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Original Research Article

The Effect of COVID-19 Vaccine on Hematological Parameters and Kidney Function

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Abstract: The 2019 coronavirus disease (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused an extraordinary setback in the global economy and public health. Vaccination is one of the most effective measures to significantly reduce severe illness and death from COVID-19. In recent years, there have been an increasing number of reports of new acute kidney injury (AKI) following COVID-19 vaccination. Podocyte injury, IgA nephropathy, vasculitis, tubulointerstitial injury, and thrombotic microangiopathy are considered to be the major pathological phenotypes. Nevertheless, whether the association between COVID-19 vaccination and acute kidney disease (AKD) is causal or chance remains to be tested. Indeed, it is undeniable that mass vaccination against COVID-19 will bring significant benefits in preventing morbidity and mortality from COVID-19. The study included the effect of the Corona vaccine on kidney functions and blood variables MCV, HGB, among vaccinated adults aged (18-32) years in Anbar province, auditors Ramadi Teaching Hospital and Anah General Hospital.40 blood samples were collected and a test was conducted for blood variables and kidney functions (creatinine and urea), and it was found that the percentage of urea and creatinine has increased among the vaccinated compared to its percentage when the unvaccinated, and that the percentage of MCV, HGB decreased among the vaccinated compared to the unvaccinated, as the study showed that the percentage of urea was among the unvaccinated (21.7) while among the vaccinated (36.41). Creatinine was among the unvaccinated (0.695) while among the vaccinated (1.041). The MCV rate among the unvaccinated (85.86) while among the vaccinated (82.74) and the percentage of HGB among the unvaccinated (13.58) while it was among the vaccinated (12.37).

Keywords: COVID-19, Kidney, Hematological, Vaccine.

INTRODUCTION

Controlling disease outbreaks as the 2019 coronavirus disease (COVID-19) pandemic progresses and new variants of severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) emerge There is an urgent need for the rapid development of an effective and safe preventive vaccine. [1, 2]. Over the past two years, hundreds of novel coronavirus disease (COVID-19) vaccine candidates have emerged, including protein-based vaccines (Novavax), inactivated vaccines (Sinovac Life Science), and viral vector vaccines (Janssen, Oxford-AstraZeneca). It has been developed, tested and finally brought to market.). And mRNA vaccines (Pfizer/BioNtech, Moderna, CureVac) [2, 3].

Among them, mRNA-based agents are new, but not unknown [4]. mRNA vaccines deliver transgenic mRNA via lipid nanoparticles that act as carriers. After injection, the mRNA is translated into target proteins in vivo, resulting in a strong immune response and a two-dose regimen that gives him 95% protection against COVID-19. [5].

So far, large Phase III and IV studies have found these vaccines to have a favorable safety profile with few serious reactions [3- 7]. Common short-term adverse events include injection site reactions, fever, fatigue, generalized pain, and headache [6- 8]. However, since mass vaccination, there have been case reports of acute renal failure (AKI), acute renal failure (AKD), proteinuria, edema, gross hematuria, and other renal adverse events requiring hospitalization after COVID-19 vaccination. [9].

Serum creatinine (SCR) levels and proteinuria resolved within 3 months of treatment in most patients. The majority of cases occurred after mRNA vaccine and adenoviral vector injection, and cases of glomerulonephritis associated with inactivated virus vaccines have also been reported.

As more residents are vaccinated, cases of hematological side effects of vaccinations become more pronounced. One of the most serious side effects include thrombocytopenia and thromboembolism due to vaccination. A case of thromboembolism has been reported in a patient with pre-existing thrombocytopenia after vaccination with the Oxford-AstraZeneca vaccine [10].

Another systematic review of 286 patients who experienced any form of thromboembolism after vaccination revealed that a large percentage of patients also experienced thrombocytopenia, high D-dimers, and antiplatelet antibodies [11].

