Original Article

A Correlation Study between Red Cell Distribution Width and Ranson Score in Predicting Severity and Outcome of Acute Pancreatitis

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Introduction : Some patients with Acute Pancreatitis develops severe feature and it accounts for 20% of patients with Acute Pancreatitis. Our study is conducted with an aim to investigate the correlation between Red Cell Distribution Width and Ranson score in patients with Acute Pancreatitis.

Methods : 119 patients suffering from Acute Pancreatitis were studied and they were divided into 2 groups - patients with Mild or Severe Acute Pancreatitis according to the presence or absence of the features of organ failure for >48 hours and/or local complications. Routine laboratory investigations, including complete hemogram and Red Cell Distribution Width, Liver Function Test (LFT), Renal Function Test (RFT), Serum Calcium, Serum Amylase, Serum Lipase, Serum Lactate Dehydrogenase (LDH), Serum Electrolytes, Arterial Blood Gas analysis, Ultrasonography of abdomen, Chest X-ray, Contrast Enhanced Computed Tomography (CECT) of whole abdomen were done. The data was tabulated and analyzed. Chi square test was applied to calculate the significance and p-value <0.05 is significant. The correlation between Red Cell Distribution Width – Co-efficient of variation and Ranson score was measured by using Pearson's correlation coefficient (r).

Results : 30 patients (25.21%) had features of severe type of acute pancreatitis. The cut-off values for Ranson score and Red Cell Distribution Width level in severe type of acute pancreatitis were ≥3 and 14.6% respectively. At time of admission, Red Cell Distribution Width correlated with Ranson score at 48-hour ('r' value of 0.7812 and 'p' value of <0.001).

Conclusion : Red Cell Distribution Width emerges as an independent prognostic factor in predicting severity and outcome of the acute pancreatitis patients.

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***Key words* : Acute pancreatitis, Red Cell Distribution Width (RDW), Ranson score; Severity.**

The inflammation of pancreas in Acute Pancreatitis (AP) is a reversible process and it can involve the peri-pancreatic tissue of other regional tissues or remote organ systems in varying degree[1]. The activation of pancreatic enzyme during AP causes pancreatic tissue damage and it results in an acute inflammation of pancreas, that has variable aetiology and natural histories, and making it difficult in the early identification of patients at high risk. 80% of AP cases are mild and has self-limiting course without sequelae. 10%-20% of cases develop severe disease and various parts of the pancreas and surrounding tissues become necrotic. The acute inflammation may lead to Systemic Inflammatory Response Syndrome (SIRS) and/or Multiorgan Failure (MOF) and results in death[2,3]. It is one of the most common gastrointestinal causes of hospital admissions in India and worldwide[4,5]. The incidence rate for AP is about 5-35/100,000 new cases annually worldwide[6] but the rate of mortality is currently approximately 3.8% to 7% as reported by several recent studies and in severe AP, it ranges from 7% to 42%[7,8].

Editor's Comment :

- RDW is a simple and easy tool for predicting the severity of the disease process and risk stratification in AP.
- An early, aggressive and effective treatment can be initiated in AP by this simple tool. Thus local and systemic complications and mortality in AP can be minimised.

In order to decrease mortality rates in AP, early identification of patients at greater risk of mortality may be determined by rational use of diagnostic studies and prompt early institutional or medical intervention. In previous studies, the use of several biological markers and clinical events has predicted the mortality of AP. But, there has been a search for a tool for a reliable risk stratification to predict the severity and prognosis of AP. The variability in the size of circulating erythrocytesis measured quantitatively in RDW and the higher value of RDW reflects the greater heterogeneity in cell sizes (ie, anisocytosis). RDW is a routine and inexpensive test that can be obtained through a complete blood count which is easily

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available. It is calculated[7] as –

$$RDW = \frac{(\text{Histogram Width of 68.26\% of RBC}) \times 100}{\text{Mean Corpuscular Volume (MCV)}}$$

For these reasons, recent studies have focused on RDW to predict the severity and mortality in AP. The mortality in AP patients can be reduced by early diagnosis in the Emergency Department and prompt treatment. Therefore, the simple, easily accessible and affordable markers are needed which allows investigation at the bedside to assess whether the disease will progress in severity and predict development of complications and mortality, without any delay. There has been limited numbers of studies about the correlation of RDW with severity of AP. Hence, further studies examining the possible prognostic value of RDW for predicting various outcomes related to AP are still warranted.

