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Evaluation of the parathyroid hormone, vitamin D3, and some biochemical variables in patients with Hemodialysis and viral hepatitis C in Balad city

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Abstract

Objective: Hepatitis C virus (HCV) infection is a major global public health concern, particularly in hemodialysis (HD) patients. **Method:-** In a study conducted in Iraq, Saladin Governorate, Balad General Hospital hemodialysis patients, the study was conducted for the period of (1/10/2024 - 1/3/2025), with 70 patients, aged between (45-60) years, who were divided into two groups. The first group (G1) included 40 samples of hemodialysis patients infected with hepatitis C, and the second group (G2) included 30 samples was hemodialysis patients not infected with hepatitis C. Several biochemical parameters were tested, such as parathyroid hormone, vitamin D3, urea, creatine, uric acid, alanine aminotransferase enzyme, aspartate aminotransferase enzyme, calcium, and phosphate in the patient's blood serum. **Result:-** The results of the current study indicated an increase in (PTH, AST, and ALT) in the blood serum of the G1 group compared to the G2 group. With no significant difference in (Vit.D3, Ca, PO4, Urea, Uric acid, Creatinin) between G1 and G2 groups. **Conclusion:** The study found a relationship between the level of parathyroid hormone and kidney dialysis patients, as it can be considered an important variable for predicting the severity of the disease and its relationship with many diseases, including hepatitis C virus, in addition to the increase in liver enzyme indicators. However, there is a need for more studies on the relationship between kidney dialysis patients and some diseases and biochemical indicators.

Keywords / Hemodialysis, viral hepatitis C , parathyroid hormone , vitamin D3

Introduction

Hepatitis C virus (HCV) infection is more prevalent and is associated with higher mortality in patients receiving dialysis and in kidney transplant recipients than in the general population. Kidney transplant recipients who are

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HCV-positive are also at higher risk of allograft and liver failure than are HCV-negative recipients [1] , Viral Hepatitis C infection is global public health problem throughout the world. Different treatment regimens are used which produce different rates of response affected by many factors [2]. Hepatitis C virus (HCV) is responsible for 9% of chronic liver disease cases worldwide [3]. Currently, the World Health Organization estimates 58 million people to be chronically infected with this virus [4]. Chronic hepatitis C (CHC) is often accompanied by persistent liver inflammation and the gradual development of fibrosis [5]. As a result, 10–30% of CHC patients will progress to liver cirrhosis within a 20–30-year period [6]. Hepatitis C viral infection can negatively impact the health of individuals with chronic kidney disease (CKD) and elevate their susceptibility to infecting other patients [7].

Hemodialysis

is a method for extracorporeal removal of waste products such as creatinine and urea, as well as free water from blood when the kidneys are in renal failure. In addition to hemodialysis, there were two another therapies renal transplant and peritoneal dialysis [8]. Since hemodialysis requires access to the circulatory system, patients undergoing hemodialysis may expose their circulatory system to infections, which can lead to complications [99]. The risk factors associated with hepatitis C virus (HCV) infection among hemodialysis patients include history of blood transfusions, the volume of blood transfused, and years on dialysis [10,11]. .Number of years on dialysis is the major risk factor independently associated with higher rates of HCV infection. Hepatitis C has a frightening tendency to result in chronic hepatitis and the sequel of cirrhosis and hepatocellular carcinoma [12,13].The parathyroid hormone is four small glands located behind the thyroid gland in the neck area. The chief cells of the gland contain parathyroid hormone (PTH), which is a peptide composed of 84 amino acids with a molecular weight of 9400 daltons that plays an important role in regulating the proper balance of mineral elements, including calcium, phosphorus, and magnesium in the bones, intestines, and kidneys, which are the basic elements in building and growing bones [14]. The balance of calcium and phosphorus is essential for the functioning of all types of cells in the body. This is why the levels of these two elements in the blood are tightly controlled within a very narrow range, as they play a role in the functioning of striated or skeletal muscle, myocardium, and neuromuscular activity. In other words, they are the two basic elements for the activity, homeostasis, and balance of the human body [15]. Vitamin D deficiency is considered a public health problem due to its worldwide high prevalence and adverse clinical consequences regarding musculoskeletal health [16]. Vitamin D is a hormone naturally produced by mammalian cells in a coordinated manner by the skin, liver, and kidneys. VitD deficiency or insufficiency is prevalent in patients with CKD, and serum levels of VitD are inversely correlated with the degree of kidney inflammation and renal function [17].

