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Admission Blood Pressure As a Prognostic Marker in Acute Ischemic Stroke

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Abstract
Objective: *To evaluate the relationship between Blood pressure (systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure) on admission and early mortality and morbidity in acute stroke patients and to see the prognostic significance of BP with mortality and morbidity in inpatients*
Design: *Hospital based prospective observational study*
Setting: *Conducted in the Department of General Medicine at Sri Devaraj Urs medical college, Kolar, Karnataka.*
Subjects: *A total of 100 patients admitted within24 h from stroke. Main outcome measures are Mortality at 1 and 3day after stroke in relation to admission SBP and DBP.*
Results: *77.8% Mortality was seen in the subjects who had admission SBP of 161-180mmhg. 75% Mortality was seen in the subjects who had admission SBP>180mmhg. Both the extremity low and high admission SBP had very high mortality. 60% Mortality was seen in the subjects who had admission DBP 60-69mmhg. 85.7% Mortality was seen in the subjects who had DBP ≥110mmhg. Both the extremity low and high admission DBP had very high mortality.*
Conclusion: *The described U-shaped curve appears to relate BP to clinical outcome, with the best outcome observed in normal or mildly elevated admission BP values, suggesting that both extremely high and extremely low admission BP-values are likely to affect outcome adversely.*
Keywords: *acute stroke, blood pressure, ischaemic stroke, mortality.*

Introduction

Stroke is the third leading cause of death in Western populations after coronary heart disease and cancer. Furthermore, stroke is the most common life-threatening neurological disorder, and the resulting disability is the most important single cause of inability among these populations.[1] Blood pressure (BP) is initially elevated in patients with acute stroke and usually declines spontaneously within the first few days after admission.[2-3] It is still unknown whether reactive post stroke hypertension represents a pathophysiological response to ischemia to maintain collateral blood flow to the ischemic penumbra or whether it is a sign of the severity of stroke.[4-7]

Data on the prognostic significance of BP levels following acute stroke are conflicting.

Observational studies have suggested that high initial BP is associated with increased stroke

mortality,[8-11] impairment of functional outcome [11, 12] and stroke recurrence ,[11, 13] whilst others failed to support these findings.[14-15]

Some studies also indicated that low admission BP correlates with poor prognosis.[11, 13]

Methodological differences in the design of studies assessing the prognostic significance of BP after acute stroke may explain some of the conflicting evidence.

The aim of the present study was to evaluate the relationship between Blood pressure (systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure) on admission and early mortality and morbidity in acute stroke patients and to see the prognostic significance of BP with mortality and morbidity in inpatients. We will examine the BP- stroke mortality curves, as well as the relationship between BP- values and cause of death.

In this study we had also study the morbidity of the patients with national institutes of health stroke scale (NIHSS) on admission and after 1 week and see its correlation with admission BP.

Materials & Methods

Study Setting: A study was conducted in the Department of General Medicine at Sri Devaraj Urs medical college, Kolar, Karnataka.

Study Design: Hospital based prospective observational study

Sample Size: 100

Method of Collecting Data

Patients who presented in the emergency room of our hospital in <24hrs after symptom onset and were hospitalized. Casual supine BP was measured at hospital admission, thrice using a standard mercury sphygmomanometer and a mean is a taken to exclude human error. Glasgow Coma Scale was used for the estimation of the neurological status on admission. On admission all patients were examined, and impairment quantified with NIHSS scale and they had undergo an initial computed tomography (CT) scan of the brain or MRI brain plain and followed for one-week duration of stay at our hospital and at the end of one-week NIHSS scale is again assessed and the data collected was analysed to prove the prognostic significance of BP in acute ischemic stroke.

