ORIGINAL ARTICLE

Clinical Profile of Stroke and Correlation of NIHSS, mRS with Special Reference to Homocysteine & Hypertension in a Tertiary Care Centre

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ABSTRACT

Introduction: Stroke is an important cause of disability and more than two thirds of survivors are left with disability. Stroke scales are used to assess severity of the disease as well as outcome of patient. This study aims to evaluate the clinical profile of stroke and relationship of hyper homocysteinemia, high systolic blood pressure (SBP) and diastolic blood pressure (DBP) with various stroke scales.

Materials and Methods: 102 patients of ischemic and hemorrhagic strokes were studied and National Institutes of Health Stroke Scale (NIHSS) and Intracerebral hemorrhage (ICH) scores on admission and Modified Rankin Score (mRS) at discharge and at 90 days were compared and relationship with serum homocysteine (Hcy) level in ischemic stroke and SBP & DBP in hemorrhagic and ischemic strokes were studied.

Results: The female: male ratio was 2:1 in ischemic and 1:1 in hemorrhagic stroke. Smoking, alcoholism, hyperlipidemia and diabetes were more common in ischemic stroke. NIHSS and mRS scores were higher in hemorrhagic stroke as compared to ischemic stroke. Patients with high NIHSS had high mRS score at discharge and at 90 days in ischemic and hemorrhagic strokes. This was also seen for ICH scores in hemorrhagic stroke patients. Higher homocysteine values were seen with higher NIHSS and mRS scores in ischemic stokes. Higher SBP and DBP were seen in higher NIHSS and mRS groups in both types of strokes.

Conclusions- Higher NIHSS and ICH score at admission were related with poor stroke outcomes. Higher homocysteine levels were related with poor outcome in ischemic stroke. High SBP and DBP were seen with increased stroke severity and disability in both ischemic and hemorrhagic strokes.

Key words- DBP, Homocysteine, ICH score, mRS, NIHSS, SBP

INTRODUCTION

Stroke is an important cause of functional impairment and death all over the world. More than 65% of stroke survivors are left with a disability which impairs their ability to carry out activities of daily living unassisted. The stroke scale represents a useful tool for assessing the severity of a stroke attack and assessing the prognostic information of the hospital. Usually, the stroke scale is composed of several variables, used to observe symptoms and signs, and each variable is scored.

The National Institutes of Health Stroke Scale (NIHSS) is a fully validated and easy-to-implement stroke assessment score that is widely used worldwide. NIHSS is used to calculate all aspects of the nervous system examination and summarize the overall stroke damage. NIHSS has also been used to determine whether a patient is suitable for thrombolysis and predict the progression and outcome of acute stroke[1].

The next very common scale is the modified Rankin Scale (mRS). It is used as a measure of overall disability in stroke tests. It is easy to use, takes less time, has a wide validity period, and can also be taken over by telephone. The disadvantage is that the reliability is low, and an important part of incremental recovery may be missed[2].

In the case of hemorrhagic stroke, the severity can also be calculated from the ICH score. The ICH grading

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scale is a standard assessment tool, which can be easily and quickly determined in the performance of hemorrhagic stroke without any special neurological training. The various components of the scale (such as GCS, age, bleeding volume, intraventricular or lower abdominal position) are important predictors for predicting cerebral hemorrhage[3].

Hyperhomocysteinemia is one of the modifiable risk factors of Ischemic stroke. It mainly depends on the serum levels of folic acid, vitamin B12 and vitamin B6[4,5]. However, there are still few studies, and little is known about the relationship between Homocysteine (Hcy) levels and prognosis of stroke.

The relationship between post-stroke blood pressure (BP) and functional outcome in patients with acute ischemic stroke remains controversial. Although the results of observational studies have given conflicting results, high BP is associated with poor prognosis after acute stroke. Some authors even demonstrated better prognosis in patients with high initial BP[6].

Therefore, the outcome assessment of stroke patients can be easily done with these scales, which can help in clinical decision-making, prognosis and patient recovery. These scores are rarely compared with each other. In addition, risk factors such as high serum homocysteine, and elevated DBP and SBP have rarely been studied in relation to stroke outcomes.With these things in mind, we conducted this research.

AIM OF STUDY

1. To correlate the significance of various stroke - related scale for prognostication of acute stroke.

2. To study effect of plasma homocysteine levels in ischemic stroke.

3. To study effect of systolic and diastolic blood pressure at presentation on acute stroke.

MATERIALS AND METHOD

The present prospective study was conducted in Department of Neurology at a leading Tertiary Care Medical College Teaching Hospital of North India.

