Original Article

IAHS Medical Journal
Volume 08 Issue 02 December 2025; 80-86

Association of Platelet Indices with Clinical Outcomes and Risk Factors in Acute Ischemic Stroke: A Single-Centre Cross-Sectional Study

Md. Sherazul Islam[1] Mohammad Mohibul Alam[2] Md Mahmudul Hasan[3]
Md. Noman Hossain[4] Muhammad Asif Iqbal[5] Mohammad Nurunnabi[6]*

ABSTRACT

Background: *Stroke is a leading global cause of disability and death, with platelet indices emerging as potential biomarkers for risk and prognosis.This study aims to characterize the distribution of these indices in stroke patients and examine their associations with clinical outcomes and established risk factors.*

Material and methods: *This hospital-based cross-sectional study was conducted at Cumilla Medical College Hospital from September 2021 to March 2022, on 200 adults diagnosed as acute ischemic stroke patients within 48 hours of symptom onset. Patients with haemorrhagic stroke or platelet disorders were excluded.*

Results: *The study involved 200 patients, predominantly aged 61–80 years (53%), with a mean age of 67.5±13.5 years. Large infarction was the most common stroke subtype (77.5%), followed by lacunar infarction (22.5%). Headache (60%) and vomiting (44%) were the most frequent symptoms, alongside motor weakness, particularly right-sided hemiparesis (32.5%). Hypertension (56%) and smoking (50.5%) emerged as the leading risk factors. Regarding clinical outcomes, 25% improved, 62.5% developed disabilities and 12.5% died. Significant variations in platelet indices were noted across socioeconomic status, smoking habits and clinical outcomes. Higher MPV, PLCR, and PDW were observed in the high socioeconomic group ($p<0.05$). Smokers exhibited significantly higher MPV, PLCR, and PDW compared to non-smokers ($p<0.05$). Similarly, patients who died had the highest MPV (9.80±1.10 fL), PLCR (38.80±8.50%) and PDW (18.20±1.80 fL) all significantly elevated compared to those with disability or improvement ($p<0.05$).*

Conclusion: *The study revealed that elevated platelet indices are associated with smoking, higher socioeconomic status and worse clinical outcomes in stroke patients.*

Key words: Acute ischemic stroke; Clinical outcomes; Platelet indices; Risk factors.

Introduction

Stroke is a severe and disabling cerebrovascular condition that often results in lasting neurological deficits and substantial economic burden. It is characterized by the sudden onset of focal or global neurological dysfunction lasting 24 hours or longer, or resulting in death, with no cause other than vascular origin.[1,2] The most prevalent type, ischemic stroke, occurs when blood flow to the brain is blocked due to atherosclerotic plaques, thrombosis, or embolism.[3,4]

Platelets play a central role in ischemic stroke pathogenesis by forming thrombi at sites of atherosclerotic plaque erosion or rupture.[5] Consequently, platelet indices namely Mean Platelet Volume (MPV) Platelet Count (PC) Platelet Distribution Width (PDW) and Platelet Large Cell Ratio (PLCR) have been proposed as biomarkers of platelet activation and function. Derived from megakaryocyte fragmentation, metabolically active platelets maintain vascular integrity via hemostatic cascades that culminate in thrombus formation following arterial injury. MPV reflects both platelet size and functional capacity, as larger platelets contain denser granules and exhibit greater thrombotic potential.[6,7] Moreover, MPV and PC are inversely related, such that declines in PC are typically accompanied by elevated MPV. Elevated MPV has been associated with increased platelet reactivity and a higher risk of acute ischemic events, including stroke.[8-11]

1. Medical Officer of Medicine
Cumilla Medical College Hospital, Cumilla.
2. Junior Consultant of Medicine
Upazila Health Complex, Hajiganj, Chandpur.
3. Medical Officer
New Medinova Medical Centre, Hajiganj, Chandpur.
4. Assistant Professor of Medicine
Chandpur Medical College, Chandpur.
5. Medical Officer of Medicine
Matlob Daksin Health Complex, Chandpur.
6. Assistant Professor of Community Medicine & Public Health
Sylhet Women's Medical College, Sylhet.

