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**Prevalence of Hepatitis B and C among Patients
attending Emirates International University
Dental Clinics in Sana'a City, Yemen**

A graduation Project Submitted to Faculty of Medicine and Health Sciences as a partial
Fulfillment for requirement of Bachelor's Degree in Laboratory Medicine

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Abstract

Introduction: Evaluation of the prevalence of hepatitis B and C viruses among patients of dental clinics in Sana'a is essential to understand the local burden of this infection and to identify potential risk factors associated with its transmission.

Objective: to evaluate the prevalence rate of HBV and HCV and risk factors associated with infections among patients attending Emirates International University dental clinics in Sana'a City, Yemen.

Rationale: To highlight the importance of routine screening before any dental procedure, specially before any oral surgical procedure such as tooth extraction.

Materials and Methods: This study was conducted in Emirates International University dental clinics in Sana'a City, Yemen. The total study period was 3 months, commencing from March, 2023 to May, 2023. 385 patients were screened for HBV and HCV infection by clinical diagnostic tests that carried out by researchers before dental extraction or procedures.

Results: Of 385 patients, two were found to be positive for HBV and one HCV collectively. Among them male more incidence than female. In addition, prevalence rate was 2 (0.52 %) for HBV and 1 (0. 26%) was with HCV. Risk factors for HCV were gender and clinical status of disease while age group with HBV.

Conclusion: The prevalence of HBV and HCV was low among patients attending Emirates International University dental clinics. This study clearly emphasizes the importance of preoperative routine screening for HBV and HCV before any dental procedure.

Keywords: *Hepatitis B, Hepatitis C, Dental clinics, Yemen*

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DEDICATION

These few written words will not suffice the descriptions of our feeling.
We dedicate this our research to our University, doctors, family, and
friends and to all who support our way to the gradation and to every
knowledge seeker in our country.

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List of Abbreviations

AIDS	Acquired immunodeficiency syndrome
DNA	Deoxyribonucleic acid
EIA	Enzyme immunoassays
ELISA	Enzyme linked immune sorbent assays
ESRD	End stage renal disease
HBV	Hepatitis B virus
HCC	Hepatocellular carcinoma
HCFA	Health care financing administration
HCV	Hepatitis C virus
HD	Hemodialysis
HIV	Human immunodeficiency virus
ICT	Indirect coombs test
NAT	Nucleic acid testing
NANBH	Non A and Non B hepatitis
PCR	Polymerase chain reaction
RIA	Radio immunoassay
RIBA	Recombinant immune – blot assay
RNA	Ribonucleic acid
SD	Standard deviation
SPSS	Statistical package of social sciences
STT	Screening test transfusion
TSS	Transfusion safety study
TTDS	Transfusion transmitted diseases
TTI	Transfusion transmitted infection
WHO	World health organization

Chapter 1

Introduction

1.1. Introduction

Hepatitis B, C, and Human immunodeficiency virus (HBV, HCV, and HIV) infections were considered an occupational risk for dental professionals and other health care workers. It is a risk that includes the possibility of dental personnel getting HBV or HCV infection from an infected patient and the potential transmission of HBV to susceptible patients from infected dental personnel. (**Zhang *et al.*, 2011**).

The global prevalence of hepatitis B virus (HBV) is 3.5%, hepatitis C virus is 1% (HCV) and Human immunodeficiency virus (HIV) is 2.5% (**Petruzzello *et al.*, 2018**). However, this prevalence shows a marked variation between different regions in the world and between countries within the same region (**Nayak *et al.*, 2012**). For example, the prevalence of HBV is less than 1% in North America, it exceeds 8% in Africa (**Tassachew *et al.*, 2022**). A similar variation is observed in the prevalence of HCV, which ranges from less than 1.5% in Pacific Asia and North America to more than 3.5% in the Middle East and North Africa. In the Arabian Gulf countries, the prevalence is estimated to be 1.5%. However, this prevalence varies significantly between major groups of the population: Several studies found that receiving dental treatment was a risk factor for the high prevalence of HBV, HCV, and HIV. Patient transmission of HBV has been reported in dental clinics with inadequate infection control practices. Unsafe injections in healthcare settings, particularly in developing countries, were found to be a significant factor in the transmission of HBV, HCV and human immunodeficiency virus (HIV). This study aims to determine the prevalence of HBV, HCV

nts of percutaneous and HIV among dental patients who had been involved in incide mucocutaneous injuries at a dental and clinical in Emirates International University, in Sana'a City, Yemen as well as the dental personnel's HBV vaccination rate.

The reason for such a high co-infection rate could be the shared mode of transmission of these viruses, that is, contact with infected blood and body fluid through parenteral and sexual activities (**Beykaso, et al., 2021**). The coexistence of HIV with hepatitis B or C viruses increases the chronicity, early progression, and high fatality of liver diseases compared to HBV or HCV mono-infection (**Tassachew et al., 2022**). Although deaths related to HIV infection have considerably dropped after large-scale use of highly active antiretroviral therapy (HAART), mortalities due to non-acquired immunodeficiency syndrome (AIDS) causes, such as viral and non-viral chronic liver diseases, remain prominent and challenging among HIV-infected individuals (**Tassachew et al., 2022**). More than 70% of HIV cases in the world reside in sub-Saharan Africa, where HBV is prevalent and responsible for most viral-related chronic liver disease conditions (**Tassachew, et al., 2022**). Consequently, about 71% of HIV/HBV co-infected individuals reside in sub-Saharan Africa (**Mohareb et al., 2021**).

1.2 Justification of the study:

Hepatitis B and C viruses pose significant global health challenges due to their high prevalence and potential for serious liver-related complications. This blood-borne infection can be transmitted through various methods, including unsafe medical practices, intravenous drug use, and unprotected sexual intercourse. The dental care setting, with its potential for exposure to blood and body fluids, is a critical environment for transmission of these viruses. Understanding the prevalence of hepatitis B and C infection among patients attending dental clinics is critical for assessing disease burden, identifying risk factors, and implementing preventive measures. This thesis aims to assess the prevalence of hepatitis B and C viruses among patients of dental clinics in Sana'a city, Yemen, with the ultimate goal of improving infection control practices and enhancing patient safety.

Dental clinics serve as important healthcare facilities where oral health care services are sought by a variety of patients. However, the nature of dental procedures involving tools and equipment and potential exposure to blood and saliva puts both patients and healthcare providers at risk for blood-borne infections. Previous studies conducted in different countries have reported varying prevalence rates of hepatitis B and C viruses among patients of dental clinics, highlighting the need for country-specific data to inform local preventive strategies. In Yemen, limited research has been conducted to investigate the prevalence of this infection specifically in dental care settings, which warrants further exploration.

1.2.1. Rationale:

To highlight the importance of routine screening before any dental procedure, especially before any oral surgical procedure such as tooth extraction.

1.3 Aims of the study

1.3.1 General objective:

The objective of the study was to determine Prevalence of Hepatitis B, C and the level of Knowledge, Attitude and Practice regarding cross infections and infection control in dentistry among patients attending Emirates International University dental clinics in Sana'a City, Yemen.

1.3.2 Specific objectives:

The specific aims of this study were:

- ❖ To estimate the prevalence of HBsAg among patients attending Emirates International University dental clinics.
- ❖ To estimate the prevalence of HCV among patients attending Emirates International University dental clinics.
- ❖ To detect risk factors associated with infections.

Chapter 2

Literatures Review

2. Literature Review

2.1. Prevalence of HBV and HCV

Hepatitis B virus (HBV) infection is a major global public health problem. There are approximately 2 billion people who had been infected worldwide and more than 350 million of them are chronic carriers of HBV (**Schweitzer *et al.*, 2015**). WHO estimated also that approximately 170 million people are infected with hepatitis C virus HCV) and about 130 million are carriers and three to four million persons are newly infected each year and more than 350,000 people estimated to die from hepatitis C-related liver diseases each year worldwide. (**Georg & Bruce ., 2001**). In the industrialized world, occupational surveillance assesses and monitors the health hazards related to blood borne pathogens and prevention measures reduce the risk of transmission (**Al-Marrani *et al.*, 2018**).

Hepatitis is one of the deadliest diseases through the world. It causes liver inflammation, which progresses to liver failure and hepatic carcinoma. Patients with dual HBV and HCV infection have more severe liver disease and are at increased risk of progression to HCC. Worldwide, HBV and HCV infection causes 57% of liver cirrhosis and 78% of primary liver cancer(**Ott *et al.*, 2012; Fattovich *et al.*, 2004**).

Evidence from different studies reported that prevalence of HBV and HCV were high among patients scheduled for surgery, but there is no any published study was conducted in our country .Study conducted in Pakistan among 150 surgical patients shown that sero-prevalence of viral hepatitis B & C combined was 23.55% where as 14% were positive for Hepatitis C and 9.33% for Hepatitis B (**Umar *et al.*, 2010**).

Another Study conducted in serology laboratory of Gondar University teaching Hospital a total of 2684 clinically suspected hepatitis patients were tested for

HBV and HCV Seroprevalence of HBsAg and anti-HCV anti-body was 14.6% and 12.4% , respectively which is also high (**Tesfa *et al.*, 2013**).

In contrast, in developing countries as Yemen, exposure and health impacts are rarely monitored and much remains to be done to protect health care workers (HCWs) from such risks that cause infections, illness, disability and death that may in turn impact on the quality of health care (**Driscoll *et al.*, 2005**).

In the Arabian Gulf countries, the prevalence is estimated to be 1.5%, (**Mohamoud *et al.*, 2016**).

Several studies found that receiving dental treatment was a risk factor to the high prevalence of HBV and HCV .(**Molla *et al.*, 2015**). Patient-to-patient transmission of HBV has been reported in dental clinics with inadequate infection control practices (**Radcliffe *et al.*, 2009**). Unsafe injections in healthcare settings ,particularly in developing countries, were found to be a significant factor in the transmission of HBV, HCV and human immunodeficiency virus - HIV . (**Kane *et al.*, 1999**).

Patient safety is an important medical disciplines which aims at improving quality of patient care, minimizing treatment mistakes and improving safety (**Yamalik N, *et al.*, 2013**). Infectious diseases represent an important public health problem facing health care systems in many countries (**Moradi B, *et al.*, 2013**).

Transmission of dental infection can occur through infected air droplets, blood, saliva, and instruments contaminated with secretion. Persons who seek dental care could be in the prodromal phase or being carriers of certain infectious diseases, without knowing about their physical conditions. In addition, some infectious diseases have prolonged incubation periods or post-infection “ window period” during which antibodies can’t be detected (**Tada A, *et al.*, 2014**).

Cross-infection in dentistry can occur through many pathogenic organisms found in oral cavity and respiratory tract. Example of these microorganisms are cytomegalovirus (CMV), Hepatitis C Virus (HCV), Hepatitis B Virus (HBV), herpes simplex virus HSV types 1 & 2, HIV/AIDS, Mycobacterium tuberculosis, staphylococci, streptococci and other viruses and bacteria (**Baseer et al., 2013**).

Furthermore, nowadays we are living in an era of eco-epidemiology, with global emergence and re-emergence of many communicable diseases [6,7]. Emerging agents as Ebola, Middle East Respiratory Syndrome-Corona Virus (MERS-CoV), H1N1 and H5N1 and others [8] can be also transmitted during dental practice. (**Ibrahim et al., 2017**).

