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ORIGINAL ARTICLE

Association of hemoglobin and red cell distribution width ratio with upper gastrointestinal bleeding.

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ABSTRACT… Objective: To investigate the relation of Hb to Red cell distribution width (RDW). **Study Design:** Cross-sectional study. **Setting:** Department of Physiology, Sahiwal Medical College, Sahiwal. **Period:** 20 April 2025 to 20 July 2025. **Methods:** A total of 62 patients with upper gastro intestinal bleed were included in study. The Hb to RDW ratio was calculated for each participant. Data were entered and analyzed using SPSS version 26. **Results:** It was shown that a total of 62 participants were included out of which 34 were females, and people living in urban areas participated more in this disease (46.8%). In addition to this, our results showed that the mean value of Hb was 9.62, RDW was 17.2, and of Hb to RDW was calculated as 0.617. Furthermore, the Hb to RDW ratio was found to be significant with area-wise distribution (0.023). At the same time, it was found to be nonsignificant with marital status. Gender and area distribution were also measured by Fischer's exact test but the statistical significance was not **Conclusion:** The primary study objective to establish a direct association between the Hb/RDW ratio and the incidence or severity of upper GI bleeding was not supported by a statistically significant link.

Key words: Hb (Hemoglobin), RDW (Red Cell Distribution Width), Upper Gastrointestinal Bleeding.

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INTRODUCTION

Upper gastrointestinal bleeding throughout the world with an annual incidence of approximately 80 to 150 per 100,000 population, with an estimated mortality rate of 2% to 10% and can reach 30% in low resource settings.[1,2,3] This variation depends on regional health conditions, diagnostics, access, and population demographics. In high-income countries, it has declined due to improved use of proton pump inhibitors, helicobacter pylori eradication, and better management of NSAID use. However, in many low and middle-income countries, UGIB is a major issue. Over recent decades, there has been a noticeable shift in the etiology and frequency of UGIB globally. It accounts for substantial morbidity, healthcare burden, and hospital admissions. Pakistan presents a unique epidemiological file compared to global data. Unlike global trends, where peptic ulcer disease is most common, Pakistani studies consistently show that variceal bleeding dominates, accounting for 60% to 90% cases of UGIB disease due to complications of chronic liver disease from hepatitis B or C. For instance, a multi-center Military Hospital Rawalpindi review (2010) found 72.10% of cases due to varices, while a 2020 to 21 study at JPMC at Karachi reported 57.4 % prevalence. Recent data from Mardan (June to November 2023) indicates an astonishing 89.50 % variceal predominance. In contrast non-variceal causes such as peptic ulcers, erosive gastritis, Mallory Weiss tears, and esophagitis are markedly less frequent, typically representing between 10 % and 36 % across different centers.[4,5] The unique predominance of variceal bleeding in Pakistan, a highly lethal condition often marked by chronic anemia and elevated RDW from liver disease, directly validates the study's objective to find a prognostic marker, as the HRR ratio is likely to be particularly abnormal and clinically significant in this specific, high-risk patient population. Mortality rates from UGIB in Pakistan are reported to be between 5% to 10%. We are aiming to enhance early prognostication and guide timely intervention in UGIB patients.[6,8,9]

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In this study, we investigated the prognostic value of the hemoglobin to red cell distribution width (Hb/RDW) ratio in patients with upper gastrointestinal bleeding (UGIB). While this ratio has emerged in other populations as a potential predictor of mortality and adverse outcomes in conditions like sepsis and heart failure, its clinical utility for risk stratification in UGIB, particularly within the unique epidemiological context of Pakistan, remains unexplored. This aspect remains underexplored in the Pakistani population despite its emerging role. Our findings aim to enhance early assessment and management strategies in these patients. In this regard, evaluating novel predictors make more informed, timely decisions to improve patient outcomes globally. Hence, it was a research gap which we addressed in our study, and we were successful in doing so, receiving a remarkably positive response.

