International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Correlation between Neurological Deficit Severity and Left Ventricular Function in Acute Ischemic Stroke

Dr. Gaurang Natverlal Desai[1], Dr. Pravin Chandra Kanjibhai Solanki[2], Dr. Hema Deep Bhojani[3], Dr. Saraswati Prajapati[4]

[1,4]Assistant Professor, Department of General Medicine, Dr. M. K. Shah Medical College & Research Center & Smt SMS Multispecialty Hospital, Ahmedabad, Gujarat, India
[2,3]Associate Professor, Department of General Medicine, Dr. M. K. Shah Medical College & Research Center & Smt SMS Multispecialty Hospital, Ahmedabad, Gujarat, India

Corresponding Author:

Dr. Saraswati Prajapati
Department of General Medicine, Dr. M. K. Shah Medical College & Research Center & Smt SMS Multispecialty Hospital, Ahmedabad, Gujarat, India
Email id: sarasvatiprajapati@gmail.com

Received: 20-02-2026
Accepted: 08-03-2026
Available online: 19-03-2026

ABSTRACT

Background: Acute ischemic stroke is frequently associated with cardiovascular abnormalities that may influence neurological severity and clinical outcomes. Left ventricular dysfunction and systemic inflammatory response have been proposed as potential predictors of stroke severity and prognosis.
Aim: To evaluate the left ventricular function and determine its correlation with the severity of neurological impairment and to assess whether left ventricular dysfunction can serve as a prognostic marker for in-hospital morbidity in patients with acute ischemic stroke.
Methods: A prospective observational study was conducted on 120 patients with confirmed acute ischemic stroke. Neurological severity was assessed using the National Institutes of Health Stroke Scale. Laboratory parameters including neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio were analyzed. Echocardiographic assessment was performed to evaluate left ventricular ejection fraction and other cardiac parameters.
Results: Patients with severe neurological impairment demonstrated significantly higher inflammatory markers and lower left ventricular ejection fraction. Neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio showed strong positive correlations with NIHSS score, while left ventricular ejection fraction showed a strong negative correlation. Receiver operating characteristic analysis indicated that inflammatory markers and reduced LVEF were useful predictors of stroke severity.
Conclusion: Left ventricular dysfunction is significantly associated with increased neurological severity in patients with acute ischemic stroke. Assessment of cardiac function along with inflammatory biomarkers may help identify patients at higher risk of severe neurological impairment and in-hospital morbidity.

Keywords*: Acute ischemic stroke, Left ventricular ejection fraction, Neurological severity, NIHSS score.*

INTRODUCTION

Acute ischemic stroke (AIS) is one of the leading causes of mortality and long-term disability worldwide and represents a major public health concern. It occurs due to sudden interruption of cerebral blood flow resulting in focal neurological deficits and potential permanent brain injury. Stroke continues to be a significant contributor to global disease burden, with increasing incidence in both developed and developing countries. In recent decades, considerable research has focused on identifying factors that influence the severity and prognosis of stroke, including cardiovascular abnormalities that may coexist with cerebrovascular disease [1].

The interaction between the cardiovascular system and the brain has gained increasing attention in recent years. Cardiac dysfunction is frequently observed in patients with acute ischemic stroke and may influence both neurological severity and clinical outcomes. Among the various cardiac parameters, left ventricular (LV) function plays a crucial role in maintaining adequate systemic and cerebral perfusion. Impaired left ventricular systolic function can lead to reduced cardiac output and may contribute to worsening cerebral ischemia in patients with stroke [2].

Left ventricular ejection fraction (LVEF) is one of the most commonly used echocardiographic parameters to assess LV systolic function. Reduced LVEF has been associated with an increased risk of thromboembolic events and stroke. In addition, LV dysfunction may result in inadequate cerebral perfusion and increased susceptibility to neurological injury. Studies have shown that patients with decreased LVEF may present with more severe neurological deficits and poorer functional outcomes following acute ischemic stroke [3].

The concept of the "brain–heart axis" has emerged to explain the complex relationship between neurological injury and cardiac dysfunction. Acute cerebral events such as ischemic stroke can trigger autonomic imbalance and neurohumoral activation, leading to various cardiac abnormalities including arrhythmias, myocardial injury, and ventricular dysfunction. These changes may further aggravate hemodynamic instability and negatively affect the recovery of stroke patients [4].