Patients included in the study had a first-ever acute ischemic & hemorrhagic stroke diagnosed and treated in our department from October 2018 to September 2019. The diagnosis was made based on the clinical presentation and neuroimaging.

Informed consent was taken from each patient and the study was approved by the ethical committee of the Institution.

Patients presenting with venous sinus thrombosis, subarachnoid hemorrhage, subdural hemorrhage, extradural hemorrhage, head injury or stroke mimickers like post ictal Todd's palsy etc were excluded from the study. Patients taking drugs that may affect homocysteine (such as oral contraceptives) or drugs that affect the metabolism of vitamin B12 or folic acid were also excluded.

A detailed medical history, including past medical history was recorded. A complete clinical and neurological examination including blood pressure check was performed. Blood pressure was measured in right arm supine position; both diastolic (DBP) and systolic blood pressure (SBP) were recorded. Each patient was evaluated by brain computed tomography (CT) within 24 hours after admission. Brain magnetic resonance imaging (MRI), CT angiography or MR angiography was performed in selected cases. Laboratory investigations and Serum homocyteine levels were done.

We calculated the NIHSS score of all patients on admission. NIHSS scores are divided into three groups, namely <8 (mild), 9-17 (moderate) and> 17 (severe). They were indicative of initial stroke severity.The ICH score for hemorrhagic stroke, including those with intraventricular extension was also calculated.

The early stroke outcome was measured at discharge using the modified Rankin scale (mRS). Most patients were discharged within a week of stroke onset and admission. We also calculated the mRS scores at day 90 after the onset, on outpatient basis or over telephone. mRS score were grouped into two components, namely (0-2) patients with independent prompt function and (3-5) patients with prompt function dependent.

Mean serum fasting homocysteine levels at admission were compared in different groups of stroke patients based on their NIHSS and mRS scores.

Based on the DBP and SBP on admission, ischemic and hemorrhagic patients were sub divided into three groups and mRS and NIHSS values of each group were compared against each other. SBP groups were ≤140, 141 - 179 and ≥180mmHg. DBP groups were ≤80, 81- 100 and >100mmHg.

Statistical methods:-

The collected data was coded, tabulated, and statistically analysed using IBM SPSS statistics (Statistical package for Social Sciences) software version 22.0.

The level of significance was taken at p value ≤ 0.05 as significant otherwise as non significant.

Correlation was denoted by Pearson's correlation coefficient.

Serum homocysteine levels were compared in different NIHSS and mRS score groups of ischemic stroke patients with corresponding p values.

NIHSS and mRS scores in previously mentioned 3 groups each of Systolic and Diastolic blood pressure were compared against each other and the level of significance was measured.

1.Demographic Profile (n=102):

Parameter		Hemorrhagic	Ischemic
Total number		24	78
Gender	Male	12	28
	Female	12	50
Age	Age(M)(in yrs)	54.5+/-14.8	59.6+/-13.9
	Age(F)(in yrs)	60+/-12.8	62.3+/-9.3
Risk Factors	Smoking	8	46
	Alcohol	1	10
	Diabetes	1	14
	Hypertension	13	12
	Hyperlipidemia	0	10

Among 102 stroke patients, 24 were hemorrhagic strokes, and the remaining 78 were ischemic strokes, of which 64 were thrombotic (T) and 14 were embolic (E). There were 12 males and 12 females in the hemorrhagic stroke group; 28 males and 50 females in the ischemic stroke group. The average age of men and women in the hemorrhagic stroke group was 54.5 and 60 years old, respectively and the average age of the ischemic stroke group was 59.6 years and 62.3 years for men and women, respectively. There were 8 smokers in the hemorrhagic group and 46 in the ischemic group. The corresponding numbers for alcoholics were 1 and 10 respectively. There was 1 case of diabetes in hemorrhagic group, and 14 cases in the ischemic stroke group. 13 patients in hemorrhagic and 12 patients in ischemic were previously known hypertensive. Only 10 patients had previously reported hyperlipidemia in ischemic group, no cases of known hyperlipidemia was reported by hemorrhagic group.

