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ORIGINAL ARTICLE

CORRELATION OF RED CELL DISTRIBUTION WIDTH WITH STROKE SEVERITY AND SHORT TERM FUNCTIONAL OUTCOME IN ACUTE ISCHEMIC STROKE

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Abstract:

Background: *Red cell distribution width (RDW) has been proposed as an independent predictor of acute ischemic stroke (AIS) severity and outcomes. This study aimed to evaluate whether RDW alone can serve as a predictor of functional outcome at three months following AIS.* ***Methods:*** *In this prospective cohort study (July 2024–June 2025), patients with AIS were categorized into quartiles based on admission RDW values. Baseline characteristics were compared using Pearson's chi-square or Fisher's exact tests for categorical variables and the Mann–Whitney U test for continuous variables. Univariable and multivariable binary logistic regression analyses were performed to identify predictors of three-month functional outcome, assessed by the modified Rankin Scale (mRS 0–2 vs. 3–6).* ***Results:*** *Most patients had RDW values between 12% and 15%, with a small subset showing elevated RDW (>16%). At three months, the majority achieved good recovery (mRS 0–2). In univariable analysis, lower diastolic blood pressure was associated with greater odds of functional independence, whereas smoking, higher NIHSS score at admission, and severe baseline disability were significantly associated with lower odds. In the multivariable model, smoking and severe disability at admission remained significant, while the NIHSS score was significant at the 10% level of significance.* ***Conclusion:*** *In this prospective cohort study, admission RDW was not independently related with three-month functional outcomes following acute ischemic stroke. The findings suggest that RDW has limited value as a standalone prognostic biomarker in the early post-stroke period.*

Keywords*: Acute ischemic stroke; Functional Outcome; Red cell distribution.*

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Introduction:

Red cell distribution width (RDW), which is frequently measured by automated cell counters [1], represents the volume of red blood cells. The circulating erythrocyte size variability measurement method is represented by the erythrocyte size variation coefficient [2]. Previous research has found that RDW is associated with the incidence of all-cause mortality [4,5] and the prognosis of patients with cardiovascular illnesses such as coronary heart disease [3], heart failure [6,7] and others. This study has been enrolled all individuals at high risk of acute ischemic stroke.

Red blood cell distribution width (RDW) is a widely used metric for determining the size distribution of erythrocytes and the cause of anemia. Its value can be high in a variety of different conditions, including chronic liver disease, autoimmune disorders, and cancer, as well as after a blood transfusion.[3-5]

RDW has recently received attention for its connections with a variety of cardiovascular diseases[3,6-8], as well as overall mortality.[9]Higher RDW values have been linked to telomere shortening circumstances, including aging, oxidative stress, increased inflammatory biomarkers, dyslipidemia, and a high (≥2) CHA2DS2-VASC score in patients with atrial fibrillation (AF)[10]. and other disorders that can also be related to the etiology and prognosis of AIS, working as a potent biomarker associated with inflammation.

A large population-based prospective study found an independent association between elevated RDW and the risk of stroke in people with coronary disease over a median follow-up of five years. [11] Studies have indicated that elevated RDW levels may be a useful indication of severity and poor clinical outcome in patients with ischemic stroke, even though the precise underlying pathophysiology is yet unknown.[12-14] There are still conflicting findings in the literature on this subject, specifically in relation to its relationship to functional outcome after a stroke. For example, in patients with ischemic stroke, a recent study demonstrated a correlation between greater RDW values and both the severity of the stroke and the functional prognosis at 3 months.[12] Additionally, research demonstrated that in patients with ischemic stroke, a larger RDW was a predictor of poor functional outcomes at three months[13,14], and increased mortality. [15] Furthermore, ischemic stroke patients with higher baseline RDW are more likely to have a poor long-term prognosis and to die.[16] Recent research confirms this.

According to the World Health Organization, Bangladesh has the world's 84th highest rate of stroke-related mortality.[17] Bangladesh has normalized stroke death rates by age and gender to 54.8 per 100,000, while stroke-adjusted life years lost are 888.1 per 100,000.13 Stroke victims inflict a substantial financial burden on themselves, their families, and the nation, with long-term implications.[17]

Given the high prevalence of stroke, identifying markers to determine clinical severity and prognosis is becoming increasingly important. There is a lack of research on the effect of RDW on stroke severity and functional outcomes in Bangladeshi people with ischemic strokes. Our aim is to investigate the relationship between RDW and stroke severity, as well as short-term functional outcomes in patients with ischemic stroke in the Bangladeshi population. Improve the quality of life for the elderly by incorporating greater plan management and stroke prevention.

