Original Article

Hyperglycemia in Acute Subarachnoid Hemorrhage

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ABSTRACT

Objective: To determine the frequency of hyperglycemia in patients presented with subarachnoid hemorrhage.
Study Design: Cross-sectional/observational study
Place and Duration of Study: This study was conducted at the Department of Neurology, Sharif Medical City Hospital, Lahore from 1st August 2017 to 31st March 2020.
Materials and Methods: One hundred and five patients of both genders with ages 20 to 75 years presented with subarachnoid hemorrhage were enrolled. Patient's detailed demographics including age, sex, body mass index and Hunt Hess grade were recorded after taking informed consent. Serum glucose level was examined. Hyperglycemia was defined as serum glucose level >140mg/dl.
Results: Seventy-six (72.38%) were males while 29 (27.62%) were females. Thirty-two (30.48%) patients were ages ≤40 years, 56 (53.33%) were ages 41 to 60 years and 17 (16.19%) were ages above 60 years. Hyperglycemia was found in 67 (63.81%) patients while 38 (36.19%) patients were non-hyperglycemic.
Conclusion: The frequency of hyperglycemia in patients with subarachnoid hemorrhage was too high.

Key Words: Hyperglycemia, Acute subarachnoid hemorrhage, Frequency.

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INTRODUCTION

A critical acute health emergency with an incidence of 9 per 100.000 person-years is subarachnoid hemorrhage. The cerebral aneurysm rupture accounts for 85% of cases of subarachnoid hemorrhage. Further circulation fatality of aneurysm is 10-15 percent higher in comparison to the previous circulation aneurysm (10-15% in all aneurysm).[1]

Since the path to poor clinical outcome seems to involve hyperglycemia, insight into these mechanisms can reveals new treatment options. In order to give an overview of the potential cause and consequences of hyperglycemia in acute subarachnoid hemorrhage patients, and discuss pathophysiological mechanisms to link hyperglycemia to poor clinical result, we have undertaken a non-systematic literature search.[2] Hyperglycemia is common in non-diabetic patients and associated with higher morbidity and mortality in both critically ill patients and surgical patients.[3]

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Clinical traits of subarachnoid hemorrhage are severe and common, thunderclap, headache, pathologic disease, neck stiffness, loss of consciousness and decerebrate. Intensive therapy of insulin for medical and surgical intensive care units (ICU) has shown that sepsis incidence decreases, acute renal failure, blood transfusions, critical illness polyneuropathy, ICU stay long and mortality are reduced.[4-6] The present study was conducted aimed to examine the frequency of hyperglycemia in patients with subarachnoid hemorrhage.

MATERIALS AND METHODS

This cross-sectional/observational study was conducted at Sharif Medical City Hospital, Lahore from 1st August 2017 to 31st March 2020. A total of 105 patients of both genders with ages 20 to 75 years presented with subarachnoid hemorrhage were enrolled. Patients detailed demographics including age, sex, body mass index (BMI) and Hunt Hess grade of subarachnoid hemorrhage at admission were recorded after taking informed written consent. Patients with history of diabetes mellitus, patients with surgical intervention of stroke, patients who had lobar (frontal/parietal/temporal/occipital regions of brain) or central (brainstem/basal ganglia/thalamus) bleed on CT brain were excluded. The diagnostic criteria for SAH are defined on the basis of the CT scan brain, where one is in the CT brain: hyperdensity (blood) in the interhemispheric crack, sylvian fissure, or ventricular / parenchymal-extensed perimesencephalic cistern. Serum glucose level was examined by glucometer at admission. Hyperglycemia was defined as serum

glucose level >140mg/dl. All the data was analyzed by SPSS 24. Chi-square test was applied to examine the stratification hyperglycemia between male and female. P-value <0.05 was taken as significant.

RESULTS

There were 76 (72.38%) males while 29 (27.62%) were females. Thirty-two (30.48%) patients were ages ≤40 years, 56 (53.33%) were ages 41 to 60 years and 17 (16.19%) were ages above 60 years. Mean BMI was 24.51±2.38 kg/m$^{2.}$ 26 (24.76%) patients were Hunt Hess grade 1-2, 33 (31.43%) had grade 3, 35 (33.33%) had grade 4 and 11 (10.48%) had grade 5 (Table 1). According to the random glucose level, hyperglycemia was found in 67 (63.81%) patients while 38 (36.19%) patients were non-hyperglycemic (Fig. 1). When we stratified, we found that frequency of hyperglycemia was high in females 22/29 (75.86%) as compared to males 45/76 (59.21%). A significant association was found between hyperglycemia and female gender with p-value <0.05 (Table 2).