Blood borne infections as HIV/AIDS, HCV, HBV, and other emerging blood borne organisms represent the main risks for the transmission of infections in dental practice. Exposure to blood and body fluids need great concerns from both dental care providers and the patients (**Tada et al., 2014**).

Furthermore, a house-hold survey done in Damietta, Egypt, 2014, found that 1.1% of the participants were infected with HBV, 9.3% with HCV, and both infections co-existed in 0.4%. One of the main risk factors for both infections was exposure to dental procedures (**Edris et al., 2014**).

In addition, the continuous increase in the number of patients seeking dental clinics should give alarming signs to dentists and Dental Health Care Programs (DHCPs) for better awareness of extra-precautions required while treating the dental patients. These measures are needed for protecting both patients and staff members (**Harte, 2010**).

Accordingly, attention has focused on the risks of infection by dental care, either as a result of patient-patient exposures by inadequately sterilized instruments or of dentist-patient exposures by intimate contacts with HBsAg carriers (**Puttaiah et al., 2009**).

The survey of dental personnel in Sana'a city, Yemen, was found that the prevalence of current and life time exposure to HBV infection was high. Exposure to potentially infectious body fluids was high and yet only a small percentage of DCW were vaccinated, so there is need to vaccinate all DCWs as a matter of policy and ensure a safer work environment, (**Al Kasem et al., 2018**).

2.2. Risk Factors for HBV and HCV infection

There are different associated risk factors which are related with HBV and HCV. In the medical care delivering area surgical procedures are one way for the transmission of HBV and HCV. Study conducted in Italy shows that Invasive procedures has the strongest associations for HBV infection, abdominal surgery, oral surgery and gynecological surgery. For HCV infection obstetric/gynecological, abdominal surgery and ophthalmological surgery can transmit the virus .It is due to in adequate sterilization of medical equipments and unsafe injection practices (**Edwards et al., 2015**).

Study conducted in china reported that Hemodialysis patients are at risk for the transmission of HBV and HCV virus infections. Prevalence's of anti-HCV anti-body and HBsAg were 6.1% and 7.0 % respectively among hemodialysis patient. similarly study conducted at Rabat University hospital of Saudi reported that from 67 hemodialysis patients among them 60% were positive for anti-HCV antibody and 6% were positive for HBsAg the study was conducted retrospectively and this study also reported that the duration of dialysis can be increases the risk for the infection (**Lioussfi et al., 2014; Su et al., 2013**).

In developing countries there is higher hepatitis C virus disease transmission due to unsafe therapeutic injections and due to injectable drug users. A systematic literature review study on injectable drug users reported that the transmission rate of HCV is high among injection drug users. In North America and some countries of North Africa the prevalence HCV among drug users was 48% to 90% it's very high (Fallahian *et al.*, 2010).

Study conducted in Polish nationwide survey reported that elders are at high risk for HCV transmission than general population sero-prevalence of anti-HCV is higher than in the general Polish population. Systematic review and meta-analysis study reported from different country tattooing was significant association with HCV and HBV infection (Jafari *et al.*, 2010).

2.3. Type of viruses infecting

2.3.1 Hepatitis B Virus (HBV)

Hepatitis B is a viral infection that attacks the liver and can cause both acute and chronic disease. HBV affects humans and non-human primates. It was discovered in 1963 associated with protein antibodies from a patient with hemophilia and leukemia (Sanguanmoo *et al.*, 2004).

HBV belongs to the family hepadnaviridae and it is a DNA virus. This virus is one of the smallest enveloped viruses and is less than 45nm in diameter (Locarnini, 2004).

HBV is stable and resistant at both humid and extreme temperatures. The virus is effectively destroyed by autoclaving at 121°C for 20 minutes. The virus remains stable and infectious for not less than 7 days in dry blood (Candotti *et al.*, 2007)

The virus is transmitted through contact with the blood or other body fluids of an infected person such as serous fluids, blood and blood products, semen, vaginal fluid and saliva. Even though HBV has been identified in low concentrations in body fluids

like sweat, urine, breast milk, tears; there is yet no known study that associates such with the spread of the infections (**Allain et al., 2003**). is a potentially life-threatening liver infection caused by highly contagious blood born viral pathogen known as HBV (**Saeed et al., 2014**). HBV is the most common form of parenteral transmitted viral hepatitis that was recognized as the cause of serum hepatitis (**Zuckerman., 2009**).

HBV infection was recognized as a disease in ancient times, but its etiologic agent was only recently identified (**Gerlich., 2013**). The first discovery of an enigmatic serum protein named Australia antigen 50 years ago by Baruch Blumberg. Some year later this was recognized to be the hepatitis B surface antigen (HBsAg) (**Harkisoen et al., 2012**).

HBV is a serious public health problem worldwide and major cause of chronic hepatitis, cirrhosis and HCC. The impact of HBV infection on public health is enormous, with an estimated prevalence of 2 billion infected and 378 million chronically infected. There are approximately 1 million HBV related deaths each year. In addition, approximately 4.5 million new HBV infections occur worldwide each year, of which a quarter progresses to liver disease (**Gerlich.,2013**).

The frequency of infection and patterns of transmission vary in different parts of the world. Approximately 45% of the global population live in areas with a high prevalence of chronic HBV infection (8% or more of the population is HBsAg positive), 43% in areas with a moderate prevalence (2% to 7% of the population is HBsAg positive), and 12% in areas with a low prevalence (less than 2% of the population is HBsAg positive) (**Allain et al.,2003**).

The prevalence of HBV among general population in Arabic countries as the following: Saudi Arabia 4.25%, Oman 2-7%, Bahrain 2-7%, Qatar 2-7%, UAE 2-7%, Kuwait 3.5%, Iraq 0.6%, Syria 2-7%, Lebanon 1.6%, Jordan 1.4%, Gaza Strip 3.5%, Egypt 4%, Sudan >8%, Lybia 2-7%, Tunisia 2-7%, Algeria 3.6%, Morocco 1.3% and Mauritania 2-7% and the crude prevalence of hepatitis B in Yemen was 5.1%

(Gasim., 2013).

The chronic hepatitis is an important cause of cirrhosis and liver cancer in Yemen, but studies on the prevalence of these viruses in the general population are scarce (**Al-Waleedi and Khader., 2012**).

The prevalence rate of HBV in Yemen was found to be 2.7% among healthy volunteers though it reached 5.1% among blood donors. Such prevalence evidence of past HBV infection was significantly high in Hajjah, Aden and Taiz (9.8%, 14.1, and 18.8%, respectively) compared to Sana'a (5.4%) (**Haidar., 2002; Al-Nabehi et al., 2015**).

2.3.2. Classification

Hepatitis B virus is classified in the genus Orthohepadnavirus, which contains 11 other species. The genus is classified as part of the Hepadnaviridae family, which contains four other genera, Avihepadnavirus, Herpetohepadnavirus, Metahepadnavirus and Parahepadnavirus. This family of viruses is the only member of the viral order Blubervirales. Viruses similar to hepatitis B have been found in all apes (orangutans, gibbons, gorillas and chimpanzees), in Old World monkeys (**Dupinay et al., 2017**). and in New World woolly monkeys (the woolly monkey hepatitis B virus), suggesting an ancient origin for this virus in primates. Genotype D has 10 subgenotypes (**Hundie et al., 2017**).

2.3.3. Morphology

A. Structure

Hepatitis B virus is a member of the Hepadnavirus family. The virus particle, called Dane particle (**WHO., 2015**), (virion), consists of an outer lipid envelope and an icosahedral nucleocapsid core composed of protein. The nucleocapsid encloses the viral DNA and a DNA polymerase that has reverse transcriptase activity similar to retroviruses (**Locarnini., 2004**).

B. Components

It consists of:

- 1) HBsAg (Hepatitis B surface antigen) was the first hepatitis B virus protein to be discovered (**Jaroszewicz *et al.*, 2010**).
- 2) HBcAg (Hepatitis B core antigen) is the main structural protein of HBV icosahedral nucleocapsid and it has function in replication of the virus (**Lin *et al.*, 2012**).
- 3) HBeAg (Hepatitis B envelope antigen) is secreted and accumulates in serum. HBeAg and HBcAg are made from the same reading frame (**TSRI., 2009**).
- 4) HBx is small 154 amino acid long, nonstructural and has an important role in HBV-associated liver disease and in HBV replication in HepG2 cells(**Tang *et al.*, 2006**).

C. Size

The genome of HBV is made of circular DNA, but it is unusual because the DNA is not fully double-stranded. One end of the full length strand is linked to the viral DNA polymerase. The genome is 3020–3320 nucleotides long (for the full length strand) and 1700–2800 nucleotides long (for the short length strand) (**Kay and Zoulim., 2007**).

2.3.4. Epidemiology

At least 391 million people, or 5% of the world's population, had chronic HBV infection as of 2017. While another 145 million cases of acute HBV infection occurred that year (**GBD., 2017**). Regional prevalences range from around 6% in Africa to 0.7% in the Americas (**WHO., 2020**).

In moderate prevalence areas, which include Eastern Europe, Russia, and Japan, where 2–7% of the population is chronically infected, the disease is predominantly spread among children. In high-prevalence areas such as China and South East Asia, transmission during childbirth is most common, although in other areas of high endemicity such as Africa, transmission during childhood is a significant factor (**Alter.,**

2003).

The prevalence of chronic HBV infection in areas of high endemicity is at least 8% with 10–15% prevalence in Africa/Far East (**Komas *et al.*, 2013**). As of 2010, China has 120 million infected people, followed by India and Indonesia with 40 million and 12 million, respectively. According to World Health Organization (WHO), an estimated 600,000 people die every year related to the infection. In the United States about 19,000 new cases occurred in 2011 down nearly 90% from 1990 (**Schillie *et al.*, 2013**).

2.3.5. Transmission

Transmission of hepatitis B virus results from exposure to infectious blood or body fluids containing blood. It is 50 to 100 times more infectious than human immunodeficiency virus (HIV) (**CDC., 2015**). Possible forms of transmission include sexual contact (**Fairley and Read, 2012**), blood transfusions and transfusion with other human blood products re-use of contaminated needles and syringes and vertical transmission from mother to child during childbirth (**Buddeberg *et al.*, 2008**).

Without intervention, a mother who is positive for HBsAg has a 20% risk of passing the infection to her offspring at the time of birth. This risk is as high as 90% if the mother is also positive for HBeAg. HBV can be transmitted between family members within households, possibly by contact of nonintact skin or mucous membrane with secretions or saliva containing HBV (**IDEAS., 2009**).

2.3.6. Disease

Despite there being a vaccine to prevent Hepatitis B, HBV remains a global health problem. Hepatitis B is an infectious disease caused by the hepatitis B virus (HBV) that affects the liver (WHO, 2014). Hepatitis B can be acute and later become chronic, leading to other diseases and health conditions (**Hu *et al.*, 2019**).

2.3.7. Signs and symptoms

Acute infection with hepatitis B virus is associated with acute viral hepatitis, an illness that begins with general ill-health, loss of appetite, nausea, vomiting, body aches, mild fever, and dark urine, and then progresses to development of jaundice. The illness lasts for a few weeks and then gradually improves in most affected people (Terrault *et al.*, 2005).

