

Evaluation of Red Cell Distribution as Prognostic Marker in Acute Pancreatitis

Dr.Aishwarya NS, Dr. Manisha Narayana.

Abstract

Acute Pancreatitis(AP) is an acute inflammatory disease, one of the most frequent gastrointestinal causes of hospital admissions. Majority of patients have mild, self limited disease, however 20% of patients have severe form. The early assessment of disease severity to estimate the complications and organ failure is fundamental. Red cell distribution(RDW) has been proposed as an early prognostic marker with increased mortality in variety of pathophysiological conditions.

Our objectives are to evaluate RDW prognostic marker in Acute Pancreatitis.

The study was conducted at Bangalore medical college and research institute with 110 patients diagnosed of Acute Pancreatitis.

The diagnosis of acute pancreatitis was based on clinical, radiological and laboratory parameters. Patient demographics and the time interval between symptom onset and hospital admission was noted.

Out of 110 patients, According to the Atlanta Criteria, 82 patients (74.5%) were classified as Mild Acute Pancreatitis and 28 (25.5%) were classified as Severe Acute Pancreatitis.

Mean RDW in mild Pancreatitis was 12.220 and 14 in severe Pancreatitis. Mean RDW in survivors was 12.343 and 14.476 in non survivors. This study proves that higher the RDW greater is the risk of mortality.

RDW is easy to use, cost effective and convenient prognostic markers in treating patients with Acute Pancreatitis.

Keywords: Acute Pancreatitis; Red cell distribution width.

Date of Submission: 08-03-2021

Date of Acceptance: 22-03-2021

I. Introduction

Acute pancreatitis is characterized by inflammation of pancreas as a result of activated pancreatic enzymes due to multiple etiologies most common being alcohol and gall stones and is one of the most common surgical causes of severe acute abdomen⁽¹⁻³⁾. It is classified as mild acute to severe acute pancreatitis (SAP).

Statistics show that 10-20 % of patients with acute pancreatitis develop SAP, which usually has unfavorable disease progression. SAP is often associated with systemic inflammatory response syndrome and multiple organ failure. The mortality rate for SAP is 40-70 %⁽⁴⁻⁶⁾. To reduce mortality rate in SAP, it is important to evaluate the severity early in the disease process and initiate appropriate treatment as early as possible.

Early predictive scores of SAP include APACHE II and RANSON scores, the testing parameters in the two scores are expensive, cumbersome and not conducive to clinical implementation⁽⁷⁻⁸⁾.

Serum markers such as procalcitonin, interleukin 6 and interleukin 8 have been used to predict the severity of acute pancreatitis, but are expensive and not readily available.

RDW commonly plays a role in the differential diagnosis of anemia⁹. It is widely used parameter for the quantification of the extent of erythrocyte anisocytosis. Red blood cell distribution width (RDW) has been proved to be a strong prognostic marker in various diseases such as cardiovascular diseases, renal failure, viral hepatitis etc.

II. Results

This is a prospective observational study conducted in Bangalore medical college and Research Institute between November 2018 and November 2020 including 110 patients diagnosed of Acute Pancreatitis admitted in Victoria and Bowring and Lady Curzon hospitals.

A pre structured proforma was used to collect relevant information (patients demographic details, brief history, clinical findings, laboratory investigations, radiological features) from all selected patients.

The Significance of RDW among patients with mild and severe acute pancreatitis is analyzed using independent t test, Receiver operator curve (ROC) analysis and Chi Square test.

Table 1 : Age distribution of the study population

Age	No. of patients	Percent
<25	27	24.5
26-35	40	36.4
36-45	19	17.3
46-55	18	16.4
>55	6	5.5
Total	110	100

The peak incidence was seen in patients between the age group of 26 to 35 years.

Table 2: Sex distribution of the study population

Sex	No. of patients	Percent
Male	100	90.9
Female	10	9.1
Total	110	100

Out of 110 patients studied, 100 were males and 10 were females.

