsible for more than 95% of spontaneous SAH[1]. The classical clinical presentation of SAH is sudden onset severe headache; the worst headache ever experienced. Its onset is typically abrupt; usually reaching to the maximal intensity within an hour[4]. SAH is associated with a significant rate of complications and considerable mortality and long-term disability[3,5,6]. Significance of SAH is increased due to the lower age and poor outcome of patients[1]. Aneurysmal SAH which presented with a focal neurologic deficit is at higher risk of developing permanent neurological deficit[7].

This study aimed to illuminate the demographic data, clinical presentations, causes, risk factors, radiologic findings, and mortality rate and its associated factors among patients with SAH.

METHODS

In this cross-sectional study, participants were patients with a diagnosis of non-traumatic SAH admitted to neurology or neurosurgery ward of Namazi hospital affiliated to Shiraz University of Medical Sciences, from February 2014 to February 2017. In this study, SAH was diagnosed according to the standard criteria (confirmation by cranial CT scan or lumbar puncture). We excluded patients with history of trauma and malignancy.

We extracted our data from patients' medical records through a collection form. It included demographic data (age and gender), clinical presentations (headache, focal neurological deficit, unconsciousness, nausea, vomiting, and seizure), radiologic findings in brain CT scan, CT angiography, MR angiography or digital subtraction angiography, risk factors, and outcome (dead or alive at the end of hospital course). The Ethics Committee of Shiraz University of Medical Sciences reviewed and approved study protocol. The study was conducted according to the principles of the declaration of Helsinki. All subjects signed a general written informed consent on admission in the hospital to permit using the data of their medical records with consideration of their privacy.

Descriptive statistics for categorical and continued variables were reported as frequency (percent) and mean (SD) respectively. To determine the significance of association of clinical presentation, demographic and radiographic data and SAH outcome, independent T-test, chi-square or Fisher exact test were used as appropriate. Simultaneous association between considered factors and the outcome was assessed via multiple logistic regression analysis as all the factors with $p<0.2$ in univariate analysis were included in the model. All the statistical analysis was performed in SPSS version 25.0. Level of the significance was set at 0.05.

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RESULTS

In this study, we investigated 114 SAH cases who referred to Namazi Hospital From February 2014 to February 2017. The mean age of patients was 52.5 (±18.9) years. Sixty-three (55.3%) out of 114 patients were female, and 51 (44.7%) were male. Total mortality rate was 28.9% (33 patients). In the clinical presentation of SAH, headache was (77.2%) followed by unconsciousness (43.9%) and vomiting (37.7%). Thirty-three (28.9%) patients had an aneurysm. Twenty-five of aneurysms (75.8%) were anterior communicating artery (ACOM) and 8(24%) were middle cerebral artery (MCA). Moreover, in term of the associated disease, 67(58.8%) patients had hypertension, 4(3.5%) suffered hyperlipidemia, and 24(21.1%) were smokers (Table 1).

Table 2 shows an association between clinical presentations and mortality. Our results suggested that the proportion of mortality was significantly higher among patients with a headache than patients without a headache (73.1% versus 15.9%, P<0.001). More than half (56%) of patients with unconsciousness were dead which was significantly higher than patients without unconsciousness (7.8%, P<0.001). As a further matter, there was a positive association between vomiting and mortality (P=0.006) (Table 2).

In table 3, multiple logistic regression revealed that a headache (OR=8.80, 95% CI: 2.38-32.50) and unconsciousness (OR=9.82, 95% CI: 3.03-31.87) were associated with mortality of SAH patients.

Table 1: Demographic and clinical characteristics of patients.

Subgroup	Frequency (%)
Gender	
Male	51 (44.7)
Female	63 (55.3)
Clinical presentation	
Headache	88 (77.2)
Seizure	3 (2.6)
Unconsciousness	50 (43.9)
Focal neurologic deficit	2 (1.8)
Vomit	43 (37.7)
Aneurysm	
None	81 (71.1)
Anterior communicating artery	25 (21.9)
Middle cerebral artery	8 (7.0)
Arteriovenous malformation	
No	112 (98.2)
Yes	2 (1.8)
Intraventricular hemorrhage	
No	94 (82.5)
Yes	20 (17.5)
Associated disease	
Polycystic kidney disease	2 (1.8)
Smoking	24 (21.1)
Hypertension	67 (58.8)
Hyperlipidemia	4 (3.5)
Alcohol consumption	1 (0.9)

Table 2. Association between clinical presentations and mortality.

Subgroup	Outcome		
	Alive (n=81)	Dead (n=33)	P-value
Age	52.3± 18.5	53.0± 20.0	0.86[b]
Gender			
Male	37 (72.5)	14 (27.5)	0.75[b]
Female	44 (69.8)	19 (30.2)	
Headache			
Yes	7 (26.9)	19 (73.1)	<0.001[b]
No	74 (84.1)	14 (15.9)	
Seizure			
Yes	80 (72.1)	31 (27.9)	0.20[a]
No	1 (33.3)	2 (66.7)	
Unconsciousness			
Yes	22 (44.0)	28 (56.0)	<0.001[b]
No	59 (92.2)	5 (7.8)	
Focal neurologic deficit			
Yes	80 (71.4%)	32(28.6)	0.50[a]
No	1 (50%)	1(50%)	
Vomiting			
Yes	44 (62%)	27(38%)	0.006[b]
No	37 (86%)	6(14%)	
Aneurism location			
Anterior communicating artery	18 (72%)	7 (28%)	0.40[b]
Middle cerebral artery	4 (50%)	4 (50%)	
Without aneurism	59 (72.8%)	22 (27.2%)	
Arteriovenous malformation			
No	79(70.5%)	33(29.5%)	0.99[b]
Yes	2(100%)	0 (0)	
Intraventricular hemorrhage			
No	70(74.5%)	24(25.5%)	0.08[b]
Yes	11 (55%)	9(45%)	
Associated disease			
Polycystic kidney disease	1(50%)	1(50%)	0.50[a]
Hyperlipidemia	3(75%)	1(25%)	.99[b]
Current smoker	18(75%)	6(25%)	0.63[b]
Hypertension	45(67.2%)	22(32.8%)	0.27[b]