Chronic infection with hepatitis B virus either may be asymptomatic or may be associated with a chronic inflammation of the liver, leading to cirrhosis over a period of several years. This type of infection dramatically increases the incidence of hepatocellular carcinoma (HCC; liver cancer). Across Europe, hepatitis B and C cause approximately 50% of hepatocellular carcinomas (El-Serag, 2011).

2.3.8. laboratory Diagnosis

Serological markers for HBV infection

Serological markers for HBV infection consist of HBsAg, anti-HBs, HBeAg, anti-HBe, and anti-HBc IgM and IgG. The identification of serological markers allows: to identify patients with HBV infection; to elucidate the natural course of chronic hepatitis B (CHB); to assess the clinical phases of infection; and to monitor antiviral therapy (CDC, 2011).

HBsAg is the serological hallmark of HBV infection. After an acute exposure to HBV, HBsAg appears in serum within 1 to 10 weeks. Persistence of this marker for more than 6 months implies chronic HBV infection (Kao, 2008). Several studies have reported the association between transcription activity of cccDNA in the liver and serum HBsAg levels (Thompson *et al.*, 2010). Differences in the serum HBsAg levels during the different phases of infection indicate the distribution of cccDNA during the respective phases of the disease. The serum HBsAg titers are higher in patients with HBeAg-positive CHB than in HBeAg-negative CHB (Jaroszewicz *et al.*, 2010). Monitoring of quantitative HBsAg levels predicts treatment response to interferon and

disease progression in HBeAg-negative CHB patients with normal serum alanine aminotransferase levels (**Martinot-Peignoux *et al.*, 2013**).

Anti-HBs is known as a neutralizing antibody, and confers long-term immunity (**Weber., 2005**). In patients with acquired immunity through vaccination, anti-HBs is the only serological marker detected in serum. In the past HBV infection, it is present in concurrence with anti-HBc IgG. Occasionally, the simultaneous appearance of HBsAg and anti-HBs has been reported in patients with HBsAg positive (**Tsang *et al.*, 1986**). In most cases, anti-HBs antibodies are unable to neutralize the circulating viruses, thus these patients are regarded as carriers of HBV.

In the past, HBeAg and anti-HBe had been used to know infectivity and viral replication, but their use for this purpose has mostly been replaced by HBV DNA assay. HBeAg to anti-HBe seroconversion is related to the remission of hepatic disease (**Dény and Zoulim., 2010**), however, active viral replication is sustained in some patients with HBe seroconversion due to mutations in the pre-core and core region that inhibit or decrease the production of HBeAg (**Raimondo *et al.*, 2007**).

HBcAg is an intracellular presence in infected hepatocyte, thus it is not identified in the serum. During acute infection, anti-HBc IgM and IgG emerges 1–2 weeks after the presence of HBsAg along with raised serum aminotransferase and symptoms. After 6 months of acute infection, anti-HBc IgM wears off. Anti-HBc IgG continues to detect in both patients with resolved HBV infection and CHB. Some HBsAg-negative individuals are positive for anti-HBc IgG without anti-HBs, in this situation, it should be considered isolated anti-HBc positive. It can be seen in three conditions. First, it can be predominantly seen as IgM class during the window period of acute phase. Second, after acute infection had ended, anti-HBs has decreased below the cutoff level of detection. Third, after several years of chronic HBV infection, HBsAg has diminished to undetectable levels. If the result of serological markers shows isolated anti-HBc positive, anti-HBc IgM should be checked in order to assess the possibility of recent

HBV exposure. HBV DNA assays should be tested in chronic liver disease patients to find out occult HBV infection characterized by existence of detectable HBV DNA without serum HBsAg (**Raimondo et al., 2007**).

Table 2.1: HBV marker

Test	IgM Anti-HBc	HBeAg	HBV DNA*	ALT
Acute HBV	Positive	Positive	High	Increased
Chronic HBV -Immune Tolerant	Negative	Positive	High	Normal
Chronic HBV -Immune Active (<i>wild-type</i>)	Negative	Positive	High	Increased
Chronic HBV -Immune Active (<i>precore or core promoter mutant</i>)	Negative	Negative	High	Variable
Chronic HBV -Inactive Carrier	Negative	Negative	Low	Normal
*"High" is defined as greater than or equal to 10^5 copies/ml for wild-type infection and greater than or equal to 10^4 copies/ml for precore or core promoter mutant. ALT = alanine aminotransferase				

Molecular methods for HBV infection

HBV DNA is a direct measurement of the viral load, which reveals the replication activity of the virus. It is detectable at the early stage of infection (1 month after HBV infection) and increases up to peak level (more than 10^8 copies/mL) approximately 3 months after the exposure to HBV and then gradually diminishes in chronic infection or disappears at the recovery from HBV infection.

As the prevalence of serologically negative HBV infection (HBeAg-negative CHB and occult HBV infection) has increased, HBV-DNA detection has obtained more awareness in clinical medicine (**Datta et al., 2014**). The detection of HBV DNA is a reliable marker of replication activity, and higher titers of HBV DNA are related to the more rapid disease progression and higher incidence of HCC (**Chen et al., 2006**).

Furthermore, HBV DNA testing is useful in routine clinical setting to determine patients who need antiviral therapy and monitor them for suitable treatment (**Chevaliez and Pawlotsky., 2008**).

There are two principles of techniques to identify and quantify HBV DNA: signal amplification such as hybrid capture and branched DNA technology; target amplification such as polymerase chain reaction (PCR) (**Caliendo et al., 2011**). Real-time PCR can detect wide dynamic range of viral load (lower range, 10–15 IU/mL; upper range, 10^7 – 10^8 IU/mL). For this reason, it has come to be the standard method to detect and quantify HBV DNA in clinical setting. Furthermore, it can be fully automated and does not generate carry-over contamination. displays the comparison of assays for quantitative measurement of HBV DNA (**Bustin et al., 2005**).

2.3.9. Prevention

Vaccines for the prevention of hepatitis B have been routinely recommended for babies since 1991 in the United States (**Schillie et al., 2013**). The first dose is generally recommended within a day of birth. The hepatitis B vaccine was the first vaccine capable of preventing cancer, specifically liver cancer (**Chan et al., 2016**). Furthermore, the combination of vaccine plus hepatitis B immunoglobulin is superior to vaccine alone (**Lee et al., 2006**). This combination prevents HBV transmission around the time of birth in 86% to 99% of cases (**Wong et al., 2014**).

2.3.10. Treatment

Acute hepatitis B infection does not usually require treatment and most adults clear the infection spontaneously (**CDC., 2017**). Early antiviral treatment may be required in fewer than 1% of people, whose infection takes a very aggressive course (fulminant hepatitis) or who are immunocompromised (**Lai and Yuen., 2007**).

Treatment lasts from six months to a year, depending on medication and genotype. Treatment duration when medication is taken by mouth, however, is more variable and usually longer than one year (**Terrault et al., 2016**). As of 2018, there are eight

medications licensed for the treatment of hepatitis B infection in the United States. These include antiviral medications lamivudine, adefovir, tenofovir disoproxil, tenofovir alafenamide, telbivudine, and entecavir, and the two immune system modulators interferon alpha2a and PEGylated interferon alpha-2a. In 2015 the World Health Organization recommended tenofovir or entecavir as first-line agents. Those with current cirrhosis are in most need of treatment (**WHO., 2015**).

The use of interferon has been supplanted by longacting PEGylated interferon, which is injected only once weekly (**Dienstag., 2008**). The treatment reduces viral replication in the liver, thereby reducing the viral load (the amount of virus particles as measured in the blood) (**Pramoolsinsup., 2002**).

2.4. Hepatitis C Virus (HCV)

HCV is a liver disease caused by the Hepatitis C virus and found worldwide. The virus can cause both acute and chronic hepatitis infection, ranging in severity from a mild illness lasting a few weeks to a serious life-long illness. It is a blood-borne virus and the most common modes of infection are through unsafe injection practices; inadequate sterilization of medical equipment and the transfusion of unscreened blood and blood products. 130 –150 million people globally have chronic HCV infection (**Fabrizi et al., 2002**).

A significant number of those who are chronically infected will develop liver cirrhosis or liver cancer. Approximately 500,000 people die each year from HCV-related liver diseases (**Karki et al., 2008**).

Hepatitis C virus has been considered to be one of the most potential pathogens that have hindered the medical community all over the world (**Gacche and Al-Mohani., 2012**).

HCV is of global importance, affecting all countries, leading to a major global health problem that requires widespread active interventions for its prevention and control (**Lavanchy., 2011**).

The history of hepatitis C virus (HCV) has always been characterized by discoveries, challenges, opportunities and difficulties. Starting with the same virus name: a Lancet editorial in 1975 suggested the term non-A, non-B hepatitis to describe the hepatitis neither diagnosed as A nor B, underlining that the diagnosis was one of exclusion. Fifteen years after, in 1989, Choo *et al* suggest the virus responsible for most post-transfusion hepatitis, also called type C hepatitis, parenterally transmitted non-A non-B hepatitis (PT-NANB), non-B transfusion-associated hepatitis, post-transfusion non-A non-B hepatitis, HC, was finally identified (**Ansaldi *et al.*, 2014**).

HCV's ability to live for a prolonged period of time outside the body under the right conditions has extraordinary implications for its transmission. Therefore, blood-contaminated surfaces and objects can serve as sources for HCV transmission. Generally, such transmission among hemodialysis units is considered to be nosocomial with possible factors being failure to disinfect devices between patients, sharing of single- use vials of infusions, poor sterile technique, poor cleaning of dialysis machines, poor distance between chairs in addition to dialyzer reuse, duration and frequency of dialysis (**Daw and Dau., 2012**).

Some of the carriers known to transmit the virus include straws used for nasal drug use, needles used for administering drugs, tattooing, sharing personal care equipment like razors or toothbrushes, certain sexual devices and reuse of medical equipment in healthcare settings. Although we know that it spreads between blood sources, inanimate objects often act as the intermediary to transmit infection (**Mankoula., 2016**).

It is now well established that HCV is a global health challenge (**Cuadros., 2014**). It has been calculated that 130-170 million people are infected with HCV, with a global prevalence of infection estimated at 2-3% and more than one million new cases were reported annually. As measurement of incidence fails to produce reliable numbers, because of the mostly asymptomatic form of acute infection (**Lavanchy., 2011**).

Furthermore, an estimated 27% of cirrhosis and 25% of HCC worldwide occur in HCV-infected people. HCV prevalence is characterized by a high variability between world's regions, individual countries and between age and risk groups within countries, this can be partially explained by the characteristic of the analysed population and the primary mode of transmission (**Gacche and Al-Mohani., 2012**).

HCV prevalence is highest in Africa and the Middle East, where Egypt, Cameroon, Saudi Arabia, Iraq and Syria account for the majority of cases and prevalence ranges from 2% to 15%. North America, Australia, Japan and Northern and Western Europe report lower prevalence of HCV infection, with no country showing a rate > 2%. China, India, Egypt, Pakistan and Indonesia account for approximately half of the global HCV-infected subjects (**Ansaldi et al., 2014**).

Arabian peninsula is unique geographical area a composed 35% of Arab world that it is composed of Saudi Arabia, Yemen, Oman, Qatar, Bahrain, UAE, and Kuwait. Yemen is the second largest heavily populated and the poorest country in Arabian peninsula; the prevalence rate of HCV in Yemen was found to be 1.7% among healthy volunteers though it reached 2.7% among blood donors. Such prevalence reached up to

62.7% in hemodialysis patients. The most of epidemiological studies were done in different cities in Yemen, the prevalence rates of HCV antibodies is 2.3 % in Sana'a, 0.6% in Aden, 0.8 % in Hajah, 5.1 % in Soqatra (**Bajubair et al., 2008; Selm, 2010**).

