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ORIGINAL ARTICLE

Correlation of Haemoglobin and Haematocrit with Hepatitis C Infection Among Patients Undergoing Hemodialysis in a Tertiary Hospital in Ogun State, Nigeria

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ABSTRACT

Background: The Hepatitis C Virus (HCV) is a major cause of morbidity among patients with chronic kidney disease undergoing hemodialysis. This study investigates the correlation between hemoglobin (Hb), hematocrit (HCT), and HCV infection in these patients, aiming to provide insights into the hematological implications of HCV in hemodialysis patients.

Materials and Methods: This retrospective study was conducted at the Hemodialysis Center of Babcock University Teaching Hospital, Ogun State, Nigeria, between April and May 2019. A total of 40 participants were recruited using the Cochran formula for sample size determination, with an expected HCV prevalence of 4.8%. Patients with chronic kidney disease, who had undergone blood transfusion, and those undergoing hemodialysis were included. Blood samples were collected and analyzed for complete blood count (CBC) and HCV status using ELISA and real-time PCR methods. Statistical analysis was performed using SPSS to assess the correlation between Hb, HCT, and HCV infection.

Results: The mean hemoglobin concentration was 10.13 ± 1.99 g/dL, and the mean packed cell volume was 30.81 ± 5.90%. There was no significant correlation between HCV status and either Hb ($r = -0.028$, $p = 0.865$) or HCT ($r = -0.014$, $p = 0.932$). Additionally, patients with positive HCV status did not show significant differences in Hb and HCT compared to HCV-negative patients. However, there was a significant association between HCV status and family history of hepatitis infection ($p < 0.000$), and previous HCV diagnosis ($p = 0.043$).

Conclusion: There is no significant correlation between hemoglobin and hematocrit levels with HCV status in hemodialysis patients. However, family history and previous HCV infection are significant factors associated with HCV status. Further studies are needed to explore the hematological impact of HCV in hemodialysis patients.

Keywords: Hemodialysis, Hepatitis C Virus, Hemoglobin, Hematocrit, Chronic Kidney Disease.

INTRODUCTION

Chronic kidney disease (CKD) has emerged as a global public health issue due to its increasing prevalence and the significant burden it places on healthcare systems. Hemodialysis is a critical life-saving treatment for patients with end-stage renal disease (ESRD), a severe form of CKD. During hemodialysis, the patient's blood is filtered externally to remove waste products and excess fluids, mimicking the natural function of the kidneys. However, hemodialysis is not without its complications, one of the most significant being infections, including viral infections like hepatitis C virus (HCV).

Hepatitis C infection is a significant concern for patients undergoing hemodialysis. It is a bloodborne virus primarily transmitted through exposure to infected blood. Hemodialysis patients are particularly vulnerable to HCV due to frequent blood transfusions, vascular access procedures, and shared dialysis equipment (1). Despite improvements in infection control practices, HCV remains prevalent in dialysis centers worldwide, especially in low- and middle-income countries (2). HCV infection can lead to chronic liver disease, cirrhosis, and hepatocellular carcinoma, posing additional risks for hemodialysis patients already dealing with CKD.

One of the significant clinical consequences of CKD and HCV infection is anemia, characterized by low hemoglobin (Hb) and hematocrit (Hct) levels in the blood. Hemoglobin is a protein found in red blood cells that carries oxygen throughout the body, while hematocrit measures the proportion of blood volume occupied by red blood cells. Anemia in hemodialysis patients can be multifactorial, arising from impaired erythropoietin production by the damaged kidneys, iron deficiency, and the chronic inflammatory state associated with CKD and viral infections like HCV (3). Several studies have explored the relationship between HCV infection and anemia in hemodialysis patients. For instance, a survey by Altintepe et al. found that HCV-infected dialysis patients had significantly lower hemoglobin and hematocrit levels than their non-infected counterparts (4). This suggests that HCV may exacerbate the severity of anemia in these patients. The exact mechanisms linking HCV infection to worsened anemia are not fully understood, but it is hypothesized that HCV may directly affect erythropoiesis (red blood cell production) or contribute to hemolysis (destruction of red blood cells) through immune-mediated mechanisms (5).

