

Comparison of Various Factors Related to Severity of Ischemic Stroke in Patients with and Without Good Glycemic Control

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Abstract

Background: Stroke medicine is an evolving specialty under the umbrella of neurology. It not only covers the neuropathological impact of stroke but provide holistic care to these patients for early recovery with minimum disability.

Objective: To compare various factors related to severity of ischemic stroke in patients with and without good glycemic control managed at our Neurology/Medicine Department

Material and Methods: In this comparative cross-sectional study, carried out at the Department Neurology/Medicine, Pak Emirates Military Hospital Rawalpindi. From September 2022 to December 2022. Out of 100 patients of acute ischemic stroke suffering from diabetes mellitus was included. Patients of ischemic stroke with confirmed diagnosis on neuroimaging were recruited. Severity of stroke by NHSS classification and size of infarct on CT scan was assessed for all the study participants. Glycosylated hemoglobin was performed on all patients and patients were classed as having glycemic control or not. On the basis of this investigation, stroke severity parameters were compared in groups with and without glycemic control.

Results: In the study. Male were 66 (66%) , while 34 (34%) were female. Mean age of patients of stroke recruited in analysis was 56.31 ±8.18 years. Out of total, 44 (44%) patients had glycemic control while 56 (76.25%) had no glycemic control. Statistical analysis revealed that when comparison was made among two groups, more stroke severity and infarct size of more than 50 ml were seen statistically significantly more in patients who did not have glycemic control (p-value<0.001).

Conclusion: Poor or no glycemic control was seen in almost half of the patients who presented with ischemic stroke. More stroke severity and large size of infarct were seen in patients without glycemic control in our study participants.

Key words: Glycemic control; Ischemic stroke; Mortality; Size; Severity

Cite this article: L Faiqa, Asif, Afsheen. Sohail s, Tahir M,Hussain A. Comparison of various factors related to severity of ischemic stroke in patients with and without good glycemic control, BMC J Med Sci. 2024.5(1): 27-30

Introduction

Patients of stroke are managed in routine in emergency , medical and neurology units and incidence of this potentially lethal condition is on a rise across the globe.¹ Age bracket of patients presenting with stroke has also been changing and it is no more considered as disease of only geriatric age group.²Severity of stroke at presentation and outcome after the management is a complex phenomenon and depends upon number of factors related to patients general health and treatment

Provided at health care facility.³

A lot of health related conditions and metabolic or endocrine disease predispose the individual to develop stroke and stroke related complications.⁴Diabetes Mellitus is a multi-system disorder which affects the human body in number of ways leading to devastating consequences.⁵Patient of diabetes mellitus is at a high risk for developing cerebrovascular accidents but prevention could be done by controlling the blood sugar levels and keeping them in defined range. Studies have clearly demonstrated that poorly controlled diabetes is

Authorship Contribution: ¹⁻⁶Substantial contributions to the conception or design of the work; or the acquisition, data analysis, drafting the work or revising it critically for important intellectual content, Final approval of the version to be published & supervision

Funding Source: none

Conflict of Interest: none

Received: March 29,2024

Accepted: May 6 2024

Published: July 2,2024

more lethal as compared to controlled disease.⁶ Patients of DM developing cerebrovascular accidents have been studied for relationship of glycemic control with severity of stroke parameters. A study published in 2023 highlighted the role of early profile of glycaemic controls in determining stroke type and prognosis. Authors revealed that fasting blood sugar levels determined the type of infarct (lacunar or non-lacunar) and also the early outcome in patients suffering from ischemic stroke.⁷ A systematic review and meta-analysis in 2021 analyzed role of persistent hyperglycaemia in determining mortality after the stroke they concluded that persistent hyperglycaemia predicted high mortality in patients of stroke even in patients who were not suffering from diabetes mellitus.⁸ A neuropathological study of patient dying of stroke established relationship of blood glucose levels with size of infarct in these patients. They revealed that variations in blood glucose did not affect the size of infarct in patients dying of acute ischemic stroke.⁹ Stroke medicine is an evolving specialty under the umbrella of neurology. It not only covers the neuropathological impact of stroke but provide holistic care to these patients for early recovery with minimum disability. A recent local study tried to evaluate the relationship of glycemic control with hemorrhagic transformation of ischemic stroke but authors could not establish any such relationship in their stroke patients.¹⁰ Patients with Diabetes Mellitus who have poor control may be more prone towards complication related to stroke and more severe symptomatology. Limited local data has been available in this regard. We therefore planned this study with the rationale to compare various factors related to severity of ischemic stroke in patients with and without good glycemic control managed at our neurology/medicine department.