Hepatitis C virus is well studied in Saudi Arabia, and its status is known among the different population. The universal prevalence of HCV in the general population ranged from 1.1 to 1.7%. Such prevalence was found to be high among the risk groups such as hemodialysis patients where it ranged from 18.6 to 56%, 40% among the hemophilia patients, and 94.8% among IDUs. In the less populated Gulf states, HCV was found to be 0.9 to 1.5% in blood donors of Oman and 26% in hemodialysis patients, though it was found to be 40% among hemolytic Bahraini patients. In Qatar, the prevalence rate among the general population reached 6.3% and 44.6% in dialysis patients, though in UAE, the prevalence was found to be 23% among hemodialysis patients. In Kuwait, HCV is better known, and different studies were carried out to determine the prevalence of HCV as it was found to be 0.8% among the general populations and 71% among hemodialysis patients (**Daw and Dau., 2012**).

2.4.1. Virology

The hepatitis C virus (HCV) is a small, enveloped, single-stranded, positive-sense RNA virus (Rosen, 2011). It is a member of the genus Hepacivirus in the family Flaviviridae (**Ray et al., 2009**). There are seven major genotypes of HCV, which are known as genotypes one to seven (**Nakano et al., 2012**). In the United States, about 70% of cases are caused by genotype 1, 20% by genotype 2 and about 1% by each of the other genotypes (**Wilkins et al., 2010**). Genotype 1 is also the most common in South America and Europe (**Rosen., 2011**). The half-life of the virus particles in the serum is around 3 hours and may be as short as 45 minutes (**Lerat and Hollinger., 2004; Pockros., 2011**). In an infected person, about 10^{12} virus particles are produced each day (**Lerat Hollinger., 2004**).

2.4.2. Transmission

Generally, percutaneous contact with contaminated blood is responsible for most infections; however, the method of transmission is strongly dependent on both a country's geography and economic status (**Hagan and Schinazi., 2013**). Indeed, the primary route of transmission in the developed world is injection drug use, while in the developing world the main methods are blood transfusions and unsafe medical procedures (**Maheshwari and Thuluvath., 2010**). The cause of transmission remains unknown in 20% of cases (**Pondé., 2011**).

A. Drug use

Injection drug use (IDU) is a major risk factor for hepatitis C in many parts of the world. Of 77 countries reviewed, 25 (including the United States) were found to have a prevalence of hepatitis C of between 60% and 80% among people who use injection drugs. Twelve countries had rates greater than 80% (**Nelson et al., 2011**). It is believed that ten million intravenous drug users are infected with hepatitis C; China (1.6 million), the United States (1.5 million), and Russia (1.3 million) have the highest absolute totals (**Nelson et al., 2011**). Occurrence of hepatitis C among prison inmates in the United States is 10 to 20 times that of the occurrence observed in the general population (**Imperial., 2010**).

B. Healthcare exposure

Blood transfusion, transfusion of blood products, or organ transplants without HCV screening carry significant risks of infection (**Wilkins et al., 2010**). The United States instituted universal screening in 1992 (**Marx., 2010**). and Canada instituted universal screening in 1990 (**Day et al., 2009**). This decreased the risk from one in 200 units (Marx, 2010). to between one in 10,000 to one in 10,000,000 per unit of blood (**Pondé., 2010**). This low risk remains as there is a period of about 11–70 days between the potential blood donor's acquiring hepatitis C and the blood's testing positive depending on the method (**Pondé., 2010**).

Those who have experienced a needle stick injury from someone who was HCV positive have about a 1.8% chance of subsequently contracting the disease themselves (Wilkins *et al.*, 2010). The risk is greater if the needle in question is hollow and the puncture wound is deep (Alter., 2007).

C. Sexual intercourse

Sexual transmission of hepatitis C is uncommon. Studies examining the risk of HCV transmission between heterosexual partners, when one is infected and the other is not, have found very low risks (Kim., 2016).

D. Body modification

Tattooing is associated with two to threefold increased risk of hepatitis C. This can be due to either improperly sterilized equipment or contamination of the dyes being used (Jafari *et al.*, 2010). It is rare for tattoos in a licensed facility to be directly associated with HCV infection (CDC., 2012).

E. Shared personal items

Personal-care items such as razors, toothbrushes, and manicuring or pedicuring equipment can be contaminated with blood. Sharing such items can potentially lead to exposure to HCV. HCV is not spread through casual contact, such as hugging, kissing, or sharing eating or cooking utensils (CDC, 2012). nor is it transmitted through food or water (Wong and Lee., 2006).

F. Mother-to-child transmission

Mother-to-child transmission of hepatitis C occurs in fewer than 10% of pregnancies. There are no measures that alter this risk (Lam *et al.*, 2010). It is not clear when transmission occurs during pregnancy, but it may occur both during gestation and at delivery (Pondé., 2010). A long labor is associated with a greater risk of transmission (Alter., 2007).

2.4.3. Epidemiology

The World Health Organization estimated in a 2021 report that 58 million people globally were living with chronic hepatitis C as of 2019 (**WHO., 2021**). About 1.5 million people are infected per year, and about 290,000 people die yearly from hepatitis C-related diseases, mainly from liver cancer and cirrhosis (**WHO., 2022**). As a result, the number of chronic patients receiving treatment worldwide has grown from about 950,000 in 2015 to 9.4 million in 2019. During the same period, hepatitis C deaths declined from about 400,000 to 290,000 (**WHO., 2015; WHO., 2021**).

Previously, a 2013 study found high infection rates (>3.5% population infected) in Central and East Asia, North Africa and the Middle East, intermediate infection rates (1.5–3.5%) in South and Southeast Asia, subSaharan Africa, Andean, Central and Southern Latin America, Caribbean, Oceania, Australasia and Central, Eastern and Western Europe; and low infection rates (<1.5%) in Asia-Pacific, Tropical Latin America and North America (**Mohd Hanafiah et al., 2013**). Among those chronically infected, the risk of cirrhosis after 20 years varies between studies but has been estimated at ~10–15% for men and ~1–5% for women. The reason for this difference is not known. Once cirrhosis is established, the rate of developing hepatocellular carcinoma is ~1–4% per year (**Yu and Chuang., 2009**). In Egypt, following Egypt's 2030 Vision, the country managed to bring down the infection rates of Hepatitis C from 22% in 2011 to just 2% in 2021 (**Egypt Today., 2021**). In the United States, about 2% of people have chronic hepatitis C (**Wilkins et al., 2010**). In 2014, an estimated 30,500 new acute hepatitis C cases occurred (0.7 per 100,000 population), an increase from 2010 to 2012 (**CDC., 2016**). The number of deaths from hepatitis C has increased to 15,800 in 2008 (CDC, 2014). having overtaken HIV/AIDS as a cause of death in the US in 2007 (**Nrw York Time., 2012**). In Europe the percentage of people with chronic infections has been estimated to be between 0.13 and 3.26% (**Blachier et al., 2013**). In the United Kingdom about 118,000 people were chronically infected in 2019 (Hepatitis C, 2017). The total number of people with this infection is

higher in some countries in Africa and Asia (**Holmberg *et al.*, 2011**). Countries with particularly high rates of infection include Pakistan (4.8%) and China (3.2%) (**WHO., 2011**).

Since 2014, extremely effective medication have been available to eradication the disease in 8–12 weeks in most people. In 2015 about 950,000 people were treated while 1.7 million new infections occurred, meaning that overall the number of people with HCV increased (**Lombardi and Mondelli., 2019**).

A. HCV in children and pregnancy

Worldwide the prevalence of hepatitis C virus infection in pregnant women and children has been estimated to 1–8% and 0.05–5% respectively (**Arshad *et al.*, 2011**). The vertical transmission rate has been estimated to be 3–5% and there is a high rate of spontaneous clearance (25–50%) in the children. Higher rates have been reported for both vertical transmission (18%, 6–36% and 41%) and prevalence in children (15%) (**Fischler., 2007**). In developed countries transmission around the time of birth is now the leading cause of HCV infection. In the absence of virus in the mother's blood transmission seems to be rare (**Thomas *et al.*, 1998**). Factors associated with an increased rate of infection include membrane rupture of longer than 6 hours before delivery and procedures exposing the infant to maternal blood (**Indolfi and Resti., 2009**).

2.4.4. Signs and symptoms

The incubation period for hepatitis C ranges from 2 weeks to 6 months. Following initial infection, approximately 80% of people do not exhibit any symptoms. Those who are acutely symptomatic may exhibit fever, fatigue, decreased appetite, nausea, vomiting, abdominal pain, dark urine, pale faeces, joint pain and jaundice (yellowing of skin and the whites of the eyes). Acute symptoms develop in some 20–30% of those infected (**WHO., 2016; CDC., 2020**).

2.4.5. laboratory Diagnosis

There are a number of diagnostic tests for hepatitis C, including HCV antibody enzyme immunoassay (ELISA), recombinant immunoblot assay, and quantitative HCV RNA polymerase chain reaction (PCR) (**Wilkins *et al.*, 2010**). HCV RNA can be detected by PCR typically one to two weeks after infection, while antibodies can take substantially longer to form and thus be detected (**Ozaras and Tahan., 2009**). Diagnosing patients is generally a challenge as patients with acute illness generally present with mild, non-specific flu-like symptoms, while the transition from acute to chronic is sub-clinical (**Westbrook and Dusheiko., 2014**). Chronic hepatitis C is defined as infection with the hepatitis C virus persisting for more than six months based on the presence of its RNA (**Kanwal and Bacon., 2011**).

A. Serology

Hepatitis C testing typically begins with blood testing to detect the presence of antibodies to the HCV, using an enzyme immunoassay. If this test is positive, a confirmatory test is then performed to verify the immunoassay and to determine the viral load. A recombinant immunoblot assay is used to verify the immunoassay and the viral load is determined by an HCV RNA polymerase chain reaction (**Wilkins *et al.*, 2010**).

B. Biopsy

Liver biopsies are used to determine the degree of liver damage present; however, there are risks from the procedure (**Rosen., 2011**).

2.4.6. Prevention

As of 2016, no approved vaccine protects against contracting hepatitis C (**Abdelwahab and Said., 2018**). A combination of harm reduction strategies, such as the provision of new needles and syringes and treatment of substance use, decreases the risk of hepatitis C in people using injection drugs by about 75% (**Hagan *et al.*,**

2011). The screening of blood donors is important at a national level, as is adhering to universal precautions within healthcare facilities (**Ray and Thomas., 2009**).

2.4.7. Treatment

Those with chronic hepatitis C are advised to avoid alcohol and medications that are toxic to the liver (**Wilkins *et al.*, 2010**). They should also be vaccinated against hepatitis A and hepatitis B due to the increased risk if also infected (**Wilkins *et al.*, 2010**). Use of acetaminophen is generally considered safe at reduced doses (**Kim., 2016**).

