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ORIGINAL RESEARCH

Seroprevalence and Predictors of Hepatitis B and C Virus Infections Among Patients with Chronic Liver Diseases in Dodoma Region, Tanzania: A Cross-Sectional Study

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Background: The known major causes of chronic liver diseases (CLDs) include, hepatitis B virus (HBV) and hepatitis C virus (HCV); however, there is scarcity of data regarding their seroprevalence in Tanzania. We aimed to evaluate the seroprevalence of HBsAg and anti-HCV and their predictors among patients with CLDs. Additionally, we also described the clinical patterns of the patients.

Methods: A cross-sectional analytical study design was carried at the two referral public hospitals in Dodoma region; Dodoma referral regional hospital (DRRH) and Benjamin Mkapa hospital (BMH) among 118 patients with CLDs. Rapid test immunochromatography was used to test for HBsAg whereas anti-HCV antibody positivity was tested using lateral flow chromatographic immunoassay. Multivariable binary logistic regression was used to evaluate the predictors of HbsAg positive results, and statistical significance was set at $p<0.05$.

Results: The seroprevalence of HBsAg and anti-HCV antibody was 28% (33/118) and 3.4% (4/118), respectively. Having a chronic illness (AOR = 2.3, 95% CI = 1.76–7.19, p = 0.041), raised level of alanine transaminase (ALT) (AOR = 3.6, 95% CI = 1.74–8.21, p = 0.025), increased AST/ALT ratio (AOR = 2.9, 95% CI = 2.57–11.57, p = 0.039), and increased level of total bilirubin (AOR = 5.1, 95% CI = 1.09–24.39, p = 0.039) remained the predictors of HBsAg positivity.

Conclusion: This study reports that almost one-third of the study subjects had positive HbsAg, and the positivity of anti-HCV antibody was quite low. The positivity of HbsAg was associated with having chronic illness, increased levels of ALT, total bilirubin, and AST/ALT ratio. Therefore, emphasis should be made to maximize the screening practices for individuals with such predictors due to high possibility of being infected with HBV.

Keywords: chronic liver diseases, HbsAg, anti-HCV antibody, HBV, HCV

Introduction

Inflammation of the liver is usually caused by viruses, especially hepatitis B virus (HBV) and hepatitis C virus (HCV), which are well-known for leading to serious liver related medical conditions.[1] Viral hepatitis attributed to HBV and HCV account for about 96% of deaths globally.[2] Sometimes in their lives, over 2000 million people around the world have been reported to be infected with HBV.[3] Recently, long-standing viral hepatitis has been as the fifth most common contributing factor of morbidity and mortality worldwide.[4] Both HBV and HCV induce progressive different liver conditions, and the vast majority of them transform into chronic ones such as liver cirrhosis after, for example, over 30 years.[5] In 2017, the World Health Organization (WHO) initial report showed that, the magnitude of HBV in Sub-Saharan Africa (SSA) ranged from 5% to 19%, and carriers of these infections were almost 58 million of whom 12.5 million carriers were more likely to succumb to HBV-related liver cirrhosis.[6] Approximately, 350 million have

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chronic and inactive HBV infections compared to 170 million of HCV globally, and such infections normally increase the odds of suffering from CLDs.[7]

Viral hepatitis, especially HBV, remains a major health problem of public concern globally. Despite low incidence of HCV worldwide, this virus is known for its high morbidity and mortality compared to HBV, and it has a high tendency of causing chronic infection and related complications like liver cirrhosis as well as liver cancers.[8,9] These viral infections contribute to significant hospitalization globally, and majority of cases resulting from such infections come from developing settings where such infections contribute to socioeconomic burden as a result of the existing fragile healthcare systems. The seroprevalence of HbsAg and anti-HCV antibody has been found to be differing across various regions of the world.[10] One study which was done in India among patients with chronic liver diseases (CLDs) reported that the level of HbsAg positive results was 9.6%, whereas that of anti-HCV antibody was 5.6%.[11] Ayele et al reported the seroprevalence of 35.8% of HBsAg and 22.5% for anti-HCV antibody in a study which was conducted in Ethiopia.[12] Also, in a study which was done by Chin'ombe et al in a cohort of cases with hepatocellular carcinoma (HCC) the detection rate of 48.3%, 20.0%, and 8% was documented for HBsAg, anti-HCV and co-infections, respectively.[13] Moreover, 32.6% (HbsAg), 10.6% (anti-HCV), and 2.6% (dual HBsA and anti-HCV) were reported in a study that was conducted in the Democratic Republic of Congo (DRC).[14] In Tanzania, a study which was done by Jaka et al reported magnitude of HBsAg and anti-HCV antibody in individuals with CLDs of 66.2% and 16.9%, respectively.[15]

There is a wide range of the clinical features of the patterns of the clinical characteristics of patients with CLDs, and such features vary from subtle and nonspecific symptoms to more severe, and decompensating signs and symptoms.[16,17] Fatigue, anorexia, weight loss, and nausea are among the common non-specific manifestations of patients with CLDs.[18] Progression of CLDs is associated with more specific clinical features such as jaundice, varying degree of ascites, and hepatic encephalopathy.[19,20] Physically, patients with CLDs are usually found to have a constellation findings including spider angiomas, palmar erythema, and hair loss which develop as a result of hormonal imbalances and changes in blood vessel dilation due to liver dysfunction.[21] Additionally, patients with advanced form of CLD may present clinically with some complications such as esophageal varices, which can cause intra-abdominal bleeding, portal hypertension, and even HCC.[22,23]

