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#### **Original Research Article**

## Levels of Red Cell Indices and Aspartate Aminotransferase in Patients Diagnosed with Chronic Liver Cirrhosis in Owerri, Nigeria

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Abstract: Background: Liver cirrhosis is a chronic liver disease characterized by fibrosis and inflammation, leading to altered liver function and systemic changes. Several haematological and biochemical abnormalities have been reported in patients with liver cirrhosis. Objective: This study aimed to evaluate the levels of red cell indices and aspartate aminotransferase (AST) in patients diagnosed with liver cirrhosis at Specialist Hospital Umuguma, Owerri. Methods: A total of 60 subjects (30 patients with liver cirrhosis and 30 healthy controls) were recruited. After obtaining informed consent, five millilitres of venous blood samples were collected. Two milliliters were dispensed into EDTA containers for hematological analysis, and three milliliters into plain containers for biochemical assays. AST levels were determined from serum, while red cell indices were evaluated from whole blood. Data were analyzed using SPSS version 27 with t-tests, correlations, and significance set at p<0.05 Results: The mean values of AST (27.10±15.20) IU/L and RDW (17.00±2.61) % were significantly higher in patients with chronic liver cirrhosis when compared to controls ( $4.63\pm1.94$ ) IU/L and ( $12.27\pm1.23$ ) % (t= 8.03, p= 0.000, t= 8.98, p=0.000). That of PCV (24.03±4.72)%, Hb (8.09±1.50)g/dl, RBC (x10<sup>6</sup>/ul)mg/dl, MCV (75.17±4.65)fl, MCH (26.13±3.32) pg and MCHC (33.40±2.37)% were significantly lower in patients with chronic liver cirrhosis when compared to controls (37.03±4.07)%,  $(12.99\pm1.36)$ g/dl,  $(4.16\pm0.39)$ mg/dl,  $(89.17\pm7.34)$ fl,  $(31.20\pm1.75)$ pg and  $(34.83\pm1.82)$ %. (t=11.43, p=0.000; t=13.21, p=0.000; t=1p=0.000; t=6.59, p=0.000; t=8.82, p=0.000; t=7.39, p=0.000; t=2.63, p=0.011). There was no significant difference in the mean values of AST (26.79±15.93)IU/L, MCV (75.32±4.99)fl, MCH (26.05±3.63)pg, MCHC (33.37±2.26)% in male patients with chronic liver cirrhosis when compared to females (27.64±14.58)IU/L, (74.91±4.23)fl, (26.27±2.87)pg and (33.45±2.66)% (t=0.15, p=0.886; t=0.23, p=0.822; t=0.17, p=0.865; t=0.09, p=0.926).The mean values of PCV (25.95±3.94)%, Hb (8.72±1.22)g/dl and RBC (x106/ul) mg/dl were significantly raised in male patients with chronic liver cirrhosis when compared to females  $(20.73\pm4.19)\%$ ,  $(7.02\pm1.36)$ g/dl and  $(2.75\pm0.54)$ mg/dl (t=3.42, p=0.002; t=3.53, p=0.003; t=3.29, p=0.003). The mean values of RDW (15.89±2.02) % was significantly lower in male patients with chronic liver cirrhosis when compared to females (18.91±2.47)% (t=3.63, p=0.001). There was no significant difference in the mean values of AST (25.94±11.89)IU/L, PCV (23.06±3.99)%, HB (7.84±1.36)g/dl, RBC (x10<sup>6</sup>/ul)mg/dl, MCV (74.50±4.88)fl, MCH (26.33±3.86)pg, MCHC (33.50±2.26)% and (17.28±2.74)% in patients with chronic liver cirrhosis of ages (40-60)yrs when compared to patients with chronic liver cirrhosis of ages (>60)yrs(31.30±20.70) IU/L, (24.80±5.71)%, (8.25±1.73)g/dl, (3.23±0.80)mg/dl, (75.90±4.70)fl, (25.90±2.64)pg, (33.30±2.87)% and (16.60±2.46)% (t=0.87, p=0.390; t=0.95, p=0.351; t=0.69, p=0.493; t=0.33, p=0.743; t=0.74, p=0.468; t=0.32, p=0.755; t=0.20, p=0.841). There was a non-significant negative correlation of AST with PCV (r=-0.11, p=0.554), Hb (r=-0.78, p=0.687), RBC (r=-0.10, p=0.588), MCV (r=-0.08 p=0.672) and MCHC (r=-0.28, p=0.127) in Patients with Chronic Liver Cirrhosis. Correlation of AST with MCH (r=0.25, p=0.174) and RDW (r=0.07, p=0.729) in Patients with Chronic Liver Cirrhosis showed a non - significant association. Conclusion: Elevated AST and RDW are significantly associated with liver cirrhosis. These parameters, alongside red cell indices, may aid in the clinical assessment and diagnosis of patients with suspected liver cirrhosis.

