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Original Article

Risk Factors for Progression of Hepatitis C Virus (HCV) Infection to Hepato Cellular Carcinoma (HCC)

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Abstract

Chronic Hepatitis C virus (HCV) infection is closely associated with cirrhosis and with the prospective risk of Hepato-Cellular-Carcinoma (HCC). The long-term duration required for HCV transforming into HCC necessitates thorough study of various co-morbidities associated with HCV patients, some of which may act as predictors of HCC. Present paper reports co-morbidities among HCV patients. This is a hospital-based study. The patients reporting to Outdoor Patient Department (OPD) of Sharda hospital, Greater Noida, UP, India were enrolled for the study. Total number of 134 HCV positive patients were studied for the parameters pertaining to Liver Function Test (LFT), Kidney Function Test (KFT), Complete Blood Count (CBC). Of the 134 patients included in the study 31.34% were smokers and alcoholics and reported to the hospital with complaints of abdominal pain. Few patients (1.49%) presented the evidence of Chronic Liver Disease and/or cirrhosis. Among 61.9% patients high SGOT levels than normal and among 38.8% patients high SGPT levels were observed. Kidney function parameters viz; high levels of chloride are 29.85% of study subjects and higher levels of uric acid was observed in 18.6% of study subjects. In 55.55% of patients low levels of Hb was observed. Our study shows a parallel trend of abnormal parameters in the LFT, KFT and CBC parameters of HCV patients. The important lead is the simultaneous dysfunction of liver and kidney impacting upon haemoglobin which may lead to seriousness of respiratory efficiency caused due to low haemoglobin.

Keywords: *Hepatitis C virus, Hepato-cellular carcinoma, Hematology*

Introduction

Hepatitis C virus (HCV) is known to play a crucial role in causing Hepato-Cellular Carcinoma (HCC) **(**Stroffolini and Stroffolini, 2023). Moreover, the liver carcinoma has now become a global health challenge (Leonardo *et al.,* 2022). Long term persistence of this virus leads to serious consequences and cirrhosis as seen in about 1-4% in HCV infected patients developing hepatocellular carcinoma per year (Martinello *et al.,* 2023; Grakoiu *et al.,* 2020; Negro, 2020). And so, the further risk of developing HCC (hepato-cellular-carcinoma) increases by 17-20-fold as compared HCV to negative subjects (Howard *et al.,* 2013; Donato *et al.,* 2002). It has been studied that approximately 71 million people are infected every year and 400,000 morbidities (Cristina *et al.,* 2024; Blach *et al.,* 2015) are reported annually because of HCV related deaths (World Health Organization, 2022). It has been reported that HCV alters the hepatocyte gene expression. Unlike most RNA viruses, HCV can cause chronic hepatitis C (CHC) with an elevated risk of developing cirrhosis, fibrosis, and ultimately hepatocellular carcinoma (HCC). This hepatotropic virus can persist in up to 80% of patients (Felix *et al.,* 2024). The prevalence of HCC in HCV infected patients corresponds with the development of liver fibrosis (Hae Won Yoo *et al.,* 2022; Bandeira *et al.,* 2016; Hoshida *et al.,* 2014). The time period

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between the fibrosis and the exposure to HCV infection modifies the risk of HCC development and this process is different in all HCV infected patients (Maria *et al.,* 2022; El-Serag, 2002; Kamal, 2008; Tan *et al.,* 2008). Since it takes long time for HCV to be transformed into prospective HCC, the duration gives opportunities to study whether co-morbidities associated with HCV interaction could serve as reliable predictors of prospective HCC. The objective of our study was simultaneous observations on levels of LFT, KFT, and CBC to enquire if few of these parameters of HCV patients serve as predictors of HCC.

Materials and Methods

Patients reported to Sharda Hospital Greater Noida, Uttar Pradesh, India, during the period 2022-23 and who were diagnosed positive for Ab- HCV were included for this study. The clinical parameters of the patients were recorded. To perform this study, the ethical approval was taken by the Sharda University, Institution Ethical Committee (File No. SU/SMS&R/76-A/2021/40, dated 11/02/2021). The blood samples of the patients were taken for the various assays including KFT, LFT and CBC and was then carried to the lab following all the biosafety measures. A total of 134 HCV positive patients were examined for our study **(**using 4th Generation HCV TRI-DOT Kit). The plasma/serum was separated from the sample by using clinical centrifuge for 5-10 minutes at 5000 rpm. The plasma samples were labelled patient wise and stored in Eppendorf tubes in -80°C. The plasma samples of 88 patients were subjected for Antibody-Antigen detection employing the HCV ELISA kit (m/s ErbaLisa HCV Gen4 Ag+Ab) (following the manufacturer's protocol Erba$^{@}$ Mannheim). The OD values (Optical Density) of plasma samples were recorded at 450nm in ELISA reader (m/s Agilent, USA). The values of parameters of LFT, KFT and CBC were obtained from the hospital records.