Table 3 : Aetiology of Acute Pancreatitis

Etiology	Frequency	Percent
Ethanol	95	86.4
Gall stone	8	7.3
Idiopathic	3	2.7
Post ERCP	1	0.9
Post traumatic	2	1.8
Valproate	1	0.9
Total	110	100

Out of 110 patients 95 had Ethanol induced Pancreatitis and 8 patients had gallstone induced Pancreatitis.

Table 4 : Severity of Pancreatitis

Type of Pancreatitis	Frequency	Percent
Mild	82	74.5
Severe	28	25.5

Out of 110 patients 82 (74.5%) patients had mild Pancreatitis and 28(25.5) had severe Pancreatitis

Table 5 : Local complications

Complications	Frequency	Percent
None	99	90.0
Pseudocyst	6	5.5
Pancreatic ascites	1	0.9
Pancreatic necrosis	2	1.8
PPF	2	1.8
Total	110	100

Out of 110 patients with acute Pancreatitis, 99 (90%) had an uncomplicated outcome. 11 patients developed local complications out of which 6(5.5) patients developed Pseudocyst, 2(1.8) patients developed pancreatic necrosis and pleuropancreatic fistula each and 1(0.9) patient developed pancreatic ascites.

Table 6: Systemic complications

Complications	Frequency	Percent
None	91	82.7
MODS	16	14.5
ARDS	2	1.8
SEPSIS	1	0.9

Table 7 : Outcome in patients

Outcome	Frequency	Percent
Survivors	93	84.5
Non survivors	17	15.5

Out of 110 patients, 93(84.5%) were survivors and 17(15.5%) were non survivors.

Table 8 : RDW and severity of Pancreatitis

Type of Pancreatitis	Mean +/- SD	P value
Mild	12.220 +/- 1.3817	<0.001
Severe	14.000 +/- 1.3084	<0.001

Mean RDW in mild Pancreatitis was 12.220 and 14 in severe Pancreatitis with a p value of <0.001 showing significant association of RDW and severity of Pancreatitis.

Table 9 : RDW and outcome

Outcome	Mean +/- sd	P value
Survivors	12.343 +/- 1.4336	<0.001
Non survivors	14.476 +/- 0.8850	<0.001

Mean RDW in survivors was 12.343 and 14.476 in non survivors with a p value of <0.001 showing significant association between RDW and outcome of acute Pancreatitis. Mortality was higher in patients with higher values of RDW.

ROC for RDW to predict mortality

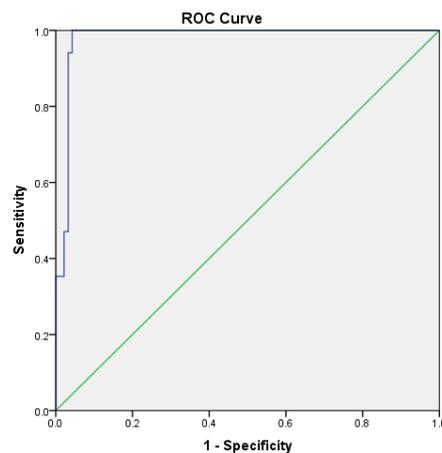


Fig 22: ROC for RDW to predict mortality

An RDW with a cutoff value of 13.450 presented an area under the curve of 0.902 (95%CI: 0.837-0.967) in Receiver operating characteristic curves and predicted mortality in approximately 88% of the patients (sensitivity, 88%, 95% CI: 81.1 - 92.6; specificity, 73.1%, 95%CI: 68.1 – 80.1). With NPV of 97.14% (95% CI: 91.10- 98.9), PPV 37.5% (95% CI 31.1 -42.6).

III. Discussion :

The study includes 110 patients with Acute Pancreatitis.

Most of the patients with acute pancreatitis have a mild course of the disease, severe forms require more attention because of its high morbidity and mortality. The rate of mortality in severe acute pancreatitis may be as high as 25%. Thus, early diagnosis and management is fundamental to maximize organ support and to prevent irreversible organ dysfunction. There are several simple predictors to evaluate the severity of the disease. Several scoring systems, such as Ranson, Glasgow and APACHE II, are useful in clinical practice¹⁰

These scoring systems have been proven to be valuable in the assessment of severity of AP, but rely on numerous indicators that be collated at 24h or even 48h after admission, determination of these scoring systems in a clinical patient is complex and time-consuming.