In Nigeria, the prevalence of HCV among hemodialysis patients is a critical issue. Studies have reported varying rates of HCV infection in dialysis centers across the country, with some indicating prevalence as high as 17% (6). The high burden of infectious diseases, inadequate screening protocols, and limited healthcare resources contribute to the continued spread of HCV in Nigerian healthcare settings. Given the significant impact of HCV on the health and survival of hemodialysis patients, it is essential to investigate its correlation with key hematological parameters like hemoglobin and hematocrit.

For several reasons, understanding the correlation between hemoglobin, hematocrit, and HCV infection in hemodialysis patients is essential. Firstly, it could help identify patients at higher risk of anemia early and guide interventions such as erythropoiesis-stimulating agents or iron supplementation. Secondly, recognizing the role of HCV in exacerbating anemia could lead to more targeted screening and treatment strategies for HCV infection in dialysis settings. Finally, this knowledge could improve patient outcomes by reducing the burden of anemia-related complications and enhancing the quality of life for patients undergoing long-term hemodialysis.

In light of these considerations, this study aims to investigate the correlation between hemo-

globin and hematocrit levels and HCV infection among hemodialysis patients at a tertiary hospital in Ogun State, Nigeria. By doing so, it seeks to contribute to the growing body of literature on the impact of viral infections on the hematological profile of dialysis patients and provide valuable insights for clinicians managing anemia in this vulnerable population.

MATERIALS AND METHODS

Research Design

This was a retrospective study conducted between April and May 2019 to monitor patients with hepatitis C virus undergoing hemodialysis at the hemodialysis center of Babcock University Teaching Hospital, Ilishan-Remo, Ogun State, Nigeria.

Sample Size Determination

The sample size was determined using the Cochran formula for estimating proportions in a population outlined by Uduma et al. [7]:

$n = (Z^2 (Pq))/e^2$

where n = minimum sample size

Z = 1.96 at 95% confidence level,

P = known/expected prevalence

e = error margin tolerated at 5% = 0.05

q = 1 - p

The existing prevalence of hepatitis C virus is 4.8%.

P = 4.8% = 0.048

q = 1 – p

= 1 – 0.048

= 0.952

$n = (1.96)^2 (0.048 \times 0.952))/(0.05)^2$

$n = 3.8416 \times (0.045696))/0.0025$

n = = 40

A total of 40 participants were recruited for this study.

Eligibility Status

Inclusion criteria

- Subjects with chronic kidney disease
- Subjects who have undergone blood transfusion or blood product transfusion
- Subjects who are seropositive & negative to Hepatitis C virus.
- Subjects who are undergoing hemodialysis.

Exclusion criteria

- healthy Patients
- Patients who did not give their consent.

Ethical Consideration

Ethical clearance was obtained from the Babcock University Health and Research Ethics Committee (BUHREC). Informed consent was obtained from the participants before the commencement of the study. The study's aims, objectives, purpose, and benefits were adequately explained to each participant. They were assured protection and confidentiality and informed that they could withdraw from the study anytime. All the participants were made to complete a consent form. They stated that they chose to participate in this study without any pressure. The study was carried out at no cost to the participants.

Sample Collection

About 3-5 ml of venous blood was obtained from the subjects via venepuncture by a medical laboratory scientist in the hematology department. The process of venepuncture was achieved by allowing the participant to sit comfortably and uprightly on a chair, after which the participant extended their arms to

form a straight line from the shoulder to the wrist. After this, the most prominent vein was searched for, and a tourniquet was applied 3-4 inches to the participant's upper arm. The test subject was asked to make a fist, after which the puncture site was cleaned and sterilized circularly using cotton wool and methylated spirit. Thus, the needle and syringe were used to make an incision on the vein to penetrate the skin. After this, the blood was released with the aid of a plunger. The subject was asked to release her fist, and the tourniquet, which was tied to the arm, was removed, and the needle was withdrawn gently from the vein. Then, a dry swab (cotton wool) was placed over the puncture site to prevent bleeding until the bleeding stopped completely. 2mls of the blood sample was transferred into an EDTA bottle, and the remaining 2mls into a plain bottle. The container containing the blood was inverted several times to mix the blood properly with the anticoagulant in the bottle. The samples were placed into their respective anticoagulant bottles (EDTA and Plain bottles) to preserve them before transportation to the laboratory for processing.