A. Medications

Ribavirin: Approximately 90% of chronic cases clear with treatment (**WHO., 2016**). Treatment with antiviral medication is recommended for all people with proven chronic hepatitis C who are not at high risk of death from other causes (**AASLD/IDSA., 2015**). More than 90% of people with chronic infection can be cured when treated with medications (**CDC., 2019**) However, accessing these treatments can be expensive (**WHO., 2016**). The combination of sofosbuvir, velpatasvir, and voxilaprevir may be used in those who have previously been treated with sofosbuvir or other drugs that inhibit NS5A and were not cured. Prior to 2011, treatments consisted of a combination of pegylated interferon alpha and ribavirin for a period of 24 or 48 weeks, depending on HCV genotype (**Wilkins *et al.*, 2010**). This treatment produces cure rates of between 70 and 80% for genotype 2 and 3, respectively, and 45 to 70% for genotypes 1 and 4. Treatment during the first six months of infection (the acute stage) is more effective than when hepatitis C has entered the chronic stage (**Ozaras and Tahan., 2009**). In those with chronic hepatitis B, treatment for hepatitis C results in reactivation of hepatitis B about 25% of the time (**Mücke *et al.*, 2018**).

Chapter 3

Subject Materials & Methods

3.. Subject Materials and Methods:

3.1 . Study design:

The study was conducted as a descriptive cross-sectional study among patients attending Emirates International University dental clinics in Sana'a City, Yemen during the year 2023.

3. 1.1. Study Area:

The study will conduct at Emirates International University dental clinics, in Sana'a city, Yemen.

3.1.2. Sample size:

The required sample size was estimated using a single population Proportion Standard formula Epi Info software, version 6 (Centers for Disease Control and Prevention CDC, USA and as per: $n = (z^2 p (1-p)/d^2)$, Where (CDC) (WWW.cdc.gov)

n = sample size

z = z score of confidence interval, which is z statistic level of confidence ,

d = acceptable error as (Absolute precision); and

p = expected prevalence of infection .

The prevalence (p) of IP among displaced Yemeni persons was not known. That was as a result of, the lacking of previous studies on this issue, wherefore (p) rate was taken to be 50% (0.5). Besides, 95% confidence interval (z) which equivalent 1.96; and a 5% (0.05) as a margin of error (d) were used. In accordance with the above formula, therefore: $n = (1.96^2) 0.5(1-0.5)/ 0.05^2$, subsequently, the sample size of this study was initially and minimally 84. Lastly, with addition (38) %10of the minimum sample size as a potential contingency or as none responses, the overall maximum sample size was 422. From the

other point of view, Chapter 3 Subjects and Methods 11 with Selected randomly from five districts hosting IDCs were considered as the study population.

3.1.3. Inclusion criteria :

All outpatients in dental clinic at Emirates International University.

3.1.4. Exclusion criteria:

All non-outpatients in dental clinic at Emirates International University.

3.1.5. Data collection:

A questionnaire for each OPs was filled with the Ops information (This includes the age, gender, clinical history .

3.1.6. Study variable:

The dependent variable of this study was be HBV, and HCV, test result, whereas the independent variables were age, gender, and marital status.

3.2. Methods

3.2.1. Sample collection:

Five ml of venous blood was collected from each individual into vacutainer (plain) tubes. The specimens was allowed to clot at room temperature and centrifuged at 3500 rpm for five minutes. Serum was separated from each sample Eppendorf tubes and stored at -20°C till tested for the different laboratory markers.

3.2.2. Immunochromatography (cassette) test:

Principle:

Rapid test is antibodies or antigens lateral Flow Chromatography Immunoassay of qualitative detection of antigens or antibodies in human serum or plasma for HBV, and HCV. Mf (ABON). (WWW.trinitybiotech.com)

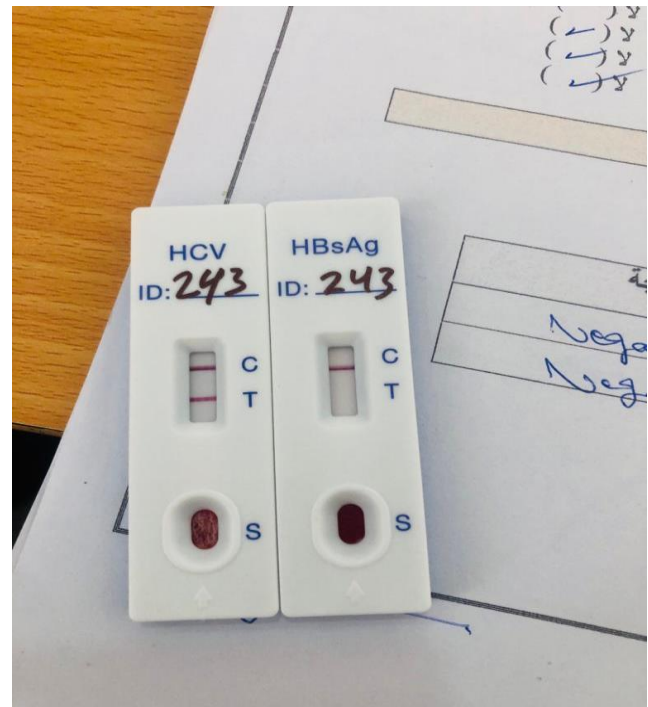


Figure (4,5): Rapid tests cassette for HBsAg and HCV



3.3. Statistical analysis

The result will be analyzed by Social Package of Statistical Science (SPSS) version 26 (LEAD Technologies; Inc. USA). 95% confidence interval. P values <0.05 will be considered statistically significant variables were represented as frequencies and %. In addition, association between variables were assessed by χ^2 test and Fisher's exact test.

3.4. Ethics Considerations:

All students of laboratory medicine of Emirates International University in this study will be given a consent Form, and information about the experimental procedures before giving their written consent, (appendix1).

Chapter 4

Results

4. Results

A total of three hundred-eighty-five patients attending Emirates International University dental clinics in Sana'a City, Yemen during the year 2022. The study aimed to estimate or detect the prevalence rate of HBV and HCV and risk factors associated with infections among patients attending Emirates International University dental clinics in Sana'a City, Yemen.

4-1: Demographic data:

The study was a cross sectional study, analytic study, conducted during the year 2022 at Emirates International University Dental Clinics.

According to gender most of patients **241 (62.6%)** was **males** and **144 (37.4%)** was **females**. Moreover, the majority of patients were in age group **20-40 (76.9%)** years old, followed by age group **<20 (15.1%)** years old, then age group **41-60 (7.3%)** years old and age group **>60 (0.5%)**, with age Mean /SD was 26, 21 / 10.9. **Table 4.1.**

Table 4.1 Demographic Characteristics of the study population (n= 385)

Age group in years	Frequency	%
<20	58	15.1
20-40	296	76.9
41-60	28	7.3
>60	2	0.5
Total	385	100
Mean /SD	26,21 /10.9	
Median	24	
Mode	23	
Range	1 to 70	
Gender	Frequency	%
Male	241	62.6
Female	144	37.4
Total	385	100

4-2: Prevalence of HBV & HCV:

The overall Prevalence of HBV & HCV was **0.78 %**, i.e., the Prevalence of HBV was double (**0.52 %**) than HCV (**0.26%**) among patients attending Emirates International University dental clinics in Sana'a City, Yemen. **Table (4.2).**

Table (4.2): Prevalence of HBV and HCV among patients attending Emirates International University dental clinics in Sana'a City, Yemen

Virus Type	Frequency n=385	Prevalence rate
HBs-Ag.	2	0.52 %
HCV –Ab	1	0.26%
Total	3	0.78 %

In addition, there was a significant different between male and female among patients with HCV but not with HBV patients, where X^2 & P was 0.996, 0.020, **table (4.3)** and **(4.4)**.

Table 4.3: Distribution of HBV patients according to gender

Gender	HBVs –Ag				Total		χ^2	p
	Reactive		Non-reactive					
	No.	%	No.	%	No.	%		
Male	1	0.4	240	99.6	241	62.6	0.56	0.053
Female	1	0.7	143	99.3	144	37.4		
Total	2	0.5	383	99.5	385	100.0		

Table 4.4: Distribution of HCV patients according to gender.

Gender	HCV-Ab.				Total	χ^2	<i>p</i>
	Reactive		Non-reactive				
	No.	%	No.	%			
Male	1	0.4	240	99.6	241	0.996	0.020
Female	0	0.0	144	100.0	144		
Total	1	0.3	384	99.7	385		

According to age group, patients with HBV had aged among 20-40 category, while patients with HCV had aged >60 year category. There was a significant different between age group and HBV but not with HCV infection, where X^2 & P was 9,21, 0.005, table (4.5) and (4.6) respectively.

Table 4.5: Distribution of HBV patients according to age group

Age group	HBVs –Ag		Total	χ^2	<i>p</i>
	Reactive	Non-reactive			
<20	0	58	58	9.21	0.005
20-40	2	294	296		
41-60	0	28	28		
>60	0	1	1		
Total=385	2	383	385		

Table 4.6: Distribution of HCV patients according to age group.

Age group	HCV-Ab.		Total	χ^2	<i>p</i>
	Reactive	Non-reactive			
<20	0	58	58	4.61	0.103
20-40	0	296	296		
41-60	0	28	28		
>60	1	0	1		
Total=385	1	384	385		

4-3: Risk factors associated with HBV & HCV infections:

Risk factors associated with HBV and HCV infections were shows in table (4.7) & (4.8).

Chronic disease, clinical stage of the patient with HCV was the only risk factor with OR= 0.933, $\chi^2 = 24.731$, $p = 0.00$, **table (4.8)**.

No risk factors was detected with both HBV and HCV infections in this study.

Table 4.7: Risk factors associated with HBV infections.

Risk factors		HBV		Total	OR	χ^2	p
		Reactive	Non-reactive				
Received blood transfusion	Yes	0	28	28	0.00	0.158	0.692
	No	2	355	357			
Marital status married	Married	0	155	155	0.00	1.355	0.245
	single	2	228	230			
Surgery operation	Yes	1	97	98	2.948	0.638	0.425
	No	1	286	287			
Pre-dental procedure	Yes	0	30	30	0.00	0.170	0.680
	No	2	353	355			
HBV vaccine	Yes	1	39	40	8.821	3.388	0.066
	No	1	344	345			
Chronic disease	Yes	0	15	15	0.00	0.082	0.776
	No	2	368	370			
Family history of hepatitis	Yes	0	31	31	0.00	0.177	0.675
	No	2	351	352			

Table 4.8: Risk factors associated with HCV infections.

Risk factors		HCV		Total	OR	χ^2	p
		Reactive	Non-reactive				
Received blood transfusion	Yes	0	28	28	0.003	0.079	0.779
	No	1	356	357			
Marital status married	Married	1	154	155	0.994	1.488	0.223
	single	0	230	230			
Surgery operation	Yes	0	98	98	0.003	0.342	0.559
	No	1	286	287			
Pre-dental procedure	Yes	0	30	30	0.003	0.085	0.771
	No	1	354	355			
Chronic disease	Yes	1	14	15	0.933	24.731	0.000
	No	0	370	370			
Family history of hepatitis	Yes	0	31	31	0.003	0.088	0.767
	No	1	352	352			

Chapter 5

Discussion

5. Discussion

Globally, there are approximately 257 million people infected with HBV and 71 million people infected with HCV. Studies from countries such as Ethiopia, Egypt, Morocco, Turkey and Italy found a relatively high prevalence of HBV and HCV that was attributed to risk factors, one among which was dental treatment. (Al-Amad S. 2018).

