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Study of Hematological Parameters of Children with Chronic Kidney Disease on Hemodialysis and Peritoneal Dialysis in Wasit Governorate

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ABSTRACT: The aim of this study was to evaluate some hematological parameters in pediatric patients with chronic kidney disease (CKD) in children who are on hemodialysis (HD) and peritoneal dialysis (PD). It is characterized by its irreversibility. Deterioration of kidney function that gradually progresses to end-stage renal function illness. Over the past two decades, the incidence of CKD in children has increased Steady increase. The major health consequences of CKD include not only progression to kidney failure, but also increased risk of cardiovascular disease. The study was conducted in the dialysis unit of Al-Zahraa Teaching Hospital in Wasit governorate and the Child Protection Teaching Hospital -Medical City in Baghdad. During the period from November 2023 to April 2024. This study aimed to examination of risk factors (height, weight, age, sex, inheritance of the disease in the family, medical history, symptoms of the disease, other diseases, treatment methods) for CKD in general. The biochemical effect was also studied and blood indicators for patients on HD and PD purpose. For the purpose of studying the hematological of patients undergoing dialysis and comparing those results with their values in both HD and PD. This study was done on (80) Iraqi children (30) of them suffering from kidney failure and (50) of them was healthy with age range (1 day -17) years old. HD was performed for 22 children with CKD, and PD was performed for 8 patients with CKD. This study involved dividing patients into three Groups according to the age at which the disease begins, from (1 day-5 years), (6-11) years and (12-17) years, included 15 females and 15 males. Samples were collected based on the incidence of CKD and type of treatment, as well as the diagnosis of all patients according to international standard by the physician. The results of our study with regard to the hematological of patients undergoing PD showed a significant increase in the levels of (WBC) $p \leq 0.05$ and also showed a significant decrease in the levels of (RBC, Hb, PCV, ESR) $p \leq 0.05$. a non-significant increase in TSH levels $p \geq 0.05$. The results of our study with regard to the hematological parameters of patients on HD showed a significant increase in the levels of (ESR) $p \leq 0.05$ and a significant decrease in the levels of (WBC, RBC, PCV, Hb) $p \leq 0.05$.

Keywords: Chronic Kidney Disease in children, Hematological, Hemodialysis, Peritoneal dialysis

1. INTRODUCTION

Chronic kidney disease in children is a non-communicable disease characterized by a progressive loss of kidney function over time that gradually progresses to end-stage kidney disease (ESRD). Children with CKD including those with end-stage renal disease, develop various secondary complications that significantly and adversely affect their development and quality of life (1).

Inflammation and oxidative stress increase in kidney disease in parallel with disease progression. Children with CKD face significant challenges to maintaining adequate nutrition and growth. Poor nutritional status directly contributes to poor growth. Poor growth in CKD is a marker of disease severity and quality of care. Chronic kidney disease of childhood presents specific clinical features that are quite characteristic of pediatric age such as the impact of the disease on growth (2).

The study aims to study evaluating the blood parameters of children with chronic kidney disease who on hemodialysis and peritoneal dialysis and rephrase the effect of dialysis on the mean values of these parameters in both hemodialysis and peritoneal dialysis.

2. MATERIAL AND METHODS

2.1 Study design

The present study was included a comparison of a group of (80) samples: (30) patient samples, (50) control samples. The study was conducted in the dialysis unit of Al-Zahraa Teaching Hospital in Wasit governorate and the Child Protection Teaching Hospital -Medical City in Baghdad. During the period from November 2023 to April 2024, and their ages ranged from (1 day -17) years old. The study included hemodialysis was performed for 22 children with CKD, and peritoneal dialysis was performed for 8 patients with CKD, and 50 samples of control group. This study involved dividing patients into three Groups according to the age at which the disease begins, from (1 day-5 years), (6-11) years and (12-17) years, included 15 females and 15 males.

Samples were collected based on data recorded for all patients: height, weight, age, sex, other diseases, inheritance of the disease in the family, questions about medical history, symptoms of the disease and treatment methods. hematological and biochemical parameters in the blood were measured (WBC , RBC , Hb , PCV , ESR).

