



## **Assessment of Complete Blood Count of Chronic Renal Failure Patients Under Hemodialysis**

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### **ABSTRACT**

This study aimed to detect the effects of renal hemodialysis on some blood parameters in chronic renal failure patients using complete blood count (CBC) Hb, HCT, RBC, MCV, MCH, MCHC, WBC and blood platelets. The patients were divided into two groups according to their age. Group (A) patients below 16 years, group (B) patients with age ranged between 40-55 years. Eighty chronic renal failure patients under hemodialysis attending Khartoum North Dialysis Center, Selma Dialysis Center and Soba Hospital, were enrolled (group A). Twenty control individuals were selected for the study. Fifty patients with chronic renal failure under hemodialysis attending Alnaw Hospital were selected for the study, their age ranged between 40-55 years (Group B). Twenty individuals who were matched as a control. A specimen of 2.5 ml of blood was collected from each patient in EDTA container. Automated hematological analyzer (Sysmex KX -21N) was used to measure the parameters. The results showed a significant decrease in Hb, HCT and RBC in both groups compared to control group. Hb of group A is  $9.6 \pm 2.2$  g/dl and that of control is  $13.4 \pm 0.89$  g/dl. In group B, Hb is  $8.8 \pm 2.1$  g/dl compared to  $15.1 \pm 1.5$  g/dl of control group. MCV, MCH and MCHC of group A significantly decreased compared to control. MCV =  $83.1 \pm 5.4$  fl, MCH =  $27.3 \pm 2.2$  pg, MCHC =  $32.7 \pm 1.4$  g/dl. No significant change was observed in MCV, MCH and MCHC of group (B). TWBC of group B increased insignificantly, from  $5.00 \pm 1.0$  cell/cmm (control level) to  $6.4 \pm 2.6$  cell/cmm. Platelets of group B decreased significantly from control level but within range of  $314.3 \pm 52.6$  cell/cmm to  $209.4 \pm 79.2$  cell/cmm. In conclusion CRF patients under hemodialysis are at risk of anemia, thrombocytopenia and bleeding tendency.

### **المستخلص**

هدفت هذه الدراسة لقياس خضاب الدم والهيماتوكريت وتعداد كرويات الدم الحمراء ومتوسط حجم الخلية ومتوسط خضاب الدم ومتوسط تركيز خضاب الدم في الخلية وتعداد كرويات الدم البيضاء والصفائح الدموية لمرضى الفشل الكلوي المزمن تحت الغسيل الدموي. تم جمع 80 عينة دم من مرضى الفشل الكلوي المزمن أعمارهم دون الستة عشر عاماً يترددون على مركز الخرطوم بحري لغسيل الكلى ومركز سلمى ومستشفى سوياً تم تقسيم المرضى الى مجموعتين إعتياداً على أعمارهم. المجموعة (أ) أعمارهم دون الستة عشر عاماً والمجموعة (ب) تتراوح أعمارهم بين 40 الى 55 عاماً. أيضاً تم إختيار عشرون من المتبرعين الأصحاء ظاهرياً كمجموعة ضبط. كما تم جمع 50 عينة دم من مرضى الفشل الكلوي المزمن المترددون على مستشفى

النو. تتراوح أعمارهم بين 40-55 عاماً. تم اختيار 20 مريضاً كمجموعة ضبط. جمعت 2.5 مل من الدم الوريدي من كل مشارك في وعاء محتوي على مانع التجلط (EDTA) لقياس تعداد الدم الكامل بواسطة جهاز قياس تعداد الدم الآلي. (Sysmex KX-21N) أظهرت النتائج إنخفاض دلالة إحصائية في كل من خضاب الدم والهيماتوكريت وتعداد كريات الدم الحمراء في المجموعتين مقارنةً مع مجموعات الضبط. إنخفاض خضاب الدم للمجموعة (أ) إنخفاضاً ذات دلالة إحصائية من  $13.4 \pm 0.89$  g/dl في مجموعة الضبط إلى  $9.6 \pm 2.2$  g/dl في المجموعة (ب) إنخفاض خضاب الدم إنخفاضاً دلالة إحصائية إلى  $8.8 \pm 2.1$  g/dl في مجموعة الضبط  $15.1 \pm 1.5$  g/dl جرام. متوسط حجم الخلية ومتوسط خضاب الدم ومتوسط تركيز خضاب الدم في الخلية للمجموعة (أ) إنخفاضاً دلالة إحصائية مقارنةً بمجموعة الضبط. متوسط حجم الخلية =  $83.1 \pm 5.4$  fl. متوسط خضاب الدم =  $27.2 \pm 2.2$  pg متوسط تركيز خضاب الدم في الخلية =  $32.7 \pm 1.4$  g/dl. لا توجد اختلافات ذات دلالة إحصائية في متوسط حجم الخلية أو متوسط خضاب الدم أو متوسط تركيز خضاب الدم في الخلية للمجموعة الأخرى. تعداد كريات الدم البيضاء في المجموعة (ب) أظهرت ارتفاعاً ذات دلالة غير إحصائية حيث ازدادت من  $5.00 \pm 1.0$  cell / cmm في مجموعة الضبط إلى  $6.4 \pm 2.6$  cell / cmm، أوضحت نتائج الصفائح الدموية إنخفاضاً ذات دلالة إحصائية للمجموعة (ب) مقارنةً بمجموعة الضبط. حيث إنخفضت من  $314.3 \pm 52.6$  cell / cmm في مجموعة الضبط إلى  $209.4 \pm 79.2$  cell / cmm. خلصت النتائج إلى أن مرضى الفشل الكلوي المزمن الخاضعون للغسيل الدموي عرضة للإصابة بالأنيميا ونقص في عدد الصفائح الدموية والنزف.

