

## Use of National Institutes of Health Stroke Scale Score for Predicting In-Hospital Mortality Due To Ischemic Stroke

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**ABSTRACT Objective:** the target of this study was to assess the usefulness of the National Institutes of Health Stroke Scale Score (NIHSS) in our general population through the assessment of in-hospital mortality in ischaemic stroke patients. **Materials and Methodology:** This prospective observational study was conducted at the Department of drugs, Civil Hospital, Karachi, Pakistan from 1st April to 30th September 2017. Patients of either gender and age of 18-75 years were included. Patients admitted within 24 hours of the onset of symptoms of stroke and having NIHSS score >16 were selected, while those with any sort of intracranial hemorrhage, malignancy, diabetes with complications, asymptomatic stroke, transient ischemic attack, the onset of symptoms >24 hours, coronary failure, chronic kidney failure, tuberculoma, meningitis, encephalitis, or hydrocephalus were excluded. A neurological examination was done and patients were scored on the idea of NIHSS. They were then observed for 72 hours after the stroke to work out the result. **Results:** Out of a complete of 256 patients, 178 were males and 78 females, with a mean age of 52.43±8.62 years. The mean onset of stroke was 10.83±5.67 hours while the NIHSS score was 20.35±2.85. The frequency of mortality was noted to be 39 (15.2%). those that couldn't survive had how higher mean NIHSS score (24.15±3.12 vs 19.67±2.19). There was a big association of mortality with age (p=0.034), duration of stroke (p=0.000), and history of DM (p=0.001). **Conclusion:** The baseline NIHSS score was significantly related to mortality among patients in our study having age quite 45 years, the onset of stroke before presentation >12 hours, and diabetes. The burden of stroke seems to be high in Pakistan. It also can be concluded that NIHSS in patients with ischaemic stroke may help to categorize the patients who should receive thrombolytic treatment and who needs only rehabilitation. **Keywords:** Stroke, Hemorrhage, Infarction

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## INTRODUCTION

Cerebrovascular accident (CVA), commonly called Stroke, is that the second leading explanation for death and therefore the third leading explanation for serious long-term disability worldwide. According to a report by the planet Health Organization, globally, around 15 million people get a stroke annually, of which five million die and another five million are permanently disabled.<sup>1</sup> Moreover, the amount of deaths is predicted to get up to 7.8 million by 2030.<sup>2</sup> A overwhelming majority of those stroke-related deaths occur in low and middle-income countries, with an outsized number reported from

South Asia.<sup>3-5</sup> In countries like Pakistan, India, Russia, China, and Brazil, middle-aged people suffering a stroke are five to 10 times higher, in comparison with the UK or the US.<sup>6</sup> Moreover, in 2016, the crude (age- and sex-adjusted) annual incidence of stroke was found to be 95 per 100,000 people, with the very best incidence being 584,000 of 650,000, noted among individuals of 75-85 years aged.<sup>7</sup> Stroke could also be hemorrhagic or ischemic. Early identification of transient ischaemic attack (TIA) or minor ischemic stroke (MIS) may be a crucial aspect of management since these are at high risk of

recurrent strokes within the future. For this, there are various predictive scores made, so as to boost awareness and assess the danger of recurrent strokes. This, in turn, might improve adherence to prevention strategies.<sup>8</sup> Moreover, these clinical prediction rules could also be the foremost helpful in triaging the patients.<sup>9</sup> It is believed that a robust correlation exists between the baseline stroke severity and therefore the ultimate outcome. The usefulness of risk defining scores depends on their predictive value, consistency, and ease of calculation. Routine use of such a tool can assist healthcare providers in documentation and communication, formulating prevention strategies, making treatment decisions, or designing clinical trials. Of many scales in use, the National Institutes of Health Stroke Scale (NIHSS) may be a validated and therefore the most generally used tool for assessing the initial stroke severity and the resulting deficits. During this way, it's been shown to predict mortality in acute ischaemic stroke in several prior studies.<sup>10-12</sup> However, those efforts were confined to a little number of patients in single-center studies, which too within the western population.<sup>11</sup> With the increasing negligence for the adulthood population in our part of the planet and lack of care, this study can assist in defining a general approach towards them especially for those having a CVA. Early suspicion, diagnosis and prompt management of these in need will cause better and simpler use of our limited health care resources. Besides, worse outcomes of a manageable disorder are going to be prevented. The target of this study was to assess the usefulness of the NIHSS in our general population through the assessment of in-hospital mortality in ischaemic stroke patients.

