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Assessment of the Prevalence of Hepatitis B Viruses among Chronic Renal Failure Patients Receiving Hemodialysis

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Abstract

It considers chronic kidney failure one of the risk factors that requires continuous follow-up, and considers chronic kidney disease one of the most common causes Viral disease, specific to hepatitis B virus (HBV). The aim of this study is to determine the mode of transmission of HBV virus in chronic kidney failure patients, and to study some of the factors associated with it. This study was conducted on a patient with kidney failure disease, tests were performed using the ELISA test and detected that Age 30 – 39 is the most common cause of hepatitis B. Age 60 – 69 and 70 – 79 is the most common cause of hepatitis B. The number of infected persons increased from 32 (32%) and non-infected persons from 68 (68%). The results of the existence of a proportion of HBV-infected patients underscore the importance of adherence to preventive and anti-inflammatory measures within the laundry units. The study recommends the necessary of periodic screening for chloroplast disease, and encourages the health prevention program to prevent the spread of these viruses.

Keywords: kidney failure, disease, infected, hepatitis, preventive.

الملخص:

يُعد الفشل الكلوي المزمن من الأمراض الخطيرة التي تتطلب المتابعة المستمرة، ويُعتبر مرضى الغسيل الكلوي من الفئات الأكثر عرضة للإصابة بالعدوى الفيروسية، خاصة فيروس التهاب الكبد B (HBV). تهدف هذه الدراسة إلى تحديد مدى انتشار فيروس HBV ين مرضى الفشل الكلوي الخاضعين للغسيل الكلوي، ودراسة بعض العوامل المرتبطة بالإصابة. أُجريت هذه الدراسة على عينة من مرضى الغسيل الكلوي، حيث تم اجراء الفحوصات المصلية باستخدام اختبار الELISA وقد اضحت ان الفئات العمرية 30 – 39 هى الاكثر اصابة بنسة 5% بينما الفئات العمرية 60 – 69 و 70 – 79 لم تسجل بها إى إصابة بفيروس التهاب الكبد B. وقد بلغ عدد المصابين 32 بنسبة 32% وغير المصابين 68 بنسبة 68% بنسة

اعلى لدى الاناث 21 (21%) و الزكور بنسبة 11 (11%) إضافةً إلى ذلك أظهرت النتائج وجود نسبة من المرضى المصابين بفيروس HBV مما يشير إلى أهمية الالتزام بإجراءات الوقاية ومكافحة العدوى داخل وحدات الغسيل الكلوي. توصي الدراسة بضرورة الفحص الدوري لمرضى الغسيل الكلوي، وتعزيز برامج التوعية الصحية للحد من انتشار الإصابة بهذه الفيروسات.

الكلمات المفتاحية: الفشل الكلوي، فيروس، اصابة، الفئات العمرية

1. **Introduction**

The renal system consists of the kidney, ureters, and the urethra. The overall function of the system filters approximately 200 liters of fluid a day from renal blood flow whichh allows for toxins, metabolic waste products, and excess Ion to be excreted while keeping essential substances in the blood. The kIdney regulates plasma osmolarity by modulating the amount of water, solutes, and electrolytes in the blood. It ensures long term acid-base balance and also produces erythropoietin whichh stimulates the production of red blood cell. It also produces renin for blood pressure regulation and carries out the conversion of vitamin D to its active form. The renal development, the process of urine production and excretion, and the clinical significance of the renal system will be the focus of this article

Hepatitis B and C viruses are serious health concerns, especially among patients with chronic renal failure undergoing hemodialysis, due to their increased risk of infection. However, the prevalence and .associated risk factors among this group are not clearly defined

3. Materials and Methods

We collected 100 samples from patients under dialysis, aged from 20 up to 72 years

This study was conducted as a descriptive analysis on patients with chronic renal failure undergoing hemodialysis. A total of 100 patients were included, and their data and blood samples were collected over the period from 2020 to 2025.

The participants’ ages ranged from 20 to 72 years, with the study population consisting of 58 males (58%) and 42 females (42%).

Approximately 5 mL of venous blood was drawn from each participant under strict aseptic conditions. The collected blood samples were allowed to clot at room temperature and then centrifuged to separate the serum. The obtained serum was used for the detection of Hepatitis B virus (HBV) and Hepatitis C virus (HCV) markers.

