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Universal Journal of Pharmaceutical Research
An International Peer Reviewed Journal
ISSN: 2831-5235 (Print); 2456-8058 (Electronic)

RESEARCH ARTICLE

PREVALENCE AND RISK FACTORS ASSOCIATED WITH HEPATITIS B VIRUS INFECTION AMONG ONCOLOGY PATIENTS

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Article Info:

Article History:
Received: 15 October 2024
Reviewed: 7 November 2024
Accepted: 21 December 2024
Published: 15 January 2025

Cite this article:
Almohya GAM, El-Zine MAY, Al-Shamahy HA, Al-Madhaji AG, Assayaghi RM. Prevalence and risk factors associated with Hepatitis B virus infection among oncology patients. Universal Journal of Pharmaceutical Research 2024; 9(6): 5-13.
http://doi.org/10.22270/ujpr.v9i6.1233

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Abstract

Background and aims: Hepatitis B virus (HBV) screening for patients with newly diagnosed solid cancer is not standard practice in oncology, and authorities disagree on whether complete screening should be carried out. Additionally, research on the risk factors for HBV infection in this patient population may differ from that in the general population. Therefore, estimating the prevalence of HBV and risk factors for HBV infection in individuals with recently diagnosed solid cancer was the study's goal.
Subjects and methods: Newly diagnosed cancer patients at the oncology center of Al-Jumhori Hospital in Sana'a, are included in this cross-sectional study. A regular questionnaire created specifically for this study was used to gather data, which included demographic information, risk factors, cancer type, and test findings. Using an ELISA assays for HB surface antigen and HB Core IgG anti-antibodies were conducted.
Results: The study analyzed 300 cancer patients with HBV testing, with a mean age of 42.9 years and a sex distribution of 37.6% men and 62.4% women. The crude HBV prevalence was 5%, with females having a higher prevalence. The study found no significant association between age, rural residency, married status, blood transfusion frequency, or blood sources with HBV risk. No association was found between under treatment chemotherapy and HBV infection.
Conclusions: This study examines the frequency of HBV infections in patients with solid tumors for the first time in Yemen. Our study found that the nationwide prevalence of HBV was higher in cancer patients than in the broad population.
Keywords: anti-HB core IgG antibodies, associated odds factors, cancers, HB S Ag, HBV infections, Yemen.

INTRODUCTION

Oncologists do not routinely screen all recently detected cancer patients for the hepatitis B virus (HBV), and there is disagreement among experts over the recommendation of screening. Universal screening is supported by a number of arguments. Population studies indicate that infections with this virus are more common among people who are old enough to have higher risks of cancer, even though the prevalence rate of prior HBV in Yemen is believed to be between 1% and 7%[1-10]. Family members and healthcare professionals are at risk of contracting HBV from patients who have undetected chronic infections[11-14]. Furthermore, since there are effective treatments for this virus, failing to screen for it is a missed chance to prevent viral reactivation during treatment, which would increase morbidity and death, as well as lower future morbidity linked to these infections[15]. As more cancer patients receive treatment with immune-system-altering medications, this could be a special problem. The annual screening of all Yemeni patients with newly diagnosed cancer for HIV, HBV, and HCV will raise the expense of cancer treatment and may have little impact on patient outcomes. False-positive test results are more likely to occur in medical laboratories with extremely poor quality control, like Yemen, which could cause more patient concern and postpone cancer treatment. In order to prevent possible negative consequences like viral reactivation, physicians may choose to use "less toxic" cancer treatments with questionable efficacy, or they may delay cancer treatment even for people with true-positive testing[16]. The potential advantages of delaying or changing

cancer treatment are still speculative, yet there is a genuine risk to the prognosis of individuals who have just received a cancer diagnosis. This is because it is uncertain how likely it is for people with latent infections to experience serious side effects from the majority of cancer treatments.

The fact that it is unknown how common these viruses are in individuals with recently diagnosed cancer is a significant barrier to the discussion of universal screening. Furthermore, we don't know how much knowledge patients with recently diagnosed cancer have about their viral status in a time when primary care is placing more focus on viral screening. We conducted this prospective cohort analysis to assess the frequency of HBV infection among individuals with newly diagnosed solid cancer in order to better inform these concerns and to advise decisions about viral screening in practice. Additionally, we aimed to describe prevalence by self-reported HB virus risk factors and by the types of cancer that presented.

SUBJECTS AND METHODS

Population: The primary national cancer center, the Republican Hospital's Oncology Center, served as the recruitment site. Arabic-language informed consent forms were given to the patients to sign. On August 15, 2023, the High Graduated Studies Protocol Review Committee granted approval from the Institutional Review Board. Patients were eligible if, within 120 days of the original diagnosis, as verified by the medical record, they came to the clinic for examination or treatment of a cancer. After their initial visit to the clinic, patients have to enroll within ninety days. Eligible patients included individuals who started cancer therapy at another facility and came in for second opinions on newly confirmed malignancies. Except for skin cancers such as basal cell carcinoma or squamous cell carcinoma, cervical cancer in situ, or breast cancer in situ, individuals were not eligible if they had received a new cancer diagnosis during the previous five years. According to the study protocol, hepatitis B virus (HBV) screening should be offered to all patients (except from hematologic patients) who are presenting for evaluation or treatment for a new malignancy. It was necessary to provide proof of previous testing within 365 days before study enrollment, either in the form of blood test results or appropriate evidence of viral status.

Specimen collection: Each patient had five milliliters of whole blood drawn aseptically via venous puncture, and the serum was separated by centrifugation following coagulation. Before testing, the sera were kept at -20℃ in an Eppendorf tube containing the samples.

