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To Study the Correlation of Red Cell Distribution Width (RDW) With the Severity and Mortality of Acute Pancreatitis and Its Prognostic Implication

Rahul Vijay[1], Rajesh Yadav [2], V B singh[3]

[1,2] Resident Doctor, [3] Senior Professor & HOD

Department of general Medicine, S.P. Medical College and Associated group of Hospital Bikaner

Corresponding Author: Rajesh Yadav, Resident Doctor, Department of general Medicine, S.P. Medical College and Associated group of Hospital Bikaner

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Abstract

Background: Acute pancreatitis (AP) is characterized by the destruction and inflammation of pancreas tissue through the activation of pancreatic acinar cells as a result of being triggered by various factors and it can cause significant morbidity and mortality.

Methods: This was a prospective observational study with a definite diagnosis of acute pancreatitis made both clinically, laboratory and radiologically, conducted among patients admitted in department of medicine PBM hospital Bikaner Rajasthan from September 2015 to September 2016. Venous samples were drawn within 48 hours of the onset of symptoms and sent for routine blood examinations including measurement RDW.

Results: In our study 74% of the patients completly recovered usually with no residual stigmata of disease and 22 % patiens develop residual stigmata of disease. Out of the 4 patients that expired 3 (75%) had RDW>13.3 whereas 1 patient had RDW ranging 12.6-13.3 and out of 22 patients that develop residual stigmatas only 3 patients(13.64%) had RDW ranging 12.6-13.3%) and 19 patients had RDW ranging >13.3.Thus RDW is a good predictor of mortality and complications.

Conclusion: RDW is convenient, economic, and sensitive monitoring method for helping clinicians to determine severity,complications and mortality In AP patients.

Keywords: RDW, Acute pancreatitis (AP), Computed tomography (CT)

Introduction

Acute pancreatitis (AP) is characterized by the destruction and inflammation of pancreas tissue through the activation of pancreatic acinar cells as a result of being triggered by various factors and it can cause significant morbidity and mortality. The patients who come to the emergency service with a complaint of acute stomach ache and who are diagnosed with acute pancreatitis through clinical, laboratorial and radiological screening methods should be assessed quickly. Forming risk defining systems and determining the severity of the disease are of great importance in prognosis and how successful the treatment in the literature, it has been stated that indicators such as the Ranson criteria and computed tomography (CT) can be used to determine the severity of AP.[1,2]

The diagnosis for AP was based on typical clinical presentation, plasma amylase and lipase level exceeding 3 times the upper normal level and or confirmed pancreatitis

by abdomen a computed tomographic scanning or ultrasonography, Clinically the AP ranges from a mild form, edema and necrosis of the parenchyma, to severe AP involving a systemic inflammatory response syndrome, multi-organ failure. Although, the pathophysiologic mechanisms for the relationship between high RDW and prognosis of acute pancreatitis. RDW refers to an evaluation of the sizes of the red blood cells (RBCs) circulating in the vasculature, demonstrating the width of distribution of RBCs based on their sizes. It is a component of the complete blood cell (CBC) test. It is calculated by dividing the histogram width of 68.26% of RBCs by the mean corpuscular volume (MCV), then multiplying the result by 100. RDW values are also affected in other of diseases, including celiac disease, pulmonary embolism, and coronary artery disease.[3-5] In addition, elevated levels of RDW were determined in inflammatory and infectious bacteraemia, severe sepsis, and septic shock.

To study the correlation of red cell distribution width (RDW) with the mortality and severity of acute pancreatitis and its prognostic implication

Material and methods

This was a prospective observational study with a definite diagnosis of acute pancreatitis made both clinically, laboratory and radio logically, conducted among patients admitted in department of medicine PBM hospital Bikaner Rajasthan from September 2015 to September 2016. Ethical approval was obtained from institutional research ethic committee and written informed consent was taken from all subjects. Venous samples were drawn within 48 hours of the onset of symptoms and sent for routine blood examinations including RDW.

Inclusion criteria

All cases of acute pancreatitis based on typical clinical presentation, plasma amylase and lipase level exceeding 3 times the upper normal level and/or confirmed by abdominal computed tomographic scanning or ultrasonography.