Hepatitis B and C are blood borne infections. Dentists including oral surgeons are one of many professionals who are at higher risk of getting these infections from patients (Khan C. *et al.*, 2021).

The objective of this study was to determine prevalence of HCV and HBV in patients reporting for dental treatment. Further, individual seeking dental care may be healthy or suffering from dreadful diseases like hepatitis B and C or may be carriers that cannot be easily identified. Such patient may act as a source for spreading such infection among dental health care workers and other patients in dental clinics. Hence, another objective of present study was to highlight the potential hazards and risk factors of HBV and HCV to the dental doctors and other associated health workers as well as to patients attending clinics.

The present study found that males participants **241 (62.6%)** was more than females **144 (37.4%)**. Similar finding found with other studies conducted in Iraq and Pakistan (Merza *et al.*, 2017 & Latoo *et al.*, 2017).

The present study found that the prevalence of **HBV** and **HCV** was **0.52** and **0.26**, respectively, among patients attending Emirates International University dental clinics in Sana'a City, Yemen.

Several similar studies on prevalence of **HBV** and **HCV** carried out and had different result without agreement with results of this study, i.e. The prevalence of HBV and HCV was **0.52** and **0.26**, in the present study and low as compared with study conducted in Iraq and Pakistan. They found that the prevalence of HBV and HCV was (1.99) and (0.00) in Duhok, Kurdistan, Iraq (Merza *et al.*, 2017), while Latoo *et al.*, 2017 in Kashmir Valley, Pakistan found that the prevalence of HBV and HCV was 4.4% and 4.3 % respectively.

In the present study, the prevalence of HBV was more than HCV and this agreed with other study that found the prevalence of HBV 2.7% and HCV 1.5% that conducted at Sandeman Provincial Hospital Quetta, Pakistan (Khan C. *et al.*, 2021). Moreover, this study disagreed with study that found the prevalence of HBV 2.2% and HCV 3.8% that conducted at a teaching dental hospital, United Arab Emirates (Al-Amad S. 2018).

The incidence of HBV was equal among male female participants and one male infected with HCV in this study. In addition, there was a significant different between male and female among patients with HCV but not with HBV patients, where X^2 & P was 0.996, 0.020.

Our study-demonstrated predominance of HBV in male sex (0.52 %), which were in support to the finding of other previous reports (**Merza et al., 2017**).

The higher rate of HBV in men can be explained by a greater exposure to this virus through high-risk jobs and sexual activities. In contrast, other studies have shown lower frequency of HBV among male gender (**Qureshi H, et al., 2010**).

Regarding to age, the present study found that patients with HBV aged among 20-40 category had high prevalence, while patients with aged >60-year category had HCV. There was a significant different between age group and HBV but not with HCV infection, where X^2 & P was **9,21, 0.005**. This result was agreed with other study conducted in Yemen (**Al Kasem MA et al., 2018**) and Pakistan (**Latoo et al., 2017**).

According to risk factors associated with HBV & HCV infections in this study, it was found that chronic disease, clinical stage of the patient with HCV was the only risk factor with OR= 0.933, $\chi^2 = 24.731$, $p = 0.00$.

This result was disagreed with other study that found other risk factor associated with viral hepatitis such as history of dental treatment (**Latoo et al., 2017**).

This variation in the detection of risk factors perhaps because of small sample size and or few cases had diagnosed in this study.

Chapter 6

Conclusion & Recommendations

6- Conclusions & Recommendations

6-1 Conclusions:-

- 1) The prevalence of HBV and HCV was low among patients attending Emirates International University dental clinics.
- 2) The prevalence of HBV and HCV was more among male than female patient.
- 3) Risk factors for HCV were sex and clinical status of disease while age group with HBV.

6-2 Recommendations:-

- 1) Further studies must be conducted with large sample size.
- 2) Further studies must be conducted concerned with advanced diagnostic methods.
- 3) Routine screening clinical diagnostic tests should be requested before any dental procedure, especially before any oral surgical procedure such as tooth extraction in the EIU dental clinics.



References

References

- 1)** AASLD/IDSA HCV Guidance Panel (2015). Hepatitis C guidance: AASLD-IDSA recommendations for testing, managing, and treating adults infected with hepatitis C virus. *Hepatology*. 62 (3): 932–954.
- 2)** Abdelwahab KS, Said ZN (2016). Status of hepatitis C virus vaccination: *Rec*
- 3)** Al Kasem MA Abbas, Abbas M Al-Kebsi, Ebtihal M Madar and Hassan A Al-Shamahy (2018): Hepatitis B Virus among Dental Clinic Workers and the Risk Factors Contributing for its Infection. *Online Journal of Dentistry & Oral Health* .
- 4)** Al Kasem MA Abbas, Abbas M Al-Kebsi, Ebtihal M Madar and Hassan A Al-Shamahy 2018: Hepatitis B Virus among Dental Clinic Workers and the Risk Factors Contributing for its Infection. *Online Journal of Dentistry & Oral Health*, DOI: 10.33552/OJDOH.2018.01.000509.
- 5)** Al- Nabehi BAH, Al- Shamahy H, Saeed WSE, Musa AM, El Hassan A.M. and Khalil EAG. Sero-molecular epidemiology and risk factors of viral hepatitis in Urban Yemen. *Int J Virol* 2015; 11: 133-138. <https://doi.org/10.3923/ijv.2015.133.138>
- 6)** Al Waleedi, A.A. and Y.S. Khader, 2012. Prevalence of hepatitis B and C infections and associated factors among blood donors in Aden City, Yemen. *EMHJ*, 18: 624-629
- 7)** Al-Amad Suhail H. (2018): Prevalence of hepatitis B, C, and HIV among patients attending a teaching dental hospital. A 7-year retrospective study from the United Arab Emirates. *Saudi Med J*; Vol. 39 (5): 500-505. doi: 10.15537/smj.2018.5.22116.
- 8)** Al-Marrani. W&. Al-Shamahy H. (2018): Prevalence of HBV & HCV; and their associated risk factors among public health cleaners centers at selected public health centers in Sana'a city-Yemen *Universal Journal of Pharmaceutical Research* 3(5):58-62.
- 9)** Alter MJ (2003). Epidemiology and prevention of hepatitis B. *Seminars in Liver Disease*. 23 (1): 39–46
- 10)** Alter MJ (2007). Epidemiology of hepatitis C virus infection. *World Journal of Gastroenterology*. 13 (17): 2436–24 and for administering postexposure management.

References

MMWR. Recommendations and Immunology. 200 (1): 7–11. and Reports. 62 (RR-10): 1–19.

11) Baseer MA, Rahman G, Yassin MA. Infection control practices in dental school: a patient perspective from Saudi Arabia. *Dent Res J (Isfahan)* 2013;10:25–30.

12) Beykaso, Gizachew, et al. "Estimating the transmission risks of viral hepatitis and HIV among blood donors in Hossana, Southern Ethiopia." *Risk Management and Healthcare Policy* 14 (2021): 3117. biological roles of hepatitis B virus x protein. *Cancer Science*.

13) Bustin SA, Benes V, Nolan T, et al. Quantitative real-time RT-PCR--a perspective. *J Mol Endocrinol* 2005;34:597-601. 10.1677/jme.1.01755

14) Caliendo AM, Valsamakis A, Bremer JW, et al. Multilaboratory evaluation of real-time PCR tests for hepatitis B virus DNA quantification. *J Clin Microbiol* 2011;49:2854-8. 10.1128/JCM.00471-11

15) Canadian medical-surgical nursing (Canadian 2nd ed.). Philadelphia, PA

16) Centers for Disease Control and Prevention (CDC) (2012). Hepatitis C FAQs

17) Centers for Disease Control and Prevention (CDC) (2014). Quick Reference

18) Centers for Disease Control and Prevention (CDC) (2015)

19) Centers for Disease Control and Prevention (CDC) (2016). U.S. 2014

20) Centers for Disease Control and Prevention (CDC) (2017). Men who have sex

21) Centers for Disease Control and Prevention (CDC) (2020). Q and A for health professionals. Viral Hepatitis.

22) Chen CJ, Yang HI, Su J, et al. Risk of hepatocellular carcinoma across a biological gradient of serum hepatitis B virus DNA level. *JAMA* 2006;295:65-73. 10.1001/jama.295.1.65

23) Chevaliez S, Pawlotsky JM. Diagnosis and management of chronic viral hepatitis: antigens, antibodies and viral genomes. *Best Pract Res Clin Gastroenterol* 2008;22:1031-48.

24) Datta S, Chatterjee S, Veer V. Recent advances in molecular diagnostics of hepatitis B virus. *World J Gastroenterol* 2014;20:14615-25. 10.3748/wjg.v20.i40.14615

References

- 25)** Day RA, Paul P, Williams B (2009). Brunner and Suddarth's textbook of Deny P, Zoulim F. Hepatitis B virus: from diagnosis to treatment. *Pathol Biol (Paris)* 2010;58:245-53. 10.1016/j.patbio.2010.05.002
- 26)** Dolin R (eds.). Mandell, Douglas, and Bennett's principles and practice of Dupinay T, et al. (2013). Discovery of naturally occurring transmissible chronic
- 27)** Edris A, Nour MO, Zedan OO, Mansour AE, Ghandour AA, Omran T. Seroprevalence and risk factors for hepatitis B and C virus infection in Damietta Governorate, Egypt. *East Mediterr Health J* 2014;20:605—13.
- 28)** Edwards, D. J., Coppens, D. G., Prasad, T. L., Rook, L. A. & Iyer, J. K. 2015: Access to hepatitis C medicines. *Bulletin of the World Health Organization*, 93, 799-805.
- 29)** Egypt Today (2021). Hepatitis C prevalence in Egypt drops from 7% to 2% thanks to Sisi's initiative.
- 30)** El-Serag HB (2011). Hepatocellular carcinoma. *New England Journal of England Journal of Medicine*. 364 (25): 2429~C38
- 31)** Fairley CK, Read TR (2012). Vaccination against sexually transmitted
- 32)** Fallahian, F., Najafi, A. & Alavian, S. 2010: Intravenous drug use: the predominant risk factors for hepatitis C virus infection. *Shiraz E Medical Journal*, 11, 209-218.
- 33)** Fattovich, G., Stroffolini, T., Zagni, I. & Donato, F. 2004: Hepatocellular carcinoma in cirrhosis: incidence and risk factors. *Gastroenterology*, 127, S35-S50.
- 34)** Fischler B (June 2007). Hepatitis C virus infection. *Seminars in Fetal and for health professionals. Centers for Disease Control and Prevention Gastroenterology and Hepatology*. 17 (Suppl): S125~C45
- 35)** GBD (2017). Disease and injury incidence and prevalence, collaborators .2018 .(Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories
- 36)** Georg M, Bruce D. Hepatitis C virus infection. *National England J Med* 2001; 345: 41-52 ..<https://doi.org/10.1038/nrdp.2017.6>.
- 37)** Guide Laboratory Testing for the Diagnosis of HIV Infection: Updated