Laboratory tests: Using a commercial kit, a closed-system enzyme-linked immunosorbent assay (ELISA) was used to detect the levels of HB surface antigen and anti-core IgG antibodies in the samples.

Ethical approval: The current study was approved by the Institutional Ethics Committee of the Faculty of Medicine and Health Sciences, Sana'a University, No.: 2023-29 dated August 1, 2023. Before enrollment and starting the study procedures, written informed consent was obtained from all participants.

Statistical analysis: The Statistical Package for Epi-Info version 7 was used for all statistical analyses which were then shown as percentages, means, SD representations. Calculated chi-square test, geometric means, 95% CI, and logistic regression were used to determine the odds ratio for risks and its significance. If the *p*-value was less than 0.05, significant differences were indicated.

RESULTS

The age and sex distribution of 300 cancer patients who had HBV testing is displayed in Table 1. The group's mean age was 42.9±16.5 years, and the patients' ages ranged from 10 to 89 years. There are 37.6% men and 62.4% women. The frequency of HBV (HBsAg) in 300 cancer patients by age and sex is shown in Table 2. HBV had a crude prevalence of 5%, with females having a 5.9% higher prevalence than males (3.5%). In terms of age categories, the largest number (10.8%) was seen in the group over 55 years.

Table 1: Gender and age distribution of 300 tumor patients tested for HBV in oncology center in Sana'a city.

Characters	N (%)
Sex	
Male	113 (37.6)
Female	187 (62.4)
Age in Years	
Less than 16 years	19 (6.4)
16-25 years	38 (12.7)
26 – 35 years	39 (13)
36-45 years	71 (23.7)
46-55 years	50 (16.7)
>55 years	83 (27.7)
Mean	42.9 years
SD	16.5 years
Median	45 years
Mode	40 years
Min to Max	10-89 years

Table 2: prevalence of HB surface antigen among different sex and age groups of 300 tumor patients in oncology center, Sana'a city.

Characters	N (%)
Sex	
Male, n=113	4 (3.5)
Female, n=187	11 (5.9)
Total, n=300	15 (5)
Age group	
Less than 16 years, n=19	0 (0)
16-25 years, n=38	1 (2.6)
26 – 35 years, n=39	0 (0)
36-45 years, n=71	3 (4.2)
46-55 years, n=50	2 (4)
>55 years, n=83	9 (10.8)
Mean	56 years
SD	12.6 years
Median	60 years
Mode	65 years
Min to Max	23- 70 years

Table 3: Prevalence of HB Core IgG antibodies among different genders and ages for 300 tumor patients in the Oncology Center in Sana'a City.

Characters	N (%)
Sex	
Male, n=113	11 (9.7)
Female, n=187	37 (19.8)
Total, n=300	48 (16)
Age in Years	
Less than 16 years, n=19	0 (0)
16-25 years, n=38	6 (15.8)
26 – 35 years, n=39	6 (15.4)
36-45 years, n=71	13 (18.3)
46-55 years, n=50	10 (20)
>55 years, n=83	13 (15.7)
Mean	46.2 years
SD	14.4 years
Median	45 years
Mode	60 years
Min to Max	19- 75 years

Table 3 displays the prevalence of HB Core IgG antibodies in 300 tumor patients from the Oncology Center in Sana'a City by age and gender. According to core IgG antibodies, the crude prevalence of HBV was 16%, with females having a 19.8% higher prevalence than males (9.7%). Regarding age categories, the largest percentage (20%) was found in the 46–55 age group, followed by the 36–45 age group (18.3%). The percentage was zero percent for the age group under 16 years old. Table 4 shows the frequency of blood transfusions, residence, and blood supply details for cancer patients who have been tested for HBV. The majority of patients were resident rural areas, counting 78.9%, while only 21.1% live in urban areas (cities). When marital status was considered, 85.1% were married and 14.5% were single. When it came to blood transfusions, 42.9% of the patients received blood transfusions once and 12.8% twice, while 0.7% received them just once. The major source of the blood was Al-Jumhori hospital (43.8%), followed by private hospitals (34.9%) and blood banks (21.3%). Table 5 shows the types of cancer among cancer patients who had a hepatitis B virus test. The incidence of lung cancer was 31.3%, gastric cancer 28%, breast cancer 15.3%, colorectal cancer 10.7%, lymphoma 5.7%, liver cancer 4.3%, prostate cancer 3.3%, and other cancers 1.3%. The results were statistically significant (p = 0.02) when looking at the associated factors of HBV.

Table 4: Frequency of residence, blood transfusion, sources of the blood among cancer patients tested for HBV.

Characters	N (%)
Residency	
Urban	63 (21.1)
Rural	237 (78.9)
Marital status	
Married	255 (85.1)
Single	44 (14.5)
Others	1 (0.4)
Blood transfusion	
None	131 (43.6)
Once	129 (42.9)
Twice	38 (12.8)
More than 2	2 (0.7)
Source of the blood n=169	
Main Blood bank	36 (21.3)
Al-Jumhori Hospital	74 (43.8)
Private hospital	59 (34.9)

Table 5: Type of cancers among patients tested for HBV.

Types of cancers	N (%)
Lung cancer	94 (31.3)
Gasteric cancer	84 (28)
Breast cancer	46 (15.3)
Colorectal cancer	32 (10.7)
Lymphoma	17 (5.7)
Liver cancer	13 (4.3)
Prostate Cancer	10 (3.3)
Others	4 (1.3)
Total	Total n=300

The odds ratio for a female patient was 2.2, whereas the *OR* for a male patient was 0.4, with a confidence range spanning from 1.1 to 4.7. There was no significant related odds ratio between age groups when age groups were taken into consideration. In comparison to an urban residency *OR* of 0.2, a rural resident had an associated odds ratio of 4.7 with a significant p value of 0.006 and a confidence range spanning from 1.4 to 15.6 when looking at the connected determinants of HBV. When examining the related factors of HBV, a married status had an associated odds ratio of 2.1, but the result was not statistically significant (p=0.15). When blood transfusion was considered, there was no significant association found with blood transfusion or frequency of blood transfusion.

