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Original Research Article

Hepatitis B and Hepatitis C Viral Infection Burden among the Patient Attending OPD in a Tertiary Care Hospital in Bihar

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Conflict of interest: Nil

Abstract:

Introduction Hepatitis B virus (HBV) and Hepatitis C virus (HCV) prevalence is continuously in increasing trends in Bihar, India; however, their exact state-wide prevalence data are not available till now. An understanding of HBV and HCV prevalence, risk factors and genotype distribution can be used to plan control measures in Bihar.

Material & Method: A prospective, OPD-based serosurvey was conducted from March-2024 to October-2024 at ANMMCH Gaya, Bihar. Children aged >=5 years and adults were eligible to participate. Demographic and risk behavior data were collected, and serological specimens were obtained and tested for Hepatitis B surface antigen (HBsAg) and anti-HCV antibody.

Result: Out of 14,707 and 8,767 OPD patients participated for the HBV and HCV prevalence study respectively shows 2.30% of HBV and 0.27% of HCV prevalent. Sex wise distribution shows there was male preponderance with 68.44% of HBV and 58% of HCV. Both HBsAg and Anti-HCV positivity was most prevalent in the 40–49 year-old and 30–39 year-old age groups with HBsAg was 30.09% and 24.77% and Anti-HCV was 33.33% and 25.0% in respective age group. Among all HBsAg positive cases having a history of Diabetes, Hypertension, Chronic Renal Failure and Cancer were 8.26%, 12.09%, 1.77% and 1.18% and among all Anti-HCV positive cases having a history of Diabetes, Hypertension, Chronic Renal Failure and Cancer were 3.15%, 3.94%, 0.79% and 0.79%.

Conclusion: This study findings estimate the overall prevalence of chronic HBV and HCV infection, their associated risk factors and demographic characteristics. These findings help and guide prevention and control efforts, including management options.

Keywords: HBV, HBsAg, HCV, Anti-HCV antibody, Seroprevlance.

Introduction

Viral hepatitis is a public health problem worldwide including India and is caused by Hepatitis A, B, C, D and E viruses. Hepatitis A and E, transmitted through fecal-oral route, usually present as acute infections which may occur sporadically or as outbreaks. Hepatitis B and C, transmitted predominantly by per-cutaneous or mucosal exposure to infected blood and various body fluids, can lead to chronic infection and progress to cirrhosis and hepatocellular carcinoma [1]. Hepatitis B virus (HBV) is a double-stranded DNA virus belonging to the genus Orthohepadnavirus and family Hepadnaviridae [2]. Hepatitis B virus (HBV), is one of the blood borne viruses that cause notifiable diseases, which consume health resources and have public health implications. HBV specifically attacks the liver and can cause both acute and chronic diseases. HBV transmitted predominantly in high endemicity areas by perinatal transmission or vertical transmission (from mother to child at birth) and in low-endemicity areas HBV is primarily transferred by horizontal transmission (transmission among individuals of the same generation) by close contact between children has also been documented and is strongly linked to high-risk behaviors such as unprotected sex and injectable drug use [3]. It is estimated that globally there are 296 million people

who are chronically infected with HBV [4]. Antiviral therapy has decreased the rates of liver decompensation and, as a result, lowered hospitalization and mortality rates. The longer-term benefits of antiviral therapy may include reversing liver fibrosis, reducing the risk of developing hepatocellular carcinoma, and decreasing the number of patients requiring liver transplantation [5,6,7]. Globally, an estimated 257–400 million people have chronic HBV infection [8,9,10] and estimated 29% of cirrhosis-related deaths worldwide were due to HBV [11]. Now Hepatitis B ranks as the 15th leading cause of death worldwide [12]. India ranks in the intermediate endemic zone for the HBV and prevalence of 3–4.2% of Hepatitis B surface antigen (HBsAg) and 40 million HBV carriers in the world [12]. The Global Health Sector Strategy on viral hepatitis (2016–2021) endorsed by the World Health Assembly in 2016 [13] called for the elimination of viral hepatitis as a public health threat by 2030. Bihar, an north-eastern state of India, has high percentage of tribal population in the country and limited information is available regarding the prevalence of HBsAg.

Hepatitis C virus (HCV) is a small, enveloped, positive-strand RNA virus belongs to the Flaviviridae family and the Hepacivirus genus [1]. HCV is primarily transmitted through exposure to infected blood or body fluids. There are an estimated 70 million people living with hepatitis C Virus (HCV) infection around the world [14]. Persons living with HCV infection are at risk of developing liver cirrhosis and progressing to end stage liver disease and liver cancer (hepatocellular carcinoma). Globally, an estimated 700,000 people die annually due to complications related to HCV infection [15].

The World Health Organization (WHO) has set ambitious targets to eliminate HCV infection as a public health problem by 2030 [16]. In order to achieve these targets, which include reduction of new infections by 90% and deaths by 65%, there is a need to increase prevention strategies and access to treatment.

