Section: General Medicine

Original Research Article

PREVALENCE OF HEPATITIS B AND C INFECTION IN PREDIALYSIS AND DIALYSIS CHRONIC KIDNEY DISEASE IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: Hepatitis B virus (HBV) and hepatitis C virus (HCV) are common blood-borne infections in patients with chronic kidney disease (CKD), particularly in those on haemodialysis, owing to increased exposure to blood products and invasive procedures. This study aimed to assess the prevalence of HBV and HCV and evaluate the associated biochemical and liver fibrosis profiles in patients with CKD. **Aims and Objective:** To determine the prevalence and biochemical characteristics of hepatitis B and C infections among patients with CKD, including those in the dialysis and predialysis stages. **Materials and Methods:** This prospective cross-sectional study included 100 patients with CKD aged 18–80 years. Viral markers (HBsAg, anti-HCV, and HCV RNA) and liver enzymes (ALT and AST) were assessed, and APRI scores were used to estimate liver fibrosis. Clinical risk factors, CKD stage, and dialysis status were also recorded. **Result:** Most patients were aged 41–50 years (33%) and were male (65%). Diabetes and hypertension were present in 45% and 58% of the patients, respectively. Stage IV and V CKD were observed in 32% of patients, and 24% were on dialysis. HBV and HCV were positive in 6% and 4% of the patients, respectively. ALT and AST levels were significantly higher in HBV-positive (114.33 ± 150.49, 103.67 ± 133.65 IU/L) and HCV-positive patients (187.75 ± 60.80, 235.00 ± 113.48 IU/L) than in negative patients ($p < 0.01$). APRI was significantly higher in HCV-positive (4.10 ± 2.22) than in HCV-negative (0.45 ± 0.34, $p = 0.001$) cases. Severe fibrosis was observed in 75% of HCV-positive cases. **Conclusion:** Hepatitis B and C are prevalent in CKD patients, with HCV significantly linked to advanced liver fibrosis. Routine screening and early intervention are essential in this population group.

INTRODUCTION

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are the most common chronic blood-borne infections worldwide. These viruses are mainly spread through parenteral means. The high frequency of blood transfusion sessions puts haemodialysis (HD) patients at significant risk for hepatitis, including HBV and HCV infection. These patients frequently have anaemia, require long-term vascular access, are at a high risk of coming into contact with contaminated equipment and infected patients, and are susceptible to cross-contamination from the dialysis circuits.[1-3] Patients with end-stage renal disease (ESRD) undergoing haemodialysis are more susceptible to HCV infection.

Recent studies have shown that hepatitis C infection has the most detrimental consequences for individuals with chronic renal disease. Depending on the population, the prevalence of HCV infection in haemodialysis facilities ranges from 3 to 68%.[4] HBV and HCV viral infections are major causes of morbidity and mortality in HD patients in renal dialysis facilities. These infections complicate the management of these patients.[5]

Previous international research has indicated a higher incidence of HCV in patients with chronic kidney disease (CKD) who have not undergone dialysis. In pre-dialysis patients, the prevalence of HCV varies from 2 to 20% depending on the nation and research facility.[6] Prolonged HBV and HCV infections may pose health hazards since they can lead to hepatic cirrhosis and hepatocellular cancer.[7] HBV infection

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is less common in HD units than HCV infection, which can be explained by regular screening, immunisation campaigns, HBV infection control strategies, and greater viral clearance rates.[8] HBV infection rates have been significantly lowered by the isolation of patients who test positive for the virus, the use of specialised dialysis equipment, and routine surveillance for HBV infection.[9]

Basic infection control procedures and routine HCV screening of HD patients are the cornerstones for preventing HCV infection in HD settings. It is not recommended to isolate HCV-positive individuals or employ special equipment unless there are documented local outbreaks. Strict adherence to general precautions combined with isolating dialysis patients who are HBV- and HCV-positive may help prevent the spread of illness in HD units.10 This study aimed to evaluate the prevalence of hepatitis B and C in patients receiving HD at our tertiary care centre by employing anti-HCV antibody and hepatitis B surface antigen (HBsAg) prevalence.

Aims and objectives

To assess the biochemical characteristics and prevalence of Hepatitis B and C infections among patients with CKD, including those undergoing dialysis and those in the pre-dialysis stage.

MATERIALS AND METHODS

This prospective cross-sectional study with 100 CKD patients was conducted in the Department of General Medicine at Government Dharmapuri Medical College and Hospital, over 12 months from November 2022 to October 2023. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants before enrolment.

Inclusion Criteria

Patients aged between 18 and 80 years diagnosed with CKD (eGFR <60 ml/min/1.73m² as per the MDRD formula), regardless of dialysis status, were included.

Exclusion Criteria

Patients aged below 18 or above 80 years, those who did not provide consent, and those with pre-existing liver disease from non-viral causes were excluded from the study.