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Collection of blood

In a study conducted in Iraq, Saladin Governorate, Balad General Hospital hemodialysis patients, the study were conducted for the period of (1/10/2024 - 1/3/2025), with 70 patients, aged between (45-60) years, who were divided into two groups. The first group (G1) included 30 samples of hemodialysis patients without hepatitis C, and the second group (G2) included 40 samples was hemodialysis patients infected with hepatitis C. Several biochemical parameters were tested, such as parathyroid hormone, vitamin D3, urea, creatine, uric acid, alanine aminotransferase enzyme, aspartate aminotransferase enzyme, calcium, and phosphate in the patient's blood serum.

Methods: The study involved the determination of serum concentrations of (Parathyroid stimulating hormone-, Vit-D3) by using an Enzyme-linked immunosorbent assay ELISA kit provided by Monobind company-USA.The Rapid detection of HIV Ab, HCV Ab, and HBs Ag was performed according to the method supplied with the test kit by the manufacturer (HIGHTOP/China) Also, the renal levels were determined according to the kit prepared by the Tunisian company Bio Maghreb. Urea [18], creatinine [19], and uric acid [20,21] were estimated in this study. Also, the activity of each enzyme (AST, ALT) was measured by adopting the ELISA technique (Sandwich) and by following the ready-made steps indicated in the custom analysis kit, and it differs from one device to another and according to its manufacturer. On the other hand, Serum calcium concentration was measured according to several ready-made analyses by the Spanish company LiNER [22].

Statistical Analysis: The SPSS statistical program was used and the mean ± S.D was determined for the two groups (patients and control), using the F.Test and at the probability level of $P \geq 0.05$.

Results:

According to the findings of this study, the concentration of PTH significantly increased in the group of hemodialysis without HCV (G1) compared to hemodialysis with HCV (G2). While the Vit.D3 , Ca, PO_4, with no significant difference between G1 and G2 (Table 1).

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Table (1):-Mean ± S.D of the (PTH, Vit.D3, Ca, PO4) in G1 and G2 groups

Groups	Mean ± SD		p-value
	Hemodialysis without HCV (G1)	Hemodialysis with HCV (G2)	
Parameters	N (35)	N (30)	
PTH	444.345±148.194	273.016±150.064	0.014*
Vit.D3 (ng/ml)	12.063±4.983	10.547±3.482	0.434
Ca	8.636±0.576	8.612±0.934	0.935
PO4	4.621±1.154	5.101±1.161	0.273

$P \leq 0.05$

Also, the results indicate that the activity of liver enzymes including (AST, and ALT) significantly increased in the group of hemodialysis without HCV (G1) compared to hemodialysis with HCV (G2) , while the kidney function (Urea, Uric acid, Creatinen) with no significant difference between G1 and G2 (Table 2).

Table (2):-Mean ± S.D of the liver enzyme and renal function in G1 and G2 groups

Groups	Mean ± SD		p-value
Parameters	Hemodialysis without HCV (G1)	Hemodialysis with HCV (G2)	
	N (35)	N (30)	
Urea (mg/dl)	136.667±21.503	142.026±34.839	0.658
Creatinine (mg/dl)	9.114±1.640	7.892±2.248	0.123
Uric acid (mg/dl)	6.793±1.193	6.650±1.306	0.783

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ALT (IU/L)	20.875±5.768	12.511±5.454	0.003*
AST(IU/L)	25.900±4.875	15.580±4.595	<0.0001*

$P \leq 0.05$

Discussion

Hepatitis C virus (HCV) is one of the main causes of acute and chronic liver disease worldwide, and therefore we notice a high rate of morbidity and mortality due to this disease. Rapid screening results of serum samples from various sources indicated that 40 samples were positive for HCV out of 70 samples.