Treatment for HCV has improved dramatically with the addition of direct acting antivirals (DAAs), which are easy to take oral regimens that are highly effective, have minimal side effects, and achieve cure rates of over 90% [17,18].

In order to establish effective prevention and treatment programs, there is a need to understand the epidemiology and burden of disease in the country or community. However, such data are lacking in many countries, particularly in lower and middle income countries which shoulder most of the burden [19]. There are significant geographical variations in prevalence patterns and genotype distribution globally [19,20], with populations in North America and Western Europe having anti-HCV prevalence rates generally less than 1%, while in some areas of Asia and the Middle East, prevalence rates exceed 5% [14,19,20,21,22]. In India, where genotype 3 is thought to be most common [23], population based studies on HCV infection prevalence are lacking, and the epidemiology is not well described. Some studies from India suggest the HCV prevalence may be low, however, there are significant variations within regions and sub-populations, with some studies demonstrating very high prevalence rates [22,24].

HBV and HCV seroprevalence data are lacking in Bihar, a state in North-estern India. Epidemiological assessment of the burden of disease and related risk factors in the state are essential for public health planning strategies to combat this disease. The present study was undertaken to estimate the seroprevalence of HBsAg and HCV among the patient attending in OPD of ANMMCH Gaya, Bihar situated at north-eastern state of India.

Aims and Objectives

From the study we were able -

- To estimate the seroprevalence of HBsAg and anti-HCV antibody among the patient attending in OPD of ANMCH Gaya, Bihar, India.
- To know associated risk factors and their demographic characteristics.
- To help policy makers for formulating appropriate control strategies against Hepatitis B and Hepatitis C virus.

Materials and Methods

Type of Study -This was a hospital lab based prospective study.

Period of study - Study conducted from March 2024 to October 2024 (7 months).

Place of study - Microbiology department, ANMCH Gaya.

Age: Children aged >=5 years and adults were eligible to participate in this study.

Gender: No gender specification.

Methodology:

2ml blood sample was drawn in a serum separator tube from patient attending OPD who were visited first time in ANMCH Gaya, Bihar irrespective of previous HBsAg and anti-HCV status, after taking consent from patient, or from his/her parents if he/she not able to give consent. These samples collected at sample collection unit and sent to Microbiology department for further study. Within one hour of collection, the samples were

centrifuged for 15 minutes at 3,000 revolutions per minute and were tested for anti-HCV antibody. Unused blood was disposed of as per healthcare waste management guidelines and all specimens were destroyed following completion of the study.

Demographic and risk behavior data were also collected by survey questionnaire, after obtaining informed consent. The study questionnaire was administered as a face-to-face interview and if needed by telephonic mode also about socio-demographic data, medical history, lifestyle information.

Data Analysis & Results

There were a total of 14,707 HBsAg and 5,546 anti-HCV samples collected separately from different OPD attending patients who agreed to participate in the study. Different results and socio-demographic characteristics of the HBsAg study were analysed and shown in Table (1-5) and Figure (1-5). Out of 14,707 OPD patients tested for HBsAg 339 were found positive for HBsAg and shows the prevalence of HBsAg. The overall prevalence of HBsAg was 2.30% (339/14707 x100) as shown in Figure 1.

Sex wise distribution shows that there was male preponderance. Out of total number of positive cases (339), 232 (68.44%) were males and 107 (31.56%) were females as shown in Figure 2.

HBsAg positivity was most prevalent in the 40–49 year-old and 30–39 year-old age groups (30.09% and 24.77% respectively) as shown in Table 1 and Figure 3.

In this study among all positive cases having a history of Diabetes, Hypertension, Chronic Renal Failure and Cancer were 8.26%, 12.09%, 1.77% and 1.18% respectively as shown in Table 2-5.

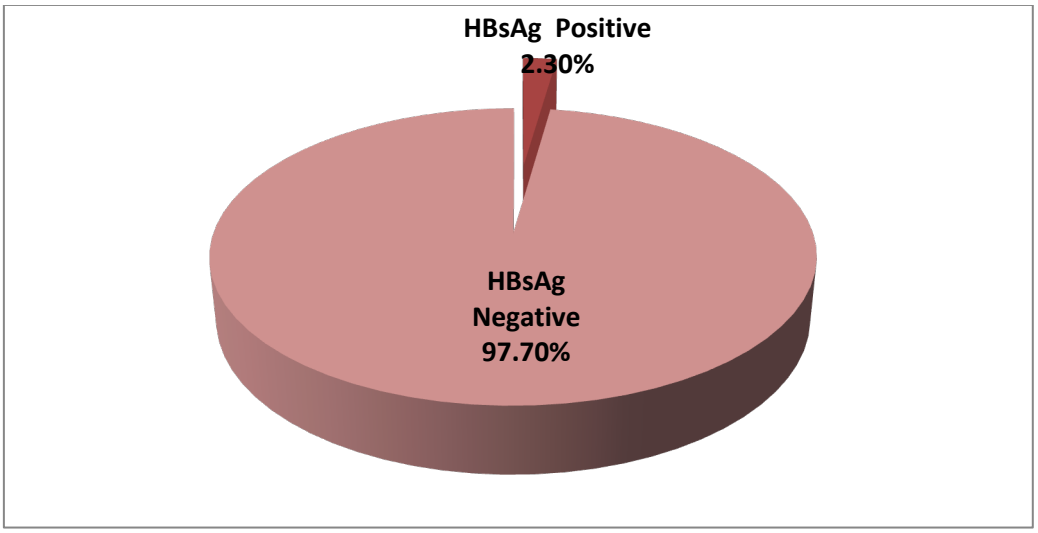

Figure 1: Seropositivity of HBsAg

Demographic characteristics and risk factors associated among HBsAg seropositive patients (n=339) described in Figure (2-3) and Table (1-5)

