

# Assessment of Outcome of Acute Stroke Using National Institute of Health Stroke Scale (NIHSS)

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## ABSTRACT

**Background:** In view of the long-term disabilities caused by stroke the need for an accurate early prediction of future functional abilities is paramount for setting therapeutic goals, starting early rehabilitation planning, implementing home adjustments and community support tailored to patients' needs, and informing patients about their prospects and prognosis. In this study we have assessed significance of the national institute of health stroke scale (NIHSS) score, on the day of admission in predicting the severity and outcome on 30th day, in acute stroke patients. **Methods:** It is an observational prospective study. Study conducted on 93 patients of stroke who were admitted in Shri B M Patil Medical College hospital who were diagnosed and admitted with acute stroke on the basis of the History, Clinical examination and proved on CT/MRI scan. Patients were selected on the basis of the inclusion and exclusion criteria. NIHSS score is noted on the day of admission and then after 30days of stroke and the patient is independent at home or requires assistance is also noted and statistically analyzed. **Results:** In this study, after 1 month of stroke among 3 patients who had baseline NIHSS score 1-4, all 3 (100%) are independent at home, among 73 patients who had baseline NIHSS score 5-15, 47 (64.4%) are independent and 26 (35.6%) required assistance, among 7 patients who had score 16-20, 1 (14.3%) patient was independent at home, 6(85.7%) required assistance, and among 10 patients who had score more than 20, 7 (70%) died, 3 (30%) required assistance and none of them are home independent. With the p value <0.001 which is statistically significant. **Conclusion:** Baseline NIHSS score helps in predicting the outcome of the patient. Lesser the baseline score better will be the outcome.

**Keywords:** National Institute of Health Stroke Scale (NIHSS), Stroke.

## INTRODUCTION

Stroke is the leading causes of death and disability worldwide.<sup>[1]</sup> The most common cause of stroke is represented by cerebral ischemia and approximately 80% of strokes are due to ischemic cerebral infarction and 20% due to brain hemorrhage. Economical and psychological cost of stroke is enormous.<sup>[10]</sup>

Incidence of stroke has increased considerably in India and other developing countries. On an average, in comparison with high income countries stroke occurs 15 yr earlier in and causes more deaths in low and middle economic countries. The increasing incidence of stroke may be a reflection of - increased longevity, adoption of high fat diet, sedentary life style, increasing incidence of diabetes and hypertension, central obesity.

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In view of the long-term disabilities caused by stroke the need for an accurate early prediction of future functional abilities is paramount for setting therapeutic goals, starting early rehabilitation planning, implementing home adjustments and community support tailored to patients' needs, and informing patients about their prospects and prognosis. The National Institutes of Health Stroke Scale (NIHSS) is a well-validated, reliable scoring system for use specifically with stroke patients in assessing severity of the stroke and in predicting the outcome.<sup>[2]</sup> The National Institutes of Health Stroke Scale (NIHSS) can be used as a standard measurement instrument by physicians to evaluate the severity of a patient and outcome.

Many conditions can present like TIA or stroke. Seizures, infection, neoplasm, intracranial haemorrhage, hypoglycemia and other metabolic abnormalities are some of the conditions mimicking a stroke and TIA.<sup>[11-13]</sup> National Institutes of Health stroke Scale (NIHSS) was also found to be helpful in diagnosis of stroke.<sup>[14,15]</sup>

## MATERIALS AND METHODS

It is Hospital based observational prospective study. Information was collected through prepared Performa for each patient at the time of admission and followed up after 1 month.

With 95% confidence level and margin of error of  $\pm 7.5\%$ , a sample size calculated is 93 subjects by using the formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where

Z= z statistic at 5% level of significance

d is margin of error

p is anticipated prevalence rate

### Statistical Analysis

All characteristics will be summarized descriptively. For continuous variables, the summary statistics of N, mean, standard deviation (SD) will be used. For categorical data, the number and percentage will be used in the data summaries and data will be analyzed by Chi square test for association, comparison of means using t test, ANOVA and diagrammatic presentation.

### Inclusion criteria:

- All male and female cases of acute stroke.
- Patients of age more than 18yrs.

### Exclusion criteria:

- Patients of age less than 18yrs.
- Transient ischemic attacks.
- Subdural/Epidural hematomas.