2.2 Blood Sampling

3 ml of venous blood samples were withdrawn and 1 ml was placed in a tube containing Ethylene diamante tetra acetate for checking the complete blood count and 2 ml in a tube containing 3.8% trisodium citrate for checking the Erythrocyte Sedimentation Rate (ESR).

Hematological and Biochemical Parameters:

Complete blood count was measured using the sysmex XP300 and erythrocyte sedimentation rate was measured using the Westergren method.

3. RESULTS AND DISCUSSION

Table (1) Comparison between control group and peritoneal dialysis patients and control group and hemodialysis patients of blood parameters in children

parameters	Mean of control n=50	Mean of patient n=8	Peritoneal dialysis F	Peritoneal dialysis P.value	Mean of control n= 50	Mean of patient n= 22	Hemodialysis F	Hemodialysis P.value
WBC (g\L)	9.33	13.11	22.49	0.000	9.33	6.97	6.90	0.011
RBC	4.63	3.09	42.86	0.000	4.63	3.59	32.21	0.000
HB(g\dL)	12.03	8.39	77.34	0.000	12.03	8.87	121.97	0.000
PCV %	37.76	26.89	48.40	0.000	37.76	30.19	35.65	0.000
ESR (mm\h)	9.59	21.31	50.43	0.000	9.59	50.41	119.25	0.000

According to the hematological, the tests for peritoneal dialysis, the test value showed that (P.value) was less than the level of significance (0.05) in blood parameters, which means that there are significant differences between these values for peritoneal dialysis and control groups. And in hemodialysis, the test value showed that (P.value) was less than the level of significance (0.05) in blood parameters, which means that there are significant differences between these values for hemodialysis and control groups.

Table (2): Comparison between two groups before and after hemodialysis in children with CKD to blood parameters

Parameters	Mean Before n=22	Mean After n=22	T	P.value
WBC (g\L)	9.90	6.96	3.66	0.011
RBC	3.56	3.59	-0.23	0.817
HB(g\dL)	9.39	8.86	5.09	0.000
PCV %	29.45	30.18	-1.89	0.073
ESR (mm\h)	66.09	50.40	5.44	0.000

Tests for before and after hemodialysis the value test showed significant because the probability values associated with each test (P.value) for (WBC , Hb , ESR) are less than the level of significance (0.05), which means that there are significant differences before After hemodialysis, which did not showed significant at the level of (0.05) for (RBC, PCV), the test also showed that the (P.value) was much greater than the (P.value) level (0.05), which means that there is no significant difference between These values are in hemodialysis. Also, some t-test results showed a negative sign, which means that the effect of hemodialysis was through an increase in the percentages or averages of parameter readings compared to what they were after hemodialysis.

Table (3): Comparison between two groups before and after peritoneal dialysis in children with CKD to blood parameters

Parameters	Mean Before n=8	Mean After n=8	T	P.value
WBC (g\L)	18.00	13.11	6.73	0.000
RBC	4.05	3.09	3.31	0.013
HB(g\dL)	9.70	8.83	7.74	0.000
PCV %	31.8	26.88	3.01	0.020
ESR (mm\h)	29.50	21.12	6.78	0.000

Tests for before and after peritoneal dialysis the value test showed significant because the probability values associated with each test (P.value) for (WBC , RBC , Hb , PCV , ESR) are less than the level of significance (0.05), which means that there are significant differences before After peritoneal dialysis.

4. DISCUSSION

Blood parameters:

In children with chronic kidney disease on peritoneal dialysis, there was a significant increase in (ESR and WBC) levels and a significant decrease in (RBC, Hb, PCV) levels compared to the control group. This is due to the fact that the process of chronic renal failure can lead to an increase in the number of white blood cells and high levels of ESR, which leads to peritonitis and increased infection rate at the catheter exit site (3). Kidney damage also leads to less production of erythropoietin, which leads to decreased production of red blood cells, iron deficiency anemia, infection, and malnutrition (4).

A significant increase in ESR levels and a decrease in WBC, RBC, Hb, PCV levels were also observed in children undergoing hemodialysis compared to the control group. This decrease in children can be

worrisome because it may indicate an increased risk of infection, and some viral infections such as hepatitis C can lead to a decrease in most blood parameters (5).