Results

A total of 134 patients were registered for the study. The patients were categorized on the basis of age, gender, past infection, persistent infection and liver diseases like fatty liver, liver inflammation, hepatomegaly, chronic liver disease etc. The patients were age wise divided into 5 categories: Category I: 6-15 years; Category II: 16-40 years, Category III: 41-55 years; Category IV: 56-69 years and Category V: 70 years and above. Out of these, 71 (52.98%) were males and 63 (47.01%) were females. The highest infection was recorded in the age group of Category II. Varied symptoms were observed in the HCV positive patients. Almost 42 patients (31.34%), 21 males and 21 females reported to hospital with abdominal pain, followed by Smoking, alcoholic, Intravenous drug users in 36 (26.86%) patients i.e. 30 males and 6 females; Bloating in 21 (15.67%) patients 12 males and 9 females; fatty liver in 19 patients (14.17%) 11males and 8 females; High grade fever/pyrexia in 18 (13.43%) patients 10 males and 8 females; Indigestion in 7 (5.22%) patients 4 males and 3 females; Blood transfusion in 4 (2.98%) patients 1male and 3 females and Cirrhosis/Chronic Liver Disease in 2 (1.49%) patients, 1 male and 1 female. Comorbidities like Hypertension, Diabetes etc. along with Extrahepatic manifestation was observed in almost all the HCV patients.

When the major symptoms emerging with age were observed then it was seen that highest number of male patients complaining of abdominal pain were in Category II while for females, it was Category III. Similarly, when the symptoms of Smoking, alcoholic, Intravenous drug users was observed, highest was in the males of age group Category II and Category IV while in females it was Category III years. The bloating observed was highest in males of Category II while for females it was Category III. The fatty liver conditions observed was highest in Category II and for females it was Category III. Pyrexia was observed to be high in males of Category III while in females it was Category II. Indigestion was seen to be highest in males of Category II while high in females of Category IV. Blood transfusion cases were highest in male of Category III while in females of Category II. Cirrhosis/Chronic Liver Diseases was highest in males of Category III while in females it was Category II. This suggests that males at early stage start having symptoms while females at the age of 41-55 (Category III) start developing symptoms.

Analysis of Renal parameters of HCV positive patients

The renal parameters recorded from the patients included Urea, Creatinine, Uric acid, and Electrolytes (Sodium, Potassium and Chloride). Separate observations were made in both male and female categories. Out of 134 Ab-HCV positive patients, 71 male patients were reported positive. Out of this it was found that high levels of urea were present in 23 male patients (21.6%) followed by uric acid in 20 patients (21.86%), high levels of chloride were reported in 16 patients (22.5%), creatinine in (21.1%), sodium in 4 patients (5.63%) and potassium in 3 patients (4.22%). The low levels of urea were observed in 8 patients (11.2%), sodium in 7 patients (9.85%), uric acid in 2 patients (2.8%), potassium in 3 patients (4.2%) and chloride in 1 patient (1.4%).

Out of 134 Ab-HCV positive patients 63 female patients were reported positive. Out of which high levels of chloride were observed in 24 patients (38.09%), urea in 6 patients (9.52%), uric acid in 5 patients (7.93%), creatinine in 3 patients (4.76%), sodium in 3 patients (4.76%) and potassium in 3 patients (4.76%). The low levels of urea were observed in 9 patients (14.28%) and potassium in 5 patients (7.93%), creatinine in 3 patients (4.76%), sodium in 3 patients (4.76%) and chloride in 1 patient (1.58%).

