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Original Article

Impact of blood pressure on clinical outcome of acute ischemic stroke over two (02) months in a tertiary care hospital of Bangladesh

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Abstract:

Background: *Stroke is a familiar medical emergency and is one of the notable causes of death in Bangladesh.*

Objective: *To determine the impact of systolic blood pressure (SBP) on outcomes of the patient with acute ischemic stroke.*

Materials and methods: This prospective observational study was conducted in Dhaka Medical College Hospital from August 2015 to February 2016 with 100 participants admitted to medicine ward with ischemic stroke. SBP was measured and Modified Rankin's scale (MRs) was calculated. Outcomes at discharge and in 2nd month were evaluated by MRs and observed in relation to SBP.

Results: *58% were found to be dependency group, followed by 27% and 15% were in good outcome group and dead respectively within 7 days. 37% were found to be in good outcome group in the 2nd month. 31% were in dependency group and 32% died at the end of 2 months. The mean SBP was 158.40 mmHg ranging from 100 mmHg to 230 mmHg. Mean SBP of good outcome at discharge and 2nd month were 144.63 (±21.48) and 145.68 (±22.05) respectively. Mean SBP was higher (p-value <0.05) in death and dependency groups than that of good outcome within 7 days and in 2nd month. The lowest frequency of death within 7 days (1%) and at 2 months (2%) occurred in patients with baseline SBP of 140-159 mmHg and below or above this range frequency of death was increased in both situations. A U-shaped interrelation was observed between admission SBP and death.*

Conclusion: *Both high and low SBP were associated with poor outcomes in patients with ischemic stroke over 2 months.*

Keywords: *systolic blood pressure, Ischemic stroke, outcome.*

Introduction:

Stroke is a common medical emergency. The incidence rises steeply with age and in many lower and middle-income countries.

World Health Organization (WHO) ranks Bangladesh's mortality rate because of stroke as number 84 in the World. The reported prevalence of stroke is 0.3% in Bangladesh.[1] Ischemic stroke was found to be the top cause of emergency admission in the medicine ward of Dhaka Medical College Hospital and constituted 8-9% of the total patient in the ward.[2]5.8% of the admitted patients were diagnosed as stroke and hypertension is the main cause of ischemic stroke and hemorrhagic stroke in BIRDEM Hospital, Bangladesh.[3]The high number of disability-adjusted life years lost due to stroke (485 per 10000 people) which very badly affects Bangladesh's economy.[4]

There are several risk factors of stroke, some are non-modifiable and some are modifiable. Hypertension is one of the most common and important risk factors for the development of ischemic stroke. Post-stroke blood pressure (BP) is high in most patients with acute ischemic stroke. This hypertensive response is transient and the BP spontaneously decreases with time.[5-8] High BP may increase the risk of cerebral edema and hemorrhagic transformation.[9]

There is controversy in lowering BP in the acute phase of stroke.[10,11] Several observational studies have reported an interconnection between baseline systolic blood pressure (SBP) and short- and long-term outcome.[12-14] A large decline in SBP within 24 hours of stroke is associated with poor outcome.[15] Interestingly, there is a J- or U-shaped association between the post-stroke BP and the clinical outcomes.[12,14, 16,17]

The results of relationship between blood pressure and clinical outcome among patients with acute ischemic stroke are different in previous studies. The motivation of the study was to perform a prospective investigation on the blood pressure in acute stage and clinical outcomes in patients with acute ischemic stroke. This study may guide physicians to take appropriate measures in preventing different complications of stroke.

Methodology and materials:

This prospective observational study was carried out at the department of Medicine, Dhaka Medical College Hospital, Dhaka for the period of six months from August 2015 to February 2016.

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All Patients aged more than 18 years, admitted to Dhaka Medical College Hospital under the Medicine department with symptoms and signs of stroke and diagnosed as ischemic stroke by imaging (CT scan of head showing infarction) after obtaining informed written consent were included in the study. Patients having co-morbid conditions like Diabetes, Heart failure and patients suffering from transient ischemic attack (TIA) were excluded from the study. The study was not randomized. Sampling was purposive.