Various factors have been found to be associated with HBV and HCV infections. Different lifestyle characteristics and other medical intervention practices such as blood transfusion have all been associated with HBV and HCV infections.[24] Other risk factors of these infections include, being hospitalized for treatment, undergoing procedures like dental procedures and body piercing, sharing same house with infected individuals, and not being protected from not contracting the infections.[25] Additionally, poor standards of living have also been found to be associated with increased risk of acquiring HBV and HCV infections.[26,27] There is paucity of documentation of the seroprevalence of HBV and HCV infections in a population of patients with CLDs in Tanzania, particularly Dodoma region. This creates a gap in knowledge, and implementation of the policy on vaccination and other preventive measures among people in the region, and the country at large. Therefore, this study evaluated the prevalence of HBV and HCV infections, clinical patterns and associated risk factors among patients with CLDs who were attending at DRRH and BMH.

Methodology

Study Design and Setting

The present study was an analytical cross-sectional study design that employed quantitative approach with prospective data curation. This study was carried out at two referral public hospitals (DRRH and BMH) which are located in Dodoma city. Dodoma city is the capital city of Tanzania, which is currently associated with increased influx of people from rural areas. Dodoma region covers an area of 2669 square kilometers of which 625 km^2 are urbanized. Dodoma region has a total population of about 3,085,625 people, according to the Tanzanian House and Population Census of 2022.[28] BMH and DRRH are two tertiary hospitals with a capacity of attending 20 and 10 patients with CLD per month, respectively.

Patients' Characteristics

We enrolled a total of 118 patients who were aged 18 years or over with a diagnosis of CLD (age range from 19 to 89 years), and the sample consisted of 83 males and 35 females. The criteria for recruitment of the study subjects were based

on clinical and initial laboratory investigations. The clinical features included, ascites, jaundice, and lower limb edema. On the other hand, the initial laboratory findings that were used in selecting the participants were increased level of alanine transaminase (ALT) or aspartate transaminase (AST). Additionally, abdominal ultrasound findings, including increased liver echogenicity as well as coarseness, and irregularity of the liver parenchyma were used as supplementary diagnostic criteria. This approach was adapted from two previous studies done in three areas of Ethiopia (TikurAnbessa, St. Paul, and Zewditu Memorial hospitals in Addis Ababa)[12] and rural area of central part of India.[29] Patients with known results on HBV and HCV and were on treatment on CLDs were excluded from the analysis.

Sample Size Calculation and Sampling Method

We determined the sample size using the formula that was developed by Yamane.[30]

$$n = \frac{N}{1 + N(e)^2}$$

n = sample size, N = population size, e = marginal error which was set at 0.05 assuming a confidence level of 95% and the approximated population size of patients with CLDs from the study sites for the five months of data collection was 150. n = (150 ÷ (1+150(0.05^2)) = (150 ÷ (1+0.375)), n = 150÷1.375 = 109.09. Therefore, the obtained sample size was 109. Then, a non-response rate of 10% was considered to make the total sample size for the study to be 118. The study participants were obtained from the study population conveniently, and they were recruited consecutively until the required samples size of 118 was obtained.

Selection Process of the Study Subjects

The recruitment process of the study subjects is presented in Figure 1. Of all the suspected patients with CLDs, 84.7% (127/150) were diagnosed with CLDs). A total of 7.1% (7/127) of patients that were diagnosed with CLDs were excluded from the analysis due to various reasons, and the remaining 92.9% (118/127) were included in the study for analysis.

