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PHYSIOLOGICAL AND PATHOLOGICAL IMPACT OF HEPATITIS B AND C, PUBLIC HEALTH STRATEGIES FOR PREVENTION AND CONTROL

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Abstract

Objectives: The goal of this study is to analyze the physiological and pathological impacts of hepatitis B and C on liver and to measure the effectiveness of the health-related prevention and control programs in Pakistan.

Materials and Methods: This was a cross-sectional and prospective investigation of 200 patients with chronic hepatitis B or C in Karachi, Pakistan, who were evaluated with liver function tests (ALT, AST), abdominal ultrasonography, and serological markers. Demographic factors, health behavior, and medical history data were also captured.

Results: Both hepatitis B and C patients were shown to have increased ALT and AST, with hepatitis C presenting higher results for both tests. In contrast, 40% of hepatitis C patients were shown to have cirrhosis via ultrasound examination compared to 20% of hepatitis B patients. A large proportion of the participants came from low household incomes, and many did not know their infection status.

Conclusion: Hepatitis B and C are medically categorized as Liver disorders with Hepatitis C being more dangerous to the liver than Hepatitis B. As a result, early diagnosis and intervention were critical for improving health status.

Keywords: Hepatitis B, Hepatitis C, Liver Function, Cirrhosis, Public Health, Pakistan.

INTRODUCTION

Hepatitis B and C are amongst the most common viral diseases in today's world, with a long-term health impact because of the chronicity of the diseases and their potential to cause liver cirrhosis and hepatocellular carcinoma (HCC). These viruses particularly affect the liver and lead to changes that would negatively affect its function both physiologically and pathologically. Hepatitis B virus (HBV) has been reported to have several immunobiological features in which host immunity responses

contribute to the clinical outcome and chronicity (1). Likewise, the Hepatitis C virus (HCV) causes changes in hepatic responses, including fibrosis, cirrhosis, and high incidence of HCC, mainly due to chronic inflammation (2). The interactions between host immunity and these viruses range from viral clearance to a chronic infection that may lead to severe liver pathology in the long run (4).

Hepatitis B and C are still prevalent globally, as millions of people are infected even in underdeveloped countries where healthcare facilities to treat these ailments may still be inadequate. Pakistan, especially, is considered to have one of the highest incidences of HBV and HCV in the world, thus becoming a considerable public health concern. Hepatitis C itself targets a high concentration in the community, and many people do not seek medical attention, hence propagating the disease (7, 15). Lack of early detection and treatment, compounded with limited healthcare facilities, makes the effect of these infections worse. For this reason, many patients end up developing complications related to liver diseases at an advanced level when they decide to seek medical attention (9).

It is indicated that the pathogenesis of HBV and HCV occurs through many mechanisms. In the case of HBV, the virus enters the liver to establish a chronic infection because of its tropism for the host genome, enabling it to replicate and escape immune detection (4). In contrast, the hepatitis C virus is a virus of high genetic variability that poses challenges in terms of immune surveillance and response, as well as in the development of therapeutic immunity as compared to natural immunity responses (5). HBV persistent infection causes different liver diseases, including chronic hepatitis B, liver cirrhosis, and HCC, which are mostly asymptomatic in the early stages (8, 14). The host immune response, especially the activation of hepatic stellate cells and the stimulation of fibrosis, is primarily responsible for liver disease in patients with both hepatitis B and C (5,13).

Even though there have been significant developments in the management of HBV and HCV, these infections remain a major challenge in prevention and control. Hepatitis B control measure, which incorporates early identification, vaccination, and antiviral treatment programs, has been effective in the prevention and control of transmission as well as in the improvement of quality of life for the infected persons (3). However, there is still no generally efficient vaccine against hepatitis C, and the cost of antiviral medications for chronic infection is prohibitive for most developing countries, which hampers global elimination campaigns (6). In Pakistan, where a significant population is still at risk, efforts have been directed toward the improvement of merely awareness and screening for specifically identified categories like intravenous drug users, patients on hemodialysis, and blood donors (15).

Another challenge is the general population's ignorance of hepatitis B and C as potential causes of diseases and illness. For some people, chronic infections go unnoticed for years and continue to circulate and worsen their liver conditions. Several works have shown that knowledge, attitude, and practices on matters pertaining to hepatitis B are poor among some healthcare workers, which highlights the need for health promoter intervention (9). However, screening and vaccination for targeted and high-risk groups are still a problematic issue in many centers nowadays (3, 7). Preventive measures that include accurate detection, vaccines and anti-viral medications, and public enlightenment campaigns are needed to address these increasing viral disease burdens.

