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Assessment of the Level of Ferritin, Serum Iron, Blood Urea, Serum Creatinine, and Some Hematological Indicators in Patients with Hepatitis C Virus and Renal Failure

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ABSTRACT

Background: *Hepatitis C virus infections are widely spread among patients with kidney diseases like renal failure and chronic kidney disease CKD. This patient population can acquire HCV through the sharing of contaminated equipment and tools; therefore, HCV is a significant public health issue. Hepatitis C virus infection is associated with an increased risk and progression of chronic kidney disease (CKD), as well as increased death in CKD and renal transplant patients. Anemia is the most common hematological problem in the final stage of illness.* ***purpose:*** *the current research was aimed to evaluate some of the* hematological parameters, biochemical parameters in patients with hepatitis C virus and renal failure. ***Methods:*** *one hundred samples were Collected from the hemodialysis unit in the Al Sader Hospital in the Najaf province / Iraq, from September to December 2025. The age group ranged from 20 to 79 years. The ELISA technique was used to detect anti-HCV antibodies, and all parameters were evaluated in the medical laboratory.* ***Results****: The results showed that HCV was more prevalent in patients with renal failure compared with the control group. The results showed no statistically significant differences in hemoglobin ($p = 0.11$), white blood cells ($p = 0.92$), blood urea ($p = 0.06$), and serum ferritin ($p = 0.42$) between patients and the control group. However, a statistically significant decrease in platelet count ($p = 0.04$) and significant increases in serum creatinine ($p = 0.03$) and serum iron ($p = 0.001$) were observed in patients compared with the control group.* ***Conclusion****: This study showed hepatitis C virus more prevalent among patients with kidney disease. The results also showed no significant differences were observed in hemoglobin, blood urea, ferritin, and white blood cell while significant changes in platelet count, serum creatinine and serum iron levels.*

Keywords: Hepatitis C Virus, Renal Failure, Hematological Parameters, Biochemical Parameters.

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INTRODUCTION

Viral hepatitis represents a significant global public health concern, causing considerable morbidity and mortality worldwide. [(1)]. There are five basic types of hepatitis viruses, namely hepatitis A, B, C, D, and E, all of which mainly infect hepatocytes are many hepatitis viruses, such as A, B, C, D, and E, that infect liver cells [(2)]. Hepatitis C virus is transmitted via blood products, intravenous drugs, sexual contact, from mother to child, and in patients receiving organ transplants [(3)].

Hepatitis C infection frequently progresses to chronic stage, while the acute stage is typically subclinical and is usually diagnosed in the chronic stage [(4)]. Egypt has historically been shown to have one of the highest rates of Hepatitis C virus (HCV) prevalence in worldwide [(5)].

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The Hepatitis C is a short-term disease, but for 70–85% of persons infected with (HCV), it converts to a chronic infection, a long-term disease [6]. Hepatitis C virus is a major cause of liver cirrhosis. The chronic hepatitis C virus infection not only affects liver cells but also exhibits extrahepatic activity in other tissues and organs, such as the kidneys [7].

Renal failure is the inability of the kidneys to remove metabolic waste products from the blood and to maintain PH, electrolyte, and fluid equilibrium in the extra-cellular fluids [8]. Chronic kidney disease (CKD) and chronic hepatitis C virus are significant public health concerns; worldwide, approximately 71 million persons have hepatitis C virus in a chronic phase of infection, and the adult general population in developed countries has 10-15% of chronic kidney disease [9]. Hepatitis C virus is more prevalent among patients with chronic renal illness, particularly in those on routine dialysis and those receiving kidney transplants. This infection is a significant cause of death in these people [10].

METHODS

Study design

This study was designed as a case–control study conducted to evaluate hematological and biochemical parameters in patients infected with HCV associated with renal disease.

Samples for the Study

The study included 100 participant divided in to two group:

- patients with HCV infection associated with renal disease receiving hemodialysis 50.
- Healthy control individuals without renal illness or HCV infection 50.

The study was conducted at the hemodialysis unit at Medical Al Sader Hospital in Najaf province / Iraq, from September 2025 to December 2025.

Evaluation of Hematological and Biochemical Parameters

A complete blood count device (Abacus 380 hematology analyzer Manufacture by Diatron MI Plc., Hungary) measured hemoglobin, leucocyte count, and platelet count. Blood urea, serum creatinine, iron, and ferritin were measured using an autoanalyzer device (Biossays 240 Plus Manufacture by Beijing Leadman Biochemistry Co., Ltd., Beijing, China) after blood was collected from patients in the laboratories of the Medical Al Sader Hospital in Najaf province / Iraq.