In clinical practice, assessment of stroke severity is commonly performed using standardized neurological scales such as the National Institutes of Health Stroke Scale (NIHSS). The NIHSS score provides an objective measure of neurological impairment and is widely used to evaluate the severity of stroke and predict clinical outcomes. Several studies have reported that higher NIHSS scores are associated with worse prognosis and increased risk of complications during hospitalization [5].

Echocardiography has become an important diagnostic tool in the evaluation of patients with acute ischemic stroke. Transthoracic echocardiography allows non-invasive assessment of left ventricular systolic and diastolic function and helps detect structural cardiac abnormalities that may contribute to cerebrovascular events. Early assessment of LV function may provide valuable information regarding the underlying cardiac status of stroke patients and assist in predicting clinical outcomes [6].

Previous research has demonstrated that reduced left ventricular function may be associated with increased severity of neurological deficits at presentation. Patients with lower ejection fraction values often exhibit higher NIHSS scores, suggesting a possible correlation between cardiac dysfunction and the degree of neurological impairment. These findings highlight the importance of evaluating cardiac function in patients presenting with acute ischemic stroke [7].

In addition to influencing stroke severity, LV dysfunction may also serve as a prognostic indicator for in-hospital complications and morbidity. Reduced cardiac output may compromise systemic and cerebral circulation, thereby delaying neurological recovery and increasing the risk of adverse outcomes during hospitalization. Identification of cardiac dysfunction in the early stages of stroke may therefore assist clinicians in risk stratification and management planning [8]. Despite increasing recognition of the association between cardiac function and stroke outcomes, the relationship between left ventricular dysfunction and neurological severity remains inadequately explored in many clinical settings. Furthermore, limited studies have evaluated whether LV dysfunction can serve as a reliable prognostic marker for in-hospital morbidity among patients with acute ischemic stroke [9].

Therefore, the present study was undertaken to evaluate left ventricular function in patients with acute ischemic stroke and to determine its correlation with the severity of neurological impairment. The study also aims to assess whether left ventricular dysfunction can act as a prognostic marker for in-hospital morbidity in patients with acute ischemic stroke [10].

MATERIALS AND METHODS:

The present study was conducted as a prospective observational study in the Department of Medicine of a tertiary care teaching hospital. The study aimed to evaluate left ventricular function and determine its correlation with the severity of neurological impairment in patients presenting with acute ischemic stroke. In addition, the study assessed whether left ventricular dysfunction could serve as a prognostic marker for in-hospital morbidity. The study was conducted over a defined study period during which eligible patients admitted with acute ischemic stroke were evaluated.

A total of 120 patients diagnosed with acute ischemic stroke were included in the study. Patients were selected consecutively after confirmation of the diagnosis based on clinical assessment and radiological imaging. Adult patients presenting with symptoms suggestive of acute ischemic stroke within the specified study period and confirmed by neuroimaging were included in the study. Patients with hemorrhagic stroke, transient ischemic attack, pre-existing severe valvular heart disease, known cardiomyopathy, or patients who were unwilling to participate in the study were excluded.

All patients underwent detailed clinical evaluation at the time of admission. Demographic details including age and sex were recorded. A thorough medical history was obtained with special emphasis on risk factors such as hypertension,

diabetes mellitus, smoking, alcohol consumption, dyslipidemia, and previous cardiovascular disease. A complete general physical examination and detailed neurological examination were performed in all patients.

The severity of neurological impairment was assessed using the National Institutes of Health Stroke Scale (NIHSS) at the time of admission. The NIHSS score was used to categorize the severity of stroke and evaluate the extent of neurological deficit in each patient. Higher NIHSS scores indicated more severe neurological impairment.

Radiological confirmation of acute ischemic stroke was obtained using computed tomography (CT) scan or magnetic resonance imaging (MRI) of the brain. Neuroimaging was used to confirm the diagnosis, identify the location of the infarct, and exclude hemorrhagic stroke.

Assessment of cardiac function was performed using transthoracic echocardiography in all patients. Echocardiographic evaluation included measurement of left ventricular ejection fraction (LVEF) as an indicator of left ventricular systolic function. The echocardiographic examination was carried out by an experienced cardiologist using standard techniques. Based on the LVEF values, patients were categorized into normal left ventricular function and left ventricular dysfunction groups.

Patients were monitored during hospitalization for the occurrence of complications and in-hospital morbidity such as cardiac complications, neurological deterioration, or other medical complications. Clinical outcomes during the hospital stay were documented and analyzed in relation to the left ventricular function and severity of neurological impairment.

