Evaluation of some Hematological Changes among Chronic Renal Failure Patients in Qatan Hospital, Hadhramout Governorate - Yemen

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Abstract

This study was achieved at the industrial kidney center in Qatan hospital during the period from February 2018 to July 2018, the study aimed at evaluating some hematological changes that occur in patients with chronic renal failure (CRF) undergoing hemodialysis and comparing them with healthy people. Blood sample of 55 cases of both sexes were collected: 35 patients with CRF and on regular maintenance dialysis, and a control group of 20 healthy persons for comparison, in the age group ranged between 25-70 years for both groups. Hemoglobin concentration, total red cells count, packed cell volume, total white blood cells count, neutrophils and lymphocytes differential count and platelets count were assessed by using Sysmex hematology analyzer. Data was analyzed through statistical package for social sciences (SPSS) version 24. Results recorded a significant decrease ($p<0.05$) in Hemoglobin concentration, total red cells count, packed cell volume and platelets count in patients with CRF compared to the healthy group. Although the total white blood cells count did not record any significant change, the differential count of lymphocytes decreased significantly ($p<0.05$), and the differential count of neutrophils increased without significant differences in patients with chronic renal failure CRF compared to healthy subjects. In conclusion, the present findings suggested that the chronic renal failure CRF had a negative effect in most of hematological parameters under study. Therefore, hematological parameters that need careful evaluation and management in chronic renal failure CRF patients.

Keywords: Chronic renal failure, Hemodialysis, Hematological changes, Hadhramout.

Introduction:

Nearly 2.6 million patients worldwide have different kidney diseases [17], kidney failure is one of this kidney diseases. When kidney failure becomes chronic, the kidneys slowly stop functioning [29]. Renal failure is defined as a condition in which the kidneys are not able to do their normal functions in filtering blood from impurities and secondary body products [33], which lead to the accumulation of wastes and fluid in the body [11].

Hemodialysis (HD) is one of the replacement therapy for chronic kidney disease; using HD involves the elimination of excessive toxic fluids and toxic metabolic end products from the body [26]. HD procedure is performed two to three times a week over two to four hours. The duration of dialysis varies according to many factors, including kidney function, amount of waste in the body, level of salts, as well as body weight [30].

Kidney failure affects different body organs, and among these effects: The effect on blood variables, as anemia is one of the most important symptoms of kidney failure [10], it leads to a decrease in the number of total red cells count (RBCs), Hemoglobin concentration (HB), and packed cell volume (PCV) [19, 21], as well as reduced the mean cell volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) [22].

As there is limited literature regarding the hematological profile of patients with chronic renal failure (CRF) in Hadhramout- Yemen, this study aimed at assessing hematological parameters in patient of CRF and comparing them with healthy person results.

Material and Methods:

Study design, area, and period

This analytical cross-sectional study was carried out at the industrial kidney center in Qatan hospital , Hadhramout governorate – Yemen , during the period from February 2018 to July 2018.

Study population

Two study groups were involved: Case and control groups. Case group includes 35 patients with CRF undergoing hemodialysis (22 males and 13 females). The control group was selected for comparison which includes 20 healthy subjects (14 males and 6 females), who were similar with cases in age and sex (age group ranged between 25-70 years for both groups).

Samples collection and laboratory analysis

Venous blood samples (2.5 ml) were collected from all participants (patients and healthy persons) in ethylene diamine tetra acetic acid (EDTA) tube for investigation of hematological parameters: RBCs count, HB concentration, PCV, PLT count, WBCs count and differential count of NEUT and LYM using automatic hematology analyzer (Sysmex KX-21, 2000, Japan).

Ethical consideration:
Consent form was taken from all the participants after brief description of the study.

Statistical analysis:
The SPSS, version 24.0 program was used in this study. The study data was expressed using Mean ± Standard Deviation (SD). The t- test for independent variables was considered significant when ($p > 0.05$).

Results:
Table 1 shows that there was a significant decrease ($p < 0.05$) in the mean values of RBCs mass (HB level, RBCs count, PCV) Figure 1, and PLT count Figure 2 in group of CRF patients as compared to the healthy group. Despite the significant decrease in the PLT count in CRF patients, they are still within the normal values. Also, Table 1 indicates that there are no significant differences in the mean values of the total WBCs counts in patients with CRF compared with healthy subjects, and that there are differences in the mean values of the differential of WBCs; the differential count of NEUT increased without significant differences, and the differential count of LYM decreased significantly ($p < 0.05$) in patients with CRF compared to healthy subjects, Figure 3.

