Clinical Study

Prevalence and Risk Factors of Hepatitis B and Hepatitis C Virus Infections among Patients with Chronic Liver Diseases in Public Hospitals in Addis Ababa, Ethiopia

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Background and Aims. Hepatitis B and hepatitis C viruses are major public health problems worldwide. The aim of this study was to determine the prevalence and risk factors of hepatitis B and C virus infections in patients with chronic liver diseases in three public hospitals in Addis Ababa City, Ethiopia. **Methods.** The study was conducted on 120 clinically diagnosed chronic liver disease patients. Possible associated factors with infections by the viruses were collected from patient using questionnaire. Serum was screened for the presence of hepatitis B surface antigen and antihepatitis C virus antibodies using qualitative immunochromatographic method. **Results.** Hepatitis B surface antigen was detected in 43 (35.8%) and anti-HCV antibody 27 (22.5%) patients clinically diagnosed to have chronic liver diseases. Hepatitis B virus infection was higher in males 29/76 (38.2%) compared to 14/44 (31.8%) females, while antihepatitis C virus antibody was higher in females 13/44 (29.5%) compared to 14/76 (18.4%) males. Of the study participants, 3 (2.5%) had dual hepatitis B and C virus coinfection. **Conclusion.** The prevalence of hepatitis B surface antigen and anti-HCV antibody was high in patients below 50 years of age. Dental extraction procedure at health facility was associated with hepatitis C virus infection (OR, 2.95; 95% CI, 1.21–7.17, $P = 0.015$).

1. Introduction

Hepatitis is an inflammation of the liver, most commonly caused by a viral infection. Of these viruses, hepatitis B virus (HBV) and hepatitis C virus (HCV) infections account for a substantial proportion of liver diseases worldwide. These viruses are responsible for liver damages ranging from minor disorders to liver cirrhosis and hepatocellular carcinoma (HCC). Approximately 7% of the world's population (350 million people) are infected with HBV and 3% (170 million people) with HCV [1]. On the basis of the HBV carrier rate, the world can be divided in 3 regions of high, medium, and low endemicity. In Sub-Saharan Africa, the HBV carrier rate is over 8% [2]. Combined HBV and HCV infection is possible because of common modes of viral transmission [3]. HBV is transmitted through exposure to infective blood, semen, other body fluids, or from infected

mothers to infants at the time of birth. Transmission may also occur through transfusions of HBV-contaminated blood and blood products, contaminated injections during medical procedures, and through injection drug use. HCV is mostly also transmitted through exposure to infective blood through transfusions of HCV-contaminated blood and blood products, contaminated injections during medical procedures, and through injection drug use. Sexual transmission is also possible [4].

Chronic liver disease (CLD) results from an inflammatory injury to the liver, which has persisted for six or more months without complete resolution. CLD comprises of a spectrum of disease such as chronic hepatitis, liver cirrhosis, and HCC [5]. It is responsible for over 1.4 million deaths annually and is characterized by permanent inflammatory processes that predispose to liver cancer. About 1-2 million people die annually from HBV-related acute and chronic

FIGURE 1: The distribution of hepatitis B surface antigen by age among chronic liver disease patients.

liver diseases worldwide. The majority of chronic carriers of HBV are found in sub-Saharan Africa. The world health organization (WHO) estimates that there are 350 million people with chronic HBV infection and 170 million people with chronic HCV infection worldwide [6]. The estimated hepatitis B surface antigen (HBsAg) seroprevalence ranges between 0.1%–20% in different parts of the world [7]. In Africa, infections with HBV play a major role in the etiology of most liver diseases. In sub-Saharan Africa, the prevalence of liver disease is high. It was reported that 12% of the hospital admissions and 31% of the mortality in medical wards in Ethiopian hospitals was due to CLD [8]. To ensure the optimal clinical managements of CLD patients, it is important to know the HBV and HCV status of these patients. Studies in Ethiopia on various groups of subjects have demonstrated 2% [9] and another population based study 0.9% prevalence [10]. However, studies on coinfection of HBV and HCV among chronic liver disease are limited. Thus, this study was undertaken to determine the prevalence and risk factors of HBV and HCV in patients with chronic liver diseases visiting outpatient departments of public hospitals in Addis Ababa.