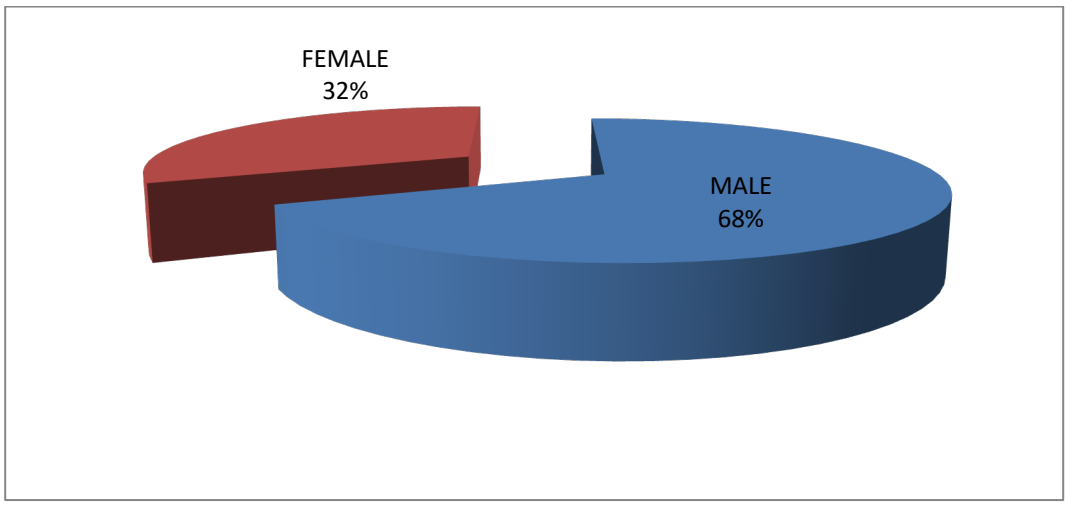

Figure 2: Distribution of HBsAg seropositive cases according to sex n=339

Table 1: **Distribution of HBsAg seropositive cases according to Age group n=339**

Age Group (years)	HBsAg positive n (%)
5-18	16 (4.72%)
19-29	28 (8.26%)
30-39	84 (24.77%)
40-49	102 (30.09%)
50-59	75 (22.12%)
>=60	34 (10.03%)