Methods

After obtaining informed consent, demographic and clinical details such as age, sex, comorbidities, dialysis status, and risk factors (e.g. prior surgery, blood transfusion, tattooing, and multiple sexual partners) were recorded using a pre-designed proforma. Blood investigations, including complete blood count, urea, creatinine, AST, ALT, and platelet count, were performed. HIV, HBsAg, and anti-HCV antibody tests were performed on all the patients. HCV RNA PCR was performed for those who tested positive for anti-HCV. The estimated glomerular filtration rate (eGFR) was calculated using the MDRD formula. Liver fibrosis was assessed using the AST-to-platelet ratio index (APRI), and patients were categorised into minimal/no fibrosis, moderate fibrosis, or severe fibrosis groups based on APRI values.

Statistical Analysis: Continuous variables are presented as mean ± standard deviation, and categorical variables are presented as frequency and percentage. The unpaired t-test was used to compare continuous variables, and the chi-square test was applied to assess associations between categorical variables. A p-value <0.05 was considered statistically significant. Data analysis was performed using the IBM SPSS v24.

RESULTS

Most patients were between 41–50 years (33%), followed by 51–60 years (27%), 31–40 years (18%), >60 years (15%), and <30 years (7%). Males comprised 65% of the patients, while females accounted for 35%. Diabetes mellitus was present in 45%, hypertension in 58%, and alcohol use in 15% of the study population. [Table 1]

Table 1: Demographic and clinical characteristics

Characteristic	Category	N (%)
Age Group (years)	<30	7 (7%)
	31–40	18 (18%)
	41–50	33 (33%)
	51–60	27 (27%)
	>60	15 (15%)
Sex	Male	65 (65%)
	Female	35 (35%)
Diabetes Mellitus	Present	45 (45%)
	Absent	55 (55%)
Hypertension	Present	58 (58%)
	Absent	42 (42%)
Alcohol Use	Yes	15 (15%)
	No	85 (85%)

Stage IV and V CKD were each observed in 32%, stage IIIB in 28%, stage IIIA in 7%, and stage VI in 1% of patients. At the time of assessment, 24% of the patients were on dialysis and 76% were not. Hepatitis B and C infections were identified in 6% and 4% of the patients, respectively. HIV positivity was found in 1%, and anti-HIV and HCV PCR was positive for 4(4%). [Table 2]

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Table 2: CKD stage, dialysis status, and viral infections

Variable	Category	N (%)
CKD Stage	Stage IIIA	7 (7%)
	Stage IIIB	28 (28%)
	Stage IV	32 (32%)
	Stage V	32 (32%)
	Stage VI	1 (1%)
Dialysis Status	On Dialysis	24 (24%)
	Not on Dialysis	76 (76%)
HBsAg (Hepatitis B)	Positive	6 (6%)
	Negative	94 (94%)
Anti-HCV	Positive	4 (4%)
	Negative	96 (96%)
HCV PCR	Positive	4 (4%)
	Negative	96 (96%)
HIV Status	Positive	1 (1%)
	Negative	99 (99%)

Three patients (3%) reported a history of multiple sexual partners, of whom two were positive for hepatitis B. Major surgery was documented in two patients (2%), with one case each of hepatitis B and hepatitis C. A history of blood transfusion was present in three patients (3%), and hepatitis B was identified in one patient. Tattooing was reported in three patients (3%), with one case each of hepatitis B and C. [Table 3]

Table 3: Risk factors associated with Hepatitis B and C

Risk Factor	Patients with Risk	HBV Positive	HCV Positive
Multiple Sex Partners	3 (3%)	2	0
Major Surgery	2 (2%)	1	1
Blood Transfusion	3 (3%)	1	0
Tattooing	3 (3%)	1	1

Based on the APRI index, minimal or no fibrosis was observed in 61 patients (61%), moderate fibrosis in 35 (35%), and severe fibrosis in 4 (4%). Among those with hepatitis B, two had minimal fibrosis, three had moderate fibrosis, and one had severe fibrosis; the association was not significant ($p = 0.152$). In hepatitis C-positive cases, one had moderate fibrosis and three had severe fibrosis, with no cases of minimal fibrosis; this association was significant ($p = 0.001$).[Table 4]

Table 4: Liver fibrosis and viral correlation (Based on APRI Index)

Fibrosis Grade	Total N (%)	HBV Positive	HBV Negative	HCV Positive	HCV Negative
Minimal/No Fibrosis	61 (61%)	2	59	0	61
Moderate Fibrosis	35 (35%)	3	32	1	34
Severe Fibrosis	4 (4%)	1	3	3	1
p-value	-	0.152		0.001	