Keywords: Packed Cell Volume, Haemoglobin, Red Blood Cell, Red Cell Indices, Aspartate Aminotransferase, Liver Cirrhosis.

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## 1. INTRODUCTION

Liver cirrhosis is a progressive, irreversible condition characterized by widespread fibrosis, nodular regeneration, and distortion of the hepatic architecture, often resulting from chronic liver injury such as viral hepatitis, alcohol abuse, or non-alcoholic fatty liver disease (NAFLD) [1,2]. As cirrhosis progresses, it impairs normal liver functions including protein synthesis, detoxification, and hematopoiesis regulation [3]. These derangements often manifest as changes in both biochemical markers and hematological parameters.

Aspartate aminotransferase (AST) is a hepatic enzyme commonly used to assess liver cell injury. Elevation of AST levels in liver cirrhosis indicates ongoing hepatocellular damage [4]. Red cell indices, including packed cell volume (PCV), hemoglobin concentration (Hb), red blood cell count (RBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC), provide insights into the hematological status of patients and are often altered due to hypersplenism, gastrointestinal blood loss, and bone marrow suppression associated with cirrhosis [5,6].

Red cell distribution width (RDW), a marker of anisocytosis, has emerged as a potential indicator of disease severity in chronic liver conditions, as it reflects systemic inflammation and nutritional deficiencies frequently seen in cirrhotic patients [7]. This study investigates the levels of AST and red cell indices in patients with liver cirrhosis attending Specialist Hospital Umuguma, Owerri, Nigeria, with the aim of identifying hematological and biochemical markers that may assist in clinical monitoring and disease assessment.

#### 2. MATERIALS AND METHODS

#### 2.1 Study Area

The study was carried out at Specialist Hospital Umuguma, Owerri, Imo State. Nigeria.

#### 2.2 Study Design

This study employed a comparative crosssectional design to evaluate the levels of aspartate transaminase (AST) and red cell indices in patients diagnosed with liver cirrhosis. The study was conducted at the Specialist Hospital Umuguma, Owerri, Nigeria. A total of 60 participants were recruited, comprising 30 patients diagnosed with liver cirrhosis and 30 apparently healthy age- and sex-matched individuals as controls.

#### 2.3 Method of Recruitment

Participants for the study were recruited from February- March, 2024. Liver cirrhosis patients attending the medical outpatient clinic or admitted to the medical ward of the Specialist Hospital Umuguma, Owerri, and who met the inclusion criteria, were selected consecutively. Diagnosis of liver cirrhosis was based on clinical evaluation and supporting laboratory and radiological findings documented in their medical records.

Control subjects were healthy individuals without a history of liver disease, matched for age and sex, and recruited from hospital staff and voluntary blood donors. Inclusion criteria for all participants included age  $\geq 18$  years, and willingness to provide informed consent. Exclusion criteria included known hematological disorders, malignancies, recent blood transfusions (within the last three months), or current treatment with cytotoxic or immunosuppressive drugs.

#### 2.4 Ethical Consideration

Ethical approval for the study was obtained from the Ethical Review Committee of Specialist Hospital Umuguma, Owerri. All participants were informed about the purpose and procedures of the study. Written informed consent was obtained from each participant prior to recruitment. Confidentiality was maintained by anonymizing the data and storing it securely. Participants retained the right to withdraw from the study at any point without any consequence to their care.