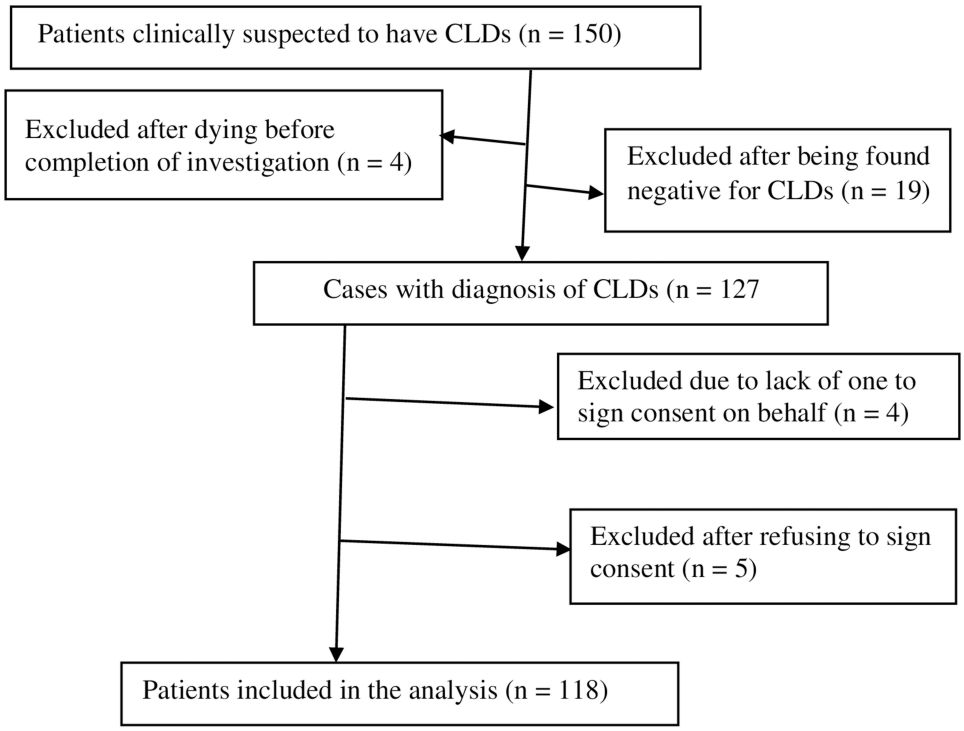

Figure 1 Flow chart of selection of the patients analyzed in the study.

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Data Collection Procedure

The process of data collection was done by one of the researchers and two general medical doctors who were first trained regarding on how to interact with the patients and collect the required data. We used a self-made structured research tool. A pilot study was done among 20 individuals from the study sites to check for reliability and validity of the collected data. Before collecting the data, the objective of the study was explained to the study subjects followed by obtaining written informed consent from the participants. Data were collected on sociodemographic and clinical characteristics, laboratory investigations, as well as ultrasound findings. Both patients' files and laboratory requisition forms were used to extract the required data. Use of screens for maintaining privacy of the patients was observed throughout the period of data collection, including anonymization of the identities of the patients.

Screening for HBsAg and Anti-HCV Antibody

For HBsAg screening, Meriscreen HBsAg reagent (RPDHBV-01, Chala, India) was used which has sensitivity and specificity of greater than 98.0% and 99.5%, respectively. This is a rapid test based on the immunochromatography principle, and the screening process was based on the manufacturer' instructions. Screening for anti-HCV antibody was done using Laborex strip contains anti-HCV antibody rapid test strip (Bioscience International Ltd, Nairobi, Kenya). This is a lateral flow chromatographic immunoassay based on the principle of the double antigen sandwich technique with a sensitivity of 98.1% and specificity of 98.9%. The procedure for anti-HCV antibody screening was as per manufacturer's instructions. Observer bias was mitigated through blinding the laboratory technicians regarding disease severity or outcomes of the patients so as to reduce bias and increase the credibility of results.

Statistical Analysis

Data analyzed was performed using SPSS program version 16.0 (SPSS Chicago, IL, USA). Categorical and continuous variables were presented in frequencies and percentages and mean ± standard deviation (SD), respectively. Bivariate association of the variables was done using Chi-square and Fisher's statistical tests, as appropriate. However, inferential statistics were performed using binary logistic regression to assess the predictors of HBsAg positivity. Covariates that had statistically significant p-value ($p<0.05$) in bivariate regression analysis were fitted in multivariate regression analysis using enter model for assessing predictors of HBsAg positivity after controlling for all variables (age, marital status, alcoholism, history of chronic illness, ALT, AST/ALT ratio, and total bilirubin). A two-tailed $p< 0.05$ was considered statistically significant.

Results

Sociodemographic and Lifestyle Characteristics

Table 1 shows the sociodemographic data of the study subjects that were included in the analysis. The mean age of the patients was 49.8 ± 16.9 years. Almost half 48.3% (57/118) of the study subjects were aged 50 years or over, and majority 70.3% (83/118) of the patients were males. Most 41.5% (49/118) of the patients had attained primary school education. Also, over half 55.1% (65/118) of the patients were residing in rural areas.

Clinical Patterns of the Patients

The clinical patterns (characteristics) of the study participants are shown in Figure 2. Of all the clinical patterns evaluated, the vast majority of the patients 96.6% (114/118) followed by bilateral lower limb edema and jaundice which every consisted of 87.3% (103/118). Body wasting was another clinical presentation, and it was the third most common feature, present in 57.6% (68/118) of all patients. Palmer erythema was the least common clinical characteristic which was found in 16.1% (19/118) of all patients.

Seroprevalence of HBsAg and Anti-HCV Positivity

The seroprevalence of HBsAg and anti-HCV antibody regarding their positive results is shown in Figure 3. The positivity level of HBsAg and anti-HCV antibody was 28% (33/118) and 3.4% (4/118), respectively.

Table 1 Sociodemographic Characteristics of the Patients (N = 118)

Variables	Frequency (n)	Percentage (%)
Age (years) (mean: 49.8 ± 16. 9)		
19-30	18	15.3
31-49	43	36.4
≥50	57	48.3
Sex		
Male	83	70.3
Female	35	29.7
Marital status		
Single	37	31.4
Married/cohabiting	81	68.6
Level of education		
No formal education	10	8.5
Primary	49	41.5
Secondary	46	39.0
Tertiary	13	11.0
Place of residence		
Rural	65	55.1
Urban	53	44.9
Occupation		
Unemployed	11	9.3
Self-employed	95	80.5
Employed	12	10.2

Bivariate Analysis of the Association of Sociodemographic Characteristics with HBsAg Positivity

Patients who were aged 19–30 years had higher percentage of HBsAg positivity compared to patients with age ≥50 years (66.7 vs 14.0%) ($p<0.001$). Similarly patients aged between 31 and 49 years had higher percentage of HBsAg positivity compared to patients with age ≥50 years (30.2 vs 14.0%) ($p<0.001$). Study subjects who were married or cohabiting had higher percentage of HBsAg positivity compared to patients who single (28.4 vs 24.3%) ($p = 0.018$). Alcoholism was also associated with high percentage of HBsAg positivity compared to patients who were not taking alcohol (32.3 vs 9.1%) ($p = 0.002$) (Table 2).