RDW reflects the heterogeneity of the red blood cell by the automated blood cell analyzer, routinely performed as part of a complete blood count. The elevated level of RDW can reflect an underlying inflammatory state.

The mechanisms underlying between RDW and severity of Acute Pancreatitis are not known. Firstly, RDW may be related to inflammation. Inflammation itself inhibits maturation of RBCs. Lack of red blood cells synthetic material (including iron, vitamin B12, and folic acid) and erythropoietin hyosecretion together promote the red blood cells cannot get enough iron, which is associated with an increase in RDW levels.¹¹ In addition, some inflammatory factors (such as granulocyte colony-stimulating factor and erythropoietin) may also contribute to high RDW, and the mechanism probably is that inflammatory cytokines can desensitize bone marrow erythroid progenitors to erythropoietic, blocking its antiapoptotic and promoting maturation effects¹² Second, oxidative stress is responsible for shortening the half-life of red blood cells, by the destruction of the nucleic protein and lipid, thereby affecting the survival time of red blood cells, which is characterized by the increasing RDW levels¹³

Many studies, such as Yao and Lv¹⁴ Ucar Karabulut et al.¹⁵, Hu et al.¹⁶ and Ilhan et al.¹⁷ have confirmed that RDW is positively correlated with AP severity, and can be used as one of the predictors of AP severity and mortality.

In a cross sectional study conducted by Jinmei yao et al (2011-13) spanning over two years studied the association between RDW and acute Pancreatitis including 106 patients, RDW was higher in non survivors when compared to healthy people and survivors. The area under the Roc curve of RDW was 0.846 with a cut off value of 14.2 RDW, sensitivity and specificity of RDW to predict mortality were 75% and 89.8% and it was observed that probability of death increased with high RDW values¹². In our study, the area under the ROC curve of RDW was 0.902 with a cut off value of 13.450 RDW, sensitivity and specificity to predict mortality were 88.2% and 73.1%.

Şenol et al demonstrated that an increased RDW level was an independent predictor of mortality in AP patients..

Based on the above studies, we asked whether RDW could be useful to assess the mortality of patients with AP. We then evaluated these parameters for our patients on hospital admission.

We found that mean RDW(14.476) and RPR(0.00007368) in non survivors were significantly higher than among survivors (RDW 12.343. And RPR 0.00004453).

An RDW with a cutoff value of 13.450 presented an area under the curve of 0.902 (95%CI: 0.837-0.967) in Receiver operating characteristic curves and predicted mortality in approximately 88% of the patients (sensitivity, 88%, 95% CI: 81.1 - 92.6; specificity, 73.1%, 95%CI: 68.1 – 80.1). With NPV of 97.14% (95% CI: 91.10- 98.9), PPV 37.5% (95% CI 31.1 -42.6).

IV. Conclusion

Acute pancreatitis is a common condition associated with Acute abdomen. The disease can present in mild form in one to fulminating processes with multi-organ failure.

It is mainly a clinical diagnosis supplemented with biochemical and radiological findings.

We assessed the ability of RDW values to predict the patient with AP who should be admitted to ICU.

Mean RDW in Survivors is 12.343 and Non Survivors is 14.476.

The optimal cutoff value for RDW to predict mortality was 13.45 with a sensitivity of 88.2% and a specificity of 73.1%.

From this study we can conclude that patients with SAP have significantly higher RDW than patients MAP.

Hence, Red cell distribution width can be useful prognostic marker in Acute Pancreatitis especially in developing countries as CBC is a simple and inexpensive laboratory test that is used routinely in clinical practice and these two indices will help us to assess the severity and mortality rate of this disease and help in effective management of patients with Acute Pancreatitis.

There are potential limitations to this study. Although the inclusion criteria are set in strict accordance with the diagnostic criteria, it was a single-center study and the cohort size is rather small. Therefore, all of our results may not be generalized before future large-size and multicenter studies clarify whether RDW is predictor in patients with AP in future.

