Annals of Medical Laboratory Science (2022) **2**(1): 42 - 51
https://www.annalsmls.org
https://doi.org/10.51374/annalsmls.2022.2.1.0057

Prevalence of Hepatitis B, C and HIV infections among haemodialysis patients at the Cape Coast Teaching Hospital, Ghana; A retrospective study

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How to cite this paper: Ephraim, R.K.D., Addo, R.T., Awuku, Y. A., Agbodjakey, H., Adoba, P., Okyere, P., Bachelle, S.V., Abaka-Yawson, A., and Afrifa, J. (2022) Prevalence of Hepatitis B, C and HIV infections among haemodia- lysis patients at the Cape Coast Teaching Hospital, Ghana; A retrospective study, *Annals of Medical Laboratory Science* **2**(1): 42 - 51

Received: August 13, 2021
Accepted: February 27, 2022
Published: March 30, 2022

ISSN No: 2805-4024

ABSTRACT

Background: End stage renal disease (ESRD) patients undergoing hemodialysis could be at a higher risk of acquiring viral infections such as hepatitis B, C (HBV, HCV) and human immunodeficiency virus (HIV). The study investigated the prevalence of HBV, HCV, HIV and identified the determinants of these viral infections among end stage renal disease (ESRD) patients undergoing hemodialysis at the Cape Coast Teaching Hospital (CCTH).

Methods: This retrospective hospital-based record review was conducted at the CCTH among 89 patients who underwent hemodialysis in at the renal unit of the hospital. The viral infection histories of all the recruited patients were collected as well as clinical and demographic data to identify the determinants of these infections.

Results: Of the 89 patients comprising of 59 (66.3%) males and 30 (33.7%) females, 11(12.4%) were found to be positive for hepatitis B surface antigen (HBsAg), and 6 (6.7%) were found to be positive for HCV infection. Five (5.6%) patients were positive for HIV and 5 (5.6%) participants had co-infection of HBV and HCV. No co-infection of the three viral infections was reported among the participants. Of the various parameters assessed, only average monthly dialysis sessions varied significantly by gender. Univariate logistics regression analysis indicated that HCV [OR=64.17; 95% CI (6.42-641.41) p<0.001] and HBV [OR=35.45; 95% CI (3.78-332.35) p=0.002] infection was a significant independent risk factor of acquiring HBV and HCV infection respectively. The commonest causes of ESRD among participants were hypertension (54.5%) and chronic glomerulonephritis (27.3%).

Conclusion: Prevalence rates of the three viral infections studied were high. The likelihood of getting infected with one viral agent as a result of an already existing viral agent was significant. There is therefore an urgent need for the intensification of health education on the occurrence so as to help curb a possible escalation of the viral infection in the general population.

Annals of Medical Laboratory Science (2022) 2(1), 42 - 51

Keywords: End stage renal disease, viral infections, hemodialysis, co-infection

INTRODUCTION

Viral infection is an important cause of morbidity and mortality among end stage renal disease (ESRD) patients who are undergoing haemodialysis as a form of renal replacement therapy (Saha & Agarwal, 2001). End stage renal disease (ESRD)

https://doi.org/10.51374/annalsmls.2022.2.1.0057

patients undergoing haemodialysis are found to be at a higher risk of acquiring viral infections such as hepatitis B (HBV), hepatitis C (HCV) and human immunodeficiency virus (HIV) (Malhorta *et al* 2016). These viral infections also present challenges in the management of ESRD patients as they predispose both patients and health workers to the risk of acquiring an infection.

The development of co-infection of HBV and HCV is common due to the similarities in their mode of transmission (Liu & Hou, 2006). Patients with a co-infection of HBV and HCV develop severe clinical presentations and an infrequent response to interferon alpha treatment (Sagnelli et al., 2002). Frequent and multiple exposure to blood, blood products and prolonged vascular exposure puts patients at a further risk of acquiring these infections (Alashek *et al.,* 2012).

ESRD patients have been found to be at higher risk of HBV and HCV infection than the general population due to exposure to contaminated dialysis parts and also the frequent blood transfusions that ESRD patients require (Alashek *et al*., 2012). HBV and HCV infections among patients on dialysis means extra health complications for the already burdened individual due to their immunocompromised state. These infections are of great concern to the welfare of ESRD due to the damage they cause to the liver in the form of cirrhosis and hepatocellular carcinoma (Kim *et al*., 2016). Despite these risks, and in spite of the increasing dialysis centres in Ghana there is no study accessing the prevalence of HBV and HCV among haemodialysis patients. Also, all the studies reviewed in the sub-region considered only viral hepatitis B and C or HIV and not the co-infection between the three. Consequently, we sought to determine the prevalence of viral hepatitis (HBV and HCV) and HIV, as well as the various determinants of viral infections among ESRD patients undergoing haemodialysis.