Methods:

This prospective cohort study was conducted in the department of neurology, Sir Salimullah Medical College, Mitford, Dhaka, Bangladesh from July 2024 to June 2025 to examine the association between red cell distribution width (RDW) and both stroke severity and short-term functional outcomes in patients with acute ischemic stroke (AIS). The study was carried out at a tertiary care center, where patients were consecutively enrolled upon admission with a confirmed diagnosis of AIS based on clinical presentation and neuroimaging findings (CT or MRI). The duration of the study spanned a predefined period, during which eligible patients were recruited.

A total of 100 patients were included in the study. Inclusion criteria comprised adult patients (e"18 years) with radiologically confirmed AIS. Patients were excluded if they had hemorrhagic stroke, transient ischemic attacks, hematologic disorders, chronic systemic inflammatory conditions, advanced malignancies, or other medical conditions that could influence RDW levels. Written informed consent was obtained from all participants or their legal guardians before enrollment.

Clinical data were collected at three time points: at admission, during hospital stay, and at a follow-up visit three months post-stroke. A structured case record form was used to capture demographic information (age, sex, date of admission/discharge, and contact number), clinical presentation, comorbidities (e.g., hypertension, diabetes mellitus, atrial fibrillation, smoking status, previous stroke, MI/IHD), and vital signs including systolic and diastolic blood pressure. The timing and nature of stroke symptoms were also documented.

Stroke severity was measured using the National Institutes of Health Stroke Scale (NIHSS) at the time of admission. [18,19] The NIHSS score ranges from 0 to 42 and assesses various neurological domains. Patients were categorized based on NIHSS scores as having minor (1–4), moderate (5–15), moderate to severe (16–20), or severe strokes (21–42). Functional status was assessed using the modified Rankin Scale (mRS) at admission and again at the 3-month follow-up. [20] The mRS score ranges from 0 (no symptoms) to 6 (death), and for analytical purposes, patients were dichotomized into functionally independent (mRS 0–2) and dependent (mRS 3–6).

At admission, venous blood samples were drawn to assess red cell distribution width (RDW, %), hemoglobin (g/L), random blood sugar (mmol/L), serum creatinine (µmol/L), and lipid profile parameters including total cholesterol, HDL, LDL, and triglycerides (mg/dL). RDW values were divided into quartiles: Q1 (11.3–12.7%), Q2 (12.8–13.3%), Q3 (13.4–13.9%), and Q4 (14.0–21.7%). Neuroimaging findings from CT or MRI scans were reviewed to identify infarct locations, including the frontal, temporal, occipital, frontoparietal, temporoparietal, thalamic, and basal ganglia regions.

Data analysis was performed using Stata version 16.0. Continuous variables were expressed mean value, and categorical variables were summarized as frequencies and percentages. Comparisons across RDW quartiles and between functional outcome groups were performed using the Pearson's chi-square test or Fisher's exact test for categorical variables and the Mann–Whitney U test for continuous variables. A correlation matrix was generated to explore associations among RDW, NIHSS, mRS, and other variables. Univariable and multivariable binary logistic regression analyses were conducted to identify predictors of functional independence at 3 months. Variables that were statistically significant in the univariable model or deemed clinically relevant were included in the multivariable analysis. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were reported. The final model included variables such as diastolic blood pressure, smoking status, NIHSS score, baseline mRS score, RDW quartile, and basal ganglia involvement. A p-value of less than 0.05 was considered statistically significant.