Age wise distribution of Urea in males indicated high levels in Category IV (10 in nos) followed by Category III (7) and Category II (4). In females, it was high in Category III (2) followed by Category IV (2) and Category V (1). High creatinine levels were seen in males in Category IV (6 in nos) followed by Category V (4 in nos), Category III (2) and Category II (1). In Females it was seen in Category V (2) and Category IV (1). High uric acid levels in males were seen in the Category II (7 in nos) followed by category IV (6), Category V (3) and Category III (2). In females it was seen in Category IV (1) followed by Category III (1) and Category V (1). High sodium levels were seen in almost all age groups Category II (2 in nos), Category III (2) and Category IV (4). In Females it was seen in Category IV (2) and Category V (1). High potassium levels in males were seen in two categories only: Category III (2) and Category V (1). In Females it was high in Category IV (2) and Category II (1). High chloride levels in males were observed in Category II (5 in nos) followed by Category III (4), Category IV (4) and Category V (3). In Females it was high in Category III (7) followed by Category II (6), Category IV (4) and Category V (4). Major fluctuation levels in Renal parameters age wise was seen in Urea, Creatinine and Chloride comparatively (Figure 1&2 , Table 1).

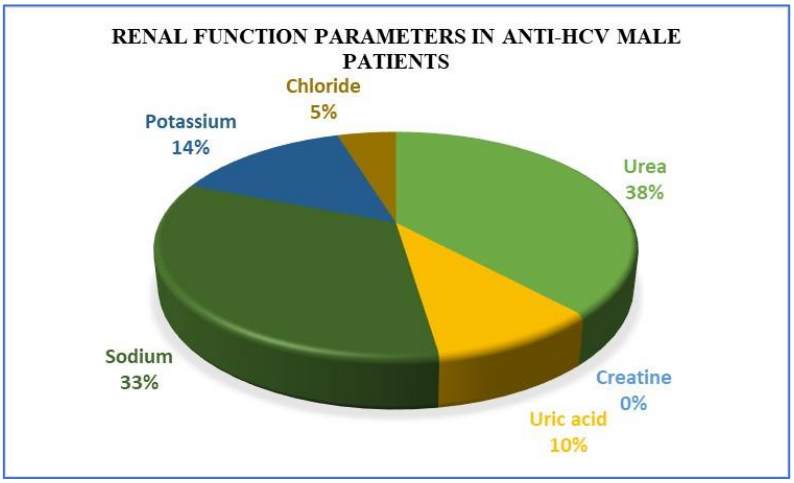

Figure 1. Percent Distribution of Renal parameters presented in HCV (male) positive patients

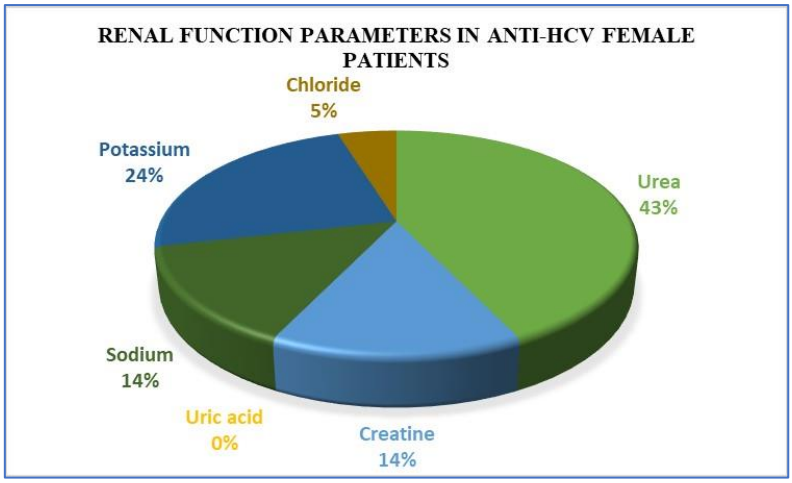

Figure 2. Percent Distribution of Renal parameters presented in HCV (female) positive patients

Age wise distribution of Urea in males indicated low levels in Category II (7) and Category III (1). In females, low levels were seen in Category II (5) and Category III (2). Creatinine was seen low only in females in two Categories II (2) and Category III (1). Uric acid levels were seen low in Males in Category II (2) only. Low Sodium levels in males were seen in Category II (3), Category III (2) and Category IV (1). In females, low levels were seen in Category II (1) only. Low Potassium levels in males were seen in Category IV (3) only. In females, low levels were seen in Category II (2), Category III (2) and Category IV (1). Low Chloride levels were not seen in neither male nor female patients (Figure 1&2, Table 2).