The mean ALT level in HBV-positive patients was 114.33 ± 150.49 IU/L, compared to 37.85 ± 34.28 IU/L in those without HBV ($p = 0.001$). The AST levels were 103.67 ± 133.65 IU/L in HBV-positive patients and 43.34 ± 46.09 IU/L in HBV-negative patients ($p = 0.009$). The APRI ratio in HBV-positive cases was 1.07 ± 1.26, while it was 0.57 ± 0.85 in the negative group; this difference was not significant ($p = 0.181$). Among HCV-positive patients, the mean ALT and AST levels were 187.75 ± 60.80 IU/L and 235.00 ± 113.48 IU/L, respectively. In HCV-negative patients, the corresponding values were 36.39 ± 40.65 IU/L and 39.13 ± 35.75 IU/L (both $p = 0.001$). The APRI ratio was significantly higher in HCV-positive cases (4.10 ± 2.22) than in those without the infection (0.45 ± 0.34), with a p-value of 0.001. [Table 5]

Table 5: Liver enzymes and APRI ratio: viral infection correlation

Parameter	HBV Positive	HBV Negative	p-value	HCV Positive	HCV Negative	p-value
ALT (IU/L)	114.33 ± 150.49	37.85 ± 34.28	0.001	187.75 ± 60.80	36.39 ± 40.65	0.001
AST (IU/L)	103.67 ± 133.65	43.34 ± 46.09	0.009	235.00 ± 113.48	39.13 ± 35.75	0.001
APRI Ratio	1.07 ± 1.26	0.57 ± 0.85	0.181 (NS)	4.10 ± 2.22	0.45 ± 0.34	0.001

DISCUSSION

In our study, most patients were in the 41–50 years age group (33%), and 65% were male, with hypertension (58%) and diabetes (45%) being the most common comorbidities. Similarly, Sehgal et al. reported a mean age of 51.2 ± 12.71 years (dialysis) and 52.72 ± 15.88 years (non-dialysis), with a near-equal gender distribution in both groups (dialysis group: 54.3% males, non-dialysis group: 51.4% males), which broadly aligns with our patient profile.11 A study by Wai et al. reported mean ages

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of 46.8 ± 0.6 years (training set) and 47.7 ± 0.9 years (validation set), with male patients accounting for 64–66%, showing a closely matching demographic distribution.[12]

Similarly, Kataruka et al. included 135 patients, predominantly male (77%), with a mean age of 41.18 ± 14.9 years in HCV RNA-negative and 37.14 ± 13.4 years in HCV RNA-positive patients. Their study also showed a high prevalence of hypertension (74.8%) and diabetes (11.8%), reflecting a clinical profile similar to ours.[13] A similar male predominance was observed in the study by Bhaumik et al., where 72.7% (120/165) were males, and the mean age was 48.16 years, which closely matches our results.[14] Likewise, Rungta et al. reported that among 65 patients with HBV/HCV, 37 were male and 28 were female, with a mean age of 46.13 ± 12.21 years (HBV) and 47.18 ± 11.79 years (HCV).[15]

We reported HBV positivity in 6% and HCV in 4% of 100 CKD patients, of whom only 24% were on dialysis. In contrast, Raina et al. observed HBV in 11.66% (7 out of 60) and HCV in 31.66% (19 out of 60) of dialysis patients. This higher infection rate is likely due to the greater dialysis exposure, with 100% HCV positivity seen in those receiving > 200 sessions in their study, compared to the lower viral rates in our mixed dialysis and pre-dialysis group.[16] Bhaumik et al., who studied 165 haemodialysis patients, reported a 7.3% HBV and 12.1% HCV prevalence. Their higher HCV rate likely reflects exclusive dialysis exposure, as well as longer mean dialysis duration in infected patients (13 months) compared to 8 months in non-infected patients.[14]

In our study, the infection rates in patients undergoing dialysis were slightly higher. Additionally, while we found severe fibrosis in 75% of HCV-positive cases, this aligns with Rungta et al., who evaluated 934 patients with advanced CKD and found a total HBV/HCV positivity rate of 6.96%. Among the dialysis patients (n=315), 8.25% were infected (HBV: 2.86%, HCV: 5.4%), while among the non-dialysis patients (n=619), 6.3% were infected (HBV: 3.72%, HCV: 2.58%). Also reported cirrhosis in 1.27% of dialysis and 1.29% of non-dialysis patients, suggesting that liver complications may occur in both groups, especially when viral infections are undetected or untreated.[15]

Our study found a combined prevalence of HBV and HCV of 6.2% in CKD patients, with a higher proportion of HCV (4.1%) than HBV (2.1%). While Liu et al. focused solely on patients with chronic hepatitis C undergoing haemodialysis, their large study of 279 HCV-positive HD patients reinforced the burden of HCV among the CKD population, aligning with our finding that HCV is more prevalent than HBV in this group.[17]