Laboratory Analysis

Complete Blood Count (CBC)

Principle of Automation (Auto Analyser)

A complete blood count was performed using an automated hematology analyzer following the manufacturer's instructions in the operation manual. Blood cells were diluted in a buffered electrolyte solution, after which a calculated volume of the blood sample was aspirated through an aperture tube between two electrodes. The blood cells interrupted the flowing current, after which a pulse was produced due to the alteration of the electrical charge. The amplitude of each pulse was proportional to the volume of the cell that caused the interruption of the current.

The presence of a threshold circuit ensured that only pulses greater than the pre-set threshold were counted. The total cell count for each was determined by the total number of pulses counted or obtained in a given blood volume. Hence, the cells were counted based on measurable variations in electrical impedance produced by non-conductive particles in an electrolyte solution.

Investigation of Hepatitis C Virus (HCV) using Rapid Test Strip

Principle

The HCV Rapid Test Strip (Serum/Plasma) is a qualitative, membrane-based immunoassay for detecting antibodies to HCV serum or plasma. The membrane is pre-coated with recombinant HCV antigen on the test line region of the strip. The serum or plasma specimen reacts with recombinant HCV antigen-conjugated colloid gold during testing. The mixture migrates upward on the membrane chromatographically by capillary action to react with the recombinant HCV antigen on the membrane, generating a colored line.

This colored line indicates a positive result, while absence indicates a negative result. To serve as a procedural control, a colored line will always appear at the control line region, indicating that the proper volume of specimen has been added and membrane wicking has occurred.

Procedure

Instructions on the test kit were entirely read before the test. Specimens were at room temperature before testing. Frozen specimens were thawed and mixed before testing. Specimens weren't frozen and thawed repeatedly. Before testing, the test strip, specimen, and controls were left to equilibrate at room temperature. The pouch was brought to room temperature before opening. Test strips were removed and used immediately from the

sealed bag. The strips were placed on a clean and level surface. The dropper was held vertically for serum and plasma, and a drop of serum or plasma was added to the specimen area; then, 2 drops of buffer and time were noted. Wait for the colored line(s) to appear. The test was read after 15 minutes.

Positive: Two distinct colored lines appeared. One color line was on the control region (C), and another was on the test region (T).

Note: The intensity of the color in the test line region (T) varies depending on the concentration of HCV antibodies in the specimen. Therefore, any shade of red in the test region is considered positive.

Negative: One color line appeared in the control region (C). No red or pink line appeared in the test region (T).

Invalid: The control line fails to appear. Insufficient specimen volume or incorrect procedural techniques are likely reasons for failure in control line.

Determination of HCV using ELISA (Enzyme-Linked Immunosorbent Assay)

Principle of Test

The microtiter plate provided in this kit has been pre-coated with specific antigens. Samples were added to the appropriate microtiter plate wells and incubated. Then, incubate Horseradish Peroxidase (HRP)-conjugated-anti-human immunoglobulin to each well. Finally, substrate solutions are added to each well. The enzyme-substrate reaction is terminated by the addition of a sulphuric acid solution, and the color change is measured spectrophotometrically at a wavelength of 450 nm ± 2 nm. Calculate the valence of human anti-hepatitis C virus antibody in the samples.

Test Procedure

About 100µl of sample diluents were added per well, not a blank well. 10µl of sample positive control and negative control was added per well. It was covered with the adhesive strip and incubated for 45 minutes at 37°C. Each well was aspirated and washed; the process was done five times for five washes. It was cleaned by filling each well with Wash Buffer (350µl) using a squirt bottle, multi-channel pipette, manifold dispenser, or auto washer; it was left for 30 seconds. Complete removal of the liquid at each step was essential for good performance. After the last wash, any remaining Wash Buffer was removed by aspiration or decantation. The plate was inverted and blotted against clean paper towels. 100µl of HRP-conjugate was added to each well, except the blank well. The microtiter plate was covered with a new adhesive strip and incubated for 30 minutes at 37°C. Aspiration was repeated and washed five times as before. 50µl of substrate A and 50µl of Substrate B were added to each well and incubated for 10 minutes at 37°C. The plate was kept away from drafts and other temperature fluctuations in the dark. 50µl of Stop Solution was added to each well when the first four wells containing the highest concentration of standards developed a blue color. When the color change wasn't uniform, the plate was gently tapped to ensure thorough mixing. The optical density of each well was determined within 10 minutes with a microplate reader at 450 nm.