Material and Method

This comparative cross-sectional study was conducted at the neurology/medicine department of Pak Emirates Military Hospital Rawalpindi between September 2022 to December 2022. Sample size was calculated by using the World Health Organization sample size calculator. Two groups were used for this calculation. Group-I with no glycemic control as 19.1% and group-II with glycemic control as 77%.¹⁰ Non probability consecutive technique was used to gather the sample for the study. Inclusion criteria: Patients of both genders of age between 18 and 70 years presenting with acute ischemic stroke and suffering from diabetes mellitus were included.

Exclusion criteria: Patients outside above mentioned age bracket or those whose diabetes mellitus status could not be established were not recruited. Patients with hemorrhagic stroke or those with history of brain tumors or any other cancer were excluded from the study. Those who themselves or their families refused to get baseline investigations, CT scan or HBA1c were also not made part of this study. Those who died within three hours of presentation or were shifted to any other hospital due to any reason were excluded as well. Ethical approval (letter no: IH/76004/2/P-2) for the study was obtained from the ethical review board committee. Patients and/or their caregivers were provided with a detailed description of the study and were inducted into the study after written informed consent. Presence of ischemic Stroke was confirmed by CT scan brain after detailed initial clinical evaluation. Confirmation of diabetes mellitus was done by asking from patient, primary caregivers or seeing the medical record. All baseline investigations were carried out within first three hours of arrival at the hospital and diagnosis of ischemic stroke. Glycemic control was assessed on the basis of HbA1c levels carried out at our own hospital laboratory with a cutoff of ^{10, 11, 12} Size of infarct was measured on diffusion weighted image (DWI) of CT scan and cut off of 50ml was used as cut off.¹³ Severity of stroke was determined by the clinical team on the basis of NHSS classification.¹⁴

Characteristics of participants and the distribution of the patients with respect to glycaemic control were described by using the descriptive statistics. Qualitative and quantitative variables were described as n (%) and mean \pm SD respectively. Comparison of various clinical and radiological variables between the two study groups was determined by using the Pearson chi-square test keeping the p-values \leq 0.05 as significant. SPSS.24.0 was used for all data analysis required for study.

Results

Out of 100 patients of acute ischemic stroke suffering from diabetes mellitus included in the study, 66 (66%) were male while 34 (34%) were female. In Table-I, summary of basic characteristics of stroke patients recruited in the study has been mentioned. Mean age of patients of stroke recruited in analysis was 56.31 ± 8.18 years. Out of total, 44 (44%) patients had glycemic control while 56 (76.25%) had no glycemic control. In Table-II results of statistical analysis had been summarized. It was revealed that when comparison was made among two groups, more stroke severity and infarct size of more than 50 ml were seen statistically

significantly more in patients who did not have glycemic control (p-value<0.001).

Study parameters	n(%)
Age (years) Mean + SD	56.31 ±8.18 years
Gender	
Male	66 (66%)
Female	34 (34%)
Mortality in two weeks	
Yes	02 (2%)
No	98 (98%)
Severity of stroke	
Mild	62 (62%)
Mild to moderately severe	14 (14%)
Severe	15 (15%)
Very severe	09 (9%)
Glycemic control	
No	56 (56%)
Yes	44 (44%)