MATERIALS AND METHODS

Study Design/Study Area

This retrospective hospital-based study was conducted from January to June 2018 at Cape Coast Teaching Hospital (CCTH). Cape Coast is the capital of the Central Region and has a population of 169,894 according to the 2010 census. Majority of people in Cape Coast are professionals, students, traders and fisherfolks. The Cape Coast Teaching Hospital is the largest hospital in the region and the only one with a dialysis centre. The dialysis centre has the second greatest population of dialysis patients in Ghana with a total of 68 patients as of December 2016 (Tannor *et al*., 2018). The study population was individuals suffering from end stage renal disease who underwent haemodialysis at the CCTH for at least, the past three (3) years (2015-2018).

Selection of Participants/ Eligibility Criteria

The study involved analysis of already existing data of 90 ESRD patients who underwent haemodialysis at CCTH during the past three years (2015-2018). Selection of the participants was non-randomized. All ESRD patients who underwent dialysis at CCTH during the years under review were eligible for the study. There was no exclusion criteria in this study.

Ethical Considerations

The study was approved by the Ethical Review Committee of the Cape Coast Teaching Hospital (CCTHERC/EC/2018/13). The approval letter was sent to the appropriate officials at the Renal Centre for further approval and clearance. Confidentiality was ensured by using initials and batch numbers in representing participants instead of names. Due to the highly sensitive nature of the data collected, care was taken to protect the database at all times.

Data Collection Basic Demographic Characteristics

The study made use of secondary data. Demographic characteristics such as age, gender, occupation and geographical location were collected from the entry records at the dialysis centre for each participant included in the study. A spreadsheet protocol from Microsoft Office Excel was created to aid in the collection of these data. Some additional information was obtained orally

https://doi.org/10.51374/annalsmls.2022.2.1.0057

from the nurses and staff at the dialysis centre.

Collection of clinical data

Clinical data was obtained from the patients' records (folder) issued by the hospital for each patient coming for dialysis upon admission to the hospital. The clinical data sought after in this study was primarily the viral infection history of each participant. These include history of hepatitis B surface antigen testing (HBsAg), anti-hepatitis C virus antibodies (anti-HCV) and human immuno-deficiency virus (HIV). Patients at the dialysis centre

Table 1: General characteristics of study participants

Variable	Total, n = 89	Male, n = 59	Female, n = 30	p-value
Age				
<20	2 (2.2)	0 (0.0)	2 (100.0)	0.266
20-39	33 (37.1)	22 (66.7)	11 (33.3)	
40-59	45 (50.6)	30 (66.7)	15 (33.3)	
≥60	9 (10.1)	7 (77.8)	2 (22.2)	
Occupation				
Unemployed	12 (13.5)	7 (58.3)	5 (41.7)	0.185
Formal	10 (11.2)	9 (90.0)	1 (10.0)	
Informal	47 (52.8)	27 (57.4)	20 (42.6)	
Retired	8 (9.0)	7 (87.5)	1 (12.5)	
Students	12 (13.5)	9 (75.0)	3 (25.0)	
Marital Status				
Single	23 (25.8)	15 (65.2)	8 (34.8)	0.081
Married	61 (68.5)	42 (68.9)	19 (31.1)	
Divorced	2 (2.2)	2 (100.0)	0 (0.0)	
Widowed	3 (3.4)	0 (0.0)	3 (100.0)	
Hepatitis B Virus (HBV)				
Negative	78 (87.6)	50 (64.1)	28 (35.9)	0.322
Positive	11 (12.4)	9 (81.8)	2 (18.2)	
Hepatitis C Virus (HCV)				
Negative	83 (93.3)	53 (63.9)	30 (36.1)	0.093
Positive	6 (6.7)	6 (100.0)	0 (0.0)	
HIV/AIDS				
Non-Reactive	84 (94.4)	54 (64.3)	30 (35.7)	0.163
Reactive	5 (5.6)	5 (100.0)	0 (0.0)	
History of transfusion				
Yes	56 (62.9)	39 (69.6)	17 (30.4)	0.487
No	33 (37.1)	20 (60.6)	13 (39.4)	
Average dialysis sessions/month				
1 - 3	34 (38.2)	19 (55.9)	15 (44.1)	0.028
4 - 6	40 (44.9)	26 (65.0)	14 (35.0)	
7 - 9	15 (16.9)	14 (93.3)	1 (6.7)	
Duration of dialysis treatment/month				
1 - 5	56 (62.9)	39 (69.6)	17 (30.4)	0.178
6 - 10	7 (7.9)	6 (85.7)	1 (14.3)	
11 - 15	12 (13.5)	7 (58.3)	5 (41.7)	
16 - 20	7 (7.9)	2 (28.6)	5 (71.4)	
>20	7 (7.9)	5 (71.4)	2 (28.6)	
Visits to other dialysis centers				
Yes	10 (11.2)	8 (80.0)	2 (20.0)	0.485
No	79 (88.8)	51 (64.6)	28 (35.4)	