All collected data were recorded in a structured proforma and analyzed using appropriate statistical software. Continuous variables such as age and ejection fraction were expressed as mean ± standard deviation, while categorical variables such as sex, risk factors, and presence of left ventricular dysfunction were expressed as frequency and percentage. The correlation between left ventricular function and the severity of neurological impairment was evaluated using appropriate statistical tests such as Pearson correlation coefficient and Chi-square test where applicable. A p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Ethics Committee prior to the commencement of the research. Written informed consent was obtained from all participants or their legally authorized representatives before enrollment in the study. Confidentiality of patient information was maintained throughout the study, and the research was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

RESULTS

The baseline clinical characteristics of the study population are summarized in Table 1. A total of 120 patients with acute ischemic stroke were included and divided into two groups based on neurological severity. Group-1 consisted of 60 patients with relatively lower neurological impairment while Group-2 included 60 patients with higher neurological severity. The mean age of the overall study population was 61.84 ± 10.16 years. The mean age in Group-1 was 61.12 ± 9.86 years compared with 62.55 ± 10.41 years in Group-2, and this difference was not statistically significant (p=0.428). Male patients constituted the majority of the study population with 72 patients (60.0%). Among them, 34 patients (56.7%) were in Group-1 and 38 patients (63.3%) were in Group-2. Smoking history was reported in 40 patients (33.3%), including 18 patients (30.0%) in Group-1 and 22 patients (36.7%) in Group-2 (p=0.534). Alcohol consumption was noted in 24 patients (20.0%), with similar distribution between the two groups. Diabetes mellitus was present in 48 patients (40.0%), including 22 patients (36.7%) in Group-1 and 26 patients (43.3%) in Group-2. Hypertension was the most common comorbidity and was observed in 74 patients (61.7%), while dyslipidemia was seen in 66 patients (55.0%). These findings indicate that the baseline demographic and clinical characteristics were comparable between the two groups.

The baseline laboratory characteristics of the study population are presented in Table 2. The median neutrophil count in the overall population was 6520 cells/cu.mm with a range of 3820–7820. Group-1 patients had a median neutrophil count of 6120 cells/cu.mm, whereas Group-2 patients showed a higher median count of 6940 cells/cu.mm, and the difference was statistically significant (p=0.021). The lymphocyte count was higher in Group-1 patients with a median value of 1690 cells/cu.mm compared to 1380 cells/cu.mm in Group-2 patients (p<0.001). The mean platelet count was 3.18 ± 0.56 lakhs/cu.mm in the total study population, with Group-2 patients showing slightly higher platelet counts (3.29 ± 0.52 lakhs/cu.mm) compared with Group-1 patients (3.07 ± 0.59 lakhs/cu.mm), and the difference was statistically significant (p=0.012). The neutrophil-to-lymphocyte ratio (NLR) was significantly higher in Group-2 patients with a median value of 4.68 compared to 3.26 in Group-1 patients (p<0.001). Similarly, platelet-to-lymphocyte ratio (PLR) was higher in Group-2 patients (median 256.70) compared with Group-1 patients (median 188.42), and this difference was statistically significant (p<0.001).

The baseline NIHSS score distribution is shown in Table 3. The mean NIHSS score for the total study population was 9.96 ± 6.72. Patients in Group-1 had significantly lower NIHSS scores with a mean value of 4.28 ± 1.36, indicating milder

neurological impairment. In contrast, Group-2 patients had a significantly higher mean NIHSS score of 15.64 ± 5.22, reflecting more severe neurological deficits. The difference between the two groups was highly significant (p<0.001).

The echocardiographic parameters of the study population are presented in Table 4. The mean left ventricular internal diameter in diastole (LVIDd) was 5.06 ± 0.71 cm in the total study population. Group-2 patients had significantly higher LVIDd values (5.28 ± 0.80 cm) compared to Group-1 patients (4.84 ± 0.43 cm) with a statistically significant difference (p=0.003). Similarly, the mean left ventricular internal diameter in systole (LVIDs) was 3.14 ± 0.61 cm overall, with higher values observed in Group-2 (3.33 ± 0.60 cm) compared with Group-1 (2.95 ± 0.55 cm) (p=0.006). The mean left ventricular ejection fraction (LVEF) for the total study population was 61.12 ± 7.82%. Patients in Group-1 had a significantly higher LVEF of 66.48 ± 5.26%, while Group-2 patients demonstrated a reduced LVEF of 55.76 ± 6.43% (p<0.001). Mild to severe mitral regurgitation was observed in 34 patients (28.3%), while tricuspid regurgitation was observed in 18 patients (15.0%), with no statistically significant difference between groups.