Clinical and radiological parameters	Glycemic control	No Glycemic control	p-value
Size of Infarct <50 ml 50 ml or more	43 (97.7%) 01 (2.3%)	34 (60.7%) 22 (39.3%)	<0.001
Stroke Severity Mild Mild to moderately severe Severe Very severe	38 (86.3%) 04 (9.1%) 01 (2.2%) 01 (2.2%)	24 (42.8%) 10 (17.8%) 14 (25%) 08 (14.3%)	<0.001
Mortality at two weeks No Yes	44 (100%) 00 (00%)	54 (96.4%) 02 (3.6%)	0.125

Discussion

Poor glycaemic control was seen in significant number of patients who presented with acute ischemic stroke at our hospital. We included severity parameters both from radiological and clinical perspective and found out that

patients with poor glycemic control have more severity of illness. Diabetes especially if poor controlled affects human body in number of ways and prone the patient to multiple complication. Stroke itself could be one complication of diabetes but poorly controlled diabetes may be more potentially lethal condition as compared to controlled diabetes. Levels of prevention may vary according to the stage of illness patient is having and clinical team could emphasize on relevant parameters. We conducted this study with the aim to compare various factors related to severity of ischemic stroke in patients with and without good glycemic control managed at our neurology/medicine department.

Patients of subcortical infarction were assessed for difference in size of infarction among patients with and without diabetes mellitus. They did not find any significant difference in size of infarct in the two groups.15Our study groups were slightly different as we made two groups within patients of diabetes mellitus, with and without glycemic control. In our study patients without diabetes control were compared to patients with diabetic control and we found out that most of the patients without diabetes control had infarct size of more than 50ml.

Impact of glycemic control on infarct size and clinical outcome parameters among patients managed for stroke was studied and it was revealed that in patients suffering from diabetes, poor diabetes control and persistent hyperglycemia was associated with larger infarct size and poor clinical outcome.16Our results supported the results generated by Toni et al. as our patients without glycemic control were found more at risk of larger infarct volume and more severity of stroke. A meta-analysis regarding role of glycemic control in predicting early mortality in patients managed for acute ischemic stroke concluded that high glycemic variation early after the stroke was predictor of mortality in these patients.17Among our study participants, only two died in first week after the acute stroke and both of them were among the group which represented patients with no glycemic control.

Patients of diabetes presenting with stroke were Assessed for relationship of acute to chronic glycemic ratio with severity of stroke in a study published in 2022. Authors came up with the conclusion that this ration predicted severity better than acute glucose levels.18We studied HbA1c levels and found out that variation in these levels and poor glycemic control is associated with more severity of stroke.

Study limitations

Stroke severity and mortality are the parameters which may get affected by number of health related matters prior to occurrence of stroke. We cannot conclude with

this study design that severity and mortality was due to poor glycemic control. In future, if longitudinal study design is adopted instead of cross-sectional, better results may be achieved in this regard.

Conclusion

Poor or no glycemic control was seen in almost half of the patients who presented with ischemic stroke. More stroke severity and large size of infarct were seen in patients without glycemic control in our study participants.. Conflict of interest