References

- 38)** Hagan H, Pouget ER, Des Jarlais DC (2011). A systematic review and meta-analysis of interventions to prevent hepatitis C virus infection in people who inject drugs. *The Journal of Infectious Diseases*. 204 (1): 74–83.
- 39)** Haidar NA. Prevalence of hepatitis B and hepatitis C in blood donors and high risk groups in Hajjah, Yemen Republic. *Saudi Med J* 2002; 23(9):1090
- 40)** Harte JA. Standard and transmission-based precautions: an update for dentistry. *J Am Dent Assoc* 2010;141:572–81.
- 41)** HCV RNA detection. *The Journal of Infectious Diseases*. 189 (1): 3–6.
- 42)** HCV. In Schiffman ML. *Chronic Hepatitis C Virus Advances in Treatment hepatitis and sexually transmitted infections*, 2021. www.who.int.
- 43)** Hepatitis B FAQs for the public. Archived from the original on 20 August 2015 hepatitis B virus infection among *Macaca fascicularis* from Mauritius *Hepatology*. 4 (3):355–64
- 44)** Holmberg S (2011). Brunette GW, Kozarsky PE, Magill AJ, Shlim DR, Whatley AD (eds.). *CDC health information for international travel 2012*. New York Oxford University Press. p. 231.
- 45)** Hu J, Protzer U, Siddiqui A (2019). Revisiting hepatitis B virus: Challenges of curative therapies. *Journal of Virology* .
- 46)** Hundie GB, Raj VS, Michael DG, Pas SD, Osterhaus ADME, Koopmans MP, et al. Molecular epidemiology and genetic diversity of hepatitis B virus in Ethiopia. *J Med Virol*.
- 47)** Hutin YJ, Harpaz R, Drobeniuc J, Melnic A, Ray C, Favorov M, et al. Injections given in healthcare settings as a major source of acute hepatitis B in Moldova. *Int J Epidemiol* 1999; 28 :782-786
- 48)** Hutin, Yvan J-F., Marc Bulterys, and Gottfried O. Hirschall. "How far are we from viral hepatitis elimination service coverage targets?" *Journal of the International AIDS Society* 21 (2018): e25050. infection. *Journal of Medical Virology*. 81 (5): 836–43. infections. *Current Opinion in Infectious Diseases*. 25 (1): 66–72. infectious diseases (7th ed.). Philadelphia, PA: Churchill Livingstone. International. 39 (3): 416–426. Island. *Hepatology*. ITC33–CITC48.

References

- 49) Imperial JC (2010). Chronic hepatitis C in the state prison system: insights into Indolfi G, Resti M (2009). Perinatal transmission of hepatitis C virus
- 50) Jafari, S., Copes, R., Baharlou, S., Etminan, M. & Buxton, J. 2010: Tattooing and the risk of transmission of hepatitis C: a systematic review and meta-analysis. *International journal of infectious diseases*, 14, e928-e940.
- 51) Jaroszewicz J, Calle Serrano B, Wursthorn K, Deterding K, Schlue J .Kane A, Lloyd J, Zaffran M, Simonsen L, Kane M. Transmission of hepatitis B, hepatitis C and human immunodeficiency viruses through unsafe injections in the developing world: model-based regional estimates. *Bull World Health Organ* 1999; 77: 801-807.
- 52) Kanwal F, Bacon BR (2011). Does treatment alter the natural history of chronic
- 53) Kao JH. Diagnosis of hepatitis B virus infection through serological and virological markers. *Expert Rev Gastroenterol Hepatol* 2008;2:553-62.
- 54) Kay A, Zoulim F (2007). Hepatitis B virus genetic variability and evolution. *Virus*
- 55) Khan. Changaiz, Shahbaz Khan, Nizam Ul Mulk, Mirza Khan Tareen, Jahangir Hammad, Mir Zaman Kasi (2021): Frequency of hepatitis B and C in patients attending oral and maxillofacial surgery department for dental extraction at Sandeman Provincial Hospital Quetta. *International Journal of Surgery: Global Health*, 4:e49. doi.org/10.1097/GH9.0000000000000049.
- 56) Kim A (2016). Hepatitis C virus. *Annals of Internal Medicine* (Review). 165
- 57) Komas NP, Vickos U, H"bschen JM, B"r"i A, Manirakiza A, Muller CP, LeFaou A (2013). Cross-sectional study of hepatitis B virus infection in rural communities, Central African Republic. *BMC Infectious Diseases*. 13: 286.
- 58) Lai CL, Yuen MF (2007). The natural history and treatment of chronic hepatitis B a critical evaluation of standard treatment criteria and end points. *Annals of Internal Medicine*. 147 (1): 58"C61.
- 59) Lam NC, Gotsch PB, Langan RC (2010). Caring for pregnant women and newborns with hepatitis B or C (PDF). *American Family Physician*. 82 (10)

References

- 60)** Lee C, Gong Y, Brok J, Boxall EH, Gluud C (2006). Hepatitis B immunisation for newborn infants of hepatitis B surface antigen-positive mothers. The Cochrane Database of Systematic Reviews. (2): CD004790.
- 61)** Lerat H, Hollinger FB (2004). Hepatitis C virus (HCV) occult infection or occult
- 62)** Lin YJ, Wu HL, Chen DS, Chen PJ (2012). Hepatitis B virus nucleocapsid but not free core antigen controls viral clearance in mice. *Journal of Virology*.
- 63)** Lioussfi, Z., Errami, Z., Radoui, A., Rhou, H., Ezzaitouni, F., Ouzeddoun, N., Bayahia, R. & Benamar, L. 2014: Viral hepatitis C and B among dialysis patients at the Rabat University Hospital: prevalence and risk factors. *Saudi Journal of Kidney Diseases and Transplantation*, 25, 672.
- 64)** Lippincott Williams and Wilkins. p. 1237.
- 65)** Locarnini S (2004). Molecular virology of hepatitis B virus". *Seminars in Liver Disease*.
- 66)** Lombardi A, Mondelli MU (2019). Hepatitis C: Is eradication possible. *Liver*
- 67)** Mücke MM, Backus LI, Mücke VT, Coppola N, Preda CM, Yeh ML, et al (2018) Hepatitis B virus reactivation during direct-acting antiviral therapy for hepatitis C: systematic review and meta-analysis. *The Lancet Gastroenterology and Hepatology*. 3 (3): 172–180.
- 68)** Maheshwari A, Thuluvath PJ (2010). Management of acute hepatitis C. *Clinics in Liver Disease*. 14 (1): 169–176.
- 69)** *Medicine*. 365 (12): 1118–1127.
- 70)** Merza, M. ,Bahar Jaafar Selivany, Mohammed Rashed Nabi Aldoski. (2017): Prevalence of Hepatitis B and C Viruses among Patients Who Underwent Dental Interventions in a Dental Care Units at College of Dentistry, Duhok, Kurdistan. *Annals of International Medical and Dental Research*, Vol (3), Issue (6).
- 71)** Mohamoud YA, Riome S, Abu-Raddad LJ. Epidemiology of hepatitis C virus in the Arabian Gulf countries: Systematic review and meta-analysis of prevalence. *Int J Infect Dis* 2016; 46: 116-125.

References

- 72)** Mohareb, Amir M., et al. "Mortality in relation to hepatitis B virus (HBV) infection status among HIV-HBV co-infected patients in sub-Saharan Africa after immediate initiation of antiretroviral therapy." *Journal of viral hepatitis* 28.4 (2021): 621-629
- 73)** Mohd Hanafiah K, Groeger J, Flaxman AD, Wiersma ST (2013). Global epidemiology of hepatitis C virus infection: new estimates of age-specific antibody to HCV seroprevalence. *Hepatology*. 57 (4): 1333–C42.
- 74)** Molla S, Munshea A, Nibret E. Seroprevalence of hepatitis B surface antigen and anti HCV antibody and its associated risk factors among pregnant women attending maternity ward of Felege Hiwot Referral Hospital, northwest Ethiopia: a cross-sectional study. *Virol J* 2015; 12: 204.
- 75)** Moradi Khanghahi B, Jamali Z, Pournaghi Azar F, Naghavi Behzad M, Azami-Aghdash S. Knowledge, attitude, practice and status of infection control among Iranian dentists and dental students: a systematic review. *J Dent Res Dent Clin Dent Prospects* 2013;7:55—60.
- 76)** Nahla K. Ibrahim ,Hebah A. Alwafi, Samaa O. Sangoof, Asraa K. Turkistani, Bushra M. Alattas. (2017): Cross-infection and infection control in dentistry: Knowledge, attitude and practice of patients attended dental clinics in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. *Journal of Infection and Public Health* 10, 438—445.
- 77)** Nakano T, Lau GM, Lau GM, Sugiyama M, Mizokami M (2012). An updated analysis of hepatitis C virus genotypes and subtypes based on the complete coding region. *Liver International*. 32 (2): 339–C45.
- 78)** Natural history of hepatitis B virus (HBV)-infection: A European Nayak, Nabeen C., et al. "Etiologic types of end-stage chronic liver disease in adults: analysis of prevalence and their temporal changes from a study on native liver explants." *European journal of gastroenterology & hepatology* 24.10 (2012): 1199-1208.
- 79)** Nelson PK, Mathers BM, Cowie B, Hagan H, Des Jarlais D, Horyniak D Degenhardt L (2011). Global epidemiology of hepatitis B and hepatitis C in
- 80)** *Neonatal Medicine*. 12 (3): 168–C73.

References

- 81)** Ott, J., Stevens, G., Groeger, J. & Wiersma, S. 2012: Global epidemiology of hepatitis B virus infection: new estimates of age-specific HBsAg seroprevalence and endemicity. *Vaccine*, 30, 2212-2219.
- 82)** Ozaras R, Tahan V (2009). Acute hepatitis C: prevention and treatment. *Expert Review of Anti-Infective Therapy*. 7 (3): 351–361.
- 83)** People who inject drugs: results of systematic reviews. *Lancet*. 378 (9791):571–583. perspective. *Journal of Hepatology*.
- 84)** PetruzzIELLO, Arnolfo. "Suppl-1, M3: epidemiology of hepatitis B virus (HBV) and hepatitis C virus (HCV) related hepatocellular carcinoma." *The open virology journal* 12 (2018): 26.
- 85)** Pockros P (2011). Novel and combination therapies for Hepatitis C Virus, An Issue of *Clinics in Liver Disease*. p. 47.
- 86)** Pond RJ, RA (2011). Hidden hazards of HCV transmission. *Medical Microbiology*
- 87)** Pramoolsinsup C (2002). Management of viral hepatitis B. *Journal of Promise for the Future*. Springer Verlag. pp. 103–104.
- 88)** Puttaiah R, Shulman JD, Youngblood D, Bedi R, Tse E, et al. (2009) Sample infection control needs assessment survey data from eight countries. *Int.Dent. J.* 59(5): 271-276.
- 89)** Qureshi H, Bile KM, Jooma R, Alam SE, Afridi HUR (2010):. Prevalence of hepatitis B and C viral infections in Pakistan: Findings of a national survey appealing for effective prevention and control measures. *East Mediterr Health J*; 16:15-23.
- 90)** Radcliffe RA, Bixler D, Moorman A, Hogan VA, Greenfield VS, Gaviria DM, et al. Hepatitis B virus transmissions associated with a portable dental clinic, West Virginia, 2009. *J Am Dent Assoc* 2013; 144: 1110-1118
- 91)** Raimondo G, Allain JP, Brunetto MR, et al. Statements from the Taormina expert meeting on occult hepatitis B virus infection. *J Hepatol* 2008;49:652-7. 10.1016/j.jhep.2008.07.014
- 92)** Raupach R, et al. (2010). Hepatitis B surface antigen (HBsAg) levels in the Recommendations (PDF). cdc.gov. New York State Department of Health June 27. pp. 1–2.