#### 2.5 Sample Collection

Five milliliters (5 ml) of venous blood was collected aseptically from the antecubital vein of each participant using sterile disposable syringes and needles. Two milliliters (2 ml) of blood was dispensed into a containers containing ethylenediaminetetra-acetic acid (EDTA) for hematological analysis, while the remaining three milliliters (3 ml) were transferred into a plain containers, allowed to clot, and centrifuged at 3,000 rpm for 10 minutes to obtain serum for the estimation of AST.

The EDTA samples were stored at 4°C and used for the determination of red cell indices (PCV, Hb, RBC, MCV, MCH, MCHC, and RDW) using an automated hematology analyzer. The serum samples were stored at -20°C and used for AST estimation using standard enzymatic colorimetric methods

#### 2.6 Statistical Analysis

Data obtained were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics such as mean and standard deviation were used to summarize continuous variables. Student's t-test was employed to compare the means of biochemical and hematological parameters between the patient and control groups, as well as between sexes and age categories. Pearson's correlation coefficient was used to assess the relationship between AST levels and red cell indices in patients with liver cirrhosis. Statistical significance was set at p < 0.05.

#### 3 Laboratory Analysis

The PCV, Hb, RBC, MCV, MCH, MCHC, and RDW were estimated using an automated hematology

analyzer while AST was determined using standard enzymatic colorimetric methods.

#### **4. RESULTS**

The mean values of AST ( $27.10\pm15.20$ ) IU/L and RDW ( $17.00\pm2.61$ ) % were significantly higher in patients with chronic liver cirrhosis when compared to controls ( $4.63\pm1.94$ ) IU/L and ( $12.27\pm1.23$ ) % (t= 8.03, p=0.000, t=8.98, p=0.000)

That of PCV  $(24.03 \pm 4.72)\%$ , Hb  $(8.09 \pm 1.50)$ g/dl, RBC  $(x10^{6}/ul)mg/dl$ , MCV (75.17±4.65)fl, MCH (26.13±3.32) pg and MCHC (33.40±2.37)% were significantly lower in patients with chronic liver cirrhosis when compared to controls  $(37.03\pm4.07)\%$ ,  $(12.99\pm1.36)g/dl$ ,  $(4.16\pm0.39)mg/dl$ ,  $(89.17\pm7.34)$ fl,  $(31.20\pm1.75)$ pg and  $(34.83\pm1.82)$ %. (t=11.43, p=0.000; t=13.21, p=0.000; t=6.59, p=0.000; t=8.82, p=0.000; t=7.39, p=0.000; t=2.63, p=0.011).

Table 1: Mean Values of AST, PCV, HB, RBC, MCV, MCH, MCHC and RDW in Patients with Chronic Live
Cirrhosis Versus Controls

Parameter	Test	Control	t-value	p-value
AST (IU/L)	27.10±15.20	4.63±1.94	8.03	0.000*
PCV (%)	24.03±4.72	37.03±4.07	11.43	0.000*
HB (g/dl)	8.09±1.50	12.99±1.36	13.21	0.000*
RBC (mg/dl)	3.21±0.68	4.16±0.39	6.59	0.000*
MCV (fl)	75.17±4.65	89.17±7.34	8.82	0.000*
MCH (pg)	26.13±3.32	31.20±1.75	7.39	0.000*
MCHC (%)	33.40±2.37	34.83±1.82	2.63	0.011*
RDW (%)	$17.00 \pm 2.61$	12.27±1.23	8.98	0.000*

KEY: AST: Aspartate amino transferase PCV: Packed Cell Volume HB: Haemoglobin RBC: Red Blood Cell MCV: Mean Corpuscular Volume MCH: Mean Corpuscular Haemoglobin MCHC: Mean Corpuscular Haemoglobin Concentration \*: Significant p value.