NIHSS - Stroke scale (NIHSS)		Date and time	DD-MM-YYYY	HH:MM (24h)
<b>1. a. Level of Consciousness</b>				
0: Alert				
1: Not alert, but arousable with minimal stimulation				
2: Not alert, requires repeated stimulation to attend				
3: Coma				
<b>1. b. LOC questions (Ask patient the month and her/his age)</b>				
0: Answers both correctly				
1: Answers one correctly				
2: Both incorrect				
<b>1. c. LOC commands (Ask patient to open/close eyes &amp; form/release fist)</b>				
0: Obeys both correctly				
1: Obeys one correctly				
2: Does not obey				
<b>2. Best gaze (only horizontal eye movement)</b>				
0: Normal				
1: Partial gaze palsy				
2: Total gaze paresis or forced deviation				
<b>3. Visual Field testing</b>				
0: No visual field loss				
1: Partial hemianopia				
2: Complete hemianopia				
3: Bilateral hemianopia (blind including cortical blindness)				
<b>4. Facial Paresis (Ask patient to show teeth/ raise eyebrows &amp; close eyes tightly)</b>				
0: Normal symmetrical movement				
1: Minor paralysis (flattened nasolabial fold, asymmetry on smiling)				
2: Partial paralysis (total or near total paralysis of lower face)				
3: Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)				
<b>5. Motor Function - Arms</b>				
0: Normal (extends arms 90° (or 45°) for 10 seconds without drift)				
1: Some effort against gravity				
2: No effort against gravity				
3: No movement				
4: Unstable (Joint fused or limb amputated) (do not add score)				
<b>6. Motor Function - Legs</b>				
0: Normal (hold feet in 30° position for 5 sec without drift)				
1: Drift				
2: Some effort against gravity				
3: No effort against gravity				
4: No movement				
5: Unstable (Joint fused or limb amputated) (do not add score)				
<b>7. Limb Ataxia</b>				
0: No ataxia				
1: Present in one limb				
2: Present in two limbs				
<b>8. Sensory (Use pinprick to test arms, legs, trunk and face- compare side to side)</b>				
0: Normal				
1: Mild to moderate decrease in sensation				
2: Severe to total sensory loss				
<b>9. Best Language (Ask patient to describe picture, name items, read sentences)</b>				
0: No aphasia				
1: Mild to moderate aphasia				
2: Severe aphasia				
3: Mute				
<b>10. Dysarthria (Ask patient to read several words)</b>				
0: Normal articulation				
1: Mild to moderate slurring of words				
2: Near unintelligible or unable to speak				
3: Unintelligible				
4: Intubated or other physical barrier (do not add score)				
<b>11. Extinction and inattention (Formerly Neglect) (Use visual or sensory double stimulation)</b>				
0: Normal				
1: Instillation or extinction to bilateral simultaneous stimulation in one of the sensory modalities				
2: Severe hemi-inattention or hemi-mutilation to more than one modality				
Total Score				

### Study Design

- In patients diagnosed to have stroke by CT/DW MRI, NIHSS scoring is done on the day of admission.
- Based on the NIHSS score severity is assessed at the time of admission, 1-4 indicates minor stroke, 5-15

indicates moderate stroke, 16-20 indicates moderate to severe stroke, 21-42 indicates severe stroke.

- Patients are followed up after one month; NIHSS score after 30 days of stroke is noted.
- After 30 days of stroke the patient is independent at home or requires assistance is noted.

## RESULTS

The average age of the study population was 63.3 with standard deviation [SD] of =12.94, age ranged from 26 to 90 years. There were 63 (67.7) male patients and 30(32.3) female patients, there is male preponderance with male to female ratio 2.1:1 respectively. Distribution of cases according to NIHSS at admission is shown in [Table 1]

In this study, 3 (3.2%) patients had minor stroke, 73 (78.5%) patients had moderate stroke, 7 (7.5%) patients had moderate to severe stroke and 10 (10.8) patients had severe stroke. The distribution of patients based on their age category and stroke severity profile is shown in [Table 2 & Figure 1]. Majority of the stroke patients are in the age group from 51 to 70 years, majority of the moderate to severe and severe stroke are in the age group of 61 to 70 year. Distribution of cases according to independent/assistance required shown in [Table 3 & Figure 2]. 7.5% had died at one month, 54.8% were independent at home and 37.6% patients required assistance at the end of one month. Association of independent/assistance required after 1 month and NIHSS at admission is shown in [Table 4 & Figure 4]. After 1 month of stroke, among 3 patients who had baseline NIHSS score 1-4, all 3 (100%) are independent at home, among 73 patients who had baseline NIHSS score 5-15, 47 (64.4%) are independent and 26 (35.6%) required assistance, among 7 patients who had score 16-20, 1 (14.3%) patient was independent at home, 6(85.7%) required assistance, and among 10 patients who had score more than 20, 7 (70%) died, 3 (30%) required assistance and none of them are home independent.

