

Correlation between short-term blood pressure variability and functional outcome in cases of acute ischaemic strokes.

¹Dr. Karan Singh, Junior Resident, Department of General Medicine, BVDU and MCH, Pune, Maharashtra, India.

²Dr. Col V.P. Singh, Professor, Department of General Medicine, BVDU and MCH, Pune, Maharashtra, India.

³Dr. Shankar Prasad Gorthi, Professor, Department of Neurology, BVDU and MCH, Pune, Maharashtra, India.

⁴Dr. Meghana Nadagoudar, Junior Resident, Department of General Medicine, BVDU and MCH, Pune, Maharashtra, India.

⁵Dr. Siri Chandana Komalla, Junior Resident, Department of General Medicine, BVDU and MCH, Pune, Maharashtra, India.

Corresponding Author: Dr. Karan Singh, Junior Resident, Department of General Medicine, BVDU and MCH, Pune, Maharashtra, India.

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Abstract

Background: A Stroke, also known as a Cerebrovascular Accident, is a heterogeneous condition characterized by an abrupt onset neurologic deficit caused by a focal vascular cause. Hypertension increases the risk of Stroke manifold. Acute Hypertensive response is also seen post a Cerebrovascular accident in the acute setting. Admission Systolic Blood pressure also serves as a predictor for infarct volume. Blood Pressure variability also seems to have an effect on the functional outcome in these outcomes. This study aims to investigate and determine whether there is an association between mean Systolic blood pressure during

the first 72 hours of admission and functional outcome in Acute Ischaemic Stroke patients.

Methods: This study is a prospective observational study done at a tertiary care hospital. Diagnosed cases of Acute Ischaemic Strokes were enrolled in the study. Blood pressure was monitored closely post admission and Blood pressure variability was measured. This was then correlated with the functional outcome in such cases. The duration of the study was 2 years.

Results: A total of 122 patients with acute ischaemic stroke were included in the study. The mean age of the patients was 59.48 ± 14.28 years. We found significant ($p < 0.001$) association between favorable outcome and

the group of patients in whom Mean Systolic blood pressure was within the range of 140-180 mm Hg during the first 72 hours of admission as opposed to the groups in whom Mean systolic blood pressure was outside this range.

Conclusion: Finding a Correlation between Short Term Blood Pressure Variability and outcome in cases of Acute Ischemic Strokes will help us in reducing Morbidity and Mortality in cases of Acute Ischemic Strokes.

Keywords: Cerebrovascular accident, Acute Ischaemic Stroke, Blood pressure, Blood pressure variability.

Introduction

Stroke is the most common cause of death and disability in the world. It's a disease with a lot of comorbidities and a coagulation problem. [1] Hypertension increases the risk of having a stroke manifold. Hypertensive Response is seen in acute setting in 60 percent of both Ischaemic and Haemorrhagic stroke cases within the first 24 hours of the stroke. The Blood Pressure is at its highest at the time of admission and gradually decreases over time as the Stroke progresses. [2]

This is a self-limiting response that is linked to a poor outcome. Small lumen diameter and increased Vaso constriction of cerebral arteries and arterioles in acute stroke can increase the perfusion deficit and impair collateral perfusion, resulting in increased infarction and a poor outcome. As a result, admission systolic blood pressure is a predictor of infarct volume. [3]

Myogenic tone in the ipsilateral cerebral hemisphere controls cerebral autoregulation of blood pressure. Brain autoregulates cerebral blood pressure between 60-160 mm hg of Systolic blood pressure during a perfusion fluctuation phase. The cerebral blood flow becomes dependent on arterial pressure beyond this range. Due to

diminished penumbra and poor collaterals, cerebral infarction is larger in hypertensive patients. Furthermore, large fluctuations in blood pressure are linked to a higher risk of death after 90 days. Blood pressure variability (BPV) is the variation in blood pressure over time. [4]

In Acute Strokes, systolic BP variability (not diastolic) for the first 24-48 hours is linked to poor functional outcomes. [5]

The main conundrum in Acute Stroke Management is whether to treat hypertension aggressively or not - on a long-term basis.

Symptomatic Haemorrhage (Haemorrhagic Transformation of Infarct), Cerebral Edema, and poor recanalization of the infarct-related artery are all symptoms of high blood pressure. Hypo tension, on the other hand, impairs cerebral circulation and jeopardizes penumbra mid supply. In the days following an Ischaemic Stroke, increased Systolic Blood Pressure Variability is linked to a worse outcome. [6] Extremes of blood pressure should therefore be avoided.

In a retrospective analysis of the International Stroke Trial, patients presenting with an average Systolic Blood Pressure of 140 - 180 mmHg in the acute phase of ischaemic strokes had the lowest likelihood of death or dependency at 6 months.