Screening was initially performed using rapid diagnostic tests, and all reactive samples were subsequently confirmed using the EnzymeLinked Immunosorbent Assay (ELISA) technique to ensure diagnostic accuracy.

3.1Enzyme immunoassays (EIAs)

Use the catalytic properties of enzymes to detect and quantify immunologic reactions. Enzyme-linked immunosorbent assay (ELISA) Is a heterogeneous EIA technique commonly used in clinical analyses In ELISA, one of the reaction components is either nonspecifically adsorbed or covalently bound to the surface of a solid phase, such as a microtiter well, magnetic particle, or plastic bead. This attachment facilitates efficient separation of bound and free-labeled reactants.

In the most common ELISA approach, an aliquot of the sample or calibrator containing the antigen (Ag) to be quantified Is added to a solid-phase antibody (Ab) and allowed to bind. After washing, an enzyme-labeled antibody is Introduced, forming a “sandwich complex” of solid-phase Ab–Ag–Ab–enzyme. Unbound antibody is removed by washing, and the enzyme substrate is added. The amount of product generated is proportional to the antigen concentration In the sample Unlike traditional ELISA, the competitive ELISA method Is used to measure low-molecular-weight antigens or haptens. In this format, the antigen in the sample competes with a labeled antigen for binding to a limited amount of solid-phase antibody. The signal produced is inversely proportional to the concentration of antigen In the sample

Specific antibodies in a sample can also be quantified using an ELISA procedure in which the antigen, rather than the antibody, is bound to a solid phase. An enzyme-labeled secondary antibody specific for the analyte antibody Is then added.[4] This format, known as an indirect ELISA, Is commonly used to detect antiviral antibodies. ELISA assays have been widely applied to detect antibodies to viruses and autoantigens in serum or whole blood.

Recent advancements have led to the development of ultrasensitive ELISA techniques capable of detecting biomarkers at femtomolar concentrations via enzymatic amplification. In addition, enzyme conjugates coupled to substrates that generate visible reaction products have been used to develop ELISA-type assays that can be visually interpreted. These assays are very useful for screening, pointof-care testing, and home testing

3.2 An ELISA immunoassay consists of 4 main steps:

- Coat the plate with an antigen or an antibody
- Block nonspecific binding sites with bovine serum albumin (BSA)
- Detect bound antigen or antibody using an enzyme-linked system
- Measure the signal after substrate addition

3.3 Direct ELISA

Both direct and indirect ELISAs begin by coating antigens onto the ELISA plates. The Initial binding step Involves adding antigens to the plates, whichh are incubated for 1 hour at 37 °C or overnight at 4 °C. Once the Incubation step is complete, the plates are washed to remove any unbound antibodies, and the remaining binding sites on the ELISA plate are blocked using agents such as bovine serum albumin, ovalbumin, aprotinin, or other animal proteinsThis second step is crucial becausee it prevents the binding of any nonspecific antibodies to the plate and minimizes false-positive results. After adding the buffer, the plates are washed again, and a selected enzyme-conjugated primary detection antibody Is added. The plates are then Incubated for an additional 1 hour.

In a direct ELISA, the primary detection antibody binds directly to the protein of interest.The plate Is then washed to remove any unbound antibodies. An enzyme, such as alkaline phosphatase or HRP, is added to the plate, whichh results in a color change. ThIs color change in the sample occurs either through the hydrolysis of phosphate groups on the substrate by alkaline phosphatase or through the oxidation of substrates by HRP.

The advantages of using direct ELISA include the elimination of secondary antibody cross-reactivity and a faster assay workflow due to fewer steps compared with Indirect ELISA. However, disadvantages include lower sensitivity than other ELISA formats and higher reagent costs.Recent developments have reported novel enzyme conjugates, such as engineered glucose oxidase variants, that enhance signal stability and enable multiplexed direct ELISA workflows, thereby improving throughput.ELISA

3.4 Diagnostic Tests

ELISAs are widely used in diagnostic testing.ELISA can be performed on a broad range of biological fluids, including blood, saliva, urine, milk, cerebrospinal fluid, amniotic fluid, gastric juice, semen, pleural fluid, peritoneal fluid, synovial fluid, bronchoalveolar lavage fluid, as well as cyst fluids (such as ovarian or hydatid cysts) and fluids from various fistulas. These applications are used in both research and diagnostic settings. Some uses of ELISA are listed below