*Correspondence : **Dr. Mohammad Nurunnabi**
Cell : +88 017178 70 559
Email : nur.somch@gmail.com

Date of Submission : 18th July 2025
Date of Acceptance : 19th November 2025

IAHS Medical Journal
Volume 08 Issue 02 December 2025; 80-86

Stroke remains a leading global cause of death and disability, accounting for over 5 million deaths annually, with one in six survivors suffering a recurrence event within five years.[12-14] Mortality has declined in industrialized nations like Japan but has risen in Eastern Europe. Although men have a higher incidence, stroke severity and 1-month mortality are greater in women (24.7% vs. 19.7%).[15,16] In Southeast Asia, the Global Burden of Disease 2019 data reported approximately 1.33 million new stroke cases and 731,800 deaths, predominantly from India, Indonesia and Bangladesh.[17,18] Indonesia's age-standardized incidence reached 293 per 100,000 people.[19] Case-fatality rates in South and Southeast Asia remain high at 12-15%, driven by severe strokes, diabetes accelerates intracranial atherosclerosis and unequal healthcare access.[20-22] Strengthening Emergency Department services at secondary-level hospitals is essential for early stroke recognition, rapid neuroimaging and timely intervention, which can significantly reduce morbidity and mortality.[18,23-26]

Platelets play a critical role in the pathogenesis of ischemic stroke, with larger, more metabolically active platelets contributing to thrombus formation.[27] Mean Platelet Volume (MPV) an indicator of platelet size and activity, has been explored as a predictor of stroke severity and recurrence.[28] Some studies have reported elevated MPV in Acute Ischemic Stroke (AIS) patients, associating it with poorer outcomes and higher recurrence risk, though findings remain inconsistent. Platelet indices such as MPV, platelet count (PC), platelet distribution width (PDW) and platelet large cell ratio (PLCR) have been investigated for their prognostic potential.[3,26,29] Beyond platelet biomarkers, utilization patterns of antimicrobials in stroke units can influence post-stroke infection rates and secondary inflammation, indirectly modulating platelet activation and affecting recovery trajectories.[30,31] Moreover, lipid-lowering therapy has been shown to reduce platelet hyperreactivity and its combination further enhances lipid control and may attenuate platelet-driven thrombosis.[32] This study examines the association of these platelet indices with clinical outcomes including recovery, disability and mortality and with common vascular risk factors such as hypertension, diabetes, smoking, dyslipidaemia and ischemic heart disease in AIS patients. By analysing these associations, the research aims to elucidate the prognostic value of platelet indices in AIS and their potential role in personalized risk stratification and treatment planning.

Materials and methods

This hospital-based cross-sectional descriptive study was conducted at the Department of Medicine, Cumilla Medical College Hospital, Bangladesh, between September 2021 and March 2022. The study population comprised adult patients aged 18 years and above who were diagnosed with acute ischemic stroke confirmed by neuroimaging (CT or MRI) within 48 hours of symptom onset. A sample of 200 patients was selected using consecutive sampling, though the calculated sample size was 384 based on a 95% confidence interval and a 5% margin of error.[33] Patients with haemorrhagic stroke, known platelet disorders, recent antiplatelet medication use, febrile illness before stroke, thrombocytopenia, recent vaccination, or those who declined participation were excluded.

Data were collected using a structured questionnaire capturing sociodemographic details, clinical presentation, stroke subtypes (Large infarction or lacunar infarction), risk factors such as hypertension, diabetes, dyslipidemia, smoking and alcohol use, along with socioeconomic status. A 2 ml venous blood sample was collected from each participant within 48 hours of symptom onset and analyzed using MINDRAY-BC 6000 and BC 3600 Auto Analyzers. The platelet indices measured included platelet count (PC) mean platelet volume (MPV), platelet distribution width (PDW) platelet large cell ratio (PLCR) and plateletcrit (PCT). Clinical outcomes were recorded as improved, disabled or deceased.

The collected data were cleaned, edited and analyzed using SPSS software. Descriptive statistics summarized the baseline characteristics, while comparative analyses, including t-tests, ANOVA and Chi-square tests, were employed to explore associations between platelet indices, stroke subtypes, risk factors and clinical outcomes. A p-value of less than 0.05 was considered statistically significant.