Aim and Objective

The study was conducted to correlate and evaluate the outcome of AP by Ranson's criteria and RDW.

Materials and Methods

It was a cross sectional study done between 1st July, 2018 to 30th June, 2019. All consecutive patients presenting with typical signs and symptoms of AP, admitted in our hospital were taken up for the study after fulfilling the selection criteria. A total of 119 patients of Acute Pancreatitis were included in the present study. Inclusion criteria included- age >12 years old, all cases of AP and those who gave consent for the study. Exclusion criteria included- age ≤12 years old, anaemia, chronic kidney disease, chronic liver disease, cancer patients, pregnancy and recent history of blood transfusion within 3 months.

The diagnosis of AP (according to revised Atlanta classification)[9] required any two of the three features – (i) pain abdomen consistent with acute pancreatitis (acute onset of a persistent, severe, epigastric pain often radiating to the back); (ii) raised serum lipase or amylase activity (≥ thrice the upper limit of normal); and (iii) characteristic features of AP on Contrast-enhanced Computed Tomography (CECT), Magnetic Resonance Imaging (MRI) or Transabdominal Ultrasonography.

AP was classified into 2 groups - as Mild Acute Pancreatitis (MAP) and Severe Acute Pancreatitis (SAP) based on the presence/absence of organ failure for >48hours and/or local complications.The organ failures included Systolic Blood Pressure (SBP)<90 mmHg (shock), pulmonary insufficiency (SpO_2<90%) and renal failure (serum creatinine level >2 mg/dl). Local complications included acute peri-pancreatic fluid collection, pseudocyst of pancreas, acute necrotic collection and walled-off necrosis.

Demographic profile was collected from patients. Routine laboratory investigations, including complete hemogram and RDW, Liver Function Test (LFT), Renal Function Test(RFT), Serum Calcium, Serum Amylase, Serum Lipase, Serum Lactate Dehydrogenase (LDH), Serum Electrolytes, Arterial Blood Gas analysis (ABG), Ultrasonography (USG) of abdomen, Chest X-ray (CXR), Contrast Enhanced Computed Tomography (CECT) of whole abdomen were done.

At the time of hospital admission, RDW was calculated. From the data recorded in first 24 hours and 48 hours after admission, Ranson score was calculated. Patients with Ranson score ≥3 had the severe disease (SAP).

Statistical Analysis :

The data recorded on pre-designed and pre-tested proforma was tabulated and master chart was prepared. Applicable statistical methods were used to analyse the various sets of data by using a computer program Statistical Package for Social Sciences (SPSS for Windows, Version 21.0. Chicago, SPSS Inc). The discrete data were expressed as proportion and percentage and were analysed by using Chi square test. Significant P-value was <0.05.The correlation between Red Cell Distribution Width – Co-efficient of variation (RDW-CV) and Ranson score was measured by using Pearson's correlation coefficient (r).

Results

In our present study, all the patients belonged to the age group of 13 to 71 years with mean age of 36.37 ± 10.85 years. Other demographic features were shown in Table 1.

The mean RDW for MAP was 13.92±0.84 while that of SAPwas 16.43±1.41. It was observed that out of total 70 patients with RDW-CV level in the range of 11.6-14.6%, SAP and mortality were seen in 1 and 0 patients respectively. However, out of total 49 cases with RDW-CV level in the range of >14.6%, SAP and mortality were seen in 29 and 15 patients respectively (Table 2).

