



## Cross-sectional Study

# Inpatient assessment of the neurological outcome of acute stroke patients based on the National Institute of Health Stroke Scale (NIHSS)



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## ABSTRACT

**Objective:** Identify the association between stroke severity and the neurological outcome of an acute stroke using the National Institutes of Health stroke scale (NIHSS).

**Study design:** A descriptive cross-sectional study.

**Place and duration of study:** Northwest hospital Hayatabad Peshawar.

**Methodology:** A cross-sectional descriptive study was done in the general plus stroke unit of the northwest hospital in Peshawar, KPK during Jan 2022 to July 2022. 400 admitted patients diagnosed with acute stroke in the past three months were included for NIHSS assessment and were classified as mild, moderate, or severe stroke. After entering all of the data from the collection into SPSS version 16, the information was transferred to an Excel spreadsheet. To further assess the results, the researcher and statistician evaluated all of the cases, radiological findings, and laboratory test data.

**Results:** In this cross-sectional descriptive study, 400 individuals ranging from 30 to 90 years of age were divided into two groups: males and females. The survey was conducted by 49% of men and 51% of women. The stroke severity was assessed to be mild in 22% of cases, moderate in 49%, and severe in 29% of patients. As evaluated by the NIHSS, Patients with acute ischemic stroke were divided into four groups depending on their neurological outcomes: those who improved were 160 (40%), those who remained stable were 124 (31%), and those who deteriorated were 52 (13%), and those who died were 64 (16%). Patients with greater triglyceride levels were 88, while those with lower levels were 312. Acute stroke was also detected in 34% of patients with a covid history, 28% of patients who were covid positive, and 38% of patients who were covid free in this investigation.

**Conclusion:** According to our findings, the NIHSS is a reliable scale for evaluating patients' neurological outcomes and determining the association between acute stroke severity and cognitive functioning (NIHSS).

## 1. Introduction

Globally, stroke is the leading cause of mortality and long-term disability, triggering significant challenges for patients and their

caregivers [1]. The prognosis of patients with ischemic stroke is a primary concern. Important prognosis determinants are the stroke's severity and clinical symptoms on the first day of treatment [2]. Improving clinical outcomes is essential for in-patient rehabilitation and

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specialized care for better recovery of the patients and their families. 1, 750,000 strokes occur a year in the United States, with a 150,000-mortality rate [3]. In the developing world, hypertension is a more prevalent cause of increasing hemorrhagic and ischemic stroke incidence. As hypertension management has improved, the proportion of hemorrhagic stroke has reduced, whereas the proportion of cardiovascular diseases and ischemic stroke has increased [4]. To control and minimize stroke, it is necessary to identify multiple flexible and non-modifiable characteristics. Diet (modifiable factor), age, gender, and race (immutable factors), infectious events, sepsis, stress (short-term risk or trigger), hypertension, and hyperlipidemia are intermediate-term risk factors [5]. However, these variables vary between young and elderly patients. In Pakistan, India, China, Thailand, Sri Lanka, and Nepal, stroke death rates are significantly higher due to low socioeconomic status and increased risk factors [6].

According to the Aga Khan University in Pakistan’s National Health Survey, 33% of the adult population, 20% of smokers, and 2 million diabetics are affected by hypertension [7]. A lack of information and awareness, insufficient time to seek care, and an emergency transit system exist in Pakistan. According to research, most patients had a prehospital delay of 6–9 h [8]. A clinical evaluation can evaluate and estimate a stroke’s severity. Various scoring methods are utilized to assess and measure the severity of a stroke. As a result, the National Institute of Health Stroke Scale (NIHSS) has become a widely accepted and widely utilized grading system.

## 2. Methodology

This cross-sectional study was conducted at the general plus stroke unit of Northwest Hospital in Peshawar, Pakistan during Jan 2022 to July 2022. The Northwest General Hospital and Research Centre Hayatabad Peshawar’s ethical committee accepted the inpatient evaluation of the neurological outcomes of acute stroke patients using the National Institutes of Health Stroke Scale (NIHSS).

The sample consisted of two groups, 140 men and women between the ages of 30 and 90. Only hospitalized patients with acute middle cerebral artery ischemic stroke who acquired symptoms over 40 months were included in the analysis (for sample collection).

