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Duration of dialysis increases risk of hepatitis C virus infections among hemodialysis patients in Anambra state, Nigeria

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ABSTRACT

BACKGROUND

Sexually transmitted infections and syphilis are a major public health concern. Hemodialysis patients are at an increased risk of acquiring hepatitis B virus (HBV) and hepatitis C virus (HCV) infection. The aim of this study was to determine the seroprevalence of HBV, HCV, syphilis, and the association between these infections and hemodialysis among hemodialysis patients.

METHODS

A cross-sectional study was conducted involving 90 hemodialysis patients. Blood samples were collected and analysed for HBV, HCV and syphilis using immunochromatographic test kits. All subjects completed a questionnaire on demographic characteristics and other risk factors. A chi-square test was used to analyse the data.

RESULTS

The prevalence of HBV, HCV and syphilis infections was 4.4%, 6.7% and 2.2% respectively. Highest prevalence of HBV, HCV and syphilis were found in patients whose duration of dialysis were >1 year, >1 year, and 4 months to 1 year, respectively. Similarly, those who had undergone dialysis for > 10 times had the highest prevalence of these infections. The major risk factor the patients was exposed to was blood transfusion (100%), with those who had been transfused for 5 times having the highest prevalence of HBV and HCV and those transfused twice for syphilis. A significant association was seen between duration of dialysis and HCV infection ($p < 0.05$).

CONCLUSION

This study has demonstrated that duration of dialysis increased HCV infection in hemodialysis patients. The prevalence of HBV, HCV and syphilis in the hemodialysis unit is a warning that universal precautions will be the next challenge for decentralised hemodialysis services.

Keywords: Hepatitis B virus, hepatitis C virus, syphilis, hemodialysis patients

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INTRODUCTION

Hemodialysis, commonly called kidney dialysis or simply dialysis, is a process of purifying the blood of a patient with diseased kidneys. Nigeria has the third highest number (6.3 per million population) of patients on hemodialysis after South Africa and Kenya.⁽¹⁾

It is estimated that one third of the world's population are infected with hepatitis B virus (HBV) and more than 350 million persons have chronic hepatitis C virus (HCV) infection with about three to four million new infections occurring each year, with more than 2 million and 350 thousand people dying yearly from hepatitis B and hepatitis C-related diseases and complications. The highest frequencies however have been reported in the developing countries of sub Saharan Africa such as Nigeria where it is hyperendemic and pandemic.⁽²⁾ Both infections share common means of transmission through contact with infected blood or body fluids. Risk factors for both infections include working in a health care setting, transfusions, dialysis, tattooing, sharing razors or tooth brushes with an infected person, acupuncture, intravenous drug use, and unsafe sex.^(3,4) Both viruses can produce acute (rapid onset) and chronic liver injury, although HCV has greater chances of chronicity and a longer incubation period.⁽⁵⁾

Syphilis is a sexually transmitted infection caused by the bacterium *Treponema pallidum* subspecies *pallidum*. Syphilis has been known as "the great imitator" as it may cause symptoms similar to many other diseases.⁽⁶⁾ Approximately 90% of all syphilis is sexually transmitted and can also be transmitted through infected blood and blood products (blood transfusion). In 2013, syphilis infected about 315,000 people.⁽⁷⁾

Hepatitis B and hepatitis C virus and syphilis infections may occur in patients with end-stage renal disease on renal replacement therapy (dialysis and/or transplantation). The prevalence of HBV and HCV infection among hemodialysis cases is high and varies between countries. A major risk factor for HBV and HCV

is nosocomial routes of transmission which includes the use of contaminated equipment and patient to patient exposure.

A study among hemodialysis patients showed that the risk factors for HCV included blood transfusion, multiple visits to different hemodialysis units and frequency of hemodialysis.⁽⁸⁾ Another study showed that risk factors for HCV infection were dialysis duration, blood transfusion, and attending more than one dialysis unit. HBV infection was independently associated with age, family member with hepatitis infection, gender, and surgery.⁽⁹⁾ A systematic review and meta-analysis showed that duration and frequency of dialysis and exposure to blood transfusions were the most commonly reported risk factors for HCV infection among hemodialysis patients in the Middle East and North Africa.⁽¹⁰⁾ However, a study among 104 hemodialysis patients showed no association between blood transfusion and duration of hemodialysis with HBV and HCV infections.⁽¹¹⁾

A negative impact of HBV and HCV infection on survival after renal transplantation has been linked to extrahepatic complications, including chronic glomerulonephritis, sepsis, chronic allograft nephropathy, post-transplantation diabetes mellitus, and abnormal metabolism of calcineurin-inhibitors.⁽¹²⁾

This study was not just aimed at determining the seroprevalence of syphilis, hepatitis B and C but also determine the risk factors that predisposed these subjects undergoing dialysis to these infections.