Table 6: Associated of sex and age with HBV infection (HBV core IgG positive) for cancer patients.

Characters	Positive HBV n=48 N (%)	*OR*	*95% CI*	X^2	*p*
Sex					
Male, n=113	11 (9.7)	0.4	0.2-0.89	5.2	0.02
Female, n=187	37 (19.8)	2.2	1.1-4.7	5.2	0.02
Total=300	48 (16)				
Age in Years					
Less than 16 years, n=19	0 (0)	0	Undefined	3.9	0.04
16-25 years, n=38	6 (15.8)	0.9	0.3-2.4	0.04	0.96
26 – 35 years, n=39	6 (15.4)	0.9	0.3-2.4	0.01	0.9
36-45 years, n=71	13 (18.3)	1.2	0.6-2.5	0.36	0.54
46-55 years, n=50	10 (20)	1.3	0.6-3.1	0.7	0.39
>55 years, n=83	13 (15.7)	0.96	0.4-1.9	0.009	0.92

Table 7: Association of residence, blood transfusion, sources of the blood with contracting HBV infections for cancer patients.

Characters	Positive HBV N (%)	*OR*	*95% CI*	X^2	*p*
Residency					
Urban, n=63	3 (4.8)	0.2	0.06-0.7	7.5	0.006
Rural, n=237	45 (19)	4.7	1.4-15.6	7.5	0.006
Marital status					
Married, n=255	44 (17.3)	2.1	0.7-6.2	1.9	0.15
Single, n=44	4 (9.1)	0.48	0.1-1.4	1.8	0.17
Blood transfusion					
None, n=131	21 (16.0)	1.0	0.53-1.9	0.002	0.98
Once, n=129	23 (17.8)	1.3	0.7-2.3	0.5	0.45
Twice, n=38	4 (10.5)	0.5	0.19-1.7	0.97	0.32
More than 2, n=2	0 (0)	0	Undefined	0.35	0.53
Source of the blood					
Main Blood bank, n=36	7 (19.4)	1.3	0.51-3.2	0.36	0.54
Al-Jumhori Hospital, n=74	14 (18.9)	1.3	0.7-2.6	0.6	0.43
Private hospital, n=59	14 (23.7)	1.9	0.97-3.8	3.2	0.07

Also, when blood sources were considered, no significant association was found with the sources of the blood that was given to the patients. Lung cancer had an odds ratio of 2.9 with a confidence interval spanning from 1.5 to 5.4 and a significant *p* value of 0.0007 when the relationship between HBV infections and cancer type was examined. Infections with HBV did not significantly correlate with other malignancies observed in this investigation. With a significant *p*-value of 0.01 and an odds ratio of 10.9 with a confidence range of 1.1 to 12.2, a family history of HBV was associated with HBV infections in cancer patients.

Table 8: Association of type of cancers with HBV infections among cancer patients.

Types of cancers	Positive HBV N (%)	OR	95% CI	X^2	*p*
Lymphoma, n=17	0 (0)	0	undefined	3.4	0.06
Gasteric cancer, n=84	11 (13.1)	0.70	0.36-1.5	0.7	0.39
Lung cancer, n=94	25 (26.6)	2.9	1.5-5.4	11.4	0.0007
Colorectal cancer, n=32	5 (15.6)	0.9	0.35-2.8	0.003	0.95
Liver cancer, n=13	0 (0)	0.96	0.32-2.6	0.003	0.95
Prostate Cancer, n=10	0 (0)	0	undefined	1.9	0.16
Breast cancer, n=46	5 (10.9)	0.59	0.2-1.6	1.06	0.3
Others, n=4	2 (50)	5.4	0.74-3.9	3.5	0.06
Total, n=300	48 (16)				

Furthermore, the associated odds ratio of 2.5 with a confidence range of 1.3 to 4.7 and a history of operation as a risk factor for HBV infection showed a significant *p* value of less than 0.006. Furthermore, it was discovered that our cancer patients' history of dental visits was a risk factor for HBV infection; the associated odds ratio for this factor was 3.3, with a significant p value of 0.0008 and a confidence interval ranging from 1.6 to 7.0. While there was no association between chemotherapy and contracting HBV in the cancer patients (*OR*=0.96, CI=0.2-4.8, *p* =0.94).

DISCUSSION

Viral hepatitis continues to wreak havoc on communities, businesses, and health systems worldwide despite the availability of safe and effective vaccines and antiviral therapies. This is especially true in nations like Yemen, where control programs and immunizations are inadequate. In order to give Member States a workable plan for getting rid of viral hepatitis as a hazard to global public health by 2030, WHO released its Global Health Sector Strategy on Viral Hepatitis in 2016-2017. Chronic hepatitis B or occult HBV infection is caused by persistent hepatitis B virus (HBV) infection[18]. The study provides data in favor of Yemen's urgently needed expansion of HBV screening and prevention for cancer patients as standard clinical practice. According to our research, 5% of patients with cancer had chronic hepatitis B, which is greater than the HB surface antigen prevalence rates for children in Shabowah governorate (3.8%) and Sana'a city (1.8%)[8]. Also less than that of PHCCs studied, where HBV was discovered in 8.2% of health professionals, and less than that reported among heamodialysis patients, where 9.9%, 8.9%, and 2.97% were found to be infected with HCV, HBV, and Co-HBV/HCV infection, respectively[6,11]. Chronic hepatitis B prevalence rates of 0.3% in France[19], 4.6% in the Republic of Korea[20], 6.6% in Iran[21], 7.78% in Taiwan[22], 8.2% in China[23], 14% in South Africa[24], and 29.1% in Kenya[25] have been found in prior international investigations involving cancer patients. These prevalence statistics differ according to individual risk factors, types of malignancies analyzed, and endemicity levels of hepatitis B. Regretfully; solid data regarding the prevalence of chronic hepatitis B in Yemeni patients who do not have hepatic malignancies