Detection of the Hepatitis C Virus

Enzyme-Linked Immunosorbent Assay (ELISA) was used from (BioTek, USA) to detect the anti-HCV for all samples. It is important to note that ELISA detects anti-HCV antibodies and indicates exposure to the virus; therefore, active infection should be confirmed by HCV RNA PCR.

Statistical analysis

Each parameter was expressed as mean and standard deviation (SD) with lower and upper 95% confidence intervals for all data and the probability a p value < 0.05 was considered a statistically significant. statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26. An independent samples t-test was used to compare the means between the two independent groups.

RESULTS

Patient's Participants

The fifty HCV individuals suffering from renal failure were distributed based on age group and gender. The age group ranged from 20-79 years, divided into (20-39), (40-59), and (60-79), respectively. Male (60%) and female (40%) compared with the control group (Table 1)

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Concentrations of Hematological and Biochemical Parameters

The results indicate that hemoglobin levels were slightly higher in the patient group suffering from renal failure and infected with HCV (10.48 ± 1.95), compare with control group (9.89 ± 1.73). In contrast white blood cells count were lower in the patients group (**4**.93 ± 1.15) compared with the control group (6.37 ± 1.86). Platelet count were decreased (162.48 ± 84.43) compared with the control group (Table 2).

The biochemical parameters showed significant higher value in the group of patients who suffered from renal failure and were infected with HCV for serum creatinine (10.63 ± 3.93), serum iron (147.09 ± 80.99) while blood urea (167.87 ± 46.95) and serum ferritin (741.48 ± 296.24) showed no statistically significant differences compared with the control group (Table 2).

Prevalence of HCV Among Patients According to Stage of Renal Failure

Hepatitis C virus was detected in patients with different stages of chronic kidney disease. The prevalence rates were 58% and 42% in the acute stage and chronic stage. (Figure 1).

Frequency of HCV- IgG and HCV IgM Among all Patients

In the patient group, 56% were positive for HCV-IgM, and 44% of persons were positive for HCV-IgG. In contrast, the control group consisted of apparently healthy individuals who tested negative for HCV infection. The results of the present study showed that serum levels of IgM and IgG were significantly higher in patients with renal failure infected with HCV (949.44 ± 34.26 mg/dl and 99.66 ± 37.22 mg/dl, respectively) compared with the control group. (Figure 2).

Table 1: Participants patients according to gender and age groups.

Age group	Patients (n=50)		Control (n=50)	
	Male	Female	Male	Female
20-39 years	8 (16%)	6 (12%)	17 (34%)	15 (30%)
40- 59 years	10 (20%)	7 (14%)	6 (12%)	4 (8%)
60-79 years	12 (24%)	7 (14%)	5 (10%)	3 (6%)
Total	30 (60%)	20 (40%)	28 (56%)	22 (44%)

Table 2: Statistical analysis of hematological and biochemical parameters.

Parameters	Mean ± SD		P. value *
	Patients	Control	
Hb(g/dl)	10.48 ± 1.95	9.89 ± 1.73	0.11
WBC (10^3/*ml*)	4.93 ± 1.15	6.37 ± 1.86	0.92
PLT(10^3/*ml*)	162.48 ± 84.43	192.06 ± 60.53	0.04
B. Urea (mg//dl)	167.87 ± 46.95	152.74 ± 30.98	0.06
S. creatinine(mg//dl)	10.63 ± 3.93	9.20 ± 2.51	0.03
S. Iron (mg/dl)	147.09 ± 80.99	96.90 ± 58.84	0.001
S. ferritin (ng/ml)	741.48 ± 296.24	687.92 ± 361.62	0.42

**The results are considered statistically significant when P. Value ≤ 0.05.*

*HB (hemoglobin); WBC., (White blood cells)., PLT (platelets)., B. Urea (blood urea)., S. creatinine (serum creatinine)., S. Iron (serum iron)., S. ferritin (serum ferritin).

