Original Article

Prognostic Use Of Fasting Lipid Profile, Erythrocyte Sedimentation Rate And C - Reactive Protein In The Management Of Hypertensive Individuals With Chronic Kidney Disease

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Abstract

Introduction: One major cause of secondary hypertension is chronic kidney disease and this has broadly triggered a vast majority of cardiovascular events. With growing evidences of atherogenic dyslipidamia in CKD patients. The present study assessed the fasting lipid profile, erythrocyte sedimentation rate and C-reactive protein level in adult hypertensive with chronic kidney disease at Nnamdi Azikiwe University teaching hospital, Nnewi, and relates the findings to the prevalence of cardiovascular disease.

Methods: The study conveniently selected 80 hypertensive individuals (female =45; male = 35) with evidence of CKD from internal medicine clinic and 80 (female =40; m = 40) non hypertensive individuals without CKD (control) within the ages of 20-70 years. Fasting lipid profile [total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL), triglyceride (TG)] and CRP were determined using enzymatic method while ESR was done using the Westergren method

Results: The result shows that serum TC, LDL and TG were significantly (*P*=.000) increased while, HDL was decreased in hypertensive individuals with CKD when compared with non-hypertensive individuals without CKD (*P*=.017). CRP and ESR were significantly (*P*=.000) increased in hypertensive individuals with CKD compared with their non-hypertensive counterpart.

Conclusions: This suggests the role of abnormal lipid metabolism and inflammation in renal dysfunction. With this finding, high level of lipoprotein with increased Hs- CRP and ESR can be used as indices for early diagnosis and management of hypertensive individuals to reduce some of the risk factors that may predispose them to CKD and further cardiovascular complications.

Key Words: Chronic kidney disease, Inflammation, Hypertension, ESR, CRP, Lipid profile, Nigeria.

INTRODUCTION

The overall world statistics of CKD has escalated globally. [13] Even within Nigeria, there are distinctive incidences of CKD. [1,2] Chronic kidney disease (CKD) is marked by accelerating kidney dysfunction resulting in elevated systemic hypertension [32] and cardiovascular complications which subsequently can lead to end- stage kidney disease (ESKD) and BP severity. [4] It has been documented that individuals with a baseline BP as much as 180/100 mm Hg were more likely to develop ESKD compare with a baseline BP of about 110/70 mm Hg.[5] Meanwhile, the cumulative decrease in kidney function can trigger unbridled HTN due to distended and increased systemic vascular resistance. Recent evidence has shown that lowering the blood pressure will decelerate eGFR as well as limit the incidence of CVD and progression to ESRD.[6] CKD has been associated with a host of disease complications including abnormalities in concentration of electrolyte, bone problems, atherosclerotic process, anemia, dyslipidemia, and hypertension. Hypertension through various mechanisms, has been documented as the determinant of major body organs impairment thereby, resulting in increased mortality and morbidity globally.[7] The critical role of atherosclerotic process in lipid metabolism, renal dysfunction and reduced estimated glomerular filtration rate (GFR) has remained unclear. Conversely, altered lipid metabolism has been shown to worsen malnutrition, inflammation and CVD in CKD patients. [8] Previous documentation has implicated chronic renal failure and inflammation in the end stage renal disease (ESRD) and cardiovascular events. [9] Hypertension has been listed among the disease conditions that produces steady and constant low body inflammation. [7, 10]

However, considering the importance of patient safety in clinical practice, according to Runciman and colleagues, [11] patient safety entails "reducing the risk and harmful processes/conditions related to health care of a patient to the barest minimum," hence, design of the present study.

MATERIALS AND METHODS

A cross sectional study designed to assess the fasting lipid profile, ESR and CRP level in newly diagnosed adult hypertensive with CKD at NAUTH, Nnewi, Anambra State, Nigeria.

A total of 160 individuals aged between 30- 80 years were conveniently selected for the study. 80 participants were hypertensive with CKD (female =45; male =35) selected from internal medicine clinic while, the remaining 80 (female = 40; male = 40) were non hypertensive participants without CKD who were regarded as control.