Out of total 76 patients with Ranson score <3, no mortality was observed among the patients and no patients had developed severe acute pancreatitis. However, out of total 43 patients with Ranson score ≥3, 30 patients had developed SAP and death had occurred in 15 patients (Tables 3 & 4 and Fig 1).

In the above figure, a positive correlation between RDW at time of admission and Ranson score with a 'r' value of 0.7812 and significant 'p' value (p-value <0.001) was seen.

Table 1 — *Demographic and Clinical Characteristics of the patients with AP*

Characteristics	Total (n=119)	Patients with MAP (n=89)	Patients with SAP (n=30)
Sex :			
Male	102	74	28
Female	17	15	2
Aetiology :			
Alcoholic	83	58	25
Gallstones	27	24	3
Idiopathic	18	18	0
Hypertriglyceridemia	3	1	2
Mean hospital stay (in days)	5.5	4.72±1.14	7.63±2.29
Mean RDW	14.55±1.49	13.92±0.84	16.43±1.41
Mean Ranson score	1.91±1.85	1.07±1.07	4.40±1.38
Outcome :			
Improved	104	89	15
Expired	15	0	15

Discussion

In our study, there was a positive correlation between RDW and Ranson score with a significant difference in RDW between MAP and SAP.

In our study, it was seen that patient with higher Ranson score (≥3) had more complications and mortality with sensitivity of 40% to 80%. It became the common and simple scoring systemto evaluate severity of AP. Ranson score was used as important tool in predicting the patient's outcome in AP in the studies of Khanna A K *et al*[10]and Chand *et al*[11].

RDW was an independent prognostic marker to determine risk of complications and mortality in varied range of clinical manifestations. Senol *et al*[7] observed in their study that patients with severe AP had increased RDW values (cut-off of 14.8%). Peng Tao *et al*[12] found in their study that RDW was an independent risk factor for persistent organ failure (Hazard ratio 2.26, 95% confidence interval: 1.46-3.51; P<0.001) after uni-and multi-variable analysis. The best cut-off value of RDW was 13.05% to predict the persistent organ failure with an area under the curve of 0.791 with a sensitivity of 97.4% and specificity of 55.8%. Zhang Ting *et al*[13] also found significantly higher RDW values in patients with moderately severe acute pancreatitis and severe acute pancreatitis (14.03±1.74% *versus* 13.23±1.23%, P<0.001) in comparison to mild acute pancreatitis in their study. Moharamzadeh *et al*[14] found in their study that the mean RDW of the patients was 13.82±1.69%. Mean RDW in dead patients and other patients was 16.44±4.22% and 13.68±1.37% respectively (P<0.001). The cut-off point of 14.55% for RDW with 80% sensitivity and 85% specificity was determined for predicting mortality in patients. In our study, it was seen that patients with higher RDW-CV level (SAP 16.43±1.41% *versus* MAP 13.92±0.84%) had higher proportion of SAP and mortality. Also, it was observed that out of total 70 patients with RDW-CV level in the range of 11.6-14.6%, SAP and mortality were seen in 1 and 0 patients respectively. However, out of total 49 cases with RDW-CV level in the range of >14.6%, SAP and mortality were seen in 29 and 15 patients respectively.