Operational Definition:

Modified Rankin's Scale (MRs) [18]

The scale scores from 0-6, starting from perfect health without symptoms to death.

Score	Description
0	No symptoms
1	No remarkable disability in spite of symptoms; able to carry out all regular duties and activities
2	Slight disability; unable to carry out all previous activities, but able to take care of own affairs without assistance
3	Moderate disability; requiring some help, but capable to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead [18]

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Status at discharge

- It is defined by good outcome, dependency and death on basis of MRs

Good outcome

- MRs < 3

Dependency

- MRs ≥ 3

Procedure of data collection

After the arrival suspected stroke patient was seen by the duty doctor of the corresponding medicine unit. Then the study physician was informed and immediately attended the patient and examined the patient thoroughly with special attention to nervous system. The primary outcomes were good outcome and dependency at discharge or death within 7 days and death or dependency at 2 months. All data were collected by using a preformed data sheet. A single baseline measurement of systolic blood pressure was recorded immediately. The Patients were monitored after hospital admission and the occurrence of clinical events were recorded over 7 days. Follow up at 2ndmonth was performed. All the outcomes were assessed by Modified Rankin's scale.

Laboratory tests

All participants were advised for routine laboratory investigations for acute ischemic stroke such as CT scan of head, ECG, serum creatinine, blood glucose and serum electrolytes. Study patients bared the cost of the relevant investigations as these tests are routinely done in the ward as part of treatment.

Ethical measures

The research protocol was approved by the Dhaka Medical College Ethical Review committee.

Methods of data processing and statistical analysis

Data were scrutinized, verified for consistency and edited for final result. After editing and coding, the coded data were directly entered into the computer by using SPSS software. Data analysis was executed using the statistical package for social sciences (SPSS) version 20.0 for Windows. The result was presented in mean, standard deviation (SD) and percentages. Two sample z-tests were used to examine the association between admission SBP and clinical outcomes. A p-value less than 0.05 were considered as significant.

Results:

Total 100 patients with acute ischemic stroke fulfilling the inclusion criteria were included in this study. The mean age was found 58.06 (±15.29) years in male and 57.51 (±14.26) years in female. Among the patients, 49% were male and 51% were female.

Majority (29.0%) of the respondents were found in the SBP group of ≥ 180 mm of Hg. The lowest frequency (1%) of death and highest frequency (12%) good outcome occurred in patients with baseline SBP of 140-159 mm Hg and below or

above this range frequency of death was increased and that of good outcome was decreased within 7 days.

Table I: Baseline demographic and clinical characteristics of the study subjects (N=100)

Characteristic	Mean ± SD or Number (%)	Range
Age Group (year)	<51	27 (27)
	51-60	34 (34)
	61-70	18 (18)
	>70	21 (21)
Age in year	57.78±14.70	25-89
Sex		
	Male	49 (49)
	Female	51 (51)
Systolic Blood Pressure (SBP) in mm of Hg	158.40±31.65	100-230

Table II: Modified Rankin's scale(MRs) of the study subjects on enrolment (N=100)

Modified Rankin's scale	at admission	Within 7 days or at 2 months at discharge	
	Number (%)	Number (%)	Number (%)
MRs-0	00	05	12
MRs-1	01	10	10
MRs-2	04	12	15
MRs-3	15	14	11
MRs-4	47	26	13
MRs-5	33	18	07
Total	100	85	68

Table II shows on admission, most of the patients (95%) presented with moderate to severe disability at admission (MRs≥3).

