

**A STUDY OF ASSOCIATION BETWEEN BLOOD PRESSURE AND HSCRP IN ACUTE ISCHEMIC STROKE**

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**ABSTRACT**

Stroke remains a major cause of human mortality and morbidity. Cardiovascular and cerebrovascular diseases appear to be very frequently encountered now and responsible for great deal of morbidity. Acute ischemic stroke with high blood pressure (BP) and high level of C-reactive protein (CRP) at the time of admission are associated with poor functional outcome. We observed 60 patients over a period of 2 years, studied the association between BP, hsCRP and NIHSS. An increase in systolic BP and diastolic BP were significantly associated with higher level of CRP, independent of other risk factors. An increase in BP and hsCRP associated with higher NIHSS score which in turn predicts functional outcome in acute ischemic stroke patients.

**Keywords:** Blood pressure, high sensitivity C-reactive protein, ischemic stroke, NIHSS

Stroke remains a major cause of human mortality and morbidity. Cardiovascular and cerebrovascular diseases appear to be very frequently encountered now and responsible for great deal of morbidity. In spite of our increasing understanding of the pathophysiology and epidemiology of cardiovascular diseases and stroke and continuing advances in prevention and treatment, the burden of above said diseases are high.

Furthermore traditional atherogenic risk factors such as hypertension, smoking, hyperlipidemia, and diabetes mellitus do not fully account for the clinical occurrence of CHD and stroke in different populations. There is no surprise that extensive search/study is necessary for potential risk factors.

Hypertension is a well-known risk factor for ischemic stroke, and the effect of blood pressure lowering treatment in preventing first stroke is well established, but the pathogenic and molecular mechanisms by which elevated blood pressure leads to vascular disease are uncertain, hypertension may promote endothelial expression of cytokines and stimulate inflammation. These data are

particularly intriguing given that inflammation plays a critical role in the pathogenesis of atherosclerosis.

Perspective data demonstrate that inflammation, particularly C-reactive protein (CRP), appears to predict the risk of cardiovascular events among healthy subjects, patients with high vascular risk, those with stable and unstable angina, and stroke patients. Signs of an acute inflammatory response are also evident in acute ischemic stroke. These acute phase reactants, such as cytokines and CRP may reflect inflammation related to the pathobiology of ischemic stroke. However many patients (~25%) had normal levels of inflammation markers after stroke, implying that ischemic lesion itself does not induce a full-blown acute -phase response. The specific stimuli that promote inflammatory response in acute ischemic stroke have not been fully elucidated.

Both high and low BP were found to be independent prognostic factors for poor outcome. A stronger inflammatory response after stroke is associated with a severe neurological deficit and a poor outcome with a higher risk of new recurrent cardiovascular events. An exploratory analysis has suggested that elevated levels of systolic or diastolic BP in the acute phase after an ischemic stroke are associated with elevated levels of CRP. Limited words have been published on CRP changes in stroke despite high

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incidence of CVA in India. The present study, sought to determine whether BP levels might contribute to inflammatory response in acute ischemic stroke

**2.METHODS**

Single centered prospective study carried out in the department of Medicine, Rajah Muthiah Medical college and hospitals, Annamalai University,Chidambaram.

**Period of Study:** Between October 2012 – September 2014.

**Sample Size:** 60 patients.

**Study groups**

- Group 1 : Patients who fall in JNC 7 stage 1 and more
- Group 2 : Patients who fall in JNC 7 optimal to pre-hypertension range

**JNC 7 Blood pressure criteria used for grouping patients.**

**Inclusion Criteria**

Patients with acute ischemic stroke (48hrs of onset) without radiological evidence of intracerebral bleed

**Exclusion Criteria**

1. Recurrent stroke
2. Patients admitted after 48 hours of onset of stroke
3. Concurrent Renal or Hepatic disease
4. Neoplastic disease
5. Recent surgery/trauma/acute osteoarthritis
6. Recent infection less than 3 – 4 days of duration.