2. Materials and Methods

2.1. Study Population and Period. A prospective study was conducted in Addis Ababa in 3 public hospitals: Tikur Anbessa, St. Paul, and Zewditu Memorial hospitals in Addis Ababa between November 2010 and May 2011. A total 120 study participants aged ≥ 18 years with clinically diagnosed CLD were included in the study by convenient sampling technique. Patients were recruited by consecutive basis. The diagnostic criteria for grouping patients as chronic liver disease were based on history, clinical, ultrasound, and impaired liver function tests.

2.2. Data Collection and Processing. Clinically diagnosed patients with CLD who fulfilled the eligibility criteria were interviewed to gather data on sociodemographic and risk

factor using predesigned questionnaire after consent was obtained. Five milliliter of blood was collected and serum separated and divided in two aliquots. One aliquot was used for HBsAg screening and the other for anti-HCV antibody screening as per manufacturer instruction.

2.2.1. One Step Test for HBsAg. (Instant HBsAg, Tulip Diagnostics Ltd, India) It utilizes the principle of immunochromatography.

2.2.2. Rapid Anti-HCV Test. One step HCV serum/plasma test strip (Biocare TM Diagnostics, China) was used immunochromatographic direct binding test for the visual detection of HCV antibodies in serum samples.

Data were entered into Epi Info 3.5.1 and analyzed using SPSS 17.0 statistical software. The Chi-square test was utilized in assessing statistical significance of association that could exist between measured variables. P value < 0.05 was considered as significant. Odds ratio (OR) and 95% confidence interval (CI) were used to measure the strength of association.

3. Results

3.1. Study Subjects. A total of 125 patients with signs and symptoms of CLD were recruited. Of these, 120 (95.0%) subjects completed the study. Of these, 76 (63.3%) were males and 44 (36.7%) females (male to female ratio of 1.7:1). The mean age $\pm$ SD for all the study population was 40.99 ± 14.00 years (range = 18–80). Majority, 75.8% were below the age of 50 years, 67 (55.8%) were married, 32 (26.7%) single, 11 (9.2%) divorced, and 10 (8.3%) widow. In relation to residence area, 91 (75.8%) of the participants were urban dwellers. The prevalence of HBsAg and anti-HCV Ab in relation with sociodemographic characteristics is shown in Table 1.

3.2. Magnitude of HBV and HCV Infection. The prevalence of HBsAg in chronic liver disease was 43 (35.8%). The prevalence was higher in males 29/76 (38.2%) than females 14/44 (31.8%) but the difference was not statistically significant ($cOR = 1.322$; 95% CI: 0.603–2.900; $P = 0.556$). The prevalence of HBV was highest, 16/26 (61%) in the age group of 28–37 years but none (0%) in age groups above 68 years (Figure 1). More urban dwellers, 34 (28.3%) were HBsAg positive than rural dwellers, 9 (7.5%). Married patients had prevalence of 23 (19.2%), single were 15 (12.5%) and widows, 3 (1.7%).

Among patients with CLD, 27 (22.5%) were positive for anti-HCV-Ab. The prevalence was higher among females, 13/44 (29.5%) than males 14/76 (18.4%) [$cOR = 0.538$; 95% CI, 0.226–1.284; $P = 0.179$]. The magnitude of HCV by age group was high in the age group of 48–57 years and was lowest above 68 years of age. The prevalence of anti-HCV Ab progressively increased from 1.7% in the age group 18–28 years to 9.2% in the age group 48–57 years then declining to 0% in the age group > 68 years (Figure 1). Seropositivity for anti-HCV Ab was high among widows (50%) and divorced

TABLE 1: The prevalence of hepatitis B surface antigen and antihepatitis C virus antibody in relation to sociodemographic characteristics in chronic liver disease patients.