Determination of HCV using RNA REAL-TIME POLYMERASE CHAIN REACTION

Principle of Test

In real-time PCR, the amplified product was detected via fluorescent dyes. These were usually linked to oligonucleotide probes binding to the amplified product. Monitoring the fluorescence intensities during the real-time PCR run allows the detection and quantitation of the accumulating product without having to re-open the reaction tubes after the PCR run. Standard curves were generated using the software (Rotor-Gene version 6.0) in the Ro-

tor-Gene™ 3000. Based on the fluorescent intensities of the sample, the HCV RNA viral load was derived from the standard curve. Sometimes, PCR inhibitors cannot be reliably removed from the sample, and viral RNA may be degraded or not efficiently removed from the viral coat protein. The IC (internal control) serves as a control to rule out PCR inhibitors during the extraction and amplification step. A sample result was accepted only when IC was amplified. The assay amplified the region of the HCV genome, which was detected by the cycling A.FAM channel. The assay was also used as an internal control, which was detected by the cycling A.ROX channel.

Test Procedure

About 30µl of the reaction mixture was added into each PCR tube containing 20µl of RNA from the serum sample and RNA from a diluted standard. Corresponding, 20µl of at least one of the quantitation standards was used as a positive control and 20µl of water as a negative control. The temperature profile was created to detect HCV RNA, and all specifications were referred to in the Rotor-Gene 6000 software version 1.7.94. The detection range of the fluorescence channels was determined according to the fluorescence intensities in the PCR tubes. The gain values were determined by the channel calibration saved automatically and listed in the programming procedure's last menu window. After the run was done, the data was analyzed. The signal was detected in the fluorescence channel Cycling Green, and the result of the analysis was considered positive; the sample containing HCV RNA, while in the fluorescence channel cycling Green, no signal was detected, so it was considered negative. At the same time, a signal for internal control amplification was detected in the cycling orange channel. On the Rotor-Gene 6000, the relevant channels were cycling. A FAM for the positive signal and Cycling A. ROX for internal control.

Data Analysis

The data obtained from the research was entered into Microsoft Excel. Statistical analysis was done using Chi-square using SPSS (Statistical Package for Social Sciences), Frequency distribution, Bivariate Correlation (Pearson and Spearman's rho Correlation Coefficients).

RESULTS

The demographic characteristics of the respondents (Table 1) reveal that the majority are married (95%), predominantly Christian (65%), and all are Nigerian nationals (100%). The Yoruba tribe is most represented (80%), followed by Hausa (15%) and Igbo (5%). In terms of gender, 77.5% of the respondents are male. The HBsAg and HCV statuses show that only 2.5% tested positive for each condition, while the remaining 97.5% were negative. Regarding physical characteristics, the respondents have a mean age range of 4.05 ± 0.99 years, with the majority falling between 51-60 years (35%). Their mean height is 3.40 ± 0.55 meters, and their weight averages 2.45 ± 0.50 kg, suggesting a relatively healthy adult population. The BMI averages 20.99, indicating normal weight. The mean packed cell volume (PCV) is 30.81%, and hemoglobin concentration is 10.13 g/dL.

Figure 2 shows a significant positive correlation between packed cell volume (PCV) and hemoglobin ($p < 0.0005$, $r = 0.9876$), indicating that as PCV increases, hemoglobin levels also rise. Table 2 highlights a weak, negative correlation between HCV and HBsAg statuses with hemoglobin and PCV, though this relationship is not statistically significant. The results suggest that the likelihood of a positive HCV or HBsAg status decreases as PCV and hemoglobin increase.

In Table 3, the respondents' association with HCV status shows significant findings. There is a statistically significant correlation between respondents who have a family history of hep-

atitis C infection ($p < 0.000$) and those who had previously been diagnosed with hepatitis C ($p < 0.043$). However, no significant association was found between HCV status and factors like vaccine completion or blood transfusions. Other factors, such as tattoos, multiple sex partners, or recent medication use, showed no statistically significant relationship with HCV status.

