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Evaluation of Some Hematological and Biochemical Parameters of Early Atherosclerosis in Patients with Chronic Kidney Disease in Wasit Governorate

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ABSTRACT: The aim of the study was to evaluate some Hematological and Biochemical Parameters in patients with early atherosclerosis in Wasit Governorate. atherosclerosis is one of the leading causes of death among the aged. The localized deposition of fat in the arteries, along with the development of smooth muscle cells and a fibrous matrix, is the primary issue with atherosclerosis.

The study took place in a hemodialysis unit Al-Zahraa Teaching Hospital in Wasit Governorate during the period from November 2023 to April 2024. This study aimed to studying the effect of biochemical and blood indicators of atherosclerosis in patients with chronic kidney disease for the purpose of predicting early cases of atherosclerosis in patients with chronic kidney disease and finding solutions to reduce them.

Study includes (90) samples: (60) patients suffering from early atherosclerosis and chronic kidney disease (dialysis stage) and 30 samples of healthy people (control group), their ages ranged from (40 to 70 years). The samples were divided into two age groups, where the first group had an average age of 40-55 years and the second group was 56-70 years old, the categories were divided equally into males and females Samples were collected based on the incidence of kidney disease first, and then the main risk factors of early atherosclerosis were relied upon, which are (smoking, age, sex, dyslipidemia, hypertension, diabetes, left ventricle valve, physical inactivity).

The results of our study regarding diagnostic markers of atherosclerosis showed a significant increase cholesterol, HDL and LDL at $p \leq 0.5$, while a significant decrease in triglycerides at $p \geq 0.5$, and Biochemical indicators (albumin and globulin) showed a decrease in significance at $p \geq 0.5$, while significance was high for C-reactive protein.
The result of the sedimentation rate test (ESR) and the platelet result showed a significant increase at $p \leq 0.5$. While differential white blood cell results did not appear significant in the study at $p \geq 0.5$.

Conclusions: In patients with early atherosclerosis the level of cholesterol, HDL and LDL and ESR, Platelet showed a significant increase at $p \leq 0.5$ for infected people, while a significant decrease in triglycerides at $p \geq 0.5$. also, the (albumin and globulin) showed a decrease in significance at $p \geq 0.5$, while significance was high for C-reactive protein. This is an important indication of the importance of these parameters to detecting the disease.

Keywords: Early atherosclerosis, Chronic Kidney Disease, Hematological, Biochemical Parameters.

1. INTRODUCTION.

Atherosclerosis constitutes the most common medical and surgical problem. This can be manifested clinically as stroke, coronary artery disease, or peripheral vascular disease. the definition of atherosclerosis and the five theories of atherogenesis are described. These are: the lipid theory, the hemodynamic theory (1), the fibrin incrustation theory, the nonspecific mesenchymal hypothesis and the response to injury hypothesis. Based on the above theories the sequence of events in athero genesis is analyzed (2).

The biological root of cardiovascular disease is atherosclerosis, and thrombosis, platelet aggregation, and unstable atherosclerotic plaque rupture will result in arterial stenosis or occlusion, resulting in acute cardiovascular illness (3).

According to the disease's course, the American College of Cardiology divides Atherosclerosis into six groups. The Type I and Type II early phases can be identified by lipid patches. Yellow patches and a few foam cell accumulations can be seen in the artery's intima (4), Lipid droplets and smooth muscle cells that T lymphocytes have penetrated are present in the intima. Pre plaque, or Type III, is characterized by more extracellular lipid droplets generating lipid nuclei between the layers of smooth muscle cells in the intima and mesomembrane without forming a lipid pool. The stage of atherosclerotic plaque production is Type IV (5), Since the lipids are more concentrated, the lipid pool has already formed (5). The artery wall is distorted, and the intimal structure is obliterated. The development of thin-walled fibro-atheroma is a hallmark of Type V. It is the lesion of atherosclerosis that is most recognizable. Lumen stenosis develops when white plaque enters the artery lumen (6). A proliferative fibrous cap encircles the lipid pool, and the intima of the plaque surface is obliterated. Type VI is referred to as a complicated atherosclerotic lesion, which is a serious lesion. It is distinguished by bleeding, necrosis, ulceration, calcification, and fibrous plaque wall thrombosis (7).

objectives of the study are studying some hematological and biochemical parameter (Lipid profile, Albumin, Globulin, blood cells and CRP) and their relationship to early atherosclerosis in patient with chronic kidney disease.