10ml of blood was taken aseptically by venepuncture from each subject, 5ml dispensed into anticoagulant containers (Trisodium citrate) for determination of ESR and CRP while the remaining 5ml was dispensed into plane tubes for serum fasting lipid profile estimations. Values obtained constituted the data for the study**.** Questionnaires were drafted and shared among the subjects to get their biodata, anthropometric parameters and medical records.

Inclusion and exclusion criteria

Only the hypertensive male and female participants who have been diagnosed of CKD were included, those currently on conservative management within the age range 30-80 years and non- hypertensive subjects without chronic kidney disease were also included as control. While, participants with other chronic diseases were excluded from the study.

Ethical consideration and Informed consent

Ethical clearance was obtained from the board of ethics committee of NAUTH, Nnewi, Nigeria While, the informed consent of the participants was sought and obtained prior to study.

Anthropometric Analysis

Weight and height measurements were taken from each participant. Body Mass Index (BMI) was calculated using weight in kilogram divided by height in meter square as was described by Zierle-Gosh. [11] The Waist Hip Ratio was calculated by dividing the waist measurement by the participant hip measurement while, the systolic (SBP) and diastolic (DBP) blood pressure was measured using the auscultatory method, with a duly calibrated mercury-column sphygmomanometer and a Littman stethoscope according to the manufacturers' instructions

Determination of Lipid profile, ESR and CRP

Fasting lipid profile (TC, TG, HDL, and LDL) were determined using enzymatic method as was described by Nigam. [12] ESR was done using the Westergren method while, CRP assay was done using ELISA as was described by McBride et al. [13]

Statistical analysis

The data obtained was statistically analyzed using Statistical Package for Social Science (SPSS) version 20. Student independent t-test was used to determine the difference between test and control. *P-value ≤ .05* was considered significant.

RESULTS

Anthropometric characteristics in test and control participants

The mean value for age in test group (60.64 ± 12.77) was not significantly different when compared with control group (55.90 ± 10.99) (*P*=.095).

However, BMI was significantly higher in hypertensive individuals (30.59 ± 8.76) when compared with control group (26.95 ± 4.86) (*P*=.040).

The mean SBP and DBP in test group was significantly higher (155.68 ± 31.32, 108.04 ± 23.99) when compared with controls (114.93 ± 5.30, 77.87±4.11) (*P*=.000 respectively).

The mean waist/hip ratio values in hypertensive with CKD was not significantly different (1.24 ± .36) when compared with control group (1.30 ± .26) (*P*=.467) (Table 1).

Serum lipid profile, ESR and CRP level in test and control participants.

The mean TC, TG and LDL was significantly higher in the hypertensive individuals with CKD (212 .2 ±44.61, 128.14±56.20, 145.22±42.68) when compared with control group (174.07±18.72, 104.03±34.05, 105.17±25.53) (*P*=.000, .037, .000 respectively). However, the mean value of HDL in hypertensive individuals with CKD (39.96±8.68) was significantly lower when compared with the control group (45.33±9.95) (*P*=.017). Very low density lipoprotein for hypertensive individuals with CKD (28.30±21.99) was not significantly different when compared with control group (20.80±6.86) (*P*=.074).

The mean CRP in hypertensive individuals with CKD (11.59 ± 6.60) was significantly higher when compared with control group (3.83 ± 1.68) (*P*=.000).

Similarly, the mean ESR in hypertensive individuals with CKD was significantly higher (64.58 ± 39.34) when compared with control group (33.20 ± 7.14) (*P*=.000) (Table 2).

Anthropometric characteristics in gender

The mean values of age, BMI, waist/hip ratio were not significantly different in male and female hypertensive individuals with CKD when compared with controls (*P*=.049) respectively.

However, the mean SBP and DBP were significantly higher in female and male hypertensive individuals with CKD when compared with their corresponding control group (*P*=.000 respectively) (Table 3).

Serum lipid profile, ESR and CRP level in gender

The mean TC and LDL were significantly higher in female hypertensive individuals with CKD when compared with male control individuals (*P*=.000) respectively. However, the mean values of TG, HDL and VLDL were not significantly different in male hypertensive individuals with CKD when compared with female control (*P*=.049) respectively.

