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Original Research Article

Outcome assesment of acute ischemic stroke by NIHSS score

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ABSTRACT

Need for the study: 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 30^{th} day ,in acute stroke patients.

Materials and Methods: It is a 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. This study was conducted between December 2017 to July 2019.

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.

1. Introduction

1.1. Definition

"Acute stroke is defined as abrupt onset of focal neurological deficit that is attributable to a focal vascular cause."[1]

1.2. Impact of stroke

The direct and indirect cost of acute stroke in united states alone was approximated to be $56.8 million in the year 2005. Every year in us more than 7,00, 000 people have stroke, one third in that are recurrent events. There was about 6.2million stroke death in the year 2015, making it the second leading cause of death worldwide.[2] Strokes are even more important because of prolonged disability they cause. The history of world has undoubtedly been altered by stroke. Many important leaders in science, medicine and politics have had their productivity cut permanently or prematurely short by stroke.[2] Among the stroke survivors around 15% and 30% become permanently disabled, while 20% of them remain in institutional care three months after the stroke. The economical and psychological costs of stroke are enormous.

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1.3. Stroke diagnosis and outcome prediction

STROKE MIMICS Diagnosis of stroke is not easy always. Diagnosis is difficult if patient presents with altered level consciousness. Many conditions can present like TIA or stroke. Seizures, infection, neoplasms, intracranial haemorrhage, hypoglycemia and other metabolic abnormalities are some of the conditions mimicing a stroke and TIA.[3–5] National Institutes of Health stroke Scale (NIHSS) was found to be helpful both in diagnosis of stroke and in stratifying patients, so that outcome could be predicted and also to decide for acute intervention. Among various stroke scales, NIHSS has been studied extensively and its reliability and validity are well documented in scientific literature.[6] So NIHSS was selected for this study and used on patients diagnosed with stroke and its consistency with the diagnosis of stroke and its usefulness in assessing the outcome was studied and confirmed.

National Institute of Health Stroke Scale (NIHSS)

2. Aims and Objectives

To study the clinical profile, note the baseline NIHSS score and to find out the significance of the national institute of health stroke scale (NIHSS) score on the day of admission in predicting the severity and outcome on 30^{th} day, in acute stroke patients

3. Materials and Methods

3.1. Source of data

The information for the study will be collected from Patients with Acute Stroke admitted to BLDEU'S Shri B. M. Patil medical college and hospital and Research centre, Vijayapur, between December 2017 to June 2019.

3.2. Method

Observational prospective study using National institute of health stroke scale to diagnose and assess outcome of acute stroke using it. NIHSS applied on patients diagnosed with stroke, two scores were obtained for each patient, one on day of admission another after 30 days .NIHSS score at the day of admission and after 30 days of admission were noted and statistically analyzed.

3.2.1. Type of study

Observational prospective study

3.2.2. Sample size

• With 95% confidence level and margin of error of ±7.5%, a sample size of 93 subjects will allow the study to determine the predictive value of NIHSS in diagnosis and outcome of stroke with finite population correction.

• 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

3.3. 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.

3.4. Inclusion criteria

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

3.5. Exclusion criteria

1. Patients of age less than 18yrs.
2. Transient ischemic attacks.
3. Subdural/Epidural haematomas.

3.6. Study design

1. Patients diagnosed to have stroke by CT/DW MRI, NIHSS scoring is done on the day of admission.
2. 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.
3. Estimation of Complete hemogram, Urine routine, Renal function test, ECG, Chest X-ray, RBS, HbA1C and 2D Echo,CT/MRI scan done at the time of admission.
4. Patients are followed up after one month, NIHSS score after 30 days of stroke is noted.
5. After 30 days of stroke the patient is independent at home or requires assistance is noted.

4. Results and Observation

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 60-70 years

In this study, 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.

In this study, hypertension is the major risk factor, followed by diabetes mellitus, tobacco chewing and smoking etc.