Table 1: Demographic information of all the patients

Variables	No.	%
Gender		
Male	76	72.38
Female	29	27.62
Age (years)		
<40	32	30.48
41 – 60	56	53.33
> 60	17	16.19
H-H score		
Grade 1-2	26	24.76
Grade 3	33	31.43
Grade 4	35	33.33
Grade 5	11	10.48
Body mass index (kg/m^2)	24.51±2.38	

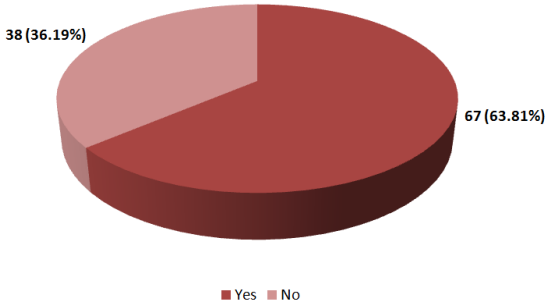

Figure No.1: Frequency of hyperglycemia in subarachnoid hemorrhage patients

Table 2: Stratification of hyperglycemia according to gender

Hyperglycemia	Male (n=76)	Female (n=29)	P-value
Yes	45(59.21%0	22(75.86%)	0.028
No	31(40.79%)	7(24.14%)	

DISCUSSION

Hyperglycemia is one of the most commonly found complications in patients with severe neurological disorders and associated with higher morbidity and mortality.[7,8] Majority of patients in our study were male 72.38%. 32 (30.48%) patients ages were ≤40 years, 56 (53.33%) were ages 41 to 60 years and 17 (16.19%) were ages above 60 years. These results were comparable to many of previous studies in which male patients were high in numbers and accounted 60% to 75% and majority of patients were ages above 50 years 70% [9-10]. We found that 26 (24.76%) patients were Hunt Hess grade 1-2, 33 (31.43%) had grade 3, 35 (33.33%) had grade 4 and 11 (10.48%) had grade 5. A study conducted by Frontera et al[11] reported that majority of patients of subarachnoid hemorrhage had Hunt Hess grade 3 to 5 that was similar to our study.

In present study, hyperglycemia was found in 67 (63.81%) patients while 38 (36.19%) patients were non-hyperglycemic. A study conducted by Malik et al[12] reported in their study that out of 75 subarachnoid hemorrhage patients, hyperglycemia was found in 78.67% patients while 21.33% were non-hyperglycemic. Another study by Azar et al[13] regarding metabolic complication in patients with subarachnoid hemorrhage, in their study they reported that hyperglycemia was observed in 23% patients among 483 subarachnoid hemorrhage patients.

Hyperglycemia patients are about three times more susceptible, with no association to the various cut-off levels used for the purposes of hyperglycemia.[14] This is a risk for poor outcomes. The relationship between high blood glucose levels and poor clinical outcome is stronger than hyperglycemia at admission.[15]

The median highest glucose burden in the study population of 7.6 mmol / L, 3.2 to 40.5 mmol / L, and the median glucose burden of more than 5.8 mmol / L was 1.8 mmol / L (range of 0.1 to 12.9 mmol / L) reported by Frontera et al.[11] Patients with hyperglycemia have also reported poor clinical outcomes compared to those with non-hyperglycemia.

Hyperglycemia intensifies the injury caused by subarachnoid hemorrhage by increasing mitochondrial dynamic imbalance, apoptosis and inflammation, and thereafter.[16] The level of glucose at entry depends on the severity of the initial bleeding. Previous studies have showed an autonomous predictor for the incidence of delayed brain ischemia and poor outcomes in subarachnoid hemorrhage patients in the initial hyperglycemia. In management protocols of subarachnoid hemorrhage patients, the prognostic potential of the plasma glucose level was proposed to be beneficial.[17-19].

CONCLUSION

The frequency of hyperglycemia was high in patients with subarachnoid hemorrhage. Examination of serum

glucose level at admission is very essential for the management of hyperglycemia and it will help to reduce the morbidity and mortality in patients with subarachnoid hemorrhage.

Author's Contribution:

Concept & Design of Study:	Muhammad Moosa
Drafting:	Farhan Fateh Jang, Amna Malik
Data Analysis:	Rizwan Jamil
Revisiting Critically:	Muhammad Moosa, Farhan Fateh Jang
Final Approval of version:	Muhammad Moosa

Conflict of Interest: The study has no conflict of interest to declare by any author.

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