**C-Reactive protein assay**

1. At the time of admission
2. At 48 hrs
3. At the time of discharge

Quantification of functional impairment done with NIHSS scale<sup>[xii]</sup>

Score	Stroke Severity
0	No Stroke Symptoms
1-4	Minor Stroke
5-15	Moderate Stroke
16-20	Moderate to Severe Stroke
21-42	Severe Stroke

**CT scan Brain**

1. At the time of admission
2. If stroke proved – Next CT taken on or before discharge(3-5 days of onset)
3. If stroke not seen – Next CT taken within 48 hours of onset of stroke.

**Other study variables**

Age, gender, BMI, hypertension, diabetes, CAD, RHD, TIA, smoking, alcohol abuse, hypercholesterolemia, hypertriglyceridemia, Diabetes mellitus, peripheral vascular disease, stroke subtypes.

**TABLE 1: AGEDISTRIBUTION**

AGE	GROUP 1		GROUP 2	
	N	%	N	%
37-47	10	25.6	6	20
48-58	13	33.3	12	40
59-69	8	20.5	8	26.7
70-80	3	7.7	4	13.3
81-87	5	12.8	-	-
<b>TOTAL</b>	<b>39</b>	<b>100</b>	<b>30</b>	<b>100</b>

**Table 2: G-1 HSCRPI \* G-1 NIHSS Crosstabulation**

Group-1 HSCRPI	G-1 NIHSS			Total
	5-15	16-20	21-24	
1-3	12	0	0	12
>3-10	14	8	4	26
>10	0	0	1	1
<b>Total</b>	<b>26</b>	<b>8</b>	<b>5</b>	<b>39</b>

Pearson chisquare: value=14.908 and SIG=.005

**Table 3:G-2 HSCRPI \* G-2 NIHSS Crosstabulation**

Group 2 HSCRPI	G-2 NIHSS		Total
	1-4	5-15	
<1	4	4	8
1-3	1	20	21
>3-10	1	0	1
<b>Total</b>	<b>6</b>	<b>24</b>	<b>30</b>