Viral hepatitis C infection is an important cause of morbidity and mortality in hemodialysis patients, and its prevalence varies considerably among different areas of the world [(23)]. Individuals with chronic kidney disease (CKD) have been found to be at increased risk of death, particularly those with end-stage renal disease. These deaths are associated with multiple diseases, and the mortality rate suggests identifying additional risk factors that can be modified to improve survival in patients requiring dialysis. HCV infection has been associated with several non-liver comorbidities, such as kidney disease, cardiovascular disease, insulin resistance, diabetes, and lymphoproliferative disease, and these factors are associated with the transmission of HCV among adult hemodialysis patients [(24)]. The research results showed that there was an increase in the levels of parathyroid hormone in dialysis patients who were not infected with viral hepatitis, compared to dialysis patients who were infected with viral hepatitis. A few studies using heterogeneous methods that included patients with different dialysis vintages showed an association between low PTH levels and all-cause mortality [(25,26)] Also, it is well

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known that at present, a high proportion of patients receiving dialysis therapy have relatively low serum PTH levels [27].

The results were not consistent with what was indicated by [28], who found a decrease in hormone levels in patients with kidney disease before dialysis compared to patients with dialysis. In another study, there was a difference in hormone levels, as there was an increase in hormone levels in patients with dialysis and those with viral hepatitis, so the virus may lead to an exacerbation of the condition of patients diagnosed with chronic kidney disease [29]. Chronic kidney disease has been found to often lead to the development of renal hyperparathyroidism , a condition characterized by elevated parathyroid hormone levels due to disturbances in the control of calcium, phosphate, and vitamin D [30]. Therefore, low vitamin D3 levels in individuals with CKD could be attributed to several mechanisms that limit the kidneys' ability to tolerate vitamin D3 levels when parathyroid hormone levels are elevated [31]. Therefore, hepatitis C virus infection can negatively impact the health of individuals with chronic kidney disease and increase their susceptibility to other diseases. However, this investigation did not reveal any significant changes in the levels of many biochemical tests, except parathyroid hormone levels.

Hyperparathyroidism represents one of the most common complications of CKD progression and could be explained by several interrelated mechanisms. Under hypocalcemic conditions, the percentage of intact PTH released into the bloodstream increases, and under hypercalcemic conditions, it decreases [32]. During renal failure, hypocalcemia sets about reductions in renal tubular reabsorption and intestinal calcium absorption, which will directly stimulate PTH mRNA synthesis. Indeed, parathyroid cells can sense even small changes in serum calcium The hormone [33] levels through a membrane receptor (CaSR), resulting in changes in PTH release and synthesis· level, in CKD and dialysis patients is similar to the work of Mondé in renal failure patients [34]. This is indicative of hyperparathyroidism . However, the significant decrease in PTH observed during dialysis could be due not only to the decrease in its secretion induced by the hypercalcemia occurring during dialysis but also to its elimination in the dialysate [35].

The results also showed that there were no significant differences in vitamin D3 levels between the two groups, but their levels fell below the normal limits (20-30) ng/ml, while no significant differences were observed in calcium and phosphate levels in the two groups. Vitamin D and parathyroid hormone are critical factors affecting bone health and mineral metabolism in patients with chronic kidney disease. Research indicates that viral hepatitis and kidney failure can lead to an imbalance in hormone levels, thereby increasing the risk of other diseases [36]. Another study also indicated that vitamin D3 levels were lower than normal in patients with kidney failure and viral hepatitis. Since vitamin D3 levels decreased significantly from normal levels in patients with viral hepatitis, the

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results were consistent with [37-38] so the patient who suffers from severe vitamin D3 deficiency is at risk of infection with the hepatitis C virus and the positive association between low vitamin D3 and the level of infection with hepatitis C virus because vitamin D3 has a role in the formation of immunity and the arrangement of both the innate and adaptive immune systems [39].

