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Original Research Article

Correlation of Haematological Abnormalities and Biochemical Alterations in Various Liver Diseases: A Cross Sectional Study at Tertiary Care Centre

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Abstract:

Introduction: Chronic liver diseases frequently are associated with haematological abnormalities. Anaemia occurs in about 75% of patients with chronic liver disease. The most common type of anaemia seen in liver cirrhosis is normocytic normochromic anaemia, due to the chronic inflammatory state, blood loss from oesophageal and rectal varices. The purpose of this study was to study the haematological manifestations and biochemical alterations in patients with chronic liver disease.

Objectives of Study: The objective of this study was to correlate haematological abnormalities and biochemical alterations in various liver diseases.

Materials and Methods: The study was conducted in the Central Laboratory of Pathology department, during the period from May 2021 to April 2022. This study included 187 patients clinically diagnosed with liver disease. Biochemical liver function test including serum bilirubin, SGOT, SGPT, ALP, Total protein and serum albumin were noted from the investigation chart of the patients and hematological parameters like platelet count and MCV were estimated by using automated hematology analyzer and the results were evaluated in groups.

Result: Out of 187 patients, 142(75.9%) were males and 45(24.1%) were females. It was found that Chronic liver disease and Acute viral hepatitis was the most commonly present in most of the participants; 73 (39%) and 46 (24.6%). Followed by Alcoholic Liver Disease, Hepatitis, Hepatocellular Jaundice, Liver Abscess, Acute Liver Failure and Portal Hypertension and Least number of participants had Obstructive Jaundice. In our study, 179 (95.7%) patients had SGOT > 40 IU/L with mean 193.9 ± 173.1, 163 (87.2%) had SGPT > 45 IU/L with mean 229 ± 312.4, 169 (90.4%) had serum bilirubin > 1.2 mg/dl with mean values of 4.6 ± 3.6, 80 (42.8%) had ALP > 147 IU/L with mean value of 162.1 ± 122.8, 62 (33.2%) had total protein < 6.3g/dl with mean value of 6.5 ± 0.5, 83 (44.4%) had serum albumin < 3.4 gm/dl with mean value of 3.4 ± 0.6, 75 (40.1%) had < 1.5 lac/mm^3 and 1 (0.5%) had > 4 lac/mm^3 with mean value of 182.8 ± 72.7, 118 (63.10%) of the participants had MCV 80 - 100 fL with Mean value of MCV was 88.3 ± 10.23. It was found that SGOT was maximum with acute liver failure followed by Hepatocellular jaundice and Alcoholic liver disease. SGPT was maximum raised in acute liver failure followed by Hepatocellular jaundice and acute viral hepatitis. Platelet count was lowest in acute liver failure patients. MCV was highest in Alcoholic liver disease.

Conclusion: Alterations in haematological and biochemical parameters are frequently associated with various liver diseases showing anaemia, leucopenia and thrombocytopenia along with derangement in liver enzymes. Prolongation of prothrombin time and abnormality in peripheral blood film are also seen in these patients. In our study, MCV and MCH were increased and remaining other haematological parameters like Hb, RBC, PCV, MCHC, platelet, PT all were decreased. Nevertheless, MCH was statistically not increased. Biochemical parameters like altered liver function test were all increased except total protein and albumin. Thus, the complete blood picture had shown the picture of anaemia, leucopenia and thrombocytopenia.

Keywords: Biochemical, Hematological, Cirrhosis, Viral Hepatitis, Obstructive Jaundice.