Results:

A total of 100 patients with acute ischemic stroke were included, with a mean age of 66 years. The cohort consisted of 59 males (58.4%) and 41 females (41.6%). The mean systolic and diastolic blood pressures at admission were 131 mmHg and 84 mmHg, respectively. Hypertension was the most common comorbidity (64.4%), followed by diabetes mellitus (42.6%) and atrial fibrillation (36.6%). Nearly half of the patients (46.5%) were smokers, while 22.8% had a history of previous stroke and 16.8% reported myocardial infarction or ischemic heart disease.Stroke severity, measured by NIHSS, showed a mean score of 8.37. Based on severity categories, 35.6% of patients had minor stroke, 49.5% moderate stroke, 5.0% moderate-to-severe stroke, and 9.9% severe stroke. Functional status at admission, measured by the modified Rankin Scale (mRS), had a mean score of 3.62. Most patients presented with moderately severe disability (45.5%) or severe disability (27.7%), while smaller proportions had no significant, slight, or moderate disability. Neuroimaging revealed that the most frequently affected regions were the frontoparietal (43.6%) and temporal lobes (39.6%), followed by the frontal (28.7%) and occipital lobes (27.7%). Additional involvement was noted in the thalamus (20.8%), temporoparietal region (16.8%), and basal ganglia (10.1%).The lipid profile showed a mean total cholesterol of 199 mg/dL, LDL 156 mg/dL, HDL 44 mg/dL, and triglycerides 231 mg/dL. (Table I).

Table I

Socio Demographic and Heath characteristics of patients.

Characteristics	Categories	Frequency (%)
Age (years)		66
Gender	Male	59 (58.4%)
	Female	41 (41.6%)
Blood pressure	Systolic BP (mmHg)	131.08
	Diastolic BP (mmHg)	84.19
Medical History	Hypertension	65 (64.4%)
	Diabetes Mellitus	43 (42.6%)
	Atrial Fibrillation	37 (36.6%)
	Smoking Habit	47 (46.5%)
	Previous Stroke	23 (22.8%)
	MI/IHD	17 (16.8%)
NIH Stroke Scale (NIHSS)	Mean	8.37
	Minor Stroke	36 (35.6%)
	Moderate Stroke	50 (49.5%)
	Moderate to Severe Stroke	5 (5.0%)
	Severe Stroke	10 (9.9%)
Modified Rankin Scale (mRS) at admission	Mean	3.62
	No significant disability	16 (15.8%)
	Slight disability	7 (6.9%)
	Moderate disability.	4 (4.0%)
	Moderately severe disability	46 (45.5%)
	Severe disability	28 (27.7%)
Radiological Findings (CT/MRI)	Frontal Lobe	29 (28.7%)
	Temporal Lobe	40 (39.6%)
	Occipital Lobe	28 (27.7%)
	Frontoparietal	44 (43.6%)
	Temporoparietal	17 (16.8%)
	Thalamus	21 (20.8%)
	Basal Ganglia	10 (10.1%)
Lipid Profile and Blood Markers	Cholesterol (mg/dL)	199 (38)
	HDL (mg/dL)	44 (13)
	LDL (mg/dL)	156 (42)
	Triglycerides (mg/dL)	231 (102)

*Data presented as n (%) for categorical data and mean for continuous data. NIHSS score: Minor Stroke=NIHSS1-4; Moderate Stroke=NIHSS5-15; Moderate to Severe Stroke=NIHSS 16 -20; Severe Stroke = NIHSS 21- 42; mRS score: 1-No significant disability; 2-Slight disability; 3-Moderatedisability; 4-Moderately severe disability; 5-Severe disability; 6 - Dead.

Baseline Characteristics of Patients Stratified by Red Cell Distribution Width Quartiles

Table 2 summarizes the baseline characteristics across RDW quartiles. Age showed a progressive increase, with patients in Q4 being older on average than those in Q1 (p = 0.048). Sex distribution, blood pressure, and most comorbidities (hypertension, diabetes, smoking, prior stroke, MI/IHD) did not differ significantly between quartiles. However, atrial fibrillation was significantly more common in higher RDW groups, particularly Q3 (63.6%) compared to Q1 (18.5%) (p = 0.008).Stroke severity (NIHSS) ranged from 5.9 in Q1 to 10.6 in Q4, but this difference did not reach statistical significance (p = 0.223). Similarly, functional status at admission (mRS) did not differ overall (p = 0.182), though patients in Q3 and Q4 more frequently presented with moderately severe or severe disability.Radiological findings demonstrated a notable difference in frontoparietal involvement, which was highest in Q4 (64%) compared to 26% in Q1 (p = 0.009). Other regions, including frontal, temporal, occipital, temporoparietal, thalamus, and basal ganglia, did not show significant quartile-specific differences.Lipid profiles and blood markers were largely comparable across quartiles, although LDL and triglyceride levels showed borderline variation, with lower LDL in Q4 and lower triglycerides in Q3 (p = 0.057 and p = 0.071, respectively).