2. MATERIAL AND METHODS

2.1 Study design:

The present study was included a comparison of a group of (90) samples: (60) patient samples, (30) control samples. The study was conducted from the dialysis unit at Al Zahraa Teaching Hospital in November 2023 to April of 2024, and their ages ranged from (40 to 70 years) the study included 60 patients suffering from early atherosclerosis and chronic kidney disease (dialysis stage), and 30 samples of healthy people (control group). The samples were divided into two age groups, where the first group had an average age of 40-55 years and the second group was 56-70 years old , the categories were divided equally into males and females.

Samples were collected based on the incidence of kidney disease first, and then the main risk factors of early atherosclerosis were relied upon, which are (smoking, age, sex, dyslipidemia, hypertension, diabetes, left ventricle valve, physical inactivity).

2.2 Blood sample:

7 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) and 4 ml in gel tube and clot activator for check the level of Hematological and Biochemical parameters.

Hematological and Biochemical Parameters:

Determination Complete blood count and ESR

The complete blood count was measured by using the Mindray BC-30vet Analyzer device and the erythrocyte sedimentation rate using Westergren method method.

Determination Lipid profile

Lipid profile was measured by using APEL PD-307 Devise.

Determination of (Albumin, Globulin)

These parameters are measured by Cobas C111 device from Roche company in the dialysis laboratory unit at Al-Zahraa Teaching Hospital.

Device principle:

Immunoturbidimetric assay. Anti-albumin, globulin antibodies react with the antigen in the sample to form antigen/antibody complexes which, following agglutination, are measured turbidimetrically.

Determination of (C.R.P)

These Test are measured by Ichroma II device, The test uses a sandwich immune detection method; the detector antibodies in buffer bind to antigens in the sample, forming antigen-antibody complexes, and migrate onto nitrocellulose matrix to be captured by the other immobilizedantibodies on test strip. More antigens in the sample will form more antigenantibody complexes which lead to stronger fluorescence signal by detector antibodies, which is processed by instrument for Ichroma tests to show CRP concentration in the sample**.**

2.3 Statistical Analysis:

The data were analyzed statistically using SPSS vet.25, and the averages were compared using Chi-square under a probability level of 0.05. one way analysis of variance (ANOVA). The appropriate statistical method for testing hypotheses is F Statistics.

Accepting or rejecting the test hypothesis based on the probability value method associated with the F Statistics, based on the statistical significance level of 5% or 1%

3. RESULTS AND DISCUSSION

Table 1: Distribution the effect of age groups on parameters measurements between patients and control groups.

Parameters	No. of Classes of Age		Mean		F-statistic	P-value	Sig
	Patients	Control	Patients	Control			
	40-55 and 56-70	40-55 and 56-70					
LDL	60	30	85	64.6	0.25	0.018	Sig.*
HDL	60	30	66.7	53.5	5.22	0.045	Sig.*
Triglycerides	60	30	107.4	87.9	2.80	0.098	Ns
Cholesterol	60	30	159.8	121.1	6.30	0.014	Sig.*
NEUT	60	30	66.9	58.9	4.71	0.061	Ns
LYM	60	30	24.2	24.6	0.09	0.771	Ns
PLT	60	30	205	270.0	6.24	0.014	Sig.*
Basophil	60	30	0.513	0.488	0.17	0.682	Ns
Eosinophil	60	30	2.8	3.1	0.97	0.328	Ns
Monocyte	60	30	5.4	5.2	0.26	0.614	Ns
HCT	60	30	29.6	33.4	7.93	0.076	Ns
HGB	60	30	9.3	9.8	2.10	0.151	Ns
RBC	60	30	3.2	3.3	1.25	0.266	Ns
WBC	60	30	3.5	3.9	3.63	0.060	Ns
ESR	60	30	25.8	16.9	1.67	0.002	Sig.*
Albumin	60	30	4.2	3.8	1.88	0.173	Ns
Globulin	60	30	2.6	2.7	0.45	0.503	Ns
C.R.P	60	30	12.5	7.5	3.44	0.010	Sig.*