Table 1. Comparative analysis of various risk factors in HCV positive patients (Hyper levels)

Sl. No.	Parameter	Male/ Female	Observation as per Gradation in levels (Hyper level)				
			Category I	Category II	Category III	Category IV	Category V
1.	Urea	Male	-	3	2	1	-
		Female	-	-	1	2	3
2.	Creatinine	Male	-	4	3	1	2
		Female	-	-	-	2	1
3.	Uric acid	Male	-	1	4	2	3
		Female	-	-	2	1	3
4.	Sodium	Male	-	1	2	3	-
		Female	-	-	-	1	2
5.	Potassium	Male	-	-	1	-	2
		Female	-	2	-	1	-
6.	Chloride	Male	-	1	2	2	3
		Female	-	2	1	3	3
7.	Bilirubin total	Male	4	1	3	2	
		Female	-	1	2	-	3
8.	Bilirubin direct	Male	5	1	2	3	4
		Female	-	1	1	2	3
9.	Bilirubin indirect	Male	-	2	1	-	-
		Female	-	-	-	-	1
10.	SGOT	Male	4	1	2	2	3
		Female		2	1	2	3
11.	SGPT	Male	4	1	1	2	3
		Female		2	1	2	3
12.	Alkaline phosphatase	Male	5	1	2	3	4
		Female	-	1	1	2	3
13.	Protein total	Male	-	1	2	3	-
		Female	-	1	2	-	-
14.	Albumin	Male	-	1	1	-	-
		Female	-	-	-	-	-
15.	Globulin	Male	-	1	2	2	3

		Female	-	1	2	3	2
16.	A/G ratio	Male	-	1	-	-	-
		Female	-	-	-	-	-
17.	Hemoglobin	Male	-	1	2	-	-
		Female	-	-	-	-	-
18.	Total leucocyte count	Male	-	1	3	2	4
		Female	-	-	-	1	2
19.	Neutrophils	Male	-	3	1	2	4
		Female	-	1	1	1	2
20.	Lymphocytes	Male	-	-	1	-	-
		Female	-	1	-	2	-
21.	Eosinophils	Male	-	1	2	3	4
		Female	-	2	1	3	4
22.	Monocytes	Male	-	1	2	2	-
		Female	-	-	-	1	-
23.	Basophils	Male	-	-	-	-	-
		Female	-	-	-	-	-
24.	RBC count	Male	-	1	2	-	-
		Female	-	-	-	-	-
25.	PCV	Male	-	1	1	2	-
		Female	-	-	-	1	-
26.	Platelet count	Male	-	1	-	-	-
		Female	-	-	1	-	-

Table 2. Comparative analysis of various risk factors in HCV positive patients (Hypo levels)

Sl.No.	Parameter	Male/ Female	Observation as per Gradation in levels (Hypo level)				
			Category I	Category II	Category III	Category IV	Category V
1.	Urea	Male	-	1	2	-	-
		Female	-	1	2	-	-
2.	Creatinine	Male	-	-	-	-	-
		Female	-	1	2	-	-
3.	Uric acid	Male	-	1	-	-	-
		Female	-	-	-	-	-
4.	Sodium	Male	-	1	2	3	
		Female	-	1	-	-	-
5.	Potassium	Male	-	-	-	1	-
		Female	-	1	2	3	-
6.	Chloride	Male	-	-	-	-	-
		Female	-	-	-	-	-
7.	Bilirubin total	Male	-	-	-	-	-
		Female	-	-	-	-	-
8.	Bilirubin direct	Male	-	-	-	-	-
		Female	-	-	-	-	-
9.	Bilirubin indirect	Male	-	-	-	-	-
		Female	-	-	-	-	-
10.	SGOT	Male	-	-	-	-	-
		Female	-	-	-	-	-
11.	SGPT	Male	-	-	-	-	-
		Female	-	-	-	-	-
12.	Alkaline phosphatase	Male	-	-	-	-	-
		Female	-	-	-	-	-
13.	Protein total	Male	-	1	-	-	-
		Female	-	-	-	-	-
14.	Albumin	Male	-	1	2	2	3
		Female	-	1	1	2	-
15.	Globulin	Male	-	-	-	-	-
		Female	-	-	-	-	-
16.	A/G ratio	Male	-	1	3	2	4
		Female	-	2	1	1	2