Ethical clearance was granted by the institutional ethics committee and written informed consent was obtained from all participants or their legal representatives. Participant confidentiality was strictly preserved, and the right to voluntary withdrawal at any stage was ensured. The study was conducted in accordance with the principles outlined in the 2013 revised Declaration of Helsinki and its subsequent amendments or equivalent ethical guidelines.

IAHS Medical Journal
Volume 08 Issue 02 December 2025; 80-86

Results

Table I Socio-demographic characteristics of the patients (n=200)

Variables	Frequency (n)	Percent (%)
Age group (In years)		
21-40	7	3.5
41-60	46	23
61-80	106	53
>80	41	20.5
Mean age: 67.5±13.5 years		
Socioeconomic status		
Low	108	54
Middle	90	45
High	2	1

The Table I summarizes that most (53%) are aged 61-80 years, with a mean age of 67.5±13.5 years. The majority (54%) belong to the low socioeconomic group, followed by 45% middle and 1% high. This indicates the study population is mainly older adults from lower to middle socioeconomic status.

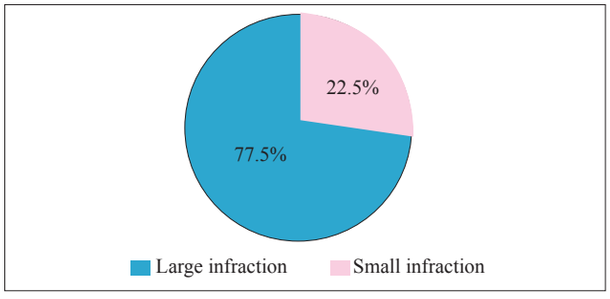

Figure 1 Type of ischemic stroke (n=200)

Figure 1 illustrates the stroke subtypes, with large infarctions comprising 77.5% and lacunar infarctions making up the remaining 22.5%.

Table II Mode of presentations (n=200)

Symptoms	Frequency (n)	Precent (%)
Headache	120	60.0
Vomiting	88	44.0
Right-sided hemiparesis	65	32.5
Left-sided hemiparesis	54	27.0
Slurred speech	44	22.0
Unconsciousness	37	18.5
Dysphagia	23	11.5
Aphasia	16	8.0
Ataxia	14	7.0
Bladder involvement	14	7.0
Quadriparesis	12	6.0
Seizure	8	4.0
Visual problems	5	2.5

In Table II, the most common symptom was headache (60.0%), followed by vomiting (44.0%) and right-sided hemiparesis (32.5%). Left-sided hemiparesis was present in 27.0% of cases, highlighting the prevalence of unilateral motor weakness in stroke presentations. Other significant symptoms included slurred speech (22.0%) and unconsciousness (18.5%) reflecting notable neurological impairment. Less frequent symptoms were dysphagia (11.5%) aphasia (8.0%) ataxia and bladder involvement (both 7.0%). Quadriparesis (6.0%) seizures (4.0%) and visual problems (2.5%) were relatively rare.

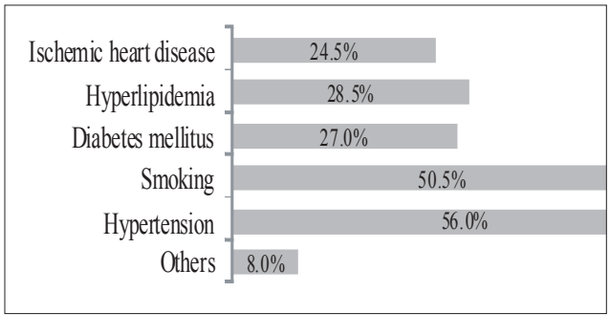

Figure 2 Pre disposing risk factors for stroke (n=200)

Figure 2 reflects that among the patients, hypertension was the predominant risk factor, present in 56%. cases Smoking depicls 50.5% of the group, followed by hyperlipidemia (28.5%), diabetes mellitus (27%) and ischemic heart disease (24.5%). Other risk factors account for 8%.