Ns: non-significant P>0.05 // S: significant P≤0.05

Table (1) Shows the distribution of parameters used in studying the effect of early atherosclerosis in people with chronic kidney disease, dividing them into two age groups, where the ages of the first group ranged from 40-55 years and the second age group ranged from 56-70 years.

The result of the F statistical test showed that there was a significant difference for the LDL in Patients groups from the control groups, where the P. Value highlighted the difference because it was less than 0.05, and this indicates that there is a significant difference between the Patients groups and control.

According to the lipid profile for patients with atherosclerosis and healthy people the statistical test for the HDL parameter showed higher average results in the patient groups than the control group, and the result of the F-statistical test showed that there was little difference regarding the HDL parameter in the patient groups than the healthy group. Where the P value was less than 0.05, this indicates a difference between patients and control.

According to Differential WBC parameters, The statistical group for the NEUT, LYM, HCT, HGB, RBC, WBC, Basophil, Eosinophil and Monocyte parameters showed a convergence of the average results in the first age groups in patients and the same groups in control, The result of the F statistical test showed that there was no significant difference regarding the NEUT, LYM, HCT, HGB, RBC, WBC, Basophil, Eosinophil and Monocyte parameters in patients from the control groups, as the P. Value was higher than 0.05, and This indicates that there is no significance between the two groups.

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The statistical tests for the PLT Parameter showed a higher rate of test results in the control groups than the patients groups, The result of the F statistical test showed that there was a significant difference for the PLT Parameter in patients groups from the control groups, where the P. Value highlighted the difference because it was less than 0.05, and this indicates that there is a significant difference.

The statistical tests for the ESR parameter showed a higher rate of test results in the patients groups than in the control groups, The result of the F statistical test showed that there was a significant difference for the ESR in patients from the control groups, where the P. Value highlighted the difference because it was less than 0.05, and this indicates that there is a significant difference.

According to Biochemical parameters, The statistical test for the Albumin and Globulin parameters showed a convergence of the average results in the patients and control groups, The result of the F statistical test showed that there was no significant difference regarding the Albumin and Globulin parameters in patients from the control groups, as the P. Value was higher than 0.05, and this indicates that there is no significant difference.

The statistical tests for the CRP parameter showed a higher rate of test results in the patients group than in the control groups , The result of the F statistical test showed that there was a significant difference for the CRP parameter in patients group from the control groups , where the P. Value highlighted the difference because it was less than 0.05, and this indicates that there is a significant difference as illustrated in table (1).

Table 2: Distribution the effect of age groups on parameters measurements only in patients.