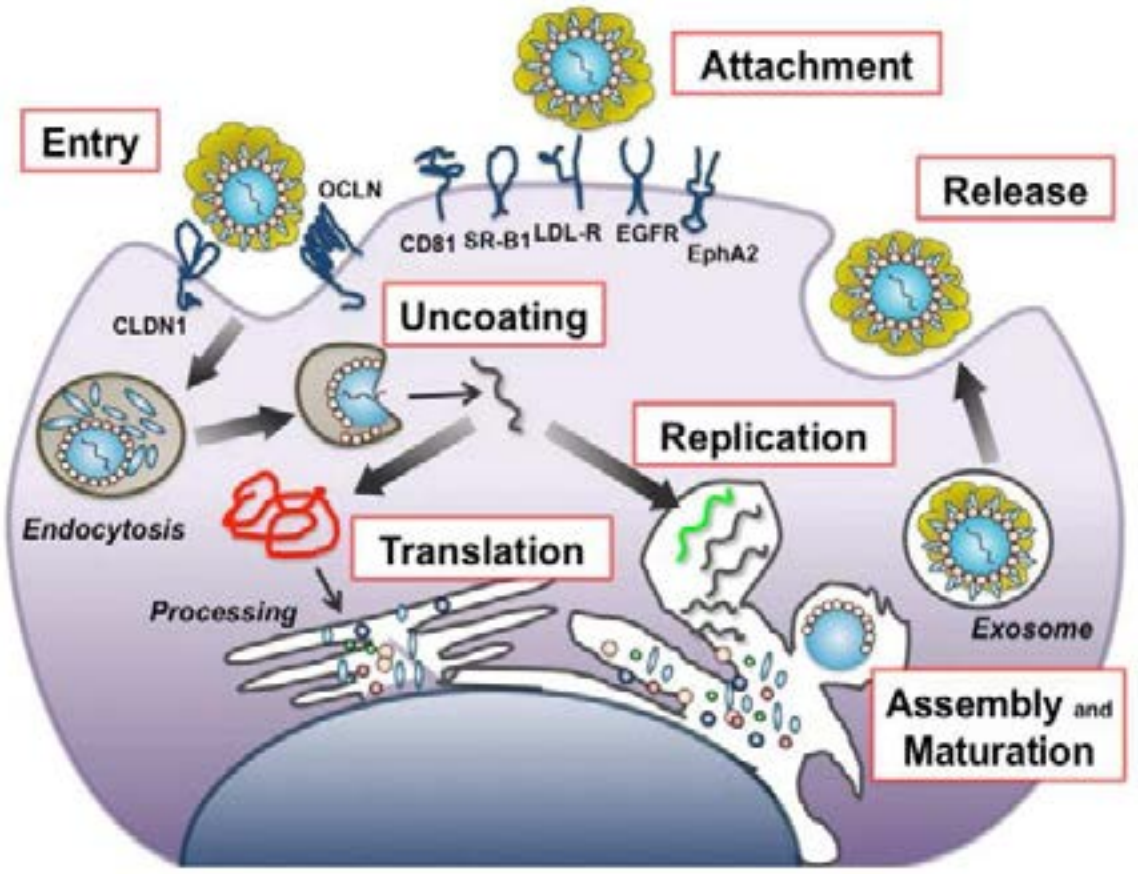

Figure 1: Lifecycle of Hepatitis C virus

Table 1: Demographic Characteristics of the Respondents

Characteristics	**Category**	**Respondents (N = 40)**
		Number (N) & Percentage (%)
Marital Status	Married	38 (95.0)
	Single	2 (5.0)
	Divorced	0 (0.0)

Religion	Christianity	26 (65.0)
	Muslim	14 (35.0)
	Others	0 (0.0)
Nationality	Nigerian	40 (100.0)
	Others	0 (0.0)
Tribe	Igbo	2 (5.0)
	Hausa	6 (15.0)
	Yoruba	32 (80.0)
Gender	Male	31 (77.5)
	Female	9 (22.5)
HBsAg Status	Positive	1 (2.5)
	Negative	39 (97.5)
HCV Status	Positive	1 (2.5)
	Negative	39 (97.5)
Age Range	Mean ± Standard Deviation	4.05 ± 0.99
	Maximum Value	6.00
	Minimum Value	2.00
	Range	4.00
Height (m)	Mean ± Standard Deviation	3.40 ± 0.55
	Maximum Value	4.00
	Minimum Value	2.00
	Range	2.00
Weight (Kg)	Mean ± Standard Deviation	2.45 ± 0.50
	Maximum Value	3.00
	Minimum Value	2.00
	Range	1.00
BMI	Mean ± Standard Deviation	20.99 ± 1.06
	Maximum Value	23.50
	Minimum Value	19.30
	Range	4.20