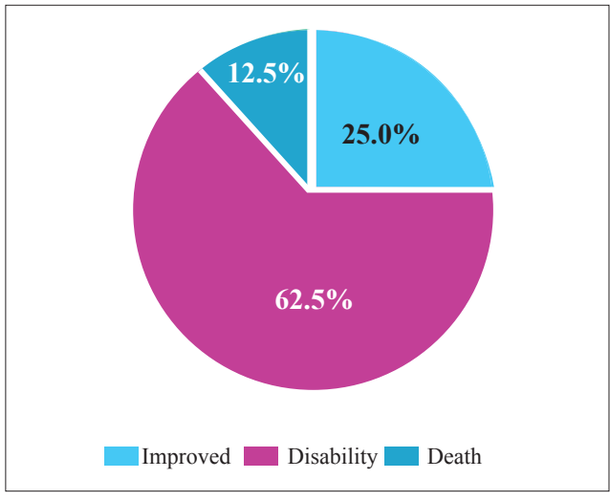

Figure 3 Clinical outcomes of the patients (n=200)

Figure 3 reflects that 25% experienced clinical improvement, while the majority (62.5%) experienced some form of disability and 12.5% died, indicating that most patients faced significant health challenges after treatment.

IAHS Medical Journal
Volume 08 Issue 02 December 2025; 80-86

Table III Platelet indices in relation to socioeconomic conditions (n=200)

Parameter	High (n=2) Mean ± SD	Average (n=90) Mean ± SD	Low (n=108) Mean ± SD	p-value
PC (/cumm)	236,985 ± 52,305	245,226 ± 94,914	253,852 ± 78,928	0.320
MPV (fL)	10.50 ± 0.30	9.01 ± 1.57	8.60 ± 1.20	*0.040
PCT (%)	0.239 ± 0.04	0.216 ± 0.08	0.225 ± 0.10	0.200
PLCR (%)	42.50 ± 3.00	36.10 ± 9.20	32.00 ± 8.50	*0.018
PDW (fL)	20.50 ± 0.50	17.10 ± 3.29	15.80 ± 2.00	*0.012

Independent t-test done, p<0.05 considered as statistically significant value.

Table III demonstrates the relationship between platelet indices and socioeconomic status among patients. While Platelet Count (PC) and Plateletcrit (PCT) did not differ significantly across socioeconomic groups (p=0.320 and p=0.200, respectively) significant variations were observed in other indices. Mean Platelet Volume (MPV) was highest in the high socioeconomic group (10.50±0.30 fL) compared to the average (9.01±1.57 fL) and low (8.60±1.20 fL) groups, with a statistically significant difference (p=0.040). Similarly, the Platelet Large Cell Ratio (PLCR) and Platelet Distribution Width (PDW) were significantly higher in the high socioeconomic group (PLCR: 42.50±3.00%, PDW: 20.50±0.50 fL) than in the average and low groups (p=0.018 and p=0.012, respectively).

Table IV Platelet indices in relation to smoking habit (n=200)

Parameter	Smoker (n=101) Mean ± SD	Non-Smoker (n=99) Mean ± SD	p-value
PC (/cumm)	241,440 ± 86,832	263,500 ± 80,000	*0.045
MPV (fL)	9.20 ± 1.30	8.50 ± 1.40	*0.038
PCT (%)	0.396 ± 1.83	0.228 ± 0.10	0.050
PLCR (%)	36.50 ± 9.50	33.20 ± 8.30	*0.042
PDW (fL)	17.10 ± 3.00	15.90 ± 2.10	*0.030

Independent t-test done, p<0.05 considered as statistically significant value.

Table IV shows the relationship between platelet indices and smoking habits. Significant differences were observed between smokers and non-smokers in several parameters. Non-smokers had a higher platelet count (263,500±80,000 /cumm) compared to smokers (241,440±86,832 /cumm) with a significant p-value of 0.045. In contrast, smokers exhibited significantly higher MPV)(9.20±1.30 fL), PLCR (36.50±9.50%), and PDW (17.10±3.00 fL) compared to non-smokers (MPV: 8.50±1.40 fL, PLCR: 33.20±8.30%, PDW: 15.90±2.10 fL), with p-values of 0.038, 0.042 and 0.030 respectively. Although PCT was higher in smokers, the difference was borderline significant (p=0.050).