In the initial hours after a stroke, there is a U-shaped relationship between stroke outcome and blood pressure. [7] Systolic Blood pressure between 140- and 180-mm Hg, there is the lowest risk of a poor outcome. There is a 16 percent increase in the risk of death in 14 days for every 10 mm Hg drop in systolic blood pressure outside of this range and a 5% increased risk of dependency, as well as a 5% increased risk of death within 14 days for every 10 mm Hg increase in Systolic Blood Pressure beyond this range. [8]

As a result, we proposed to investigate and determine whether there is an association between mean Systolic blood pressure during the first 72 hours of admission and functional outcome in Acute Ischaemic Stroke patients.

Material and methods

- A Prospective Observational study was conducted in a tertiary care hospital in Maharashtra, India. All patients of Acute Ischaemic Stroke admitted in ICUs and who fulfill the inclusion criteria were selected for the study.

Inclusion criteria

1. Patients above 18 years of age who have been diagnosed as Acute Ischaemic Stroke.
2. Patients admitted in ICU in the hospital.

Exclusion criteria

1. Patients with Stroke due to other causes like – Haemorrhage, Infection, and Malignancies.
2. Patients with admission time NIH Stroke Scale Score Of more than 20 (21-42 – Severe Stroke Cases) were excluded from the study.
3. Patients who do not give consent for the study.

Methodology

After ethical committee clearance, 122 diagnosed cases of Acute Ischaemic Stroke admitted in the Intensive Care Units and who fulfilled the inclusion criteria were selected. Detailed clinical history of patients was taken and 6 hourly blood pressure was measured during the first 72 hours of admission.

The Blood Pressure Variability for the first 72 hours was measured in terms of Mean and Standard Deviation. Stroke Severity on admission and discharge was measured using the NIH Stroke Scale.

On the 30th day of admission, the Functional Status of these patients was be measured by using the Modified Rankin Scale.

Statistical analysis

The above Data was then be compiled and Chi Square Tests was used to find out if any correlation exists between Blood Pressure Variability and Functional Outcome in cases of Acute Ischaemic Strokes.

Results

Demographic details

A total of 122 patients with acute ischaemic stroke were included in the study. the mean age of the patient was 59.48 ± 14.28 years, most (55 (45.1%) of the patient belong to each group category of 61 to 80 years, followed by 46 (37.7%) between 40 to 60 years, 14 (11.5%) were ≤ 40 years and only 7 (5.7%) where about the age of 80. (Table 1) out of total 122, 87 (71.312%) patients were males and 35 (28.69%) were females with male to female ratio of 2.49:1. (Table 2)

Table 1: distribution of patients as per age group

Age category	Frequency	Percent
≤ 40	14	11.5
40-60	46	37.7
61-80	55	45.1
> 80	7	5.7
Total	122	100.0

Table 2: Gender distribution

Gender	Frequency	Percentage
Male	87	71.31
Female	35	28.69

Out of the total 122 patients included, there were 92 patients with underlying comorbidities. Hypertension was present in 64 (52.5%) and diabetes was present in 44 (36.1%) patients with acute ischaemic stroke. (Table 3 and 4)

Table 3: Distribution of patient as per presence or absence of comorbidities

Co-morbidities	Frequency	Percent
Yes	92	75.4
No	30	24.6
Total	122	100.0

Table 4: distribution of comorbidities

	Frequency	Percent
Diabetes mellitus	44	36.1
Hypertension	64	52.5

The systolic blood pressure was measured in all participated acute ischaemic stroke patients and shown in table number 5 also presented graphically. Out of 122 majority (78 (63.9%)) of patients' blood pressure was in the range of 140 to 180 mmHg, followed by 34 (27.9%) patients with systolic blood pressure of <140 mmHg and 10 (8.2%) patients having systolic blood pressure of >180 mmHg.

Table 5: distribution of patients according to range of SBP

Range of SBP (mm HG)	Frequency	Percent
<140	34	27.9
140-180	78	63.9
>180	10	8.2
Total	122	100.0

The patients were distributed according to the outcome as good or poor (As per Modified Rankin Scale – Good outcomes had a mRS of less than 3 while poor outcomes had an mRS of more than or equal to 3) and presented graphically and in table number 6. Good outcome was reported among 93 of 122 (76.2%) patients while poor outcome was reported in 29 (23.8%) of patients with acute ischaemic stroke.

Table 6: distribution of patient as per outcome

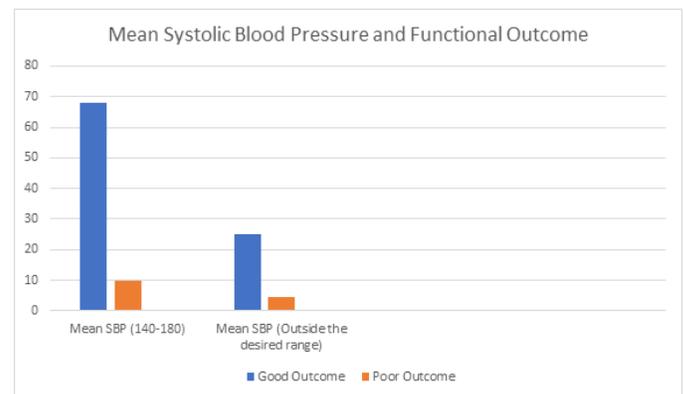
Outcome	Frequency	Percent
Good	93	76.2
Poor	29	23.8
Total	122	100.0

We found significant (p- <0.001) association between favorable outcome and the group of patients in whom Mean Systolic blood pressure was within the range of 140-180 mm Hg during the first 72 hours of admission as opposed to the groups in whom Mean systolic blood pressure was outside this range.