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Introduction

Liver is one of the largest organs of the body weighing 1-1.5 Kg, which is 1.5-2.5% of the lean body mass. It performs numerous and vital roles in maintaining homeostasis and health. It plays major role in synthesis of proteins, regulation of nutrients, metabolism and conjugation of bilirubin and drugs, detoxification, production of bile and maintenance of immunity (Kupffer cells). Right from being a primary site of haematopoiesis in foetal life to maintenance of haematological parameters in postnatal life, the liver has an extremely important role in maintenance of blood- homeostasis. It stores

iron, folic acid and vitamin B12, secretes clotting factors and inhibitors. Hence, liver diseases cause wide range of abnormalities in haematological parameters. Peripheral blood picture in chronic liver disease is influenced by the presence of jaundice, liver cell failure, portal hypertension and hypersplenism, reduced red cell half-life. CLD is frequently associated with haematological abnormalities and is associated with increased morbidity and mortality in these patients. [1]

It causes generalized suppression of blood cell production and produces abnormal blood cell precursors that cannot mature into functional cells. The changes frequently seen in CBC (Complete blood count) are anaemia, structurally abnormal RBC's, reduced numbers of WBC's, and platelets. Liver function tests are altered only in the later stages of alcoholic liver disease. Heavy drinking alters some biochemical parameters like gamma-glutamyl transferase or mean corpuscular volume. [2]

Haematological abnormalities are frequently seen in chronically ill-patients of liver diseases. Anaemia is one of the common presentation in patients with chronic liver disease. [3] The normocytic normochromic anaemia is the most common type of anaemia seen in liver cirrhosis, due to the chronic inflammatory state. Bleeding from oesophageal and rectal varices, portal hypertensive gastropathy and antral vascular ectasia can give rise to iron-deficiency anaemia (microcytic hypochromic anaemia). [4] Red cell membrane defects leads to formation of acanthocytes and reduced life span of RBC's. Hypersplenism and hepcidin deficiency is also one of the reason for anaemia in patient with chronic liver disease. Macrocytosis is common haematological abnormality seen in chronic liver disease patients. There are multiple factors are involved to cause macrocytosis in liver cirrhosis. Alcohol is one of the common cause of chronic liver disease. It causes direct bone marrow toxicity. Alcoholics often develop anaemia caused by vitamin B12 and folate deficiency due to secondary malnutrition. In few patients, hepatitis causes aplastic anaemia which is characterized by pancytopenia and hypocellular bone marrow. In patients of chronic hepatitis C treated with interferon and ribavirin develops anaemia due to haemolysis caused by ribavarin. [5]

Objectives of Study: The objective of this study was to correlate haematological abnormalities and biochemical alterations in various liver diseases.

Materials and Methods: This is a hospital based observational cross sectional study and a total 187 patients including all age groups and both sexes presenting with liver disease admitted in In Patient Department in our institute over a period of 1 year from May 2021 to April 2022 were included in our study.

Place of Study: Central Laboratory, Department of pathology, Jhalawar Medical College, Jhalawar.

Sample Size: 187 cases.

Inclusion Criteria

1. Primary criterion of inclusion was presence of liver disease including cirrhosis, hepatitis, acute or chronic liver failure, liver abscess, alcoholic liver disease and all other liver diseases.
2. All patients of both sexes, age ranging from 20 to 70 years and irrespective of socioeconomic status, were included.
3. Only clinically diagnosed and radiologically confirmed cases of liver pathology had done liver function test at time of admission were included in this study.

Exclusion Criteria

1. All those patients with incomplete history or not willing to participate in study.
2. Rejected samples in pre-analytical phases– e.g. Sample not adequate, clotted samples, improper vacutainers collection etc.
3. Patients who were on treatment for anaemia or had blood transfusion in last 3 months.
4. Patients on drugs causing bone marrow suppression.
5. Patients suffering from end stage medical diseases like heart failure, chronic kidney disease (CKD) and those who were chronic smokers were excluded.

Criteria of Liver Disease Patient:

1. Patients were labeled as liver disease patients on the basis of Liver Function Tests (LFT) done in the hospital at the time of admission.
2. Following parameters were included in Liver Function Test, serum bilirubin, SGOT, SGPT, ALP, Total Protein and serum albumin.

