

*Research article***Prevalence rates of HIV, HBsAg and HCV co-infections among tuberculosis patients in Sokoto Metropolis, Northwest Nigeria**M Imoru¹, A Bala¹, AH Marafa²*Sri Lankan Journal of Infectious Diseases 2018 Vol.8 (2):84-92*DOI: <http://dx.doi.org/10.4038/sljid.v8i2.8219>**Abstract**

Introduction and Objectives: Tuberculosis (TB) and viral hepatitis are global health problems which are common in developing and undeveloped countries. The current study was aimed at determining the prevalence and co-infections of HIV, HBsAg and HCV among patients with tuberculosis in Sokoto, Northwest Nigeria.

Methods: A cross-sectional study was conducted on a total of 276 patients with tuberculosis, aged 19-60 years at Usmanu Danfodiyo University Teaching Hospital, Sokoto and Specialist Hospital, Sokoto between May and November 2015. Blood samples collected were screened for HIV, HBsAg and HCV using immunochromatographic techniques.

Results: The prevalence rates of HIV, HBsAg and HCV among TB patients were 16.3%, 14.9% and 5.4%, respectively while the prevalence of co-infections HIV-HBsAg, HIV-HCV, HBsAg-HCV and HIV-HBsAg-HCV in TB patients were 50.7%, 1.81%, 2.9% and 1.45%, respectively. Prevalence of HIV and HCV showed no relationship with age ($P=0.240$ and 0.987 , respectively) but prevalence of HBsAg was associated with age ($P=0.0304$). There were no relationships of frequencies of HIV, HBsAg and HCV with gender.

Conclusion and Recommendations: The study showed high prevalence rates of HIV, HBsAg and HIV-HBsAg co-infections among patients with tuberculosis in Sokoto, while age and gender showed little or no association. HIV and HBsAg tests are recommended for every patient diagnosed with tuberculosis to guide therapeutic decisions.

Keywords: Prevalence, Viral infections, Tuberculosis patients, Sokoto metropolis

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Introduction

Tuberculosis (TB) remains a leading health problem in both developing and developed countries¹ and it is caused by *Mycobacterium tuberculosis* complex.² The World Health Organization (WHO) estimated 8.6 million new cases of TB in 2012 and 1.3 million deaths³ while two billion people have been reported to be affected worldwide with a global incidence of 219/100,000 and death rate of 25/100,000.^{4,5} Nigeria has been ranked 10th among the 22 high TB burden countries of the world and the fourth highest in Africa (after South-Africa, Ethiopia and DR Congo).⁶

The World Health Organization (WHO) estimated approximately 240 million people worldwide as being chronically infected with hepatitis B virus (HBV)⁷ while areas of high prevalence are similar to the global TB epidemiological ‘hotspots’ and these include Sub-Saharan Africa and South Asia, where the prevalence is estimated to be between 8 and 20%.⁸

Human immuno-deficiency virus (HIV) infection increases the risk of TB 20 fold compared with HIV seronegative individuals in high HIV-prevalence countries.⁹ The HIV epidemic increased the number of TB cases in countries with a high prevalence of HIV infection starting in the late 1980s, with a 3-fold increase in the number of TB case notifications over the decade, particularly in Sub-Saharan Africa.¹⁰ Worldwide, 14.8% of TB patients have HIV co-infection, and as many as 50-80% have HIV co-infection in parts of Sub-Saharan Africa.¹¹

Tuberculosis and hepatitis C virus (HCV) co-infection contributes to major disease mortality and morbidity. However, the causal link between HCV infection and TB risk remains unclear but a study has suggested that HCV infection is associated with a higher risk of developing active TB disease.¹²

Injection drug use is a key factor in the transmission of blood borne pathogens. Behavioral epidemiological studies have shown that both injection-related risk factors of injecting drugs, type of drug injected, direct and indirect sharing of injection paraphernalia and sex-related risk factors (lack of condom use, multiple sexual partners, survival sex) have been associated with the spread of HIV, HBV and HCV.¹³

HIV and TB have a synergistic interaction and each of these accentuates progression of the other. In 2010, TB was flourishing unhindered, reaching a proportion of 82% TB cases co-infected with HIV in Sub-Saharan African region.¹⁴ The HIV/AIDS pandemic has been linked to the resurgence of TB, leading to increased morbidity and mortality worldwide.¹⁴