Table 7:

	Range	Good Outcome	Poor Outcome	p-value
Range of SBP	<140	22	12	<0.001
	>180	3	7	
	140-180	68	10	

Graph 1:



Discussion

The second most common cause of death worldwide is a stroke. High rates of morbidity, mortality, and disability are its defining characteristics. Stroke is currently a significant global public health issue that places a significant financial burden on families and society. The most frequent type of stroke, accounting for between

60% and 80% of all cases, is an acute ischaemic stroke (AIS). [9, 10]

Blood pressure variability (BPV), rather than absolute systolic (SBP) and diastolic (DBP) blood pressure levels, is a separate predictor of stroke outcome. While the prognostic significance of DBP variability is still debatable, this association is stronger with SBP variability. [11,12]

The present study was done to assess the effect of short-term blood pressure variability on functional outcome in patients with acute ischaemic stroke, and to determine the association between Systolic mean blood pressure over the period of the first 72 hours of admission and functional outcome. A total of 122 patients with acute ischaemic stroke were included in the study. The patient's mean age was 59.48 ± 14.28 years, with the majority (55, or 45.1%) falling into the age range of 61 to 80 years. There were 87 (71.312%) males and 35 (28.69%) females among the 122 patients, for a male-to-female ratio of 2.49:1.

On admission, the median NIHSS score was 4 (IQ range: 2-8), with a mean of 5.45 ± 4.04 . A total 122 patients included, there were 92 patients with some comorbidities; hypertension was present in 64 (52.5%) and diabetes was present in 44 (36.1%) patients with acute ischaemic stroke.

Yang C. [13] et al. reported the same fundamental characteristics among 367 eligible patients with an overall mean age of 66.6 years, a female prevalence of 34.3 percent, and a presence of diabetes in 99 patients. The NIHSS score at admission was 7, with an interquartile range of 3 to 14.

According to a study by Zhang Y [14] et al, the majority of the patients, 180 out of 542, were under the age of 70, and there was a male predominance. This study's male to

female ratio was also 1.75:1, which is similar to the previous studies. Out of 542 patients, 318 (58.67%) and 115 (21.22%) had a history of hypertension and diabetes, respectively. They also disclosed a history of CHD, atrial fibrillation, and a previous stroke in addition to these two comorbid conditions. In their study, 407 patients (75.19%) had an admission NIHSS score of 5 or lower.

The results of this study weigh in BPV as a target therapeutic risk factor and have significant ramifications for how acute ischaemic stroke patients are managed. Our findings show that a higher risk of unfavorable outcomes is associated with increased SBP variability up to 72 hours after admission. The values are slightly lower than those reported by Thatikonda N. [15] et al. and Tziomalos K. [16] et al., who reported that 36.5 percent and 39.5 percent of patients had poor outcomes, respectively, according to the mRS score we reported, which showed 93 (76.2 percent) patients with good outcomes and 29 (23.8 percent) patients with poor outcomes.

The mechanism underlying this association is still unknown, though. Although it is true that changes in blood pressure contribute to tissue ischaemia and lesion expansion, an inverse causality can also be proposed given that severe strokes cause greater autonomic dysfunction and, consequently, higher blood pressure values (BPV). [17]

Pedro T. [18] et al. also found unadjusted associations between SBP variability and poor functional outcomes at all time points.

We found a significant relationship between favorable outcome if mean of Systolic blood pressure was within the range of 140-180 mm hg during the first 72 hours of

admission as opposed to the groups where Mean SBP was outside this range of 140-180 mm Hg.

Similar to the current study, Ahmed et al [19] in a retrospective analysis of the Safe Implementation of Thrombolysis in Stroke–International Stroke Thrombolysis Register (SITS-ISTR), found a U-shaped Association with mortality and dependence at 3 months. The best 3-month outcome was in patients with mean systolic BP levels of between 140 and 150 mmHg.

Conclusion

A significant relationship was found between favourable outcome if mean of Systolic blood pressure was within the range of 140-180 mm hg during the first 72 hours of admission as opposed to the groups where Mean SBP was outside this range of 140-180 mm Hg.

Further studies with larger subjects are needed in order to find out if these findings hold true in larger population groups as establishing this relation will help us in formulating Blood pressure control strategies in such cases and ultimately help in reducing the morbidity and mortalities in cases of Acute Ischaemic Strokes.

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