Pearson chisquare: value=11.548 and SIG=.003

Fig 1: shows the gender distribution of acute ischemic stroke

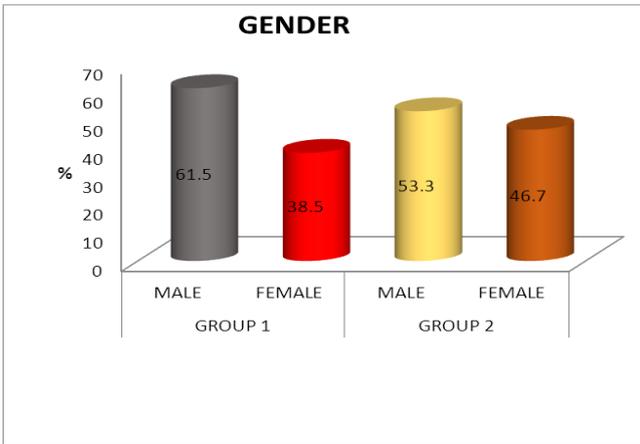


Fig 2: shows the occurrence of risk factors in both groups

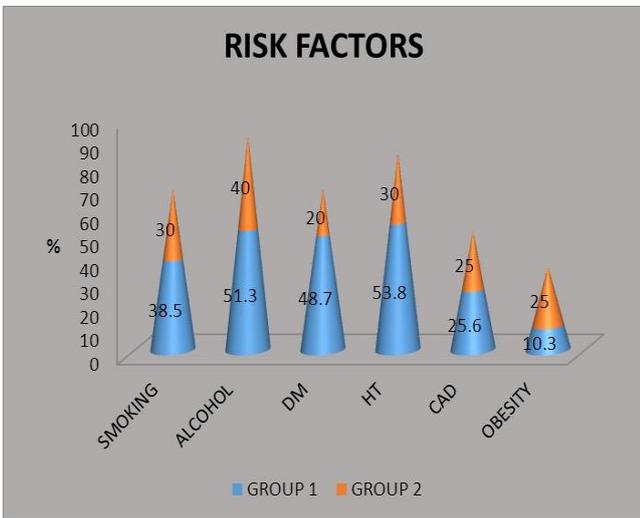


Fig 3: shows NIHSS scoring in both group of patients

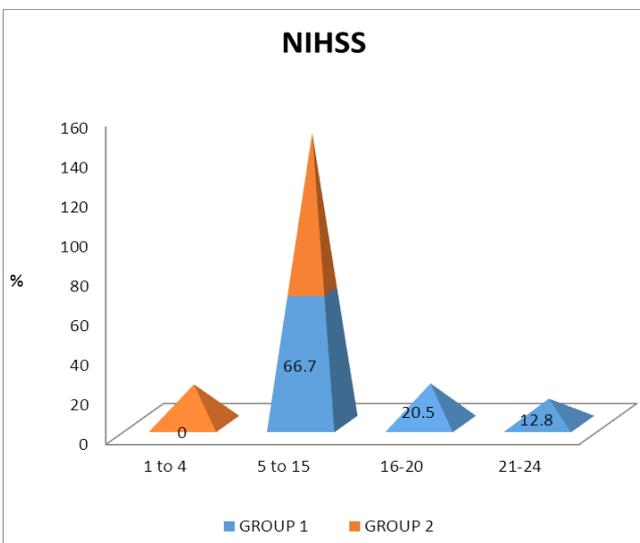


Fig 4: shows the relationship between HSCR and BP among Group 1 patients

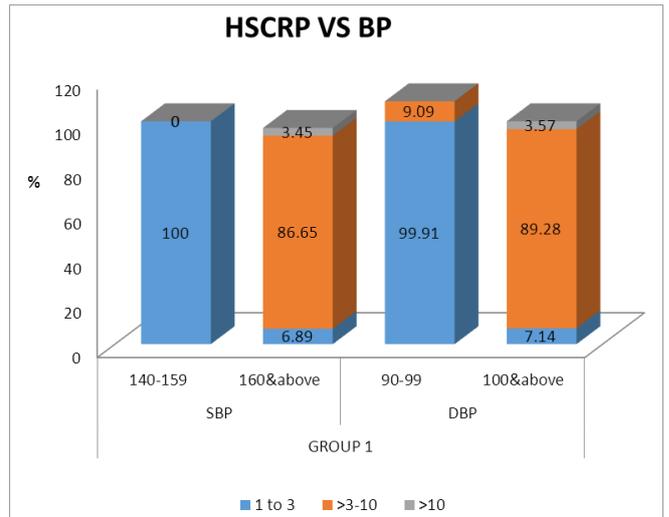


Fig 5: shows the relationship between HSCR and BP among Group 2 patients

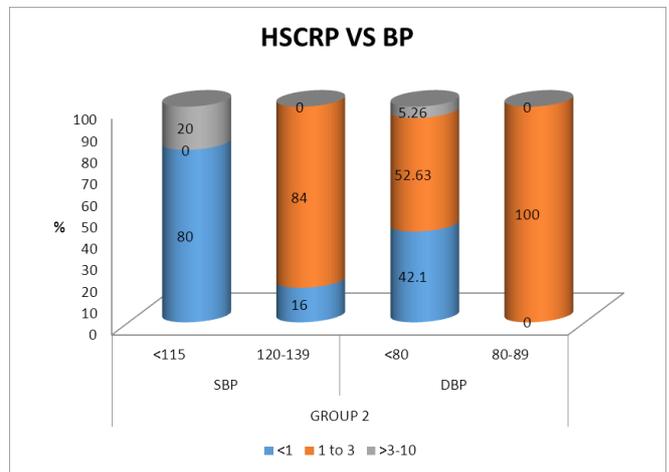
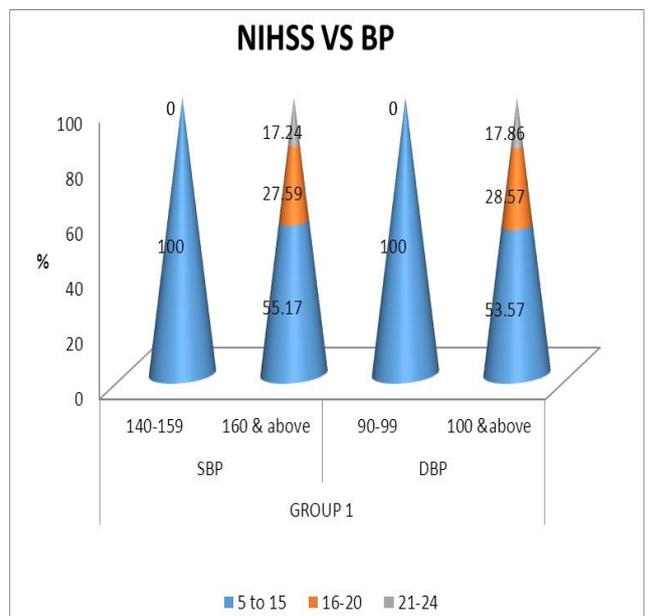
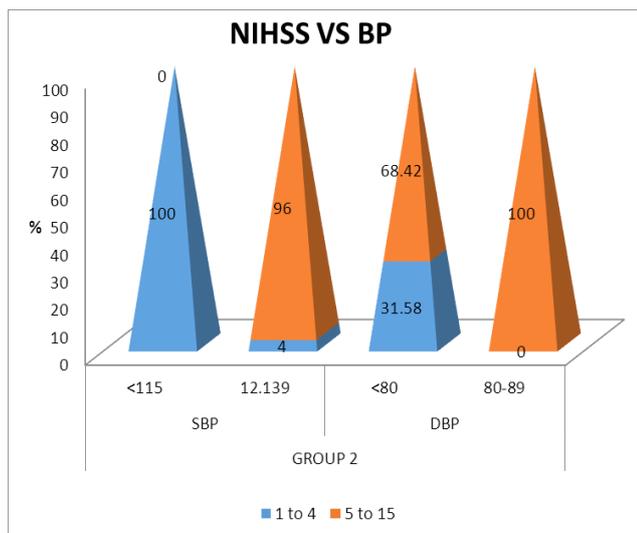


Fig 6: Shows the relationship between BP and NIHSS in Group 1 patients



**Fig 7: Shows the relationship between BP and NIHSS in Group 2 patients**



### 3.DISCUSSION

#### Statistical Analysis

In the present study, the relationship of blood pressure with hsCRP was analyzed, further,

the influence of Blood pressure and hsCRP on the prognostic significance of acute ischemic stroke patients was analyzed, the study patients were divided in to group 1 (stage 1 and 2 HT) and group 2(optimal, normal and pre hypertensive subject) the frequency distribution of age, gender, risk factors, Random blood sugar, T.Cholesterol, hsCRP, BP and NIHSS were carried out for both groups and comparison were made. The chi – square test of association was carried out to study the relationship of BP and hsCRP, NIHSS and hsCRP, risk factors and hsCRP.

#### Summary of results

- The immediate hsCRP
  - group 1: 1 - 3 in 30.8% of patients
  - 3-10 in 66.7% of patients.
  - group 2: <1 in 26.7% of patients
  - 1- 3 in 70% of patients
  - 3-10 in 3.3% of patients
- Fig 3 shows among group 1 patients, 66.7% had NIHSS score of 5-15, 20.5% had score of 16-20,12.8% had score of 21-24. where as none of the group 2 patients had score of >15.
- Fig 4 shows that 29 out of 39 patients in Group 1 had Systolic BP of >160, among them 26 patients had hsCRP value of >3-10,1 patient had hsCRP value of >10. 28 out of 39 patients in group 1 had Diastolic BP of >100.among them 25 patients had hsCRP value of >3-10,1 patient had value of >10.Only one patient in group 2 had hsCRP value of >3-10.there was significant positive association observed between

hsCRP and immediate blood pressure (both systolic and diastolic) .