is not as readily available and could be attributed to inadequate disease surveillance and routine screening programs in the Yemen region. Furthermore, the crude prevalence of HBV among cancer patients in the current study was 5%, which is comparable to the estimated 4.1% (316 million) of the global population that has chronic hepatitis B and the 555,000 people who died from HBV-related sequelae in 2019 alone[18]. For these reasons, prevention and control of HBV infection continue to be top priorities in the global health agenda. The situation is even worse in Africa, where 71000 people die each year from chronic hepatitis B, which has an estimated prevalence of 6.5%.

Table 9: Associated confessional risk factors of HBV among cancer patients.

Factors	Positive HBV n=48 N (%)	*OR*	*95% CI*	X^2	*p*
Blood products transfusion, n=158	27 (17.1)	1.2	0.6=2.2	0.29	0.58
Family history of HBV, n=3	2 (66.7)	10.9	1.1-12.2	5.7	0.01
History of operation, n=152	33 (21.7)	2.5	1.3-4.7	7.5	0.006
History of dental visit, n=172	38 (22.1)	3.3	1.6-7	11.1	0.0008
Heamodiaylasis, n=1	1 (100)	Undefined		5.3	0.02
Chemotherapy, n= 288	46 (16)	0.96	0.2-4.8	0.004	0.94
Radiation, n=0	0 (0)	-	-	-	-

In sub-Saharan Africa, the illness load differs in the Western (9.0%), Central (6.4%), Eastern (4.8%), and Southern (4.5%) regions. The prevalence of chronic hepatitis B in South Africa is 3.5% in all age groups. This is largely due to a disproportionate residual burden among high-risk adult populations, such as those who inject drugs (5%), work in healthcare (1.3–5.1%), are pregnant (0.4-4.5%)[26-30], and are living with HIV (6.4–8.5%)[31-34]. Nonetheless, the 5% pre-study rate among cancer patients is less than that of Africa, where 14% of cancer patients have HBV[24]. HBV infection has also been demonstrated to be common in patients with non hepatic cancers such as lymphoma, breast cancer, and melanoma, and gynecological cancers such as cervical, uterine, and ovarian cancers[21,23,25]. Chronic HBV infection is linked to a significant lifetime risk of developing hepato-cellular carcinoma. HBV reactivation is a significant concern for cancer patients receiving cytotoxic or immunosuppressive therapy while they have latent or uncontrolled chronic HBV infection[21,31]. A poor prognosis marked by a quick development to liver problems such as cirrhosis, fulminant liver failure, and even death is linked to HBV reactivation after extended immunosuppression; this outcome may have happened in 5% of the patients in the current study. Fortunately, prompt detection of HBV serological and molecular markers, along with the initiation of appropriate vaccinations or prophylactic and preventive antiviral therapy using nucleotide analogues, and close monitoring during cancer treatment and follow-up, can prevent HBV reactivation caused by immuno-suppressive therapy for cancer[35-37]. As a result, before beginning immunosuppressive treatment for cancer, a number of national guidelines advise testing for hepatitis B surface antigen (HBsAg) and antibody to core antigen (anti-HBc) to decide the best course of therapeutic management. HBV DNA testing, however, is only recommended for individuals who test positive for HBsAg or anti-HBc. This may rule out individuals who have a negative latent HBV infection, which is defined as being negative for all serological markers but positive for HBV DNA, as they may still be vulnerable to reactivation while on immunosuppressive medication[38].

Comprehending national patterns regarding adherence to these criteria at the facility level would be crucial. Other studies, which frequently highlight the need for greater knowledge among practitioners, demonstrate inconsistent compliance with screening and prophylactic treatment delivery before patients start immunosuppressive therapy for cancer in both HBV-endemic and low-prevalence settings[39-42]. Based on local data on the incidence and prevalence of HBV infection among cancer patients, national recommend-dations pertaining to positive results during immuno-suppressive medication for cancer patients must be more strictly enforced.

It is known that a number of factors contribute to the higher burden of HBV in settings with inadequate resources. Under diagnosis, insufficient preventive measures, contact tracking, and insufficient therapy for individuals impacted are some of these issues. Additional contributing issues include low community awareness of infection and transmission, concerns about treatment accessibility and expense, and occasionally healthcare personnel' lack of current treatment protocols. Other factors that contribute to the spread of this disease include rising rates of internal and external migration, organizational and administrative problems that hinder the national health organization's commitment to mobilizing resources, poor coordination with international partners or their departure from Yemen because of the conflict, and a lack of sense of duty on the part of some state employees towards the health of the community members[43-49].

In contrast to an urban residency's OR of 0.2, a rural resident's associated odds ratio (OR) for HBV-related characteristics in the current study was 4.7, with a confidence range spanning from 1.4 to 15.6 and a significant *p* value of 0.006. This finding differs from earlier research that found no differences in HBV prevalence in Yemen among residents 3-5. However, it did find significant differences in the method of transmission between people and geographic areas[44]. The majority of infections in endemic areas (≥ 8%

chronic HBV patients) occur during pregnancy or childhood through intimate household interactions[23].