Table V Platelet indices in relation to clinical outcomes

Parameter	Improved (n=50) Mean ± SD	Disability (n=125) Mean ± SD	Death (n=25) Mean ± SD	p-value
PC (/cumm)	249,682 ± 95,743	247,453 ± 81,806	263,500 ± 80,000	0.200
MPV (fL)	8.50 ± 1.20	9.00 ± 1.30	9.80 ± 1.10	*0.025
PCT (%)	0.232 ± 0.14	0.216 ± 0.06	0.228 ± 0.07	0.310
PLCR (%)	32.00 ± 9.00	35.50 ± 9.20	38.80 ± 8.50	*0.018
PDW (fL)	15.90 ± 2.50	16.80 ± 2.00	18.20 ± 1.80	*0.015

Independent t-test done, p<0.05 considered as statistically significant value.

Table V demonstrates the relationship between platelet indices and clinical outcomes. Significant differences were observed in MPV, PLCR and PDW across outcome groups. Patients who died had the highest MPV (9.80±1.10 fL) PLCR (38.80±8.50%) and PDW (18.20±1.80 fL) compared to those with disability (MPV: 9.00±1.30 fL, PLCR: 35.50±9.20%, PDW: 16.80±2.00 fL) and improved outcomes (MPV: 8.50±1.20 fL, PLCR: 32.00±9.00%, PDW: 15.90±2.50 fL) with p-values of 0.025, 0.018 and 0.015 respectively. Although platelet count and PCT showed no significant variation, the findings suggest that higher MPV, PLCR, and PDW are associated with poorer clinical outcomes, indicating that increased platelet size and variability may be markers of disease severity and worse prognosis.

Discussion

This study was conducted at Cumilla Medical College Hospital on 200 stroke patients to investigate platelet indices in relation to clinical and neurological characteristics. Consistent with studies from China and India, the present findings indicate that older age is a significant risk factor for stroke.[34-37] In this study, more than half of the patients (53%) were aged between 61 and 80 years, with a mean age of 67.5±13.5 years, highlighting the vulnerability of the elderly population. This aligns with regional evidence that advancing age increases the risk of stroke due to age-related vascular changes and comorbidities.Most participants (54%) belonged to the low socioeconomic group, 45% to the middle group, indicating that the study population predominantly comprised older adults from lower to middle socioeconomic backgrounds.

IAHS Medical Journal
Volume 08 Issue 02 December 2025; 80-86

In this study, large infarctions accounted for 77.5% of strokes, while lacunar infarctions comprised 22.5%. The most common symptoms were headache (60%), vomiting (44%) and unilateral hemiparesis, predominantly right-sided (32.5%). This symptom pattern reflects the diverse and often severe nature of stroke presentations reported in prior studies.[38,39] Hypertension (56%) was the leading risk factor, followed by smoking (50.5%), hyperlipidemia (28.5%) diabetes (27%) and ischemic heart disease (24.5%). These findings align with global evidence, highlighting the need for aggressive management of these conditions to lower stroke risk.[40-42]

These findings reflect that a significant proportion of stroke patients suffer long-term disabilities (62.5%) or death (12.5%), similar to outcomes reported in the study, emphasizing the global burden of stroke-related morbidity and mortality.[43] Socioeconomic status showed a significant association with platelet indices such as MPV, PLCR, and PDW, where higher values were noted in the high socioeconomic group. This was in line with studies signifying that platelet activation and variability can differ with social determinants of health.[44] Smoking was linked to lower platelet counts but higher MPV, PLCR and PDW, consistent with findings that smoking enhances platelet activation and size variability, increasing vascular risk.[45] Finally, higher MPV, PLCR and PDW were significantly associated with mortality, reinforcing the evidence that these platelet indices can predict stroke severity and poor prognosis, as supported by the studies.[46-48] Overall, these findings underscore the potential utility of platelet indices as accessible biomarkers for assessing stroke risk, severity and prognosis in clinical practice.