## METHODS AND PATIENTS

This prospective observational study was conducted at the Department of drugs, Civil Hospital, Karachi, Pakistan from 1st April 2017 to 30th September 2017 taking a sample size of 256 patients. Patients of either gender and age of 18-75 years were included. Patients admitted within 24 hours of the onset of symptoms of stroke and having NIHSS score >16 were selected through non-probability consecutive sampling. Patients were excluded if that they had any sort of intracranial hemorrhage, malignancy,

diabetes with complications, asymptomatic stroke, TIA, the onset of symptoms >24 hours, coronary failure, chronic kidney failure, or previous brain lesions (like tuberculoma, meningitis, encephalitis, or hydrocephalus). The study was conducted after approval from the moral committee of the Dow University of health science. All patients were informed about the objectives and methods of the study. Only consenting (Written consent) patients were included within the study. Patients were liberal to leave the study anytime.

For all the patients enrolled, an in depth proforma was filled by the PI himself and preapproved to avoid bias. Patient name, age, gender, admission number were recorded. A clinical neurological examination was done and patients were scored on the idea of NIHSS. The NIHSS is an ordinal nonlinear scale comprising of 15 items associated with aspects of stroke-related neurological impairments, with each scored from 0 to 4. It is often scored up to a maximum of 42, with scores >21 indicating a severe deficit. It takes 5-8 minutes to administer the scale. Patients were then observed for 72 hours after the stroke to work out the result. Data evaluation became performed via SPSS Version-20. For quantitative variables like age, NIHSS score, and period of stroke, suggest and consequently the variance (SD) have been calculated. Frequencies and percentages had been calculated for qualitative variables like gender, hypertension, DM, hyperlipidemia, and in-hospital mortality. Effect modifiers like age, gender, length of a stroke, hypertension, DM and hyperlipidemia were controlled through stratification. A post-stratification chi-square test became applied. P-value

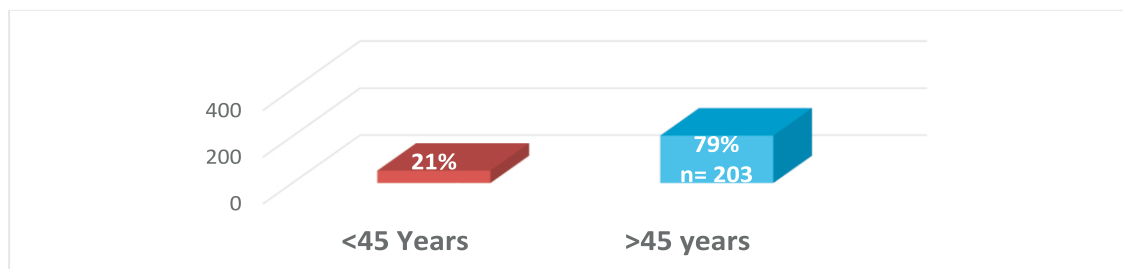
## RESULTS

A total of 256 patients meeting the inclusion criteria of the study were enrolled. Their mean age was 52.43±8.62 years with age distribution as shown in figure 1. Around 178 (69.5%) were males and 78 (30.5%) were females (Figure-2). The mean onset of stroke was 10.83±5.67 hours while the overall mean NIHSS score of study subjects was 20.35±2.85 (Table 1). Hypertension, hyperlipidemia, and Diabetes Mellitus were the three most common comorbidities as shown in Table 2. The frequency of mortality was noted to be 39 out of 256 (15.2%). Those who could not survive had a mean NIHSS score of 24.15±3.12 which was way higher

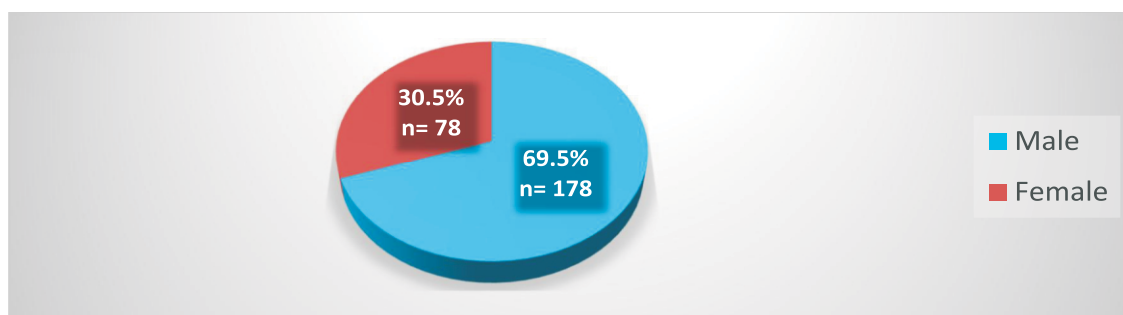
when compared to those who survived, i.e.  $19.67 \pm 2.19$  (Figure 3) (Table 2). Stratification with respect to gender, age, duration of a stroke, hypertension, diabetes mellitus, and hyperlipidemia was done to observe the association of these modifiers with mortality in stroke patients. The results

showed that there was a significant association of mortality with age ( $p=0.034$ ), duration of stroke ( $p=0.000$ ) and history of diabetes mellitus ( $p=0.001$ ). The detailed results of the associations are presented from Table-3.

