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ORIGINAL ARTICLE

Effective Management of Hyperglycemia Improve the Outcome of Aneurysmal Subarachnoid Hemorrhage

HUSNAIN HASHIM[1]
[1]Consultant neurologist, Head of Neurology, Fauji Foundation Hospital, Rawalpindi
Correspondence to: Husnain Hashim, Email: hashimneuro@hotmail.com

ABSTRACT

Aneurysmal subarachnoid hemorrhage is one of the most commonly known life-threating disease. Many neurological outcomes are associated with SAH. The poor outcomes are associated with the hyperglycemia in the aneurysmal subarachnoid hemorrhage patients. The major risk factor associated with the aneurysmal subarachnoid hemorrhage is hyperglycemia.

Objective: The purpose of this research work was to get in-depth understanding of the effect of glycemic control on changes in the outcomes associated aneurysmal subarachnoid hemorrhage.

Study design: It is a prospective study with the statistical approach, conducted at Department of Neurology, Fauji Foundation Hospital, Rawalpindi.

Methods: The 365 patients visited the neurology department of our institute were included in the study. The duration of this study was March 2020 March 2022. The 56 ± 14 years was the mean age of the patients included in this study. The 106 (29%) out of 365 were male candidates. The half of the patients were treated with the aggressive hyperglycemic management AHM protocol, while other half were treated with the standard glycemic management SGM protocols. The patients was labelled with good glycemic outcome if the mean glucose burden is less than 1.1, and labelled as poor outcome if mean glucose burden is greater than 1.1. The outcomes of the AHM and SGM group were compared. Different logistic regression models were used to quantify the poor outcome effects.

Results: The result depicted that the patients treated with the AHM protocols showed lower poor outcomes (28%) as compared to the other treated with SGM. The values remain insignificant after correction of temporal trends. The incidence of the poor outcome can be reduced by the good glycemic control. The clinical vasospasm rates remain same before or after the implementation of AHM controls.

Conclusion: The poor outcomes associated with the SAH can be reduced by good glycemic control of the patients. The study depicted the not only the blood glucose level will remain in the range but also better neurological health of the patients' will be promoted by an effective use of aggressive glucose management on the patients suffering from SAH.

Keywords: Aneurysmal subarachnoid hemorrhage, AHM glycemic control, Hyperglycemic outcomes, Vasospasm, logistic regression models.

INTRODUCTION

The intracranial aneurysms rupture is highly observed in the 6-10 people out of 10000. This disease account for 3% of all the strokes observed in the population and 5% of the stroke leading to death. The women of age 55 years are more prone to this disease. The 51% of the affected patients died within the 30 days of the disease[1-2]. The good outcomes are observed in the 50% patients, while other 33% of the survivor require the life long care. This disease is creating challenging scenario for the healthcare care physicians and adding to the burden and cost of the healthcare procedure.

The need of the hour is to improve the outcomes associated with the SAH survivor patients. The recent studies are showing that the poor outcomes of SAH are associated with the persistent hyperglycemia. The development of the vasospasm in the SAH patients further increased the poor outcomes[3-4]. For improving outcomes in the patient admitted to the intensive care units ICU, they were treated with the intensive insulin therapy. About 70-90% of the patients suffering from SAH had hyperglycemia as the most common complication. The patients with aSAH highly required the strategies to improve glycemic control that will eventually leads to increase in the good outcomes[5]. The patients suffering from acute brain injury create the challenging scenario for the physicians. It is difficult to manage glucose levels in such patients. The relationship between systematic and brain specific factors controlling the glucose transportation become complicated to understand in such patients.

The other factor increase the complexity of the process are glucose insensitive neurons. By providing insulin to the neuron, the cellular uptake of glucose remain same because, the supply of the glucose regulate its uptake in neurons[6-7]. During implication of intensive insulin therapies the extracellular glucose level usually reduced in the brain by lowering the systematic glucose levels. The worst neurological outcomes are associated with the lower systematic glucose levels[8-9]. The study was conducted to develop better understanding of the changes in the outcomes in SAH patients by implementation of aggressive insulin management protocols[10].