Serum calcium concentration has been found to be the primary determinant of parathyroid hormone (PTH) secretion. Deficiencies in vitamin D activation in the kidneys due to chronic kidney disease (CKD) lead to hypocalcemia and hyperphosphatemia, which then lead to a compensatory increase in parathyroid cellularity and PTH production, leading to secondary hyperparathyroidism (SHP). Understanding the pathophysiology of PTH and potential therapeutic agents could reduce the progression of SHP and its associated complications in patients with chronic kidney disease (CKD) [40]. The goal of dialysis is to maintain various substances, such as calcium, at normal levels. Calcium helps build bones and move muscles [41]. If calcium levels become disturbed, it can affect the functioning of the nervous system and muscles, including heart problems [42]. Both chronic kidney disease and hepatitis are truly harmful medical problems worldwide [43].A study observed a significant increase in blood calcium levels after hemodialysis. Since the concentration of calcium in the dialysis fluid is higher than that of ionized calcium in the blood, the procedure allows calcium to be transferred into the patient's blood (protein-bound calcium does not diffuse). Unfortunately, there is little clinical evidence on the basis of which calcium balance should be targeted to best address the potential benefits and risks for kidney disease patients. This makes it difficult . Elevated phosphate levels, [44]to determine the optimal calcium concentration in the dialysis bath for each patient both initially and during subsequent monitoring, have been found to be associated with mortality in patients undergoing primary hemodialysis. A positive association has been demonstrated between increased levels of calcium, calcium phosphate, and parathyroid hormone [45].

On the other hand, the current study found an increase in the activity of liver enzymes in kidney dialysis patients compared to kidney dialysis patients and those infected with viral hepatitis, as the results are consistent with what was indicated by Study [46], which found that patients undergoing kidney dialysis had higher levels of liver enzymes compared to patients not undergoing non-kidney dialysis. While another study indicated that patients with chronic kidney disease had lower levels of liver enzymes compared to the control group, according to the study of Set and Lopez [47] and Ray [48], the effectiveness of liver enzymes in patients with chronic kidney disease was inversely proportional to the progression of the patients (the lower the levels of liver enzymes, the more severe the disease). While study [49] found a significant increase in the activity of liver enzymes in dialysis patients with hepatitis C virus, this does not agree with the results of the current study. The results of the current research also

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indicated a decrease in the activity of liver enzymes in dialysis patients with the hepatitis C virus. Therefore, any abnormality in liver function tests gives a plan for the role of the liver, and enzymes are often elevated in the case of liver dysfunction with alanine aminotransferase being more specific to the liver [(50)].The study results also found an increase in urea levels in kidney dialysis patients and those infected with viral hepatitis, as the results are consistent with the study [(52)], which indicated an increase in urea levels in hepatitis patients. The study [(53)] also found a decrease in creatinine and urea levels after kidney dialysis compared to patients before kidney dialysis. Blood urea and blood creatinine are the major solutes excreted by the kidneys and are the first organic solutes detected in the blood of patients with kidney disease. This increase in creatinine and urea levels is caused by kidney failure, where the kidneys lose their ability to remove nitrogenous wastes from the blood.

Conclusion: The study found a relationship between the level of parathyroid hormone and kidney dialysis patients, as it can be considered an important variable for predicting the severity of the disease and its relationship with many diseases, including hepatitis C virus, in addition to the increase in liver enzyme indicators. However, there is a need for more studies on the relationship between kidney dialysis patients and some diseases and biochemical indicators.

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