Bivariate Analysis of the Association of Clinical Characteristics with HBsAg Positivity

We observed that patients who had chronic illness had higher percentage of HBsAg positivity compared without chronic illness (43.1 vs 13.3%) ($p = 0.011$). There was increased trend of HBsAg positivity for cases with record of hospitalization compared to cases that had no record of hospitalization (31.9% vs 22.5%) but the difference was insignificant ($p =$

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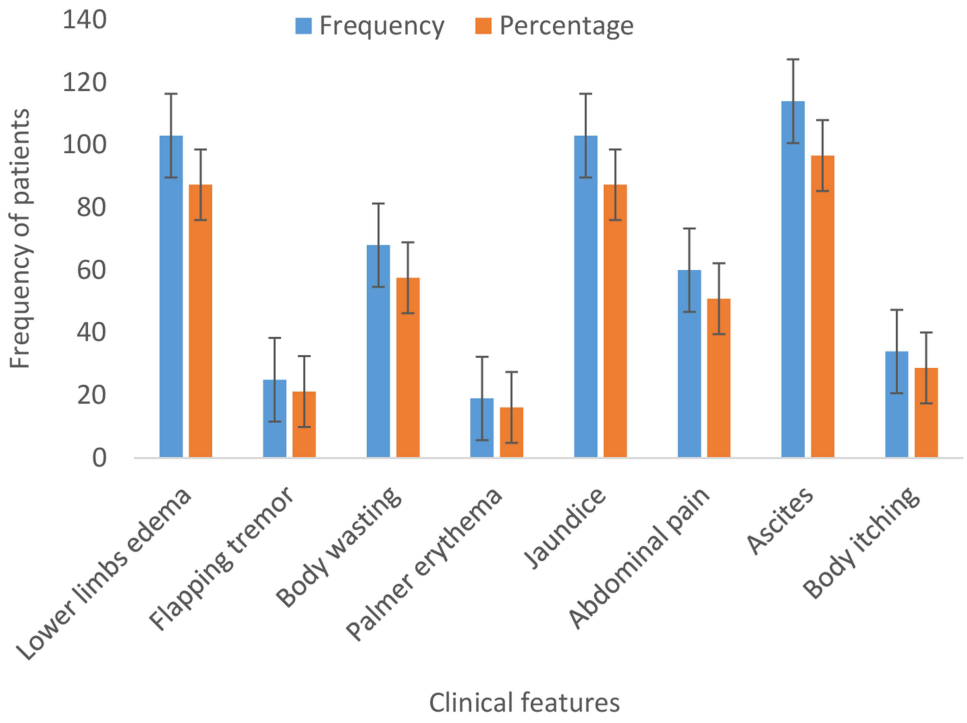

Figure 2 Clinical manifestations of the patients with chronic liver diseases.

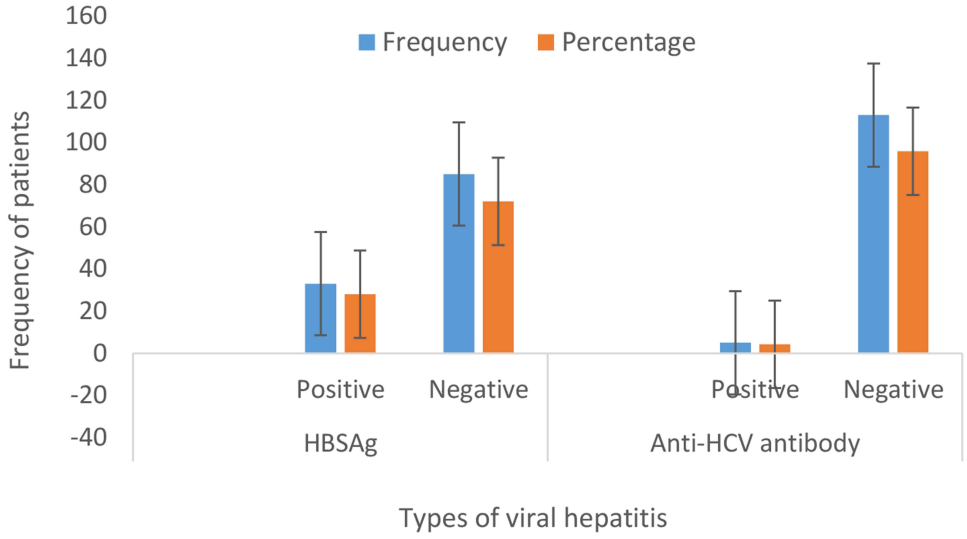

Figure 3 Prevalence of HBsAg and anti-HCV positivity among study participants with CLDs.

