Seroprevalence and Risk Factors of Hepatitis B and Hepatitis C Virus Infections in Uttarakhand, India

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Background and aims: Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are a serious global public health problem affecting billions of people. A population based serological survey was conducted in Uttarakhand, India to determine the prevalence and risk factors of HBV and HCV infections. **Methods:** A cross-sectional study was conducted to achieve the primary objective of estimating the prevalence of HBsAg and anti-HCV seropositivity and to estimate the potential risk factors. **Results:** A total of 495 volunteers completed the study questionnaire and underwent blood tests for HBsAg and anti-HCV serology. Of these, 339 (68.5%) were males and 156 (31.5%) were females. The mean age of the volunteers was 31 ± 4 years. The overall infection rate was 4.4% ($n = 22$) in the studied population. The seroprevalence of HBsAg was found to be 2.8% ($n = 14$) and of anti-HCV antibodies 1.8% ($n = 9$), whereas dual infection i.e. HBV and HCV infection was seen in 0.2% ($n = 1$). The overall analysis of risk factors of our data showed that persons who have received multiple blood transfusions, history of hepatitis among family members, visits to unregistered medical practitioners and uneducated people are at more risk for acquiring hepatitis B and hepatitis C infection. **Conclusions:** The results indicate an intermediate level of endemicity of HBV and HCV infection in this geographical area of Uttarakhand. Some independent risk factors like blood transfusion, intra familial transmission, and visit to unregistered practitioners were identified. (J CLIN EXP HEPATOL 2013;3:296–300)

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are major public health problems and are leading causes of chronic liver disease (CLD).¹ Worldwide over two billion people have been infected with HBV and more than 350 million have chronic HBV infection.² India is in the intermediate HBV prevalence area with a carrier rate of 3–4%. One hundred and seventy million people are infected with HCV and 3–4 million people get infected each year, putting viral HBV and HCV infection among the world's greatest infectious disease problems.³ These diseases are therefore important candidates for public health measures aimed at prevention, early diagnosis and treatment.⁴

Both HBV and HCV are transmitted through blood either by percutaneous or body fluids. The infections present with malaise, anorexia, abdominal pain and jaundice

but sometimes there are no symptoms till the development of cirrhosis, portal hypertension, esophageal varices, ascites, encephalopathy or hepatocellular carcinoma.⁵ The hepatitis B surface antigen (HBsAg) in serum is the first seromarker to indicate active HBV infection, either acute or chronic.⁶ The presence of anti-hepatitis C virus (anti-HCV) antibody indicates previous exposure to hepatitis C virus. This antibody is present in only 40% of acute infections but in more than 95% of chronic infections. In India, antibodies against HCV are present in approximately 15 million people with a prevalence rate of 2%.^{7,8} To understand and assess the magnitude and dynamics of transmission of a disease in a community and for its control and prevention, the assessment and study of its prevalence is very important. The available data at Uttarakhand on the seroprevalence and distribution of these blood-borne pathogens is limited.

The aim of the present study was to assess the seroprevalence of HBsAg and anti-HCV antibodies among different age groups in a tertiary care hospital and to identify the possible risk factors for acquiring these infections.

METHODS

Settings and Design

The study was conducted in a tertiary care hospital in Dehradun, Uttarakhand, India. Institutional ethical committee approved the study protocol. Patients were enrolled after

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Abbreviations: HCV: hepatitis C virus; HBV: hepatitis B virus; HBsAg: hepatitis B surface antigen; CLD: chronic liver disease; STD: sexually transmitted disease; ICTC: Integrated Counseling and Testing Center; HIV: human immunodeficiency virus; LFT: liver function test

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written informed consent. The study was conducted during free health check-up camp organized during world Hepatitis day i.e 28th July 2012. The camp was extended over a period of one week. A cross-sectional study was conducted to achieve the primary objective of estimating the prevalence of HBsAg and anti-HCV seropositivity and to estimate the potential risk factors by comparing seropositive and seronegative cases.