Exclusion criteria

1. Patients with presence of hematologic disease, hypertension, and diabetes.
2. Patients with presence of malignant tumour, active infections, respiratory diseases and serious cardiovascular disease,
3. Patients with presence of known chronic liver and/or kidney diseases, immune system disease.
4. Patients with recent transfusion history, recurrent AP, chronic pancreatitis and pregnancy

Sample size: 100 patients were chosen conveniently from patients admitted in medicine ward.

Collection of data

The present study was conducted in 100 patients diagnosed as having acute pancreatitis and admitted in PBM Hospital, Bikaner, Rajasthan.

Clinical and laboratory examinations, in addition to radiological methods, were performed for the diagnosis of AP in patients on admission to the emergency department. Blood samples were collected from diagnosed cases of AP at the time of admission and at the time of discharge.

All routine investigations like CBC (RDW), RFT, LFT, SE, ECG, RBS, URINE(R/E), Serum Amylase and Lipase were performed.

Data Analysis

The Data was presented in the form of tables, figures, graphs, and diagrams. Continuous variables will be presented as mean and standard deviations while categorical variables will be presented as number and

percentage. Suitable statistical software will be utilized, wherever necessary, for analysis of data and appropriate statistical tests will be used to find the significance of the findings. P value <0.05 (at 95% confidence interval) will be considered to indicate statistical significance.

Results

Table 1: Distribution of study population according to etiology of Acute Pancreatitis

Type	Total		Male		Female	
	No.	%	No.	%	No.	%
Cholelithiasis	40	40	16	23.19	24	77.42
Alcohol	36	36	36	52.17	-	-
Idiopathic	10	10	8	11.59	2	6.45
Injury	6	6	5	7.24	1	3.23
Others	8	8	4	5.79	4	12.90
Total	100	100.0	69	100.0	31	100.0

According to Table 1, Cholelithiasis (40%) was most common etiology in over all patients, followed by alcohol (36%), but in male patients alcohol (52.17%) was most common etiology, followed cholelithiasis (23.19%).However in Female patient's most common etiology was cholelithiasis (77.42%).

Table 2: Distribution of study population according to Red cell distribution width (RDW) at the time of presentation

RDW presentation	No.	%
<12.6	2	2
12.6-13.3	16	16
>13.3	82	82
Total	100	100.0

According to table 2, 82 % patients had RDW >13.3, 16% of the patients had RDW ranging from (12.6-13.3), whereas 2% of the patients had RDW <12.6 in our study.

Table 3: Distribution of Acute pancreatitis patients according to degree of elevation of serum amylase & lipase level.

Levels	Serum amylase(No.)	Serum lipase(No.)
Not elevated	8	10
>3x Normal	32	28
>5x Normal	60	62
Total	100	100

According to table 3, Out of 100 patients 8 patients had their Serum amylase and 10 patients had Serum lipase level within normal limits, 32 patients reported upto three times elevation in their amylase and 28 patients had lipase level more than three time of normal. While 60 of the patients had their serum amylase and 62 patients had serum lipase level elevated upto five times of normal limit.

Table 4: Distribution of study population according to Red cell distribution width (RDW) at the time of presentation

RDW presentation	No.	%
<12.6	2	2
12.6-13.3	16	16
>13.3	82	82
Total	100	100.0

According to table 4, 82 % patients had RDW >13.3, 16% of the patients had RDW ranging from (12.6-13.3), whereas 2% of the patients had RDW <12.6 in our study.

Table 5: Distribution of study population according to Red cell distribution width (RDW) &it's progression till discharge

Day wise Progression	RDW Mean±SD	
D1	14.10±3.12	ANOVA=4.237 P=0.004
D2	13.98±2.86	
D3	13.81±1.99	
D4	13.63±1.45	
D5	13.56±1.34	

According to table 5, Mean RDW at the time of admission was 14.10±3.12.On analysis of the table it was noted that RDW subsequently decreased as the days progressed and was 13.56±1.34 at the time of discharge. ANOVA test was applied and decrement in RDW value subsequently with the days was found to be statistically significant (P=0.004).