Sociodemographic Characteristics	Serostatus for HBV		Serostatus for HCV	
	Positive No. (%)	Negative No. (%)	Positive No. (%)	Negative No. (%)
Gender				
Male (76)	29 (24.2)	47 (39.2)	14 (11.7)	62 (51.7)
Female (44)	14 (11.7)	30 (25.0)	13 (10.8)	31 (25.8)
Marital status				
Married	23 (19.2)	44 (36.7)	18 (15.0)	49 (40.8)
Single	15 (12.5)	17 (14.2)	1 (0.8)	31 (25.8)
Divorced	3 (2.5)	8 (6.7)	3 (2.5)	8 (6.7)
Widow	2 (1.7)	8 (6.7)	5 (4.2)	5 (4.2)
Residence				
Urban	34 (28.3)	57 (47.5)	22 (18.3)	69 (57.5)
Rural	9 (7.5)	20 (16.7)	5 (4.2)	24 (20.0)
Occupation				
Driver	1 (0.8)	4 (3.3)	2 (1.7)	3 (2.5)
Unemployed	4 (3.3)	9 (7.5)	3 (2.5)	10 (8.3)
Daily laborer	3 (2.5)	4 (3.3)	0 (0.0)	7 (5.8)
Commercial	2 (1.7)	5 (4.2)	3 (2.5)	4 (3.3)
Student	4 (3.3)	4 (3.3)	0 (0.0)	8 (6.7)
Gov. employee	21 (17.5)	25 (20.8)	11 (9.2)	35 (29.2)
Farmer	7 (5.8)	10 (8.3)	4 (3.3)	13 (76.5)
House wife	1 (0.8)	13 (10.8)	3 (2.5)	11 (10.8)
Unspecified	1 (0.8)	2 (1.7)	0 (0.0)	3 (2.5)

3/8 (37.5%). Three (2.5%) of the patients were positive for both HBsAg and anti-HCV Ab seromarkers. These all were females aged <58 years. All the females who were positive for both seromarkers had history of circumcision and 2 (66.7%) of them had histories of home delivery with traditional birth attendants ($P > 0.05$).

3.3. Distribution and Factors Associated with HBV and HCV Infections. Of the 120 subjects with CLD, 70(58.3%) had history of admissions to hospitals. Of these, 20 (28.6%) and 16 (22.9%) were positive for HBsAg and anti-HCV-Ab, respectively. Of those who were admitted to hospital, only 25/70 (35.7%) had history of blood transfusion ($P > 0.05$). Twenty one 21 (30%) had history of either a minor or major surgery. Of those with surgical procedures, 3/21 (19.0%) and 5/21 (23.8%) were positive for HBsAg and anti-HCV-Ab, respectively. Fifty-one (42.5%) patients with CLD had history of dental extraction at health facilities, 41 (34.2%) at home and 8 (6.7%) of them in both at home and health facilities. Of those who had dental extraction at health facility, 18/51 (35.2%) were positive for HBsAg (cOR, 0.960; 95% CI, 0.451–2.044) and 17/51 (33.3%) were positive for anti-HCV-Ab (cOR = 2.95; 95% CI, 1.21–7.17, $P = 0.015$). Those who had dental extraction at health facilities were 2.95 time more likely to have infection with HCV than their counter parts and the difference was statistically significant ($P < 0.05$). Participants who had contact with jaundiced person were 25 (20.8%). From the participants with history of contact with jaundiced person, 11/25 (44%) were positive for HBsAg

and 6/25 (24%) were positive for anti-HCV-Ab (OR = 0.461; 95% CI: 0.150–1.422, $P = 0.178$) and (OR = 0.342; 95% CI: 0.197–3.17, $P = 0.739$), respectively (Table 2). The other risk factors tested were not associated with infection ($P > 0.05$) (Table 3).