Table 1: Hematological parameters (HB concentration, RBCs count, PCV, and PLT count) between the two study groups

Groups	Standard division) ±Mean (Hematological parameters						
	HB g/dl	RBCs 10^6/ µl	PCV %	PLT 10^3/ µl	WBCs 10^3/ µl	NEUT %	LYM %
Healthy group	14.6 ± 0.6	4.8 ± 0.3	39.07 ± 1.6	320 ± 60	6.9 ±0.9	55.7 ±4.07	29.9 ±3.2
Patients group	*9.95 ± 0.31	*3.8 ± 0.48	30.9 ± 4.2**	*190 ± 44	6.7 ±1.6	56.5 ±5.3	27.3 ±4.4*
P-value (Sig)	0.015	0.021	0.01	0.04	0.06	0.37	0.045

P-value <*0.05* Significant at *
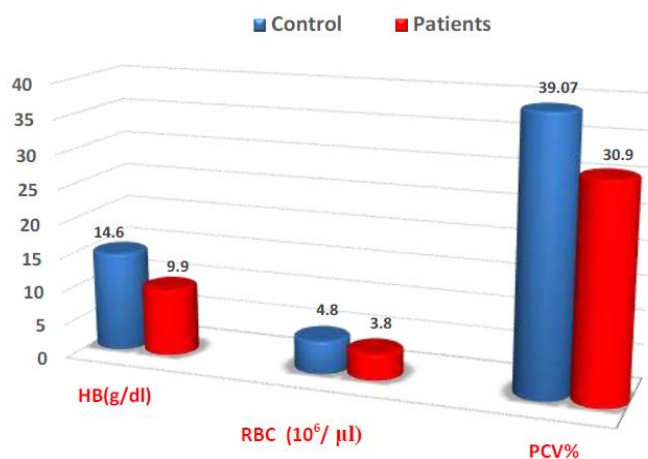
Figure (1): Shows the RBCs mass (HB concentration, RBCs count, and PCV %) between two study groups
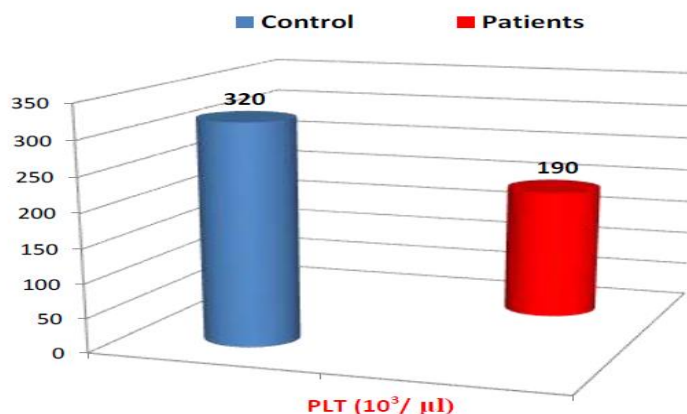
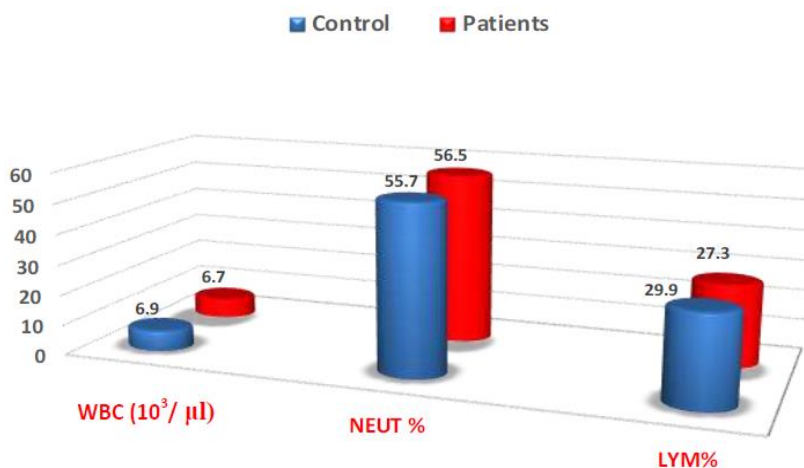**Figure (2): Shows PLT count between two study groups**

Figure (3): Shows WBCs count and differential Neut and Lym between two study groups

Discussion:

CRF stays with the individual afflicted with it throughout his life, and the disease poses a threat to the lives of patients, and often causes death if it is not dealt with carefully and the recommendations of specialists in this field are followed.