There was no significant difference in the mean values of AST  $(26.79\pm15.93)$ IU/L, MCV  $(75.32\pm4.99)$ fl, MCH  $(26.05\pm3.63)$ pg, MCHC  $(33.37\pm2.26)$ % in male patients with chronic liver cirrhosis when compared to females  $(27.64\pm14.58)$ IU/L,  $(74.91\pm4.23)$ fl,  $(26.27\pm2.87)$ pg and  $(33.45\pm2.66)$ % (t=0.15, p=0.886; t=0.23, p=0.822; t=0.17, p=0.865; t=0.09, p=0.926).

The mean values of PCV (25.95 $\pm$ 3.94)%, Hb (8.72 $\pm$ 1.22)g/dl and RBC (x10<sup>6</sup>/ul) mg/dl were

significantly raised in male patients with chronic liver cirrhosis when compared to females  $(20.73\pm4.19)$ %,  $(7.02\pm1.36)$ g/dl and  $(2.75\pm0.54)$ mg/dl (t=3.42, p=0.002; t=3.53, p=0.003; t=3.29, p=0.003)

The mean values of RDW ( $15.89\pm2.02$ ) % was significantly lower in male patients with chronic liver cirrhosis when compared to females ( $18.91\pm2.47$ )% (t=3.63, p=0.001).

 Table 2: Mean Value of AST, PCV, HB, RBC, MCV, MCH, MCHC and RDW in Male Patients and Female

 Patients with Chronic Liver Cirrhosis

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Parameter	Male	Female	t-value	p-value
AST (IU/L)	26.79±15.93	27.64±14.58	0.15	0.886
PCV (%)	$25.95 \pm 3.94$	20.73±4.19	3.42	0.002
HB (g/dl)	8.72±1.22	7.02±1.36	3.53	0.003
RBC (mg/dl)	3.48±0.61	$2.75 \pm 0.54$	3.29	0.003
MCV (fl)	75.32±4.99	74.91±4.23	0.23	0.822
MCH (pg)	26.05±3.63	26.27±2.87	0.17	0.865
MCHC (%)	33.37±2.26	33.45±2.66	0.09	0.926
RDW (%)	$15.89 \pm 2.02$	18.91±2.47	3.63	0.001
<b>KEY:</b> AST: Aspartate amino transferase				
PCV: Packed Cell Volume				
HB: Haemoglobin				
RBC: Red Blood Cell				
MCV: Mean Corpuscular Volume				
MCH: Mean Corpuscular Haemoglobin				
MCHC: Mean Corpuscular Haemoglobin Concentration				
*: Significant p value				

There was no significant difference in the mean values of AST ( $25.94\pm11.89$ )IU/L, PCV ( $23.06\pm3.99$ )%, HB ( $7.84\pm1.36$ )g/dl, RBC ( $x10^{6}$ /ul)mg/dl, MCV ( $74.50\pm4.88$ )fl, MCH ( $26.33\pm3.86$ )pg, MCHC ( $33.50\pm2.26$ )% and ( $17.28\pm2.74$ )% in patients with chronic liver cirrhosis of age (40-60)yrs when compared

to patients with chronic liver cirrhosis of age (>60)yrs  $(31.30\pm20.70)$  IU/L,  $(24.80\pm5.71)$ %,  $(8.25\pm1.73)g$ /dl,  $(3.23\pm0.80)$ mg/dl,  $(75.90\pm4.70)$ fl,  $(25.90\pm2.64)$ pg,  $(33.30\pm2.87)$ % and  $(16.60\pm2.46)$ % (t=0.87, p=0.390; t=0.95, p=0.351; t=0.69, p=0.493; t=0.33, p=0.743; t=0.74, p=0.468; t=0.32, p=0.755; t=0.20, p=0.841)

Table 3: Mean Values of AST, PCV, HB, RBC, MCV, MCH, MCHC and RDW in Patients with Chronic Liver Cirrhosis of Ages (40-60) and (>60) years

Christis of Ages (40-00) and (>00) years				
Parameter	(40-60) yrs	(>60) yrs	t-value	p-value
AST (IU/L)	25.94±11.89	31.30±20.70	0.87	0.390
PCV (%)	23.06±3.99	24.80±5.71	0.95	0.351
HB (g/dl)	7.84±1.36	8.25±1.73	0.69	0.493
RBC (mg/dl)	3.14±0.63	3.23±0.80	0.33	0.743
MCV (fl)	74.50±4.88	75.90±4.70	0.74	0.468
MCH (pg)	26.33±3.86	25.90±2.64	0.32	0.755
MCHC (%)	33.50±2.26	33.30±2.87	0.20	0.841
RDW (%)	17.28±2.74	16.60±2.46	0.65	0.522