0.261). Also, patients with history of body piercing showed increased trend of HBsAg positivity as compared to patients that had no history of body piercing (29.6% vs 23.3%); however, the difference was insignificant (p = 0.513) (Table 3).

Bivariate Analysis of the Association of Laboratory Findings with HBsAg Positivity

Table 4 presents the bivariate analysis of the association of laboratory test results with HBsAg positivity. Having raised level of ALT was also associated with high percentage of HBsAg positivity compared to patients with normal level of ALT (32.7 vs 0.0%) (p = 0.032). Also, there was significantly increased positivity of HBsAg among patients with

Table 2 Bivariate Analysis of the Association of the Sociodemographic and Lifestyle Characteristics of the Patients with HBsAg Status (N = 118)

Variables	HBsAg status			
	Total: n (%)	Negative: n (%)	Positive: n (%)	P-value
Age (years)				<0.001†
19-30	18 (100.0)	6 (33.3)	12 (66.7)	
31-49	43 (100.0)	30 (69.8)	13 (30.2)	
≥50	57 (100.0)	49 (86.0)	8 (14.0)	
Sex				0.149†
Male	83 (100.0)	63 (75.9)	20 (24.1)	
Female	35 (100.0)	22 (62.9)	13 (37.1)	
Education level				0.094*
No formal education	10 (100.0)	9 (90.0)	1 (10.0)	
Primary	49 (100.0)	38 (77.6)	11 (22.5)	
Secondary	46 (100.0)	32 (69.6)	14 (30.4)	
Tertiary	13 (100.0)	6 (46.2)	7 (53.9)	
Marital status				0.018†
Single	37 (100.0)	28 (75.7)	9 (24.3)	
Married/cohabiting	81 (100.0)	58 (71.6)	23 (28.4)	
Place of residence				0.190†
Rural	65 (100.0)	50 (76.9)	15 (23.1)	
Urban	53 (100.0)	35 (66.0)	18 (34.0)	
Occupation				0.641*
Unemployed	11 (100.0)	7 (63.6)	4 (36.4)	
Self-employed	95 (100.0)	70 (73.7)	25 (26.3)	
Employed	12 (100.0)	8 (66.7)	4 (33.3)	
Having family member with HBV				0.077*
No	116 (100.0)	85 (73.3)	31 (26.7)	
Yes	2 (100.0)	0 (0.0)	2 (100.0)	
Alcoholism				0.002†
No	22 (100.0)	20 (90.9)	2 (9.1)	
Yes	96 (100.0)	65 (67.7)	31 (32.3)	
Multiple sexual partners				0.085†
No	65 (100.0)	51 (78.5)	14 (21.5)	
Yes	53 (100.0)	34 (64.2)	19 (35.9)	

Note: †-Chi-square test, *-Fisher's exact test.
Abbreviations: HBV, Hepatitis B Virus; HbsAg, Hepatitis B Surface Antigen.

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Table 3 Bivariate Analysis of the Association of Clinical Characteristics with HBsAg Positivity Among Patients with CLDs (N = 118)

Variables	HbsAg Status			
	Total: n (%)	Negative: n (%)	Positive: n (%)	P-value
History of blood transfusion				0.440*
No	110 (100.0)	78 (70.9)	32 (29.1)	
Yes	8 (100.0)	7 (87.5)	1 (12.5)	
History of hospitalization				0.261†
Yes	69 (100.0)	47 (68.1)	22 (31.9)	
No	49 (100.0)	38 (77.6)	11 22.5)	
History of body piercing				0.513†
Yes	88 (100.0)	62 (70.5)	26 (29.6)	
No	30 (100.0)	23 (76.7)	7 (23.3)	
Body tattooing				0.217*
Present	110 (100.0)	81 (73.6)	29 (26.4)	
Absent	8 (100.0)	4 (50.0)	4 (50.0)	
HBV vaccination				0.280*
No	117 (100.0)	85 (72.7)	32 (27.4)	
Yes	1 (100.0)	0 (0.0)	1 (100.0)	
History of chronic illness				0.011†
No	60 (100.0)	52 (86.7)	8 (13.3)	
Yes	58 (100.0)	33 (56.9)	25 (43.1)	

Note: †-Chi-square test, -Fisher's exact test.
Abbreviation: HbsAg-Hepatitis B Surface Antigen.

Table 4 Bivariate Analysis of the Association of Laboratory Findings with HBsAg Positivity Among Study Participants with CLDs (N = 118)

Variables	HbsAg Status			
	Total: n (%)	Negative: n (%)	Positive: n (%)	p-value
White blood count (x 10^3/UL) (mean: 2.7 ±0.8)				0.221*
Normal (3–11)	86 (100.0)	65 (75.6)	21 (24.4)	
Low (<3)	2 (100.0)	2 (100.0)	0 (0.0)	
High (11)	30 (100.0)	18 (60.0)	12 (40.0)	
Platelets (x 10^3/UL)				0.068†
Low (<150)	74 (100.0)	49 (66.2)	25 (33.8)	
Normal (≥150)	44 (100.0)	36 (81.8)	8 (18.2)	

(*Continued*)

Table 4 (Continued).