No patients received acute thrombolytic therapy during the investigation because our institution lacked intravenous tissue plasminogen activator and rapid endovascular intervention. Since recurrent stroke is unrelated to more acute laboratory abnormalities, patients having a history of stroke, posterior circulation ischemia, or neurological disorders were excluded from this investigation.

To evaluate neurological outcomes using the NIHSS score, patients with acute stroke, covid history, triglyceride, cholesterol level, chronic heart disease, CCF, obesity, and hypercoagulable states were included in the study. After collecting samples, the data were entered into an Excel spreadsheet and then imported into SPSS by IBM version 16. The researcher and the statistician evaluated all the cases, radiological findings, and laboratory testing for additional data analysis.

Our study is fully compliant with the STROCSS 2021 guidelines [9]. A complete STROCSS 2021 checklist has been provided as a supplementary file. Our study has been registered on Research Registry with the following UIN: researchregistry8175 [10]. Our study is in accordance with the Declaration of Helsinki.

## 3. Results

This was descriptive cross-sectional research with 400 participants aged 30 to 90. The study consisted of 51% females and 49% males, as shown in Table 1. 10% were smokers whereas 11% were found to be passive smokers as shown in Table 2. In 22% of cases, the severity of a stroke was rated as mild, 49% as moderate, and in 29% of cases, it was severe, as shown in Table 3. The study categorized the neurological outcome of patients into four distinct groups, as shown in Fig. 1.

**Table 1**  
Gender distribution.

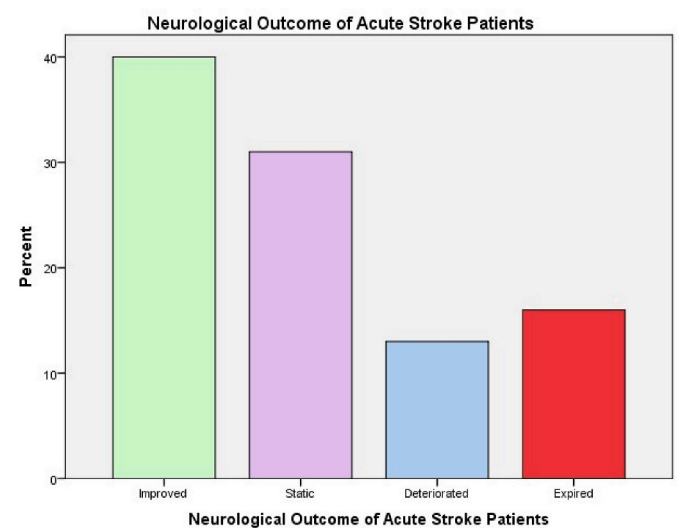
Gender	Frequency	Percentage
Male	204	51%
Female	196	49%
Total	400	100%

**Table 2**  
Patient with smoking.

Patients with smoking	Frequency	Percent
Smoking	40	10%
Smoked	48	12%
Never Smoked	268	67%
Passive Smoker	44	11%
Total	400	100%

**Table 3**  
Neurological outcome of an acute stroke patient.

Acute Stroke Patients	Frequency	Percent
Improved	160	40%
Static	124	31%
Deteriorate	52	13%
Expired	64	16%
Total	400	100%



**Fig. 1.** Neurological outcome of acute stroke patients.

According to the NIHSS, patients who improved from stroke were 160 (40%), static was 124 (31%), deteriorated were 52 (13%), and deceased patients were 64 (16%), as shown in Table 3. Patients with triglyceride levels above 150 mg/dl numbered 88, while those below 150 mg/dl numbered 312, the same was true of cholesterol levels, as shown in Table 4. In this study, 34% of patients with a history of covid, 28% of patients with a covid-positive history, and 38% of patients without a covid history had an acute stroke, as shown in Table 5. The patient’s hypercoagulable state with the highest frequency of congestive heart failure, obesity, and chronic liver illness which is shown in Table 6 and Fig. 2. In 22% of cases, the severity of a stroke was rated as mild, 49% as moderate, and in 29% of cases, it was severe, as shown in Table 7.