The results of this study showed a significant decrease in the RBCs mass (HB concentration, RBCs count, PCV) in patients with CRF who were subjected to hemodialysis comparing the healthy persons, and these results were consistent with the results of many studies conducted on patients with CRF in some countries, including: the study from Saudi Arabia [1], study from Sudan [34], study from India [19], and the study from Pakistan [21]. Many studies have indicated that anemia is a common complication associated with CRF. This is achieved through a decrease in HB concentration, RBCs counts, and PCV [6, 10, 21]. Anemia results in patients with CRF from a low level of erythropoietin (EPO) hormone [24] responsible for stimulating mothers of RBCs, (hemocytoblast) in the bone marrow, to produce and regulate RBCs, and this hormone is produced from intermediate cells in the kidney [32], as the interstitial cells around the renal tubules are responsible for secreting 85-90% of the hormone in adult human [27].

There are also other causes of anemia in patients with CRF, including blood loss during the HD process, and the lack of iron, folic acid and vitamin B_{12} levels resulting from malnutrition that patients often suffer from kidney failure [16], in addition to decrease in the duration of RBCs remaining in the

bloodstream is inversely proportional to the concentration of urea and nitrogen in the blood, which in turn improves significantly after intensive dialysis in patients. It has been found through previous studies that blood urea leads to an increase in the expression of phosphatidylserine on the outer surface RBCs, which in turn enhances the distinction of RBCs by macrophages, and subsequently leads to their destruction and a decrease in their survival [5]. Anemia in patients with CRF may also be attributed to the increased secretion of parathyroid hormone, which causes damage to the bone marrow [2].

The National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-K / DOQI) determined the required HB concentration in patients with renal failure at 11-12 mg/dl [23], which is higher than the HB concentration in patients with CRF in this study (9.9 mg/dl), this finding indicated that anemia in patients with CRF was moderate in this study, and that may have been a result of giving many patients an injection of EPO hormone. One of the important reasons that led to the low of HB concentration is the deficiency of the iron element that enters the chemical composition of the HB molecule, and this deficiency results due to malnutrition suffered by patients with CRF on the one hand, and to inhibit the absorption of iron from the intestine due to high level of immune cytokines on the other hand [13].

The results of this study showed that there is a significant decrease in PCV in patients with CRF compared with healthy people, and this is consistent with some studies, that were conducted in Saudi Arabia [1], Libya [15] and Pakistan [21], and this is due to the decrease in the RBCs count and HB concentration, as the PCV is directly proportional to the RBCs count, or due to an increase in body water due to uremia, which retains the largest amount of water. A study published in the Brazilian Journal of Hematology and Hemotherapy [4] has indicated that the decrease in HB concentration and PCV is due to a lack of EPO hormone, the hormone is responsible for the formation of RBCs from the bone marrow, and that a lack of RBCs leads to a decrease in HB and PCV.

It was observed in this study that a significant decrease in the PLT count occurred in patients with CRF compared with the healthy people group, and this decrease was consistent with published studies [10, 21], and this may be due to the accumulation of nitrogenous compounds in the blood. As nitrogenous wastes inhibit the PLT formation process in the bone marrow, as well as increase the acidity of the blood, it was found that there is an inverse relationship between the acidity of the blood and PLT, and this is consistent with the findings of other studies [3, 10, 18]. Researchers [9] indicated that the low PLT count is due to the lack of secretion of EPO hormone, because EPO levels can affect the PLT count.

It is known that WBCs originate from stem cells in the bone marrow, just like RBCs [7]. NEUT makes up the largest part of WBCs, with a percentage of 70-50%. NEUT cells are newly formed remain in the bloodstream between 10-7 hours, after which they pass into the tissues [8]. As for the percentage of LYM, it is between 20-40% of the total WBCs [31]. The increase in NEUT cells indicates the presence of a bacterial inflammatory condition, as these cells spend most of their lives in connective tissues [28].