Variables	HbsAg Status			
	Total: n (%)	Negative: n (%)	Positive: n (%)	p-value
ALT (U/L) (mean: 13.6 ± 4.2)				0.032*
Normal (2–41)	18 (100.0)	17 (94.4)	1 (5.6)	
Low (<2)	2 (100.0)	2 (100.0)	0 (0.0)	
High (41)	98 (100.0)	66 (67.4)	32 (32.7)	
AST (U/L) (mean: 9.5 ± 3.7)				0.074*
Normal (8–33)	14 (100.0)	12 (85.7)	2 (14.3)	
Low (<8)	9 (100.0)	7 (77.8)	2 (22.2)	
High (>33)	95 (100.0)	66 (69.5)	29 (30.5)	
AST/ALT ratio (mean: 1.2 ± 0.4)				0.026*
Normal (1–1.5)	13 (100.0)	12 (92.3)	1 (7.7)	
Low (<1)	9 (100.0)	7 (77.8)	2 (22.2)	
High (>1.5)	96 (100.0)	66 (68.8)	30 (31.3)	
APRI score (mean: 1.3 ± 0.7)				0.079*
Normal (<1.5)	17 (100.0)	13 (76.5)	4 (23.5)	
High (>1.5)	82 (100.0)	53 (64.4)	29 (35.4)	
Haemoglobin level (gm/dL) (mean: 11.5 ± 4.7)				0.854†
Normal (13.5–17.5 or 12.0–16.0)	30 (100.0)	22 (73.3)	8 (26.7)	
Low (<12.0 or <13.0)	88 (100.0)	63 (71.6)	25 (28.4)	
Total bilirubin (mg/dL) (mean: 1.2 ± 0.1)				0.002*
Normal (0.1–1.2)	25 (100.0)	20 (80.0)	5 (20.0)	
Low (<0.1)	30 (100.0)	27 (90.0)	3 (10.0)	
High (>1.2)	63 (100.0)	38 (60.3)	25 (39.7)	
Creatinine level (umol/L) (mean: 15.2 ± 5.1)				0.460†
Normal (61–114)	47 (100.0)	32 (68.1)	15 (31.9)	
Low (<61)	14 (100.0)	9 (64.3)	5 (35.7)	
High (>114)	57 (100.0)	44 (77.2)	13 (22.8)	
BUN level (mmol/L) (mean: 1.8 ± 0.3)				0.337*
Normal (2.1–9.2)	70 (100.0)	50 (71.4)	20 (28.6)	
Low (<2.1)	1 (100.0)	0 (0.0)	1 (100.0)	
High (9.2)	47 (100.0)	35 (74.5)	12 (25.5)	

(*Continued*)

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Table 4 (Continued).

Variables	HbsAg Status			
	Total: n (%)	Negative: n (%)	Positive: n (%)	p-value
Total protein (gm/L) (mean: 22.9 ± 10.3)				0.440*
Normal (≥61)	8 (100.0)	7 (87.5)	1 (12.5)	
Low (<60)	110 (100.0)	78 (70.9)	32 (29.1)	
Albumin (gm/L) (mean: 13.2 ± 4.5)				0.199*
Normal (35–52)	28 (100.0)	24 (85.7)	4 (14.3)	
Low (<35)	90 (100.0)	61 (67.8)	29 (32.2)	

Note: †-Chi-square test, *-Fisher's exact test.
Abbreviations: BUN, Blood Urea Nitrogen; APRI, Aspartate Aminotransferase to Platelet Ratio Index; AST, Aspartate Aminotransferase; ALT, Alanine Aminotransferase.

increased AST/ALT ratio compared to their counterparts (7.7% (normal) and 22.2% (low) vs 31.3% (high)) (p = 0.026). Additionally, we found that cases had high total bilirubin had higher percentage of HBsAg positivity compared to cases with normal total bilirubin (36.1 vs 8.6%) (p = 0.002). Other independent factors were not associated with HBsAg positivity (Table 4).

Multivariate Regression Analysis for the Predictors of HBsAg Positivity

After controlling for age of the patients, marital status, alcoholism, history of chronic illness, total bilirubin, AST/ALT ratio, ALT, and AST under multivariate analysis, it was observed that having history of chronic illness, increased level of total bilirubin, ALT level, AST/ALT ratio, and younger age remained the potential predictors of HBsAg positivity. Patients with a history of chronic illness were had significantly increased odds of testing positive HBsAg as compared to patients with no chronic illness (AOR = 2.3, 95% CI = 1.76–7.19, p = 0.041). In addition, study subjects that had raised level of total bilirubin had also significantly increased odds of positive HBsAg test results compared to cases with normal total bilirubin level (AOR = 5.1, 95% CI = 1.09–24.39, p = 0.039). Moreover, we found that patients who had elevated level of ALT had significantly increased odds of being HBsAg positive compared to participants with negative HbsAg results (AOR = 3.6, 95% CI = 1.74–8.21, p = 0.025. Patients with raised AST/ALT ratio (>1.5) had significantly increased odds of positive HBsAg results compared to patients that had normal AST/ALT ratio (≤1.5) (AOR 2.9, 95% CI = 2.57–11.57, p = 0.039). Additionally, patients who were aged 31–49 years were 2.5 times more likely to have positive HBsAg than patients who were aged 50 years or over (95% CI = 1.77–9.32, p<0.001). Other independent factors were not associated with HbsAg positivity (Table 5).