## 4. Discussion

Our research shows that the severity of a stroke was classified as

**Table 4**  
Acute stroke with triglycerides, cholesterol, HbA1c, and eGFR levels.

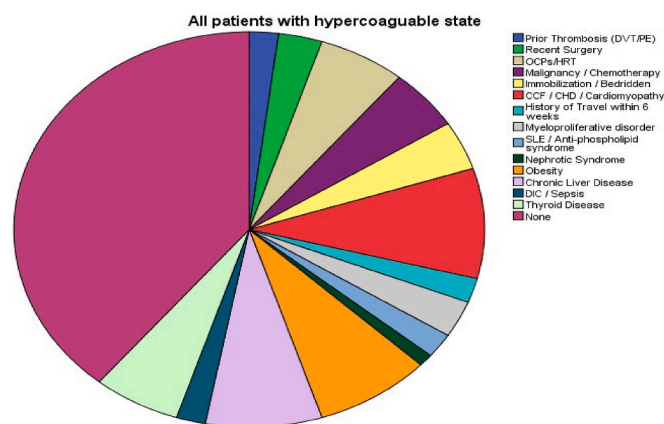
Stroke	HbA1c $\geq$ 7	BP $\geq$ 140/90 mmHg	Chronic Cardiac Disease	Triglycerides 150 mg/dl	$\geq$ cholesterol level $\geq$ 240 mg/dL or LDL $\geq$ 190 mg/dl	CKD stage 3–5 OR eGFR being lower than 45 ml/min
Yes	184	244	80	88	88	120
No	216	156	320	312	312	280
Total	400	400	400	400	400	400

**Table 5**  
Patient with Covid positive.

Patient with COVID	Frequency	Percent
COVID positive	112	28%
History of COVID none	136	34%
Total	400	100%

**Table 6**  
Hypercoagulable states in acute stroke.

Hypercoagulable States	Frequency
OCPs/HRT	6
Malignancy/Chemotherapy	5
Immobilization/Bedridden	4
CCF/CHD/Cardiomyopathy	9
History of Travel within 6 weeks	2
Myeloproliferative disorder	3
SLE/Anti-phospholipid syndrome	2
Nephrotic Syndrome	1
Obesity	8
Chronic Liver Disease	8
DIC/Sepsis	2
Thyroid Disease	6
None	39
Total	100



**Fig. 2.** All patients with a hypercoagulable state.

**Table 7**  
Severity of stroke by NIHSS scale.

Stroke Severity by NIHSS	Frequency	Percent
Mild (score less than 5)	88	22%
Moderate (score 5 to 15)	196	49%
Severe (above 15)	116	29%
Total	400	100%

moderate in 49% of instances, mild in 22% of cases, and severe in 29%. There were 160 patients who showed improvement after a stroke (40%), 124 who remained stable (31%) or deteriorated (13%) and 64 who passed away. The same was true for cholesterol levels; 88 patients had readings over 150 mg/dl, while 312 had readings below that threshold.

The NIHSS is the most reliable stroke outcome prediction scale. A study of 360 patients hospitalized with AIS in Taiwan revealed that the NIHSS was a valid predictor of death with a ratio of 1.17 three months after stroke (95% CI, 1.12–1.22). The German study reported that within the first 6 h of hospital admission, for 100 days of survival, the NIHSS is the most important predictor for acute stroke assessment. The Swiss and German trials with a sample size of 479 older age groups concluded that the highest NIHSS score was the only predictor of mortality within 30 days following stroke. Fayyaz and his team studied the clinical outcomes of 132 diabetic patients with ischemic stroke. They found that diabetic and non-diabetic patients under 40 recovered well. However, diabetic patients older than 40, especially those older than 60, had a high mortality rate.

The National Institutes of Health reported that 29.1% of ischemic stroke patients had a mean baseline NIHSS score of 18 (2–39) points. In contrast, at baseline, three-fifths of the patients had NIHSS scores of more than 16 points. They were hospitalized on the 17th day with severe neurological impairments and poor clinical outcomes. Adams et al. conducted a study in which they compared the baseline NIHSS score in acute stroke therapy (TOAST) score in 1281 patients with ischemic stroke to predict the clinical outcome on the seventh day and three months post-stroke. Utilizing the Barthel index and the Glasgow outcome scale, a stunning result was discovered in northwest China. Lui X and colleagues in northwest China found that 43.8% of individuals with advanced age, a history of stroke, and a higher NIHSS score had poorer neurological outcomes after ischemic stroke [11].