Additional measures necessary for reducing the current burden of hepatitis B and C are to enhance the availability of screening and vaccination and the possibility of antiviral treatment, as well as to tackle social factors that promote the spread of those diseases. The advent of immunobiologics, newer antiviral drugs, and the more frequent use of combination therapy may portend better times for improving the treatment of hepatitis B and C (1, 5). Moreover, these recent studies show that new remedies, including prophetic wet cupping therapy, may be used as supplementary treatment in addition to the current antiviral treatments, which may be of help in enriching the patient's care (6). Further attempts to eliminate HBV and HCV infections worldwide will need several years and multiple repeals of political, medical, and other engagements from governments, healthcare programs, and global organizations.

Objective: This article focuses on analyzing the physiologic and pathophysiologic effects of hepatitis B and C, as well as the mechanism of liver injury, and evaluating the effectiveness of public health interventions, especially in Pakistan.

MATERIALS AND METHODS

Study Design: This is a cross-sectional observational study intended to identify the prevalence and the physiological and pathological effects of hepatitis B and C in Pakistan. These viral infections shall influence the liver in various ways which will be analyzed after the study gathers both clinical data and history from the patients.

Study setting: The research will be undertaken in Karachi Pakistan, a city that has a higher percentage of patients with hepatitis B and C. Information will be collected from large tertiary care hospitals and medical facilities treating people with liver conditions.

Duration of the study: The current study was carried out for six months from January 2024 to June 2024.

Inclusion Criteria

Patient cohorts with CHB or CHC between 18 and 60 years were diagnosed through serological tests of HBV DNA and HCV RNA. Additionally, the participants were required to read and sign consent forms to be studied to ascertain that they understood the study conducted with them and the risks involved. These criteria assured that only respondents with the correct diagnosis of chronic hepatitis B or C were included in the research, and that these people contributed to the study in an ethical and voluntary manner.

Exclusion Criteria

To be more precise, there were patients who were excluded for comparability or equivalence and to minimize any obliteration bias. Such exclusions were pregnant and breast-feeding females for the reasons that Hepatitis B or C might affect maternity and neonatal health than the overall population. Patients with any HIV or other liver diseases like alcoholic liver disease, non-alcoholic fatty liver disease and other clinically significant liver diseases were also excluded as these liver diseases might affect the liver function and add on study results.

Methods

The study will be cross-sectional, and both demographic and clinical data will be collected from patients having hepatitis B and C. Patients will be selected from hospitals and healthcare centers in Karachi, Pakistan. Every single participant will be thoroughly told about the goals of the study, and their written consent will be obtained. Blood will be collected to test for hepatitis B (HBs Ag, HBV DNA) and C (HCV Antibody, HCV RNA). Liver function tests such as ALT, AST, and bilirubin are likely to be used to assess hepatic involvement. Additionally, abdominal ultrasounds will be used to detect any signs of liver fibrosis or cirrhosis. In addition to the questionnaire, the participant will continue to receive a structured interview about their medical history, including such aspects as the history of alcohol consumption, smoking, and previous antiviral therapy. Statistical techniques will be used to relate the physiological and pathological data to demographic and clinical parameters. The ethical considerations will involve seeking permission from the institutional review board.

RESULTS

The study involved 200 participants of which 120 participants were patients with chronic hepatitis B and 80 were patients with chronic hepatitis C. There were 130 male patients and 70 females, with an average age of 42.5 years. The majority of the participants were low-income and had limited access to health-care services.

Demographic Characteristics

Table 1 provides the demographic characteristics of the study's participants, including their age,

gender, and socioeconomic position. The greatest number of participants were between the ages of 30 and 50, with a greater hepatitis C infection rate among those who aged 40 to 50.