Table II

Baseline Characteristics of the Study Population Stratified by RDW Quartile

Variable	Red Cell Distribution Width Quartiles				
	RDW-Q1 (n=27)	RDW-Q2 (n=27)	RDW-Q3 (n=22)	RDW-Q4 (n=25)	p-value
Demographic History					
Age (years)	63.14	68.74	62.31	70.64	0.048
Sex - Male	17 (63.0%)	16 (59.3%)	12 (54.5%)	14 (56.0%)	0.933
Systolic BP (mmHg)	134.81	127.22	132.95	129.61	0.635
Diastolic BP (mmHg)	88.11	82.59	85.68	80.4	0.381
Medical History					
Hypertension	18 (66.7%)	16 (59.3%)	17 (77.3%)	14 (56.0%)	0.435
Diabetes Mellitus	9 (33.3%)	12 (44.4%)	11 (50.0%)	11 (44.0%)	0.683
Atrial Fibrillation	5 (18.5%)	11 (40.7%)	14 (63.6%)	7 (28.0%)	0.008
Smoking Habit	13 (48.1%)	14 (51.9%)	10 (45.5%)	10 (40.0%)	0.856
Previous Stroke	6 (22.2%)	7 (25.9%)	6 (27.3%)	4 (16.0%)	0.786
MI/IHD	3 (11.1%)	4 (14.8%)	4 (18.2%)	6 (24.0%)	0.647
Stroke Severity and Functional Status					
NIHSS	5.88	9.29	7.81	10.56	0.223
mRS at Admission					
No significant disability	4 (12.5%)	4 (31.3%)	4 (31.3%)	4 (25.0%)	0.182
Slight disability	4 (57.1%)	1 (14.3%)	0 (0.0%)	2 (28.6%)	
Moderate disability.	2 (50.0%)	1 (25.0%)	0 (0.0%)	1 (25.0%)	
Moderately severe disability	16 (34.8%)	8 (17.4%)	11 (23.9%)	11 (23.9%)	
Severe disability	3 (10.7%)	12 (42.9%)	6 (21.4%)	7 (25.0%)	
Radiological Findings (CT/MRI)					
Frontal Lobe	6 (22.2%)	9 (33.3%)	8 (36.4%)	6 (24.0%)	0.584
Temporal Lobe	12 (44.4%)	11 (40.7%)	9 (40.9%)	8 (32.0%)	0.826
Occipital Lobe	7 (25.9%)	7 (25.9%)	10 (45.5%)	4 (16.0%)	0.154
Frontoparietal	7 (25.9%)	15 (55.6%)	6 (27.3%)	16 (64.0%)	0.009
Temporoparietal	3 (11.1%)	4 (14.8%)	4 (18.2%)	6 (24.0%)	0.647
Thalamus	8 (29.6%)	4 (14.8%)	6 (27.3%)	3 (12.0%)	0.308
Basal Ganglia	2 (7.4%)	4 (14.8%)	3 (13.6%)	1 (4.0%)	0.521
Lipid Profile and Blood Markers					
Cholesterol (mg/dL)	199 (36)	197 (45)	202 (46)	201 (56)	0.669
HDL (mg/dL)	44 (12)	44 (12)	46 (10)	40 (12)	0.181
LDL (mg/dL)	166 (31)	156 (41)	151 (73)	147 (44)	0.057
Triglycerides (mg/dL)	232 (98)	222 (104)	191 (75)	237 (71)	0.071

*Data presented as n (%) and mean for continuous data. The significance level was obtained by Mann-Whitney U and Pearson's Chi-Square tests, as applicable. The patients were stratified into four groups based on the Red Cell Distribution Width quartile distribution (Q1-11.3-12.7 %; Q2-12.8-13,3 %; Q3-13.4-13.9 %; Q4-14.0- 21.7 %)

Figure 1 demonstrates the distribution of modified Rankin Scale (mRS) scores stratified by quartiles of red cell distribution width (RDW). Patients in the lower RDW quartiles (Q1 and Q2) were more likely to have favorable functional outcomes (mRS 0–2), whereas those in the higher RDW quartiles (Q3 and Q4) showed a greater proportion of poor outcomes (mRS 3–6).