17.	Haemoglobin	Male	-	1	2	3	4
		Female	-	1	1	2	3
18.	Total leucocyte count	Male	-	1	-	-	-
		Female	-	2	1	1	-
19.	Neutrophils	Male	-	-	-	-	-
		Female	-	-	-	1	-
20.	Lymphocytes	Male	-	2	1	2	3
		Female	-	-	1	1	2
21.	Eosinophils	Male	-	-	-	-	-
		Female	-	-	-	-	-
22.	Monocytes	Male	-	-	-	-	-
		Female	-	-	-	-	-
23.	Basophils	Male	-	-	-	-	-
		Female	-	-	-	-	-
24.	RBC count	Male	-	2	1	2	2
		Female	-	1	3	3	2
25.	PCV	Male	-	2	1	1	3
		Female	-	1	1	2	2
26.	Platelet count	Male	-	1	1	2	3
		Female	-	2	3	1	2

Analysis of Liver parameters in patients of HCV

All the liver parameters were recorded from patients. Out of which 61 were Ab-HCV positive male patients and 49 female patients. High levels of SGOT were observed in 49 patients (44.54%), followed by SGPT in 35 patients (31.81%), bilirubin direct in 30 patients (27.27%), alkaline phosphatase in 25 patients (22.72%), globulin in 18 patients (16.36%), bilirubin total in 14 patients (12.72%), protein total in 9 patients (8.18%), bilirubin indirect in 3 patients (2.72%) and albumin in 2 patients (1.81%). The low levels of A/G ratio were observed in 20 patients (18.18%), albumin in 18 patients (16.36%) and protein total in 4 patients (3.63%) However, we didn't find any low levels of other liver parameters in male patients. Out of 110 Ab-HCV positive patients 49 female patients were reported positive. Out of which high levels of SGOT were observed in 34 patients (30.90%), bilirubin direct in 17 patients (15.45%), SGPT in 17 patients (15.45%), globulin in 11 patients (10%), alkaline phosphatase in 12 patients (10.90%), protein total in 3 patients (2.72%), bilirubin total in 3 patients (2.72%) and bilirubin indirect in 1 patient (0.90%). The low levels of A/G were observed in 8 female patients (7.27%) and albumin in 5 patients (4.54%). We didn't find low any levels of other liver parameters in female patients.

Age wise distribution of Bilirubin total in males indicated high levels in Category II (8 in nos) followed by Category IV (3), Category IV (2) and Category I (1). One female in Category of II, III and V were found. High Bilirubin direct levels were seen in males in Category II (10 in nos) followed by Category III (9 in nos), Category IV (7), Category V (3) and Category I (1). In Females it was seen in Category II (6), Category III (6), Category IV (3) and Category V (2). High Bilirubin indirect levels in males were seen in the Category III (2 in nos) and category II (1). In females it was seen in Category V (1) only. High SGOT levels were seen in Category II (18 in nos), Category III (13), Category IV (13), Category V (4) and Category I (1). In Females it was seen in Category III (11), Category II (9), Category IV (9) and Category V (5). High SGPT levels in males were seen in Category II (11), Category III (11), Category IV (10), Category V (2) and Category I (1). In Females it was high in Category III (7), Category II (4), Category IV (4) and Category V (2). High Alkaline Phosphatase levels in males were observed in Category II (9 in nos) followed by Category III (8), Category IV (5), Category V (2) and Category I (1). In Females it was high in Category II (4), Category III (4), Category IV (3) and Category V (2). High Protein Total levels in males were observed in Category II (4 in nos) followed by Category III (3) and Category IV (2). In Females it was high in Category II (2) and Category III (1). High Albumin levels in males were observed in Category II (1 in nos) and Category III (1). In Females it was not found to be high in any category. High Globulin levels in males were observed in Category II (9 in nos) followed by Category III (4), Category IV (4) and Category V (1). In Females it was high in

Category II (4), Category III (3), Category V (3) and Category IV (1). High A/G ratio levels in males were observed in Category II (1) only. In Females no high levels were observed. (Figure 3 & 4, Table 1).

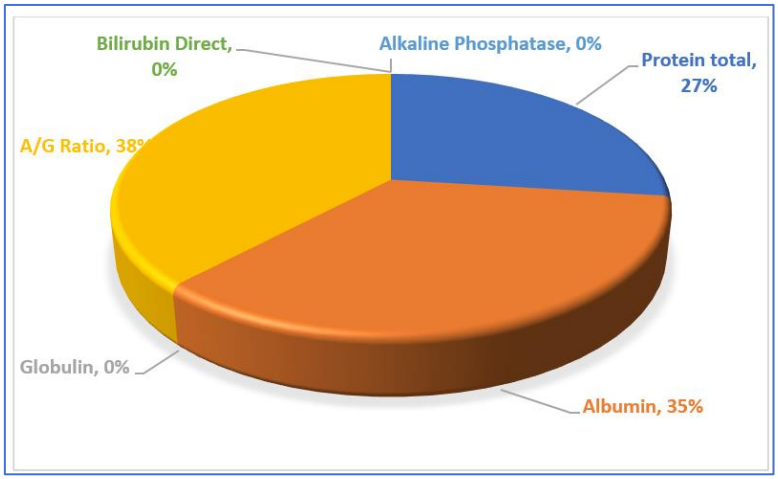

Figure 3. Percent Distribution of Liver parameters presented in HCV (male) positive patients