Sample Collection and Procedure: 3ml of whole blood was collected in K2EDTA vacutainer containing dipotassium salts of Ethylene Diamine Tetra –acetic acid anti-coagulant (1.8mg/ml of Blood). The blood should be gently mixed with anticoagulant by inversion of the vacutainer, after covering with a plastic cap. The plastic tubes were than labelled. The sodium

and potassium salts of EDTA are powerful anticoagulant, act by its chelating effect on the calcium molecules in blood.

All these samples will be processed in central laboratory of the SRG hospital for estimation of different hematological parameters by 6-Part

Automated Analyzer Sysmex XN-1000/5-Part SFRI HEMIX5-60 Analyzer.

Biochemical liver function test including serum bilirubin, SGOT, SGPT, ALP, Total protein and serum albumin were noted from the investigation chart of the patients.

Statistical Analysis: All the data was collected on predesigned proforma and statistical package for social sciences (SPSS) version 26 was used for data processing purpose. Frequencies and means ± Standard Deviation of data like age, serum bilirubin, SGOT, SGPT, ALP, Total protein, serum albumin, platelet count and MCV were calculated.

Results

Table 1: Distribution of patients according to Age group

Age Group (Years)	Frequency	Percentage
21-30	46	24.6%
31-40	55	29.4%
41-50	37	19.8%
51-60	31	16.6%
61-70	18	9.6%

In this study, 29.4% of the study participants were in the age group of 31–40 years followed by 24.6 % of the participants were in the age group of 21–30 years, 19.8%, 16.5%, and 9.6% of the study participants were in the age group of 41-50 years, 51-60 years, and 61–70 years respectively. Mean age of the study participants in this study was 41.1 ± 13.4 years. 20 – 70 years of patients were included in this study.

Table 2: Distribution of patients according to Gender

Gender	Frequency	Percentage
Male	142	75.9%
Female	45	24.1%

Above table explains that, most of the participants in this study were males 75.9%. Female participants were 24.1%.

Table-3: Distribution of patients according to Clinical Diagnosis

Clinical Diagnosis	Frequency	Percentage
Acute Liver Failure	4	2.1%
Acute Viral Hepatitis	46	24.6%
Alcoholic Liver Disease	25	13.4%
Chronic Liver Disease	73	39.0%
Hepatitis	23	12.3%
Hepatocellular Jaundice	6	3.2%
Liver Abscess	5	2.7%
Obstructive Jaundice	2	1.1%
Portal Hypertension	3	1.6%

Above table explains distribution of study participants according to Clinical diagnosis. It was found Chronic liver disease and Acute viral hepatitis was the most commonly present in most of the participants; 73 (39%) and 46 (24.6%). Followed by Alcoholic Liver Disease, Hepatitis, Hepatocellular Jaundice, Liver Abscess, Acute Liver Failure and Portal Hypertension and Least number of participants had Obstructive Jaundice.

Table-4: Mean value of hematological and biochemical parameters

		Mean ± SD	Frequency	Percentage
SGOT (IU/L)	5 - 40 IU/L	193.9 ± 173.1	8	4.3%
	> 40IU/L		179	95.7%
SGPT (IU/L)	5 - 45 IU/L	229 ± 312.4	24	12.8%
	> 45 IU/L		163	87.2%
SERUM BILIRUBIN (mg %)	0.3 - 1.2 mg%	4.6 ± 3.6	18	9.6%
	> 1.2 mg%		169	90.4%
ALP (IU/L)	44 - 147 IU/L	162.1 ± 122.8	107	57.2%
	> 147 IU/L		80	42.8%
TOTAL PROTEIN (gm/dl)	< 6.3 gm/dl	6.5 ± 0.5	62	33.2%
	6.3 - 8.5 gm/dl		125	66.8%
SERUM ALBUMIN (gm/dl)	< 3.4 gm/dl	3.4 ± 0.6	83	44.4%
	3.4 - 5.4 gm/dl		104	55.6%

