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The Impact of Hepatitis B Virus Infection on Renal Dysfunction: Mechanisms and Clinical Implications

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Abstract: Currently, the researchers explain, there are few data on the safety and efficacy of TDF and ETV in adult patients with chronic hepatitis B who have moderate or severe renal impairment and in those who show a decline in creatinine clearance (eGFR <50 ml/min). Dose adjustment of both drugs is recommended when the potential risks of treatment are considered to outweigh the potential benefits.
Chronic hepatitis B (HBV) and hepatitis C (HCV) infections are among the leading causes of liver disease in hemodialysis units. In Europe, the United States, and Japan, the global prevalence of HCV infection is 1–3% in the general population (1) and 13.5% on average among hemodialysis patients (2). In developing countries, the positivity rate is higher, exceeding 50% in many geographic areas (3–5). The prevalence of HCV infection among hemodialysis patients has been reported to be 22.5% (6). However, this prevalence in hemodialysis units appears to be gradually decreasing; For example, the Baghdad Dialysis Registry shows that the prevalence of HCV infection has increased significantly
The transmission of viral infections within contact centres has demonstrated epidemiological variation over a historical period. For the majority of the past 80 years, the infection was primarily spread through injection (blood transfusion or disinfection). the primary mode of transmission shifted to non-visible injection (penetration of viruses from biological materials causing microscopic lesions that are difficult to distinguish from the skin or mucous membrane). In the second period of the 1990s, there was a notable increase in the commitment to preventive screening and the administration of all hepatitis B virus vaccinations to patients and individuals.

Keywords: hepatitis B, virus, patients, eGFR, epidemiological, blood

Introduction

The liver plays a pivotal role in the process of nitrogenous waste conversion from food into a less toxic product, namely urea. This is then eliminated by the kidneys as a waste product in urine. Liver injury can result in the development of kidney disease through a number of potential pathways. The accumulation of toxins when the liver is no longer functioning optimally will have a deleterious impact on kidney function[1-3].
Furthermore, the inflammatory response associated with viral infection can result in renal damage in individuals with underlying susceptibility.
In certain instances of hepatitis B and C infection, the viruses are capable of directly invading the

kidneys, thereby causing kidney disease. The cumulative effect of toxins, inflammation, and direct viral assault over time can result in the development of chronic kidney disease (CKD) and, in severe cases, kidney failure.

It has been demonstrated that up to 10-20% of individuals diagnosed with chronic hepatitis B and C may develop kidney disease during the course of their illness. Some of these individuals progress to end-stage kidney disease (ESRD), necessitating dialysis or a kidney transplant. These statistics underscore the urgent need for timely screening and proactive management of kidney health in hepatitis patients. Furthermore, hepatitis is an increased health risk in patients on haemodialysis (kidney failure treatment), if the medical facility providing dialysis does not adhere to infection control guidelines. [4-7]

The hepatitis B virus (HBV) is estimated to be present in about 500 million chronic carriers worldwide, and it is thought that there are 30,000 to 50,000 cases of infection each year. Approximately 10-15% of those infected will develop chronic liver disease. The risk of acquiring HBV through blood transfusion is 1 in 63,000.

The risk of HBV infection in patients with chronic kidney disease (CKD) depends on the type and duration of dialysis, infection control practices during dialysis, blood transfusions and the HBV vaccination program.

With the implementation of a good vaccination programme and improved infection control, the prevalence of HBV in dialysis patients has decreased to 0.1-1.4% (compared to 3-7.8% in 1976), with a marked increase in hemodialysis patients (1.6%) compared to chronic ambulatory peritoneal dialysis (CAPD) (0.9%).[8]

Renal manifestations of HBV infection can occur pathologically in three ways: a) membranous glomerulonephritis, b) membranoproliferative glomerulonephritis, c) polyarthritis nodosa.

Membranous glomerulonephritis: HBV can cause nephrotic syndrome secondary to membranous nephropathy. It has been suggested that deposition of HbeAg and anti-Hbe are responsible for the formation of subepithelial immune deposits. Membranous nephropathy is more common in children and resolves spontaneously in most cases, usually with conversion to anti-HBE positive; however, conversion in adults is uncommon and tends to progress over time.