Results were presented as frequency (%); Categorical variables compared using Chi-square test. Significant at P<0.05

https://doi.org/10.51374/annalsmls.2022.2.1.0057

undergo monthly serology testing and the findings recorded in their records folders were the source of the data for viral infection history. These data were collected for each participant and recorded against their basic demographic characteristics.

Underlying cause of the ESRD was a very important class of data obtained for the purpose of this study. This information was obtained from the records entry book at the dialysis clinic. This was entered into the database created using Microsoft Office Excel. History of blood transfusion was also obtained from the record of each participant through the transfusion record slips issued by the blood bank.

Other data collected included the total duration of dialysis treatment for each participant. This was obtained from the officials at the CCTH Renal Centre. All of this information was collected for the purpose of estimating any association between these parameters and viral infection.

Data Analysis

Initial entry and organizing of data were done using Microsoft Office 2016 Excel Spreadsheet. The data entry and analyses were performed using IBM Statistical Package for Social Science (SPSS), Version 17. Descriptive statistics including total frequency and charts were used. Multinomial logistic regression was used to test the associations of the determinants. P value less than 0.05 was considered significant.

RESULTS

Table 1 shows the general characteristics of study participants. The mean age of the study participants was 41.3±13.8 years, with no significant difference in the ages of males and females (p=0.358). All characteristics were similar among all participants apart from number of dialysis sessions which was relatively high in females than in males (except 7-9 sessions which was higher in males than in females (p>0.05).

The prevalence of various infections among study participants is illustrated in Figure 1. Hepatitis B infection was prevalent in 12.4% of the participants with HCV and HIV being present in 6.7% and 5.6% respectively. HBV and HCV coinfection was present in 5.6% of the participants.

Table 2 shows a logistic regression of factors associated with HBV infection among participants. Testing positive for HCV were significant determinants of HBV infection (p<0.001).

Table 3 shows a logistic regression of factors associated with hepatitis C infection among participants. Other demographic, clinical and biochemical characteristics were all not significant determinants of HCV infection.

Logistic regression of factors associated with HIV among participants is presented in Table 4. Participants who were married (OR=1.615), had more than 20 months duration on dialysis (OR=1.812), had 7-9 dialysis sessions per month (OR=2.308) and were also insignificantly more likely to have HIV infection (p>0.05). Demographic, biochemical and clinical characteristics were all insignificant determinants of HIV infection.

The primary cause of dialysis and type of kidney abnormality in relation to HBV, HCV and HIV positivity is presented in Table 5. The commonest primary cause of dialysis among the participants positive for Hepatitis B was hypertension (54.5%).

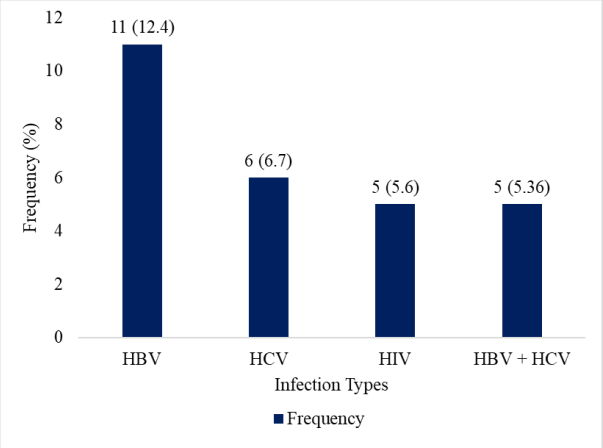

Figure 1: Prevalence of various infections among study participants

https://doi.org/10.51374/annalsmls.2022.2.1.0057

Among the HCV positive participants, most had hypertension as primary cause.