Questionnaires and Data Collected

Questionnaires were designed by a team of microbiologists and gastroenterologists familiar with modes of transmission of HBV, HCV and local customs. These assessed socio-demographic characteristics, present and past health conditions and potential risk factors for exposure to HBV and HCV. The latter included history of invasive medical procedures (blood transfusion, hemodialysis, surgery especially circumcision in male children, endoscopy, and dental procedures). Information regarding various community practices were also collected like history of sharing hypodermic needles or syringes, history of tattooing or body piercing, visit to community barber; history of jaundice or diagnosis of HBV and/or HCV among family members, visit to unregistered medical practitioners, history of animal bite or receiving any treatment for sexually transmitted disease (STD). Previous Vaccination status for HBV along with number of doses was also taken. History of any needle prick injury was also asked since many of our case population comprised of health care workers.

Serology

Five mL venous blood sample was collected from all patients attending the free health check-up camp. The collected samples were centrifuged within 6 h of collection and after serum separation; anti-HCV antibodies and Hepatitis B surface antigen were tested in the collected blood samples. Tests were performed using commercially available kits on the principle of sandwich immunoassay for HBsAg (Hepacard, J. Mitra & Co Pvt Ltd, India) and flow through technology for HCV (HCV Tridot, J. Mitra & Co Pvt Ltd, India).

Statistical Analysis

All data were analyzed using statistical package for social sciences (SPSS) version IBM SPSS-19. Data is represented in the form of frequency and percentage. OR and 95% CI was calculated for each risk factor. Chi-square test (Fisher exact test) was used to show the association between the variables. A *P* value <0.05 was considered significant.

RESULTS

A total of 495 volunteers completed the study questionnaire and underwent blood tests for HBsAg and anti-HCV serology. Of these, 339 (68.5%) were males and 156

(31.5%) were females. The mean age of the volunteers was 31 ± 4 years. Overall infection rate was 4.4% ($n = 22$) in the studied population. The seroprevalence of HBsAg was found to be 2.8% ($n = 14$) and anti-HCV antibodies were detected in 1.8% ($n = 9$), whereas dual infection i.e. HBV and HCV infection was seen in 0.2% ($n = 1$). All these 22 patients were also referred to ICTC (Integrated Counseling and Testing Center) for HIV testing since the route of transmission of HBV, HCV and HIV are quite similar but none of the patients were found to be positive for HIV 1 and/or 2 antibodies.

Demographic Features of Study Population (Table 1)

Gender of Study Population

Out of 22 patients positive for either HBV and/or HCV infection, 14 (63.6%) were males and 8 (36.4%) were females. Range of these patients was 21–65 years. Out of 473 patients negative for these seromarkers, 324 (68.5%) were males and 149 (31.5%) were females with a mean age of 31.5 years (OR = 0.80; 95% CI: 0.30–2.14, *P* = 0.643).

Educational Status

Illiteracy was higher in the patients with HBV and HCV infection. Only 8 (36.4%) patients from HBV and/or HCV positive group were educated as compared to 268 (56.7%) from negative group (OR = 0.437; 95% CI: 0.16–1.14, *P* = 0.098).

Risk Factors (Table 1)

Health Care Worker

Three of the 22 (13.6%) volunteers in the HBV and/or HCV positive group were found to be health care workers as compared to 86 of the 473 (18.2%) volunteers in the HBV and/or HCV negative group (OR = 0.71; 95% CI: 0.16–2.61, *P* = 0.779).

Received Blood Transfusion in Past

In the HBV and/or HCV positive group, 6/22 (27.3%) volunteers had received blood transfusion as compared to 59/473 (12.5%) volunteers in negative group (OR = 2.63; 95% CI: 0.99–6.99, *P* = 0.054).

Family History of Hepatitis

In the HBV and/or HCV positive group, 6/22 (27.3%) volunteers gave family history of hepatitis in the past, whereas only 36/473 (7.6%) patients from the HBV and/or HCV negative group gave this history (OR = 4.55; 95% CI: 1.48–13.4, *P* = 0.007).