- Fig 5 shows In group 1 among 29 of 39 patients who had systolic BP of >160,NIHSS score was 5-15 for 16 patients,16-20 for 8 patients, and 21-24 for 5 patients. Among 28 of 39 patients who had diastolic BP of >100,NIHSS score was 5-15 for 15 patients ,16-20 for 8 patients,21-24 for 5 patients .None of the group 2 patients had NIHSS score >15.
- There was significant positive association observed for hsCRP and NIHSS score
- There was no significant association observed for each risk factor and HSCR values.
- This showed that increasing level of BP was associated with higher level of hsCRP this facilitates the inflammatory process, higher the level of BP and hsCRP, NIHSS was also high 5-15/16-20 (moderate to severe stroke).

The Primary finding of the present study was that an increase in BP levels was associated with elevated level of hsCRP in first-ever acute ischemic stroke. This association was independent of other risk factors including smoking, alcohol, cardiovascular risk factors, and neuroradiological findings. The results persisted even when different cut off threshold of hsCRP was used. This study also found that the association between elevated blood pressure and elevated hsCRP was stronger in older than in younger patients.

An acute increase in BP more than a history of arterial hypertension was associated with higher levels of hsCRP. Probably the levels of BP after an acute ischemic stroke are one of the underlying process related to inflammation that are relevant in the inflammatory response in ischemic stroke patients than in a patient with history of arterial hypertension. Several study and theories have been offered as to why an elevated BP may be a predictor of poor outcome after stroke. High BP might promote early recurrence, Hemorrhagic transformation, or formation of cerebral edema, thus increasing the risk of death or new cardiovascular events.

### 4.CONCLUSION

- Patients with acute ischemic stroke with elevated blood pressure showed increased levels of hsCRP.
- Elevated blood pressure and elevated hsCRP level were associated with greater NIHSS score, indicates poor outcome
- Hence elevated blood pressure and increased hsCRP levels are predictors of short term prognosis in patients with acute ischemic stroke, indicates poor outcome
- The hsCRP level increases as age advances.

### 5.REFERENCES

1. Chobanian AR. The influence of hypertensive and other hemodynamic factors in atherogenesis. *Progr. Cardiovasc Dis.* 1983; 26: 177-96.
2. Fine Eldeistein JS. Precursor of extracranial

carotid atherosclerosis in the Framingham study. *Neurology* 1994; 44: 1046-50.

3. Jorgensen HS et al. Intracerebral hemorrhage versus infarction: Stroke severity, risk factors and prognosis. *Ann Neurol.*, 1995; 38: 45-50.

4. Kushner I, Feldmann G. Control of the acute phase response. Demonstration of C-reactive protein synthesis and secretion by hepatocytes during acute inflammation in the rabbit. *J. Exp. Med.* 1978; 148: 466-77.

5. Lusiani L et al. Prevalence of atherosclerotic involvement of the internal carotid artery in hypertensive patients. *Int. J. Cardiology* 1987; 17: 516.

6. Merriman CR, Pullam LA, Kampschmidt RF. Effect of leucocytic endogenous mediators on C-reactive protein in rabbits. *Proc Soc Exp Biol Med* 1975; 149: 782-84.

7. National Institute of Health, National Institute of Neurological disorders and Stroke. Stroke Scale [http://www.ninds.nih.gov/doctors/NIH\\_Stroke\\_Scale.pdf](http://www.ninds.nih.gov/doctors/NIH_Stroke_Scale.pdf)

8. Pepys MB. The acute phase response and C-reactive protein. Chapter No. 11.13.3 in *Oxford Textbook of Medicine*, Third Edition. Weatherall AJ, Ledingham JUG, Warrelli DA. Tokyo. Oxford University Press, 1996; 1527-1533 pp.

9. Reed DM et al. A prospective study of artery atherosclerosis. *Stroke* 1988; 19: 820-5.

10. Ridker et al. Inflammation, atherosclerosis, ischemic episode exploring hidden side of the moon", *NEJM* 1997, Vol. 336: 1014.

11. Ross Russell RW. How does blood pressure cause stroke? *Lancet* 1975; 2:1283-5.

Yoshiyuki Wakugawa, MD et al., C-Reactive Protein and Risk of First-Ever Ischemic and Hemorrhagic Stroke in a General Japanese Population, *The Hisayama Study Stroke*. 2006;37:27-32; originally published online November 23, 2005; Doi; 10.1161/01.STR.0000194958.88216.87.

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