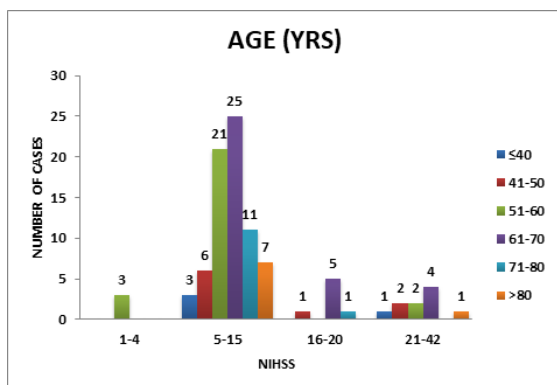
Statistical analysis of the data showed that the stroke severity at admission, measured with NIHSS, was positively associated with the 30 days outcome (P < 0.001). Moderate to severe stroke (NIHSS 16-20) and severe (NIHSS>21) stroke has got poor outcome, analyzed after 30 days of stroke.

**Table 1: Distribution of Cases According to NIHSS at Admission**

NIHSS At Admission		N	%
1-4	Minor stroke	3	3.2
5-15	Moderate stroke	73	78.5
16-20	Moderate to severe stroke	7	7.5
21-42	Severe stroke	10	10.8
Total		93	100

**Table 2: Association of age and NIHSS at Admission**

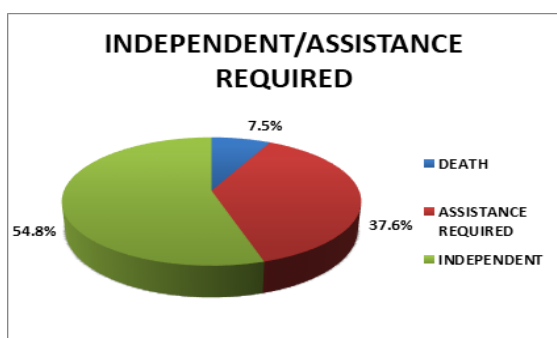
Age (yrs)	NIHSS at Admission								p value
	1-4		5-15		16-20		21-42		
	N	%	N	%	N	%	N	%	
<40	0	0.0%	3	4.1%	0	0.0%	1	10.0%	0.310
41-50	0	0.0%	6	8.2%	1	14.3%	2	20.0%	
51-60	3	100.0%	21	28.8%	0	0.0%	2	20.0%	
61-70	0	0.0%	25	34.2%	5	71.4%	4	40.0%	
71-80	0	0.0%	11	15.1%	1	14.3%	0	0.0%	
>80	0	0.0%	7	9.6%	0	0.0%	1	10.0%	
Total	3	100.0%	73	100.0%	7	100.0%	1089	100.0%	



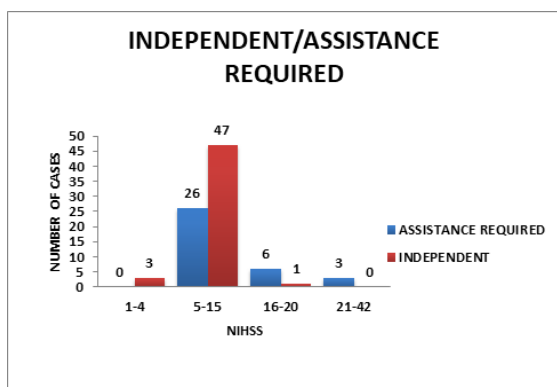
**Figure 1: Association of Age and NIHSS at Admission**

**Table 3: Distribution of Cases According to Independent/Assistance Require**

Independent/assistance required	N	%
Death	7	7.5
Assistance required	35	37.6
Independent	51	54.8
Total	93	100



**Figure 2: Distribution of Cases According to Independent/ Assistance Required**



**Figure 3: Association of Independent/Assistance Required After 30 Days and NIHSS at Admission**

**Table 4: Association of Independent/Assistance Required After 30 Days and Nihss at Admission**

Independent/assistance required	NIHSS at admission								p value
	1-4		5-15		16-20		21-42		
	N	%	N	%	N	%	N	%	
Assistance required	0	0.0%	2	35.7%	6	85.7%	3	100.0%	<0.001*
Independent	3	100.0%	4	64.3%	1	14.3%	0	0.0%	
Total	3	100.0%	7	100.0%	7	100.0%	3	100.0%	

Note: \* significant at 5% level of significance (p<0.05)

## DISCUSSION

Stroke is a medical emergency and can cause permanent neurological damage, complications and death. In view of the long-term disabilities caused by stroke the need for an accurate early prediction of future functional abilities is paramount for setting therapeutic goals, starting early rehabilitation, planning of implementing home adjustments and community support tailored to patient's needs, and informing patients about their prospects and prognosis.