Conclusion

Platelet indices are considered a potentially valuable and cost-effective prognostic tool in patients with acute ischemic stroke. However, this study found no significant association between platelet indices namely platelet count, mean platelet volume, platelet distribution width and platelet large cell ratio and demographic factors, stroke subtypes, clinical outcomes, or common risk factors such as hypertension, diabetes, smoking, and ischemic heart disease. The only exception was hyperlipidemia, where PLCR demonstrated a significant difference. Despite this, platelet indices did not show a meaningful correlation with in-hospital outcomes, including improvement, disability or death. These results suggest that routine platelet indices have limited prognostic value in acute ischemic stroke, aside from their potential link with dyslipidemia.

Recommendation

Further large-scale, prospective studies are needed to better understand the role of platelet activation markers and to evaluate whether more advanced or serial measurements could aid in risk stratification and inform early interventions or tailored treatment strategies for stroke patients.

Acknowledgments

The authors sincerely acknowledge the cooperation of all participants, their attendants and the hospital authorities for their support throughout the study.

Disclosure

All the authors declared no competing interest.

References

1. Palomeras S E, Casado Ruiz V. Epidemiology and risk factors of cerebral ischemia and ischemic heart diseases: similarities and differences. Current cardiology reviews. 2010;6(3):138-149.

2. Powers WJ. Acute ischemic stroke. New England Journal of Medicine. 2020;383(3):252-260..

3. Neki NS, Minda N, Jain A. A study of association of mean platelet volume and ischaemic stroke. Asian Pacific Journal of Health Sciences. 2016;3(4):212-219.

4. Chowdhury N, Nurunnabi M, Refat MNH, Miah KA, Islam MZ. Out-of-Pocket Expenditures of the Injured Patients Admitted in Casualty Unit of CMCH. Journal of Preventive and Social Medicine. 2022;41(1):35-40.

5. Al-Tameemi WF, Ameen AM. Significance of platelet indices in patients with acute ischemic stroke. Iraqi Journal of Medical Sciences. 2012;10(4):383-389.

6. Christian SG, Buseri FI, Eze EM. Changes in haematological parameters in stroke patients in Port Harcourt, Nigeria. International Journal of Science and Research. 2016;5(3):912-915.

7. Mohamed AA, Elnady HM, Alhewaig HK, Moslem Hefny H, Khodery A. The mean platelet volume and plateletcrit as predictors of short-term outcome of acute ischemic stroke. The Egyptian journal of neurology, psychiatry and neurosurgery. 2019;55(1):4.

8. Yao Y, Cao X, Zou R, Wen H, Zhang S, Xu H, Guo X, Guo Y. Study on the baseline factors and platelet indices that predict outcome of acute ischemic stroke patients after thrombolytic therapy. Cerebrovascular Diseases. 2022;51(3):357-364.

9. Sreejith OT, Zafar L, Beg M, Siddiqui OA. Association of mean platelet volume with risk factors and functional outcome in acute ischemic stroke. Journal of neurosciences in rural practice. 202;12(4):764.

IAHS Medical Journal
Volume 08 Issue 02 December 2025; 80-86

10. Zheng YY, Wang L, Shi Q. Mean platelet volume (MPV) and platelet distribution width (PDW) predict clinical outcome of acute ischemic stroke: A systematic review and meta-analysis. Journal of Clinical Neuroscience. 2022;101:221-227.

11. Feigin VL, Roth GA, Naghavi M, Parmar P, Krishnamurthi R, Chugh S, Mensah GA, Norrving B, Shiue I, Ng M, Estep K. Global burden of stroke and risk factors in 188 countries, during 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. The Lancet Neurology. 2016;15(9):913-924.

12. Appelros P, Stegmayr B, Terént A. Sex differences in stroke epidemiology: a systematic review. Stroke. 2009;40(4):1082-1090.

13. Yogendrakumar V, Vandelanotte S, Mistry EA, Hill MD, Coutts SB, Nogueira RG, Nguyen TN, Medcalf RL, Broderick JP, De Meyer SF, Campbell BC. Emerging adjuvant thrombolytic therapies for acute ischemic stroke reperfusion. Stroke. 2024;55(10):2536-2546.

14. Wang L, Hao M, Wu N, Wu S, Fisher M, Xiong Y. Comprehensive review of tenecteplase for thrombolysis in acute ischemic stroke. Journal of the American Heart Association. 2024;13(9):e031692.