DISCUSSION

This study estimated the prevalence rate of HBV, HCV and HIV among ESRD patients undergoing haemodialysis at the Cape Coast Teaching Hospital. Of the 89 participants studied, the prevalence of HBV, HCV and HIV were 11(12.4%), 6(6.7%) and 5(5.6%) respectively. Majority of the ESRD patients

Table 2: Logistic regression of factors associated with Hepatitis B infection among participants

Variable	Hepatitis B Positive	OR (95% CI)	p-value
Total	11 (12.4)		
Age (years)			
<20	0 (0.0)	1.0	
20-39	1 (3.0)	0.14 (0.00-5.04)	0.281
40-59	10 (22.2)	0.89 (0.03-23.44)	0.943
≥60	0 (0.0)	0.16 (0.00-11.42)	0.398
Sex			
Male	9 (15.3)	2.52 (0.51-12.49)	0.260
Female	2 (6.7)	1.0	
Occupation			
Unemployed	0 (0.0)	0.31 (0.01-8.31)	0.483
Formal	3 (30.0)	4.71 (0.41-54.84)	0.216
Informal	7 (14.9)	1.93 (0.21_17.36)	0.559
Retired	0 (0.0)	0.45 (0.02-12.49)	0.638
Students	1 (8.3)	1.0	
Marital Status			
Single	1 (4.3)	1.0	
Married	10 (16.4)	4.31 (0.52_35.78)	0.176
Divorced	0 (0.0)	3.00 (0.09-95.18)	0.533
Widowed	0 (0.0)	2.14 (0.07-63.76)	0.660
HBV			
Negative	6 (7.2) †	1.0	
Positive	5 (83.3)	64.17 (6.42-641.41)	<0.001
HIV			
Non-Reactive	11 (13.1)	1.0	
Reactive	0 (0.0)	0.58 (0.03-11.22)	0.719
History of transfusion			
Yes	7 (12.5)	1.04 (0.28-3.84)	0.958
No	4 (12.1)	1.0	
Average sessions/month			
1 - 3	6 (17.6)	1.0	
4 - 6	4 (10.0)	0.52 (0.13-2.02)	0.343
7 - 9	1 (6.7)	0.33 (0.04-3.05)	0.330
Duration of dialysis treatment/month			
1 - 5	8 (14.3)	1.0	
6 - 10	1 (14.3)	1.00 (0.11-9.44)	1.000
11 - 15	2 (16.7)	1.20 (0.22-6.52)	0.833
16 - 20	0 (0.0)	0.380 (0.02-7.30)	0.521
>20	0 (0.0)	0.38 (0.02-7.30)	0.521
Visits to other dialysis centers			
Yes	0 (0.0)	0.28 (0.02-5.18)	0.395
No	11 (13.9)	1.0	

HCV: Hepatitis C Virus; HIV: Human Immunodeficiency Virus; OR: Odds Ratio; CI: Confidence Interval; †: Statistically significant association

https://doi.org/10.51374/annalsmls.2022.2.1.0057

were males 59(66%) and 39 (33.7%) were females, co -infection of HBV and HCV, represented 5.6% of the total study population and age and hepatitis C positive cases were significant determinants of HBV infection.

Our reported prevalence of HBV and HCV is consistent with known findings from other reports.

Table 3: Logistic regression of factors associated with Hepatitis C infection among participants