Platelet (*1000 /uL)	< 1.5	182.8 ± 72.7	75	40.1%
	1. 5 – 4		111	59.4%
	> 4		1	0.5%
MCV	< 80fL	88.39 ± 10.23	31	16.57%
	80 - 100 fL		118	63.10%
	> 100fL		38	20.3%

In our study, 179 (95.7%) patients had SGOT > 40 IU/L with mean 193.9 ± 173.1, 163 (87.2%) had SGPT > 45 IU/L with mean 229 ± 312.4, 169 (90.4%) had serum bilirubin > 1.2 mg/dl with mean values of 4.6 ± 3.6, 80 (42.8%) had ALP > 147 IU/L with mean value of 162.1 ± 122.8, 62 (33.2%) had total protein < 6.3g/dl with mean value of 6.5 ± 0.5, 83 (44.4%) had serum albumin < 3.4 gm/dl with mean value of 3.4 ± 0.6, 75 (40.1%) had < 1.5 lac/mm^3 and 1 (0.5%) had > 4 lac/mm^3 with mean value of 182.8 ± 72.7, 118 (63.10%) of the participants had MCV 80 - 100 fL with Mean value of MCV was 88.3 ± 10.23.

Table-5: Comparison of Mean (S.D) of hematological and biochemical parameters with various clinical diagnosis

	Clinical Diagnosis								
	Acute Liver Failure	**Acute Viral Hepatitis**	**Alcoholic Liver Disease**	**Chronic Liver Disease**	**Hepatitis**	**Hepato-cellular Jaundice**	**Liver Abscess**	**Obstructive Jaundice**	**Portal Hypertension**
SGOT (IU/L)	487.8 (301.9)	269.2 (225.4)	297.5 (85.2)	102.4 (47.3)	179.9 (129.6)	360 (307.)	36.4 (17.1)	178 (0.0)	59.3 (27.7)
SGPT (IU/L)	731.5 (580.8)	416.8 (442.8)	214.4 (77.5)	87.1 (65.1)	229.9 (195.4)	535.7 (637.2)	40.6 (17.1)	102 (0.0)	35 (8.9)
Serum Bilirubin (mg%)	15.8 (3.2)	7.1 (3.6)	5 (1.8)	2.3 (1.1)	4.6 (2.9)	7.9 (5.7)	0.9 (.6)	6.2 (0.0)	2.2 (1.0)
ALP (IU/L)	226.5 (26.3)	168 (47.5)	143.8 (41.6)	141.3 (59.5)	130 (28.)	208.5 (132.3)	150.8 (86.2)	1145.5 (488.6)	163 (19.5)
Total Protein (gm/dl)	6.1 (0.9)	6.8 (0.4)	6.4 (0.4)	6.3 (0.5)	6.9 (0.2)	6.5 (0.8)	6.5 (0.8)	6.1 (0.1)	5.7 (0.9)
Serum Albumin (gm/dl)	2.8 (0.8)	4 (0.4)	3.6 (0.4)	2.8 (0.4)	4 (0.2)	3.7 (0.5)	3.5 (0.2)	3.7 (0.1)	3 (0.4)
Platelet (*1000 /uL)	93 (21.2)	208.6 (70.9)	166.04 (69.3)	160.7 (47.5)	203.3 (64.7)	192.5 (55.6)	266 (167.1)	401 (29.7)	124.6 (26.6)
MCV	89.58 (7.78)	79.73 (6.48)	98.73 (4.13)	94.07 (6.8)	80.97 (8.74)	87.90 (5.06)	72.80 (2.31)	95.50 (10.61)	74.40 (5.41)

Author, year	**Mean age**
Garg RP et al , 2020 [8]	40.07 ± 15.21 years
Pahwa et al., 2019 [9]	42.78
Present study	41.1 ± 13.4

Author	**Mean MCV value**
RappaiM et al [10]	89.62 ± 11.55
Das S K, et al [13]]	91.6 ± 4.60
Berad and Chand et al [14]	93.42±11.62
Present study	88.3 ± 12.1

Above table explains Comparison of Mean (S.D) of hematological and biochemical parameters with various clinical diagnosis. It was found that SGOT was maximum with acute liver failure followed by Hepatocellular jaundice and Alcoholic liver disease. SGPT was maximum raised in acute liver failure followed by Hepatocellular jaundice and acute viral hepatitis. Serum bilirubin was maximum raised in acute liver failure followed by Hepatocellular jaundice and acute viral hepatitis.