2. Distribution of various stroke-related scales (NIHSS, mRS at discharge & at day 90) in Hemorrhagic stroke(n=24)

Parameter	NIHSS scores			mRS scores (at discharge)		mRS scores (at day 90)	
	<8	8-16	⩾17	0-2	3-5	0-2	3-5
	4	7	13	6	18	13	11
Mean Value	15.79±6.15			3.2±1.19		2.4±1.4	

In patients with hemorrhagic stroke, the NIHSS score of mild severity (<8) is 16.66%, moderate severity (8-16) is 29.17%, and severity (>17) is 54.17%. The average NIHSS score of patients with hemorrhagic stroke was 15.79±6.15.

The mRS scores indicating independent functioning at time of discharge of (0-2) was seen in 25% of patients and functional dependence (3-5) was seen in 75% of patients. While on follow up at day 90, independent functioning (0-2) was seen in 54.2% and dependency (3-5) was seen in 45.8%. Mean of mRS scores at time of discharge and on day 90 was 3.2±1.19 and 2.4±1.4 respectively.

On comparing NIHSS vs mRS scores of hemorrhagic patient, there was a significant relationship between NIHSS on admission with mRS at discharge (p Value=0.026) and mRs at 90 days follow up (p Value= 0.001).

3. Distribution of various stroke-related scales (NIHSS, mRS at discharge & at day 90) in Ischemic stroke (n=78)

Parameter	NIHSS scores			mRS scores (at discharge)		mRS scores (at day 90)	
	<8	8-16	⩾17	0-2	3-5	0-2	3-5
	20	33	25	38	40	60	18
Mean Value	12.96±6.81			2.7±1.33		1.7± 1.38	

In patients with ischemic stroke, NIHSS scores of mild severity (<8) was seen in 25.64%, moderate severity (8-16) in 42.30% and greater severity (≥17) in 32.05%. Mean of NIHSS score was 12.96±6.81.

The mRS scores indicating independent functioning at time of discharge of (0-2) was seen in 48.7% of patients and functional dependence (3-5) was seen in 51.3% of patients. While on follow up at day 90, independent functioning (0-2) was seen in 76.9 % and dependency (3-5) was seen in 23.07 %. Mean of mRS scores at time of discharge and on day 90 was 2.7±1.33 and 1.7±1.38 respectively.

On comparing NIHSS vs mRS scores of ischemic patient, there was a significant relationship between NIHSS on admission with mRS at discharge (p Value- 0.065) and that on 90 days follow up (p Value- 0.005).

There was a significant positive correlation between NIHSS vs. ICH scores on admission in hemorrhagic patients and also between mRS at time of discharge and ICH score on admission in these patients.

4. Correlation between ICH score vs. NIHSS score and ICH score vs. mRS score at time of discharge in hemorrhagic stroke patients

NIHSS Score	0-8	9- 16	17 and above
ICH Score(Mean)	1± 1	1.57 ± 1.27	2.36 ± 0.74
mRS Score	0-2		3- 5
ICH Score(Mean)	0.9 ± 0.99		2 ± 1.03
	NIHSS vs ICH score on admission		mRSvs ICH score
Pearson correlation	0.685		0.571
P value	0.000		0.004