Variable	Hepatitis C Positive	OR (95% CI)	p-values
Total	6 (6.7)		
Age (years)			
<20	0 (0.0)	1.0	
20-39	1 (3.0)	0.22(0.01-7.05)	0.395
40-59	5 (11.1)	0.60 (0.03-14.28)	0.755
≥60	0 (0.0)	0.26 (0.00-16.86)	0.529
Sex			
Male	6 (10.2)	6.67 (0.36-122.26)	0.201
Female	0 (0.0)	1.0	
Occupation			
Unemployed	0 (0.0)	1.0	
Formal	2 (20.0)	5.95 (0.26-138.26)	0.266
Informal	3 (6.4)	1.84 (0.09-38.05)	0.693
Retired	0 (0.0)	1.47 (0.03-81.56)	0.851
Students	1 (8.3)	3.00 (0.11-80.96)	0.514
Marital Status			
Single	1 (4.3)	1.0	
Married	5 (8.2)	1.89 (0.21-17.01)	0.572
Divorced	0 (0.0)	3.13 (0.10-99.30)	0.517
Widowed	0 (0.0)	2.24 (0.08-66.53)	0.642
HCV			
Negative	1 (1.3) †	1.0	
Positive	5 (45.5)	35.45 (3.78-332.35)	0.002
HIV			
Non-Reactive	6 (7.1)	1.0	
Reactive	0 (0.0)	1.18 (0.06-23.81)	0.913
History of transfusion			
Yes	5 (8.9)	2.95 (0.33-26.32)	0.333
No	1 (3.0)	1.0	
Average sessions/month			
1 - 3	2 (5.9)	1.0	
4 - 6	4 (10.0)	1.70 (0.29-9.86)	0.554
7 - 9	0 (0.0)	0.45 (0.02-9.83)	0.608
Duration of dialysis treatment/month			
1 - 5	4 (7.1)	1.0	
6 - 10	0 (0.0)	0.84 (0.04-17.14)	0.908
11 - 15	2 (16.7)	2.33 (0.38-14.23)	0.358
16 - 20	0 (0.0)	0.84 (0.04-17.14)	0.908
>20	0 (0.0)	0.84 (0.04-17.14)	0.908
Visits to other dialysis centers			
Yes	1 (10.0)	1.58 (0.17-14.92)	0.690
No	5 (6.3)	1.0	

HCV: Hepatitis C Virus; HIV: Human Immunodeficiency Virus; OR: Odds Ratio; CI: Confidence Interval; †: Statistically significant association

https://doi.org/10.51374/annalsmls.2022.2.1.0057

In our study, the prevalence of HBV among participants was 12.4% which is high compared to the 1.5% by Malhotra *et al.,* (2016) in a retrospective study report in North India demonstrated. Also, Reddy *et al.* (2005) reported 1.4% prevalence of HBV in India. However, Malhotra *et al.,* (2016) and Alashek *et al.,* (2012) in Libya recorded 33.5% and 31.1% of their participants to be infected with

Table 4: Logistic regression of factors associated with HIV among participants

Variable	HIV - Reactive	OR (95% CI)	p-value
Total	5 (5.6)		
Age (years)			
<20	0 (0.0)	1.0	
20-39	1 (3.0)	0.23 (0.01-7.27)	0.405
40-59	4 (8.9)	0.54 (0.02-13.15)	0.707
≥60	0 (0.0)	0.26 (0.00-16.86)	0.529
Sex			
Male	5 (8.5)	6.16 (0.33-115.15)	0.224
Female	0 (0.0)	1.0	
Occupation			
Unemployed	0 (0.0)	1.0	
Formal	0 (0.0)	1.19 (0.02-65.32)	0.932
Informal	4 (8.5)	2.59 (0.13-51.36)	0.533
Retired	0 (0.0)	1.47 (0.03-81.56)	0.851
Students	1 (8.3)	3.26 (0.12-88.35)	0.483
Marital Status			
Single	1 (4.3)	1.0	
Married	4 (6.6)	1.54 (0.16-14.59)	0.705
Divorced	0 (0.0)	3 (0.09-95.18)	0.533
Widowed	0 (0.0)	2.14 (0.07-63.76)	0.660
HCV			
Negative	5 (6.4)	1.0	
Positive	0 (0.0)	0.58 (0.03-11.22)	0.719
HIV			
Non-Reactive	5 (6.0)	1.0	
Reactive	0 (0.0)	1.10 (0.05-22.13)	0.951
History of transfusion			
Yes	2 (3.6)	0.37 (0.06-2.34)	0.291
No	3 (9.1)	1.0	
Average sessions/month			
1 - 3	2 (5.9)	1.0	
4 - 6	1 (2.5)	0.410 (0.04-4.73)	0.475
7 - 9	2 (13.3)	2.46 (0.31-19.38)	0.392
Duration of dialysis treatment/month			
1 - 5	4 (7.1)	1.0	
6 - 10	0 (0.0)	0.78 (0.04-15.94)	0.870
11 - 15	0 (0.0)	0.47 (0.02-9.24)	0.617
16 - 20	0 (0.0)	0.78 (0.04-15.94)	0.870
>20	1 (14.3)	2.17 (0.221-22.67)	0.519
Visits to other dialysis centers			
Yes	0 (0.0)	0.65 (0.03-12.53)	0.772
No	5 (6.3)	1.0	