15. Xu J, Hou S, Chen Z, Liu Y, Deng X, Wang C, Liu S, Wang Y. The burden of ischemic stroke in Eastern Europe from 1990 to 2021. BMC neurology. 2025;25(1):74.

16. Ohara T, Makita N, Fujinami J, Maezono-Kandori K, Fukunaga D, Tanaka E, Fujii A, Takezawa H, Tokuda N, Yamada T, Ogura S. Clinical characteristics of ischemic stroke in Japanese young adults. Cerebrovascular Diseases Extra. 2025;15(1):154-161.

17. Pandian JD, Srivastava MV, Aaron S, Ranawaka UK, Venketasubramanian N, Sebastian IA, Injety RJ, Gandhi DB, Chawla NS, Vijayanand PJ, Rangamani S. The burden, risk factors and unique etiologies of stroke in South-East Asia Region (SEAR). The Lancet Regional Health-Southeast Asia. 2023;17:1-10.

18. Venketasubramanian N. Stroke epidemiology in Asia. Cerebrovascular Diseases Extra. 2025;15(1):81-92.

19. Tan CS, Muller-Riemenschneider F, Ng SH, Tan PZ, Chan BP, Tang KF, Ahmad A, Kong KH, Chang HM, Chow KY, Koh GC. Trends in stroke incidence and 28-day case fatality in a nationwide stroke registry of a multiethnic Asian population. Stroke. 2015;46(10):2728-2734.

20. Ng JC, Churojana A, Pongpech S, Vu LD, Sadikin C, Mahadevan J, Subramaniam J, Jocson VE, Lee W. Current state of acute stroke care in Southeast Asian countries. Interventional Neuroradiology. 2019;25(3):291-296.

21. Ajim MA, Juty MLN, Ahmed F, Ara J, Yasmeen W, Nurunnabi M. Dietary Adherence and Glycemic Status among Type 2 Diabetes Patients in Rural Areas. Medicine Today. 2025;37(1):127-132.

22. Karmakar P, Islam MZ, Hoshen MM, Nurunnabi M. Correlation between Vitamin D and Glycated Hemoglobin (HbA1c) in Patients with Type 2 Diabetes Mellitus: A Single Center Cross-sectional Study. Journal of the Medical College for Women & Hospital. 2025;21(1):32–37.

23. Yesmin T, Shaheen S, Rahman T, Rahman MS, Moulee ST, Ferdous J, Ferdouse M, Akter F, Nurunnabi M. Management of Emergency Department Services at a Secondary Level Hospital. Journal of Monno Medical College. 2024;10(1):36-42.

24. Nurunnabi M, Tarafdar MA. Factors affecting Patient Satisfaction at Outpatient Department in a Tertiary Level Hospital. Osmani Medical Teachers Association Journal. 2017;16(2):140-143.

25. Chowdhury SM, Islam ANMS, Rahman MR, Zabir MA, Khan S, Azizi S, Nurunnabi M. Levels of Patient Satisfaction Regarding Healthcare Services in Upazila Health Complexes. Eastern Medical College Journal. 2023;8(2):31-38.

26. Nurunnabi M, Tarafdar MA, Kaiser FR. Study on Level of Satisfaction of the Patients Attending Outpatient Department of a Tertiary Level Hospital at Sylhet. Journal of Sylhet Women's Medical College. 2018;8(1):16-21.

27. Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, Mohler ER, Reilly MP, Berger JS. Mean platelet volume as a predictor of cardiovascular risk: A systematic review and meta• analysis. Journal of Thrombosis and Haemostasis. 2010;8(1):148-156.

28. Mayda-Domaç F, M s rl H, Y lmaz M. Prognostic role of mean platelet volume and platelet count in ischemic and hemorrhagic stroke. Journal of Stroke and Cerebrovascular Diseases. 2010;19(1):66-72.

29. Sadeghi F, Kovács S, Zsori KS, Csiki Z, Bereczky Z, Shemirani AH. Platelet count and mean volume in acute stroke: A systematic review and meta-analysis. Platelets. 2020;31(6):731-739.