On the other hand, in countries with low HBV prevalence (≤ 2 chronic HBV patients), most infections happen in adulthood[50]. Children in the Netherlands are at a significant risk of acquiring HBV if one or both of their parents were born in a country where the virus is widely endemic, according to Hahné *et al.*[51], Hutin and colleagues[52] emphasized nosocomial transmission, pointing out that a major cause of HBV infection in Moldova is the frequent reuse of single-use, inadequately cleaned needles in healthcare settings.

When examining the related factors of HBV in the current study, a married status had an associated odds ratio of 2.1 but the result was not statically significant (p=0.15). There was no discernible correlation between blood transfusion frequency or blood transfusion volume when blood transfusion was taken into account. Furthermore, no statistically significant correlation was observed between the blood sources and the blood supplied to the patients. Despite this, the patient's frequency of other suggested risk factors such as dental visits and surgery was higher. Current findings differ from those of Al-Showkani *et al.*[3], who observed that blood transfusion was strongly linked to the spread of HBV genotypes and that patients may be exposed to super- or co-infection through the transfusion of contaminated blood.

A female patient's associated odds ratio of 2.2 was observed in the current study when the connected factors of HBV were examined compared to a male patient's *OR* of 0.4. The results were statistically significant (p=0.02) and had a confidence range ranging from 1.1 to 4.7. There was no statistically significant related odds ratio between age groups when age groups were taken into consideration. In contrast, over half of our patients were young adults (age range: 15–40 years) in Ramsey *et al.*[53]. The increased prevalence of risk variables around the end of adolescence may be the cause of this outcome.

Conversely, Ramsy *et al.*[53], observed a marginal rise in patients over 50 years of age and a decline in patients in their 40s. Living with HBsAg-positive parent(s) was a significantly predominant risk factor among patients under 30 years of age when independent risk factors were analyzed with respect to age and gender[3]. They suggested that this was most likely due to household transmission not related to having solid cancer. A history of operation was also found to be a significant risk factor for HBV infection in the current study, with a p value of less than 0.006 for the related odds ratio of 2.5 with a confidence range of 1.3 to 4.7. These findings are consistent with those of Ozer *et al.*[54], who found that risk-bearing activities, like surgery, were among the most important modes of transmission in the population under study. Thus, our findings imply that in order to lower HBV transmission in Yemen, nosocomial hygiene and infection control strategies need to be strengthened. This study found that a family history of HBV was associated with an odds ratio of 10.9, a significant p value of 0.01, and a confidence range spanning from 1.1 to 12.2. These results are similar to those reported by Turkey, where Kose *et al.*[55], found that an HBV (+) family member was associated with HBV transmission in 958 chronic HBV patients (80.6%).

Lung cancer had an associated odds ratio of 2.9 with a confidence interval spanning from 1.5 to 5.4 and a significant p value of 0.0007 when the relationship between HBV infections and cancer type was examined. This study could not find any evidence of a significant correlation between HBV infections and other documented malignancies. This result differs from that of Ramsey *et al.*[53], who found that patients with gastrointestinal cancers other than lung, liver, or colorectal and prostate cancer (12.0%; 95% CI, 6.4%-20.0%) had the highest prevalence of HBV infection. Liver, gastrointestinal tract cancers other than colorectal or liver, head and neck, lung, and prostate were among the malignancies with the highest infection incidence in other studies. However, the rates of different viral infections within certain tumors varied significantly. Due to their viral-positive status, only 8.0% of patients with any type of infection altered their cancer therapies[53].

Different oncology practice guidelines advocate different things when it comes to viral screening. Before beginning anti-CD20 medication or hematopoietic cell transplantation, the American Society of Clinical Oncology and the National Comprehensive Cancer Network recommendations[56,57] advise screening for HBV infection. Patients with risk factors for HBV infection should also be screened, according to the National Comprehensive Cancer Network[56,57]. However, in places where risk-based screening is not feasible, universal screening should be taken into consideration. There are many that advocate for universal HBV screening. Views on the clinical management of HCV infection during cancer treatment differ. Increases in liver function tests and HCV RNA have been reported in specific trials following chemotherapy; however, it is unclear what these results mean clinically and how they may affect treatment[58-60].

Limitations of the study

It is important to talk about the limitations of the current study. Initially, nothing was known about earlier HBV antiviral treatments. Second, the patient database did not contain the findings of testing for abnormal liver enzyme levels or imaging investigations of the hepatobiliary system. Fourth, because genetic detection of the HBV genome and viral load was not performed for our patients, the detection tests had a variety of limitations that could have resulted in an overestimation or underestimating of the frequency of occult HBV in our population. We are also unable to confirm that the prevalence of viral infections is the same as it is in the general population since we did not include a control group of patients who did not have cancer.

CONCLUSIONS

This is the first study of its kind in Yemen looking into the frequency of viral infections in cancer patients. Our findings indicated that the nationwide prevalence of HBV was marginally higher in cancer patients than in

the general population. On the other hand, the prevalence of HBV is similar among HD patients and healthcare workers who are receiving maintenance. Clinicians strongly advise screening patients for HBV infections since these patients are more vulnerable to side effects related to treatment.

ACKNOWLEDGEMENT

The work was funded by Sana'a University in Sana'a, Yemen, which the authors are grateful for.

AUTHOR'S CONTRIBUTIONS

Gameel Ahmed Mohammed Almohya: Writing the original draft, method, and investigation **Monya Abdullah Yahya El-Zine:** formal analysis, data organization, visualization**. Hassan Abdel-Wahab Al-Shamahy:** formal analysis, data organization, visualization, and the rest of the authors: reviewing and editing the article. All authors reviewed and approved the final version of the article.

DATA AVAILABILITY

The data will be available to anyone upon request from the corresponding author.

CONFLICT OF INTEREST

There is no conflict of interest around this work.