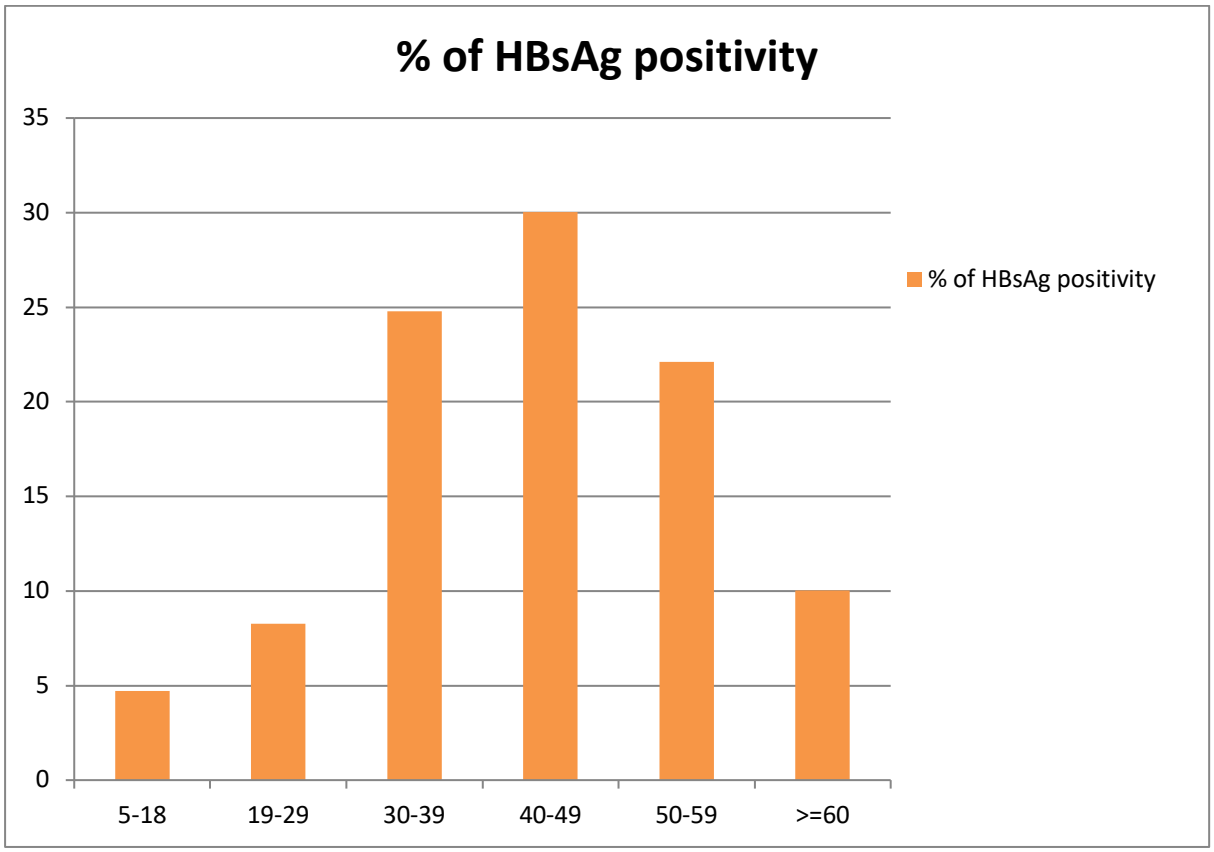

Figure 3: Comparison of HBsAg positivity with different Age group

Table 2: Distribution of HBsAg seropositive cases according to Diabetes status n=339

Diabetes status	n (%)
YES	28 (8.26%)
NO	311 (91.74%)

Table 3: Distribution of HBsAg seropositive cases according to hypertension status n=339

Hypertension status	n (%)
YES	41 (12.09%)
NO	298 (87.91%)

Table 4: Distribution of HBsAg seropositive cases according to Chronic Renal Failure status n=339

Chronic Renal Failure	n (%)
YES	06 (1.77%)
NO	126 (98.23%)

Table 5: Distribution of HBsAg seropositive cases according to Cancer status n=339

Cancer status	n (%)
YES	04 (1.18%)
NO	335 (98.82%)

Different results and socio-demographic characteristics of the Anti-HCV study were analysed and shown in Table (6-10) and Figure (6-10). Out of 8767 OPD patients tested 24 were found positive for anti-HCV antibody and shows the prevalence of anti-HCV antibody. The overall prevalence of anti-HCV was 0.27% (24/8767 x100) as shown in Figure 6. Sex wise distribution shows that there was slight male preponderance. Out of total number of positive cases (24), 14 (58.33%) were males and 10 (41.66%) were females as shown in Figure 7. Anti-HCV antibody positivity was most prevalent in the 40–49 year-old and 30–39 year-old age groups (33.33% and 25.00% respectively) as shown in Table 6 and Figure 8. The mean age of positive patients was 42.9 years with the majority (approx 33%) of positive cases in the 40–49 years age group as shown in Figure 8. In this study among all positive cases having a history of Diabetes, Hypertension, Chronic Renal Failure and Cancer were 8.33%, 12.50%, 4.16% and 8.33% respectively as shown in Table 7-10.

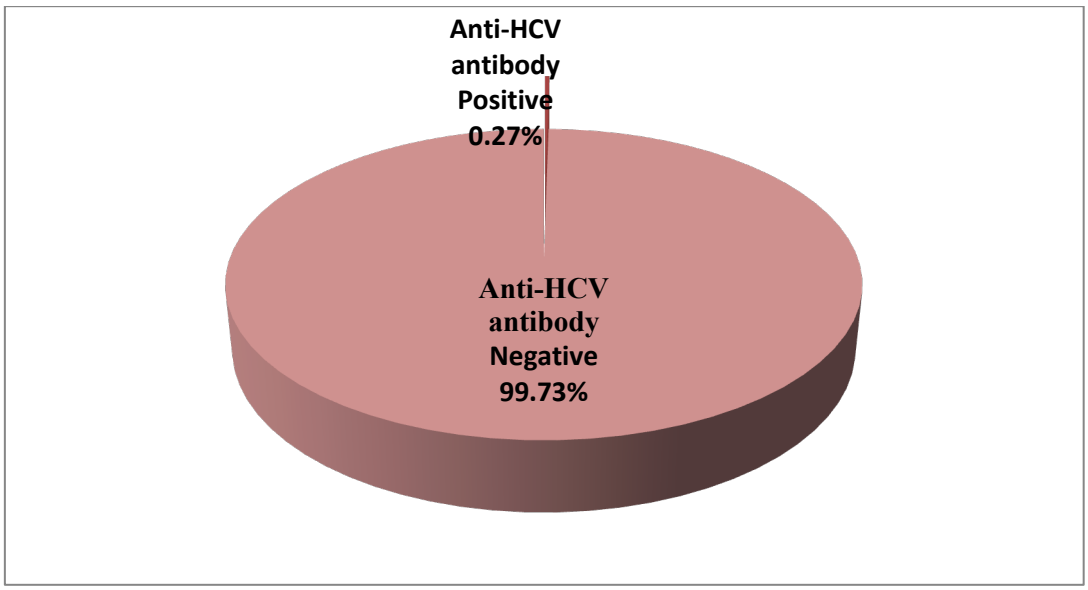

Figure 6: Seropositivity of anti-HCV antibody

Demographic characteristics and risk factors associated among anti-HCV seropositive patients (n=24) described in Figure (7-8) and Table (6-10)