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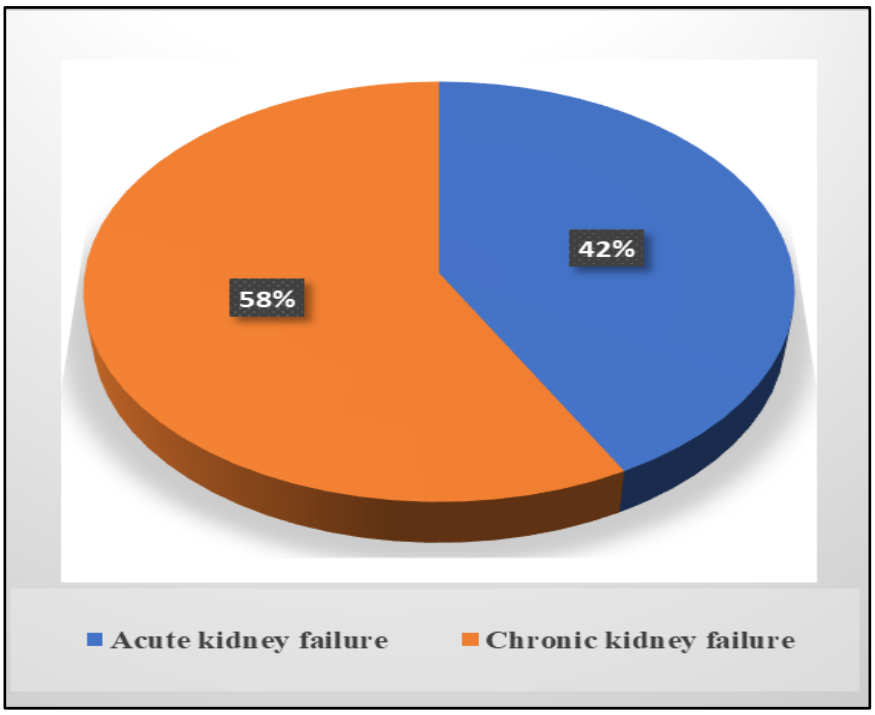

Figure 1: Prevalence of HCV among patients according to stage of renal failure.

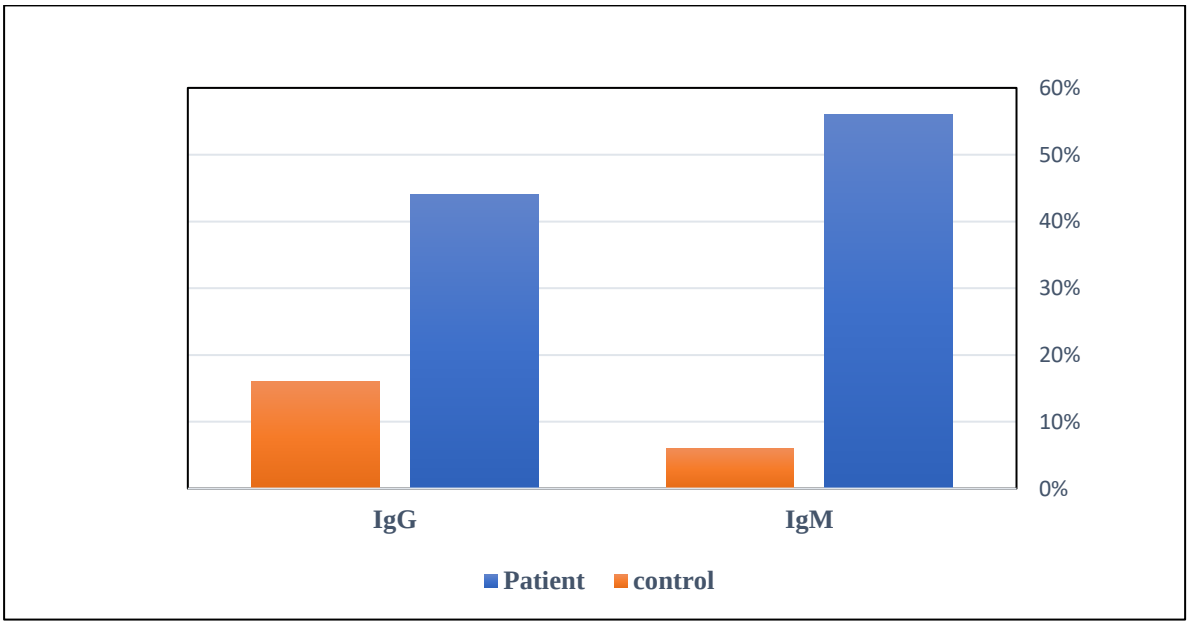

Figure 2: HCV-IgM and HCV-IgG among all patients.

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DISCUSSION

The relationship between HCV and CKD has been bidirectional; HCV can both induce and result from CKD. Based on a meta-analysis and a systematic review of observational research (n = 574,081 patients on long-term dialysis) from (n = 23 studies), anti-HCV positive serologic cases were a standalone higher risk factor for mortality in patients with chronic progressive renal disease on long-term dialysis [10,11]. The important complications of the hepatitis C virus that can occur in extrahepatic cells are renal failure. In these patients, the liver infection may be attenuated or even undetected clinically [12]. The direct contact of patients with chronic kidney disease (CKD) with blood contaminants or blood products is considered a major reason for the transmission of HCV among patients that happens in hemodialysis units because of not disinfecting frequently used drug supplies and equipment, using heparin vials, and not cleaning up blood spills right away [13].