Table III summarizes patient characteristics stratified by 3-month functional outcome. Patients who achieved functional independence (mRS 0–2) had significantly lower diastolic blood pressure (77 vs. 87 mmHg, p = 0.015) and NIHSS scores at admission (mean 6.8 vs. 12.2, p = 0.001), while systolic BP was lower but borderline significant (p = 0.067). Smoking was significantly more frequent among dependent patients (p = 0.004).Admission functional status strongly predicted outcome (p < 0.001): severe disability (mRS = 5) was markedly more common in dependent patients (55.2%) compared to independent patients (16.7%). Among neuroimaging variables, basal ganglia infarction was significantly associated with dependency (56.1% vs. 20.7%, p = 0.024), whereas lesions in other regions (frontal, temporal, occipital, thalamus, parietal subregions) showed no significant differences.No significant variation was observed in lipid profiles (total cholesterol, HDL, LDL, triglycerides) or in RDW quartile distribution between outcome groups.

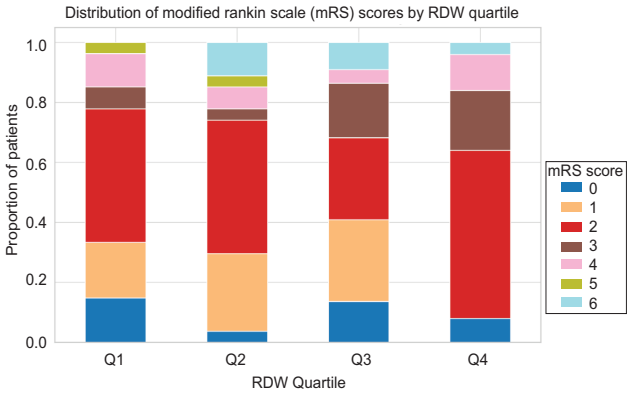

Figure 1: Distribution of after 3 months modified Rankin Scale (mRS) score stratified by Red Cell Distribution Width Quartile (RDW-Q1 to RDW-Q4).

Table-III

Characteristics	Categories	Functional Outcome		p value
		Independent (mRS 0 to 2)	Dependent (mRS 3 to 6)	
Age (years)		68.41	65.47	0.275
Gender	Male	18 (62%)	41 (56.9%)	0.636
	Female	11 (38%)	31 (43.1%)	
Blood pressure	Systolic BP (mmHg)	123.27	134.23	0.0669
	Diastolic BP (mmHg)	77.37	86.94	0.0154
Medical History	Hypertension	17 (58.6%)	48 (66.7%)	0.445
	Diabetes Mellitus	13 (44.8%)	30 (69.8%)	0.771
	Atrial Fibrillation	8 (27.6%)	29 (67.4%)	0.231
	Smoking Habit	20 (69.0%)	27 (62.8%)	0.004
	Previous Stroke	10 (34.5%)	13 (30.2%)	0.075
	MI/IHD	3 (10.3%)	14 (32.6%)	0.269
NIH Stroke Scale (NIHSS)	Mean	12.17	6.84	0.0014
Modified Rankin Scale (mRS) at admission	No significant disability	15 (20.8%)	1 (3.4%)	0.0001
	Slight disability	6 (8.3%)	1 (3.4%)	
	Moderate disability.	3 (4.2%)	1 (3.4%)	
	Moderately severe disability	36 (50%)	10 (34.5%)	
	Severe disability	12 (16.7%)	16 (55.2%)	
Radiological Findings (CT/MRI)	Frontal Lobe	5 (17.2%)	24 (58.5%)	0.205
	Temporal Lobe	12 (41.4%)	17 (41.5%)	0.817
	Occipital Lobe	10 (34.5%)	19 (46.3%)	0.335
	Frontoparietal	9 (31.0%)	20 (48.8%)	0.107
	Temporoparietal	3 (10.3%)	14 (34.1%)	0.269
	Thalamus	5 (17.2%)	24 (58.5%)	0.577
	Basal Ganglia	6 (20.7%)	23 (56.1%)	0.024
Lipid Profile and Blood Markers	Cholesterol (mg/dL)	199 (54)	199 (43.5)	0.2861
	HDL (mg/dL)	44 (14)	44 (11.5)	0.3745
	LDL (mg/dL)	159 (43)	156 (41)	0.7867
	Triglycerides (mg/dL)	230 (125)	231 (91)	0.6629
Red Cell Distribution Width	RDW-Q1	21 (29.1%)	6 (22.2%)	0.703
	RDW-Q2	20 (27.7%)	7 (25.9%)	0.75
	RDW-Q3	15 (20.8%)	7 (25.9%)	0.451
	RDW-Q4	16 (22.25)	9 (26.5%)	0.277