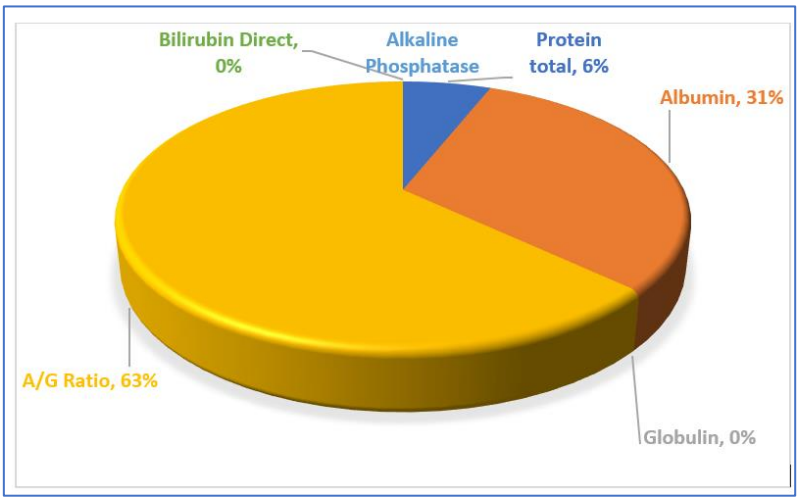

Figure 4. Percent Distribution of Liver parameters presented in HCV (female) positive patients

Age wise distribution of low levels of Bilirubin total, Bilirubin direct, Bilirubin indirect, SGOT, SGPT and Alkaline Phosphatase were not seen in males and females. In females, one more parameter i.e. Protein total was also not seen. Low Protein Total levels in males were observed in Category II (4 in nos) only. Low Albumin levels in males were observed in Category II (7 in no's), Category III (5), Category IV (5) and Category V (1). In Females it was found in Category II (2), Category III (2) and Category IV (1). Low A/G ratio levels in males were observed in Category II (7), Category III (5), Category IV (6) and Category V (2). In Females low levels were observed in Category III (3), Category IV (3), Category II (2) and Category V (2) (Figure 3 &4, Table 2).

Analysis of Haematological parameters in patients of HCV

The CBC parameters were recorded from all the 71 male patients. Out of which high neutrophil levels were observed in 25 patients (35.2%), TLC in 15 patients (21.15), Eosinophils in 11 patients (15.4%), monocytes in 9 patients (12.6%), PCV in 7 patients (9.85%), RBC count in 3 patients (4.22%). The high levels of Hb, lymphocytes and platelet count were reported amongst 1 patient from each (1.4%). The low levels of Hb were reported among 41 patients (57.74%), platelet count in 29 patients (40.84%), lymphocytes in 26 patients (36.6%), PCV in 14 patients (19.7%), RBC count in 8 patients (11.26%) and TLC in 3 patients (4.22%). Additionally, we didn't find any low levels of remaining CBC parameters in male patients. The CBC parameters were also recorded from 63 female patients. Out of

which high neutrophils were found among 5 patients (7.93%), TLC in 4 patients (6.34%), lymphocytes in 3 patients (4.76%) and only 1 patient were found with high levels of PCV and platelet count (1.58%). However, we didn't find higher values in remaining parameters. The low levels of Hb were reported among 33 patients (52.3%), PCV in 16 patients (25.3%), platelet count in 13 patients (20.63%), RBC count in 9 patients (14.2%), neutrophils in 4 patients (6.34%) and low levels of TLC and lymphocytes were reported in 5 patients (7.93%).