Table 6: Distribution of study population according to Red cell distribution width (RDW) & Severity of Acute Pancreatitis

RDW presentation	Mild		Severe	
	No.	%	No.	%
<12.6	18	47.36	0	0
12.6-13.3	17	44.73	5	8.1
>13.3	3	7.89	57	91.9
Total	38	100	62	100

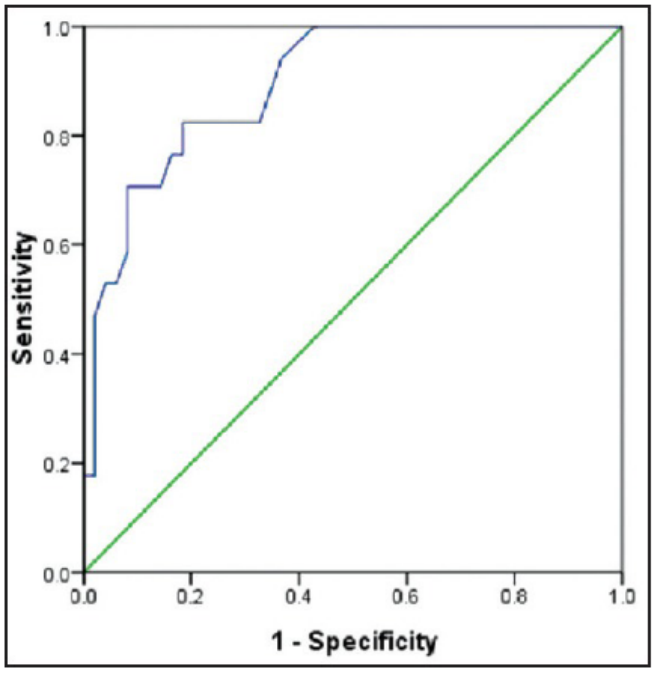
According to table 6, out of the 38 patients that had mild acute pancreatitis, 18 patients (47.36) had RDW <12.6, 17 patients (44.73%) had RDW ranging from 12.6-13.3. whereas only 3 patients (7.89%) had RDW >13.3, while among the 62 patients that had severe acute pancreatitis, 91.9% of the patients had RDW >13.3 whereas 8.1% of the patients had RDW ranging from 12.6-13.3%. It was seen that none of the patients that had severe acute pancreatitis had RDW <12.6.

Table 7: Distribution of study population according to Red cell distribution width (RDW) &outcome

RDW presentation	Recovered (Complete)		Residual Complications		Died		Total	
	No.	%	N0.	%	No.	%	No.	%
<12.6	2	2.70	0	0	0	0	2	2
12.6-13.3	12	16.21	3	13.64	1	25	16	16
>13.3	60	84.50	19	86.36	3	75	82	82
Total	74	100	22	100	4	100	100	100

According to table 7, it was seen that in our study 74% of the patients usually complete recovered without no residual stigmata of disease. 22 % patiens develop residual stigmata of disease. Out of the 4 patients that expired 3 (75%) had RDW>13.3 whereas 1 patient had RDW ranging 12.6-13.3.And out of 22 patients that develop residual stigmatas only 3 patients(13.64%) had RDW ranging 12.6-13.3%) and 19 patients had RDW ranging >13.3.Thus RDW is a good predictor of mortality and complications.

Figure 1



The area under the curve (AUC) and the optimal cut-off v alue were calculated. The AUC forRDW value was 0.894 (P < 0.001, 95% confidence interval = 0.823-0.966). The optimal cut-off value topredict deaths was 14.35 (sensitivi ty = 88.2%, specificity = 91.8%).

Discussion

This was a prospective observational study with a definite diagnosis of acute pancreatitis made clinically, laboratory and radio logically, conducted among 100 patients admitted in department of medicine PBM hospital Bikaner Rajasthan from September 2015 to September 2016. Ethical approval was obtained from institutional research ethic committee and written informed consent was taken from all subjects.