**KEYWORDS :** Anemia , thrombocytopenia , Hemoglobin.

## INTRODUCTION

Anemia is a frequent complication of chronic kidney disease (CKD). Inadequate production of erythropoietin by the failing kidney leads to decreased stimulation of the bone marrow to produce red blood cells, three fourth of patients initiating dialysis have a hemoglobin  $< 11$ g/dl. Anemia of CKD develops early and worsen with progressive renal insufficiency<sup>(1)</sup>. In predialysis patients, several causes of anemia in children with CKD include: infection, blood loss, vitamin B<sub>12</sub> and folate deficiency and erythropoietin deficiency<sup>(2)</sup>. Uremia is associated with red cell destruction<sup>(1)</sup>. Bacterial Infections is one of the most common and important health problem for patient with end-stage renal disease (ESRD) who undergo maintenance hemodialysis (HD)<sup>(3)</sup>. Bacterial infection, particularly those involving vascular access are the most frequent infection. Risk factors for infection includes: catheters ,grafts, fistula, other potential risk factors include: poor

patient hygiene, poor needle insertion technique, older age and other associated diseases such as Diabetes Mellitus<sup>(4)</sup>. Heparin is the most commonly used anticoagulant in hemodialysis, it is well known that immune-mediated thrombocytopenia due to immunoglobulin antibody formation against the complex of platelet factor 4 (PF4). Heparin may also contribute to hemodialysis associated with, thrombocytopenia and increased platelet factor 4 release from platelets during a heparin dialysis session<sup>(5)</sup>.

## MATERIALS and METHODS

This is a prospective , cross sectional study carried out in Khartoum North Dialysis Center, Selma Dialysis Center, Soba Hospital and Alnaw Hospital in the period between April 2010 and March 2011. Subjects were divided into two groups A and B, all of them are chronic renal failure patients under hemodialysis. Group A: eighty subjects all of them under 16 years of age, attending North Dialysis Center, Selma Dialysis Center, Soba

Hospital and twenty were matching control. Group B : fifty regular dialyzers with age ranged between 40 and 55 years of age attending Anaw Hospital and twenty were matching control. After approval by Hematology Department – Sudan University of Science and Technology – a written consent was obtained from each patient before sample collection. 2.5 ml of venous blood was collected in EDTA container to determine Hb, RBC, MCV, MCH, MCHC, WBC and blood platelets using Automated hematological analyzer Sysmex KX-21N (2003), following the instructions provided by the manufacture. Red blood Cells, RBC indices and blood platelets were measured in RBC

counting chamber Hb was measured in WBC counting chamber, HCT was measured by integration of volume of RBC which flow in the RBC chamber aperture. Quality control was achieved by confirmatory test of a known for each parameter. <sup>(3)</sup>

### Statistical Analysis

Statistical Package for Social Science (SPSS), soft ware program was used for data analysis, and the results were expressed as mean  $\pm$  SD, p – value  $\leq$  0.00.5.

### RESULTS

Eighty patients were tested for Hb, HCT, RBC, MCV, MCH and MCHC, the results are shown in table (1).