References

- 93)** Ray SC, Thomas DL (2009). Chapter 154: Hepatitis C. In Mandell GL, Bennett Research.
- 94)** Review of hepatitis C virus (HCV) vertical transmission: risks of transmission to infants born to mothers with and without HCV viraemia or human immunodeficiency virus infection. *International Journal of Epidemiology*. 27 (1): 108–117.
- 95)** Rosen HR (2011). Clinical practice. Chronic hepatitis C infection. The New Schillie S, Murphy TV, Sawyer M, Ly K, Hughes E, Jiles R, et al. (2013). CDC guidance for evaluating health-care personnel for hepatitis B virus protection
- 96)** Schweitzer, A., Horn, J., Mikolajczyk, R. T., Krause, G., & Ott, J.J. (2015). Estimations of worldwide prevalence of chronic hepatitis B virus infection: A systematic review of data published between 1965 and 2013. *Lancet*, 386 (10003), 1546–1555.
- 97)** Su, Y., Yan, R., Duan, Z., Norris, J. L., Wang, L., Jiang, Y., Xing, W., Chen, Y., Xiao, Y. & Li, L. 2013: Prevalence and risk factors of hepatitis C and B virus infections in hemodialysis patients and their spouses: A multicenter study in Beijing, China. *Journal of medical virology*, 85, 425-432. Surveillance data for viral hepatitis, statistics and surveillance, Division of Viral Hepatitis
- 98)** Suhail Latoo, S., Mohammad S., Humaira N. (2017): Sero-prevalence of Hepatitis B and C virus among patients attending Dental clinics in Kashmir Valley. *International Archives of Integrated Medicine*, Vol. 4, Issue 2.
- 99)** Tada A, Watanabe M, Senpuku H. Factors influencing compliance with infection control practice in Japanese dentists. *Int J Occup Environ Med* 2014;5(1):24–31.
- 100)** Tang H, Oishi N, Kaneko S, Murakami S (2006). Molecular functions and
- 101)** Tassachew, Yayehyirad, et al. "Prevalence of HIV and Its Co-Infection with Hepatitis B/C Virus Among Chronic Liver Disease Patients in Ethiopia." *Hepatic Medicine: Evidence and Research* 14 (2022): 67
- 102)** Terrault N, Roche B, Samuel D (2005). Management of the hepatitis B virus in
- 103)** Terrault NA, Bzowej NH, Chang KM, Hwang JP, Jonas MM, Murad MH 2016. (AASLD guidelines for treatment of chronic hepatitis B. *Hepatology*. 63 (1): 261–283.

References

- 104)** Tesfa, H., Biadgo, B., Getachew, F., Tegegne, K., Yismaw, G. & Muluye, D. 2013: Seroprevalence of hepatitis B and C virus infection among patients attending serology laboratory of Gondar University Hospital. BMC research notes, 6, 164.
- 105)** The liver transplantation setting: a European and an American perspective. Liver Transplant. 11 (7): 716–732.
- 106)** The problems and possible solutions. Expert Review of Gastroenterology and treatment (PDF). American Family Physician. 81 (11): 1351–1357.
- 107)** Thomas SL, Newell ML, Peckham CS, Ades AE, Hall AJ (February 1998). A Tsang TK, Blei AT, O'Reilly DJ, et al. Clinical significance of concurrent hepatitis B surface antigen and antibody positivity. Dig Dis Sci 1986;31:620-4. 10.1007/BF01318693
- 108)** TSRI - News and Publications (2009). Retrieved 3 January 2009 .
- 109)** Umar, M., Tul Bushra, H., Ahmad, M., Khurram, M., Usman, S., Arif, M., Adam, T., Minhaz, Z. & Arif, A. 2010: Hepatitis C in Pakistan: a review of available data. Hepatitis monthly, 10, 205, update. World Journal of Gastroenterology. 22 (2): 862–873.
- 110)** Weber B. Recent developments in the diagnosis and monitoring of HBV infection and role of the genetic variability of the S gene. Expert Rev Mol Diagn 2005;5:75-91. 10.1586/14737159.5.1.75
- 111)** Westbrook RH, Dusheiko G (2014). Natural history of hepatitis C. Journal of Hepatology. 61 (1): S58-68.
- 112)** Wilkins T, Malcolm JK, Raina D, Schade RR (2010). Hepatitis C: diagnosis and with men | populations and settings division of viral hepatitis CDC. www.cdc.gov. 31 May 2015.\
- 113)** Wong F, Pai R, Van Schalkwyk J, Yoshida EM (2014). Hepatitis B in . pregnancy: a concise review of neonatal vertical transmission and antiviral prophylaxis. Annals of Hepatology. 13 (2): 187–195.
- 114)** Wong T, Lee SS (2006). Hepatitis C: A review for primary care physicians .CMAJ. 174 (5): 649–659.
- 115)** World Health Organization (WHO) (2011). Hepatitis C. June 2011 .Archived from the original on 2011-07-12.

References

- 116)** World Health Organization (WHO) (2015). Hepatitis B. www.who.int. Archived from the original on 10 July 2015.
- 117)** World Health Organization (WHO) (2016). Hepatitis C fact sheet N .World Health Organization (WHO) (2020). Hepatitis C. Archived from the original on 2020-05-26.
- 118)** World Health Organization (WHO) (2021). Global progress report on HIV, viral
- 119)** Yamalik N, Van Dijk W. Analysis of the attitudes and needs/demands of dental practitioners in the field of patient safety and risk management. *Int Dent J*.2013;63:291—7.
- 120)** Zhang, Tiejun, et al. "Prevalence of human herpesvirus 8 and hepatitis C virus in a rural community with a high risk for blood-borne infections in central China." *Clinical Microbiology and Infection* 17.3 (2011): 395-401.
- 121)** WWW.trinitybiotech.com
- 122)** WWW.cdc.gov
- 123)** <https://www.emro.who.int/emhj-volume-18-2012/>
- 124)** <https://www.elsevier.es/index>.
- 125)** <https://academicjournals>.
- 126)** <https://www.sciencedirect.com>
- 127)** <https://www.beeandlifecongress.com>



Study Questionnaire

Prevalence of Hepatitis B, C and Human Immunodeficiency Virus among patients attending Emirates International University dental clinics in Sana'a City, Yemen

I- Personal data

- Serial No () - Name.....
- Age () years - Gender ☐ M ☐ F
- Marital status ☐ Married ☐ Single

II- Illness history and risk factors

1. Have you received blood transfusion or any blood product before?
☐ Y ☐ N
2. Do you have surgery operation before? ☐ Y ☐ N
If yes what operation and when?
3. Do you been exposed dental procedure before? ☐ Y ☐ N
4. Is there any family history of hepatitis? ☐ Y ☐ N
5. Do you receive HBV vaccine before? ☐ Y ☐ N
6. Do you have any chronic illness? ☐ Y ☐ N
7. Have you agreed to do this test? ☐ Y ☐ N

العدوى الدموية بين المرضى المترددين الى عيادات طب الاسنان بالجامعة الاماراتية الدولية في
مدينة صنعاء، اليمن

1- البيانات الشخصية:

- الرقم التسلسلي ()
- العمر () سنوات
- الجنس :
- الحالة الاجتماعية :
- محل الإقامة :
- الاسم -
ذكر () انثى ()
متزوج () أعزب ()
المدينة () القرية ()

2- تاريخ المرض وعوامل الخطر:

1. هل وافقت على إجراء هذا الاختبار ؟
2. هل تلقيت نقل دم أو أي منتج دم من قبل؟
3. هل أجريت عملية جراحية من قبل؟
إذا كانت الإجابة بنعم ، فما هي العملية ومتى؟
4. هل تعرضت لعملية الأسنان من قبل؟
5. هل هناك تاريخ عائلي لالتهاب الكبد؟
6. هل تلقيت لقاح الكبد الوبائي نوع بي من قبل؟
7. هل تعاني من أي مرض مزمن؟
نعم () لا ()
نعم () لا ()
نعم () لا ()
نعم () لا ()
نعم () لا ()
نعم () لا ()
نعم () لا ()
نعم () لا ()

3- نتائج الفحوصات:

اسم الفحص	النتيجة
فيروس الكبد الوبائي بي	
فيروس الكبد الوبائي سي	

توقيع المريض

توقيع المختص

الملخص

مقدمة: يعد تقييم مدى انتشار فيروسات التهاب الكبد B و C ما بين مرضى عيادات الأسنان في صنعاء أمراً ضرورياً لفهم العبء المحلي لهذه العدوى وتحديد عوامل الخطر المحتملة المرتبطة بانتقالها.

الهدف: تقييم معدل انتشار فيروس التهاب الكبد B وفيروس التهاب الكبد C وعوامل الخطر المرتبطة بالعدوى ما بين المرضى الذين يترددون على عيادات الأسنان بالجامعة الإماراتية الدولية في مدينة صنعاء ، اليمن.

الأساس المنطقي: تسليط الضوء على أهمية الفحص الروتيني قبل أي إجراء للأسنان، وخاصة قبل أي إجراء جراحي للفم مثل خلع الأسنان.

المواد والطرق: أجريت هذه الدراسة في عيادات طب الأسنان بالجامعة الإماراتية الدولية في مدينة صنعاء، اليمن. كانت فترة الدراسة الإجمالية 3 أشهر، بدأت من مارس 2023 إلى مايو 2023. تم فحص 385 مريضاً بحثاً عن الإصابة بفيروس التهاب الكبد B وفيروس التهاب الكبد C من خلال الاختبارات التشخيصية السريرية التي أجراها الباحثون قبل خلع الأسنان أو إجراءاتها.

النتائج: من بين 385 مريضاً، تبين أن حالتين إيجابيتين مصابة بالتهاب الكبد B و حالة واحدة مصابة بفيروس التهاب الكبد C إجمالاً. ومن بينهم الذكور أكثر إصابة من الإناث. بالإضافة إلى ذلك، كان معدل الانتشار 2 (0.52%) لفيروس التهاب الكبد B و 1 (0.26%) لفيروس التهاب الكبد C. كانت عوامل الخطر للإصابة بفيروس التهاب الكبد C هي الجنس والحالة السريرية للمرضى بينما كانت الفئة العمرية للإصابة بفيروس التهاب الكبد C.

الاستنتاج: كان معدل انتشار فيروس التهاب الكبد B وفيروس التهاب الكبد C منخفضاً بين المرضى الذين يترددون على عيادات الأسنان بالجامعة الإماراتية الدولية. تؤكد هذه الدراسة بوضوح على أهمية الفحص الروتيني قبل الجراحة لفيروس التهاب الكبد B وفيروس التهاب الكبد C قبل أي إجراء في طب الأسنان.

الكلمات المفتاحية: التهاب الكبد B - التهاب الكبد C - عيادات الأسنان ، اليمن

انتشار التهاب الكبد الفيروسي بي وسي بين المرضى المترددون على عيادات طب الأسنان بالجامعة الإماراتية الدولية في مدينة صنعاء ، اليمن

بحث تخرج مقدم إلى كلية الطب والعلوم الصحية كاستيفاء جزئي
لمتطلبات نيل درجة البكالوريوس في الطب المخبري

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