**Figure-1:** Age distribution of all patients (n = 256).



**Figure-2:** Distribution of gender among all patients (n=256)



**Table-1:**Pre-treatment basic demographic statistics of all patients (n=256).

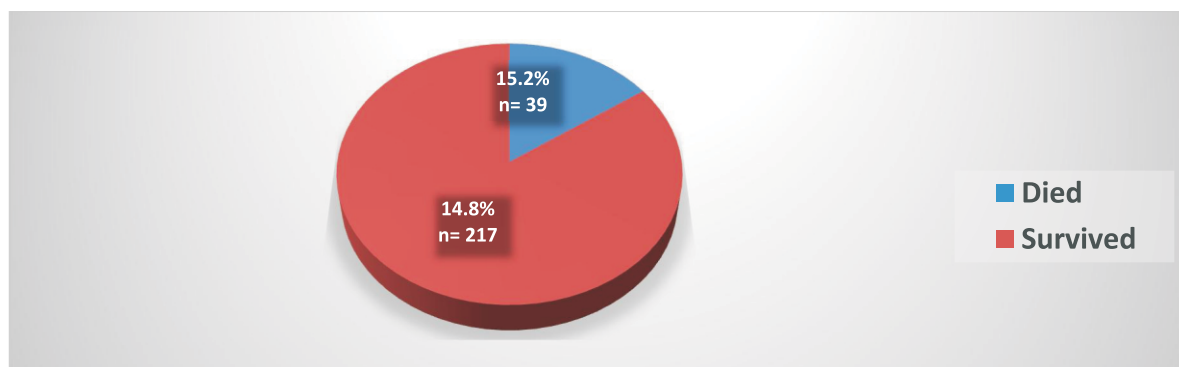
	Mean $\pm$ SD	Min	Max	Median (IQR)	95% C.I.
<b>Age (years)</b>	52.43 $\pm$ 8.62	34	66	53 (13)	51.37, 53.49
<b>Duration of Stroke (hours)</b>	10.83 $\pm$ 5.67	4	24	8 (9)	10.13, 11.53
<b>Score on NIHSS scale</b>	20.35 $\pm$ 2.85	17	31	20 (4)	20.00, 20.70
<b>Age of those who died</b>	49.79 $\pm$ 9.14	35	65	50 (18)	46.80, 52.73
<b>Stroke duration of those who died</b>	16.46 $\pm$ 5.08	6	24	17 (8)	14.81, 18.11
<b>NIHSS score of those who died</b>	24.15 $\pm$ 3.12	17	31	24 (2)	23.14, 25.16

Abbreviation: NIHSS, National Institutes of Health Stroke Scale; SD, Standard deviation

**Table: 2.** Comorbidities (n=256)

	Frequency	Percentage (%)
<b>Hypertension</b>	178	69.5
<b>Diabetes Mellitus</b>	81	31.6
<b>Hyperlipidemia</b>	96	37.5

**Figure-3:**Frequency of mortality among all stroke patients. (n = 256).



**Table-3:**Association of outcome with National Institutes of Health Stroke Scale score (n=256)

	Outcome	
	Died(n=39)	Survived (n=217)
<b>Descriptive statistics</b>		
<b>Mean ± SD</b>	24.15 ± 3.12	19.67 ± 2.19
<b>95%CI</b>	23.14,25.16	19.37,19.96
<b>Median (IQR)</b>	24.00 (2)	19.00 (3)
<b>Range</b>	17-31	17-28

**Table: 3.** Stratified analysis showing the association of mortality in stroke with risk factors (n=256)

	Mortality		Total	p-value
	Yes	No		
<b>Gender</b>				0.424
Male	25	153	178	
Female	14	64	78	
Total	39	217	256	
<b>Age</b>				0.034
≤45 years	13	40	53	
>45 years	26	177	203	
Total	39	217	256	
<b>Stroke Onset</b>				0.0001
≤12 hours	12 (%)	164 (%)	176	
>12 hours	27 (%)	53 (%)	80	
Total	39 (%)	217 (%)	256	
<b>Hypertension</b>				0.065
Yes	32 (%)	146 (%)	178	
No	7 (%)	71 (%)	78	
Total	39 (%)	217 (%)	256	
<b>Diabetes Mellitus</b>				0.0001
Yes	21 (%)	60 (%)	81	
No	18 (%)	157 (%)	175	
Total	39 (%)	217 (%)	256	

Chi-Square Test was applied., P-value≤0.05 considered as significant. \*\*Not significant at 0.05 level.