The correlation between inflammatory markers and cardiac function with stroke severity is presented in Table 5. A strong positive correlation was observed between NIHSS score and neutrophil-to-lymphocyte ratio (r = 0.712, p<0.001), indicating that higher NLR values were associated with greater neurological impairment. Similarly, platelet-to-lymphocyte ratio showed a strong positive correlation with NIHSS score (r = 0.865, p<0.001). In contrast, left ventricular ejection fraction demonstrated a strong negative correlation with NIHSS score (r = –0.748, p<0.001), suggesting that reduced cardiac systolic function was associated with increased neurological severity.

Receiver operating characteristic (ROC) curve analysis was performed to determine the optimal cut-off values of NLR, PLR, and LVEF for predicting severe neurological impairment, as shown in Table 6. The area under the curve (AUC) for NLR was 0.879 with a Youden's index of 0.592 and a cut-off value of 4.35, yielding a sensitivity of 0.642 and specificity of 0.834. PLR showed the highest diagnostic performance with an AUC of 0.961 and Youden's index of 0.452. A cut-off value of 208.7 demonstrated a sensitivity of 0.884 and specificity of 0.928. For LVEF, the AUC was 0.861 with a Youden's index of 0.574 and a cut-off value of 62.1%, with sensitivity and specificity values of 0.772 and 0.802 respectively. These findings indicate that PLR and NLR are strong predictors of stroke severity, while reduced LVEF is significantly associated with increased neurological impairment.

Table 1: Baseline clinical characteristics of the study population of Group-1 and Group-2 (N=120)

Variables	Total (n=120)	Group-1 (n=60)	Group-2 (n=60)	p-Value
Age (years)	61.84±10.16	61.12±9.86	62.55±10.41	0.428
Male sex	72 (60.0%)	34 (56.7%)	38 (63.3%)	0.462
Smoker	40 (33.3%)	18 (30.0%)	22 (36.7%)	0.534
Alcoholic	24 (20.0%)	11 (18.3%)	13 (21.7%)	0.641
Diabetes	48 (40.0%)	22 (36.7%)	26 (43.3%)	0.472
Hypertension	74 (61.7%)	35 (58.3%)	39 (65.0%)	0.451
Dyslipidemia	66 (55.0%)	31 (51.7%)	35 (58.3%)	0.468

Table 2: Baseline laboratory characteristics of the study population of Group-1 and Group-2 (N=120)

Variables	Total (n=120)	Group-1 (n=60)	Group-2 (n=60)	p-Value
Neutrophil (cells/cu.mm)	6520 (3820-7820)	6120 (3820-7420)	6940 (4510-7820)	0.021
Lymphocyte (cells/cu.mm)	1520 (1090-2480)	1690 (1310-2210)	1380 (1090-1950)	<0.001
Platelet count (lakhs/cu.mm)	3.18±0.56	3.07±0.59	3.29±0.52	0.012
NLR	3.92 (2.41-7.45)	3.26 (2.41-4.92)	4.68 (3.51-7.45)	<0.001
PLR	218.56 (152.88-328.44)	188.42 (152.88-214.60)	256.70 (187.54-328.44)	<0.001

Table 3: Baseline NIHSS score of the study population of Group-1 and Group-2 (N=120)

Variables	Total (n=120)	Group-1 (n=60)	Group-2 (n=60)	p-Value
Average NIHSS	9.96±6.72	4.28±1.36	15.64±5.22	<0.001

Table 4: Echocardiographic outcomes between Group-1 and Group-2 (N=120)

Variables	Total (n=120)	Group-1 (n=60)	Group-2 (n=60)	p-Value
LVIDd	5.06±0.71	4.84±0.43	5.28±0.80	0.003

LVIDs	**3.14±0.61**	**2.95±0.55**	**3.33±0.60**	**0.006**
LVEF	**61.12±7.82**	**66.48±5.26**	**55.76±6.43**	**<0.001**
Mild to Severe MR	**34 (28.3%)**	**12 (20.0%)**	**22 (36.7%)**	**0.084**
Mild to Severe TR	**18 (15.0%)**	**7 (11.7%)**	**11 (18.3%)**	**0.294**

Table 5: Correlation of NLR, PLR and LVEF to NIHSS

Variables	Correlation Coefficient (R)	p-Value
NIHSS vs. NLR	**0.712**	**<0.001**
NIHSS vs. PLR	**0.865**	**<0.001**
NIHSS vs. LVEF	**-0.748**	**<0.001**