Ns: non-significant P>0.05 // S: significant P≤0.05

Parameters	No. of Classes of Age		Mean		F-statistic	P-value	Sig
	Patients		Patients				
	40-55	56-70	40-55	56-70			
LDL	30	30	68.89	69.24	0.00	0.973	Ns
HDL	30	30	58.10	53.38	0.44	0.508	Ns
Triglycerides	30	30	108.52	82.19	2.01	0.162	Ns
Cholesterol	30	30	161.35	170.78	0.15	0.700	Ns
NEUT	30	30	66.98	60.41	1.72	0.194	Ns
LYM	30	30	24.076	24.379	0.01	0.904	Ns
PLT	30	30	206.6	266.0	3.12	0.082	Ns
Basophil	30	30	0.5152	0.3429	4.10	0.048	Sig.*
Eosinophil	30	30	2.715	2.300	0.73	0.397	Ns
Monocyte	30	30	5.491	5.043	0.38	0.542	Ns
HCT	30	30	29.517	30.886	0.49	0.487	Ns
HGB	30	30	9.272	9.747	0.84	0.363	Ns
RBC	30	30	3.1935	3.2543	0.15	0.696	Ns
WBC	30	30	4.513	4.114	2.96	0.091	Ns
ESR	30	30	25.98	22.93	0.45	0.507	Ns
Albumin	30	30	4.195	3.864	0.71	0.402	Ns
Globulin	30	30	2.5761	4.1929	5.72	0.020	Sig.*
C.R.P	30	30	15.741	16.011	1.67	0.201	Ns

Table (2) Shows the distribution of the results of the parameters used in the study of early atherosclerosis in people with chronic kidney disease for the age groups specific only to the group of affected people.
Statistical tests for the lipid profile (cholesterol, triglycerides, LDL and HDL) showed similar test results in the first age group compared to the second age group, except for the triglyceride rate, which was high in the first age group.
The P value showed that there was no significant difference between the indicators in terms of the two age groups because the value was greater than 0.05.

Statistical tests for the Differential white blood cells (Neutrophil, lymphocyte, Platelet, RBC, WBC, HGB, HCT, Eosinophil, Monocyte and ESR) showed similar test results in the first age group compared to the second age group. The P value showed that there was no significant difference between the indicators in terms of the two age groups because the value was greater than 0.05.

Statistical tests for differential white blood cells showed a higher rate of Basophil cells results in the first age group compared to the second age group, The P value showed a significant difference because the value was less than 0.05.

Statistical tests for Biochemical test Globulin showed a higher rate of test results in the second age group compared to the first age group and the result of the F statistical test showed this, P-value proved the significant difference between the two groups,

Statistical tests for Biochemical tests (Albumin and CRP) showed similar test results in the first age group compared to the second age group.

P- value showed that there was no significant difference between the indicators in terms of the two age groups because the value was greater than 0.05 as shown in Table (2).

4. DISCUSSION

In this study, the Lipid Profile of patients with Atherosclerosis was measured, and the results showed a significant effect in the concentrations of (LDL, HDL and CH) compared to the control group, and a significant decrease in TG compared to the control group. The significant increase in CH concentration may depend on the genetic basis. (8) and LDL levels due to an inherited abnormality of very low-density lipoprotein. This is probably caused by increased fatty acid efflux and impaired clearance of VLDL from plasma (9).

or perhaps there is another reason that explains this increase in the consumption of foods rich in fat, which leads to an increase in the production of chylomicrons in the intestine. When they are degraded, fatty acids are released, so the liver cells will receive large amounts of fatty acids, thus increasing the release of Cholesterol into VLDL-C (10).

The results of the blood parameters test showed a significant difference between the infected group and the control group with regard to platelet parameter, HCT, and ESR, while the rest of the parameters did not show significant differences between the two groups.

The results of Platelet were consistent with previous studies (11). Emerging evidence supports a role for platelets in the progression of atherosclerosis in addition to an involvement in thrombotic vascular occlusion. Platelet Factor 4 (PF4), a chemokine released by activated platelets, stimulates several pro-atherogenic processes (11).

The results of hematocrit were consistent with previous studies (12). The results of this study appeared demonstrate that blood viscosity and hematocrit are increased in men with internal carotid atherosclerosis, independently of the presence of risk factors for atherosclerosis coronary artery.

This study on ESR was consistent with previous studies, where patients with Early Atherosclerosis show elevated levels of ESR in their blood. The comparison of the cardiovascular risk factors according to the treatment modality showed that all of the inflammation markers; ESR, WBC were significantly higher in patients than healthy people (13).