## DISCUSSION

The NIHSS basically determines the neurological deficit by assessing the conscious level, visual field, eye movements, sensory and motor function, speech, inattention, and cognition. The scoring, therefore, determines the stroke severity and predicts the outcome after acute ischemic stroke.<sup>14,15</sup> The current study, by using the NIHSS evaluated stroke patients in a local setting and found that stroke patients presenting with NIHSS score >16 had an elevated risk of adverse outcomes as the mean score associated with mortality was 24.15±3.<sup>12</sup> It was noted that there were about six times higher mortality rates in those presenting with stroke onset of >12 hours (33.75%) compared to those with stroke appearing in <12 hours' time (6.82%; p-value < 0.0001). Similarly, Ali A in a take a look at on Stroke related complications conducted in Pakistan determined a higher fee of complications in patients imparting with a postpone of 12 hours or more.<sup>16</sup> A single-center have a look at from Taiwan with 360 stroke patients concluded that the NIHSS measured stroke severity on presentation is the strongest predictor of 3-month mortality (odds ratio, 1.17, 95% CI, 1.12–1.22). A prior look at for the “Get With The Guidelines-Stroke” program confirmed that NIHSS become the most powerful predictive model for in-medical institution mortality (c-statistic 0.seventy two to 0.85). Similarly, Ali A at some point of a have a look at on Stroke related headaches conducted in Pakistan found a better charge of complications in patients presenting with a put off of 12 hours or more.<sup>16</sup> A single-center look at from Taiwan with 360 stroke patients concluded that the NIHSS measured stroke severity on presentation is that the most powerful predictor of 3-month mortality (odds ratio, 1.17, 95% CI, 1.12–1.22). A previous take a look at for the “Get With The Guidelines Stroke” program confirmed that NIHSS became the most powerful predictive version for in-hospital mortality (c-statistic 0.seventy two to 0.85). Similarly, Ahmed R, et al. carried out a study on the primary prediction of final results after stroke evaluated via NIHSS (the rating ranged between 2 and 28), and mentioned that NIHSS may be a very good predictor of functional outcome in sufferers with ischaemic stroke.<sup>17–19</sup> Shabbir et al, in his work, concluded that stroke can be a disorder of the elderly imposing a serious effect on their mortality rates. In our study, the mean age of the patients was 52.43±8.62 years with 79% >45 years aged. In another

local study, most of the themes (86%) were >45 years aged with a mean age of 64.<sup>20,21</sup> Age difference revealed that stroke patients having age above 45 years had twice the danger of death compared thereto of compared to that of <45 years (24.53% vs 12.81%; p-value=0.034). The studies from Switzerland and Germany also found that old age and higher NIHSS score among stroke patients was associated with more mortality and adverse outcomes.<sup>11,22</sup> Similar results from other studies also documented that survival of younger patients was more than the older patients having stroke history, and a higher NIHSS total score. However, the NIHSS score predicts mortality in them very well.<sup>21</sup> Likewise, death due to stroke in females was much higher (18% vs 14%) than their counterparts however, the results lacked statistical significance (p-value=0.424). The ratio of mortality in males to females was comparable i.e. 1:1 in other Pakistani studies.<sup>21,24</sup> This might be due to less offering of acute stroke treatment females.<sup>25</sup> The presence of comorbidities like hypertension and diabetes mellitus were also associated with the doubling of an adverse outcome (death) among stroke patients (p values 0.065 and < 0.0001 respectively). Bruno et al. also reported similar results.<sup>26</sup> Overall, within the presence of those risk factors, there's an absolute need for techniques so as to predict the danger and outcomes of stroke. Researchers are trying to return up with stroke risk prediction models for functional decline and mortality.<sup>19</sup> Similar scores could potentially be engaged to spot TIA patients who are in need of admission but haven't been evaluated clinically.<sup>27</sup> A study from China and a couple of other countries have constructed a model for predicting the 15-year incidence of stroke and these models could also be useful in identifying individuals at high risk of stroke.<sup>28–31</sup> Here, we are limited by the fact that this was a single-center experience with small sample size and therefore, the results cannot be generalized. Moreover, the follow-up period was very short.

## CONCLUSION

In the line of fire of the increasing stroke incidence and a major public health problem, putting a significant impact on individuals, their families and wider society, the risk prediction models like NIHSS score provide a great ray of hope. The baseline NIHSS score was significantly associated

with mortality among patients in our study having age more than 45 years, the onset of stroke before presentation >12 hours, and diabetes. The burden of stroke seems to be high in Pakistan. It can also be concluded that NIHSS in patients with ischemic stroke may help to categorize the patients who should receive thrombolytic treatment and who needs only rehabilitation.

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