METHODS

Study Sample:

40 blood samples were collected from the vaccinated patients visiting Ramadi General Hospital in Anbar Governorate, for a period from 6/7/2020 to 1/9/2021, and the blood sample was collected in EDTA Tube for the purpose of conducting (CBC analyzes), in addition to separating part of the blood by centrifugation to obtain serum for the purpose of conducting kidney function analyzes (creatinine and urea).

Complete Blood Count:

CBC test results, measured from the blood sample obtained immediately after diagnosis, were compared between the patients and control group. CBC results of the 3rd day in the study, some parameters and ratios such as hemoglobin (HGB) and mean corpuscular volume (MCV).

Biochemical Analyses:

A Study included measuring determination of the level biochemical variables (Urea and creatinine), in this assay, concentration is determined by a couple enzyme reaction, which results in a colorimetric (570 nm) product, proportional to the Urea present.

Statistical Analyses:

In order to compare the mean values of two population, the SPSS statistical program was employed, and T- test was preformed, a P- value of less than (0.05) and (0.01).

RESULTS

- The results of the statistical analysis, as shown in Table (1) and Figure (1) (2), showed that there is a significant increase in the level of creatine and urea in vaccinated people compared to non-vaccinated people due to the fact that at the beginning of immunization, a series of kidney disease cases spread widely with the appearance of glomerulopathy or reactivation of glomerulopathy in addition to nephrons.

Group	**Mean ± SE**	
	Creatinine	**Urea**
Patients	1.041 ±0.12	36.41 ±2.16
Control	0.695 ±0.04	21.70 ±1.83
T-test	0.318 *	8.955 **
P-value	0.0459	0.0018
*** (P≤0.05), ** (P≤0.01).**		

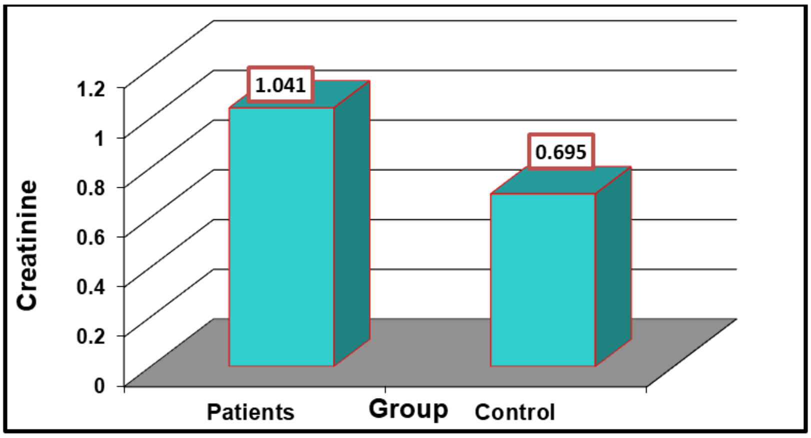

Figure 1: Comparison between patients and control groups in Creatinine

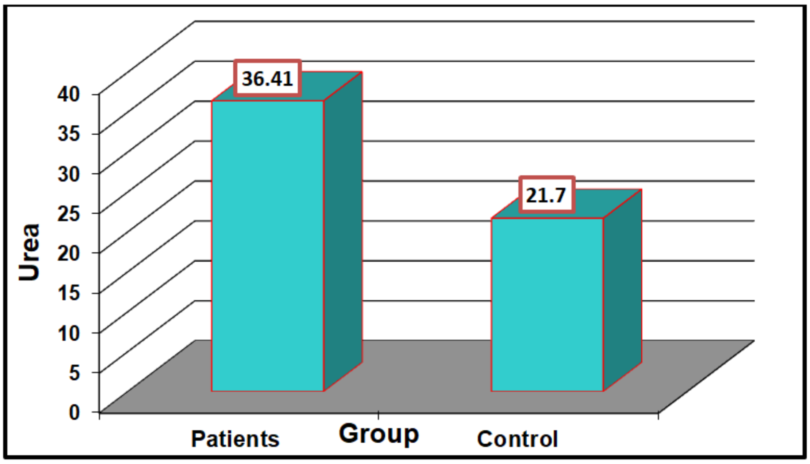

Figure 2: Comparison between patients and control groups in Urea

- The results of the statistical analysis of HGB and MCV showed a non-significant decrease as in Table (2), Figure (3) and (4), as the reason is that there was a lack of platelets and the occurrence of blood clots, which led to a decrease in the level of red cell count.