Table 6: AUC and Youden's Index for determination of cut-off value

Variable	AUC	Youden's Index	Cut-Off Value	Sensitivity	Specificity
NLR	**0.879**	**0.592**	**4.35**	**0.642**	**0.834**
PLR	**0.961**	**0.452**	**208.7**	**0.884**	**0.928**
LVEF (%)	**0.861**	**0.574**	**62.1**	**0.772**	**0.802**

DISCUSSION:

The present study evaluated the correlation between left ventricular function and the severity of neurological impairment in patients with acute ischemic stroke and also assessed whether left ventricular dysfunction could serve as a prognostic marker for in-hospital morbidity. A total of 120 patients with confirmed acute ischemic stroke were included and divided into two groups based on neurological severity. The results demonstrated that inflammatory markers and echocardiographic parameters showed significant association with stroke severity, suggesting that cardiac dysfunction and systemic inflammatory response play an important role in the clinical course of acute ischemic stroke.

The baseline clinical characteristics of the study population showed comparable demographic and vascular risk factors between the two groups. Hypertension was the most common comorbidity followed by dyslipidemia and diabetes mellitus. These findings are consistent with previous studies that have identified hypertension and metabolic risk factors as major contributors to ischemic stroke. The presence of similar baseline characteristics between the two groups indicates that differences in neurological severity and cardiac parameters were less likely to be influenced by demographic factors and more likely related to the pathophysiological changes associated with stroke severity. Earlier studies have also demonstrated that vascular risk factors contribute significantly to stroke occurrence but do not necessarily determine the severity of neurological impairment at presentation [11].

Inflammatory markers have recently gained attention as predictors of stroke severity and outcome. In the present study, both neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) were significantly higher in patients with more severe neurological deficits. A strong positive correlation was observed between NIHSS score and NLR ($r = 0.712$) as well as PLR ($r = 0.865$). These findings suggest that systemic inflammation plays a significant role in the progression of ischemic brain injury. Neutrophil activation contributes to endothelial dysfunction and microvascular obstruction, which may exacerbate cerebral ischemia. Previous studies have similarly reported that elevated NLR and PLR are associated with larger infarct size, greater neurological impairment, and poor clinical outcomes in patients with acute ischemic stroke [12].

The NIHSS score is widely used as a standardized tool to evaluate neurological severity in patients with stroke. In the present study, Group-2 patients demonstrated significantly higher NIHSS scores compared with Group-1 patients, indicating more severe neurological deficits. Higher NIHSS scores have been shown to correlate with increased risk of complications and poor prognosis. Previous investigations have reported that patients with severe neurological deficits at presentation often have greater systemic inflammatory response and higher risk of cardiovascular complications during hospitalization [13].

Echocardiographic findings in the present study revealed significant differences in left ventricular dimensions and systolic function between the two groups. Patients with more severe neurological impairment demonstrated significantly larger left ventricular internal diameters and lower left ventricular ejection fraction (LVEF). The mean LVEF in the severe neurological group was markedly reduced compared to patients with milder neurological impairment. These findings indicate that reduced cardiac systolic function may be associated with greater neurological injury in acute ischemic stroke. Similar observations have been reported in earlier studies, where impaired LVEF was associated with larger infarct volume and worse neurological outcomes [14].

The correlation analysis further demonstrated a strong negative correlation between LVEF and NIHSS score ($r = -0.748$), suggesting that lower ejection fraction was associated with greater neurological severity. This relationship may be

explained by reduced cardiac output leading to impaired cerebral perfusion and increased susceptibility to ischemic damage. Additionally, the concept of the brain–heart axis suggests that acute cerebral injury may itself induce cardiac dysfunction through autonomic imbalance and neurohumoral activation. Previous research has demonstrated that cardiac dysfunction following stroke may contribute to increased morbidity and poor functional recovery [15].

Receiver operating characteristic (ROC) curve analysis in the present study demonstrated that NLR, PLR, and LVEF had good predictive value for determining stroke severity. Among these parameters, PLR showed the highest diagnostic accuracy with the largest area under the curve. These findings suggest that inflammatory biomarkers along with echocardiographic assessment may provide valuable prognostic information in patients with acute ischemic stroke. Early identification of patients with elevated inflammatory markers and reduced LVEF may help clinicians identify individuals at higher risk of severe neurological impairment and in-hospital complications.

