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Red Cell Distribution Width with Platelet Count Ratio as a Marker of Severity in Acute Biliary Pancreatitis

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ABSTRACT

Objective: To evaluate and compare red cell distribution width-to-platelet count ratio (RPR) as marker of severity among patients managed for mild and severe acute biliary pancreatitis.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi Pakistan, from Apr 2021 to Mar 2022.

Methodology: Patients were diagnosed with mild or severe acute pancreatitis by using the modified Atlanta criteria: (1) Epigastric pain (2) Increased serum lipase levels, and (3) CT imaging findings indicative of acute pancreatitis. Patients with comorbidities including ischemic heart disease, cerebrovascular accidents, or pregnant females were excluded. The clinical severity of illness was assessed by Ranson and Glasgow scores at the time of admission and at 48 hours. Red cell distribution width-to-platelet count ratio (RPR) values were also assessed at the time of admission. Patient mortality was assessed at 7 days post admission and at 30 days after discharge.

Results: Out of a total of 45 patients, mean age was estimated at 47.6±12.0 years while 20(44%) cases fulfilled the criteria of severe acute pancreatitis. Mean RPR values were significantly increased among patients with severe clinical illness (p<0.001) and among non-surviving cases (p=0.014). Nine (20%) patients died during the 30-day follow-up.

Conclusion: Red cell distribution width-to-platelet count ratio is a substantially efficient parameter in the early diagnosis of severe acute pancreatitis.

Keywords: Acute Pancreatitis, Disease Severity, Mortality, Platelet Count Red Cell Distribution Width.

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INTRODUCTION

Acute pancreatitis has been comprehended as an acute surgical emergency with a progressively increasing incidence worldwide. Acute pancreatitis can arise due to a multitude of conditions including chronic alcoholism and biliary tract stones, and eventually lead to systemic inflammatory response syndrome (SIRS).[1,2] Acute pancreatitis has been rated amongst the most prevalent gastrointestinal conditions linked to hospital admissions in developed countries.[3,4] In developing nations including Pakistan, acute pancreatitis can have a mortality rate as high as 78%, which necessitates a rapid and efficient diagnostic system for this condition.[5]

The revised Atlanta classification defines acute pancreatitis based on clinical history, markedly elevated serum lipase levels, and characteristic findings on computed tomography (CT) imaging.[6] In addition, several scoring criteria have been implemented to allow early assessment of disease severity. Prediction of inpatient mortality is carried out both at the time of admission and 48 hours following admission by using the Acute Physiology and Chronic Health Evaluation (APACHE II) criteria and Ranson score.[7] Furthermore, the bedside index score for severity of acute pancreatitis (BISAP) is applied within the first 24 hours whereas Glasgow criteria are utilized at 48 hours post-hospitalization. A comparative analysis of these scores indicates that while Glasgow criteria display the maximum sensitivity value, the admission Ranson score carries the highest degree of accuracy in estimating the overall disease severity and predicting the risk of inpatient mortality.[8] However, these criteria are either complex to calculate or require a minimum duration of 48 hours. This potentially undermines their applicability, especially in developing countries.

A useful alternative is an implementation of red cell distribution width-to-platelet count ratio (RPR) which is an inexpensive laboratory test, and can be routinely carried out.[9,10] Our study was designed to determine the role of RPR as a prognostic tool for

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determining the disease severity among patients with acute pancreatitis.

METHODOLOGY

This Cross-sectional study was conducted at the Department of General Surgery, Combined Military Hospital, Rawalpindi Pakistan, from April 2021 to March 2022, after approval was granted by the Institutional Ethical Review Board (ERB approval #265).

Inclusion Criteria: Adult patients of either gender who were diagnosed with acute pancreatitis based on the revised Atlanta criteria were included.

Exclusion Criteria: Individuals with documented pre-existing medical comorbidities including ischemic heart disease, cerebrovascular accidents, and pregnant females were excluded.

Sample size was calculated using WHO calculator. Population prevalence of severe acute pancreatitis causing mortality was taken as 5.8%.[10] Participants were recruited using the non-probability convenience sampling technique.

Using Atlanta criteria, patients were diagnosed with mild or severe (moderately severe and severe) attack of acute pancreatitis. Atlantis criteria include (1) Severe abdominal epigastric pain, with or without radiation to the back, and relieved by anteflexion; (2) Serum lipase levels increased ≥3 times than the baseline concentration; (3) CT imaging findings suggestive of pancreatic involvement.[11] Both Ranson and modified Glasgow scores were utilized to assess the clinical severity of illness on the day of admission and at an interval of 48 hours. Blood samples were sent for complete blood picture at the time of admission into the emergency department. The ratio of red cell distribution of width and total platelet count (RPR) was calculated and compared between the patients with mild and severe disease. Mortality rate was assessed at 7 days post admission and subsequently, at 30 days after discharge from the hospital. Furthermore, RPR values were correlated with the survival rate of patients.

Prior to data collection, patients and their family members were thoroughly briefed about the study protocol and informed consent was obtained. Data was collected under standardized guidelines of the Helsinki Protocol.[12]

A standardized data collection proforma was used to document clinical assessment of various patient-related parameters. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 23. Mean±SD values were calculated for variables including patient age, and Ranson, Glasgow and RPR scores. Independent t-test was used to assess the statistical association of disease scores with the clinical severity of acute pancreatitis and patient mortality. A p-value <0.05 was considered significant.