Kilic *et al*[15] observed that RDW (14%) at time of hospital admission was correlated with Ranson score ≥4 at 48-hour after admission (r=0.22; p<0.002). In our study, it was observed that RDW at time of hospital admission (14.6%) was correlated with Ranson's score ≥3 in predicting SAP and mortality than novel prognostic markers in the literature used to predict mortality ('r' value of 0.7812 and 'p' value of <0.001). In our study, sensitivity and specificity of RDW in diagnosis of SAP was 83.7% and 82.89% respectively

Table 2 — *Distribution of patients with RDW*

RDW–CV Level (%)	Number (n=119)	Mild Acute Pancreatitis		Severe Acute Pancreatitis		Mortality	
		n	%	n	%	N	%
11.6–13.6	34	34	100.00	0	0.00	0	0.00
>13.6–14.6	36	35	97.22	1	2.78	0	0.00
>14.6–15.6	23	18	78.26	5	21.74	0	0.00
>15.6–16.6	15	2	13.33	13	86.67	4	26.67
>16.6	11	0	0.00	11	100.00	11	100
Total	119	89	74.79	30	25.21	15	12.61

Table 3 — *Distribution of patients with Ranson score*

Ranson's Score	Number (n=119)	Mild Acute Pancreatitis		Severe Acute Pancreatitis		Mortality	
		n	%	n	%	N	%
0–2	76	76	100.00	0	0.00	0	0.00
3–4	32	13	40.63	19	59.38	5	15.63
5–6	8	0	0.00	8	100.00	7	87.50
≥7	3	0	0.00	3	100.00	3	100.00
Total	119	89	74.79	30	25.21	15	12.61

Table 4 — *Association between RDW and Ranson score*

RDW–CV Level (%)	Number (n=119)	Ranson's Score <3		Ranson's Score ≥3		P-value
		n	%	n	%	
<14.6	70	63	90.00	7	10.00	<0.001
>14.6	49	13	26.53	36	73.47	
Total	119	76	63.87	43	36.13	

with a negative predictive value of 90%.

Our findings also support the useful role of RDW as a quick and easy method for risk assessment in AP.

Conclusion

RDW level at the time of hospital admission is helpful to predict the severity of AP in the earliest time, especially at first-line centres, as compared to the multifactorial complex scoring systems presently available. After evaluation of the cases, it was observed that AP patients with higher RDW level were at greater risk for developing severity as well as mortality. Importantly it was also observed that RDW was a better predictor for severe disease and mortality than Ranson score. Therefore, in our setup, RDW should be assessed in all patients suffering from acute pancreatitis to help in early risk stratification, thus guiding the initiation of early, aggressive and effective treatment and prevention of both local and systemic complications as compared to standard Ranson criteria that takes longer period of assessment.

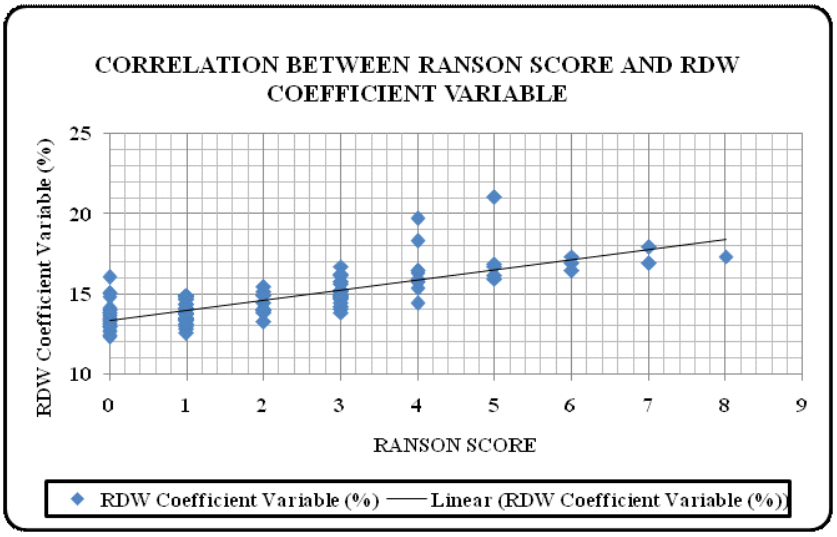

Fig 1 — Correlation between RDW with Ranson score

Limitations :

(1) More cases needed.

(2) Validation studies needed in future homogenous cohorts.

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Conflict of interest : None

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