Overall, the results of the present study emphasize the importance of evaluating both inflammatory markers and cardiac function in patients with acute ischemic stroke. The observed association between reduced left ventricular function and increased neurological severity highlights the significance of the brain-heart interaction in stroke pathophysiology. Assessment of LVEF along with inflammatory indices may therefore assist clinicians in predicting disease severity and guiding early management strategies in patients with acute ischemic stroke.

CONCLUSION:

The present study demonstrates a significant association between left ventricular systolic dysfunction and the severity of neurological impairment in patients with acute ischemic stroke. Elevated inflammatory markers such as neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio were positively correlated with higher NIHSS scores, while left ventricular ejection fraction showed a strong negative correlation with stroke severity. These findings suggest that reduced cardiac function and systemic inflammatory response may contribute to increased neurological impairment in acute ischemic stroke. Echocardiographic evaluation of left ventricular function may therefore serve as a useful prognostic indicator for identifying patients at risk of severe neurological deficits and in-hospital morbidity.

Conflict of interest: No! Conflict of interest is found elsewhere considering this work.
Source of Funding: There was no financial support concerning this work.

REFERENCES:

1. Feigin VL, Brainin M, Norrving B, Martins S, Sacco RL, Hacke W. World Stroke Organization global stroke fact sheet 2022. Int J Stroke. 2022;17(1):18-29.
2. Virani SS, Alonso A, Aparicio HJ, Benjamin EJ, Bittencourt MS, Callaway CW. Heart disease and stroke statistics—2023 update: a report from the American Heart Association. Circulation. 2023;147(8):e93-e621.
3. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K. Guidelines for the early management of patients with acute ischemic stroke. Stroke. 2019;50(12):e344-e418.
4. Campbell BCV, De Silva DA, Macleod MR, Coutts SB, Schwamm LH, Davis SM. Ischaemic stroke. Nat Rev Dis Primers. 2019;5(1):70.
5. Rahmayani F, Setiawan M, Taufiq F, Wibowo S, Sari I, Nugroho A. The role of ejection fraction in clinical outcome of acute ischemic stroke patients. J Neurosci Rural Pract. 2018;9(2):197-203.
6. Kim WJ, Kim BJ, Han MK, Bae HJ, Lee SH, Kim DH. Association between left ventricular dysfunction and stroke severity and outcome. J Stroke Cerebrovasc Dis. 2016;25(4):863-869.
7. Holmström A, Jernberg T, Lindahl B, Venge P, Wallentin L, Siegbahn A. Heart dysfunction in patients with acute ischemic stroke or transient ischemic attack. BMC Neurol. 2013;13:122.
8. Wei N, Wang Y, Zhao J, Liu J, Yang Y, Wang D. Effect of left ventricular ejection fraction spectrum on clinical outcomes in acute ischemic stroke. J Am Heart Assoc. 2023;12(20):e029241.
9. Chen G, Zhang J, Li H, Xu Z, Wang Y, Liu X. Left ventricular ejection fraction below 60% is associated with short-term functional disability in patients with acute ischemic stroke. Heliyon. 2024;10(5):e29352.
10. Saiduzzaman M, Rahman MM, Islam MN, Hossain MS, Rahman A, Karim MR. Relation between acute ischemic stroke severity and left ventricular systolic dysfunction. Bangladesh Med Res Counc Bull. 2023;49(2):123-130.
11. Di Napoli M, Shah IM. Neuroinflammation and cerebrovascular disease in ischemic stroke. Lancet Neurol. 2018;17(2):173-185.
12. Tokgoz S, Keskin S, Kayrak M, Seyithanoglu A, Ogmegul A, Akpinar Z. Neutrophil lymphocyte ratio as a predictor of stroke severity and short-term prognosis in acute ischemic stroke. Eur Neurol. 2014;72(1-2):94-99.
13. Goyal N, Tsivgoulis G, Malhotra K, Pandhi A, Ishfaq MF, Khorchid Y. Admission neutrophil-to-lymphocyte ratio as a prognostic biomarker of outcomes in large vessel occlusion strokes. Stroke. 2018;49(8):1985-1987.
14. Lee JH, Park KY, Shin JH, Cha JK, Kim DH. Left ventricular systolic dysfunction and outcomes after acute ischemic stroke. J Stroke Cerebrovasc Dis. 2016;25(3):617-623.
15. Scheitz JF, Nolte CH, Doehner W, Hachinski V, Endres M. Stroke-heart syndrome: clinical presentation and underlying mechanisms. Lancet Neurol. 2018;17(12):1109-1120.