Table 1: National Institute of Health Stroke Scale (NIHSS)

National institute of health stroke scale Catagory		
1a.Levelof Consciousness(LOC):	0 = Alert; 1=Drowsy 2=Stuporous 3=Coma	
1b. LOC Questions: (Month, Age)	0=Answers both question correctly 1=Answers one correctly 2=Answers both incorrect	
1c.LOC Commands: (eyes close/open, make fist & let go)	0=Obeys both correctly 1=Obeys one correctly 2=Both incorrect	
2.Best gaze: (Eyes open- pt follows examiner's fingers or face)	0=Normal 1=Partial gaze palsy 2=Forced deviation	
3.Visual: (Introduce visual stimulus/threat to pt's visual field quadrants. Cover 1 eye and hold up fingers in all 4 quadrants.)	0=No visual loss 1=Partial hemianopsia 2=complete hemianopsia 3=Bilateral hemianopsia	
4.Facial Palsy: (Show teeth, raise eyebrows and squeeze eyes tightly shut.)	0 = Normal symmetrical movements. 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis of one or both sides	
5. Motor Arm: ("Elevate extremity to 90 degrees and score drift/movement. Count to 10 out loud and use fingers for visual cue".)	0 = No drift; limb holds 90 (or 45) degrees for full 10 seconds. 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity. 4 = No movement. UN = Amputation or joint fusion, 5a. Left Arm 5b. Right Arm	**Score**
6. Motor Leg: ("Elevate extremity to 90 degrees and score drift/movement. Count to 10 out loud and use fingers for visual cue".)	0 = No drift; leg holds 30-degree position for full 5 seconds. 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement. UN = Amputation or joint fusion 6a. Left Leg 6b. Right Leg	
7. Limb Ataxia: (Finger to nose, heal down shin)	0 = Absent. 1 = Present in one limb. 2 = Present in two limbs. UN = Amputation or joint fusion	
8. Sensory: (Pin prick to face, arms, trunk, and legs- compare sharpness side to side, or no feeling at all.)	0 = Normal; no sensory loss. 1 = Mild-to-moderate sensory loss 2 = Severe to total sensory loss	
9. Best Language: ("Name items, describe picture, and read sentences. Don't forget glasses if they normally wear them".)	0 = No aphasia; normal. 1 = Mild-to-moderate aphasia 2 = Severe aphasia 3 = Mute, global aphasia; no usable speech or auditory comprehension.	
10. Dysarthria: (Evaluate speech clarity by pt reading or repeating words on list.)	0 = Normal. 1 = Mild-to-moderate dysarthria 2 = Severe dysarthria UN = Intubated or other physical barrier, explain:—	
11. Extinction and Inattention (formerly Neglect): ("Use information form prior testing or double simultaneous stimuli testing to identify neglect face, arms, legs and visual fields".)	0 = No abnormality. 1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities. 2 = Profound hemi-inattention or extinction to more than one modality; does not recognize.	
NT= Not Testable		
Total Score		

Table 2: Distribution of cases according to age

Age (Yrs.)	N	%
≤40	4	4.3
41-50	9	9.7
51-60	26	28
61-70	34	36.6
71-80	12	12.9
>80	8	8.6
Total	93	100

	Min	Max	Mean	SD
Age (Yrs.)	26	90	63.3	11.8

Table 3: Distribution of cases according to sex

Sex	N	%
Male	63	67.7
Female	30	32.3
Total	93	100

Table 4: Association of age and sex

Age (yrs.)	Male		Female		p value
	N	%	N	%	
≤40	2	3.2%	2	6.7%	
41-50	6	9.5%	3	10.0%	
51-60	20	31.7%	6	20.0%	
61-70	21	33.3%	13	43.3%	0.772
71-80	9	14.3%	3	10.0%	
>80	5	7.9%	3	10.0%	
Total	63	100.0%	30	100.0%	