The trial had 400 participants, of whom 204 were male, and 196 were female. After admission, NIHSS criteria evaluate patients. Mild stroke patients had a score less than 5, moderate stroke patients had a score between 5 and 15, and severe stroke patients had a score greater than 15. According to NIHSS criteria, the neurological outcome of acute stroke was regained in 160 patients (40%), static in 124 patients (31%), deteriorated in 52 patients (13%), and fatal in 64 patients (16%). It was discovered that triglyceride levels were inversely proportional to stroke severity, as an increase in triglyceride levels was associated with a mild stroke. The role of increased serum triglyceride levels in reducing stroke severity was investigated, as was the relationship between blood triglyceride levels and stroke severity.

Dziedzi et al. found that lower triglyceride levels were associated with more severe strokes [12]. According to studies, there is a correlation between low-grade stroke and cholesterol levels. Despite this, contemporary pathophysiology models cannot explain why hypertriglyceridemia is a risk factor for stroke due to its effects on the vascular endothelium [13,14]. In a few experiments, some researchers suggested that serum triglycerides did not directly protect against cerebral neuronal damage but lowered the severity of cerebral ischemia-induced stroke [15]. As the number of plaques or clots containing lipids increases, they become more brittle and can embolize into the distal

cerebral arteries, causing a minor stroke [16].

In the current investigation, raising lipid triglycerides had a favorable effect on acute ischemic strokes. Patients with triglyceride levels >150 mg/dl had a mortality rate of 88, but those with lower levels had a mortality rate of 312; the same was true for cholesterol levels. In this study, acute stroke was recognized in 34% of patients with a history of COVID, 28% of COVID-positive patients, and 38% of COVID-negative patients. Coronaviruses are responsible for acute stroke and arterial thrombosis. All had a bad prognosis and coagulopathy [17]. Patients with congestive heart failure, obesity, and chronic liver disease had the highest frequency of hypercoagulable states. While the percentages of patients who had the coronavirus and had a history of the disease were 28 and 34%, respectively. In a prior study, smoking was a significant risk factor for stroke [18], while in our study, 10% of participants were smokers, and 11% were passive smokers.

## 5. Conclusion

According to the findings of our study, the NIHSS is a valid scale for determining the neurological outcomes of patients admitted to tertiary care hospitals. Using the National Institutes of Health Stroke Scale (NIHSS), acute stroke severity and neurological prognosis can be evaluated. This study has some limitations, including the small sample size, which limits the validity of the conclusions, and the fact that it was conducted at only one tertiary care hospital in Peshawar. A larger sample size with ethnic groupings and more hospitals are necessary to improve the outcomes of the present study and future research.

## Future implications of this work

Using these results, we can easily evaluate patients of acute stroke severity and neurological prognosis through NIHSS scale & can give improved patient care.

## Provenance and peer review

Not commissioned, externally peer-reviewed.

## Ethical approval

The Northwest General Hospital and Research Centre Hayatabad Peshawar's ethical committee accepted the inpatient evaluation of the neurological outcomes of acute stroke patients using the National Institutes of Health Stroke Scale (NIHSS).

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Nil.

## Author contribution

1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work: Mohammad Ali Khan, Faheemullah, Javed Iqbal, Waqas Khan.

- Drafting the work or revising it critically for important intellectual content: Bushra Ghafoor, Wiqar Ahmad, Izaz Ahmad
- Final approval of the version to be published: Hassan Mumtaz
- Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: Shahzad Ahmad, Muhammad Ismail Safi, Mohammad Haris Shah

## Registration of research studies

1. Name of the registry: Research registry

2. Unique Identifying number or registration ID: researchregistry8175

## Guarantor

Faheem ullah, Hassan Mumtaz.

## Consent

The informed consent from the patients was obtained considering Helsinki's Declaration.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104770>.

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