References

- [1]. Bhattacharya: The Pancreas. In: N.S.Williams: Bailey and Love's Short Practice of Surgery, 26th ed. England: CRC Press; 2013: 1127-1128.
- [2]. Roberts SE, Akbari A, Thorne K, Atkinson M, Evans PA. The incidence of acute pancreatitis: impact of social deprivation, alcohol consumption, seasonal and demographic factors. *Alimentary Pharmacology & Therapeutics*. 2013;38(5):539–48.
- [3]. Banks PA, Bollen TL, Dervenis C, Gooszen HG, Johnson CD, Sarr MG, et al. Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus. *Gut*. 2012;62(1):102–11.
- [4]. Maheshwari R, Subramanian RM. Severe Acute Pancreatitis and Necrotizing Pancreatitis. *Critical Care Clinics*. 2016;32(2):279–90.
- [5]. Bugiantella W, Rondelli F, Boni M, Stella P, Polistena A, Sanguinetti A, et al. Necrotizing pancreatitis: A review of the interventions. *International Journal of Surgery*. 2016;28.
- [6]. Wang X, Cui Z, Zhang J, Li H, Zhang D, Miao B, et al. Early Predictive Factors of Inhospital Mortality in Patients With Severe Acute Pancreatitis. *Pancreas*. 2010;39(1):114–5.
- [7]. Carroll JK, Herrick B, Gipson T, Lee SP. Acute pancreatitis: diagnosis, prognosis, and treatment. *Am Fam Physician* 2007;75:1513–1520
- [8]. Kahl S, Mayer JM. Update on experimental acute pancreatitis. *Minerva gastroenterol dietol* 2012; 58:355-63.
- [9]. England JM, Down MC. Red cell distribution volume curves and the measurement of anisocytosis. *lancet* 1974;1:701-3.
- [10]. ChoJH, KimTN, ChungHH, KimKH: Comparison of scoring systems in predicting the severity of acute pancreatitis. *World J Gastroenterol* 21(8):2387–2394, 2015.
- [11]. Lippi G, Targher G, Montagnana M, Salvagno GL, Zoppini G, Guidi GC: Relation between red blood cell distribution width and inflammatory biomarkers in a large cohort of unselected outpatients. *Arch Pathol Lab Med* 133(4):1543-165, 2009.
- [12]. Forhecz Z, Gombos T, Borgulya G, Pozsonyi Z, Prohaszka Z, Janoskuti L: Red cell distribution width in heart failure: prediction of clinical events and relationship with markers of ineffective erythropoiesis, inflammation, renal function, and nutritional state. *Am Heart J* 158(4):659–666, 2009.
- [13]. Senol K, Saylam B, Kocaay F, Tez M: Red cell distribution width as a predictor of mortality in acute pancreatitis. *Am J Emerg Med* 31(4):687–689, 2013.
- [14]. Yao J, Lv G: Association between red cell distribution width and acute pancreatitis: a cross-sectional study. *BMJ Open* 4(8):e004721, 2014.
- [15]. Ucar Karabulut K, Narci H, Ucar Y, Uyar M: Association between red blood cell distribution width and acute pancreatitis. *Med Sci Monit* 20:2448–2452, 2014.
- [16]. Hu ZD, Wei TT, Zhong RQ: Red blood cell distribution: an index without additional cost in estimating the prognosis of acute pancreatitis. *Clin Chem Lab Med* 54(12):E389–E390, 2016.
- [17]. Ilhan M, Ilhan G, Gok AFK, Bademler S, Atmaca FV, Ertekin C: Evaluation of neutrophil-lymphocyte ratio, platelet-lymphocyte ratio and red blood cell distribution width-platelet ratio as early predictor of acute pancreatitis in pregnancy. *J Matern Fetal Neonatal Med* 29(9):1476–1480, 2016

Dr. Aishwarya NS, et. al. "Evaluation of Red Cell Distribution as Prognostic Marker in Acute Pancreatitis." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(03), 2021, pp. 51-55.