REFERENCES

1. El-Zine MAY, Dawood YAS, Al-Shamahy HA, *et al*. Hepatitis C virus and leukemia patients: Prevalence and risk factors associated with infection among leukemia patients who achieve long-term remission after chemotherapy. Universal J Pharm Res 2024; 9(4): 21-27. *http://doi.org/10.22270/ujpr.v9i4.1150*
2. Al-Shami HZ, Al-Mutawakal ZAM, Al-Kholani AIM, *et al*. Prevalence of hepatitis A virus, hepatitis B virus, and hepatitis C virus, among patients with hepatic jaundice in Sana'a city, Yemen: A hospital based study. Universal J Pharm Res 2021; 6(6):12-17. *https://doi.org/10.22270/ujpr.v6i6.693*
3. Al-Shawkany EM, AlShawkany AARM, Bahaj SS, *et al*. Prevalence of different hepatitis B virus genotypes and risk factors associated among selected Yemeni patients with chronic hepatitis B infection. Universal J Pharm Res 2021; 6(3):24-29. *https://doi.org/10.22270/ujpr.v6i3.603*
4. Edrees WH, Al-Ofairi BA, Alrahabi LM, *et al*. Seroprevalence of the viral markers of hepatitis B, hepatitis C, and HIV among medical waste handers in some hospitals in Sana'a city-Yemen. Universal J Pharm Res 2022; 7(3):12-19. *https://doi.org/10.22270/ujpr.v7i3.774*
5. Al Makdad ASM, Al-Haifi AY, Al-Mutaa NAM, AlShamahy, HA. Immunological status of hepatitis B virus infection among freshmen university students in Yemen. Universal J Pharm Res 2023; 8(1):55-60. *https://doi.org/10.22270/ujpr.v8i1.900*
6. Amran OAA, Al-Shamahy HA, Al-Haddad AM, Jaadan, BM. Explosion of hepatitis B and C viruses among hemodialysis patients as a result of hemodialysis crisis in Yemen. Universal J Pharm Res 2019, 4(5):13-17. *https://doi.org/10.22270/ujpr.v4i5.311*
7. Al-kadassy AM, Al-Ashiry AFS, Al-Shamahy HA. Seroepidemiological study of hepatitis B, C, HIV, and Treponema pallidum among blood donors in Hodeida city,Yemen. Universal J Pharm Res 2019, 4(2):38-42. *https://doi.org/10.22270/ujpr.v4i2.256*
8. Al-Shamahy HA, Ajrah MA, Al-Madhaji AG, *et al*. Prevalence and potential risk factors of hepatitis B virus in a sample of children in two selected areas in Yemen. Universal J Pharm Res 2019; 4(3): 1-6. *https://doi.org/10.22270/ujpr.v4i3.269*
9. Centers for Disease Control and Prevention HIV 5 surveillance report, 2016. Accessed August 20, 2024. *https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-report-2015-vol-27.pdf*
10. Centers for Disease Control and Prevention Viral hepatitis surveillance, United States, 2015. Accessed August 20, 2024. *https://www.cdc.gov/hepatitis/statistics/2015surveillance/pdfs/2015hepsurveillancerpt.pdf*.
11. AL-Marrani WHM, Al-Shamahy HA. Prevalence of HBV and HCV; and their associated risk factors among public health center cleaners at selected public health centers in Sana'a city-Yemen. Universal J Pharm Res 2019, 3(5):58-62. *https://doi.org/10.22270/ujpr.v4i5.204*
12. Terrault NA, Lok ASF, McMahon BJ, *et al*. Update on prevention, diagnosis, and treatment of chronic hepatitis B: AASLD 2018 hepatitis B guidance. Hepatol 2018; 67(4):1560-1599. *https://doi.org/10.1002/hep.29800*
13. Center for Disease Control and Prevention Testing recommendations for hepatitis C virus infection 2018; *https://www.cdc.gov/hepatitis/hcv/guidelinesc.htm* Accessed August 20, 2024.
14. Branson BM, Handsfield HH, Lampe MA, *et al*. Centers for Disease Control and Prevention (CDC). Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. MMWR Recomm Rep 2006; 55(RR-14):1-17. PMID: 16988643
15. Loomba R, Rowley A, Wesley R, *et al*. Systematic review: The effect of preventive lamivudine on hepatitis B reactivation during chemotherapy. Ann Intern Med 2008; 148(7):519-528. *https://doi.org/10.7326/0003-4819-148-7-200804010-00008*
16. Mahale P, Kontoyiannis DP, Chemaly RF, *et al*. Acute exacerbation and reactivation of chronic hepatitis C virus infection in cancer patients. J Hepatol 2012; 57(6):1177-1185. *https://doi.org/10.1016/j.jhep.2012.07.031*
17. World Health Organization. Global health sector strategy on viral hepatitis 2016-2021. Towards ending viral hepatitis. (2016). World Health Organization. *https://apps.who.int/iris/handle/10665/246177*
18. Sheena BS, Hiebert L, Han H, *et al*. Global, regional, and national burden of hepatitis B, 1990–2019: A systematic analysis for the global burden of disease study 2019. Lancet Gastroenterol Hepatol 2022; 7(9):796–829. *https://doi.org/10.1016/S2468-1253(22)00124-8*
19. Chonco F, Rangiah S. Susceptibility to hepatitis B infection, hepatitis B/HIV co-infections and hepatitis B immunity in HIV-positive patients starting HAART in Durban, South Africa. South Afr Family Practice (2019) 61(2):65–8. *https://doi.org/10.1080/20786190.2018.1518023*
20. An J, Kim JW, Shim JH, *et al*. Chronic hepatitis B infection and non-hepatocellular cancers: A hospital registry-based, case-control study. PloS One 2018; 13(3):e0193232. *https://doi.org/10.1371/journal.pone.0193232*
21. Mahmoudvand S, Shokri S, Mirzaei H, *et al*. Frequency of hepatitis B virus infection among patients before chemotherapy treatment. Asian Pacific J Cancer Prev 2021; 22(9):2939–44. *https://doi.org/10.31557/APJCP.2021.22.9.2939*
22. Chen CH, Hsieh HH, Wu TY. Real-world prevalence of hepatitis B virus reactivation in cancer patients in Taiwan. J Oncol Pharm Practice 2021; 27(1):63–70. *https://doi.org/10.1177/1078155220913095*