Inclusion Criteria

- Patients with clinical suspicion of stroke

Exclusion Criteria

- Transient ischemic stroke
- Haemorrhagic stroke
- Age<18 years

Statistical Analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two quantitative variables. ANOVA was used as test of significance to identify the mean difference between more than two quantitative variables. Correlations were performed with Pearson Correlation coefficient. P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical Software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data

Results

During the study period we have included 100 subjects. Out 100 subjects 34 were female and 66 were male. The ratio of Female:Male was 1: 3.The mean age of the study subjects was 65.31 $\pm$ 10.61yrs with minimum age was 45yrs and maximum was 92yrs.39 subjects had Hypertension and only 9 subjects had type 2 diabetes mellitus. Smoking history was present in 44% of the subjects and Alcohol intake history was present in 33% of the subjects.

The mean systolic BP was 142 ±22.97 mmhg with minimum 90mmhg and maximum 240mmhg, mean diastolic BP was 86.62 ±14.62 mmhg minimum 60mmhg and maximum 150mmhg, mean MAP was 105.34 ± 16.88 mmhg minimum 70mmhg and maximum 180mmhg.Out of 100 subjects 30 died and 70 survived at the end of the study.

Table 1: Association of Various parameter with the outcome

		Survived		Dead		P Value
		No of subjects	Percentage	No of subjects	Percentage	
Age Group	45-54yrs	12	80.0%	3	20.0%	**0.026**
	55-64yrs	25	86.2%	4	13.8%	
	65-74yrs	25	65.8%	13	34.2%	
	75-84yrs	5	38.5%	8	61.5%	
	85-94yrs	3	60.0%	2	40.0%	
Gender	Female	22	64.7%	12	35.3%	0.407
	Male	48	72.7%	18	27.3%	
Hypertension	No	48	78.7%	13	21.3%	**0.025**
	Yes	22	56.4%	17	43.6%	
Diabetes Mellitus	No	65	71.4%	26	28.6%	0.446
	Yes	5	55.6%	4	44.4%	
Smoking	No	38	67.9%	18	32.1%	0.664
	Yes	32	72.7%	12	27.3%	
Alcohol	No	48	71.6%	19	28.4%	0.647
	Yes	22	66.7%	11	33.3%	

61.5% Mortality was seen among the 75-84yrs age group, 40% Mortality was seen among the 85-94yrs age group, 34.2% Mortality was seen among the 65-74yrs age group, 20% Mortality was seen among the 45-54yrs age group and 13.8% Mortality was seen among the 55-64yrs age group. There was a statistical significant difference found between age group and outcome.
35.3% mortality among female and 27.3% mortality among male. There was no a statistical significant difference found between gender and outcome.
43.6% mortality among the subjects who had hypertension and only 21.3% mortality among the subjects who did not had hypertension. There was a statistical significant difference found between Hypertension and outcome. 44.4% mortality among the subjects who had Diabetes Mellitus and only 28.6% mortality among the subjects who did not had Diabetes Mellitus. There was no a statistical significant difference found between Diabetes Mellitus and outcome.
27.3% mortality was found in smoker and 32.1% mortality was found in non-smoker. There was no a statistical significant difference found between Smoking and outcome.33.3% mortality was found in alcoholic and 28.4% mortality was found in non-alcoholic. There was no a statistical significant difference found between alcohol and outcome.

Table 2: Comparison of mean age SBP, DBP, MAP with Outcome

	Survived		Dead		P Value
	Mean	SD	Mean	SD	
Age in years	63.60	10.13	69.30	10.81	0.017
SBP (in mmhg)	139.54	18.27	150.33	30.40	0.031
DBP (in mmhg)	84.06	11.86	92.60	18.51	0.007
MAP (in mmhg)	102.55	13.43	111.84	21.95	0.011

Mean age was 63.60 ±10.13yrs among the survived subjects and 69.30 ±10.81yrs among dead subjects. There was a statistical significant difference found between mean age and outcome.