The mean values of CRP and ESR were significantly higher in female and male hypertensive individuals with CKD when compared with their control counterparts (*P*=.000, .005) respectively. The mean value of CRP was significantly higher in male hypertensive individuals with CKD when compared with female control group (*P*=.000). However, the mean ESR was not significantly different in male hypertensive individuals with CKD when compared with the female control counterpart (*P*=.049).

DISCUSSION

Hypertension is the most common risk factor for CKD and can degenerate to increased cardiovascular complications as well as ESRD. Our study reveals increased mean TC, LDL and TG with decreased HDL and VLDL in hypertensive individuals when compared with control. Significant derangement in lipoprotein fractions in various stages of CKD have been previously documented.[14,15] LDL-C derangement has been seriously documented as important cardiovascular threat for coronary heart disease which as a result of its degree of abnormality can eventually lead to chronic renal disease. [16] This was attributed to development oxygen radicals in the target organs and the effect of Ang II on blood pressure. [14, 17] Studies have shown that deteriorations in kidney function and inflammation were strong proof of lipoprotein particles dysfunction. [14] As in our study, hypertriglyceridemia has been reported in early stages of CKD. [18] This was due to inactivity of the lipoprotein lipase (LPL), thereby reducing the triglycerides breakdown causing chylomicron remnants, LDL cholesterol and Apo lipoprotein C-III/C-II ratio to accumulate. [18, 19] Previous reports have shown that decreased serum cholesterol levels can result to increased death rates in CKD patients. This was attributed to high systemic inflammation and oxidative stress as a result of cardiovascular complications. [14,19] Evidence shows that HDL metabolism in adult hypertensive patients with CKD is impaired and this can lead to adverse cardiovascular events. This is due to inability of HDL-3 to mature into HDL-2 as a result of lecithin- cholesterol acyl-transferase (LCAT) deficiency thereby causing accumulation of oxidized LDL with subsequent progression to oxidative stress and adverse cardiovascular events.[20,22] Increased alteration of HDL cholesterol in CKD patients can result to accumulation of atherosclerotic plaques. This could occur because of deranged LCAT which results from reduced HDL cholesterol level in CKD individuals [14]

Our study revealed a positive association of dyslipidemia with hypertension and chronic kidney disease which may subsequently lead to the development of coronary heart diseases as well as ESRD. [20] Previous reports have shown that dyslipidemia may incidentally influence the microcirculation by affecting balance of vascular endothelial functions, thereby leading to hypertension. [22,23, 24] Hypertension on the other hand, has been indicated as a membrane disease. [25] The observed increase in serum TC, TG and LDL in female hypertensive participants agrees with several reports. [21] This was attributed sex hormones differences and lipoprotein degradations in both sexes. [26, 27]

Our study reported increased ESR and Hs-CRP level in hypertensive individual with CKD. The report was consistent with previous finding. [28] Though the actual cause of elevation in the level of CRP in inflammatory conditions has not been fully elucidated, some authors have attributed it to the expansion of extracellular fluid volume, adverse cardiovascular complications, other medical conditions and genetic modifications which may subsequently lead to renal arteriolar degenerative process. [29] Collares and Vidigal, [30] in their study indicated that increased level of CRP is an important marker for prediction of both acute and chronic inflammatory processes in CKD patients.

The increase in systolic and diastolic blood pressure in female hypertensive participants with CKD when compared with their corresponding male participants agrees with other reports. [10,31] Though the reasons still remain obscure, the authors have attributed it abnormal degradation of lipids and sex hormone imbalance. [32]

As in our study, the increased BMI and Waist/hip ratio in female hypertensive participants have been previously reported. [33,34] the elevation in waist circumference, BMI ESR and CRP in hypertensive individuals with CKD shows strong evidence of inflammatory condition and cardiovascular risk. Both hs-CRP and ESR been documented as important predictors of CKD.[35]

In conclusions**,** the finding in this study demonstrates an intermingling relationship between hypertension dyslipidemia and CKD. The abnormal lipid profile observed with increased inflammatory markers strongly indicates adverse cardiovascular events which if not checked may subsequently cause mortality in CKD individuals due to increased uremic toxin. Therefore assessment of lipid profile and vascular inflammatory markers is recommended regularly among adults with chronic kidney disease to put to check the risk of cardiovascular diseases such as stroke and atherosclerosis.