PCV (%)	Mean ± Standard Deviation	30.81 ± 5.90
	Maximum Value	42.10
	Minimum Value	13.50
	Range	28.60
Haemoglobin (g/dL)	Mean ± Standard Deviation	10.13 ± 1.99
	Maximum Value	14.50
	Minimum Value	4.80
	Range	9.70
Age Range	20 - 30 YEARS	0 (0.0)
	31 - 40 YEARS	1 (2.5)
	41 - 50 YEARS	12 (30.0)
	51 - 60 YEARS	14 (35.0)
	61 - 70 YEARS	10 (25.0)
	71 - 80 YEARS	3 (7.5)
Height (m)	<1.20 M	0 (0.0)
	1.20 - 1.40 M	1 (2.5)
	1.41 - 1.60 M	22 (55.0)
	1.61 - 1.80 M	17 (42.5)
	> 1.80 M	0 (0.0)
Weight (Kg)	< 40kg	0 (0.0)
	40kg-60kg	22 (55.0)
	61kg- 80kg	18 (45.0)
	81kg-100kg	0 (0.0)
	>100kg	0 (0.0)

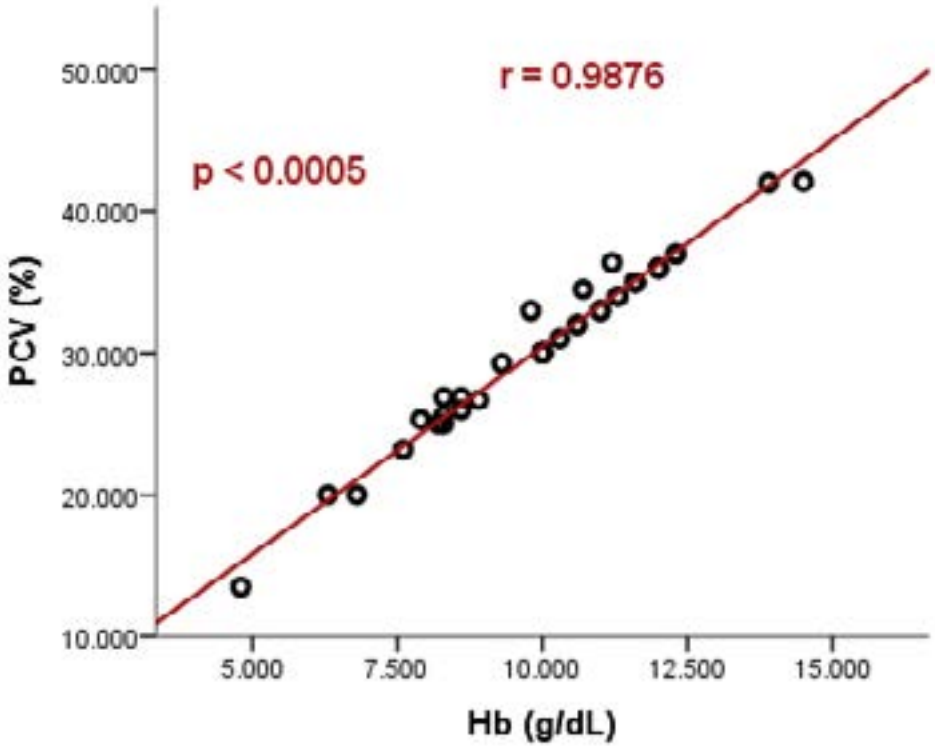

Figure 2: showing the correlation between the packed cell volume and the hemoglobin.

There was a significant positive correlation between the packed cell volume and the haemoglobin ($p < 0.0005$ and correlation coefficient, $r = 0.9876$).