4. Discussion

In this study, serological analysis revealed high frequency of hepatitis B and C viruses among CLD patients. The prevalence of HBsAg and anti-HCV-antibody in patients with CLD was 35.8% and 22.5%, respectively. Dual infection was observed in 3 (2.5%) patients. The prevalence of HCV in patients with CLD is high compared to the national prevalence of 1.9% in the general population [11]. A recent study in Ethiopia showed a prevalence of 1% and 0% for HBV and HCV, respectively in the general population without any risk for infection [12]. A similar study conducted in India has reported high prevalence of HBV of 55% and HCV of 25.8% in patients with CLD [12]. A study in 97 CLD patients in Pakistan showed that one-fourth (24.7%) were positive for HBsAg and 61.1% for anti HBc [13].

On HCV showed prevalence of 26% in India [14] and 75.5% in Egypt [15]. Higher HBV prevalence of 22% was from Sudan in HCC patients [16] and 30.4% from Pakistan in patients with CLD [17] were reported.

Age distribution of CLD patients in this study showed that 75.8% of CLD cases were below 50 years of age. A comparable high age distribution (42%) of CLD cases age

TABLE 2: Distribution of associated factors among chronic liver disease patients with respect to serostatus of hepatitis B virus in three public hospitals in Addis Ababa.

Associated factors	Hepatitis B surface antigen No. (%)			OR (95%, CI)	P value
	Positive	Negative	Total		
Community associated					
Tattooing of gums	8 (40.0)	12 (60.0)	20	1.24 (0.46–3.31)	0.67
Tattooing on body	5 (38.5)	8 (61.5)	13	1.14 (0.35–3.71)	0.53
Body piercing	8 (42.1)	11 (57.9)	19	1.37 (0.51–3.72)	0.53
Ear piercing	16 (31.4)	35 (68.6)	51	0.711 (0.33–1.53)	0.38
Uvulectomy	14 (27.5)	37 (72.5)	51	0.52 (0.24–1.14)	0.09
Shaving at barbershop***	22 (42.3)	30 (57.7)	52	1.78 (0.63–5.03)	0.27
Contact with jaundiced person	11 (44.0)	14 (56.0)	25	1.55 (0.63–3.79)	0.34
Circumcision	43 (36.4)	75 (63.6)	118	NA	0.41
Dental extraction at home	15 (36.6)	26 (63.4)	41	1.05 (0.48–2.30)	0.90
Hospital associated					
Hospitalization	20 (28.6)	50 (71.4)	70	0.47 (0.22–1.00)	0.05
Blood transfusion	6 (22.2)	21 (77.8)	27	0.43 (0.16–1.17)	0.09
Dental extraction	18 (35.3)	33 (64.7)	51	0.96 (0.45–2.04)	0.92
Surgical procedure	4 (17.4)	19 (82.6)	23	0.31 (0.09–0.99)	0.04
Behavioral associated					
Alcohol consumption	13 (37.1)	22 (62.9)	35	1.08 (0.48–2.45)	0.85
Delivery by TBA**	6 (31.6)	13 (68.4)	19	0.98 (0.27–3.53)	0.98
Abortion**	3 (25.0)	9 (75.0)	12	0.64 (0.14–2.84)	0.42

** Traditional birth attendants (for females only); *** for males only; NA: not applicable.

TABLE 3: Distribution of associated factors among chronic liver disease patients with respect to serostatus of hepatitis C virus in three public hospitals in Addis Ababa.