23. Lu LJ, Adhikari VP, Zhao CX, *et al*. Clinical study on the relationship between hepatitis B virus infection and risk of breast cancer: A large sized case-control and single center study in southwest of China. Oncotarget 2017; 8(42):72044–53. *https://doi.org/10.18632/oncotarget.19132*
24. Mak D, de Villiers CB, Chasela C, Urban MI, Kramvis A. Analysis of risk factors associated with hepatocellular carcinoma in black South Africans: 2000–2012. PloS One 2018; 13(5):e0196057. *https://doi.org/10.1371/journal.pone.0196057*
25. Wanyama FM, Tauber R, Mokomba A, Nyongesa C, Blanchard V. The burden of hepatitis B, hepatitis C, and human immunodeficiency viruses in ovarian cancer patients in Nairobi, Kenya. Infect Dis Rep 2022; 14(3):433–45. *https://doi.org/10.3390/idr14030047*
26. Joseph Davey D, Hsiao Ny, Spearman CW, *et al*. Low prevalence of hepatitis B virus infection in HIV-uninfected pregnant women in Cape Town, South Africa: Implications for oral pre-exposure prophylaxis roll out. BMC Infect Dis 2022; 22(1):719. *https://doi.org/10.1186/s12879-022-07697-5*
27. Chotun N, Preiser W, van Rensburg CJ, Fernandez P, Theron GB, Glebe D, *et al*. Point-of-care screening for hepatitis B virus infection in pregnant women at an antenatal clinic: A South African experience. PloS One 2017; 12(7):e0181267. *https://doi.org/10.1371/journal.pone.0181267*
28. Diale Q, Pattinson R, Chokoe R, Masenyetse L, Mayaphi S. Antenatal screening for hepatitis B virus in HIV-infected and uninfected pregnant women in the Tshwane district of South Africa. South Afr Med J 2015; 106(1):97–100. *https://doi.org/10.7196/SAMJ.2016.v106i1.9932*
29. Burnett RJ, Dramowski A, Amponsah-Dacosta E, Meyer JC. Increasing hepatitis B vaccination coverage of healthcare workers global lessons for South Africa. Curr Opin Immunol 2021; 71:6–12. *https://doi.org/10.1016/j.coi.2021.03.010*
30. Scheibe A, Young K, Moses L, *et al*. Understanding hepatitis B, hepatitis C and HIV among people who inject drugs in South Africa: Findings from a three-city cross-sectional survey. Harm Reduction J 2019; 16(1):28. *https://doi.org/10.1186/s12954-019-0298-2*
31. Samsunder N, Ngcapu S, Lewis L, *et al*. Seroprevalence of hepatitis B virus: Findings from a population-based household survey in KwaZulu-Natal, South Africa. Int J Infect Dis 2019; 85:150–7. *https://doi.org/10.1016/j.ijid.2019.06.005*
32. Chonco F, Rangiah S. Susceptibility to hepatitis B infection, hepatitis B/HIV co-infections and hepatitis B immunity in HIV-positive patients starting HAART in Durban, South Africa. South Afr Family Practice 2019; 61(2):65–8. *https://doi.org/10.1080/20786190.2018.1518023*
33. Msomi N, Naidoo K, Yende-Zuma N, Padayatchi N, Govender K, Singh JA, *et al*. High incidence and persistence of hepatitis B virus infection in individuals receiving HIV care in Kwa Zulu-Natal, South Africa. BMC Infect Dis 2020; 20(1):847. *https://doi.org/10.1186/s12879-020-05575-6*
34. Elbedewy TA, Elashtokhy HEA, Rabee ES, Kheder GE. Prevalence and chemotherapy-induced reactivation of occult hepatitis B virus among hepatitis B surface antigen negative patients with diffuse large B-cell lymphoma: Significance of hepatitis B core antibodies screening. J Egypt Natl Cancer Instit 2015; 27(1):11–8. *https://doi.org/10.1016/j.jnci.2015.01.004*
35. Pattullo V. Hepatitis B reactivation in the setting of chemotherapy and immunosuppression - prevention is better than cure. World J Hepatol 2015; 7(7):954–67. *https://doi.org/10.4254/wjh.v7.i7.954*
36. Pattullo V. Prevention of hepatitis B reactivation in the setting of immunosuppression. Clin Mol Hepatol 2016; 22(2):219–37. *https://doi.org/10.3350/cmh.2016.0024*
37. South African National Department of Health. National Guidelines for the Management of Viral Hepatitis. Available *https://www.knowledgehub.org.za/elibrary/national-guidelines-management-viral-hepatitis*
38. Sun WC, Hsu PI, Yu HC, *et al*. The compliance of doctors with viral hepatitis B screening and antiviral prophylaxis in cancer patients receiving cytotoxic chemotherapy using a hospital-based screening reminder system. PloS One 2015; 10(2):e0116978. *https://doi.org/10.1371/journal.pone.0116978*
39. Sun WC, Tang PL, Chen WC, *et al*. Hepatitis B virus screening before cancer chemotherapy in Taiwan: A nationwide population-based study. Front Med (2021) 8:657109. *https://doi.org/10.3389/fmed.2021.657109*
40. Leber K, Otten HMJMMB, Brandjes DPM, Claassen MAA, Lauw FN. Clinical practice of hepatitis B screening in patients starting with chemotherapy: A survey among Dutch oncologists. Eur J Cancer Care 2021; 30(6):e13495. *https://doi.org/10.1111/ecc.13495*
41. Hwang JP, Fisch MJ, Lok ASF, Zhang H, Vierling JM, Suarez-Almazor ME. Trends in hepatitis B virus screening at the onset of chemotherapy in a large US cancer center. BMC Cancer 2013; 13(1):534. *https://doi.org/10.1186/1471-2407-13-534*
42. Bane A, Patil A, Khatib M. Healthcare cost and access to care for viral hepatitis in Ethiopia. Int J Innov Appl Stud. 2014; 9(4):1718–23.
43. Sheena BS, Hiebert L, Han H, *et al*. Global, regional, and national burden of hepatitis B, 1990–2019: A systematic analysis for the global burden of disease study 2019. Lancet Gastroenterol Hepatol 2022;7(9):796–829.
44. Tordrup D, Hutin Y, Stenberg K, *et al*. Additional resource needs for viral hepatitis elimination through universal health coverage: projections in 67 low-income and middle-income countries, 2016–30. The Lancet Global Health 2019;7(9):e1180–e8.
45. Easterbrook P, Johnson C, Figueroa C, Baggaley R. HIV and hepatitis testing: global progress, challenges, and future directions. AIDS Rev 2016;18(1):3–14.
46. Odimayo MS, Adebimpe WO, Jeff-Agboola YA, *et al*. Screening, vaccination, and referrals as viral hepatitis elimination triad among internally displaced persons in Edo State, Nigeria. Clin Liver Dis (Hoboken) 2020 Dec 10;16(5):218-222. *https://doi.org/10.1002/cld.1063*
47. Shiferaw F, Letebo M, Bane A. Chronic viral hepatitis: policy, regulation, and strategies for its control and elimination in Ethiopia. BMC Public Health 2016; 16: 769. *https://doi.org/10.1186/s12889-016-3459-1*
48. Tran TT, Martin P. Hepatitis B: Epidemiology and natural history. Clin Liver Dis 2004 May; 8(2):255-66. *https://doi.org/10.1016/j.cld.2004.02.008*
49. Martinson FE, Weigle KA, Royce RA, *et al*. Risk factors for horizontal transmission of hepatitis B virus in a rural district in Ghana. Am J Epidemiol. 1998;147(5):478–87.
50. Hahne S, Ramsay M, Balogun K, Edmunds WJ, Mortimer P. Incidence and routes of transmission of hepatitis B virus in England and Wales, 1995-2000: Implications for immunisation policy. J Clin Virol 2004;29(4):211–20.
51. Hahné SJ, Veldhuijzen IK, Smits LJ, Nagelkerke N, van de Laar MJ. Hepatitis B virus transmission in The Netherlands: a population-based, hierarchical case-control study in a very low-incidence country. Epidemiol Infect 2008 Feb; 136(2):184-95. *https://doi.org/10.1017/S0950268807008205*
52. Hutin YJ, Harpaz R, Drobeniuc J, *et al*. Injections given in healthcare settings as a major source of acute hepatitis B in Moldova. Int J Epidemiol 1999;28(4):782–6.
53. Ramsey SD, Unger JM, Baker LH, *et al*. Prevalence of hepatitis B virus, hepatitis C virus, and HIV infection among patients with newly diagnosed cancer from academic and community oncology practices. JAMA Oncol. 2019 Apr 1;5(4):497-505. *https://doi.org/10.1001/jamaoncol.2018.6437*