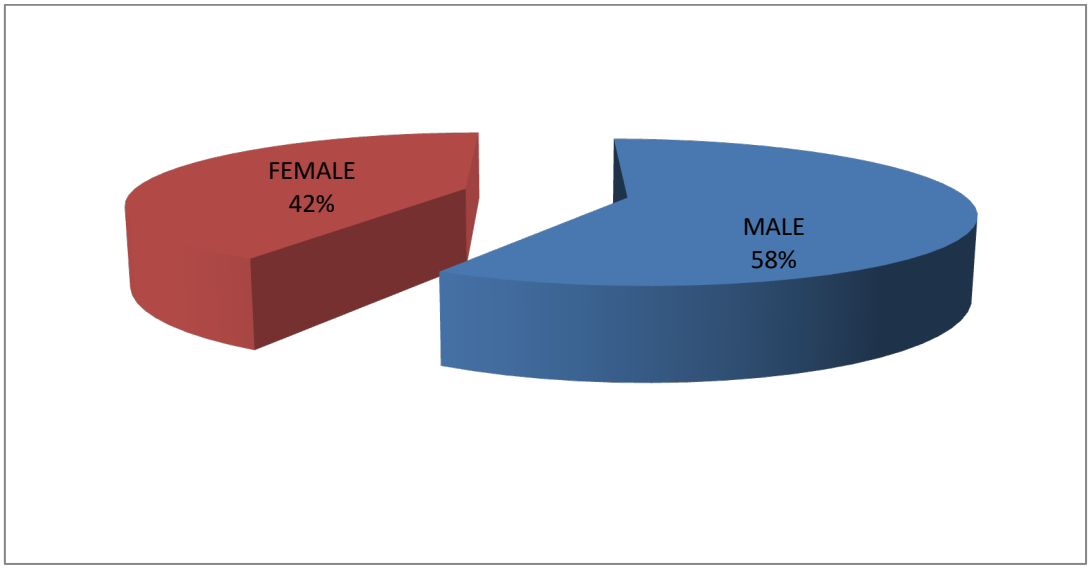

Figure 7: Distribution of anti-HCV seropositive cases according to sex n=24

Table 6: Distribution of anti-HCV seropositive cases according to Age group n=24

Age Group (years)	HBsAg positive n (%)
5-18	01 (4.16%)
19-29	02 (8.33%)
30-39	06 (25.00%)
40-49	08 (33.33%)
50-59	05 (20.83%)
>=60	02 (8.33%)