METHODS

Study sites

The study was carried out at Nnamdi Azikiwe University Teaching Hospital (NAUTH), St. Charles Borromeo Specialist Hospital, Onitsha and Iyien Mission Hospital, Ogidi, all being located in Anambra State, South eastern Nigeria. These are hospitals with well-equipped hemodialysis units.

Research design

A cross-sectional study was conducted among hemodialysis patients in some hospitals in Anambra State. The study was conducted between February and July 2016.

Study subjects

A total of 90 subjects (both male and females) undergoing hemodialysis in the three selected hospitals within the stipulated time were consecutively recruited for the study based on voluntarism of the patients. Both male and female adult individuals undergoing hemodialysis were included in the study. However, subjects with renal disease but not undergoing hemodialysis were excluded.

Data collection

A close-ended questionnaire was used to collect relevant socio-demographic data and other information such as duration and number of dialysis, history of blood transfusion and other possible risk factors.

Specimen collection

Three millilitres of whole blood sample was collected from each of the subjects with a sterile syringe through vene-puncture. It was dispensed into a plain container and was allowed to clot and centrifuged to separate the serum. This sample was screened for HBV, HCV and syphilis infections.

Laboratory analysis

Hepatitis B assay was performed using HBV one-step lateral rapid immunochromatographic strip test. The pouch was brought to room temperature and opened to remove the test strip. The test strip was then immersed vertically in the serum with arrows pointing downwards for 10-15 seconds, making sure that the maximum (MAX) line on the test strip was not exceeded. The strip was placed on a non-absorbent flat surface and the result read at 15 minutes. The test was read positive when two distinct red lines appear, one on the control

region and the other on the test region. The test was read negative when only one red line appears on the control region. The test was recorded as invalid when the control line failed to appear. A procedural control is included in the test. A coloured line appearing in the control region (C) is the internal procedural control. It confirms sufficient specimen volume and correct procedural technique. Hepatitis C assay was performed using HCV test strip. Also, positive and negative hepatitis C virus sera were used to pre-control batches of the test strips so as to ascertain the workability of the strips. Syphilis assay was performed using syphilis ultra-rapid test strip. The test was read positive when two distinct red lines appear, one on the control region and the other on the test region. The test was read negative when only one red line appears on the control region.

Data analysis

The results obtained from the study were presented in tables and subjected to statistical analysis using Statistical Package for Social Science [SPSS] version 20. Chi square was used to analyse associations between variables. A $p < 0.05$ was considered statistically significant.

Ethical clearance and informed consent

Ethical approval was obtained from the Nnamdi Azikiwe University Teaching Hospital Ethics Committee (NAUTH/CS/66/VOL9/65) and written permissions were obtained from the Medical Directors of the other hospitals. Also, informed consent of the individuals was obtained.

RESULTS

Of the 90 subjects recruited, 52 (57.8%) were males, and 26 (28.9%) were single. Also, 26 (28.9%) were aged between 20-30 years, and 49 (54.4%) obtained secondary education. And out of the 90 subjects, 90 (100%) were transfused with blood, 8 (8.9%) had previous infection, 13 (14.4%) had history of HBV vaccine, 5 (5.6%) had multiple sex partners in the past while 6

Table 1. Socio-demographic parameters and risk factors of the hemodialysis subjects (n=90)

Socio-demographic parameters	n	%
Marital Status		
Married	64	71.1
Single	26	28.9
Educational Status		
Primary	13	14.4
Secondary	49	54.4
Tertiary	28	31.1
Age groups (years)		
20 – 30	26	28.9
31 – 40	16	17.8
41 – 50	20	22.2
51 – 60	15	16.7
>60	13	14.4
Gender		
Male	52	57.8
Female	38	42.2
Risk factors		
Blood transfusion		
Yes	90	10.0
No	0	0.0
Previous infection (HBV, HCV or syphilis)		
Yes	8	8.9
No	82	91.1
Family history of infection (HBV, HCV or syphilis)		
Yes	5	5.6
No	85	94.4
HBV vaccine history		
Yes	13	14.4
No	77	85.6
Multiple sex partner		
Yes	5	5.6
No	85	94.4
Unprotected sex		
Yes	6	6.7
No	84	93.3
Sharing personal items		
Yes	4	4.4
No	86	95.6

Table 2. Sero-prevalence of hepatitis B and C virus and syphilis infections among hemodialysis patients

Infection/Co-infection	Positive (n, %)	Negative (n, %)
Hepatitis B virus	4 (4.4)	86 (95.6)
Hepatitis C virus	6 (6.7)	84 (93.3)
Syphilis	2 (2.2)	88 (97.8)
HBV / HCV	1 (1.1)	89 (98.9)
HBV/HCV/Syphilis	0 (0.0)	90 (100.0)

(6.7%) and 4 (4.4%) were seen to be having unprotected sex and sharing of personal items respectively (Table 1).

