



RESEARCH ARTICLE

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

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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 infections¹¹⁻¹⁴. 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 infections¹⁵. 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 testing¹⁶. 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°C 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
Gastric 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) infection¹⁸. 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 Shabawah 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 hemodialysis 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 France¹⁹, 4.6% in the Republic of Korea²⁰, 6.6% in Iran²¹, 7.78% in Taiwan²², 8.2% in China²³, 14% in South Africa²⁴, and 29.1% in Kenya²⁵ 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 alone¹⁸. 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
Heamodialysis, 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 HBV²⁴. 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 hepatocellular 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 immunosuppressive therapy for cancer³⁵⁻³⁷. 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 medication³⁸.

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 settings³⁹⁻⁴². Based on local data on the incidence and prevalence of HBV infection among cancer patients, national recommendations pertaining to positive results during immunosuppressive 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 members⁴³⁻⁴⁹.

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 areas⁴⁴. The majority of infections in endemic areas ($\geq 8\%$

chronic HBV patients) occur during pregnancy or childhood through intimate household interactions²³.

On the other hand, in countries with low HBV prevalence (≤ 2 chronic HBV patients), most infections happen in adulthood⁵⁰. 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 colleagues⁵² 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 gender³. 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 therapies⁵³.

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.

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AUTHOR'S CONTRIBUTIONS

Gameel Ahmed Mohammed Almohya: Writing the original draft, method, and investigation **Monya Abdullah Yahya El-Zine:** formal analysis, data organization, visualization, 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.

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