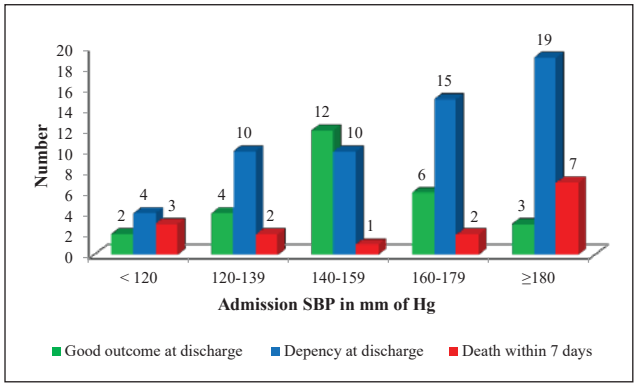

Figure-1: Blood pressure and Outcome of the study subjects within 7 days

Figure-1 shows total 15 (15%) patients died in the hospital within 7 days. Majority (58.0%) of the respondents was found to be dependency group at discharge and 27 (27%) patients were found to be in good outcome group during discharge at 7 days

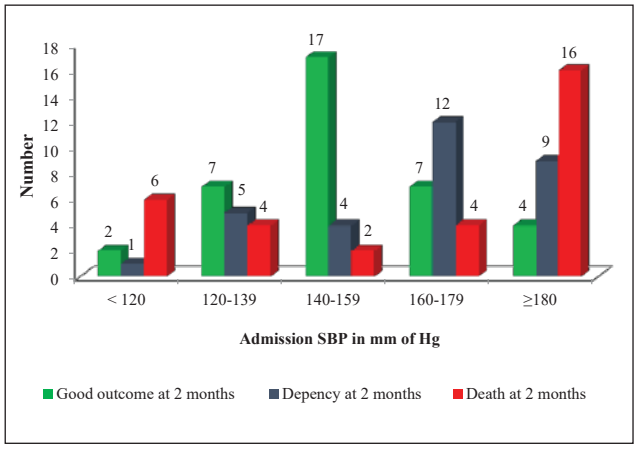

Figure-2: Blood pressure and Outcome of the study subjects at 2 months

Figure-2 shows most of the patients were found to be in good outcome group (37%) at 2 months. Total 31(31%) patients were in dependency group and 32 (32%) patients were died at the end of 2 months.

Majority (29.0%) of the respondents were found in the SBP group of ≥ 180 mm of Hg. The lowest frequency (2%) of death and highest frequency (17%) good outcome occurred in patients with baseline SBP of 140-159 mm Hg and below or above this range frequency of death was increased and that of good outcome was decreased at 2 months.

Table III: Admission SBP and outcome group

Outcome groups	Number of patients	Admission SBP Mean± SD	P-value
At discharge or within 7 days			
Discharge	85	156.41±28.19	
Good	27	144.63±21.48	
Dependency	58	161.90±29.41	<0.05
Death	15	169.67±46.42	<0.05
At 2 months			
Good	37	145.68±22.05	
Dependency	31	164.84±24.61	<0.05
Death (7^{th} day-2 months)	17	164.41±38.36	> 0.05
Death (total)	32	166.88±41.71	< 0.05