Table 5 Multivariate Analysis for the Predictors of HBsAg Positivity Among Patients with CLDs

Variables	Multivariate Analysis	
	aOR [95% CI]	P-value
Age (years)		
19-30	Ref	
31-49	2.5 [1.77–9.32]	<0.001
≥50	0.3 [0.57–0.89]	0.015

(*Continued*)

Table 5 (Continued).

Variables	Multivariate Analysis	
	aOR [95% CI]	P-value
Marital status		
Single	Ref	
Married/cohabiting	2.4 [0.54–7.65]	0.441
Alcoholism		
No	Ref	
Yes	3.2 [0.85–11.91]	0.085
History of chronic illness		
No	Ref	
Yes	2.3 [1.76–7.19]	0.041
ALT (U/L)		
≤40	Ref	
>40	3.6 [1.74–8.21]	0.025
AST/ALT ratio		
Normal (1–1.5)	Ref	
Low (<1)	1.3 [0.48–4.92]	0.208
High (>1.5)	2.9 [2.57–11.57]	0.039
Total bilirubin (μmol/L)		
≤21	Ref	
>21	5.1 [1.09–24.39]	0.039

Discussion

Our findings have highlighted the predominance of HBV as the main infectious etiological factor, which is commonly found among patients with CLDs in Tanzania. This study has indicated that infection of HCV leading to CLD among adults is significantly lower than the rate at which HBV contributes to such diseases. Moreover, our study has shown that, there is quite a wide range of factors that influence the possibility of contracting HBV infection, and this may contribute to developing CLDs.

The seroprevalence of HBsAg positivity in patients who were clinically suspected to have CLDs as well as based on abdominal ultrasound and laboratory findings in the present study was close to 34.3%, 35.8%, and 36.7%, which was reported in Tanzania[31] and Ethiopia,[12,32] respectively. Nevertheless, higher rates of HBsAg positivity for cases with CLDs than the ones observed in the present study have been reported in different places such India (57.0%),[33] Uganda (45.0%),[34] and Ethiopia (40.0%).[35] Furthermore, other studies done in Tanzania,[15] Kenya,[36] and Nigeria also reported higher levels of HBsAg positivity in cases of CLDs of 66.2%, 50.6%, and 42.9%, respectively. In developed countries, some studies have reported quite a low rate of HbsAg positivity in cases with CLDs. For instance, in the study that was done in Japan[37] and the United Kingdom,[38] the rate of HBsAg detection was found to be 11.5% and 9.4%, respectively. In other two studies, which were done in Austria and Italy, they reported quite low prevalence of positive HbsAg tests from hospital-based data of <1% and 1.8%, respectively.[39,40]

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The similarity in the level of HbsAg positive results for the compared studies may be partly due to the fact that all studies have the same study design, similar cohort characteristics, relatively equal number of males patients with increased odds of contracting HBV infection as it was for females.[41] On the other hand, there are a number of factors that may help to decipher the difference in the magnitude of HbsAg positivity for the compared studies. For example, it has been found that in studies that include patients with a reduced mean age (younger patients), the level of HBsAg positivity is higher than that in studies in which patients have a higher mean age (elderly patients).[42,43] This is because individuals or patients at younger ages have an increased chance of contracting HBV infection as compared to those with increased age.[44] This observation was also reported in the study of Ochwoto et al in which the average age of the cases included in the study was 39.8 years, and the proportion of positive results of HBsAg was lower than the one which was found in the present study in which the average age of the study subjects was 49.8 years.[36] The variation in the characteristics of the study subjects may also account for the discrepancy in the prevalence of positivity of the HbsAg tests. Studies that include subjects with liver disease show higher positivity of HBsAg compared to studies reporting HbsAg positivity in the general population. For example, the study by Hyasinta et al,[15] which included only patients with HCC, reported a prevalence of HBsAg positivity of 66.2%, which is quite higher when compared to prevalence rate of HbsAg from the general population. For example, in the two studies which were community-based done in Uganda and Nigeria, the prevalence of the positive HbsAg tests was 2.4% and 12.4%, respectively.[45,46]

The present study reports significantly reduced seroprevalence of anti-HCV antibody, similar to that observed for HBsAg positivity.. This is in agreement with the findings from other studies which have also reported reduced level of positive results for anti-HCV antibody positivity compared to that of HbsAg. For example, in Bilman et al reported a seroprevalence of positive anti-HCV antibody of 0.7%, while that of HbsAg was 4.8%.[47] In another study by Molla et al, the proportion of positive anti-HCV antibody in the study was 0.3%, whereas HbsAg positivity was 4.4%.[48] However, some studies have reported quite high prevalence of anti-HCV antibody positivity. In Tanzania and Ethiopia, the proportion of positive results for anti-HCV antibody for cases with CLDs was found to be 16.9% and 22.5%, respectively.[12,15] This difference in the detection rates of anti-HCV antibody reported in various studies may partly be due to the variation in the sensitivity and specificity of the assays used in assessing the level of anti-HCV antibody positivity.[49] Additionally, HBV can be transmitted through various methods compared to HCV which is transmitted only through blood. This increases the chance of contracting HBV compared to HCV.