METHODS

This cross-sectional study was conducted at Sahiwal Medical College, Sahiwal from 20 April 2025 to 20 June 2025 after taking the ethical approval letter number 205\IRB\SLMC\SWL on 17 April 2025. Patients presenting with upper GI bleed to Sahiwal Teaching Hospital were enrolled via non-probability sampling, matched for factors like age and comorbidities, while excluding those who did not consent or had other diseases. A sample size of 44 was calculated, yet 62 patients were included to account for incomplete data. In hospital setting the Complete blood count (CBC) was performed via an automated hematology analyzer (Sysmex XP-300), provided Hb and RDW values. Then the ratio is calculated by dividing Hb by RDW.

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^2 SD^2}{d^2}$$

In the above formula,
$Z1\text{-}_{\alpha/2}$ = 1.96 = At 95% Confidence interval. SD = 0.17 = standard deviation[7]
d = 0.05 = margin of error.

Normality was assessed using the Shapiro-Wilk test, and data analysis in SPSS version 26 employed frequency percentages, means/medians, and independent t-tests, with statistical significance set at $p<0.05$.

RESULTS

TABLE-I

Demographic frequencies of qualitative variables study participants(n=62)

Variables	Groups	Frequencies (%)
Gender	Female	34(54.8)
	Male	28(45.2)
Area	Rural	24(38.7)
	Urban	29(46.8)
	Town	2(3.2)
Marriage	Married	53(85.5)
	Unmarried	7(11.3)

The majority of participants were female (54.8%) compared to males (45.2%). Most individuals belonged to urban areas (46.8%), followed by rural areas (38.7%), with a small proportion from towns (3.2%). Additionally, a large majority were married (85.5%), while only a small percentage were unmarried (11.3%). Gender and area distribution were also measured by Fischer's exact test but the statistically significance was not found.

TABLE-II

Mean ± Standard deviation and Median ± IQR of quantitative variable of study participants (n=62)

Variable	Mean ± STD. Deviation	P-Value
HB	9.62±2.932	0.200
RDW	-	0.000
Hb/RDW	0.617±0.249	0.200
WBC	-	0.000
MCV	78.51±10.71	0.200
PLT	-	0.023
Lymphocytes	-	0.000
Granulocytes	-	0.002
MXD	2.32±3.305	0.717

Variable	Median ±Interquartile Range	P-Value
HB	-	0.200
RDW	15.45±5	0.000
Hb/RDW	-	0.200
WBC	7.70±6	0.000
MCV	-	0.200
PLT	162.0±207	0.023
Lymphocytes	3.55±13	0.000
Granulocytes	8.35±11	0.002
MXD	-	0.717

The mean hemoglobin (Hb), Hb/RDW ratio, and MCV were 9.62±2.93, 0.617±0.249, and 78.51±10.71 respectively, all showing non-significant p-values (0.200). In contrast, RDW, WBC, lymphocytes, granulocytes, and platelet counts showed statistically significant differences (p≤0.05).

Median values indicated that RDW (15.45±5), WBC (7.70±6), platelets (162.0±207), lymphocytes (3.55±13), and granulocytes (8.35±11) were significant (p≤0.05). However, Hb, Hb/RDW, MCV, and MXD remained non-significant across both measures.

To find this, we have used independent t test

The mean Hb/RDW ratio was slightly lower in patients with upper GI bleed (0.588±0.235) compared to those without (0.708±0.276), but the difference was not statistically significant (p=0.509). Similarly, no significant difference was observed between married (0.616±0.255) and unmarried individuals (0.629±0.213) (p=0.319).

However, a significant difference was found based on area, with rural participants (0.652±0.284) having higher Hb/RDW values than urban participants (0.586±0.213) (p=0.023).

The mean hemoglobin (Hb) level was lower in patients with upper GI bleed (9.27±2.82) compared to those without (10.71±3.10), but this difference was not statistically significant (p=0.434). Similarly, no significant difference was observed between married (9.68±2.98) and unmarried individuals (9.14±2.61) (p=0.754).