This study showed a decrease in the total WBCs count in patients with CRF compared with the healthy group, with no significant differences, and this is consistent with the results of other study [32], and differs from the results of other studies [1, 12]. A study result [25] explained that the decrease in the total number of WBCs is due to two reasons: decrease in the manufacture of WBCs by the bone marrow as a result of inflammation and high concentration of pro-inflammatory cytokines, which inhibit the production of WBCs in bone marrow.

The results of this study showed that there is a significant decrease in the percentage of LYM in patients with CRF compared with healthy people, and this may be attributed to an increase in the rate of apoptosis of LYM, due to the accumulation of nitrogenous waste products. In turn, the decrease in LYM leads to a decrease in the total number of WBCs [20]. It was also evident from this study that an increase percentage of NEU cells in patients with CRF compared with healthy people, with no significant differences, and these results were in agreement with the findings the other study's findings [14]. This is due to the case of uremia, as well as HD treatment, as it leads to an increase in the number of NEU cells and mononuclear cells in response to any stimulus that leads to inflammation [14].

Conclusion: Chronic renal failure CRF is associated with different degrees of abnormality in hematological parameters. So, hematological parameters in chronic renal failure CRF patients need careful evaluation and management.

References:

1- Alghythan, A. and Alsaeed, A. H. (2012). Hematological changes before and after hemodialysis. Academic Journals, 7(4): 490-497.

2- Al-Hilali, N., Al-Humoud, H., Ninan, V. T., Nampoory, M. R., Puliyclil, M. A. and Johny, K. V. (2007). Does Parathyroid Hormone Affect ErythropoietinTherapy in Dialysis Patients?. Medical Princples and Practice, 16(1): 63-67.

3- Al-Saedi, A.H., Jameel, N.S. and Mohssen, Q. S. (2014). Frequency of Abdominal Aortic Calcification in a Group of Iraqi Hemodialysis Patients. Saudi Journal of Kidney Diseases and Transplantation, 25(5):1098-1104.

4- Alves, M. T., Vilaça, S. S. and Carvalho, M . (2015). Resistance of dialyzed patients to erythropoietin. Brazilian Journal of Hematology and Hemotherapy , 37(3) : 190–197.

5- Bramble, K.S.I., McFarlane, A., Winegard, N., Crowther, M. and Churchill, D.N. (2006). Effect of chronic kidney disease on red blood cell rheology, Clinical Hemorheology Microcirculation , 34(3): 411-20.

6- Dandekar , U.S. (2009). Association between Serum Ferritin and Body Composition in Young Women. University of Massachusetts, Amherst Magazine, 72.

7- Ganong, W.F. (2005). Thyroid physiology. Ganong's review of Medical Physiology, 2nd edition Editor: William F. Anong, Publisher: McGrawHill- Singapore.

8- Germann, W. and Stanfield, C. (2005). Principles of Human Physiology, Benjamamin Cumming, pp. 405-410.

9- Gouva, C.h., Papavasiliou, E., Katopodis, K.P., Tambaki, A.P., Christidis, D. and Tselepis, A.D. (2006). Effect of Erythropoietin on Serum paf-acetylhydrolase in patients with Chronic Renal Failure. Nephrology dialysis transplantation, 21(5):1270-1277.

10- Habib, A., Ahmad, R. and Rehman, S. (2017). Hematological changes in patients of chronic renal failure and the effect of hemodialysis on these parameters. International Journal of Research in Medical Sciences, 5(11): 4998-5003.

11- Harmon, W. (2009). Glomerular filtration rate in children with chronic kidney disease. Clinical chemistry, 55: 400-401.

12- Iyawe, I.O. and Adejumo, O.A. (2018). Hematological profile of predialysis chronic kidney disease patients in a tertiary hospital in Southern Nigeria. Journal of Medicine in the Tropics, 20(1): 36-41.

13- Kausz, A.T., Obrador, G.T. and Pereira, B.J. (2000). Anemia management in patients with chronic renal insufficiency. American Journal Kidney Diseases, 30(3): 39-51.

14- Kralova, S., Leva, L. and Toman. M. (2009). Polymorphonuclear function in naturally occurring renal failure in dogs. Veterinarni Medicina, 45(5): 236-243.