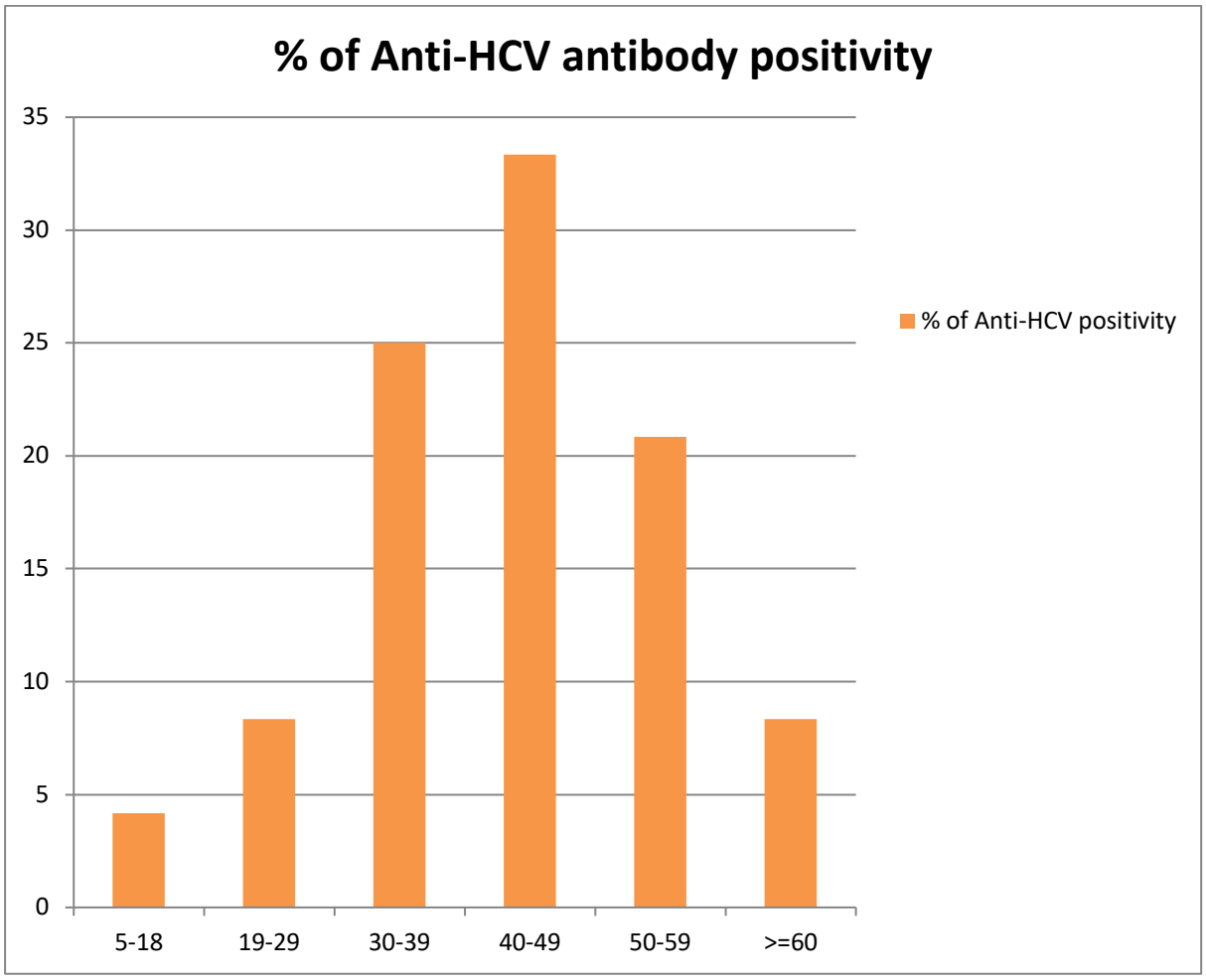

Figure 8: Comparison of anti-HCV positivity with different Age group

Table 7: Distribution of anti-HCV seropositive cases according to Diabetes status n=24

Diabetes status	n (%)
YES	02 (8.33%)
NO	22 (91.66%)

Table 8: Distribution of anti-HCV seropositive cases according to Hypertension status n=24

Hypertension status	n (%)
YES	03 (12.50%)
NO	21 (87.50%)

Table 9: Distribution of anti-HCV seropositive cases according to Chronic Renal Failure status n=24

Chronic Renal Failure	n (%)
YES	01 (4.16%)
NO	23 (95.83%)

Table 10: Distribution of anti-HCV seropositive cases according to Cancer status n=24

Cancer status	n (%)
YES	02 (8.33%)
NO	22 (91.66%)

Discussion

This study helped in assessing the prevalence and risk factors of HBV and HCV infection in Gaya region of Bihar state.

HBV:

Mathematical models shown in Murhekar et al. study in 2020 [25] helped to classify the endemicity of HBsAg as well as to quantify the burden of HBV infection. The prevalence study of HBsAg in different parts of the country by Bhattacharya et al. in 2015 [26]; Sharma et al. in 2019(27); and Manjiyil and Konikkara, in 2021[28] was higher than the HBsAg prevalence reported from our study (2.29%). Previous study by National Family Health Survey 4- Factsheet 2021(29) as a part of National Program for Surveillance of Viral Hepatitis, shown that National seroprevalence of Hepatitis B was 0.95% (0.89-1.01) which was lower than the prevalence reported from our study (2.29%). Seroprevalence was highest in group 1(Andhra Pradesh and Telangana) [2.39% (1.97-2.89)], while in group 2 (Bihar, Jharkhand, West Bengal and Andan Nicobar) was [1.26% (1.05-1.49)]. National Family Health Survey 4- Factsheet 2021[29] study have higher seroprevalence among men than women which was in accordance to our study among the participants, there were more men (68.44%) than women (31.56%). Like to our study seroprevalence had shown an increase with advancing age. Subjects with higher-risk sexual intercourse had shown greater seroprevalence [1.32% (0.86-1.78)] than those without higher risk sexual intercourse [1.03% (0.96-1.1)].

HCV:

This study, help in assessing the prevalence of anti-HCV antibody in Gaya region of Bihar state. We found an overall prevalence of anti-HCV is 0.27%. We found that males and persons aged 40-49, had the greatest odds of being infected with HCV. Another previous studies in 2014 from Punjab(30) showing the association of HCV with age, sex and rural residence has been observed, noting the increasing prevalence with age, it would be tempting to consider that transmission risk has decreased over time and younger people are at lower risk, however, the youngest age groups studied, 5±18 and 19±29 year olds, had HCV seropositive rates of over 1% and 2% respectively, suggesting that transmission risk persists in Punjab, which is similar pattern as our study. Testing for incident HCV and HBV cases is only supported by the country's national Integrated Disease Surveillance Programme (IDSP) in outbreak situations [31]. Fortunately, treatment costs for HCV infection in India have decreased significantly with the introduction of direct acting antiviral drugs in 2015, which have proven to be highly effective [32]. But our study is subject to several limitations. First, we were not able to independently verify any of the responses on the questionnaire. Also, we could not determine the number of nonresponders. As with any cross-sectional study that examines a chronic condition, it is challenging to attribute risk due to lack of temporality, as the HBV and HCV infection could have occurred at any time during the lifetime of the study subjects. The sampling method of this study, which included patient attending in OPD of ANMMCH Gaya, could lead to potential selection bias. Persons living together are more likely to exhibit similar behaviors and could lead to disproportionate risks in the sample that may not be representative of the general population.