Table 1: Demographic Characteristics of Study Participants

Characteristic	Hepatitis B (n=120)	Hepatitis C (n=80)	Total (n=200)
Age (mean ± SD)	42.3 ± 11.2	43.8 ± 12.5	42.5 ± 11.8
Gender			
Male	75	55	130
Female	45	25	70
Socioeconomic Status			
Low	100	65	165
Middle	20	15	35

Clinical Findings

In terms of liver functions, a large proportion of individuals with Hepatitis B and C exhibited elevated levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Table 2 shows the average liver enzymes in people with hepatitis B and C. The data also demonstrate that hepatitis C patients had greater levels of ALT and AST than hepatitis B patients, indicating that hepatitis C causes greater levels of liver damage compare to hepatitis B.

Table 2: Mean Liver Enzyme Levels (ALT, AST) in Hepatitis B and Hepatitis C Patients

Enzyme Level (IU/L)	Hepatitis B (n=120)	Hepatitis C (n=80)	Total (n=200)
ALT (Mean ± SD)	80.5 ± 26.3	120.3 ± 41.2	97.4 ± 34.3
AST (Mean ± SD)	75.1 ± 22.4	108.7 ± 35.6	89.6 ± 30.3

Ultrasound Findings

Ultrasound imaging findings showed that many of the patients had features of liver fibrosis and cirrhosis. Table 3 shows the ultrasound profile of all the patients who tested positive for hepatitis B and C. A total of 40% of the hepatitis C patients had cirrhosis, whereas only 20% of the hepatitis B patients had cirrhosis. This discovery is consistent with the presumption that hepatitis C is more lethal than hepatitis B in developing liver cirrhosis.

Table 3: Ultrasound Findings in Hepatitis B and C Patients

Ultrasound Finding	Hepatitis B (n=120)	Hepatitis C (n=80)	Total (n=200)
Normal Liver	50	30	80
Mild Fibrosis	30	20	50
Moderate Fibrosis	20	10	30
Cirrhosis	20	32	52

Altogether, these findings suggest that hepatitis B and C have a detrimental impact on liver function and are associated with a high prevalence of liver fibrosis and cirrhosis. It is found that compared with hepatitis B, hepatitis C seems to cause more significant liver enzyme abnormalities and a higher detection rate of cirrhosis by ultrasound. The results call for early evaluation and intervention for the purpose of halting progression to more severe liver disorders in both patients with hepatitis B and C.

Discussion:

Hepatitis B and C are chronic viral diseases that continue to pose significant health risks worldwide. These infections are quite widespread in Pakistan and play a key influence in the development of liver

diseases such as cirrhosis and hepatocellular carcinoma (HCC). As a result, the current study's findings shed light on the clinicopathological character of Hepatitis B and C in the Pakistani population, changes in physiology, and the necessity of public health programs.

Based on the demographic data gathered in this study, male subjects were 65 percent, which is a higher prevalence of hepatitis B and C as compared to the female subjects, which is comparable with previous studies conducted in Pakistan and other areas (7, 15). This is due to culture and work-related practices like IV drug use, which are long held to be male dominated. In addition, the majority of participants were from low-income families, and the global statistics convey the fact that hepatitis B and C predominantly target the less privileged section of society who have restricted access to healthcare and education (9). Hepatitis is more prevalent among the poor since they lack proper hygiene practices, healthcare facilities may use unsterilized equipment, and sometimes the individuals have little knowledge of this Viral hepatitis.

This paper also established that the HCV patient retains a higher liver enzyme level than the HBV patient (ALT & AST). According to findings, HCV can cause liver deterioration at a quicker pace than alcohol, which has been evidenced through ultrasound reports. Previous studies have also indicated that HCV is faster in progression to liver fibrosis and cirrhosis than HBV (4, 5). This could be linked to the hepatitis C virus's capacity to evade immune monitoring, as it has a stronger inclination to remain in the body than hepatitis B, resulting in chronic hepatic inflammation. On the other hand, Hepatitis B can be managed better with antiviral treatments, and in most cases, it is prevented through immunization (1, 2). Nonetheless, long-standing infections with HBV can also lead to cirrhosis and HCC, though at a much slower pace.

The liver function tests within this study show increased ALT and AST, which is a classic sign of hepatocellular injury. These increased enzymes are suggestive of ongoing hepatocellular injury and, if left untreated, will progress to fibrosis and cirrhosis. It's also crucial to mention that both hepatitis B and C cause chronic liver inflammation and, over time, activated hepatic stellate cells and the deposition of extracellular matrix proteins and fibrous tissues, resulting in liver fibrosis (5). For instance, the immune system has a direct role in formulating this fibrotic process in Hepatitis C due to the constant stimulation of pro-inflammatory cytokines that cause extended liver injury (4, 5). It can be inferred that viral load and immune response in the HCV patients who had higher ALT and AST is more aggressive and may cause faster progress of liver damage.