	Mean ± SE	
Group	**HGB**	**MCV**
Patients	12.37 ±0.37	82.74 ±1.19
Control	13.58 ±0.52	85.86 ±2.36
T-test	1.107 NS	5.362 NS
P-value	0.0439	0.249
*** (P≤0.05), NS: Non-Significant.**		

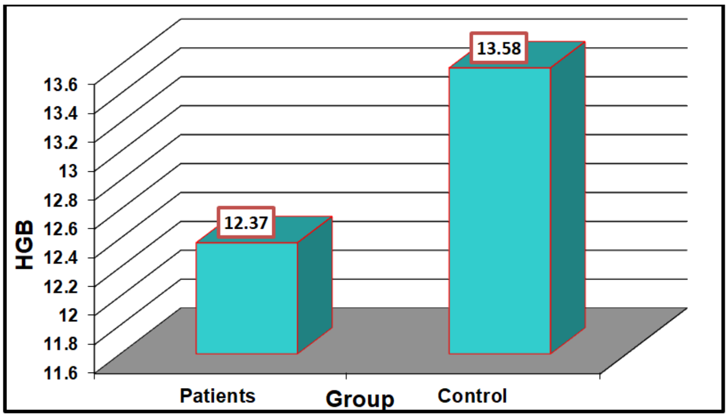

Figure 3: Comparison between patients and control groups in HGB

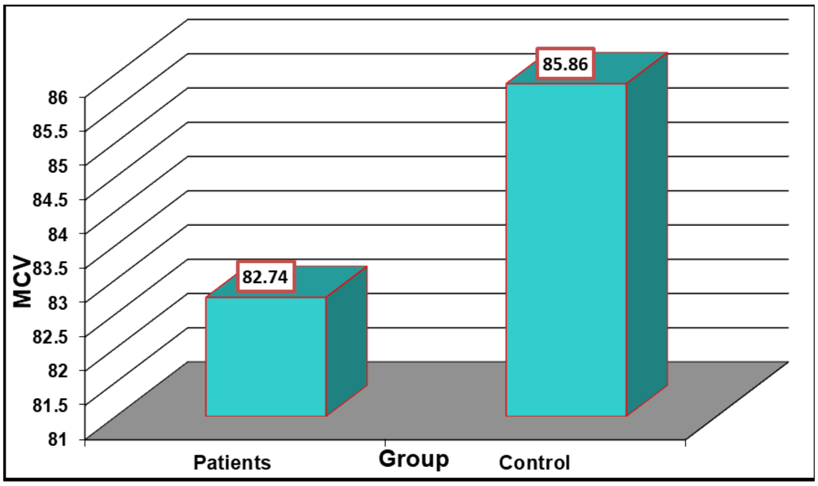

Figure 4: Comparison between patients and control groups in MCV

DISCUSSION

Since the emergence of coronavirus disease 2019 (COVID-19), severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has killed more than 6.5 million people worldwide. However, immediate application of mass vaccination programs results in high mortality, especially in high-risk subgroups such as the elderly, frail and immunocompromised. [12, 13].

In the latter group, solid organ transplant recipients (SOTR) are particularly at risk because underlying causes of organ failure and chronic immunosuppressive burden are associated with reduced immune responses to COVID-19 vaccines. It has been [14]., and with an excessive risk of death due to SARS-CoV-2 infection [15].