Past History of Surgery

In the HBV and/or HCV positive group, 8/22 (36.4%) volunteers gave past history of surgery, whereas the same history was given by 162/473 (34.2%) patients in the HBV

Table 1 Demographic features and risk factors associated with seroprevalence of hepatitis B and anti-hepatitis C in hospital based population.

Risk factor	Hepatitis B and/or hepatitis C virus		Odds ratio (OR) 95% CI	P value
	Positive <i>n</i> = 22 (%)	Negative <i>n</i> = 473 (%)		
Health care worker				
Yes	3 (13.6)	86 (18.2)	0.71 (0.16–2.61)	0.799
No	19 (86.4)	387 (81.8)		
Received blood transfusion				
Yes	6 (27.3)	59 (12.5)	2.63 (0.99–6.99)	0.054
No	16 (72.7)	414 (87.5)		
Family history of hepatitis				
Yes	6 (27.3)	36 (7.6)	4.55 (1.48–13.4)	0.007
No	16 (72.7)	437 (92.4)		
History of surgery				
Yes	8 (36.4)	162 (34.2)	1.09 (0.41–2.85)	0.822
No	14 (63.6)	311 (65.8)		
Diagnosis in family member				
HCV	2 (9.1)	0		
HBV	1 (4.5)	0		
Jaundice	6 (27.3)	122 (25.8)		
Abnormal LFT	6 (27.3)	27 (5.7)		
H/O tattoo/nose piercing				
Yes	3 (13.6)	81 (17.1)	0.76 (0.176–2.81)	1.0
No	19 (86.4)	392 (82.9)		
Visit to barber shop				
Yes	3 (13.6)	99 (20.9)	0.59 (0.14–2.18)	0.591
No	19 (86.4)	374 (79.1)		
Visit to unregistered medical practitioner				
Yes	6 (27.3)	54 (11.4)	2.9 (0.97–8.36)	0.038
No	16 (72.7)	419 (88.6)		
Patient on hemodialysis				
Yes	0	9 (1.9)		
No	22 (100)	464 (98.1)		
H/O circumcision				
Yes	0	5 (1.1)		
No	22 (100)	468 (98.9)		
H/O needle prick injury				
Yes	0	36 (7.6)		
No	22 (100)	437 (92.4)		
H/O treatment for STD				
Yes	0	9 (1.9)		
No	22 (100)	464 (98.1)		
Previous Immunization				
Vaccinated	0	87 (18.4)		
Non-vaccinated	22 (100)	386 (81.6)		

Table 1. Continued

Risk factor	Hepatitis B and/or hepatitis C virus		Odds ratio (OR) 95% CI	P value
	Positive <i>n</i> = 22 (%)	Negative <i>n</i> = 473 (%)		
Gender				
Male	14 (63.6)	324 (68.5)	0.80 (0.30–2.14)	0.631
Female	8 (36.4)	149 (31.5)		
Range of age	21–65 years	12–87 years		
Education status				
Educated	8 (36.4)	268 (56.7)	2.28 (0.94–5.56)	0.098
Non-educated	14 (63.6)	205 (43.3)		

and/or HCV negative group (OR = 1.097; 95% CI: 0.41–2.85, *P* = 0.822).

History of Tattoo/Nose Piercing

In the HBV and/or HCV positive group, 3/22 (13.6%) volunteers gave history of tattooing/nose piercing, while 81/473 (17.1%) volunteers from the HBV and/or HCV negative group gave this history (OR = 0.76; 95%CI: 0.18–2.81, *P* = 1.0).

Visit to Barber Shop

History of frequent visits to barber shop was given in 3/22 (13.6%) volunteers from the HBV and/or HCV positive group and in 99/473 (20.9%) volunteers from the HBV and/or HCV negative group gave (OR = 0.59; 95%CI: 0.14–2.18, *P* = 0.59).

Visit to Unregistered Medical Practitioner

History of visit to unregistered medical practitioner was given in 6/22 (27.3%) volunteers from the HBV and/or HCV positive group and 54/473 (11.4%) volunteers from the HBV and/or HCV negative group gave (OR = 2.9; 95%CI: 0.97–8.36, *P* = 0.038).