KEY:

AST: Aspartate amino transferase PCV: Packed Cell Volume HB: Haemoglobin RBC: Red Blood Cell MCV: Mean Corpuscular Volume MCH: Mean Corpuscular Haemoglobin MCHC: Mean Corpuscular Haemoglobin Concentration \*: Significant p value

There was a non-significant negative correlation of AST with PCV (r=-0.11, p=0.554), Hb (r=-0.78, p=0.687), RBC (r=-0.10, p=0.588), MCV (r=-0.08 p=0.672) and MCHC (r=-0.28, p=0.127) in Patients with Chronic Liver Cirrhosis. Correlation of AST with MCH

(r=0.25, p=0.174) and RDW (r=0.07, p=0.729) in Patients with Chronic Liver Cirrhosis showed a non – significant association.

#### Table 4: Correlation of AST with PCV, HB, RBC, MCV, MCH, MCHC and RDW in Patients with Chronic Liver Cirrhosis

Variable	n	r	p-value		
PCV	30	-0.11	0.554		
HB	30	-0.78	0.687		
RBC	30	-0.10	0.588		
MCV	30	-0.08	0.672		
MCH	30	0.25	0.174		
MCHC	30	-0.28	0.127		
RDW	30	0.07	0.729		
KEV.					

KEY:

AST: Aspartate amino transferase PCV: Packed Cell Volume HB: Haemoglobin RBC: Red Blood Cell MCV: Mean Corpuscular Volume MCH: Mean Corpuscular Haemoglobin MCHC: Mean Corpuscular Haemoglobin Concentration \*: Significant

### **5. DISCUSSION**

The findings from this study revealed a significant increase in AST and RDW levels among patients with liver cirrhosis compared to healthy controls. Elevated AST levels are consistent with

hepatocellular injury and have been widely reported in patients with liver diseases, including cirrhosis [4,8]. The significant rise in RDW is indicative of red cell size variability, which may reflect the systemic inflammation, bone marrow dysfunction, and micronutrient deficiencies often observed in cirrhotic patients [7,9].

In contrast, PCV, Hb, RBC, MCV, MCH, and MCHC were significantly reduced in cirrhotic patients. These reductions may result from chronic gastrointestinal bleeding, hemolysis, or impaired erythropoiesis due to bone marrow suppression [5,10]. Anemia is a common complication in cirrhosis and often multifactorial in origin, involving iron deficiency, folate deficiency, and hypersplenism [11].

Gender-based analysis showed that male patients had significantly higher levels of PCV, Hb, and RBC compared to females, while RDW was significantly lower in males. These differences might be attributed to hormonal influences and baseline hematological differences between genders [12]. However, AST and red cell indices did not show significant differences across the two age categories examined (40–60 years and >60 years), suggesting that age may not independently influence these parameters in cirrhosis.

The correlation analysis revealed a nonsignificant negative relationship between AST and most red cell indices (PCV, Hb, RBC, MCV, MCHC), implying that as hepatic injury progresses, there may be a gradual decline in hematological status. Interestingly, a non-significant positive correlation was found between AST and both MCH and RDW, indicating a possible compensatory or inflammatory effect [13]. While the correlations were not statistically significant, the trends underscore the complex interplay between liver function and hematological health in cirrhosis.

#### 6. CONCLUSION

This study demonstrates that patients with liver cirrhosis exhibit significantly elevated AST and RDW levels alongside decreased red cell indices compared to healthy individuals. These alterations reflect hepatic dysfunction and the hematological impact of cirrhosis. Gender differences were observed, but age did not significantly influence these parameters. AST and red cell indices, especially RDW, could serve as useful adjunct markers in the evaluation and monitoring of liver cirrhosis. Further studies with larger sample sizes are recommended to validate these findings and explore their prognostic significance.

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