HCV: Hepatitis C Virus; HIV: Human Immunodeficiency Virus; OR: Odds Ratio; CI: Confidence Interval; †: Statistically significant association

https://doi.org/10.51374/annalsmls.2022.2.1.0057

Table 5: Primary cause of dialysis and type of kidney abnormality in relation to HBV, HCV and HIV positivity

Variable	HBV-Positive, n = 11	HCV-Positive, n = 6	HIV-Positive, n = 5
Primary Cause			
Renal abnormalities	2 (18.2)	1 (16.7)	-
HIV	-	-	5 (100.0)
HPT	6 (54.5)	3 (50.0)	-
DM/HPT	1 (9.1)	1 (16.7)	-
HBV	1 (9.1)	1 (16.7)	-
DM	-	-	-
Intravascular haemolysis/Sepsis	-	-	-
Obstructive uropathy	-	-	-
SCD	-	-	-
Sepsis	1 (9.1)	-	-
Severe cerebral malaria	-	-	-
Uraemic Encephalopathy	-	-	-
Type of renal abnormality			
Unknown	4 (36.4)	1 (16.7)	3 (60.0)
AKI	1 (9.1)	-	1 (20.0)
CGN	3 (27.3)	3 (50.0)	1 (20.0)
Glomerulosclerosis	2 (18.2)	2 (33.3)	-
Adult Polycystic kidney disease	1 (9.1)	-	-

HBV: Hepatitis B virus, HCV: Hepatitis C virus, HIV: Human Immunodeficiency Virus, HPT: Hypertension, DM: Diabetes mellitus, SCD: Sickle Cell Disease, AKI: Acute Kidney Injury, CGN: Chronic Glomerulonephritis.

HCV respectively which is at variance with the 6.7% we observed. These discrepancies could be as a result of different diagnostic methods employed and their degrees of sensitivity to antigens and antibodies as well as different settings, expertise of the professional performing the test and sample size. In our study, the serum of each participant was analyzed for HbsAg using a one-step HbsAg test strip and rapid anti-HCV test strip for the detection of anti-HCV antibodies. However, in the study by Reddy *et al.*, (2005), Malhotra *et al.*, (2016) and Alashek *et al.*, (2012) testing of participants' serum was done by ELISA methods.

The prevalence of HIV (5.6%) recorded in our study is high compared to the 1.15% reported in Spain (Barril et al., 2005) and the no HIV cases reported in Iraq (Ibrahim et al, 2017). Ibrahim *et al.*, (2017) attributed the no case of HIV infection to rarity of HIV infections in the region. The prevalence of HIV in our study however, is low compared to the 10.4% reported by Meremo *et al.*, (2017) in Tanzania. The disparities between these studies could be due to the difference in prevalence of HIV infections in these countries. According to WHO, the prevalence of HIV in Iraq is currently less than 0.1% of the population whiles the Ghana AIDS commission estimates the prevalence of HIV in Ghana to be 1.18%. Also, Tanzania has an HIV prevalence of 5.1% (Mpondo *et al.*, 2017).

Coinfection is high among the chronic kidney disease (CKD) patients and this could be due to the high frequency of transfusions of blood/blood products and extracorporeal circulation during haemodialysis (Malhotra *et al.*,2016). The prevalence of HCV and HBV coinfection reported from this study is 5.6% which is at variance with studies of Malhotra e*t al.*, (2016), Alashek *et al.*, (2012), Duong *et al.*, (2015), who recorded 0.8% in North India, 1.2% in Libya and 1% in Vietnam in Southeastern Asia respectively. The varying prevalence of coinfection from the studies could have resulted from the different setting and sample size. However, there was no coinfection of all three infections (HBV, HCV, HIV), a possible reason for which

most studies conducted failed to report on same.

Our study is limited by the small sample size as well as the use of rapid diagnostic test kits for HBV, HCV and HIV. Also, we did not assess whether the participants acquired HBV, HCV and HIV before starting haemodialysis.

CONCLUSION

Risk of being infected with HBV, HCV and HIV is high among ESRD patients undergoing haemodialysis due to frequent exposure to blood and blood products. This study highlights the need for preventive and control measures such as HbsAg vaccination of HBV negative haemodialysis patients and regular screening for those on haemodialysis to determine unit transfer of infections early and stringent screening of the blood and blood products as well as regularly assessing the liver functions of these patients.

COMPETING INTEREST

Authors declare that they have no competing interests.

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