In contrast other parameters did not show any significant indicators between people with atherosclerosis and the control group, such as Neutrophil, Lymphocyte, Basophil, eosinophil, Monocyte, HGB, RBC, WBC.

The results of the study did not agree with the results in the study (14), which indicated a positive correlation between the rate of white blood cells and atherosclerosis. Also, the results of the study on Neutrophil, Lymphocyte, Basophil, eosinophil, Monocyte, HGB, RBC did not appear with the results in studies (15)(16)(17) that indicated a positive correlation.

As for the study (albumin and globulin in serum), the results of this study showed there is no significant correlation between the percentage Albumin and globulin in atherosclerosis when comparing the results between patients and control group, This study was consistent with findings in previous studies (18). Many observational studies did not find a relationship between serum albumin and coronary heart disease. It has been suggested that the

relationship between serum albumin and coronary heart disease may vary according to sex, age, and serum cholesterol level (18).

While previous results were opposite to the results of our study, population-based study reported that low serum albumin level was strongly associated with the occurrence of atherosclerosis and myocardial infarction, The Framingham Offspring Study reported that serum albumin was an independent predictor of atherosclerosis and myocardial infraction, Some studies have shown that low serum albumin independently predicts incident heart failure (19).

According to C-reactive protein A large number of literature supports the idea that inflammation plays a pivotal role in all phases of atherosclerosis, from the fatty streak lesion formation to the acute coronary event due to vulnerable plaque rupture (20).

The results of CRP concentration were consistent with what the researchers indicated, The role of serum levels of CRP in the CVD risk has been being discussed (20)(21). Some researchers reported that Multivariate analysis revealed that CRP was one of the independent predictors of the progression of carotid atherosclerosis. Subset analysis excluding each traditional risk factor showed a similar result. One possible reason that a high CRP level is associated with carotid atherosclerosis (22).

REFERENCES

[1] Burlacu, E., Lackmann, F., Aguilar, L. C., Belikov, S., Nues, R. V., Trahan, C., ... & Granneman, S. (2017). High-throughput RNA structure probing reveals critical folding events during early 60S ribosome assembly in yeast. *Nature communications*, *8*(1), 714.

[2] Chade, A. R., Lerman, A., & Lerman, L. O. (2005). Kidney in early atherosclerosis. *Hypertension*, *45*(6), 1042-1049.

[3] Meng, H.; Ruan, J.; Yan, Z.; Chen, Y.; Liu, J.; Li, X.;.(2022). Meng, F. New Progress in Early Diagnosis of Atherosclerosis. Int. J. Mol. Sci. 2022, 23, 8939. https://doi.org/10.3390/ ijms23168939

[4] Falk, E., Nakano, M., Bentzon, J. F., Finn, A. V., & Virmani, R. (2013). Update on acute coronary syndromes: the pathologists' view. *European heart journal*, *34*(10), 719-728.

[5] Rognoni, A., Cavallino, C., Veia, A., Bacchini, S., Rosso, R., Facchini, M., ... & S Bongo, A. (2015). Pathophysiology of atherosclerotic plaque development. *Cardiovascular & Hematological Agents in Medicinal Chemistry (Formerly Current Medicinal Chemistry-Cardiovascular & Hematological Agents)*, *13*(1), 10-13.

[6] Virmani, R., Kolodgie, F. D., Burke, A. P., Farb, A., & Schwartz, S. M. (2000). Lessons from sudden coronary death: a comprehensive morphological classification scheme for atherosclerotic lesions. *Arteriosclerosis, thrombosis, and vascular biology*, *20*(5), 1262-1275.