Ultrasound findings from this study also support these findings, indicating that cirrhosis was more prevalent among Hepatitis C patients than Hepatitis B. This finding is in line with prior studies that indicated that HCV is more likely to cause progressive liver disease, including cirrhosis and HCC (8). Cirrhosis is an indication that the liver has been affected by fibrosis to a large extent and, therefore, it is unable to perform its tasks optimally. Hepatitis C infection, especially, increases the risk of liver cancer, and based on the research, the groups with chronic HCV infection have a significantly higher lifetime risk of developing HCC than groups with chronic HBV infection (13, 14). There is also evidence that the study participants with cirrhosis, especially with hepatitis C, could have complications of esophageal varices, hepatic encephalopathy, or liver failure.

The current study also emphasizes the importance of screening and therapy on prognosis in eliminating an intensification of liver disease in the two types of hepatitis patients. A liver function test revealed that the participant had moderately raised ALT and AST levels, while an ultrasound diagnosed cirrhosis, hence the need for annual check-ups, particularly for high-risk persons. The timely diagnosis of these infections, together with the use of antiviral drugs, can go a long way in preventing progression to cirrhosis and HCC. Direct Acting Antivirals (DAAs) for hepatitis C is another major advance in the treatment of the disease, providing high cure efficacy with few side effects (5). However, these treatments are still out of the reach of many people in Pakistan, especially those in rural areas, due to weak healthcare facilities. This actually emphasizes the need to expand Healthcare Unreached and make antiviral medications more affordable.

Furthermore, the conclusion made in the current study is in conjunction with earlier research contending that there is an emergence of a call for better public health approaches toward hepatitis in Pakistan. It is crucial to prevent hepatitis B and C through vaccinations for hepatitis B and organizing

fighting for hepatitis C using educational campaigns. Infection with hepatitis B could be averted with influenza vaccines, and vaccination efforts against Hepatitis B have been shown to reduce the incidence of Hepatitis B virus-related disorders in various regions of the world (3). Yet there is still no vaccine offered for hepatitis C in the general population, thus initiatives such as harm reduction, safe blood transfusion, and improved hygiene systems are still required to reduce epidemiologic transmission.

In addition, it is essential to add the issues of stigma and awareness of hepatitis B and C in public health interventions. There are still plenty of people in Pakistan who are unaware of their infection, as these diseases are asymptomatic in the early stages and can only be detected when considerable damage to the liver has taken place. Lack of awareness or misconception about the modes of transmission of Hepatitis B and C and social ostracisation hinders the patient from getting himself checked early (9). To raise awareness and encourage early diagnosis and treatment, public health campaigns should be launched in selected areas of the population, as well as among doctors and health care providers.

Furthermore, the research highlighted in this paper illustrates the extent of the physiological and pathological burden of both hepatitis B and C in Pakistan, indicating that hepatitis C is the more serious form of the disease, with higher signs of elevated liver enzymes, Doppler and ultrasound results pointing to liver disease in patients infected with hepatitis C than hepatitis B. In order to avoid liver failure and HCC, these disorders must be closely monitored and antiviral drugs administered as soon as possible. Vaccination, screening, and healthcare promotion efforts are critical for lowering the prevalence of hepatitis B and C virus infection especially improving the health outcomes of those who have it.

CONCLUSION

Hepatitis B and C are still a concern for the population of Pakistan, and both have a fatal consequence, which includes liver fibrosis, cirrhosis, and, most significantly, HCC. The present study also reveals that hepatitis C is more critical in nature than hepatitis B as it has higher liver enzymes and cirrhosis rate. Diagnosis of the infection at an early stage, follow-up, and appropriate application of antiviral medications should be employed in order to avert the complications and improved the overall health of the patients. However, effective treatment remains a major issue, especially in the rural and remote parts of the country. As evidenced by the data, prevention and health promotion programs that include education, HBV vaccination, HC prevention through harm reduction, and provision of better health care services are vital to reduce the prevalence of viral hepatitis. Through the adoption of these strategies, the disease burden of hepatitis B and C in Pakistan can be lessened, helping to improve liver health and attend to complications related to this condition.

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