Table 2: Association/Relationship between the Hemoglobin parameters and HBV and HCV Status

Characteristics		PCV (%)	Hb (g/dL)
HBsAg Status	r	-.188	-.202
	p-value	.246	.212
HCV Status	r	-.014	-.028
	p-value	.932	.865

Key: r = Spearman's rho correlation Coefficient and there is no significant difference

Table 3: Distribution of the Association of the Respondents Responses to the HCV Status

Characteristics	Responses	HCV Status		p-value	X^2
		Positive	Negative		
		N (%)	N (%)		
Have you received any hepatitis C vaccine before?	Yes	0 (0.0)	33 (100.0)	0.055	0.381
	No	0 (0.0)	1 (100.0)		
	Not Sure	1 (16.7)	5 (83.3)		
Did you receive the complete dosage of the vaccine?	Yes	0 (0.0)	20 (100.0)	0.302	0.245
	No	1 (8.3)	11 (91.7)		
	Not Sure	0 (0.0)	8 (100.0)		
Have you been diagnosed with hepatitis C infection before?	Yes	0 (0.0)	0 (0.0)	0.043*	-0.320
	No	0 (0.0)	32 (100.0)		
	Not Sure	1 (12.5)	7 (87.5)		
Is there any family history of hepatitis C infection?	Yes	1 (100.0)	0 (0.0)	0.000**	1.000
	No	0 (0.0)	12 (100.0)		
	Not Sure	0 (0.0)	27 (100.0)		
Have you ever had a tattoo or a body piercing before?	Yes	1 (10.0)	9 (90.0)	0.079	0.277
	No	0 (0.0)	30 (100.0)		
	Not Sure	0 (0.0)	0 (0.0)		
Have you received any blood transfusion or blood products before?	Yes	1 (2.5)	39 (97.5)	NA	NA
	No	0 (0.0)	0 (0.0)		
	Not Sure	0 (0.0)	0 (0.0)		
Do you have multiple sex partners?	Yes	1 (10.0)	9 (90.0)	0.079	0.277
	No	0 (0.0)	30 (100.0)		
	Not Sure	0 (0.0)	0 (0.0)		
Are you on any medication?	Yes	1 (3.4)	28 (96.6)	0.533	0.099
	No	0 (0.0)	11 (100.0)		
	Not Sure	0 (0.0)	0 (0.0)		
Have you been diagnosed with any clinical ailment in the last 6 months?	Yes	1 (5.0)	19 (95.0)	0.599	0.160
	No	0 (0.0)	13 (100.0)		
	Not Sure	0 (0.0)	7 (100.0)		
Have you had erythropoietin or iron therapy in the last 6 months?	Yes	1 (3.4)	28 (96.6)	0.823	0.099
	No	0 (0.0)	5 (100.0)		
	Not Sure	0 (0.0)	6 (100.0)		

Key: *=> significant difference at p < 0.05 **** => significant difference at p < 0.0005**

NA => Not Available **X^2 => Chi-Square value**

DISCUSSION

This study explores the relationship between hematologic parameters and hepatitis C virus (HCV) infection in a hemodialysis patient population. This study is significant as anemia is a common complication in patients with chronic kidney disease (CKD) and those undergoing hemodialysis, particularly in the presence of hepatitis infections (B or C).

The demographic characteristics of the respondents showed that the majority of the participants were married (95%), Christian (65%), and of Yoruba ethnicity (80%). The mean age of the participants was 4.05 ± 0.99, and the population was predominantly male (77.5%). The gender disparity in this study aligns with previous findings that suggest males have a higher incidence of CKD and are more likely to undergo hemodialysis than females (8). The Yoruba ethnic dominance in the study reflects the geographical location of the tertiary hospital in Ogun State, where Yoruba is the predominant ethnic group.

The results of the study demonstrated a significant positive correlation between packed cell volume (PCV) and hemoglobin levels ($r = 0.9876$, $p < 0.0005$). This finding is consistent with the well-established relationship between PCV and hemoglobin, as both are indicators of the red blood cell concentration in the blood (9). The significant correlation observed in this study further confirms that as hemoglobin levels increase, PCV also increases, which is expected in a hemodialysis population with close monitoring of these parameters.

