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.
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 2nd month 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 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)                 | 27          |
| 51-60                | 34 (34)                 | 34          |
| 61-70                | 18 (18)                 | 18          |
| >70                  | 21 (21)                 | 21          |
| Age in year          | 57.78±14.70             | 57-89       |
| Sex                  |                         |             |
| Male                 | 49 (49)                 | 49          |
| Female               | 51 (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 Number (%) | Within 7 days or at 2 months at discharge 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 patients | Number of patients | Admission SBP | 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  | <0.05   |
| Dependency              | 31                 | 164.84±24.61  | <0.05   |
| Death                   |                     |               |         |
| (7th day-2 months)      | 17                 | 164.41±38.36  | > 0.05  |
| Death (total)           | 32                 | 166.88±41.71  | < 0.05  |
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\textsuperscript{19-21} have shown that the highest age of incidence of stroke was between 6\textsuperscript{th} to 7\textsuperscript{th} decades. The highest incidence was found at or above the age of 85 years in a previous study.\textsuperscript{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.\textsuperscript{23,24} Still others have reported that the sex differences no longer exist at older ages.\textsuperscript{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.\textsuperscript{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%.\textsuperscript{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.\textsuperscript{27} Thirty one percent patients were in dependency group at the end of 2 months which coincides with that of Siddique et al.\textsuperscript{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.\textsuperscript{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 strengthened. 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.

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