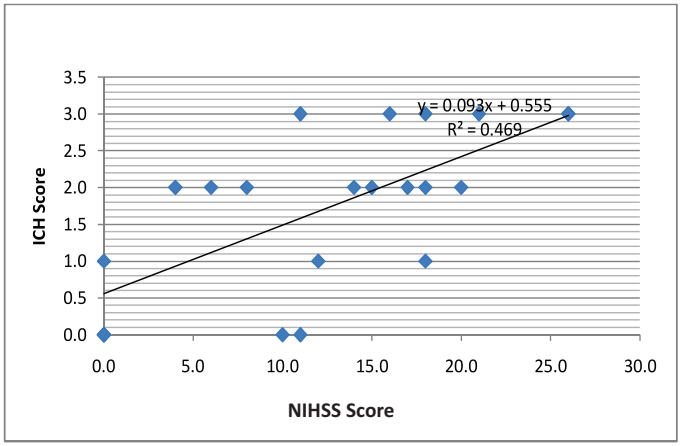

Figure 1: Correlations of ICH Score with NIHSS Score

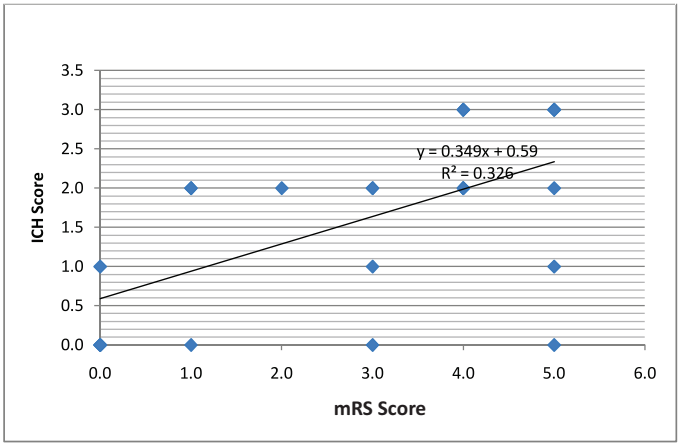

Figure 2: Correlations of ICH Score with mRS Score

5. Comparison between mean serum Homocysteine levels in different mRS and NIHSS score groups of ischemic stroke patients

	mRS scores		NIHSS scores		
	0-2	3- 5	<8	8- 17	≥17
No. of patients	38	40	20	33	25
S.Homocysteine (mean)	21 ±10.3	32.35± 11.92	19.44± 7.44	24.77±1 3.66	36.15 ±
P value	<0.001		<0.001		

On comparing the serum homocysteine values at admission in different mRS and NIHSS score groups, the difference was found to be significant.

6. Comparison of NIHSS score on admission and mRS scores at 90 days in 3 different SBP groups (in mmHG) in Ischemic stroke patients

		No. of Patients (n=78)	Mean NIHSS Score	Mean mRS Score	P value	
					NIHSS	mRS
SBP (mm Hg)	≤140	23	8.8±4.85	1.90±0.81	<0.001	0.01
	141-179	25	11.56±7.34	2.4±1.12		
	≥180	30	17.48±6.62	3.53±1.32		
DBP (mm Hg)	≤80	20	6.6±3.22	1.55±0.69	<0.001	<0.001
	81- 100	27	11.7 ±5.18	2.22±0.85		
	>100	31	17.8±5.93	3.79±1.11		

On comparison of NIHSS and mRS scores in 3 different groups each of SBP and DBP in ischemic stroke patients taken at admission, the difference in the NIHSS and mRS scores of different groups of SBP and DBP was significant.

7. Comparison of NIHSS on admission with mRS at 90 days groups(in mmHg) in Hemorrhagic stroke patients

		No. of pts (n=24)	Mean NIHSS	Mean mRS	P value	
					NIHSS	mRS
SBP (mm Hg)	≤140	5	10.2±7.22	2±1	0.008	0.002
	141- 179	8	14.8±6.84	3.12±1.36		
	≥180	11	19.1±2.95	3.81±0.75		
DBP (mm Hg)	≤80	4	10.25±6.13	2.0±0.82	0.04	0.01
	81-100	11	15.82±7.77	3.18±1.32		
	>100	9	18.22±1.39	3.78±0.83		

On comparison of NIHSS and mRS scores in 3 different groups each of SBP and DBP taken at admission in hemorrhagic stroke patients, the difference in the NIHSS and mRS scores of different groups of SBP and DBP was significant.

DISCUSSION

We wanted to find whether severe strokes at presentation had poorer outcomes and whether high blood pressure and homocysteine levels could be predictive of stroke outcomes.Ischemic strokes constituted 76.47 percent of patients and rest were hemorrhagic strokes. Another Iranian study[7] found that 84.3% strokes were ischemic and rest were hemorrhagic strokes. Such differences in numbers could be attributed to regional variations and other variables like illiteracy, belief on faith healers, etc seen in this part of the world. This difference could be accounted for a higher incidence of hemorrhagic stroke in the Indian community than in the Western countries[8].

Sex preponderance was seen in ischemic strokes female (2:1), while sex distribution was equal in hemorrhagic strokes, similar to the observations by Aiyar et al[9]. Sylaja et al[8], in their seminal research, had only one third of stroke patients who were females. In our study, stroke onset occurred at an older age in women as compared with men. The mean ages of stroke onset were 60 yrs and 54.5 yrs for hemorrhagic and 62.3 yrs and 59.6 yrs in ischemic stroke in females and males respectively. Riley et al[10], noted that this age variation could be due to a fall in sex hormones around menopause. Ong et al had similar observations with regard to age of stroke patients[11]. However, the mean age for females was 72.18 years vs. 60.95yrs as we found and for males this was 68.29 yrs vs. 68yrs, respectively. Therefore, we saw a younger age at onset of stroke in females while the values for males were similar. In our study, 82% of ischemic strokes were thrombotic in type and others were embolic. In a review by Banerjee et al[12], 59% of ischemic strokes were thrombotic, and 10 % were cardioembolic, 4% were on account of causes like vasculitis while 27% were of undetermined origin. More detailed workup was restricted due to financial considerations; this could have better elucidated the causes.