The COVID-19 pandemic is regarded as one of the greatest challenges of our time, and its impact has also had an impact on mental health and can negatively impact mental health. A recent study examining the main concerns related to the novel coronavirus disease (COVID-19) in the Italian public found that fear of possible consequences of vaccination was more common among women and young people, and among older people Fear of illness and its consequences was found to be most common, while fear of illness and its consequences (such as isolation) was more common among young people [16].

Since the first report of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was described in December 2019, the upper respiratory tract has been shown to be the primary site of infection. However, there is good evidence that organs other than the respiratory tract, such as the heart, liver, and kidneys, can be severely affected [17]. Acute Kidney Injury (AKI) Caused by Novel Coronavirus is Accompanied by a Severe Clinical Condition of Patients with Consequent Poor Prognosis, Although the mechanism of injury is not completely understood.

SARS-CoV-2 infection is triggered when the viral S protein binds to the angiotensin-converting enzyme 2 (ACE2) receptor on the host cell surface. These receptors are abundant in type II lung cells in the lung, heart, and kidney. Virus entry into cells is mediated by the binding of a protein on the surface of the virus, the so-called 'spike', to ACE2 and activation of transmembrane serine protease type 2 (TMPRSS 2), which initiates intracellular virus endocytosis. It happens when replication [18].

Autopsy studies have shown that the kidney is a specific target organ for the virus, even in patients with no history of kidney disease. This is probably due to the high expression of proteins such as his ACE2, TMPRSS2 and cathepsin L that allow viral infection [19]. Detection of viral fragments in urine by polymerase chain reaction (PCR) occurs in 21–50% of infected patients within 2 or 3 weeks after infection, suggesting a possible renal tropism of the virus [20].

Since the introduction of a vaccine against COVID-19 last year, transmission routes, morbidity and mortality have changed positively, and the number of deaths has decreased significantly. However, with the widespread use of vaccination, there are growing concerns around the world about vaccine side effects, including kidney damage. [21]. Since the beginning of mass vaccination, there has been an increase in the publication of case series of renal disease, with the emergence of new glomerulopathies and the reactivation of previous glomerulopathies. However, the associated mechanisms, risk factors and long-term effects are still poorly understood [22].

Kidney damage was present in 93% of vaccine-associated vasculitis cases. The most common histopathologic findings were crescent glomerulonephritis and fibrinoid necrosis without intracapillary proliferation or immunofluorescence deposits. [23]. A case of myeloperoxidase vasculitis and rhabdomyolysis after COVID-19 mRNA vaccination has also been reported by Pfizer BioNTech, where biopsy revealed myoglobin casts and interstitial inflammation. PICGN was found in addition to severe acute tubular lesions associated with [24].

Most of the post-vaccination glomerulopathy patients received immunosuppressive treatment according to their histopathological diagnosis. In a series of cases, her 27 patients with immunosuppression were treated and followed up. Of these, 8 had complete renal function recovery, 5 had partial recovery, 14 had no improvement, and 5 of them required hemodialysis [25].

On the other hand, there are many adverse Hematological Effects of COVID-19 Vaccination within the General Population. Several case sequences have reported hematological abnormalities, including thrombocytopenic purpura (ITP) after vector-based vaccination the results indicated that the vaccines may trigger an immune response that affects the blood system [26, 27].

CONCLUSIONS

The results showed an increase in kidney function (creatine urea). And showed a decrease in the hematological variables MCV and HP.

RECOMMENDATIONS

Despite the negative effects related to vaccination against the new coronavirus, immunization remains the main tool to control the number of new cases and deaths. Patients with glomerulopathy and proteinuria may be more susceptible to severe infections, mainly due to the loss of immunoglobulins in the urine and it is important to use available prevention measures. More studies of populations with immune kidney disease are needed. Observe signs of relapse after vaccination and that treatment should follow the usual recommendations for the underlying disease.

However, recommendations and available data on the relationship between COVID-19 vaccines and kidney lesions are still scarce. Since this is a new disease whose vaccine was developed and applied only in late 2020.

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