Non invasive, sensitive and specific RDW, which is a routinely reported parameter in the complete blood count test, has been reported to predict the mortality of AP with a low sensitivity of 47.6% and a specificity of 96.3%.[132] In the present study, we examined the RDW values in 100 AP patients and found that the mortality rate was significantly higher in patients with RDW >13.3% than those with RDW <13.3%.

In our study Mean RDW at the time of admission was 14.10±3.12.On analysis it was noted that RDW subsequently decreased as the days progressed and was 13.56±1.34 at the time of discharge. ANOVA test was applied and decrement in RDW value subsequently with the days was found to be statistically significant (P=0.004).

Acute pancreatitis involves both local inflammatory lesions and systemic pathological damage. Appropriate evaluation of the severity of AP is important for early and effective medical treatment for AP Out of the 38 patients that had mild acute pancreatitis, 18 patients(47.36) had RDW <12.6, 17 patients(44.73%) had RDW ranging from 12.6-13.3. whereas only 3 patients(7.89%) had RDW >13.3,while among the 62 patients that had severe acute pancreatitis, 91.9% of the patients had RDW >13.3 whereas 8.1% of the patients had RDW ranging from 12.6-13.3%. It was seen that none of the patients that had severe acute pancreatitis had RDW <12.6. RDW associated with the severity of acute pancreatitis in our study. RDW increases with the severity of pancreatitis which was statistically significant. It was seen that in our study 74% of the patients usually complete recovered without any residual stigmata of disease. 22 % patients develop residual stigmata of disease. Out of the 4 patients that expired 3 (75%) had RDW>13.3 whereas 1 patient had RDW ranging 12.6-13.3.And out of 22 patients that develop residual stigmata's only 3 patients(13.64%) had RDW ranging 12.6-13.3%) and 19 patients had RDW ranging >13.3.Thus RDW is a good predictor of mortality and complications.

Wang, et al [6]found that *approximately* 70-80% of AP is mild AP, which can be treated. In contrast, severe AP

develops rapidly and most patients with severe AP i.e. of MODS within 1-week after disease onset, while others die of infected pancreatic necrosis 1-week after disease onset.[147]In our study out of 100 patients 96 patients recovered and 4 patients died from acute pancreatitis.RDW presentation of recovered patients were >13.3(n=79), 12.6-13.3(n=15) and <12.6(n=2). Out of 4 patient who died, we found that the mortality rate was significantly higher in patients with RDW >13.3% than those with RDW <13.3%. Thus RDW directly correlated with outcome. Therefore, early diagnosis and appropriate treatment is critical for treating patients with severe AP and improving the survival rate of AP.

It has been reported that changes in RDW is associated with the inflammation status of the disease, which may explain why patients with higher RDW values have a higher mortality rate. It has been proposed that inflammation promotes deaths of RBCs or inhibits the maturation of RBCs, which is associated with an increase in RDW.[7-9] Some inflammatory mediators influence bone marrow function and iron metabolism and suppress erythropoietin-induced maturation of RBCs.[10] Therefore, RDW values reflect the inflammation status of AP and thus, may be used for predicting the severity of AP.

Our study suggests that the severity of AP is greater and patient mortality increased with higher RDW values. In addition, we further assessed the ability of RDW values to predict death in AP patients using ROC curve analysis. We found that the optimal cut-off value for RDW to predict death was 14.35 with a sensitivity of 88.2% and a specificity of 91.8%. The sensitivity (88.2%) identified in this study is greatly higher than that (47.6) reported by Senol *et al*.[11] and the specificity (91.8%) is slightly lower that that (96.3%) reported by Senol *et al*.[11] Our study suggests that RDW can be used a sensitive marker for predicting the mortality of AP patients.The optimal cut-off value was 0.894 (P < 0.001, 95% confidence interval = 0.823-0.966). The optimal cut-off value topredict deaths was 14.35 (sensitivity = 88.2%, specificity = 91.8%) in our study. Same result found by the Wang, et al.[6]

Conclusion

RDW is convenient, economic, and sensitive monitoring method for helping clinicians to determine severity,complications and mortality In AP patients.

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