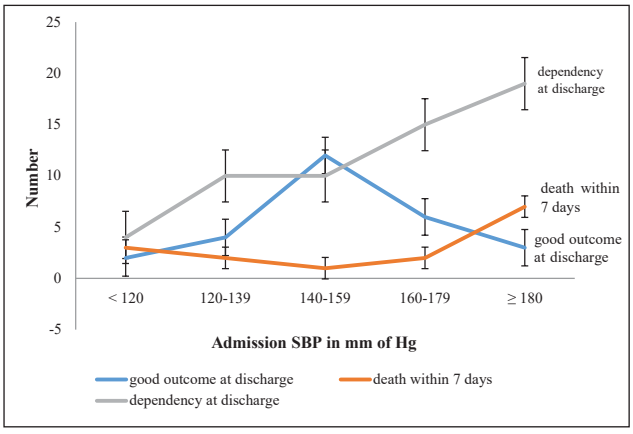

Figure-3**:** Relations of outcomes with admission SBP within 7 days

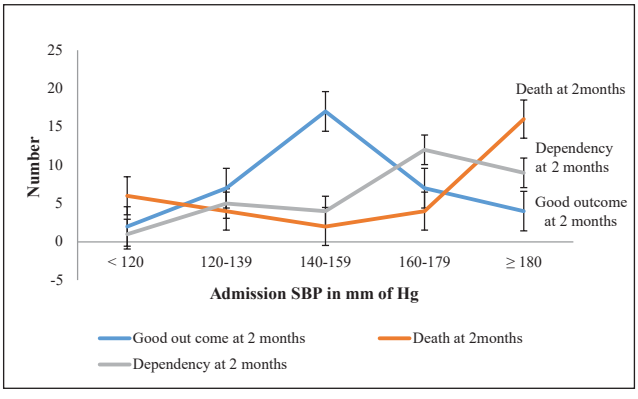

Figure-4: Relation of outcomes with admission SBP at 2 months

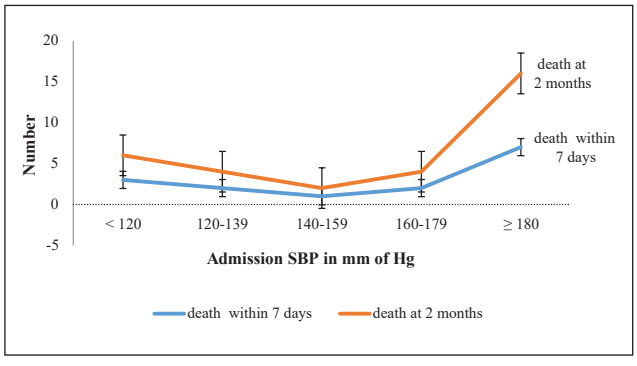

Figure-5:Relation of Death group with admission SBP

Discussion:

In this study total 100 Patients with acute ischemic stroke were included as study subjects to explore the relationship between admission systolic blood pressure with outcomes of patients with acute ischemic stroke, subsequent clinical events over 7 days, and functional outcome at 2 months in same patients.

The mean age was 57.78 (±14.70) years with range from 25 to 89 years. Majority (34.0%) of the respondents was found in the age group of 51-60 years. The mean age was found 58.06 (±15.29) years in male and 57.51 (±14.26) years in female. Some studies[19-21] have shown that the highest age of incidence of stroke was between 6th to 7th decades. The highest incidence was found at or above the age of 85 years in a previous study.[22] This discrepancy with the present study is that a small portion of the population of Bangladesh survives up to that age.

In this study, 49% were male and 51% were female and ratio was 1:1.04 which defers with several studies where stroke was higher among male than female.[23,24] Still others have reported that the sex differences no longer exist at older ages.[25,26] In the socio economic and cultural context of Bangladesh, female are often neglected and they have less opportunity for cardiovascular risk assessment than male.

Several studies have reported the high post stroke blood pressure in most patients with acute ischemic stroke. Such a hypertensive response is transient and the blood pressure spontaneously decreases with time.[5-8]Similar result was seen in present study. In present study, Majority (29.0%) of the respondents were found in the SBP of ≥ 180 mm of Hg.

15% patients died in the hospital within 7 days. However the hospital death rate was lower than the rate found in an international study where death rate was 19%.[28] This discrepancy with the present study is that a good proportion of patients who was severely disabled and suffering from co morbidity like MI, heart failure, end stage renal diseases was excluded from the study. Due to high patient load in DMCH, the patients are usually discharged as early as possible. For this reason hospital death rate was low. Thirty two percent were dead at the end of 2 months in the study, a fact also established by others.[27] Thirty one percent patients were in dependency group at the end of 2 months which coincides with that of Siddique et al.[28]

The means of admission systolic blood pressure were measured in different outcome groups. It was found that mean systolic blood pressure was significantly higher in death and dependency groups within 7 days and at 2 months than that of good outcome within 7 days and at 2 months. This study showed that association of elevated admission systolic blood pressure with dependency and death groups was significant (p- value<0.05). These findings are consistent in some of the previous studies.[12, 29-33]

The lowest frequency of death within 7 days (1%) and at 2 months (2%) occurred in patients with baseline SBP of 140-159 mm Hg and below or above this range frequency of death was increased in both situations. In fact a U-shaped relationship was found between admission SBP and both death within 7 days and death at 2 months. Interestingly highest frequency good outcome within 7 days (12%) and at 2 months (17%) also occurred in patients with baseline SBP of 140-159 mm Hg and below or above this range frequency of good outcome was decreased in both cases.