There was an insignificant increase in the levels of (RBC, PCV) and a significant decrease in the levels of (WBC, Hb and ESR) after dialysis compared to before dialysis. This increase was caused by anemia, which is common in dialysis patients. Small amounts of blood are also lost during the dialysis session, which leads to an increase in RBC levels (6). Dialysis can also lead to inflammatory reactions that play a role in the increase in PCV (7). Also, the fluid balance inside the body is affected during the dialysis process, which leads to a change in its volume, which causes a change in the properties of the blood and affects the results of the ESR test.

While there was a significant decrease in the levels of (WBC, RBC, HB, PCV, ESR) after peritoneal dialysis compared to before peritoneal dialysis, the reason for this was that peritoneal dialysis causes a temporary inflammatory response in the body (8). It also causes malnutrition as well as anemia resulting from the loss of red blood cells during the filtration process, which may cause a decrease in the level of HB and the percentage of PCV (9). In general, the decrease in ESR after peritoneal dialysis reflects the positive effect of treatment in reducing inflammation in the child because ESR is an indicator used to determine the presence of inflammation in the body (10).

5. CONCLUSIONS

Hemodialysis is highly effective in removing toxins and reducing blood parameters and returning them to their normal levels in the blood quickly. This process requires only a few hours and may be the best option in cases that require rapid and effective removal of toxins. Peritoneal dialysis may be more effective in managing fluids and reducing blood parameters but slowly, and this process also requires several days.

REFERENCES

[1] Becherucci F, Roperto RM, Materassi M, Romagnani P. Chronic kidney disease in children. Clin Kidney J. 2016 Aug;9(4):583-91. doi: 10.1093/ckj/sfw047. Epub 2016 Jun 5. PMID: 27478602; PMCID: PMC4957724.

[2] Gulati, S., & Langman, C. B. (2020). Chronic kidney disease in children. *Department of Nephrology and Transplant Medicine*.

[3] Virzi, G. M., Mattiotti, M., Milan Manani, S., Gnappi, M., Tantillo, I., Corradi, V., ... & Zanella, M. (2024). Neutrophil Gelatinase-Associated Lipocalin in Peritoneal Dialysis-Related Peritonitis: Correlation with White Blood Cells over Time and a Possible Role as the Outcome Predictor. Blood Purification, 53(4), 316-324.

[4] Mishra, O. P., Gupta, A. K., Pooniya, V., Prasad, R., Tiwary, N. K., & Schaefer, F. (2012). Peritoneal dialysis in children with acute kidney injury: a developing country experience. *Peritoneal dialysis international*, *32*(4), 431-436.

[5] Bouts, A. H., Davin, J. C., Krediet, R. T., Van Der Weel, M. B., Schröder, C. H., Monnens, L., ... & Out, T. A. (2000). Immunoglobulins in chronic renal failure of childhood: effects of dialysis modalities. *Kidney international*, *58*(2), 629-637.

[6] Hakim, Y. A., Abbas, A. A., Khali, A., & Mustafa, H. I. A. (2016). The effect of hemodialysis on hemoglobin concentration, platelets count and white blood cells count in end stage renal failure. *International Journal of Medical Research and Health Sciences*, *5*, 22-35.

[7] Reddan, D. N., Klassen, P. S., Szczech, L. A., Coladonato, J. A., O'Shea, S., Owen Jr, W. F., & Lowrie, E. G. (2003). White blood cells as a novel mortality predictor in haemodialysis patients. *Nephrology dialysis transplantation*, *18*(6), 1167-1173.

[8] Krediet, R. T., & Struijk, D. G. (2013). Peritoneal changes in patients on long-term peritoneal dialysis. *Nature Reviews Nephrology*, *9*(7), 419-429.

[9] Babitt, J. L., & Lin, H. Y. (2012). Mechanisms of anemia in CKD. *Journal of the American Society of Nephrology*, *23*(10), 1631-1634.

[10] Guz, G., Colak, B., Hizel, K., Reis, K. A., Erten, Y., Bali, M., & Sindel, S. (2006). Procalcitonin and conventional markers of inflammation in peritoneal dialysis patients and peritonitis. *Peritoneal dialysis international*, *26*(2), 240-248.