The results showed HCV was more widespread in patients with chronic renal illness (Figure 1). This is in agreement with another study that showed the infection with HCV is related to an injury and advancement of the chronic stage of kidney illness, as well as increased death rate in patients suffering from chronic kidney disease and in patients who receive renal transplant [14].

In this work, levels of hemoglobin, blood urea, and S. ferritin were no significant higher in the patient group than in the control group whereas white blood cell were lower. serum creatinine and serum iron levels showed a statistically significant increase in patients compared with the control group (P = 0.03 and P = 0.001, respectively). Platelet counts were significantly lower in patients compared with the control group (P = 0.04) (Table 2). In this research, we showed that hemoglobin levels appeared slightly higher in HCV-infected hemodialysis patients, the difference was not statistically significant (p > 0.05). This finding is consistent with the study by Fouad et al., which reported that hemoglobin levels in HCV-positive hemodialysis patients tend to be higher compared to HCV-negative patients; however, the difference was not statistically significant. [15]. While recording lower levels of platelets in hemodialysis patients who had HCV, with a mean value of (170 ± 76.8), compared with HCV-negative cases with a mean value of (219.7 ± 65.2). The hemoglobin levels showed no consistent significant difference among the studied groups. These findings are in agreement with previous studies [16, 17, 18, 19] that reported variation in hemoglobin in patients infected with the hepatitis C virus and with kidney disease. The precise causes of the higher hemoglobin levels in patients infected with HCV alone are unknown; they may be due to increased endogenous erythropoietin production from regenerated liver cells [20,21].

The low levels of white blood cells may be due to the direct effect of Hemopoiesis [22]. Those individuals with HCV infection were found to have higher hemoglobin and hematocrit values than hepatitis C virus-negative and hepatitis B virus patients. These findings largely agree with those reported by Chih-Bin Chen et al. [23]. The specific processes underlying increased HB in the HCV patient group are not fully understood; however, our results may indicate higher endogenous erythropoietin production by regenerating kidney cells [24]. It has been proposed that hepatic regeneration during hepatitis is linked to an increase in hepatic EPO production, which is proportionate to elevated interleukin-6 (IL-6) levels [25]. In these results, we showed that each HCV patients with kidney failure had elevated creatinine and urea levels.

The patients group showed non-significant slight increase in blood urea levels and significant increase in serum creatinine in the patient group compared to the control group (Table 2). This is consistent with the findings reported by Alsaffar [26], which reported

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elevated serum creatinine and urea levels, with mean values of 9.606 (mmol/L) and 176.3 (mmol/L), respectively. Creatinine and blood urea have been identified in several studies as markers of renal failure in both acute and chronic stages [27].

The rise in urea and creatinine is termed azotemia. More than three-quarters of the nephrons are nonfunctional, leading to renal azotemia and a reduced GFR. Some studies identified urea and creatinine as the main indicators of both acute and chronic kidney failure. But some creatinine was a far more accurate measure of kidney function than urea at all stages of kidney failure. The current study also showed that the patient group tended to have higher iron and ferritin levels. The survey agrees with other studies [23]. This also revealed that HCV infections were associated with elevated iron and ferritin levels. The elevated levels of serum ferritin and serum iron in the patient group compared with the control group in this study could accurately indicate liver cirrhosis or fibrosis [28].

Also, hepcidin, produced in the liver, may play a crucial role in regulating iron homeostasis. It is induced by inflammation. The pathophysiologic process of severe iron overload in HCV cases may be mediated by decreased hepatic hepcidin levels, which reflect the degree of iron overload. [29]). IgM and IgG levels are increased in the patients' group, which may be due to the body's immune response against diseases and immune conditions of the sick, and various HCV immunity cases. These results agreed with Alsaffar [26].

CONCLUSION

Hepatitis C virus is prevalent among patients with kidney disease, and this may be due to the use of non-sterile devices and tools in hospitals. The results also showed no significant differences were observed in hemoglobin, blood urea, ferritin, and white blood cell while significant changes in platelets count , serum creatinine and serum iron levels.

The results also showed significant increases in serum creatinine ($p = 0.03$) and serum iron ($p = 0.001$) were observed in patients compared with the control group. However, a statistically significant decrease in platelet count ($p = 0.04$).

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Ethical approval

The present study which is conducted by authors ((Doaa AbdAlzahra Deli) was approved by the local Department of Anesthesia Techniques committee.

Statement of Permission and Conflict of Interests

The others declare that there is have no any financial interests or connections, direct or indirect, or other situations that might raise the question of bias in the work reported or the conclusions, implications or opinions stated – including pertinent commercial or other sources of funding for the individual author(s) or for the associated department(s) or organization(s), personal relationships, or direct academic competition.

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