In our study, blood transfusion history was present in 3% of patients, and only one case of HBV infection was linked to blood transfusion. In contrast, Bhaumik et al. reported that 100% of infected patients received blood transfusions, while none of the non-transfused patients developed HBV or HCV, strongly suggesting that transfusion is a major transmission route in their setting.[15] In comparison, Sehgal et al. reported that among dialysis patients, those who received >5 transfusions had HBV positivity of 23.3% and HCV of 36.6%, versus 5% and 10%, respectively, in those with ≤5 transfusions. This significant correlation reinforces the role of transfusion as a transmission route, particularly in dialysis settings.[11]

Similarly, Schiavon et al. reported that 42% of the patients had received blood transfusions before the initiation of dialysis, and 78% acquired HCV through hemodialysis, indicating that nosocomial transmission during renal replacement therapy remains a significant concern.[18] Also, Liu et al. noted that a significant proportion of their HCV-infected patients had indications for liver biopsy before either antiviral therapy (86.7%) or renal transplantation (13.3%), indirectly indicating long-standing renal disease and potential exposure to nosocomial transmission routes such as transfusion or extended dialysis duration.[17]

In our study, 75% of HCV-positive patients had severe fibrosis based on APRI. In comparison, Wai et al. reported significant fibrosis in 47% of the training group and 50% of the validation group, with cirrhosis present in 15–17% of the patients. Although measured using the Ishak score rather than APRI, both studies underline the high burden of fibrosis in HCV-positive populations.[12] Liu et al. reported that among 279 HCV-infected HD patients, 36.2% (101/279) had significant fibrosis (F2–F4), and AST levels, platelet count, and APRI were independently associated with fibrosis severity. Their study also demonstrated that an APRI >0.95 had a positive predictive value of 80% and a negative predictive value of 70% for detecting significant fibrosis.[17]

In our study, significant fibrosis was more frequently observed in patients with HBV and HCV-positive infections based on elevated AST, ALT, and APRI levels. Schiavon et al. reported significant fibrosis (F2–F4) in 24% and advanced fibrosis (F3–F4) in 9% of their patients. AST and platelet count were identified as independent predictors of fibrosis in multivariate analysis, further supporting the clinical utility of non-invasive biomarkers like APRI in assessing liver involvement in CKD patients.[18]

We recorded ALT levels of 187.75 ± 60.80 IU/L and AST levels of 235.00 ± 113.48 IU/L in HCV-infected patients. In a study by Wai et al., liver enzyme levels were also significantly elevated in fibrosis: ALT was 3.37 × ULN and AST was 3.00 × ULN among patients with significant fibrosis, compared to 1.95 × ULN and 1.49 × ULN in those without fibrosis ($p < 0.001$), confirming a parallel pattern of liver inflammation.[12]

Our study found significantly elevated APRI scores in patients with HBV (1.94 ± 1.71) and HCV (2.03 ± 1.41) compared to virus-negative patients. In a study by Schiavon et al., APRI scores were strongly associated with fibrosis. The median APRI score in patients with significant fibrosis (F2–F4) was 0.89,

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compared to 0.37 in those with no or minimal fibrosis (F0–F1), with a significant difference ($p < 0.001$). An APRI ≥ 0.95 predicted significant fibrosis with a PPV of 66% and an NPV of 93% for scores $\leq 0.40.18$ In Liu et al.'s study, APRI was also significantly associated with fibrosis severity; patients with significant fibrosis (F2 or higher) had mean APRI scores of 78.8 ± 43.8, compared to 41.5 ± 18.4 in those with mild fibrosis ($p < 0.001$). The multivariate analysis confirmed APRI as an independent predictor of fibrosis with an odds ratio of 1.08 ($p = 0.003$).[17]

Our study highlights the predominance of middle-aged males among CKD patients with HBV/HCV, with transfusion and dialysis as key risk factors. The APRI score is valuable for assessing hepatic fibrosis and shows a strong correlation with biochemical markers. Comparisons with Schiavon and Liu further support the role of APRI as a reliable, non-invasive tool for fibrosis assessment in CKD settings.

Limitations of the study

The study was limited by its single-centre design and relatively small sample size, which may have affected generalisability. Liver biopsy, the gold standard for fibrosis assessment, was not performed because of ethical and practical constraints, and reliance on APRI alone may not fully capture fibrosis severity in all cases.

CONCLUSION

This study revealed a significant presence of hepatitis B and C infections among patients with CKD, both in the pre-dialysis and dialysis stages of CKD. While hepatitis B was more common than hepatitis C, both infections were associated with elevated liver enzymes, and hepatitis C showed a significant correlation with advanced liver fibrosis. Regular viral screening, early detection, and tailored infection control measures in patients with CKD are necessary to reduce morbidity and the potential progression to liver complications.

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