Viral hepatitis is life threatening liver disease caused by hepatitis B and C viruses and is a major public health problem, particularly in developing countries.^{15,16} Chronic liver disease increases the risk of hepatotoxicity during anti-tuberculosis treatment,¹⁷ which could be up to three to five times more than TB patients without viral infection.¹⁸ A fourteen fold increase in the risk of anti-TB hepatotoxicity has been reported in HIV and HCV co-infected patients.¹⁹

The prevalence of HIV among TB patients varies in different parts of Nigeria. HIV prevalence of 44.2% in Nassarawa State,²⁰ 53.3% in Benue State and Federal Capital Territory (FCT),²¹ 12.3%

in South-western Nigeria²² and 32.8% in Edo State²³ in TB patients has been reported in Nigeria while prevalence rates of hepatitis B surface antigen (HBsAg) of 8.7% and HCV of 14.8% among TB patients were reported in Kano, Northern Nigeria by Taura et al.²⁴ HBsAg prevalence of 2.2-15.5% and HCV of 0.7-7.0% were reported in Southern Nigeria.^{25,26} HIV prevalence rates of 11.4% in Ethiopia and 27.6% in Brazil among patients with tuberculosis have been documented by other authors.^{27,28} The prevalence of HBsAg of 5.5% in Pakistan, 9.5% in Sudan and 25.6% in Brazil have been reported amongst tuberculosis patients.^{27,29,30} while the prevalence rates of HCV in tuberculosis patients of 3.5-10.0% have been documented by earlier studies.^{29,30}

In Northern Nigeria, the information on the prevalence of the co-existence of TB, HIV and viral hepatitis is scanty. This study on prevalence and co-infections of HIV, HBsAg and HCV among patients with tuberculosis in Sokoto metropolis is important as the findings can be utilized in making plans for the management of TB patients in the metropolis and possibly Sokoto State as a whole.

Materials and methods

A cross-sectional study aimed at determining the prevalence rates of HIV, HBsAg, HCV and co-infections among TB patients was done. Patients with confirmed tuberculosis attending the TB clinics of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto and Specialist Hospital, Sokoto between May and November 2015 were recruited for the study. Patients with productive cough for three or more weeks, with at least two positive sputum smears or one positive smear and consistent X-ray findings that were suggestive of tuberculosis were included in the study while non-consenting TB patients were excluded from the study.

Three ml of whole blood was collected from each patient. The sample was allowed to clot and centrifuged at 3000 revolutions per minute for 5 minutes to separate the serum for analysis.

Hepatitis B surface antigen (onsite HBsAg rapid test kit-CTK Biotech Inc., USA. Sensitivity/Specificity 96%/99.6%), HIV antibody (Alere Determine HIV 1/ 2 kit-Alere Medical Co. Ltd. Sensitivity/Specificity 100%/98.9%) and anti-HCV antibody (onsite HCV antibody rapid test kit: CTK Biotech, Inc., USA. Sensitivity/Specificity 100%/99.6%) tests were done on every sample.

Data on age and gender were collected from all the participants using a designed and structured questionnaire.

Data were analyzed using statistical package for social sciences (SPSS version 20) to determine the prevalence of HIV, HBsAg and HCV and co-infections among TB patients. Age and gender in relation to prevalence of viral infections among TB patients were determined using chi-square and a p-value of <0.05 was considered significant.

Results

276 confirmed TB patients aged 19-60 years were included in the study. The prevalence rates of HIV, HBsAg and HCV among TB patients are shown in Table 1. The prevalence rates of HIV, HBsAg and HCV among TB patient were 16.3%, 14.9% and 5.4%, respectively. The prevalence rates of HIV, HBsAg and HCV showed significant relationship with one another ($P < 0.001$).

Table 1. Prevalence rates of HIV, HBsAg, HCV among TB patients

Status	HIV	HBsAg	HCV	P- value
Number	45	41	15	0.000
positive (%)	(16.3)	(14.9)	(5.4)	
95% CI	11.9-20.7	10.7-19.1	2.6-8.2	
Number	231	235	261	123
negative (%)	(83.7)	(85.1)	(94.6)	

Table 2 demonstrates the prevalence rates of co-infections of HIV, HBsAg, HCV in TB patients.