Limitations of the study: This was a prospective observational study with a small sample size. So the findings of this study may not reflect the exact scenarios of whole country.

Conclusion:

Both high blood pressure and low blood pressure were associated with higher death and dependency at discharge and at 2 months in patients with acute ischemic stroke in this study**.** Stroke patients may be managed in dedicated stroke ward by dedicated stroke team. Most of the patients were found disabled so rehabilitation facilities may be strengthen. It is difficult to reach definitive conclusion due to various limitations. Further large scale long term studies may be recommended for establishment of the effect of blood pressure on patient with acute stroke.

Funding:

Study patients bared the cost of the relevant investigations as these tests are routinely done in the ward as part of treatment. The researchers bore other expenses.

Conflict of interest:

There is no conflict of interest to any of the authors of the article.

References:

1. Mohammad QD, Habib M, Hoque A, Alam B, Haque B, Hossain S, et al. Prevalence of stroke above forty years. Mymensingh Med J 2011 Oct;20(4): 640-4
2. Disease profile, 2013 In: year book 2013.Dhaka; Department of Medicine, Dhaka Medical College and Hospital 2014:35-39
3. Siddique MA, Nur Z, Mahbub MS, Alam MB and Miah MT. Clinical presentation and epidemiology of stroke: a study of 100 cases. J Medicine 2009;10:86-89
4. Islam M, Moniruzzaman M, Khalil M, Basri R, Alam MK, Loo KW, et al. Burden of stroke in Bangladesh. International Journal of Stroke 2012;10:1747-49.
5. Morfi L, Schwartz RS, Poulos R, Howes LG. Blood pressure changes in acute cerebral infarction and hemorrhage. *Stroke*. 1997;28:1401–1405.
6. Oliveira-Filho J, Silva SC, Trabuco CC, Pedreira BB, Sousa EU, Bacellar A. Detrimental effect of blood pressure reduction in the fist 24 hours of acute stroke onset. *Neurology*2003;61:1047–1051.
7. Carlberg B, Asplund K, Hägg E. Factorsinfluencing admission blood pressure levels in patients with acute stroke. *Stroke*1991;22:527–530.
8. Leira R, Millán M, Díez-Tejedor E, Blanco M, Serena J, Fuentes B, et al. TICA Study, Stroke Project, Cerebrovascular Diseases Group of the Spanish Neurological Society. Age determines the effects of blood pressure lowering during the acute phase of ischemic stroke: the TICA study. *Hypertension* 2009;54:769–774
9. Qureshi AI. Acute hypertensive response in patients with stroke: pathophysiology and management. *Circulation* 2008;118:176–187.
10. The European Stroke Organisation (ESO) Executive Committee and the ESO Writing Committee. Guidelines for management of ischaemic stroke and transient ischaemic attack 2008. *Cerebrovasc Dis* 2008;25:457–507.
11. Broderick J, Connolly S, Feldmann E, Hanley D, Kase C, Krieger D, et al. Guidelines for the management of spontaneous intracerebral hemorrhage in adults: 2007 update: a guideline from the American Heart Association/American Stroke Association Stroke Council, High Blood Pressure Research Council, and the Quality of Care and Outcomes in Research Interdisciplinary Working Group. *Circulation*2007;116: e391–e413.
12. Leonardi-Bee J, Bath PM, Phillips SJ, Sandercock PA. IST Collaborative Group. Blood pressure and clinical outcomes in the International Stroke Trial. *Stroke*2002;33:1315–1320.
13. Ahmed N, Wahlgren N, Brainin M, Castillo J, Ford GA, Kaste M, et al.Relationship of blood pressure, antihypertensive therapy, and outcome in ischemic stroke treated with intravenous thrombolysis: retrospective analysis from Safe Implementation of Thrombolysis in Stroke–International Stroke Thrombolysis Register (SITS-ISTR). *Stroke*2009;40:2442–2449.