Associated factors	Anti-HCV antibody (%)			OR (95%, CI)	P value
	Positive	Negative	Total		
Community					
Tattooing on gum	5 (25.0)	15 (75.0)	20	1.18 (0.39–3.61)	0.48
Tattooing on body	1 (7.7)	12 (92.3)	13	0.26 (0.03–2.09)	0.16
Body piercing	3 (15.8)	16 (84.2)	19	0.60 (0.16–2.24)	0.33
Ear piercing	15 (29.4)	36 (70.6)	51	1.98 (0.83–4.71)	0.12
Uvulectomy	15 (29.4)	36 (70.6)	51	1.98 (0.83–4.71)	0.12
Shaving at barbershop***	8 (15.4)	44 (84.6)	52	0.55 (0.17–1.79)	0.24
Contact with jaundiced person	6 (24.0)	19 (76.0)	25	1.11 (0.39–3.14)	0.84
Circumcision	27 (22.9)	91 (77.1)	118	NA	0.59
Dental extraction at home	8 (19.5)	33 (80.5)	41	0.77 (0.30–1.94)	0.57
Hospital associated					
Hospitalization	16 (22.9)	54 (77.1)	70	1.05 (0.44–2.51)	0.91
Blood transfusion	8 (29.6)	19 (70.4)	27	1.64 (0.62–4.32)	0.31
Dental extraction	17 (33.3)	34 (66.7)	51	2.95 (1.21–7.17)	0.02*
Surgical procedure	5 (21.7)	18 (78.3)	23	0.95 (0.32–2.84)	0.92
Behavioral associated					
Alcohol consumption	11 (31.4)	24 (68.6)	35	1.98 (0.81–4.85)	0.13
Delivery by TBA**	7 (36.8)	12 (63.2)	19	1.85 (0.49–6.83)	0.36
Abortion**	5 (41.7)	7 (58.3)	12	2.14 (0.52–8.68)	0.24

TBA: traditional birth attendants; * statistically significant; ** females only; *** males only; NA: not applicable.

<50 years was observed by Bukhtiari et al. [18]. The chronic infection with hepatitis viruses leads to slow progressive liver disease. It may end up in cirrhosis, chronic liver failure, and HCC [19]. HBV and HCV share a common route of transmission and can coexist with each other. Coinfection with evidence of chronic HBV and HCV seems to result in more severe liver disease than either infection alone, with an increase risk of liver cancer [20] and probably an increase risk of fulminant hepatitis when superinfection with HCV on the background of chronic HBV. In our study the detection of co-infection with both HBV and HCV in CLD patients was based on the presence of combination of HBsAg and anti-HCV Ab.

The prevalence of HBV and HCV dual infection in this study was low. Higher findings were reported by other studies in patients on haemodialysis (3.5%), patients undergoing organ transplantation (8%), and injection drug users (42.5%) [21–23]. However, these result may underestimate the true number of people with HBV/HCV co-infection as there is an entity of occult HBV infection in patients with chronic hepatitis C infection [24]. The difference in the magnitude of co-infection among these studies and our study could be attributable to difference in the study population, geographical variation, and difference in methodology. In this study, cases of HCV-associated CLD were lower than HBV-associated cases. Similar pattern was previously reported in Ethiopia with 6.2% and 1.7% [25]. Tessema et al. [26] showed that the prevalence of HBV and HCV was 4.1% and 0.7%, respectively. In Vietnam, the prevalence of CLD due to HBV and HCV was 47% and 23%, respectively [27]. A higher HBV prevalence of 30.4% from Pakistan in patients with CLD was reported [17]. Contrary to these reports, higher prevalence of HCV to HBV in Pakistan, 64.9% HCV versus 24.7% HBV [18] higher HCV prevalence of 73.5% was reported among patients with CLD in Egypt [15]. The higher prevalence in these studies could be due to geographical variation and the higher propensity of HCV in causing liver disease than HBV [28]. HBV had higher prevalence in males while HCV was found more in females ($P > 0.05$). Similar results were reported in studies concerning HBV infection: in Ethiopia 4.9% in males and 3.3% in females [26], Pakistan 72% in males and 28% in females [29]. Our result was consistent with a study conducted in Madagascar on prevalence of HCV reported higher prevalence of anti-HCV in females than male [30]. However, no known risk exposure by gender for the differences was inferred from this data.