Table 2. Prevalence rates of co-infections of HIV, HBsAg and HCV among TB patients.

Status	HIV -HBsAg	HIV -HCV	HBsAg -HCV	HIV-HBsAg -HCV
Positive	14	5	8	4
Negative	262	271	268	272
% Positivity	5.07	1.81	2.90	1.45
95% CI	2.47-7.67%	0.21-3.41%	0.9-4.9%	0.01-2.89%

The prevalence of co-infections of HIV-HBsAg, HIV-HCV, HBsAg-HCV and HIV-HBsAg-HCV in TB patients were 5.07%, 1.81%, 2.9 and 1.45%, % respectively.

The age distribution of HIV, HBsAg and HCV infections among the TB patients is shown in Table 3. Age group of 19-28 years had the highest prevalence of HIV (23.17%), followed by age group

Table 3. Age distribution of HIV, HBsAg and HCV infections among TB patients

Age (years)	No of patients (n)	HIV positive		HBsAg positive		HCV Positive	
		n	%	n	%	n	%
19-28	82	19	23.17	20	24.39	5	6.09
29-38	50	5	10.0	4	8.0	2	4.0
39-48	60	7	11.66	13	21.66	3	5.0
49-58	68	12	17.64	6	8.82	4	5.88
> 59	16	2	12.5	2	12.5	1	6.25
P-value		0.240		0.0304		0.987	

49-58 years (17.64%), > 59 years (12.5%), 39-48 years (11.66%) and 29-38 (10.0%) but the prevalence of HIV showed no significant relationship with age ($P = 0.240$).

The age group 19-28 years had the highest

prevalence of HBsAg among TB patients (24.39%), followed by age group 39-48 years (21.66%), > 59 years (12.5%), 49-58 years (8.82%) and 29-38 years (8.0%). The prevalence of HBsAg in TB patients showed significant association with age (P=0.0304).

The highest prevalence of HCV among TB patients was observed amongst those > 59 years (6.25%), followed by 19-28 years (6.09%), 49-58 years (5.88%), 39-48 years (5.0%) and 29-38 years (4.0%). The prevalence of HCV showed no significant relationship with age (P=0.987).

Table 4. Distribution of HIV, HBsAg and HCV infections by gender among TB patients

Gender	Number of patients (n)		HIV positive		HBsAg positive		HCV positive	
	n	%	n	%	n	%	n	%
Male	157	56.88	22	14.01	22	14.01	6	3.82
Female	119	43.12	23	19.32	19	15.96	9	7.56
P-value			0.237		0.651		0.175	

Table 4 displays the distribution of HIV, HBsAg and HCV infections by gender among TB patients. Prevalence of HIV, HBsAg and HCV amongst males with tuberculosis were 14.01%, 14.01% and 3.82%, respectively while that of

females with tuberculosis were 19.32% 15.96% and 7.56%, respectively. The prevalence rates of HIV, HBsAg and HCV among TB patients showed no relationship with gender at P- values of 0.237, 0.651 and 0.175, respectively.

Discussion

Tuberculosis and viral hepatitis are global health problems which are commoner in developing and underdeveloped countries than developed countries.^{1,2,31}

Prevalence rates of HIV, HBsAg and HCV among TB patients vary from region to region in Nigeria and internationally. This study has shown the prevalence of HIV among TB patients to be 16.3% which is at variance with that of 44.2-53.3% reported in Nassarawa and Benue States as well as FCT which are parts of North Central region of Nigeria.^{20,21} This striking difference in the prevalence rates may be associated with a high prevalence rate of HIV in North Central Nigeria in contrast to prevalence rates of HIV among TB patients in Southwest Nigeria and Edo State (12.3% and 32.8%, respectively).^{22,23} The different frequencies of HIV among TB patients are similar to the reported HIV/AIDS prevalence rates by States in Nigeria.³² In the Republic of Georgia, Kuniholm et al.³³ reported HIV prevalence rate of 0.7% among TB patients while Mengesha et al.³⁴ reported a prevalence of 15% for HIV. However, the different prevalence rates of HIV among TB patients from some parts or regions of Nigeria and among other countries^{20,23,33,34} may be associated with the peculiarities of the environments and the associated prevalence rates of HIV, techniques employed, and sensitivity and specificity of test methods used among other factors.