Sampling method was a preponderance of patient attending in OPD of ANMMCH Gaya and were found to have a high prevalence of HBV than general residents. Thus these results should be interpreted with caution, as this could lead to overestimation of the prevalence in these areas.

Conclusion

The data presented in this study will provide a baseline for planning purposes and will help to get an initial understanding of HBV and HCV burden in Gaya region of Bihar. In order to monitor the trends and spread of Hepatitis B and Hepatitis C, we intent to collect robust data at regular intervals for better understanding of the epidemiology of Hepatitis B and Hepatitis C. there should be need to establish an inbuilt component of continuous surveillance as a part of the program through existing mechanisms.

References

1. Essentials of MEDICAL MICROBIOLOGY – 2nd edition by Apurba Sankar Sastry
2. Schaefer S. Hepatitis B virus taxonomy and hepatitis B virus genotypes. World J Gastroenterol. 2007; 13(1):14–21. https:// doi. org/ 10. 3748/ wjg. v13. i1. 14.
3. Trepo C, Chan HLY, Lok A. Hepatitis B virus infection. Lancet. 2014; 384(9959):2053–63. https:// doi. org/ 10. 1016/ S0140-6736(14) 60220-8.
4. WHO. https:// www. who. int/ news- room/ fact- sheets/ detail/ hepat itis-b (2021).

5. Peng CY, Chien RN, Liaw YF. Hepatitis B virus-related decompensated liver cirrhosis: benefits of antiviral therapy. J Hepatol. 2012; 57(2):442–50. https:// doi. org/ 10. 1016/J. JHEP. 2012. 02. 033.
6. Lu LG. Antiviral therapy of liver cirrhosis related to hepatitis B virus infection. J Clin Transl Hepatol. 2014; 2(3):197–201. https:// doi. org/ 10. 14218/ JCTH. 2014. 00022.
7. Khoo T, Lam D, Olynyk JK. Impact of modern antiviral therapy of chronic hepatitis B and C on clinical outcomes of liver disease. World J Gastroenterol. 2021; 27(29):4831–45. https:// doi. org/ 10. 3748/ wjg. v27. i29. 4831.
8. Schweitzer A, Horn J, Mikolajczyk RT, Krause G, Ott JJ. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. Lancet. 2015; 386(10003):1546–55. https:// doi. org/ 10. 1016/ S0140-6736(15) 61412-X.
9. Revill PA, Chisari FV, Block JM, Dandri M, Gehring AJ, Guo H. A global scientific strategy to cure hepatitis B. Lancet Gastroenterol Hepatol. 2019; 4(7):545–58. https:// doi. org/ 10. 1016/ S2468-1253(19) 30119-0.
10. Zuckerman JN, Zuckerman AJ. Current topics in hepatitis B. J Infect. 2000; 41(2):130–6. https:// doi. org/ 10. 1053/ jinf. 2000. 0720.
11. Hepatitis B. Accessed August 28, 2022. https:// www. who. int/ newsroom/ fact-sheets/ detail/ hepat itis-b.
12. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012; 380(9859):2095–128. https:// doi. org/ 10. 1016/ S0140-6736(12) 61728-0.
13. WHO Factsheet-b- World Hepatitis Day (2016). World Health Organization. Available at: https://www.who.int/docs/default-source/searo/india/health-topic-pdf/factsheet-b-hepatitisday2016.pdf?sfvrsn=da61ef0_2 Document number WHO/HIV/2016.06 (Accessed on August 03, 2022).
14. Polaris Observatory HCV Collaborators. Global prevalence and genotype distribution of hepatitis C virus infection in 2015: a modelling study. Lancet Gastroenterol Hepatol. 2017; 2(3):161±76. Epub 2017/04/14. https://doi.org/ 10.1016/S2468-1253 (16)30181-9 PMID: 2840 4132.
15. Global Burden of Disease: Mortality Collaborators. Global, regional, and national age-sex specific allcause and cause-specific mortality for 240 causes of death, 1990±2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015; 385(99 63):117±71. https://doi.org/10.1016/S0140-673 6 (14)61682-2 PMID: 25530442; PubMed Central PMCID: PMCPMC4340604.
16. World Health Organization. Combating Hepatitis B and C to reach elimination by 2030. 2016.
17. Ara AK, Paul JP. New Direct-Acting Antiviral Therapies for Treatment of Chronic Hepatitis C Virus Infection. Gastroenterol Hepatol (N Y). 2015; 11(7):458±66. PMID: 27118941; PubMed Central PMCID: PMCPMC4843024.
18. Schietroma I, Scheri GC, Pinacchio C, Statzu M, Petruzziello A, Vullo V. Hepatitis C Virus and Hepatocellular Carcinoma: Pathogenetic Mechanisms and Impact of Direct-Acting Antivirals. Open Virol J. 2018; 12:16±25. Epub 2018/03/16. https://doi.org/10.2174/18 74357901812010016 PMID: 29541275; PubMed Central PMCID: PMCPMC5842384.
19. Gower E, Estes C, Blach S, Razavi-Shearer K, Razavi H. Global epidemiology and genotype distribution of the hepatitis C virus infection. J Hepatol. 2014; 61(1 Suppl):S45±57. https:// doi.org/10.1016/j. Jhep.2014.07.027 PMID: 25086286.
20. Armstrong GL, Wasley A, Simard EP, McQuillan GM, Kuhnert WL, Alter MJ. The prevalence of hepatitis C virus infection in the United States, 1999 through 2002. Ann Intern Med. 2006; 144(10):705±14. PMID: 167025 86.
21. Balogun MA, Ramsay ME, Hesketh LM, Andrews N, Osborne KP, Gay NJ, et al. The prevalence of hepatitis C in England and Wales. J Infect. 2002; 45(4):219±26. PMID: 12423608.
22. Sievert W, Altraif I, Razavi HA, Abdo A, Ahmed EA, Alomair A, et al. A systematic review of hepatitis C virus epidemiology in Asia, Australia and Egypt. Liver Int. 2011; 31 Suppl 2:61±80. https://doi.org/10. 1111/j.1478-3231.2011.02540.x PMID: 21651703.
23. Petruzziello A, Marigliano S, Loquercio G, Cozzolino A, Cacciapuoti C. Global epidemiology of hepatitis C virus infection: An up-date of the distribution and circulation of hepatitis C virus genotypes. World J Gastroenterol. 2016; 22(34):7824±40. Epub 2016/09/30.https://doi.org/10.3748/wjg.v22.i34.7824 PMID: 27678366; PubMed Central PMCID: PMCPMC5016383.
24. Nandi J, Bhawalkar V, Mody H, Elavia A, Desai PK, Banerjee K. Detection of HIV-1, HBV and HCV antibodies in blood donors from Surat, western India. Vox Sang. 1994; 67(4):406±7. Epub 1994/01/01. PMID: 7535499.
25. Murhekar, M. V., Santhosh Kumar, M., Kamaraj, P., Khan, S. A., Allam, R. R., Barde,