Table 5: Distribution of cases according to risk factors

Risk Factors	N	%
DM	45	48.4
HTN	54	58.1
Smoking	35	37.6
Alcohol	31	33.3
Tobacco	42	45.2
DYSL	15	16.1
IHD	4	4.3
RHD	3	3.2

Table 6: Distribution of cases according to clinical presentation

Clinical presentation	N	%
Motor deficit	84	90.3
Sensory deficit	6	6.5
Altered senosorium	54	58.1
Cranial nerve involvement	53	57
Language disturbance	46	49.5
Headache	7	7.5
Seizures	8	8.6

In this study most common presentation is with motor deficit, followed by altered sensorium, cranial nerve involvement etc.

Table 7: Distribution of cases according to infarct/hemorrhage

Infarct/Hemorrhage	N	%
Infarct	86	92.5
Hemorrhage	7	7.5
Total	93	100

In this study, 7.5% patients had hemorrhagic stroke and 92.5% patients had ischemic stroke**.**

Table 8: Distribution of cases according to NIHSS at admission

NIHSS at dmission		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

In this study, 3 patients had minor stroke, 73 patients had moderate stroke, 7 patients had moderate to severe stroke and 10 patients had severe stroke.

Table 9: Distribution of cases according to NIHSS after 1 month

NIHSS after 1 month	N	%
1-4	11	12.8
5-15	69	80.2
16-20	4	4.7
21-42	2	2.3
Total	86	100

Table 10: Mean NIHSS between admission and after 1 month

NIHSS	Min	Max	Mean	SD	p value
At admission	4	29	11.7	5.7	
After 1 month	0	23	8.9	4.4	<0.001*

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

In this study, as the age increases the percentage of patients having moderate and severe stroke increases.

In this study, 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.

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

Table 11: 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%	
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%	0.310
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%	

Table 12: Association of age and NIHSS after 1 month

Age (Yrs.)	NIHSS after 1 month								p value
	1-4		5-15		16-20		21-42		
	N	%	N	%	N	%	N	%	
≤40	0	0.0%	3	4.3%	0	0.0%	0	0.0%	
41-50	0	0.0%	7	10.1%	0	0.0%	0	0.0%	
51-60	4	36.4%	20	29.0%	0	0.0%	2	100.0%	
61-70	3	27.3%	24	34.8%	3	75.0%	0	0.0%	0.576
71-80	3	27.3%	9	13.0%	0	0.0%	0	0.0%	
>80	1	9.1%	6	8.7%	1	25.0%	0	0.0%	
Total	11	100.0%	69	100.0%	4	100.0%	2	100.0%	

Table 13: Distribution of cases according to independent/assistance required

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

Table 14: Association of independent/assistance required 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%	26	35.6%	6	85.7%	3	100.0%	
Independent	3	100.0%	47	64.4%	1	14.3%	0	0.0%	<0.001*
Total	3	100.0%	73	100.0%	7	100.0%	3	100.0%	

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

Table 15: Association of independent/assistance required and NIHSS after 1 month

Independent/Assistance Required	NIHSS After 1 Month								p value
	1-4		5-15		16-20		21-42		
	N	%	N	%	N	%	N	%	
Assistance required	0	0.0%	30	43.5%	3	75.0%	2	100.0%	
Independent	11	100.0%	39	56.5%	1	25.0%	0	0.0%	0.005*
Total	11	100.0%	69	100.0%	4	100.0%	2	100.0%	

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

had score more than 20, 7(70%) died, 3(30%) required assistance and none of them are home independent.

In this study, the patients who were independent at home after one month had less NIHSS score compared to patients who required assistance.

In this study, the severity of the stroke is more with poorly controlled diabetes.

5. Discussion

Stroke is a global epidemic and an important cause of morbidity and mortality. It is the second most common cause of death and may soon become the leading cause of death worldwide.

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 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. 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.

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

93 patients admitted to Shri B.M.Patil Medical College Vijayapur, 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**.**

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.