15- Latiwesh, O.B., Elwerfaly, H.H., Sheriff, D.S. and Younis, M.Y.G. (2017). Haematological Changes in Predialyzed and Hemodialyzed Chronic Kidney Disease patients in Libya. Journal of Dental and Medical Sciences, 16(2):106-112.

16- Locatelli, F., Pozzoni, P. and Del Vecchio, L. (2007). Recombinant Human Epoietin beta in the Treatment of Renal Anaemia. Therapeutics and Clinical Risk Management, 3(3): 433-9.

17- Miura, M., Hirayama, A., Oowada, S., Nishida, A., Saito, C., Yamagata, K., Ito, O., Hirayama, Y. and Kohzuki, M. (2018). Effects of electrical stimulation on muscle power and biochemical markers during hemodialysis in elderly patients: a pilot randomized clinical trial, Renal Replacement Therapy, 4, 33: 1-8.

18- Mohammed, E.J. and Serrheed, H.Y. (2018). Hemostatic changes in patients with chronic renal failure. Journal of the Faculty of Medicine Baghdad, 60(2): 85-88.

19- Momodu, I., Hamidatu, J.M., Makursidi, M.A. and Galadima, D.A. (2018). Effect of Haemodialysis on Some Haematological Parameters in Patients with End-Stage Renal Failure. Journal of Blood Research and Hematological Disease, 3:1.

20- Moser, B., Roth, G., Brunner, M., Lilaj, T., Deicher, R., Wolner, E,. Kovarik, J., Boltz-Nitulescu, G., Vychytil, A. and Ankersmit, H. J. (2003). Aberrant T cell Activation and Heightened Apoptotic Turnover in End-Stage Renal Failure Patients: a Comparative Evaluation Between Non-Dialysis, Haemodialysis, and Peritoneal Dialysis. Biochemical and Biophysical Research Communications, 308:581–585.

21- Muhammed, A., Zeb, M. A., Ullah, A., Afridi, I. Q. and Ali, A. (2020). Effect of haemodialysis on haematological parameters in chronic kidney failure patients Peshawar-Pakistan. Pure Applied Biology, 9(1): 1163-1169.

22- Naeem, M., Ashraf, A., Safdar, H.M.Z., Khan, M.Q., Rerman, S.U., Iqbal, R., Ali, J. and Ahmad, G. (2020). Biochemical Changes in Patients with Chronic Kidney Failure in Relation to Complete Blood Count and Anemia. International Journal of Biosciences, 16(1): 267-271.

23- National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-K/ DOQI). (2000). Clinical practice guidelines for anemia of chronic kidney Disease. American Journal Kidney Diseases, 37: 5182- 238.

24- Obrador, G.T. (2009). Anemia Of Chronic Kidney Disease And End-Stage Renal Disease: Are There Unique Issues In Disadvantaged Populations?. Journal Ethnicity and Disease, 19:52-55.

25- Okoroiwu, I. L., Ifeanyi, O. E., Uzoma, O. G. and Doris, A. (2015). The Relationship between Platelet Count and Haemoglobin Level. Scholars Academic Journal of Biosciences, 3(8): 66-68.

26- Raghunandan, S. Deepak Kumar, S. and Ram Lakhan, M. (2016). Effectiveness of Self Instructional Module (SIM) on knowledge

regarding home care management among patients with chronic renal failure undergoing haemodialysis at selected hospital of Punjab. IOSR Journal of Nursing and Health Science, 5 (6): 20-31.

27- Rangel, É.B., Andreoli, M.C., Matos, A.C.C., Guimaraes-Souza, N.K., Mallet, A,C., Carneiro, F.D. and Santos, B.C. (2010). Hemoglobin and hematocrit at the end of hemodialysis: a better way to adjust erythropoietin dose. Journal of Artificial Organs, 13(1): 63-66.

28- Reddan, D. N., Preston, S. K., Lynda, A. S., Joseph, A. C., Susan O.S., William, F., Owen, J. r. and Edmund, G. L. (2003).White blood cells as a novel mortality predictor in haemodialysis Patients. Nephrology Dialysis Transplantation, 18: 1167–1173.

29- Rusul Arif, A. and Haider, S. (2014). A study of some biochemical changes in patients with chronic renal failure undergoing hemodialysis, International Journal of Current Microbiology and Applied Sciences, 3 (5): 581-586.