Mean SBP was 139.54 ±18.27mmhg among the survived subjects and 150.33 ±30.40mmhg among dead subjects. There was a statistical significant difference found between mean SBP and outcome. Mean DBP was 84.06 ±11.86 mmhg among the survived subjects and 92.60 ±18.51 mmhg among dead subjects. There was a statistical significant difference found between mean DBP and outcome. Mean MAP was 102.55 ±13.43mmhg among the survived subjects and 111.84 ±21.95mmhg among dead subjects. There was a statistical significant difference found between mean MAP and outcome.

Table 3: Association between admission blood pressure with mortality

		Survived		Dead	
		N	%	N	%
SBP(mmhg)	<120	4	50.0%	4	50.0%
	121-140	40	85.1%	7	14.9%
	141-160	23	71.9%	9	28.1%
	161-180	2	22.2%	7	77.8%
	>180	1	25.0%	3	75.0%
DBP(mmhg)	60-69	2	40.0%	3	60.0%
	70-79	13	86.7%	2	13.3%
	80-89	31	88.6%	4	11.4%
	90-99	20	60.6%	13	39.4%
	100-109	3	60.0%	2	40.0%
	>=110	1	14.3%	6	85.7%

50% Mortality was seen in the subjects who had admission systolic Blood pressure <120mmhg. 77.8% Mortality was seen in the subjects who had admission systolic Blood pressure 161-180mmhg. 75% Mortality was seen in the subjects who had admission systolic Blood pressure >180mmhg. Both the extremity low and high admission systolic BP had very high mortality. 60% Mortality was seen in the subjects who had admission Diastolic Blood pressure 60-69mmhg. 85.7% Mortality was seen in the subjects who had admission Diastolic Blood pressure≥110mmhg. Both the extremity low and high admission Diastolic BP had very high mortality.

Discussion

In our study the mean age of the study subjects was 65.31 ± 10.61yrs. Where as in study done Johan- Emil Bager et al [16]the mean age was 78.4 ±8yrs.In our study 39% of subjects had Hypertension and 9% subjects had type 2 diabetes mellitus. Where as in study done Johan- Emil Bager et al[16]57% had hypertension and 17% had DM.In our study mean systolic BP was 142 ±22.97 mmhg, mean diastolic BP was 86.62 ±14.62, mean MAP was 105.34 ± 16.88. Where as in study done Johan- Emil Bager et al[16]mean systolic BP was 166 ±29.7 mmhg, mean diastolic BP was 92 ±16.2mmhg,mean MAP was 116 ± 18.4mmhg.

Our results clearly indicate that both high and low admission BP-values are associated with a poor outcome in stroke patients. Previous studies have addressed the association of high admission BP with stroke mortality in patients with very high admission

BP-values or in those with impaired consciousness [7, 14] whilst some others have found an association of high admission BP-values with poor functional outcome [10, 11, 17].

The mechanisms underlying this relationship are poorly defined but it can presumably be explained by the hypothesis that hypertension promotes early stroke recurrence, symptomatic haemorrhagic transformation and formation of cerebral oedema[10,12,18,19]. According to the IST study, which included nearly 18 000 ischaemic stroke patients, high BP-values were associated with early recurrent stroke and fatal brain oedema [10].

Low admission BP-values were also associated with high mortality rates. Patients with heart failure and ischaemic myocardial disease are usually on antihypertensive medication and have, in comparison with other patients, a significantly lower cardiac output. It has been supported that low BP and low cardiac output result in cerebral hypoperfusion, which may cause larger ischaemic infarcts [20]. In the IST low admission SBP-values were associated with a severe clinical stroke (total anterior circulation syndrome) [10].

Our study finding are similar to the some International studies in which a "U" curve relationship between BP and in-hospital mortality, where both highand low BP were associated with an increased early fatality ratio[21.]

Conclusion

The described U-shaped curve appears to relate BP to clinical outcome, with the best outcome observed in normal or mildly elevated admission BP values, suggesting that both extremely high and extremely low admission BP-values are likely to affect outcome adversely.

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