3.5 Detection and Measurement of Antibodies in Blood

Autoantibodies (eg, anti–double-stranded DNA, anti-desmoglein 1, and antinuclear antibodies) Antibodies against infectious diseases (antibacterial, antiviral, and Rapid Test antifungal), including hepatitis A, B, and C, and HIV

4, Retsult:

The rapid test method was used to estimate the result of viral infection, and then we used ELISA method to diagnose the position

Table 1Age groups among affected individuals

Age group	Number	Percentage
20...........29	11	%11
30...........39	22	%22
40............49	25	%25
50............59	21	%21
60............69	19	%19
70............79	2	%2

This table describes the distribution of affected individuals according to age groups. The highest percentage was observed in the 40–49 age groups (25%), whereas the lowest percentage was found in the 70–79 age groups (2%)

Table 2 Infection rate among affected and unaffected Individuals

Infection	Number	Percentage%
Infected individua	32	%32
Uninfected individuals	68	%68

This table shows the Infection rate among affected and unaffected individuals. Infected individuals represented 32% of the total sample, while uninfected individuals were shows 68% out of the total sample.

Table 3 Distribution of Cases According to Gender

Sex	Number	%Percentage
Male	58	%58
Female	42	%42

This table shows the distribution of cases according to gender. Males Represented a higher percentage (58%) compared to females (42%) among the studied population.

Table 4 Number of infected patients (male and female)

Sex	Number	Percentage
Infected males	21	%21
Infected females	11	%11

This table 4 presents the number of infected patients by gender. The percentage of infected males (21%) was higher than that of infected females (11%)

Table 5 Distribution of Cases According to Age) patients infected with HBV)

Age groups individuals infected	Number	Percentage %
20.........29	3	%3
30.........39	5	%5
40.........49	4	%4
50.........59	3	%3
60.........69	0	%0
70.........79	0	%0

This table shows the distribution of HBV-infected patients according to age groups. The highest percentage of Infection was observed In the 30–39 age group (5%), followed by the

40–49 age group (4%). Lower percentages were recorded In the 20–29 and 50–59 age groups (3% each). No HBV-infected cases were detected among individuals aged 60 years and above

5.1Discussion

The findings of this study indicated that the overall prevalence of Hepatitis B Virus (HBV) among hemodialysis patients was 32%, which is a significant rate reflecting the persistent risk of viral transmission within dialysis units despite advances in infection control measures. These results are consistent with several recent studies (2020–2024) that have highlighted hemodialysis patients as one of the highest risk groups for blood-borne viral infections, due to repeated vascular access, frequent blood transfusions, and prolonged treatment exposure.

Regarding gender distribution, the results showed that males represented a higher proportion of cases (58%) compared to females (42%), with infection rates of 21% and 11%, respectively. This finding aligns with studies conducted in several developing countries between 2021 and 2023, which reported higher infection rates among males, potentially due to behavioral differences, increased exposure to risk factors, and longer dialysis duration.

In contrast, the availability of an effective HBV vaccine has contributed to relatively lower prevalence, although infections still occur, particularly in patients with 40 incomplete vaccination or impaired immune responses due to renal failure.

Age-stratified analysis revealed the highest prevalence in the 40–49-year age group (25%), followed by 30–39 years (22%). This is consistent with other studies indicating that middle-aged patients are more susceptible, likely due to the cumulative effect of risk factors over time and prolonged hemodialysis exposure. Specifically, HBV infection was highest in the 30–39-year group (5%). This variation may be explained by differences in exposure duration, number of dialysis sessions, blood transfusion history, and the effectiveness of infection control measures within dialysis centers.

Overall, these findings confirm that hemodialysis patients remain a high-risk population for HBV infections despite routine screening policies. Previous studies emphasize the importance of:

Strict adherence to infection control measures within dialysis units

Regular monitoring using ELISA and rapid diagnostic tests Completion of HBV vaccination programs

Minimizing unnecessary blood transfusions Isolating infected patients in designated areas

In conclusion, the current results support the findings of recent studies (2020–2025), indicating that complete control of viral infections in dialysis centers remains a public health challenge, necessitating the enhancement of prevention programs and continuous surveillance to reduce the spread of these viruses

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