54. Ozer A, Yakupogullari Y, Beytur A, Beytur L, Koroglu M, Salman F, Aydogan F. Risk factors of hepatitis B virus infection in Turkey: A population-based, case-control study: Risk factors for HBV infection. Hepat Mon 2011 Apr; 11(4):263-8. PMID: 22087152.
55. Kose S, Olmezoglu A, Gozaydin A, Ece G. Seroprevalence of hepatitis B and C among oncology patients in Turkey. J Health Popul Nutr 2011 Dec; 29(6):652-5. *https://doi.org/10.3329/jhpn.v29i6.9903*
56. Hwang JP, Somerfield MR, Alston-Johnson DE, *et al*. Hepatitis B virus screening for patients with cancer before therapy: American Society of Clinical Oncology provisional clinical opinion update. J Clin Oncol 2015; 33(19):2212-2220. *https://doi.org/10.1200/JCO.2015.61.3745*
57. National Comprehensive Cancer Network (NCCN) NCCN Clinical Practice Guidelines in Oncology. Prevention and treatment of cancer-related infections. Version 2.2016. 2016.
58. Baden LR, Bensinger W, Angarone M, *et al*. National Comprehensive Cancer Network. Prevention and treatment of cancer-related infections. J Natl Compr Canc Netw. 2012;10(11):1412-1445. *https://doi.org/10.6004/jnccn.2012.0146*
59. Torres HA, Hosry J, Mahale P, Economides MP, Jiang Y, Lok AS. Hepatitis C virus reactivation in patients receiving cancer treatment: A prospective observational study. Hepatol 2018;67(1):36-47. *https://doi.org/10.1002/hep.29344*
60. Jang ES, Kim YS, Kim KA, *et al*. Factors associated with health-related quality of life in Korean patients with chronic hepatitis C infection using the SF-36 and EQ-5D. Gut Liver 2018; 12(4):440-448. *https://doi.org/10.5009/gnl17322*