IAHS Medical Journal
Volume 08 Issue 02 December 2025; 80-86

30. Chowdhury MJ, Faruque CMO, Dutta SS, Deb K, Chowdhury NA, Kashem FB, Nurunnabi M. Utilization Patterns of Antimicrobials at a Tertiary Care Hospital's Intensive Care Unit. Z H Sikder Women's Medical College Journal. 2025; 7(1):4-11.

31. Nurunnabi M. Integrating Traditional and Complementary Medicine in Healthcare Systems: A Global Perspective. Journal of the Medical College for Women & Hospital. 2025;21(1):10–12.

32. Chowdhury MJ, Faruque CMO, Ahmad H, Chowdhury NB, Ferdoush N, Nurunnabi M. A Comparison of Atorvastatin Alone and its Combination with Ezetimibe among Mixed Hyperlipidemic Patients. Journal of Monno Medical College. 2024;10(1):23-29.

33. Lwanga SK, Lemeshow S. Sample size determination in health studies. Geneva: World Health Organization. 1991. https://lib.umku.ac.id/wp-content/uploads/ 2022/06/ Sample-size-determination-in-health-studies-a-practical-manual.pdf

34. Hou J, Liu C, Yao P, Chen W, He M, Wang Y, Liang Y, Miao X, Wei S, Xu T, Fang W. Association of adiposity indices with platelet distribution width and mean platelet volume in Chinese adults. PLoS One. 2015;10(6):e0129677.

35. Rong GU, Huang X, Ming ZH, Ouyang S, Yunfeng FU, Hao TA, Fengxia LI, Huang R, Meng GA, Hang DO, Yongjun WA. Establishment of the normal reference range of thrombelastogram among the healthy population and pregnant in China. Iranian Journal of Public Health. 2019;48(5):841.

36. Akula SP, Krishana VS, Krishna JR. A study of platelet indices in acute myocardial infarction: An observational study. Journal of Medical and Dental Sciences. 2017;16(6):10-13.

37. Dash D, Bhashin A, kumar Pandit A, Tripathi M, Bhatia R, Prasad K, Padma MV. Risk factors and etiologies of ischemic strokes in young patients: a tertiary hospital study in north India. Journal of stroke. 2014;16(3):173.

38. Prasad K, Singhal KK. Stroke in young: An Indian perspective. Neurology India. 2010;58(3):343-350.

39. Elavarasi A, Prasad K. Stroke in Young Adults: An Indian Perspective. Annals of Indian Academy of Neurology. 2022;25(1):3-4.

40. Boehme AK, Esenwa C, Elkind MS. Stroke risk factors, genetics and prevention. Circulation research. 2017;120(3):472-495.

41. Nurunnabi M, Nazia A, Chowdhury N, Alam MB, Islam MM, Kakoly NS. Prevalence of Post-traumatic Stress Disorder among Physicians during the COVID-19 Pandemic. Bangladesh Medical Journal. 2022;51(1):52-58.

42. Namaganda P, Nakibuuka J, Kaddumukasa M, Katabira E. Stroke in young adults, stroke types and risk factors: A case control study. BMC neurology. 2022;22(1):335.

43. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. Circulation research. 2017;120(3):439-448.

44. Patel SA, Winkel M, Ali MK, Narayan KV, Mehta NK. Cardiovascular mortality associated with 5 leading risk factors: national and state preventable fractions estimated from survey data. Annals of internal medicine. 201;163(4):245-253.

45. Vizioli L, Muscari S, Muscari A. The relationship of mean platelet volume with the risk and prognosis of cardiovascular diseases. International journal of clinical practice. 2009;63(10):1509-1515.

46. Sg C. Mean platelet volume as a predictor of cardiovascular risk: A systematic review and meta-analysis. Journal of Thrombosis and Haemostasis. 2010;8:148-156.

47. Noris P, Melazzini F, Balduini CL. New roles for mean platelet volume measurement in the clinical practice? Platelets. 2016;27(7):607-612.

48. Sadeghi F, Kovacs S, Zsori KS, Csiki Z, Bereczky Z, Shemirani AH. Platelet count and mean volume in acute stroke: A systematic review and meta-analysis. Platelets. 2020;31(6):731-739.