* Data presented as n (%) and mean for continuous data. The significance level was obtained by Mann-Whitney U and Pearson's Chi-Square tests, as applicable; Functional outcome was evaluated by dichotomization of the mRS, with patients with an mRS of 2 or below being considered independent and of 3 or above being considered dependent or dead.

Table IV

Binary logistic regression analyses for functional independence at 3 months.

Variable	OR [CI]	P value	Adjusted OR [CI]	P value
Diastolic BP (mmHg)	0.97 [0.94–0.99]	0.011	0.96 [0.92–0.99]	0.021
Smoking Habit (Ref: No)	3.70 [1.48–9.29]	0.005	7.67 [2.03–28.98]	0.003
NIHSS	1.11 [1.04–1.18]	0.001	1.09 [0.98–1.21]	0.096
mRS at Admission				
No significant disability (Ref)				
Slight disability	2.5 [0.13–46.8]	0.54	2.34 [0.05–112.6]	0.667
Moderate disability.	5 [0.24–104.1]	0.299	5.47 [0.15–204.3]	0.358
Moderately severe disability	4.17 [0.49–35.5]	0.192	5.09 [0.35–74.1]	0.233
Severe disability	20.0 [2.31–173.1]	0.007	28.36 [1.32–609.5]	0.033
Basal Ganglia	0.09 [0.01–0.66]	0.018	0.09 [0.01–0.66]	0.018
Red Cell Distribution Width				
RDW-Q1 (Ref)				
RDW-Q2	1.23 [0.35–4.28]	0.75	0.20 [0.03–1.37]	0.102
RDW-Q3	1.63 [0.46–5.85]	0.451	0.99 [0.16–6.06]	0.991
RDW-Q4	1.97 [0.58–6.67]	0.277	0.86 [0.15–4.82]	0.86

*Multivariate model Adjusted for Diastolic BP; Smoking habit; NIHSS at admission; mRS score at admission; Basal Ganglia. Ref indicates reference category. OR-Odds Ratio. AOR-Adjusted Odds Ratio;

Table IV presents factors associated with functional independence at 3 months after AIS. In univariable analysis, lower diastolic BP (OR: 0.97, p = 0.011), lower NIHSS scores (OR: 1.11, p = 0.001), and absence of basal ganglia infarction (OR: 0.09, p = 0.018) were significantly linked to favorable outcomes, whereas smoking (OR: 3.70, p = 0.005) and severe baseline disability (mRS = 5; OR: 20.0, p = 0.007) predicted poor recovery. In the multivariable model, smoking (AOR: 7.67, p = 0.003) and severe disability (AOR: 28.36, p = 0.033) remained strong independent predictors of poor outcome, while lower diastolic BP (AOR: 0.96, p = 0.021) and absence of basal ganglia involvement (AOR: 0.09, p = 0.018) independently predicted functional independence. Although NIHSS lost significance after adjustment (p = 0.096), its unadjusted association suggests it remains clinically relevant. RDW quartiles were not independent predictors, though RDW-Q2 showed a non-significant trend toward better outcomes (AOR: 0.20, p = 0.102).

Discussion:

In this prospective cohort study, we investigated the association between red cell distribution width (RDW) at admission and three-month functional outcomes among patients with acute ischemic stroke (AIS) in Bangladesh. Although higher RDW quartiles were initially associated with worse outcomes, this relationship did not persist after adjustment for established clinical and neuroimaging predictors. Instead, smoking status, baseline functional disability (mRS), diastolic blood pressure, and basal ganglia infarction emerged as independent determinants of poor recovery.