Age wise distribution of hemoglobin in males was not found statistically significant. High levels were only observed in Category II (2 in nos) and Category III (1). In females, no high levels were observed. However, the values can be considered insignificant. High levels of TLC in males were seen in Category II (6 in nos.) followed by Category IV (5 in nos), Category III (2) and Category V (1). In females, high levels were seen in Category IV (3) and Category V (1). High levels of Neutrophils in males were seen in Category II (9) followed by Category IV (7 in nos), Category II (5 in nos.) and Category V (2). In females, high levels were seen in Category II (2), Category III (2), Category IV (2) and Category V (1). High levels of Lymphocytes in males were seen only in Category III (1). In females, high levels were seen in Category II (1) and Category IV (2). High levels of Eosinophils in males were seen in Category II (5) followed by Category III (3 in nos), Category IV (2) and Category V (1). In females, high levels were seen in Category III (4), Category II (1), Category IV (3) and Category V (1). High levels of Monocytes in males were seen in Category II (5) followed by Category III (2) and Category IV (2). In females, high levels were seen only in Category IV (1). The High values of RBC count were seen only in males in Category II (2) and Category III (1). High levels of PCV in males were seen in Category II (2) followed by Category III (2) and Category IV (1). In females, high levels were seen only in Category IV (1). High levels of Platelet count were not seen much. In males there was 1 in Category II and in females, there was 1 in Category III (Figure 5&6, Table 1).

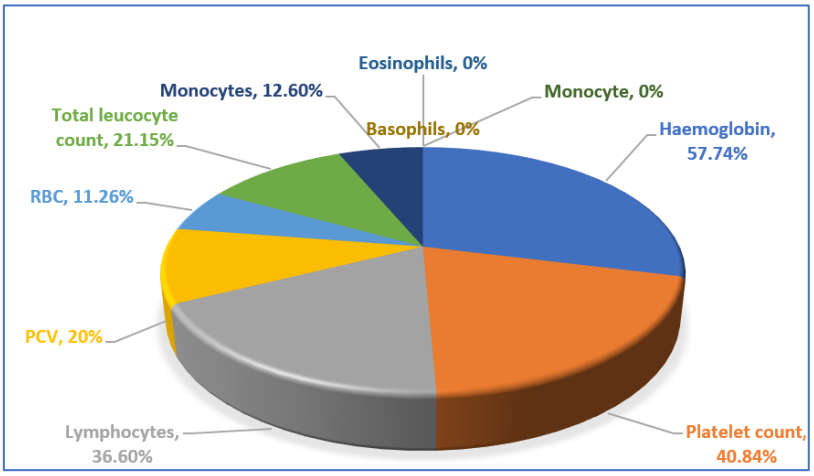

Figure 5. Percent Distribution of Blood parameters presented in HCV (male) positive patients

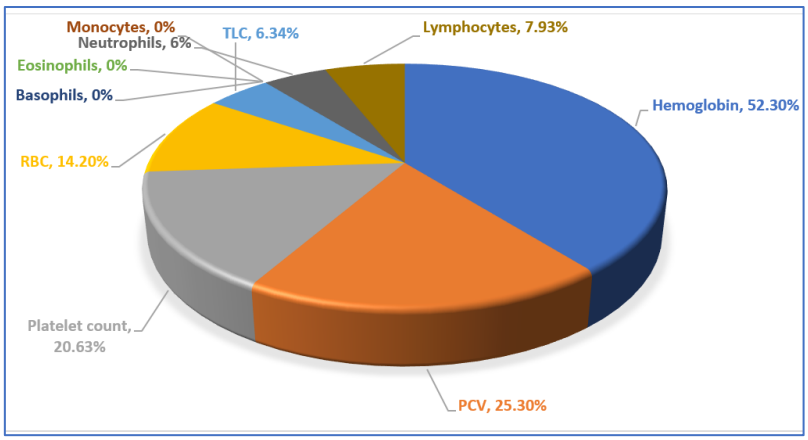

Figure 6. Percent Distribution of Blood parameters presented in HCV (female) positive patients

Low levels of hemoglobin in Males were observed in Category II (9 in nos), Category III (6), Category IV (5) and Category V (2). In females, this was observed in Category II (11 in nos), Category III (11), Category IV (6) and Category V (5). Low levels of TLC in females was seen only in Category II (3 in nos.). In females, low levels were seen in 2 individuals each in Category III and Category IV and 1 in Category II. Low levels of Neutrophils were seen only in females in Category IV (4). Low levels of Lymphocytes in males were seen only in Category III (9) followed by Category II and IV (7 in each) and Category V (3). In females, low levels were seen in Category III and IV (2 each) and Category V (1). Low levels of Eosinophils in, Monocytes and Basophils were not seen in any. The low values of RBC count seen in males were in the Category III (5) followed by Category II, Category IV and Category (V) (1 in each). In case of females, the low levels were seen in Category II (3), Category V (2), Category III and IV (1 in no.). Low levels of PCV in males were seen in Category III (4), Category IV (4), Category (3) and Category V (1). In females, low levels were seen in Category II (4), Category III (4), Category IV (3) and Category V (3). Low levels of Platelet count in males were seen in Category II (9), Category III (9), Category IV (8) and Category (2). In females it was seen in Category IV (4), Category II (3), Category V (3) and Category III (2) (Figure 5 & 6, Table 2).