[7] Meng, H.; Ruan, J.; Yan, Z.; Chen, Y.; Liu, J.; Li, X.;.(2022). Meng, F. New Progress in Early Diagnosis of Atherosclerosis. Int. J. Mol. Sci. 2022, 23, 8939. https://doi.org/10.3390/ ijms23168939

[8] Fredrickson, B. L., Tugade, M. M., Waugh, C. E., & Larkin, G. R. (2003). What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. *Journal of personality and social psychology*, *84*(2), 365.

[9] Kim, J. H., Lim, S., Park, K. S., Jang, H. C., & Choi, S. H. (2017). Total and differential WBC counts are related with coronary artery atherosclerosis and increase the risk for cardiovascular disease in Koreans. PloS one, 12(7), e0180332.

[10] Gluba A, Rysz J, Banach M .(2010). Statins in patients with chronic kidney disease: why, who and when? Expert Opin Pharmacother 11(16):2665–2674

[11] Pitsilos, S., Hunt, J., Mohler, E. R., Prabhakar, A. M., Poncz, M., Dawicki, J., ... & Sachais, B. S. (2003). Platelet factor 4 localization in carotid atherosclerotic plaques: correlation with clinical parameters. *Thrombosis and haemostasis*, *90*(12), 1112-1120.

[12] Kattula, S.; Byrnes, J.R.; Wolberg, A.S. (2017). Fibrinogen and Fibrin in Hemostasis and Thrombosis. Arter. Thromb. Vasc. Biol. 2017, 37, 13–21. [CrossRef]

[13] Yilmaz, F. M., Akay, H., Duranay, M., Yilmaz, G., Öztekin, P. S., Koşar, U., ... & Yücel, D. (2007). Carotid atherosclerosis and cardiovascular risk factors in hemodialysis and peritoneal dialysis patients. *Clinical biochemistry*, *40*(18), 1361-1366.

[14] Sekitani, Y., Hayashida, N., Kadota, K., Yamasaki, H., Abiru, N., Nakazato, M., ... & Takamura, N. (2010). White blood cell count and cardiovascular biomarkers of atherosclerosis. *Biomarkers*, *15*(5), 454-460.

[15] Kim, J. H., Lim, S., Park, K. S., Jang, H. C., & Choi, S. H. (2017). Total and differential WBC counts are related with coronary artery atherosclerosis and increase the risk for cardiovascular disease in Koreans. *PloS one*, *12*(7), e0180332.

[16] Vosseler, M., Beutel, A., Schäfer, S., Muxel, S., Jabs, A., Forconi, S., ... & Gori, T. (2012). Parameters of blood viscosity do not correlate with the extent of coronary and carotid atherosclerosis and with endothelial function in patients undergoing coronary angiography. *Clinical hemorheology and microcirculation*, *52*(2-4), 245-254.

[17] Mallika V, Goswami B, Rajappa M. (2007). Atherosclerosis Pathophysiology and the Role of Novel Risk Factors: A Clinicobiochemical Perspective. Angiology. 2007;58(5):513-522. doi:10.1177/0003319707303443
[18] Ostrakhovitch, E. A., & Tabibzadeh, S. (2019). Homocysteine and age-associated disorders. Ageing research reviews, 49, 144-164.
[19] Arques, S., & Ambrosi, P. (2011). Human serum albumin in the clinical syndrome of heart failure. *Journal of cardiac failure*, *17*(6), 451-458.
[20] Calabrò, P., Golia, E., & Yeh, E. T. (2009). CRP and the risk of atherosclerotic events. In *Seminars in immunopathology* (Vol. 31, pp. 79-94). Springer-Verlag.
[21] Al-Tu'maa, F. J., Abd-Yasera, Z. A., & Al-Naffi, K. O. (2016). Association between hs-CRP levels and the severity of coronary atherosclerosis. *J Contemp Med Sci*, *2*(6), 42-44.
[22] Hashimoto, H., Kitagawa, K., Hougaku, H., Etani, H., & Hori, M. (2004). Relationship between C-reactive protein and progression of early carotid atherosclerosis in hypertensive subjects. *Stroke*, *35*(7), 1625-1630.