Regarding predictors of HbsAg positivity in this study, we found that younger age (having less than 50 years) was associated with HbsAg positivity. This observation is in keeping with the findings in the communication of Bayo et al and Mugabiirwe et al, in which it was reported that pregnant women who were at the reproductive age had significantly associated with HbsAg positive tests.[50,51] Studies from India and Yemen similarly reported that most HBsAg-positive patients were aged 21–30 years and under 50 years, respectively.[52,53] The prevalence of HBV infection seems to show bimodal increase in which there is a low prevalence before puberty, and after puberty, the prevalence increases followed by a decrease when the individuals become not sexually active, though some contradictions have also been reported. Individuals of younger age, especially males usually engage in risky behaviors such as intravenous illicit drugs, tattooing, ear piercing among many others, all of which are more likely to have increased chances of being infected with HBV.[54,55]

Having a chronic illness among patients in our study was associated with HbsAg positivity, which is the same as what was found in the case-control study by Fatemeh et al in Iran. That study observed a significantly higher prevalence of HBsAg positivity (3.8%) among diabetic patients compared to non-diabetic patients (1.2%).[56] Also, in another study that included patients with inflammatory bowel diseases (IBDs) from China, the seroprevalence of HbsAg positivity was higher among patients with IBDs than patients with no IBDs (41.2% vs 35.9%) and the difference was statistically significant.[57] It has been found that, persons with chronic illnesses have increased chance for them to be hospitalized, and such individuals have high possibility of undergoing medical interventions including surgery, medical procedures like endoscopy, blood transfusion, and dental procedures. Such procedures are generally attributable to increased odds of being infected with HBV infection.[57]

Another predictor of increased chance of HBsAg positivity in our study was elevated total bilirubin level, which is in line with which is in line with the findings of a study conducted in China.. In that study, they found that there was a significantly increased average value of total bilirubin in the HBsAg positive group compared to HBsAg negative group

(0.97 ± 0.42 mg/mL vs 0.86 ± 0.36 mg/mL).[58] Another study by Liu et al reported that total bilirubin level was also potentially predictive of HBV infection.[59] Furthermore, in the studies of Byun et al as well as Kuo et al reported that elevated total bilirubin was associated with relapse of HBV in patients who had previously lost HBeAg following lamivudine therapy.[60,61] All forms of bilirubin including total bilirubin have been found to have a protective effects for different diseases including hepatic and cardiovascular systems. Studies have shown that total bilirubin is anti-oxidative, and its level may be raised in conditions such as liver damage due to HBV infection.[62,63] It has also been found that, total bilirubin is a prognostic factor, and it is an indicator of fibrosis for patients with CLDs.[64] Also, elevated level of ALT was associated with increased chance of having HbsAg among patients. This has also been reported in the study of Kumar et al in which 80% of the patients with positive HbsAg results had abnormal increased level of ALT.[65] In two other studies, it was reported that raised level of ALT is an indication of positive tests for HBV, and its fluctuations during clinical course of CLDs, including progression of severity of fibrosis.[66,67] Therefore, these laboratory investigations among many others may help to increase the clinical index of suspicion for detection of HBV among hospitalized patients and the general population.

Although elevated AST/ALT ratio (De Ritis ratio) is not very specific to HBV infection because it may be seen in other liver diseases including, alcoholic related liver diseases or non-alcoholic steatohepatitis (NASH); still, it is a suggestive indicator of HBsAg positivity, particularly in lieu of inactive HBV infection. Studies have shown that AST/ALT of <1 and that of >1 may be indicative of acute or mild and chronic liver injury, respectively.[68–70] The AST/ALT ratio of <1, particularly when the level of ALT is raised compared to that of AST, is more frequently observed in cases of acute viral hepatitis or other causes of hepatocellular damage, especially as the condition starts to resolve.[71,72] In this study, the increased AST/ALT ratio was significantly linked to increased odds of HBsAg positivity. This finding is in agreement with the findings in the study of Jandondo et al[70] and Chen et al[73] in which patients with raised AST/ALT had increased risk of having HBV infection.

Strengths and Limitations of the Study

Our study had several methodological limitations, including the cross-sectional nature of the study, which made it not possible to establish the causal-effect relationship. The nature of hospital-based data among patients with presumed diagnosis of CLDs could have been associated with selection bias. Failure to perform nucleic acid tests (NATs) such as PCR due to financial constraints could have contributed to false negatives, especially for occult hepatitis.

Conclusion

The results of this study has revealed that almost one-third of the patients with CLDs enrolled in the study had HbsAg positive results. Moreover, the seroprevalence of anti-HCV antibody in this study was quite low compared to that of HbsAg. More importantly, our study has shown that having elevated levels of ALT, total bilirubin, and AST/ALT ratio may be helpful in making clinical suspicion for identifying cases that are potential for HBV screening. Additionally, having chronic illnesses may also provide insights regarding possibility of HbsAg positivity. Therefore, emphasis should be put on maximizing the screening practices for individuals with such predictors so as to increase the detection rate of HBsAg positivity.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the ethical review board of the University of Dodoma (reference: MA.84/261/02/22, date: 24.05.2022), and this study also complies with the Declaration of Helsinki guidelines involving human subjects. Prior participation, all participants had to first sign the informed consent that was provided.

Informed Consent

Written informed consent was obtained from the patients, and a copy has been kept for review by the Editor-In-Chief of the journal.

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