Discussion

Hepatitis C virus is a pathogen which causes mild to chronic type of infections of the liver. Thus it is very important to understand the factors or the parameters in various categories of infected HCV people, such that risk factors progressing towards the severe forms can be analysed and treated accordingly (Tsai *et al*., 2015; Rasheed *et al.,* 2022). In our study we found firstly, that a greater number of males were infected as compared to females. The females who were infected mostly had a past history of blood transfusion, hysterectomy, child-birth, farming and use of unsterilized needles at primary health centers. The male patients who were infected mainly, were intravenous drug users (IDU's), alcoholic, smokers and unprotected sex practices. In a review done by Indian researchers recently, they have also identified similar risk factors ((Shalimar *et al.,* 2022). However, contrary to it, the high antigen and antibody sero-prevalence was found in females and their sero-positivity was closely related with their clinical, personal and behavioral risk factors. We found that patients belonging to rural areas were mainly infected because of inappropriate treatment and use of unsterilized blood products and needles. The transmission modes through which patient gets exposed to HCV needs to be pointed out and proper precautionary measures at different hospitals and mainly primary health-cares need to be focused.

Further when attempted to study the age-associated risk factors, a rise in biochemical parameters at an early stage i.e. 16-40 years in case of male patients and 41-55 years' age among females were observed. The renal parameters fluctuating in male patients were highest in 56-69 years for Urea followed by Uric Acid, while in female patients, it was Chloride followed by Urea with highest among those above 70 years of age. Low levels of renal parameters observed were Chloride, in case of male patients and Potassium in case of female patients. The Liver parameters indicated highest degree of fluctuation specifically at an early stage i.e. 16-40 years in case of both male and female. Not much of the parameters were observed high when we studied the blood parameters (CBC test). Similar observation was seen in studies done in Taiwan and Pakistan where PLT count was found to be low (Tsai *et al*., 2015; Rasheed *et al.,* 2022).

Leukocytes are the ones which provide immune defense to body and their low levels in the body indicate current infection in the body (Rehman *et al.,* 2016). In our study also, we found that the TLC was very low in females compared to males. We also observed low levels in haemoglobin in various categories of the HCV infected patients which was contrary to other study done in 2022 (Rasheed *et al.,* 2022). It has been earlier reported that thrombocytopenia is observed in patients with varying levels of HCV infections (Olariu *et al.,* 2010). More is the loss of platelets more is the seriousness observed in the patients. Some of the reasons reported for this condition are suppression of bone marrow during HCV infection, low production of thrombopoietin, autoimmune situation, age, gender,

mild or severe condition of HCV infection etc. (Olariu *et al.,* 2010; Rasheed *et al.,* 2022). In this study, low levels of platelets were observed in all the age-wise categories as well as in both the genders.

Conclusion

The present study was aimed to identify the risk factors found associated with Hepatitis C virus infection. We observed that since activities of the liver and kidney occur in a cascade manner, there is a need to develop combination of possible parameters as prediction of HCC. Further it is very important to have a check on the liver parameters specially on the electrolyte levels at an early stage when abdominal pain arises. The female population are more prone to liver infection compared to men owing to various lifestyle and hormonal changes (Estrogen and Progesterone are steroid hormones) with time, hence liver profiles need a constant check. Not many studies have been done on the risk factors associated with HCV and HCC in Indian subcontinent. Those done are mostly based on the habitual profile of the infected people. We report for the first time age-wise and gender-wise situational analysis of the various liver, kidney, blood parameters.
The only limitation of the present study is that a follow up is needed for HCV infected patients and the increase or decline in the various hepatological, haematological, kidney parameter etc. needs a constant check. As the study population was mostly from rural areas, it becomes difficult to follow them up. The observations reported by us sensitize more in depth studies to define the specific and determining role of kidney and/or liver parameters in predicting HCC

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Conflict of Interests

Authors declares no conflict of interests.

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