Membranoproliferative glomerulonephritis: Deposition of antibody-antigen immune complexes in the mesangial and sub endothelial space is characteristic of HBV-associated membranoproliferative glomerulonephritis. Both HBsAg and HbeAg deposition have been implicated in this problem, although the exact mechanism is uncertain. Polyarthritis nodosa: Hepatitis B virus can induce deposition of circulating immune complexes in large vessels (polyarteritis nodosa), and the problem usually occurs 4 months after infection[9].

Kidney Disease Symptoms to Look For

It is of the utmost importance to be able to identify the symptoms of kidney disease at an early stage to prevent the onset of irreversible damage and the subsequent progression to kidney failure. It is of the utmost importance for patients suffering from hepatitis to be aware of the following warning signs of kidney disease:

Modifications in urination: Unexplained alterations in urination patterns, such as an increased frequency, the presence of foam or blood, or the presence of blood, may indicate renal dysfunction.

Swelling: Edema, or swelling, particularly in the legs, ankles, and periorbital region, may be indicative of impaired renal function as the kidneys attempt to excrete excess fluid and waste products. [10]

Fatigue and weakness are also indicative of kidney disease. A decline in kidney function can result in anaemia, which may manifest as fatigue, weakness, and difficulty concentrating.

Hypertension: Persistently elevated blood pressure may both precipitate and perpetuate renal dysfunction in patients with hepatitis.

Electrolyte imbalances Imbalances in potassium, calcium, and phosphate levels may result from kidney dysfunction, potentially leading to muscle cramps, bone pain, and irregular heartbeats.

Hepatitis B virus (HBV) screening is essential for patients with chronic kidney disease, as it allows vaccination of non-immune individuals before infection occurs and the subsequent risk of chronic

disease, cirrhosis, and hepatocellular carcinoma is reduced.
The risk of developing chronic HBV infection after acute exposure ranges from 90% in newborns of mothers infected with the virus to 25–30% in children under 5 years of age and less than 5% in adults [11]Immunocompromised individuals are at higher risk of developing chronic infection, as are patients with chronic kidney disease
The presence of HBsAg determines the diagnosis of hepatitis B. Chronic infection differs from acute infection in that HBsAg positivity lasts at least six months

Vaccination and immunoprophylaxis against hepatitis B virus

Patients with chronic kidney disease, particularly those undergoing dialysis, are at elevated risk of hepatitis B virus (HBV) infection and transmission. In the context of kidney transplantation, HBV infection has been linked to a range of short- and long-term complications, including fulminant hepatitis, cirrhosis, and hepatocellular carcinoma. All guidelines recommend the implementation of a universal vaccination programme for patients with chronic kidney disease against HBV. The KDIGO guidelines recommend that patients be vaccinated as soon as their immunodeficiency is identified and before the commencement of dialysis and the receipt of a kidney transplant. This is because individuals with chronic kidney disease exhibit a diminished immune response to hepatitis B vaccination when compared to the general population. It has been demonstrated that with advancing age and deteriorating renal function, the probability of antibody generation is diminished [11]. Several factors have been identified as influencing the response to HBV vaccination. These include anaemia, malnutrition, obesity, male sex, renal function, secondary hyperparathyroidism, decreased immunoglobulin production, decreased interleukin-2 by T lymphocytes, dysfunction of macrophages, and elevated levels of indoleamine-2,3-dioxygenase. Two vaccination options are available. The most commonly utilised and recommended regimen is the administration of a double dose (40 μg) of the conventional vaccine (Engerix®, HBVAXPRO®) at 0, 1, 2, and 6 months. The administration of a double dose of the conventional vaccine (40 μg) has been demonstrated to enhance the proportion of patients attaining protective antibody titers, the level of anti-HBs antibodies achieved, and/or the duration of immunization [12] The rate of immunization in patients with hepatitis B who are undergoing dialysis is between 40 and 70 per cent, in comparison to 97 percent in the general population. However, there is a gradual loss of immunization over time. A variety of adjuvants have been investigated to enhance immunisation rates in specific populations. These include granulocyte-macrophage colony-stimulating factor, interleukin-2, interferon and thymopentin. The result of this research has been the development of a vaccine combination.

Conclusion

Protecting liver and kidney health is essential to the patient's overall well-being. Hepatitis patients should remain vigilant about their kidney function, recognize the early signs of kidney disease, and take proactive steps to protect their kidneys with the help of experts. With timely intervention and appropriate management, we can mitigate the risk of kidney complications, ensuring a better, healthier future for hepatitis patients.

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