30- Samaneka, W.P., Mandozana, G., Tinago, W., Nhando, N., Mgodi, N.M., Bwakura-Dangarembizi, M.F., Munjoma, M.W., Gomo, Z.A.R., Chirenje, Z.M. and Hakim, J.G. (2016). Adult Hematology and Clinical Chemistry Laboratory Reference Ranges in a Zimbabwean Population. PLOS One, 11(11): e0165821.

31- Siddiqui, M., Ristow, K., Markovic, S.N., Witzig, T.E., Habermann, T.M., Colgan, J.P., Inwards, D.J., White, W.L., Ansell, S.M., Micallef, I.N., Johnston, P.B., Call, T.G., Porrata, L.F. (2006). Absolute lymphocyte count predicts overall survival in follicular lymphomas, British Journal Haematology, 134(6): 596-601.

32- Suresh, M.M., Sharan, B.S., Hari, K.B., Shravya, k. G. and Chandrasekhar, M. (2012). Hematological Changes in Chronic Renal Failure. International Journal of Scientific and Research Publications, 2(9):1-4.

33- Vogt, B. and Faap, M. (2004). Diagnostic evolution of the patient with acute renal failure. American Journal of Physiology-Renal Physiology, 279: 195-202.

34- Yassein, R.B., Alseedig, N.O., Abd Allah, S.K., Mohmmed, A.A., Alballah5, N.A. and Syid, M.A. (2016). Haematological parameters among Sudanese patients with chronic kidney failure. International Journal of Research – Granthaalayah, 4(1): 50-54.

تقويم بعض التغيرات الدموية عند مرضى الفشل الكُلوي المزمن
في مستشفى القطن، محافظة حضرموت- اليمن

عبدالرحمن سالم ياسين   محمد علي المسيلي

الملخص

أجريت الدراسة الحالية في مركز الكُلى الصناعي بمستشفى القطن خلال الفترة من فبراير 2018 إلى يوليو 2018، ورمت إلى تقويم بعض التغيرات الدموية التي تحدث عند مرضى الفشل الكلوي المزمن الذين يخضعون لغسيل الكلى ومقارنتها مع أشخاص أصحَّاء. جُمعت 55 عينة دم من كلا الجنسين، منها 35 مريضاً بالفشل الكلوي المزمن والذين يخضعون دوريًا لجلسات الغسيل الدموي، ومجموعة ضابطة قوامها 20 شخصًا سليمًا للمقارنة، في فئة عمرية تراوحت بين 25- 70 سنة لكلا المجموعتين. تم تقويم تركيز الهيموجلوبين، العدد الكلي للخلايا الحمراء، نسبة الهيماتوكريت، العد الكلي لخلايا الدم البيضاء، العد التفاضلي لخلايا العدلات والخلايا الليمفاوية، فضلًا عن عدد الصفائح الدموية وذلك باستخدام جهاز محلل الدم Sysmex . حُللّت البيانات إحصائيًا من خلال الحزمة الإحصائية للعلوم الاجتماعية (SPSS) الإصدار 24. سجلت التحليلات الإحصائية للنتائج انخفاض معنوي ($p<0.05$) في مستوى الهيموجلوبين، عدد خلايا الدم الحمراء ، تركيز الهيماتوكريت وعدد الصفائح الدموية عند مرضى الفشل الكلوي المزمن مقارنة بالمجموعة الضابطة. على الرغم من أن إجمالي عدد خلايا الدم البيضاء لم يسجل أي تغيير معنوي ، إلا أن العدد التفاضلي للخلايا الليمفاوية انخفض معنويًا ($p<0.05$)، وزاد العدد التفاضلي للعدلات دون وجود فروق ذات دلالة إحصائية عند مرضى الفشل الكلوي المزمن مقارنة بالأشخاص الأصحاء. يُستنتج من الدراسة أن الفشل الكلوي المزمن كان له تأثير سلبي في معظم متغيرات الدم قيد الدراسة. لذلك، تحتاج المتغيرات الدموية إلى تقويم وإدارة دقيقين عند مرضى الفشل الكلوي المزمن.

الكلمات المفتاحية: الفشل الكُلوي المزمن، الغسيل الدموي، التغيرات الدموية، حضرموت.