*Table 1: Hematological Parameters of Patients (group A) and Control group*

parameter	Patients =80 Mean $\pm$ SD	Control =20 Mean $\pm$ SD	P- value
Hb g/dl	9.6 $\pm$ 2.2	13.4 $\pm$ 0.89	0.000
HCT %	29.3 $\pm$ 6.5	40.1 $\pm$ 3.1	0.000
RBC cell / cmm	3.5 $\pm$ 0.8	4.5 $\pm$ 0.45	0.000
MCV fl	83.1 $\pm$ 5.4	90.6 $\pm$ 6.3	0.000
MCH pg	27.3 $\pm$ 2.2	30.1 $\pm$ 2.1	0.000
MCHC g/dl	32.7 $\pm$ 1.4	33.3 $\pm$ 0.13	0.000

Fifty patients were tested for Hb, HCT, RBC, MCV, MCH , MCHC and blood platelets, the results are shown in table (2)

*Table 2: Hematological parameters of Patients group (B) compared to control*

Parameter	Patients =50 Mean $\pm$ SD	Control =20 Mean $\pm$ SD	p-value
Hb g/dl	8.8 $\pm$ 2.1	15.1 $\pm$ 1.5	0.000
HCT %	28.4 $\pm$ 7.0	45.7 $\pm$ 4.6	0.000
RBC cell/cml	3.1 $\pm$ 0.81	4.3 $\pm$ 65	0.000
TWBC cell/cmm	6.4 $\pm$ 2.6	5.00 $\pm$ 1.0	0.028
Platelets cell/cmm	209.4 $\pm$ 79.2	314.3 $\pm$ 52.6	0.000

MCV fl	91.7 ± 5.5	91.4 ± 5.6	0.82
MCH pg	29.2 ± 2.1	29.4 ± 1.9	0.65
MCHC g/dl	32.7 ± 1.6	32.7 ± 1.6	0.89

## DISCUSSION

Hemoglobin (Hb), HCT and RBC are decreased significantly in both groups of patients compared to control, this was expected since anemia is a well recognized complication of chronic renal diseases, particularly in predialysis patients as stated by Nnil and Agarwal<sup>(2)</sup>. Among children with several causes of anemia includes: infection, blood loss and vit D deficiency. Anemia is seen even in early stage of CKD due to infection where Hb < 10 g % and HCT < 30 %<sup>(2)</sup>. Other cause include iron deficiency, presence of uremic inhibitors (parathyroid hormone), reduced half life of circulating blood cells. Uremia is associated with shorter life span of RBC of patients have kidney diseases from 4 months to 30 to 40 days. RBC may be lost due to bone marrow suppression, bleeding or hemodilution. In addition, more than a third of people with (5) CKD become iron deficient results from a decline in platelets function and loss of blood from gastrointestinal tract and due to increased in inflammatory cytokines which block iron release from reticulo-endothelial system<sup>(1)</sup>. Significant fall of MCV, MCH and MCHC was recorded in patients bellow 16 years of age, but the drop was severe compared to adult patients. The reduction in hematocrit is associated with decline of renal function, it is more gradual in the early stages and faster in the later

stages of kidney disease<sup>(1)</sup>. These patients are susceptible to infections which may increase WBC slightly as shown in the results. Blood platelets of group B patients decreased significantly compared to control. Daugirdas and Bernardo observed a marked decreased in platelet count in a number of chronic hemodialysis patients (50% or more), resulting in mild degrees of thrombocytopenia, the platelet count decreased slightly during the first hours of dialysis, but mostly returned to initial values by the end of dialysis, platelets aggregation have been detected in the dialyzer blood outflow line<sup>(6)</sup>. Heparin Induced Thrombocytopenia (HIT) type 1 is characterized by a mild decrease in platelet count occurs 2 to 4 hours after heparin initiation, the mechanism of thrombocytopenia appears to be a direct effect on platelet activation by heparin dose<sup>(7)</sup>. Other studies concluded that clotting leads directly to blood loss as much as 200 to 300 ml for each episode, this arises complications of hemodialysis. The most common cause of clotting is the reduction of blood flow, platelets aggregation, reduced platelet count<sup>(5)</sup>. Some abnormalities in several intrinsic coagulation factors- which might be associated with hypercoagulability- have been described in hemodialysis patients. Among these factors is increased consumption of antithrombin III (AIII) due to extensive extra-vascular thrombosis or due to

continuous heparin administration. In addition, anti-thrombin III may be lost with urine in nephrotic syndrome. Other plasma factors associated with hypercoagulability include protein C which may neutralize factors V, VIII and protein S. Low circulating level of protein C in uremic patients may decrease further following hemodialysis. Erythropoietin treatment for the anemia of CRF have been shown to improve platelets function among dialysis patients and therefore associated with possible enhancement of thrombosis.<sup>(8)</sup>

### CONCLUSIONS

Hemoglobin, RBC, HCT, of chronic renal failure patients under hemodialysis are significantly decreased. No significant variation was observed in MCV, MCH. TWBC insignificantly increased indicating infection resulting from hemodialysis techniques and frequent blood draws.

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