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Table 1: Anthropometric parameters in hypertensive individuals with CKD and control groups

Subjects	Age	BMI	SBP	DBP	Waist/Hip ratio
Hypertensive with CKD (n=80)	60.64±12.77	30.59±8.76	155.68±31.32	108.04±23.99	1.24±0.36
Control group (n=80)	55.90±10.99	26.95±4.86	114.93±5.30	77.87±4.11	1.30±0.26
T-value	.786	7.821	47.846	24.942	3.056
P-value	.095	.040	.000	.000	.467

* *P-value* = .005

Table 2: Serum lipid profile (mg/dl), ESR (mm/hr) and CRP (mg/l) in hypertensive with CKD (Test) and control (C) groups

Group	TC	TG	LDL	HDL	VLDL	CRP	ESR
Hypertensive with CKD (n=80)	212.2 ±44.61	128.14±56.20	145.22±42.68	39.96±8.68	28.30±21.99	11.59 ±6.60	6458±39.34
Control group (n=80)	174.07±18.72	104.03±34.05	105.17±25.5	45.33±9.95	20.80±6.86	3.83±1.68	33.20±7.14
T-value	7.838	7.038	4.508	0.067	3.824	14.079	40.434
P-value	.000	.037	.000	.017	.074	.000	.000

* *P-value* = .005

Table 3 Mean ± SD anthropometric parameter studied in gender among hypertensive subjects with CKD and control groups.

Group	**Age**	**BMI**	**W/H Ratio**	**SBP**	**DBP**
Female hypertensive with CK0D(F)(n=45)	62.17±12.53	31.56 ±9.16	1.25±0.35	157.20±33.22	108.97±24.99
Male hypertensive with CKD (M)(n=35)	58.35±13.10	29.14 ±8.14	1.23±0.38	153.40±28.65	106.65±22.97
T-value	.181	.182	1.111	1.263	.394
P-value	.305	.345	.875	.678	.742
Control(F)(n=40)	56.11±11.88	27.42±5.79	1.26±0.28	113.89±5.56	78.16±3.44
Control(M)(n=40)	55.55±9.78	26.16±2.66	1.37±0.20	116.73±3.74	77.36±5.22
T-value	.442	7.943	1.174	.039	6.602
P-value	.896	.504	.273	3.541	.618
F vs F (test vs control)	.490	.850	.932	.000*	.000*
M vs M (test vs control)	.500	.230	.289	.000*	.000*
F vs M (test vs control)	.122	.063	.300	.000*	.000*
M vs F (test vs control)	.579	.453	.821	.000*	.000*

* *P-value*= .005

Table 4 Serum lipid profile (mg/dl), CRP ((mg/l) and ESR (mm/hr) studied in gender among hypertensive subjects with CKD and control groups.

Group	TC	TG	LDL	HDL	VLDL	CRP	ESR
Test(F)n=45	203.17±39.62	118.17±45.27	324.03±120.16	39.97±11.32	28..40±26.59	11.41±5.72	68.13±13
Test (M)n=35	225.85±49.11	143.10±68.01	154.15±50.64	39.95±7.85	28.15±12.96	11.86±7.90	59.25±40.36
t-value	.001	4.624	.289	1.516	.145	.633	.37
p-value	.875	.126	.205	.995	.969	.813	.440
Control (F)n=40	1.76±19.28	93.74±23.88	106.53±28.81	47.14±10.25	18.84±4.82	3.64±1.81	33.63±7.18
Control (M)n=40	169.64±17.70	121.81±42.27	102.82±19.07	42.18±3.52	24.18±3.64	4.15±1.44	32.45±7.45
t-value	.000	3.422	.026	13.925	4.273	1.213	.07
p-value	.333	.027	.027	.133	.037	.426	.673
F vs M (test vs control)	.010*	.817	.003*	.530	.611	.000*	.005*
M vs F (test vs control)	.000*	.005*	.001*	.018*	.006*	.000*	.010

* *P-value*=.005