The correlation between hematologic parameters (hemoglobin and PCV) and HCV status revealed no significant difference. However, a slight negative correlation was observed between PCV ($r = -0.014$) and hemoglobin ($r = -0.028$) with HCV status. This implies that as hemoglobin and PCV decrease, the likelihood of HCV infection slightly increases, though the relationship was not statistically significant. This finding aligns with other studies that found no significant association between HCV infection and hematologic parameters in hemodialysis patients (10). In contrast, other studies have reported that HCV-infected patients on hemodialysis tend to have lower hemoglobin levels due to the virus's impact on erythropoiesis and the increased need for erythropoietin (11).

However, the absence of a strong correlation in this study may be due to the relatively low prevalence of HCV infection (2.5%) among the participants. Studies with larger populations of HCV-infected patients undergoing hemodialysis have reported more pronounced hematologic changes (12). The finding of a slight negative correlation between hematologic parameters and HBsAg status ($r = -0.188$ for PCV, $r = -0.202$ for hemoglobin) aligns with previous studies showing that chronic hepatitis B virus (HBV) infection is not significantly associated with hematologic abnormalities in hemodialysis patients (13).

The analysis of risk factors associated with HCV infection showed that having a family history of hepatitis C infection was strongly correlated with HCV status ($p < 0.000$), suggesting that familial transmission or genetic susceptibility may play a role in HCV acquisition in this population. This is consistent with earlier studies that identified family history as a significant risk factor for HCV infection, especially in settings with poor infection control measures during dialysis (14).

A statistically significant difference was also observed for the variable "Have you been diagnosed with hepatitis C infection before?" ($p < 0.043$), highlighting the importance of patient history in determining current infection status. Previous studies have emphasized the need for regular screening for hepatitis C in hemodialysis patients, given the increased risk of transmission through blood products

and shared equipment (10). The study further found that no participants with HCV had received a hepatitis C vaccine, underscoring the lack of preventive measures, as no vaccine is currently available for HCV (2).

The current study's finding that no significant relationship between hematologic parameters and HCV infection contrasts with some studies that have demonstrated a higher prevalence of anemia in HCV-infected hemodialysis patients (12). A study by Molnar et al. found that HCV-infected patients on hemodialysis had lower hemoglobin levels compared to non-infected patients, attributing this to the chronic inflammatory state induced by HCV, which impairs erythropoiesis (15). Additionally, the use of interferon-based treatments for HCV has been linked to worsened anemia in these patients, though newer antiviral therapies such as direct-acting antivirals (DAAs) have reduced this complication (11).

Despite these discrepancies, the overall finding that HCV infection does not significantly impact hemoglobin or PCV levels in this study may reflect the effectiveness of anemia management in this population, including the use of erythropoietin-stimulating agents and iron supplementation, which mitigate the impact of HCV on hematologic parameters (9).

CONCLUSION

In conclusion, this study found a significant positive correlation between hemoglobin and PCV but no significant relationship between these hematologic parameters and HCV infection status. The lack of a significant correlation may be due to the small number of HCV-infected patients in the study. However, the significant associations between HCV status and risk factors, such as the family history of hepatitis C, highlight the importance of preventive measures and regular screening for HCV in hemodialysis populations. Further studies with larger populations of HCV-infected patients are necessary to confirm these findings and to explore the long-term impact of HCV on hematologic parameters in patients undergoing hemodialysis.

RECOMMENDATIONS

1. **Routine Screening**: Regular screening for hepatitis C among hemodialysis patients should be encouraged, especially for those with a family history of hepatitis C, to identify potential carriers early and initiate timely interventions.
2. **Comprehensive Hematological Monitoring**: While hemoglobin and PCV may not show strong correlations with HCV status, it remains crucial to monitor these parameters regularly to manage anemia and other blood-related complications in hemodialysis patients.
3. **Health Education**: Patients undergoing hemodialysis should receive more comprehensive education about the risks and preventive measures for HCV, particularly regarding the significance of completing hepatitis vaccination doses.
4. **Further Research**: Larger studies should further explore the relationship between hematological parameters and HCV status in hemodialysis patients. This could provide more definitive evidence on whether these parameters can serve as reliable indicators of HCV infection.
5. **Enhanced Infection Control**: Since blood transfusion is a risk factor for HCV, stringent protocols for blood screening and infection control in dialysis centers should be maintained and continually improved to prevent cross-infection.

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