None

Acknowledgment

None

References

1. Khan MI, Khan JI, Ahmed SI, Ali S. Retracted: The epidemiology of stroke In a developing country (Pakistan). *Pakistan Journal of Neurological Sciences (PJNS)*. 2019;13(3):30-44.
2. Venketasubramanian N, Yoon BW, Pandian J, Navarro JC. Stroke epidemiology in south, east, and south-east asia: A review. *Journal of stroke*. 2017 Sep;19(3):286.
3. Saengsuwan J, Suangpho P, Tiangkao S. Knowledge of stroke risk factors and warning signs in patients with recurrent stroke or recurrent transient ischaemic attack in Thailand. *Neurology research international*. 2017;2017(1):1-7.
4. Noor A, Bennett G, Arndt S, Vidal G. Comorbidities related to clinical outcomes in patients with acute ischemic stroke undergoing mechanical thrombectomy: review of literature and experience at a single comprehensive stroke center. *Ochsner Journal*. 2019 Mar 20;19(1):13-6.
5. Tomic D, Shaw JE, Magliano DJ. The burden and risks of emerging complications of diabetes mellitus. *Nature Reviews Endocrinology*. 2022 Sep;18(9):525-39.
6. Dimore AL, Edosa ZK, Mitiku AA. Glycemic control and diabetes complications among adult type 2 diabetic patients at public hospitals in Hadiya zone, Southern Ethiopia. *Plos one*. 2023 Mar 23;18(3):e0282962.
7. Forti P, Maioli F. The Prognostic Significance of Early Glycemic Profile in Acute Ischemic Stroke Depends on Stroke Subtype. *Journal of Clinical Medicine*. 2023 Feb 23;12(5):1794.
8. Hou D, Zhong P, Ye X, Wu D. Persistent hyperglycemia is a useful glycemic pattern to predict stroke mortality: a systematic review and meta-analysis. *BMC neurology*. 2021 Dec;21:1-3.
9. Cambon H, Derouesne C, Yelnik A, Duyckaerts C, Hauw JJ. Effect of diabetes mellitus and blood glucose on the size of cerebral infarction and causes of death. Neuropathological study of 77 cases of infarction in the sylvian artery area. *Revue Neurologique*. 1991 Jan 1;147(11):727-34..
10. Afzal B, Ali SA, Jamil B. Association between Raised HbA1c Levels and Hemorrhagic Transformation in Patients With Ischemic Stroke. *Cureus*. 2021 Nov 27;13(11).
11. Basit A, Fawwad A, Abdul Basit K, Waris N, Tahir B, Siddiqui IA; NDSP members. Glycated hemoglobin (HbA1c) as diagnostic criteria for diabetes: the optimal cut-off points values for the Pakistani population; a study from second National Diabetes Survey of Pakistan (NDSP) 2016-2017. *BMJ Open Diabetes Res Care*. 2020 May;8(1):e001058. doi: 10.1136/bmjdr-2019-001058. PMID: 32423963; PMCID: PMC7239497.
12. Duong KN, Tan CJ, Rattanasiri S, Thakkinstian A, Anothaisintawee T, Chaiyakunapruk N. Comparison of diagnostic accuracy for diabetes diagnosis: A systematic review and network meta-analysis. *Frontiers in Medicine*. 2023 Jan 24;10:1016381..
13. Gauriau R, Bizzo BC, Comeau DS, Hillis JM, Bridge CP, Chin JK, Pawar J, Pourvaziri A, Sestic I, Sharaf E, Cao J. Head CT deep learning model is highly accurate for early infarct estimation. *Scientific Reports*. 2023 Jan 5;13(1):189.
14. Koton S, Patole S, Carlson JM, Haight T, Johansen M, Schneider AL, Pike JR, Gottesman RF, Coresh J. Methods for stroke severity assessment by chart review in the Atherosclerosis Risk in Communities study. *Scientific reports*. 2022 Jul 19;12(1):12338.
15. Mankovsky BN, Patrick JT, Metzger BE, Saver JL. The size of subcortical ischemic infarction in patients with and without diabetes mellitus. *Clinical neurology and neurosurgery*. 1996 May 1;98(2):137-41.
16. Toni D, De Michele M, Fiorelli M, Bastianello S, Camerlingo M, Sacchetti ML, Argentino C, Fieschi C. Influence of hyperglycaemia on infarct size and clinical outcome of acute ischemic stroke patients with intracranial arterial occlusion. *Journal of the neurological sciences*. 1994 May 1;123(1-2):129-33.
17. Lin J, Cai C, Xie Y, Yi L. Acute glycemic variability and mortality of patients with acute stroke: a meta-analysis. *Diabetology & Metabolic Syndrome*. 2022 Dec;14(1):1-2.
18. Liu C, Zhu XP, Zhu XW, Jiang YM, Xi GJ, Xu L. The acute-to-chronic glycemic ratio correlates with the severity of illness at admission in patients with diabetes experiencing acute ischemic stroke. *Frontiers in Neurology*. 2022 Nov 7;13:938612.