Previous Vaccination

All 22 volunteers from the HBV and/or HCV positive group were non-vaccinated for hepatitis B whereas only 87/473 (18.4%) patients from the HBV and/or HCV negative group had taken full 3 doses of hepatitis B vaccination.

Other Risk Factors

None of the patients who were positive for HBsAg and anti-HCV gave history of needle prick injury, past history of circumcision, treatment for any sexually transmitted disease and none were on hemodialysis.

DISCUSSION

Countries are classified on the basis of endemicity of HBV infection into high (8% or more), intermediate (2–7%) or low (<2%) incidence countries. India has been placed into

the intermediate zone of prevalence rates by WHO.⁹ The overall rate of HBsAg positivity has been reported to range between 2 and 4.7%.¹⁰

The seroprevalence of HBsAg of 2.8% was noted in our tertiary care hospital population. A recent study conducted by Sood and Nalwankar² from Jaipur showed seroprevalence of HBsAg to be 0.87%. There is a wide variation in HBsAg prevalence in different geographical regions in India. Highest prevalence recorded in natives of Andamans and Arunachal Pradesh.¹¹

It has been estimated that global prevalence of HCV infection is around 2%, with 170 million persons chronically infected with the virus and 3 to 4 million persons newly infected each year.¹² Our study showed the seroprevalence for anti-HCV antibodies to be 1.8%. In India, the seroprevalence of HCV varies among hospital-based populations with 1.57% reported from Cuttack (Orissa),¹³ 4.8% from Pondicherry¹⁴ and 1.7% from Jaipur (Rajasthan).¹⁵

The prevalence of HBV and HCV infection varies from country to country and depends upon a complex mix of behavioral, environmental and host factors. In general, it is lowest in countries or areas with high standards of living (e.g. Australia, North America, North Europe) and highest in countries or areas with low socioeconomic levels (e.g. China, South East Asia, South America).

The analysis of risk factors showed that persons who have received multiple blood transfusions, history of hepatitis among family members, visits to unregistered medical practitioners are at higher risk of acquiring hepatitis B and hepatitis C infection in the study population. High prevalence rates of HBV and HCV are seen in multi-transfused populations even though maximum precautions are taken to avoid the transfusion of contaminated blood. In spite of all precautions this route of transmission tops the list of risk factors. Screening of blood products by nucleic acid amplification testing should be seriously considered in all blood banks because of limitations of serology based assays.¹⁶

While some studies have shown a relatively higher prevalence in the household members of patients with HBV

and HCV, other studies in the spouses of index cases have shown rates similar to controls.^{17,18} Sexual transmission of HCV is very low, it is likely that the high prevalence reported in household contacts may be due to the fact that they are exposed to the same community risk factors as the index patient, rather than intra-household transmission per se. In contrast, HBV intra-familial transmission is well documented and HBV is far more infectious as compared to HCV or HIV.^{19–21} The chances of higher transmission are also revealed by the study of Chowdhury et al,¹¹ in which they have reported 2.96% prevalence of Hepatitis B in family members of asymptomatic carriers from West Bengal.

Amongst the mode of transmission of these viruses, a very important mode would be the unsafe injection practice prevailing in the vast rural areas of the country. It needs to be mentioned that the rural poor population are still dependent upon the untrained paramedics for their treatment needs. Unfortunately, the sterilization of syringes, needles and minor surgical instruments are often improperly done in rural areas.²² WHO estimates that in Southeast Asia, an average person receives four injections per year, most of which are unnecessary and up to 75% are unsafe or reused.²³ The major limitation of this study is that it is a single hospital based population study and thus may not reflect all of Uttarakhand, India.

The findings highlight the need for prevention and control of HBV infection in India by improving screening facilities of blood and blood products before transfusion, implementing universal hepatitis B vaccination and creating public awareness about the spread and prevention of these infections. A continuous surveillance would provide better insight of these infections in this geographical region and also in understanding the impact of preventive measures in the population at risk.

CONFLICTS OF INTEREST

All authors have none to declare.

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