14. Vemmos KN, Tsivgoulis G, Spengos K, Zakopoulos N, Synetos A, Manios E, et al. U-shaped relationship between mortality and admissionblood pressure in patients with acute stroke. *J Intern Med*2004;255: 257–265.
15. Silver B, Lu M, Morris DC, Mitsias PD, Lewandowski C, Chopp M.Blood pressure declines and less favorable outcomes in the NINDS tPAstroke study. *J NeurolSci*2008;271:61– 67.
16. Keezer MR, Yu AY, Zhu B, Wolfson C, Côté R. Blood pressure and antihypertensive therapy as predictors of early outcome in acute ischemic stroke. *Cerebrovasc Dis*2008;25:202–208.
17. Geeganage CM, Bath PM. Relationship between therapeutic changes in blood pressure and outcomes in acute stroke: a metaregression. *Hypertension* 2009;54:775–781
18. Bonita R, Beaglehole R. "Modified Rankin Scale:Recovery of motor function after stroke" Stroke 1988 Dec;19(12):1497-1500
19. Bashar A. Study of risk factor of stroke [dissertation]. 1995. 78-80p.
20. Chowdhury SMZ. Study of Risk Factors incerebrovascular Disease-A study of 100 cases [dissertation]. 1991; p 48.
21. Arif SM. Study on risk factor for stroke in Bangladesh [dissertation].1993.
22. Aho K, Harmsen P, Hatano S. Cerebrovascular Disease in the community: Results of a WHO collaborative study. Bull WHO1880;58:113-30.
23. Alamgir SM, Mannan MA. Cerebrovascular disease: A report of 53 cases. Bangladesh Med Res Coun Bull 1995;1:45-50
24. Petrea RE, Beiser AS, Seshadri S, Kelly-Hayes M, Kase CS, Wolf PA. Gender differences in stroke incidence and poststroke disability in the Framingham heart study. Stroke 2009 Apr;40(4):1032-7. doi: 10.1161/STROKEAHA.108.542894. Epub 2009 Feb 10. PMID: 19211484; PMCID: PMC2676725.
25. Rothwell PM, Coull AJ, Silver LE, Fairhead JF, Giles MF, Lovelock CE, et al. Oxford Vascular Study. Population-based study of event-rate, incidence, case fatality, and mortality for all acute vascular events in all arterial territories (Oxford Vascular Study). Lancet 2005 Nov 19; 366(9499):1773-83. doi: 10.1016/S0140-6736(05)67702-1. PMID: 16298214.
26. Oveisgharan S, Sarrafzadegan N, Shirani S, Hosseini S, Hasanzadeh P, Khosravi A. Stroke in Isfahan, Iran: hospital admission and 28-day case fatality rate. Cerebrovasc Dis 2007; 24(6): 495-9.
27. Langhorne P, Stott D.J, Robertson L, MacDonald J, Jones L, McAlpine C et al. Medical Complications afteracute stroke. *Stroke*2000;31:1223-1229.
28. Siddique MR, Islam QT, Iqbal MT, Binte-Mosharraf SS. Socio-demographic status and associated risk factorsof the stroke patients in a tertiary care hospital. AKMMC J 2013; 4(2): 18-22
29. Carlberg B, Asplund K, Hagg E. The prognostic value of admission blood pressure in patients with acute stroke. *Stroke*1993;24:1372–1375.
30. Dandapani BK, Suzuki S, Kelley RE, Reyes-Iglesias Y, Duncan R. Relation between blood pressure and outcome in intracerebral hemorrhage. *Stroke* 1995;26:21–24.

31. Robinson T, Waddington A, Ward-Close S, Taub N, Potter J. The predictive role of 24-hour compared to casual blood pressure levels on outcome following acute stroke. *Cerebrovasc Dis*1997;7:264 –272.

32. Zhang H,JuZ,XuT,TongW,JinE,Wang N, et al. Admission blood pressure indexes and risk of in hospital death and dependency among acute hemorrhagic stroke patients, Inner Mongolia, China. Clin Invest Med 2009 Oct 1;32(5):E307-13.

33. Fogelholm R,Avikainen S,Murros K, Prognostic value and determinants of first day mean arterial pressure spontaneous supratentorium intracerebral hemorrhage. *Stroke* 1997;28(7):1396-400