The prognostic role of RDW in AIS has been increasingly explored in recent years. Several studies have suggested that elevated RDW reflects an underlying inflammatory and oxidative stress state that may worsen stroke outcomes through impaired microcirculatory flow, reduced red cell deformability, and endothelial dysfunction[21,22]. However, consistent with our findings, other investigations have reported that RDW loses statistical significance after adjusting for confounding factors such as age, comorbidities, and stroke severity[23-24]. For example, a multicentre prospective study involving 416 AIS patients found that RDW was not an independent predictor of poor functional outcome after multivariate adjustment[25]. Similarly, a large Chinese registry of 1,558 patients showed that while RDW predicted three-month mortality, its association with functional disability was attenuated in fully adjusted models[26].

Contradictory evidence also exists. A South Korean cohort of 1,901 stroke patients reported a modest but significant association between RDW and poor functional recovery (adjusted OR H" 1.12 per 1% increase)[27]. Meta-regression analyses pooling data

from over 15,000 participants have likewise demonstrated that RDW, when categorised, was associated with both mortality and poor functional outcomes, though its continuous association with disability remained inconsistent[28]. These discrepancies may be explained by heterogeneity in study design, population characteristics, follow-up duration, and statistical adjustment strategies. Our null finding for RDW after adjustment suggests that in our setting, RDW may be more of a nonspecific marker of illness severity rather than an independent prognostic determinant.

Among the independent predictors identified, smoking status was strongly associated with adverse outcomes. This is consistent with prior work demonstrating that smokers have significantly worse neurological recovery after AIS[29-30]. Large prospective datasets, including analyses from the International Stroke Trial and the AHA registry, have challenged the so-called "smoking paradox" by demonstrating no protective effect of smoking and, in most cases, a detrimental impact on recovery[31-32]. The underlying mechanisms are likely multifactorial, involving pro-thrombotic effects, impaired endothelial repair, and chronic inflammatory activation.

Baseline disability, as measured by the admission mRS score, was another strong predictor, reinforcing existing evidence that pre-stroke functional status substantially influences the likelihood of regaining independence after an acute event[33-34]. Higher diastolic blood pressure at presentation was also associated with poorer outcomes. Although the optimal management of blood pressure in the acute phase of ischemic stroke remains debated, elevated diastolic values may worsen cerebral edema or impair collateral circulation, thereby limiting recovery potential[35-36]. Furthermore, the presence of basal ganglia infarction independently predicted adverse outcomes, in line with previous neuroimaging studies showing that lesions in this region disrupt key motor and cognitive pathways essential for functional recovery[37-38].

Overall, our findings suggest that while RDW may be a useful adjunctive biomarker in the initial assessment of AIS patients, its prognostic value in functional recovery appears limited when robust clinical and imaging predictors are considered. These results highlight the need for composite prognostic tools that integrate laboratory, clinical, and neuroimaging variables to guide patient counseling and rehabilitation planning media.

Conclusion

In conclusion, this prospective cohort study found that elevated RDW at admission was not an independent predictor of short term functional outcomes in patients with acute ischemic stroke in a tertiary care hospital of Bangladesh. These findings challenge the assumption that RDW is a reliable early prognostic biomarker in AIS and suggest that its role may be limited to reflecting general illness severity rather than directly influencing recovery. The results underscore the importance of integrating RDW assessment with established predictors in comprehensive prognostic models and highlight the need for larger, multicenter studies with longer follow-up periods to better define its potential clinical utility.

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Conflict of Interest:

No author has any conflict of interest to disclose for this manuscript. The authors themselves are responsible for their ideas and views expressed in this article, which do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

Ethical Approval:

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the Institutional Review Board of the Sir Salimullah Medical College. Written informed consent was taken from all the patients before taking part of the study.

Authors' contributions:

Aminur Rahman contributed to the concept and design. Aminur Rahman, Abul Hasnat Md. Russel Ajoy Khetan, Shah Efrinul Kabir, Syed Sadib Islam, Mohammad Shahidul Islam Bhuiya performed data collection and compilation. Aminur Rahman ,Sabina Yasmin, Mohammed Nazmul Huq contributed in data analysis and manuscript writing. All authors revised and approved the manuscript.

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