ALP was maximum in obstructive jaundice followed by acute liver failure. Total protein was lowest in portal hypertension; serum albumin was lowest in chronic liver disease. Platelet count was lowest in acute liver failure patients. MCV was highest in Alcoholic liver disease.

Discussion

Chronic Liver Disease (CLD) refers to disease of the liver, which last for more than six months and involves progressive destruction and regeneration of liver parenchyma leading to fibrosis and cirrhosis. The most common cause of CLD is alcoholism. [6] Alcohol abuse is a one of the most common problem encountered in India, especially among men and among young adults. Therefore, patients with varying degrees of compensated liver function and there is need to differentiate between patients with stable, compensated cirrhosis and patients with decompensated cirrhosis. [7]

A number of studies have shown alterations in haematological and biochemical parameters in these patients. In this study 45(24.1%) patients were female, and 142(75.9%) patients were male which was comparable to study done by Suresh et al in which 85% were males and 15% were females. Mean age of study population in this study was 41.1 ± 13.4 with 29.4% patients belonging to 31-40 years of age, 24.6% patients were belonging to 21-30 years of age, and 19.8%, 16.6% & 9.6% patients were belonging to 41-50, 51-60 & 61-70 years of age respectively. This was similar to other studies. [8], [9]

Thrombocytopenia was seen in 40.1% of cases and was comparable with study done by Rajkumar et al. Mean corpuscular volume (MCV) and Mean corpuscular haemoglobin (MCH) were the parameters which were increased in this study which was comparable with study done by Esmeralda et al and Maruyama et al where MCV was significantly increased. Deranged liver function test was seen in which all parameters were elevated except total protein and albumin was decreased in our study which was comparable to study done by Elanchezhian et al.

It was found that in our study mean MCV value is 88.3 ± 12.1 and (20.3%) of the participants had MCV > 100 fL. Mean corpuscular volume (MCV) and Mean corpuscular haemoglobin (MCH) were the parameters which were increased in study done by rappaiM et al [10] which was comparable with study done by Esmeralda et al [11] and Maruyama et al [12] where MCV was significantly increased which reflect the severity of underlying liver disease.

Liver function test were deranged in our study. It was found that SGOT was maximum with acute liver failure followed by Hepatocellular jaundice and Alcoholic liver disease. SGPT was maximum raised in acute liver failure and Hepatocellular jaundice. Serum bilirubin was maximum raised in acute liver failure. ALP was maximum in obstructive jaundice followed by acute liver failure. Total protein was lowest in portal hypertension, serum albumin was lowest in chronic liver disease and acute liver failure. Platelet count was lowest in acute liver failure patients. In various forms of liver disease, serum level of numerous cytosolic, mitochondrial and membrane- associated enzymes are increased; the elevation of specific enzymes varies with the type of disease. [15]

Conclusion

Alterations in haematological and biochemical parameters are frequently associated with various liver diseases showing anaemia, leucopenia and thrombocytopenia along with derangement in liver enzymes. Prolongation of prothrombin time and abnormality in peripheral blood film are also seen in these patients. In our study, MCV and MCH were increased and remaining other haematological parameters like Hb, RBC, PCV, MCHC, platelet, PT all were decreased. Nevertheless, MCH was statistically not increased. Biochemical parameters like altered liver function test were all increased except total protein and albumin. Thus, the complete blood picture had shown the picture of anaemia, leucopenia and thrombocytopenia.

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