MATERIALS AND METHOD

The data of the 365 patients visited the neurological department of the teaching was collected and analyzed. The ethical committee of the hospital approved the study. According to the inclusion criteria the patient , diagnosed with SAH having age greater than 18 years and have survived the first 72 hours of the hospitalization were included in the study. And either endovascular coiling or surgical clipping was used to repair aneurysms within 72 hours of the ictus. The hyperglycemic levels were defined as the patients having the mean blood glucose level greater than the 7.8 mmol/L. The two groups were created on the basis of the treatment given to the patients. One group was treated with AHM aggressive hyperglycemic management therpaies, while other with the standard glycemic management protocols. The AHM group was further divided into two groups with good glycemic control and poor glycemic control outcomes. The patients having non-aneurysmal SAH and means blood glucose level less than 7 were excluded from the study. Other having incomplete records and those who died during the treatment were also excluded from the study. The standard clinical protocols were used to treat the patients. Surgical clipping and endovascular coiling was used to treat the patients with intracerebral aneurysms. Phenytoin was given to the admisintrated patients, and later on nimodipine was administrated to the patients for 21 days. Acetaminophen was used to treat hyperthermia. The patients underwent through transcranial Doppler ultrasound on regular basis. The demographic and clinical findings were recorded and analyzed.

The Rankin scale <4and>4 was used to quantified the good and poor outcomes respectively. The mean glucose levels were calculated on regular basis. The fischer exact test and t test was used to analyze the data on SAS window software.The relationship between the hyperglycemia and SAH outcomes were evaluated by using different regression models.

RESULTS

The mean age of the patients included in this study was 56 ± 14 years and among the 365 patients that were selected 106 (29%) were male candidates. There was a bad HH grade observed in almost 134 (36%) of the patients, likewise there were 300 (82%) of the patients that were included in Fischer group 3 after their admission. Of all the patients that were included in the study 65 (17%) of the patients died and there were 229 (62%) that showed quite positive outcomes while the remaining 71 (19%) of them had to face clinical vasospasm.

The complications like hypertension and diabetes were more commonly found in the AHM as compared to SHM and the use of steroid drugs was more seen in case of SHM patients.

There was no difference observed in the case of 2 groups related to admission glucose. However, it was seen that the patients that were suffering from SHM had the glucose level high as compared to other patients with 9 mmol/L. The overall mean of the parameters like glucose, hypertension, diabetes was confirmed and compared. It was also found that the daily mean of the glucose was high in case of SHM patients as compared to AHM.

The hyperglycemia was observed in the case of 30 patients and among them only one patient was taking insulin during the course of the episode of hypoglycemia. Other than that there was no immediate problem regarding hypoglycemia that was observed in these patients.

Table1: The clinical as well as the demographic parameters of SHM and AHM

Parameters	SHM n=183	AHM n=182	P value
Male members (%)	50 (27%)	59 (32%)	0.22
Mean age of the patients (years)	55 ±14	56 ± 14	0.61
Aneurysm characteristics			
Aneurysm showing anterior location (%)	112 (61%)	115 (62%)	1
Number of aneurysms median (25%, 74%)	2 (1,2)	1 (1,2)	0.08
Presentation of the patient			
Headache n (%)	25 (13%)	26 (14%)	0.78
Seizures at occurance n (%)	20 (10%)	26 (14%)	0.08
Unconsciousness n (%)	92 (50%)	79 (43%)	0.25
Stroke n (%)	20 (10%)	20 (7%)	0.03
Hypertension n (%)	66 (36%)	92 (50%)	0.04
HH Grade			
1 n (%)	33 (16%)	32(15%)	0.89
2 ,n (%)	15 (8%)	39 (18%)	0.001
3 ,n (%)	70 (36%)	48 (24%)	0.07
4, n (%)	59 (30%)	55 (27%)	0.69
5, n (%)	17 (8%)	21 (9%)	0.12
Poor HH percentage	70 (40%)	70 (38%)	0.03