The prevalence of HBV and HCV among CLD patients who had history of either minor or major surgery was 4/23 (17.4%) and 5/23 (21.7%), respectively. However, history of either minor or major surgery could not be inferred from this study as a cause of infection either by HBV or HCV. In comparison, a comparatively low prevalence was reported in a study aimed to determine the seroprevalence of HBV and HCV viral infection in patients undergoing elective eye surgery, only 1.8% and 1.2% were seropositive for HBV and HCV, respectively [31]. Similarly a study on the frequency of HBV and HCV among patients reported a high prevalence, even though it was lower when compared to our finding of HBsAg 3.2% and anti-HCV 2.6% in patients presenting for surgery [29]. In addition, a result which was contrary to our

finding was reported in a study by Pasquini et al. [31]. The study revealed exposure to three or more tribal practices, such as ritual scarring or traditional surgery, is associated with an increased risk of HBV infection (OR = 1.7, 95% CI 1.1–2.6). The overall prevalence of HBV and HCV infection in those study participants who had history of blood transfusion was 22.2% and 29.6%, respectively. Two studies on HBV and HCV in blood donors have reported 4.7% and 0.7% (23) and 6.2% and 1.7% in Ethiopia [25], respectively. With regard to history of blood transfusion, no association was found in acquisition of HBV and HCV infection. This might be explained by the currently implemented screening for potential blood borne pathogens in blood banks.

Univariate analysis showed a strong association between history of dental extraction at health facility and HCV infection. The overall prevalence of HCV among CLD patients who had history of dental extraction at health facility was 17/51 (33.3%) ($P = 0.015$). Those who had history of dental extraction at health facilities were 2.95 time more likely to have infection with HCV than their counter parts and the difference was statistically significant. This finding agreed with a study conducted in Madagascar [30] and a strong association of liver disease was found with a history of dental treatment (38%) (OR 2.3; 95% CI: 1.8–3.0). However, no other factors were associated with HCV infection in the study. A study by Ahmad et al. [29] revealed the frequency of HBV and HCV amongst urban and rural population was 45% and 55%, respectively which is different from this study. Our finding showed greater frequency in urban than rural population. A higher frequency in urban dwellers was also observed in study on the prevalence of HBV in Arsi, Ethiopia (12.6% versus 8.7%) by Pasquini et al. [31]. This higher frequency of infection in urban population may be due to the nature of living in which urban areas are densely populated as compared to rural areas and this might expose urban dwellers for different risk factors. The sociodemographic characteristics have not been significantly associated with acquisition of infection except history of dental extraction at health facility in HCV infection.

5. Conclusion

The prevalence of HBV and HCV infections among CLD patients in this study is high. Dental extraction at health facilities has 2.95 time association of acquisition of HCV infection than those who do not have history of dental extraction. Thus, all clinically diagnosed CLD patients should be tested for HBV and HCV serostatus. Proper sterilization of dental and surgical instruments must be carried out. To prevent the spread of HBV and HCV, people must be educated about these infections and modes of transmission. The immunization activity against HBV in Ethiopia should be enhanced to full coverage.

Limitation of the Study

Because of the relatively fewer number of cases, all patients with signs and symptoms of CLD were included in the study. Due to resource constraints, this study was unable to conduct

confirmatory tests for those positive results and viral load was not performed. The study was did not measure the prevalence of these viruses in the different subgroups of chronic liver disease classification.

Ethical Considerations

The study protocol was cleared by ethical committee of the Department of Microbiology and Parasitology of Addis Ababa University. Written informed consent was obtained from all patients. The study protocol followed the ethical guidelines of the Declaration of Helsinki.

Conflict of Interests

The authors have declared that no conflict of interests exists.

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