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.

The clinical severity of stroke and outcome after one month of stroke is measured using NIHSS score on admission and after one month.

In this study the patients diagnosed with stroke are further divided in to 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.

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.

Analyzing NIHSS score and age it shows that as the age increases the percentage of patients having moderate and severe stroke increases. For example only 29% of patients had moderate stroke in 41-50 age group while 61-70% had moderate to severe stroke in 61-70 age group.

NIHSS score after 1 month of stroke shows that 11(11.8%) patients had score between 1-4, 69 (74.19%) patients had score between 5-15, 4 (4.3%) patients had score between 16-20, 2 (2.15%) patients had score 21-42, and 7 (7.52%) patients died.

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.

Among 35 patients who were home independent at one month of stroke, 3 patients had score 1-4, 47 had score 5-15, 1 had score 16-20 and none had score more than 20.

Among 51 patients who required assistance at one month following stroke, 26 patients had score 5-15, 6 had score 16-20, 3 had score more than 20 and none of them had score less than 5. And all the 7 patients who had died had score more than 20.

In other way 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 shows that the patients with the NIHSS score >= 16 have high chance of severe disability or death. Whereas patients with score <16 have chances for better recovery.

In this study patient HBA1C ranged from 4.5gm% to 12.8gm%. Among 3 patients who had minor stroke (NIHSS 1-4), all 3 had HBA1C less than 6%. Among 73 patients with moderate stroke (NIHSS 5-15), 33(45.2%) had HBA1C <6%, 32(43.8%) had HBA1C 6-9, 8(11%) had HBA1C >9%. Among 7 patients who had moderate to severe stroke (NIHSS 16-20) 1 had HBA1C 6-9%, 6(85.7%) had HBA1C >9% none had HBA1C <6%. Shows that the severity of the stroke, so as the NIHSS score increases with increasing HBA1C level.

6. Summary

1. As the age increases incidence of stroke increases, age is the independent risk factor for acute stroke.

Table 16: Descriptive parameters of blood glucose and HbA1C

	Min	Max	Mean	SD
Blood glucose on admission	80	420	196.1	82.4
HbA1C	4.5	12.8	7.3	2.0

Table 17: Association of HbA1C levels and NIHSS at admission

HbA1C	NIHSS at admission								p value
	1-4		5-15		16-20		21-42		
	N	%	N	%	N	%	N	%	
<6	3	100.0%	33	45.2%	0	0.0%	0	0.0%	<0.001*
6-9	0	0.0%	32	43.8%	1	14.3%	0	0.0%	
>9	0	0.0%	8	11.0%	6	85.7%	10	100.0%	
Total	3	100.0%	73	100.0%	7	100.0%	10	100.0%	

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

2. Maximum numbers of patients were in the age group of 60-70
3. Stroke is more common in males (67.7%) compared to females (32.3%), with male :female ratio of 2.1:1. In the same way multiple risk factors are common in males compared to females.
4. Systemic hypertension was the most common risk factor associated with stroke (58.1%) followed by diabetes mellitus (48.4%) and smoking (37.6%).
5. Motor deficit is the most common presentation followed by altered sensorium and speech disturbance
6. NIHSS is most helpful in identifying patients with acute stroke
7. NIHSS is helpful in assessment and stratification and further course of management. Among patients identified with stroke most had moderate stroke compared to moderate to severe stroke and severe stroke.
8. The NIHSS score on day of admission predicts the outcome of stroke, lesser the score better the outcome of stroke. And all the patients who had died had NIHSS score more than 20.
9. Increased severity of the stroke is seen in poorly controlled diabetes mellitus
10. Medical and paramedical staff can be trained to administer NIHSS for early recognition and effective treatment of acute stroke.

7. 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.
4. HBA1C levels correlate well with the severity of the stroke and NIHSS on admission

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9. Conflict of Interest

The authors declare that they have no conflict of interest.

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