Table 2: Glucose control and outcome on AHM patients

Parameters	Control (good) n=150	Negative control n=32	Adjusted OR	P value
Vasospasm n (%)	50 (33%)	17 (53%)	0.78	0.50
Re-bleeding	15 (10%)	9 (28%)	1.9	0.5
Intracranial hypertension n (%)	63 (42%)	6 (32%)	1.13	0.06
Seizures n (%)	7 (4%)	4 (12%)	0.34	0.21
Cardiac dysfunction	45 (30%)	17 (53%)	0.56	0.18

DISCUSSION

In this study the role of glucose control on the patients suffering from a SAH in a group of population was carried out by collecting proper information and history of the patients. There were 365 patients taken for this study. The studies show that the management of hyperglycemic state is important as it targets a glucose level of 4.5 to 7.9 mm/mol/ L[11-12]. and this systemic glucose level is effective and easy to get target glucose level in the patients suffering from hypoglycemia. The link of aggressive management of glucose with the maintenance of blood sugar level provides better and more effective neurological results in patients that are suffering from SAH[13-14]. Just according to the study carried before, our study also could not find any link between admission hyperglycemia and the negative results after variable adjustments that can support the fact that it can be used as a selectable marker for finding the severity of the disease. It was found that there was failure to get the target level of glucose in the participating patients that were suffering from aSAH after they were given treatment of aggressive hyperglycemia management, and it was may be due to poor results and it can be a harmful effect of long term systemic increase in glucose level in the body[15].

The main difficulty that the doctors face related to patients that are suffering from SAH is to determine the maximum blood glucose target that is achieved after the severe brain injury. Hyperglycemia if it prevails for a longer period of time can cause severe negative side effects in patients that promote other destructive processes by up regulating their feedback mechanisms[16]. Therefore, there is a need to control the blood glucose level as soon as it gets out of control. It was proposed that insulin had direct positive effects for the results after SAH, these studies are consistent with the precious data. Lower level of glucose of the cerebral tissue is linked with high peri-ischemic depolarization of cortisol. All these complications lead to poor neurological results. There is evidence that long term hyperglycemia promotes secondary brain damage. As per studies carried out by van den Berghe there is use of intensive insulin therapy; another study also supports this finding. The study was carried out in extremely ill patients that showed mild ICU like symptoms. The other study showed that there was a reduction in morbidity but the mortality rate was not reduced[17-18].

The patients were managed in a proper way with an appropriate diet plan that has all the nutritional elements and is uniform with the needs of the patients so that balanced saline is taken by the patient without the use of dextrose. All these findings suggested that there exists a very variable effect of insulin therapy on different patients. So the impact of the therapy will be different for different patients. The results show that after aneurysmal SAH there are usually high levels of blood glucose reported by patients. There can be many reasons why there is more admission glucose levels and link between hyperglycemia and SAH. The first point is that the hyperglycemia may be caused because of an acute metabolic reaction as the SAH persisted even after the acute phase. The occurrence of such acute phases was also reposted in other cases as well[19].

As per studies after the ischemic stroke, due to infarct expansion the persistent hyperglycemia takes place along with other adverse outcomes. The glucose value after aneurysmal SAH was found to be quite high during fasting. Due to these persistent abnormalities there was a chance of vasospasm and other problems like secondary ischemia[20]. Our study has got some limitations that are very important to be addressed. Although a strict inclusion area was used still the quality of the findings can be varied. There was one issue with intensive insulin treatment that it can lead to harmful effects in the brain tissue so it is not suitable for patients that have neurocritical conditions[21]. As the tissues of the brain are insensitive to insulin's uptake of glucose and its metabolism is driven by supply in humans. Moreover, there is much evidence that the lowering of the level of glucose causes reduction in the glucose level of brain[22].

CONCLUSION

The better an effective use of aggressive glucose management will maintain blood glucose level in the range and will promote better neurological health of the patients' that are suffering from SAH. There are further findings needed to see if there is reduced clinical outcome after the occurrence of aneurysmal SAH and either it had anything to do with hyperglycemia.

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