P., et al. (2020). Hepatitis-B virus infection in India: findings from a nationally representative serosurvey, 2017-18. Int. J. Infect. Dis. 100, 455–460. doi: 10.1016/j.ijid.2020.08.084

26. Bhattacharya, H., Bhattacharya, D., Ghosal, S. R., Roy, S., and Sugunan, A. P. (2015). Status of hepatitis B infection - a decade after hepatitis B vaccination of susceptible Nicobarese, an indigenous tribe of Andaman & Nicobar (a&N) islands with high hepatitis B endemicity. Indian J. Med. Res. 141, 653–661. doi: 10.4103/0971-5916.159573
27. Sharma, R. K., Shukla, M. K., Minhas, N., and Barde, P. V. (2019). Seroprevalence and risk factors of hepatitis B virus infection in tribal population of Himalayan district Lahaul and Spiti, India. Pathog Glob Health 113, 263–267. doi: 10.1080/20477724.2019.1685802
28. Manjiyil, I. J., and Konikkara, K. V. (2021). Seroprevalence of hepatitis B virus infection among the tribal population of Attapady, Kerala, India. J. Clin. Diagn. Res. 15, DC10–DC14. doi: 10.7860/JCDR/2021/48444.15079
29. Government of India, Ministry of Health and Family Welfare. National Family Health Survey- 4, India fact sheet. Available at: http://rchiips.org/NFHS/pdf/NFHS4/India.pdf (accessed on August 27, 2022)
30. Singh P, Kaur R, Kaur A. Frequency distribution of Hepatitis C virus in different geographical regions of Punjab: Retrospective study from a tertiary care centre in North India. J Nat Sci Biol Med. 2014; 5 (1):56±8. https://doi.org/10.4103/0976-9668.127288 PM ID: 24678198; PubMed Central PMCID PM CPMC3961953.
31. Kumar T, Shrivastava A, Kumar A, Laserson KF, Narain JP, Venkatesh S, et al. Viral Hepatitis Surveillance ÐIndia, 2011±2013. MMWRMorb Mortal Wkly Rep. 2015; 64(28):758±62. PMID: 26203629.
32. Sood A, Midha V, Mahajan R, Narang V, Mehta V, Wander P, et al. Results of sofosbuvir-based combination therapy for chronic hepatitis C cohort of Indian patients in real-life clinical practice. J Gastroenterol Hepatol. 2017; 32(4):894±900. https://doi.org/10.1111/jgh.13628 PMID: 27787910.