Four (4.4%) subjects were positive for HBV, 6 (6.7%) were positive for HCV while 2 (2.2%) were positive for syphilis infection. However, only 1(1.1%) subject tested positive for HBV and C co-infection but there was no case of co-infection between the two viruses and syphilis infection (Table 2).

Table 3 shows that 7.7% (2) of the subjects from the age range of 20-30 years was positive for HBV. Similarly, 15.4% (2) of the subjects from the age ranges of 51-60 years and greater than 60 years was positive for HCV. However, 12.5% (2) of the subjects from the age range of 31-40 years were positive for syphilis. Chi-square analysis showed that there was no statistically significant association between HBV, HCV, syphilis and age ($p>0.05$).

Table 4 shows that 18.2% (2) of the subjects with duration of dialysis greater than 1 year was positive for HBV. Similarly, 36.4% (4) of the subjects with duration of dialysis greater than 1 year was positive for HCV. Interestingly, chi-square analysis showed a significant statistical association between HCV and duration of dialysis ($p<0.05$). However, there was no statistically significant association between HBV, syphilis and duration of dialysis ($p>0.05$). There was no statistically significant association between HBV, HCV, syphilis and number of blood transfusions. And there was no statistically significant association between HBV, HCV, syphilis and number of dialyses.

DISCUSSION

Hepatitis B virus, HCV and syphilis infections are important causes of morbidity and mortality in hemodialysis patients and pose problems in the management of the patients in renal dialysis units. Hemodialysis patients may likely be at high risk for hepatitis viral infections due to the high number of blood transfusions and the potential for exposure to infected patients and contaminated equipment.

Table 3. Seroprevalence of hepatitis B and C virus and syphilis infections based on age groups of hemodialysis subjects

Age group (years)	HBV			HCV			Syphilis		
	+ve	-ve	p value	+ve	-ve	p value	+ve	-ve	p value
20-30 (n=26)	2 (7.7)	24 (92.3)	0.476	0 (0.0)	26 (100)	0.690	0 (0.0)	26 (100)	0.822
31-40 (n=16)	0 (0.0)	16 (100)		2 (12.5)	14 (87.5)		2 (12.5)	14 (97.4)	
41-50 (n=20)	1 (5.0)	19 (95.0)		1 (5.0)	19 (95)		0 (0.0)	20 (100)	
51-60 (n=15)	1 (6.7)	14 (93.3)		1 (6.7)	14 (93.3)		0 (0.0)	15 (100)	
>60 (n=13)	0 (0.0)	13 (100)		2 (15.4)	11 (84.6)		0 (0.0)	13 (100)	

p-value is significant if ($p < 0.05$) ; +ve = positive; -ve= negative

In our present study, a prevalence of HBV, HCV and syphilis infections among the hemodialysis patients was observed with values of 4.4%, 6.7% and 2.2% respectively. The prevalence of HBV, HCV and syphilis infections among hemodialysis patients is high and varies between countries (2% to 60%) and between dialysis units within a single country.⁽¹³⁾

The prevalence of HBV (4.4%) among hemodialysis patients obtained in our study is lower than the prevalence of 34.9% in Libya⁽¹⁴⁾ and 7.0% in China,⁽¹⁵⁾ but higher than that reported in India which is 1.4%.⁽¹⁶⁾ Moreover the prevalence of HCV (6.7%) among hemodialysis patients obtained is lower than the prevalence of 31.1% in Libya⁽¹⁴⁾ and 15% in North-Eastern Nigeria,⁽¹⁷⁾ but higher than the 6.1% reported in China,⁽¹⁵⁾ while the prevalence of syphilis (2.2%) among hemodialysis patients is lower than the prevalence of 4.5% in France.⁽¹⁸⁾

Hepatitis B virus and HCV share a common route of transmission and can coexist with each other. Hepatitis B virus and HCV co-infection prevalence of 1.1% among hemodialysis patients in our study is lower than that reported in India of 3.7%.⁽¹⁶⁾ There was no case of co-infection between the two viruses and syphilis in this study. And another study found that out of the total 262 patients, 88 (33.5%) were found to be having HCV infection, 4 (1.5%) were found to be positive for HBV infection and dual infection was observed in 2 (0.8%) patients.⁽¹⁷⁾

The result obtained showed that infection can occur at any age. However, the age of 20-30 years recorded the highest percentage frequency

of occurrence at 7.7% for HBV, while for HCV the age of >60 years recorded the highest percentage (15.4%) and for syphilis the age group of 31-40 years had the highest percentage (12.5%). In contrast to our own finding, Ummate et al.⁽¹⁸⁾ reported that individuals aged 40-49 years had the highest prevalence of HCV with an infection rate of 6% in their own study, however this could be due to geographical differences as theirs was carried out in the North-Eastern part of Nigeria.