RESULTS

Out of 48 cases, 3 patients were lost to follow-up and their data was eliminated from the final analysis. Hence, the final study population consisted of 45 patients presenting with an acute onset of pancreatitis. Mean age of the participants was 47.6±12.0 years, out of which 27(60%) were males. Twenty-five (56%) patients were labelled as cases of mild acute pancreatitis whereas the remaining 20(44%) were cases of severe acute pancreatitis. Measured during the initial 24 hours and at 48 hours of admission, both the Ranson and Glasgow scores showed a significant degree of elevation in severe acute pancreatitis (p<0.001), as illustrated in Table-I.

Table-I: Ranson and Glasgow Scores of Patients with Mild versus Severe Acute Pancreatitis (n=45)

Patient Factors		Mild Acute Pancreatitis (n=25)	Severe Acute Pancreatitis (n=20)	p-value
Gender	Males	16(64%)	11(55%)	0.541
	Females	9(36%)	9(45%)	
Mean Age (years)		45.40±12.06	50.30±11.73	0.178
Ranson Score on Day 1		2.28±0.67	3.20±0.61	<0.001
Ranson Score at 48 hours		2.68±0.69	5.60±1.14	<0.001
Glasgow Score on Day 1		2.04±0.73	2.90±0.71	<0.001
Glasgow Score at 48 hours		3.04±0.93	4.55±1.09	<0.001

At the time of emergency presentation, Red Cell Distribution Width - Coefficient of Variation (RDW-CV) and platelet count were determined for all cases, and compared between patients with mild and severe disease. Both mean RDW-CV and mean Red blood cell distribution width to platelet ratio (RPR) values were markedly increased for patients with severe acute pancreatitis (p<0.001) (Table-II).

Table-II: Comparison of Red Blood Cell Distribution Width to Platelet Ratio values between Mild versus Severe Acute Pancreatitis (n=45)

Patient Factors	Mild Acute Pancreatitis (n=25)	Severe Acute Pancreatitis (n=20)	p-value
RDW-CV	14.22±1.36	16.52±1.84	<0.001
Platelet Count (x 103/µL)	255.00±60.81	185.00±62.50	<0.001
RPR value at admission	0.06±0.02	0.09±0.03	<0.001

** RDW-CV: Red Cell Distribution Width - Coefficient of Variation, RPR: Red blood cell distribution width to platelet ratio*

A total of nine patients (20%) expired during the 30-day interval following admission. Among these patients, both Ranson and Glasgow criteria had revealed significantly raised scores at 48 hours of admission. In addition, RPR values were also substantially elevated at the time of hospitalization within this group of patients (p=0.014) (Table-III).

Table-III: Risk of 30-day Mortality in relation to Ranson and Glasgow Scores and Red Blood Cell Distribution Width to Platelet Ratio values (n=45)

Patient Factors	Thirty-day mortality		*p*-value
	Yes (n=9)	No (n=36)	
Ranson score at 48 hours	5.66±1.41	3.55±1.53	0.001
Glasgow score at 48 hours	4.55±1.41	3.50±1.13	0.022
RPR value at admission	0.10±0.02	0.07±0.03	0.014

**RPR: Red blood cell distribution width to platelet ratio*

DISCUSSION

This study has outlined the clinical utility of a less commonly used laboratory parameter i.e., Red blood cell distribution width to platelet ratio (RPR) value in evaluating the overall severity of acute pancreatitis. Although there have been a few previous reports describing the prognostic role of RPR, this study has investigated the significance of RPR in acute pancreatitis in the tertiary care setting of a developing country where little to no pertinent data existed prior to this cross-sectional study.

Red Cell Distribution Width (RDW) is an essential component of a complete blood count analysis and being an inexpensive laboratory measure, it can be routinely performed at the time of hospitalization. In the recent few years, the clinical role of RDW has expanded beyond anaemia since it has been shown to act as a potential prognostic marker in correlation to autoimmune disorders, cardiovascular pathologies, chronic obstructive airway disease, chronic kidney disease, hepatocellular carcinoma and other malignancies.[13-15] More importantly, several authors have also elaborated its function in estimating disease severity in acute pancreatitis. In one single-center study, a total of 185 subjects with acute pancreatitis were recruited where up to 12% patients had an elevated RDW. A significantly raised RDW was also associated with a higher probability of admission into the critical care unit. Furthermore, increased RDW was also consistent with a potentially higher risk of mortality (p=0.04), which is in line with the findings of the current study.[16]

In a retrospective analysis, a total of 42 cases of severe acute pancreatitis were included where mortality was seen in up to 47.6% individuals. Moreover, RDW had an approximate sensitivity of 78% in predicting inpatient mortality.[17]

Our study determined that increased RPR was associated with increased severity of acute pancreatitis. Similar results were published by by Kılıç *et al.*, who categorized a total of 202 patients either as mild or severe acute pancreatitis (~20%). RDW was analysed at the time of patient admission which was significantly correlated to the Ranson score estimated at a period of 48 hours post-admission (p<0.002). Moreover, RDW-CV raised above the level of 14% was a significant indicator of severe acute illness.[18] Barad *et al.*, showed similar results in their study.[11]

LIMITATIONS OF STUDY

Inclusion of a limited number of study participants was a notable drawback of our study. In addition, the authors could only follow the clinical course of patients for up to 30 days post admission, which could have potentially affected the accuracy of our mortality statistics. Moreover, the authors also did not take into account the exact frequency of critically ill patients who were admitted to the ICU/HDU of the surgery department, an important indicator of disease severity.

CONCLUSION

Ratio of red cell distribution width to total platelet count (RPR) is a viable prognostic marker which provides an early assessment of clinical severity and mortality risk among patients with acute pancreatitis.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MHK & UJG: Conception, study design, drafting the manuscript, approval of the final version to be published.

KSB & TK: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

SAF & UDM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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