The study further showed the prevalence of HBsAg among TB patients to be 14.9% which is in contrast to the earlier report of 8.7% in Kano.²⁴ Akhtar et al.²⁸ and Nail et al.²⁹ reported prevalence

rates of HBsAg among TB patients to be 5.5% and 9.5%, respectively while Kuniholm et al.³³ and other researchers in Thailand reported prevalence rates of 4.3% and 9.0%, respectively.³⁵ The varying prevalence rates of HBV may be influenced by the populations of regions and their associated economic and hygienic factors,³⁶ and different methods of screening.³⁷

The current study showed a prevalence of 5.4 % for HCV among TB patients. This is in disagreement with the earlier report of 14.8% in Kano.²⁴ However, Akhtar et al.²⁸ and Nail et al.²⁹ reported prevalence rates of 10% and 3.5%, respectively for HCV while Kuniholm et al.³³ and Sirinak et al.³⁵ reported prevalence rates for HCV among TB patients to be 12% and 31%, respectively. The different prevalence rates of HCV have been linked to the geographical factors of various regions.^{38,39}

The prevalence rates of HIV, HBsAg and HCV have shown significant relationship in this study and this may be associated with shared modes of transmission.¹³

In our study, the prevalence of co-infection of HIV-HBsAg-HCV in TB patients was 1.45% compared to overall prevalence TB-HIV-Hepatitis triple infection (TB-HIV-HBV-HCV) of 2.4% in Ethiopia.³⁴ The causes of HIV-HBV-HCV co-infection has been associated with parenteral, sexual and vertical transmission, and sharing of injections by injection drug users.¹³ The co-existence of TB, HIV and viral hepatitis in the same patient poses a challenge to the patient and clinicians since very little information is available on impact of the triple viral infection on TB treatment outcome.³⁴

There is scanty information on the prevalence of co-infection of HBsAg-HCV among TB patients. This current study has shown a prevalence of 2.9%. Co-infection with hepatitis B or C viruses among tuberculosis patients has been associated with potentiating the risk of anti-tuberculosis therapy induced hepatotoxicity.¹⁷⁻¹⁹

Prevalence rates of co-infections of HIV-HBsAg and HIV-HCV in TB patients have been scarcely examined. The current study demonstrates a prevalence of 5.07% and 1.81% for HIV-HBsAg and HIV-HCV co-infections respectively while in Ethiopia, Mengesha et al.³⁴ reported HIV-HBsAg-TB and HIV-HCV-TB co-infections to be 8.9% and 7.1% respectively. The difference in the prevalence of co-infections may be associated with different sample numbers and peculiarities of each environment. HIV or viral hepatitis or both in patients with tuberculosis have been linked to the risk of hepatotoxicity during anti-tuberculosis treatment.^{17,18}

Our study has further shown that prevalence rates of HIV and HCV in TB patients are not associated with age while the prevalence of HBsAg is related to age. The age group 19-28 years showed the highest prevalence for HIV (23.17%) and HBsAg (24.39%) while TB patients of > 59 years had the highest prevalence of HCV (6.25%). The high prevalence rates of HIV and HBsAg

in TB patients among the younger age group in this study agrees with previous findings.^{30,34} which may be related to these patients being in the sexually active age group.

This study has further shown that gender is not associated with the prevalence rates of HIV, HBsAg and HCV infections among TB patients which is in agreement with the earlier study in Ethiopia.³⁴ Although there was a higher prevalence of HIV, HBsAg and HCV infections in female TB patients in the current study, this difference was not statistically significant and may be a reflection of the difference in sample size in each gender group.

Conclusion and recommendations

This study has shown lower prevalence of HIV among TB patients in the Sokoto metropolis, Northwest Nigeria compared to North Central and Southern regions of Nigeria. Age and gender showed little or no association with the prevalence rates of HIV, HBsAg and HCV infections in TB patients but the prevalence rates of the three viral infections showed significant relationship. The 19-28year age group had the highest prevalence rates of HIV and HBsAg, probably due to their increased sexual activity.

It is therefore recommended that HIV, HBsAg and HCV screening tests be carried out in diagnosed TB patients in Sokoto metropolis to guide therapeutic decisions. This would enable improved public health education on the transmission of these viral infections and assist in reducing the complications and mortality rate among TB patients.

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