The National Institutes of Health Stroke Scale (NIHSS) is a well-validated, reliable scoring system for use specifically with stroke patients. The National Institutes of Health Stroke Scale (NIHSS) can be used as a standard measurement instrument by physicians to evaluate the severity of a patient and outcome.<sup>[9]</sup>

This study is aimed at assessment of outcome of acute stroke using national institute of health stroke scale (NIHSS).

93 patients who met inclusion criteria were included in the study, age group of the patient ranged from 26yrs to 90 years, with mean age group 63.3±11.8, maximum number of patients were in the age group of 61-70 years. Age is non modifiable risk factor that correlates best with stroke. The study by Sacco RL, Risk factors, outcomes, and stroke sub types for Ischemic Stroke shows that majority of ischemic strokes occur in persons older than 65 years.<sup>[3]</sup>

There were 63 (67.7) male patients and 30(32.3) female patients with male to female ratio 2.1:1 respectively. Stroke is common in men than in

women. Hyvarinen M et al study reported that there is male preponderance with 55% men and 45% women out of 21706 cases.<sup>[4]</sup>

In our study 7 patients (7.5%) had hemorrhagic stroke and 86 (92.5%) had ischemic stroke. Analysis of data from large stroke studies shows approximately 80% of all stroke are ischemic and 20% are hemorrhagic.

In this study common risk factors were diabetes mellitus type 2, hypertension, dyslipidemia, smoking, tobacco chewing, alcoholism, ischemic heart disease, rheumatic heart disease.

These risk factors are comparable to other studies of stroke.<sup>[5,6]</sup>

The clinical severity of stroke is measured using NIHSS score on admission and outcome is measured by independence or dependence of the patient in home after one month.

In this study the patients diagnosed with stroke are further divided into minor stroke (NIHSS 1-4), moderate stroke (NIHSS 5-15) moderate to severe stroke (NIHSS 16-20) and severe stroke (NIHSS 21-42) based on baseline NIHSS score. Accordingly, 3.2% patients had minor stroke, 78.5% patients had moderate stroke, 7.5% patients had moderate to severe stroke and 10.8% patients had severe stroke. After 1 month of stroke, 35 (37.6%) patients were home independent, 51 (54.8%) patients required assistance at home and 7 (7.5%) patients had died.

After 1 month of stroke, among 3 patients who had baseline NIHSS score 1-4, all 3 (100%) are independent at home, among 73 patients who had baseline NIHSS score 5-15, 47 (64.4%) are independent and 26 (35.6%) required assistance, among 7 patients who had score 16-20, 1 (14.3%) patient was independent at home, 6 (85.7%) required assistance, and among 10 patients who had score more than 20, 7 (70%) died, 3 (30%) required assistance and none of them are home independent. No patient with NIHSS score less than 20 died, all the patients who died had severe stroke (NIHSS > 20).

In this study the results show that the patients with the NIHSS score  $\geq 16$  have high chance of severe disability or death. Whereas patients with score  $< 16$  have chances for better recovery. The results are consistent with the study (Adams HP Jr, et al. Baseline NIHSS score strongly predicts outcome after stroke.)<sup>[7]</sup> Shows NIHSS strongly predicts the likelihood of patient recovery after stroke. A score  $\geq 16$  shows high probability of death or severe disability whereas score  $\leq 6$  have good recovery. Similar study done by Gertkwakkel et al. predictive value of the NIHSS for ADL outcome after ischemic hemispheric stroke: Does timing of early assessment matters?. Showed similar results.<sup>[8]</sup>

## CONCLUSION

1. NIHSS score correlates well with the diagnosis and severity of the stroke.
2. Baseline NIHSS score is helpful in assessment and stratification of the stroke patients and also helps in further course of management of stroke.
3. Baseline NIHSS score helps in predicting the outcome of the patient. Lesser the baseline score better will be the outcome.

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