There was a significant association between duration of dialysis and HCV infection. A systematic review and meta-analysis showed similar results that among patients who were under hemodialysis for more than 5 years the prevalence of hepatitis C was higher than those who were treated for a shorter time period.⁽¹⁸⁾ It was observed that individuals with longer duration of dialysis of >1 year had the highest prevalence of hepatitis B and C virus at a rate of 18.2% and 36.4% respectively while the prevalence of syphilis was seen highest at 5% with patients that have undergone dialysis for 4 months to 1 year. Similarly, this study noted that individuals with the highest number of blood transfusions (5 times) had the highest prevalence of HBV and HCV infection. Also, the result showed that patients who were dialysed for more than 10 times had the highest prevalence of HBV, HCV and syphilis infections.

In other words, this research noted blood transfusion, duration of dialysis, and number of times dialysis was done as common possible risk factors of transmission of HBV, HCV and

Table 4: Seroprevalence of hepatitis B and C virus and syphilis infections based on duration of dialysis, number of blood transfusions and number of dialyses

	HBV			HCV			Syphilis		
	+ve	-ve	p value	+ve	-ve	p value	+ve	-ve	p value
Duration of dialysis									
<1 month (n=34)	0 (0.0)	34 (100)	0.090	1 (2.9)	33 (97.1)	0.000	0 (0.0)	34 (100)	0.553
1-3 months (n=25)	1 (4.0)	24 (96)		0 (0.0)	25 (100)		1 (4.0)	24 (96.0)	
4 months-1 year (n=20)	1 (5.0)	19 (95.0)		1 (5.0)	19 (95.0)		1 (5.0)	19 (95.0)	
>1 year (n=11)	2 (18.2)	9 (81.8)		4 (36.4)	7 (63.6)		0 (0.0)	11 (100)	
Number of blood transfusions									
Once (n=5)	0 (0.0)	5 (100)	0.174	0 (0.0)	5 (100)	0.151	0 (0.0)	5 (100)	0.546
Twice (n=36)	0 (0.0)	36 (100)		1 (2.8)	35 (97.2)		2 (5.6)	34 (94.4)	
Thrice (n=27)	1 (3.7)	26 (96.3)		2 (7.4)	25 (92.6)		0 (0.0)	27 (100)	
4 times (n=8)	1 (6.7)	7 (93.3)		0 (0.0)	8 (100)		0 (0.0)	8 (100)	
5 times (n=14)	2 (14.3)	12 (85.7)		3 (21.4)	11 (78.6)		0 (0.0)	14 (100)	
Number of dialyses									
1-3 times (n=25)	0 (0.0)	25 (100)	0.442	1 (4.4)	24 (96.0)	0.092	0 (0.0)	25 (100)	0.664
4-6 times (n=30)	1 (3.3)	29 (96.7)		1 (3.3)	29 (96.7)		1 (3.3)	29 (96.7)	
7-10 times (n=13)	1 (7.7)	12 (92.3)		0 (0.0)	13 (100)		0 (0.0)	13 (100)	
>10 times (n=22)	2 (9.1)	20 (90.9)		4 (18.2)	18 (81.8)		1 (4.5)	21 (95.5)	

p-value is significant if (P<0.05) and is not significant if (p>0.05)

+ve = positive

-ve.= negative

syphilis among hemodialysis patients. This is in agreement with the findings by Alashek et al.⁽¹⁴⁾ and Dahmani et al.⁽²⁰⁾ Our finding of a non-statistically significant difference between the risk factors and infection with HBV, HCV and syphilis could be attributed to the limited number of hemodialysis subjects used in this study.

There was a limited number of patients undergoing hemodialysis in the study sites. The need for adequate precautions in handling hemodialysis subjects is evident from this study and mandatory pre-screening for syphilis, hepatitis B and C may be necessary for hemodialysis patients to ensure a holistic management of infected patients. It is therefore recommended that appropriate screening of blood before transfusion to hemodialysis patients should be done. Also, hemodialysis patients should undergo appropriate screening before dialysis and infected patients should be handled with care to avoid cross-infections among patients and staff. Further studies will focus on how these infections influence the clinical outcome of renal disease patients.

CONCLUSION

Among dialysis patients, longer duration of dialysis, higher number of blood transfusions, and increased number of dialysis times constituted the major risk factors for HBV, HCV and syphilis infection.

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CONFLICT OF INTEREST

The authors declare that no conflict of interest exists in this study.

CONTRIBUTORS

OCO contributed to the research design, statistical and laboratory analysis as well as manuscript preparation, ACA contributed to the design, did the literature search, wrote proposal and carried out laboratory analysis while OCO and ACA played a role in interpretation, manuscript editing and review. All authors have read and approved the final manuscript. 

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