a Fisher exact test
b chi-square test

Table 3: Results of logistic regression model for effective factors on mortality.

Clinical manifestation	OR	95% CI	p-value
Headache	8.80	2.38-32.50	0.001
Vomiting	0.74	0.21-2.65	0.64
Unconsciousness	9.82	3.03-31.87	<0.001
Intraventricular hemorrhage	1.77	0.50-6.22	0.38

DISCUSSION

In this study, the mortality rate of SAH was 28.9 %. Other studies showed three-month mortality rate can be as high as 50% without early definitive treatment (8). Although SAH patients were transferred to specialized neurosurgical intensive care, the in-hospital mortality rate is still higher

than 30%[9,10]. From various epidemiologic studies, several factors play role in the prognosis and outcome including the age of patients, anatomical position of aneurysms, type of aneurysm lesion, type of postoperative complications, family history, operative approach, etc.[11,12].

The present study showed the most common clinical presentations of SAH were headaches followed by unconsciousness and vomiting. This result is in line with alarm signs and symptoms of SAH stating that a headache is the most frequent alarm sign of SAH (13). Also, other studies showed 92 % to 98 % of SAH patients admitted to the hospital with a complaint of the severe sudden onset headache that reaches to maximal intensity within second of onset[14].

This study demonstrated that SAH is more common in women. A systematic review showed the incidence of SAH to be higher in women than in men, but gender difference emerges not earlier than age 50 or older[15]. Another study showed that female hormone level might influence SAH, but the mechanism is not definite[16]. Another study showed that the female-to-male ratio was 1.15 among the 421 SAH patients[17].

In term of the associated risk factors, we found 67(58.8%) patients had hypertension, 4(3.5%) suffered hyperlipidemia and 24(21.1%) were smokers. A study by Rahmanian et al. in 2017 in Iran reported that hypertension is the most prevalent comorbidity in SAH and smoking was significantly more prevalent in the patient with multiple intracranial aneurysms[17].

We found that the history of alcohol consumption was meager (only one patient). It may be due to religious beliefs in Iran that inhibit people to consume alcohol. A meta-analysis of 14 observational studies showed that heavy alcohol consumption (>30 g/day) increased the risk of SAH. No significant association has been seen between light or moderate alcohol consumption (15-30 g/day) and risk of SAH[18].

Our study showed the prevalence of hyperlipidemia in SAH to be 3.5%. The role of total cholesterol as a risk factor for SAH is conflicting since studies report both high[19,20] and low[21,22] level of total cholesterol raised the risk of SAH. A systematic review done in 2016 by Lindbohm et al. indicated cholesterol as a risk factor for SAH. They concluded elevated total cholesterol levels might elevate risk for SAH among men, and therefore lipid profile should be taken into account when assessing risk for SAH in men. No convincing evidence existed that low total cholesterol elevated the risk of SAH[23].

In this study, the prevalence of aneurysmal SAH was 28.9%. A study done by Rahmanian et al. showed that ACOM and MCA were the most common sites of aneurysms; which was present in 128 (30.4%) of patients[17]. On the other hand, another study showed aneurysms account for approximately 80% of cases with spontaneous SAH[24]. Also, other studies showed that rupture of intracranial aneurysms accounts for 80% of non-traumatic SAH and the remaining 20% non-traumatic SAHs were caused by non-aneurysmal venous and arteriovenous malformations, other vascular lesions, and tumors[25,26]. It is also possible that several SAH patient died before admitting to our hospital and were not included in our study and it may cause the difference between our study and other studies. In our study, 75% of patient had ACOM aneurysms and 30% had MCA aneurysms. Another study done in Iran showed that ACOM and MCA were the most common site of intracranial aneurysms diagnosed in 30.4% of SAH cases[17].

In our study, the result of 70% of patients' angiographies was negative. A study done in 2014 by Kumar et al. showed that angiography negative spontaneous SAH is a significant clinical entity accounting for nearly 20% of all cases (22%). They recommended angiography in all these patients to exclude aneurysms. They showed that if initial angiography was negative, there is no need for repetition[27].

All the same, some limitations need to be considered. The main limitation of the present study was the low quality of the hospital records. We gathered our information from patients' medical records. Some physicians' notes were incomplete or illegible. Also, our sample size seems to be not very large. We suggest a large prospective multicenter study to determine the demographic and clinical data of patients with SAH.

CONCLUSION

SAH is an emergency neurological and neurosurgical disease that makes high mortality and morbidity in patients. Hypertension and smoking are important risk factors of SAH and we should reduce them to reduce mortality, morbidity and health care system costs of SAH. According to our study headache and unconsciousness were the most associated factors with mortality of SAH patients and we should pay more attention to SAH in these patients.

Conflict of interest: The authors have declared that no competing interests exist.

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