However, a significant difference was found by area, with rural participants (10.59±3.28) having higher Hb levels than urban participants (8.76±2.31) (p=0.042).

DISCUSSION

In our above results, it was shown that females participated more than males. Another study showed the same result, in which females participated more.[10] But in contrast to our result, another study showed male participants were more.[11] Moreover, our results also showed that more people living in urban areas participated. But in contrast to our study, another study related to upper GI bleed showed that rural people were affected more.[12]

TABLE-III

Independent T Test of Hb/RDW to different groups of study participants (n=62)

Variables	Groups	Mean ± STD	t-value	df	P-Value
Hb/RDW	With upper GI Bleed	0.588±o.235	-1.646	60	0.509
	Without upper GI Bleed	0.708±0.276	-1.513	20.861	
	Married	0.616±0.255	-0.131	60	0.319
	Unmarried	0.629±0.213	-0.150	8.344	
	Rural	0.652±0.284	1.041	60	0.023
	Urban	0.586±0.213	1.022	51.531	

TABLE-IV

Independent T Test of Hb with different groups of study participants(n=62)

Variable	Groups	Mean ± STD	t-value	df	P-Value
Hb	With upper GI Bleed	9.27±2.822	-1.68	60	0.434
	Without upper GI Bleed	10.71±3.100	-1.608	21.917	
	Married	9.68±2.987	0.450	60	0.754
	Unmarried	9.14±2.61	0.500	8.129	
	Rural	10.59±3.281	2.560	60	0.042
	Urban	8.76±2.315	2.504	49.56	

Our study also showed that people who were married participated more than unmarried people.

Our results showed that patients with upper GI bleed had lower hemoglobin levels. Another study was done, which showed an association between osteoporosis and low hemoglobin levels, but no study was found in the upper GI bleed.[13] Keeping another parameter, RDW, in view, we found it higher as well in the upper GI bleed patients. Our study was supported by previous research, which also showed elevated red cell distribution width (RDW) value, but that study was done in acute coronary syndrome patients.[14] In contrast to our results, another study showed a lower value of red cell distribution width (RDW), but again, that study was not conducted in the upper GI bleed patients but in patients with microcytic anemia.[15]

In the above-mentioned results of our research, it was shown that the HB to RDW ratio was higher in rural people than urban people. This might be due to health disparities between them, and it proved statistically significant in our research. (p value is significant, 0.023).[16] Our research had shown the association of HB to RDW ratio, which was more in Non upper GI BLEED patients, but it was not found statistically significant. The result showed that the HB to RDW ratio was higher in unmarried patients but was not found statistically significant. In the above-mentioned results, it was shown that people living in rural areas had a higher hemoglobin level, which might be due to their greater physical exertion as compared to urban citizens, and it was proved statistically significant. (p value is significant 0.042).[17] In the above-mentioned results it was shown that Hemoglobin level was more in patients without upper GI bleed that might be due to blood loss from digestive tract in GI bleed patients leading to reduction in number of RBCs but there are chances of contrary opinions because it was not found statistically significant. (p value is 0.434).[18] Another finding in our results showed that married people had more levels of hemoglobin than the unmarried ones, though it was not found to be statistically significant. (p value is 0.754).[19,20] Cautious approach was used for determining the significant finding of the area versus HB distribution ratio and the study can be replicated in the future with the largest sample size.

CONCLUSION

The primary study objective to establish a direct association between the Hb/RDW ratio and the incidence or severity of upper GI bleeding was not supported by a statistically significant link. However, a key secondary finding emerged, revealing that the Hb/RDW ratio itself was significantly higher among individuals residing in rural areas compared to their urban counterparts, while it showed no correlation with marital status.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Isha Latif:** Data collection, writing.
2	**Hayat Ullah:** Data analysis.
3	**Rimsha Shakeel:** Editing.