Coming to the risk factors, we found a higher preponderance of smokers, alcoholics and diabetics in ischemic stroke patients amongst which 58.9% of ischemic stroke patients were smokers. As compared to western population, Indians had a higher rate of tobacco and alcohol use according to Sylaja et al[8].

Based on NIHSS scores at admission, 21.79% of ischemic and 16.66% hemorrhagic patients had mild, 47.43% ischemic and 16.66% of hemorrhagic cases had moderate and rest were more severe strokes. In a study by Bhaskar et al[1], the distribution for mild, moderate and severe NIHSS scores for ischemic stroke were 31.6%, 34.6% and 33.8%, respectively. Thus we had larger proportion of moderate and severe strokes. The NIHSS groups in intracerebral bleed patients as found by Mohammed et al[11], were mild to moderate severity in 46% and rest were more severe, a finding similar to our observations. The mean NIHSS scores of hemorrhagic patients was 15.79 ± 6.15, while in ischemic patients this was 12.96 ± 6.81 implicating a greater severity of hemorrhagic stroke as compared to ischemic.

On comparing mRS values in ischemic stroke, 48.7% were independent and 51.3% were dependent in our study at discharge while these values were 76.9% and 23.07% at 90 days, respectively. At discharge, only one third of hemorrhagic patients were independent while rest were dependent and these values improved to 54% independent and rest dependent, at 90 days follow up.In a study by Rodriguez et al, mRS at 90 days was 50% in ischemic stroke patients[9], which was almost similar to our study. In the same study they found that 40% of hemorrhagic patients were functionally independent and rest were either dependent or dead. The mean mRS scores in our hemorrhagic stroke patients was higher than ischemic patients, again indicating poorer functional outcomes in hemorrhagic patients.

On comparing the influence of initial stroke severity with patient outcomes at discharge and at 90 days, in ischemic and hemorrhagic stroke patients, there was a significant association meaning that more severe strokes had poorer functional outcomes. In a article published in the Stroke journal, it was stated that acute impairment score (NIHSS) independently predicted mRS at 2 months to 1 year post stroke[12]. Bhaskar et al[1] also found that initial stroke severity had a dominant impact on stroke outcome at 90 days.

Mahdy et al[13] found a significant positive correlation between mRS score and ICH score similar to what we found in our study. They also found that the intra

cerebral hematoma volume on admission had a significant positive correlation with the NIHSS. Standing by this, we also got higher stroke severity in those with higher ICH scores. Combining these two results, ICH score can well be used to prognosticate hemorrhagic strokes.

Raised serum homocysteine was associated with higher NIHSS and mRS scores in our study. Biswas et al[14], observed that homocysteine levels are higher in a stroke population. Bonthapally et al also found that homocysteine level correlated well with severity of disease assessed by NIHSS[15]. Acute phase elevated homocysteine correlated with severity and prognosis in patients with atherothrombotic stroke as noted by Xu Qing Wu et al[16]. This was also observed by Kwon et al[17] that there was a significant positive correlation between homocysteine values on admission and NIHSS at 7 days and mRS at 90 days.

Patients who had higher systolic blood pressure at presentation also had higher NIHSS and mRS scores in both ischemic and hemorrhagic stroke groups. Similar findings with regards to diastolic blood pressure groups were observed in above patient groups. In a systematic review by Wilmot et al[18], high systolic blood pressure, mean arterial blood pressure and diastolic blood pressure in the acute phase of stroke are associated with a poor outcome as death or as combined death or disability and combined death or early deterioration as assessed by the NIHSS and mRS and other stroke scales. Soliman et al[19] similarly observed that NIHSS and mRS scores were significantly higher in hypertensive patients with acute ischemic stroke. Thus, initial blood pressures can have a significant impact on stroke severity outcomes.

CONCLUSIONS

1. Higher NIHSS scores on admission were suggestive of higher ICH scores (in hemorrhagic stroke) as well as higher mRS scores at 3 months follow up in patients of ischemic or hemorrhagic stroke.

2. Serum homocysteine levels on admission were significantly higher in ischemic stroke patients with higher NIHSS scores and mRS at 3 months.

3. Higher systolic and diastolic blood pressures at presentation were related to higher NIHSS and mRS scores.

CONFLICT OF INTEREST : Nil

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