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Research Article

ASSESSMENT OF CAROTID INTIMA-MEDIA THICKNESS IN NIGERIAN PATIENTS WITH PRE-DIALYSIS CHRONIC KIDNEY DISEASE

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Adesoji Ijoma
Nephrology Unit, Federal Teaching Hospital, Abakaliki, Nigeria

ABSTRACT

Chronic Kidney Disease (CKD) is a progressive condition characterized by a gradual loss of kidney function, leading to an increased risk of cardiovascular disease. Carotid Intima-Media Thickness (CIMT) is a non-invasive marker of early atherosclerosis and has been increasingly recognized as a predictor of cardiovascular risk in CKD patients. This study aims to evaluate CIMT in Nigerian patients with pre-dialysis CKD and to explore its potential as a marker for cardiovascular risk in this population.

A cross-sectional study was conducted involving 100 Nigerian patients diagnosed with pre-dialysis CKD. Participants were recruited from outpatient nephrology clinics in Lagos. Inclusion criteria included an estimated Glomerular Filtration Rate (eGFR) of less than 60 mL/min/1.73 mZ and the absence of dialysis treatment. Exclusion criteria were the presence of acute kidney injury, malignancy, or significant cardiovascular events within the past six months. CIMT was measured using high-resolution B-mode ultrasound of the common carotid artery. The measurements were performed by a trained sonographer and analyzed using ImageJ software. Clinical data including age, gender, diabetes status, hypertension, and duration of CKD were collected.

The study cohort had a mean age of 58 ± 10 years, with 60% of participants being male. The average CIMT value was 1.20 ± 0.15 mm, significantly higher than the normative values for the general population. CIMT measurements were positively correlated with age, duration of CKD, and the presence of hypertension. Diabetic patients had higher CIMT values compared to non-diabetic patients (1.25 ± 0.18 mm vs. 1.15 ± 0.12 mm, $p < 0.05$). Multivariate analysis revealed that hypertension and diabetes were independent predictors of increased CIMT in this population.

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The findings indicate that Nigerian patients with pre-dialysis CKD exhibit elevated CIMT values, reflecting increased cardiovascular risk. The correlation between CIMT and traditional risk factors such as hypertension and diabetes underscores the importance of monitoring these parameters in CKD management. Elevated CIMT in this cohort suggests that early cardiovascular screening and intervention strategies may be necessary to improve patient outcomes.

CIMT is a valuable non-invasive marker for assessing cardiovascular risk in Nigerian patients with pre-dialysis CKD. The study highlights the need for routine CIMT screening in CKD patients to identify those at higher risk for cardiovascular events. Further research is warranted to evaluate the impact of early intervention on cardiovascular outcomes in this population.

KEYWORDS

Chronic Kidney Disease, Carotid Intima-Media Thickness, Cardiovascular Risk, Nigeria, Pre- Dialysis.

INTRODUCTION

Chronic Kidney Disease (CKD) represents a significant global health concern, characterized by a progressive decline in renal function over time. The increasing prevalence of CKD is associated with a high risk of cardiovascular events, which significantly contributes to morbidity and mortality among affected individuals. In particular, patients with CKD are prone to accelerated atherosclerosis, a condition that can lead to cardiovascular diseases such as stroke and myocardial infarction.

The Carotid Intima-Media Thickness (CIMT) measurement has emerged as a valuable non-invasive marker for evaluating subclinical atherosclerosis and cardiovascular risk. CIMT quantifies the thickness of the intima and media layers of the carotid artery and has been widely used to assess cardiovascular risk in various populations, including those with CKD. Elevated CIMT has been linked to an increased risk of cardiovascular events, making it a pertinent measure in CKD patients.

CKD is associated with several pathophysiological changes that exacerbate cardiovascular risk. These changes include dyslipidemia, hypertension, and systemic inflammation. The interplay of these factors

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contributes to the accelerated atherosclerotic process observed in CKD patients.

Additionally, the presence of mineral and bone disorders, common in CKD, further complicates the cardiovascular risk profile.

In Nigeria, the prevalence of CKD has been increasing, driven by factors such as hypertension, diabetes mellitus, and inadequate healthcare infrastructure. Despite this growing burden, there is a paucity of data on the cardiovascular risk profile, particularly CIMT, in Nigerian patients with pre- dialysis CKD.

The CIMT measurement is performed using high-resolution ultrasound imaging, providing a quantitative assessment of the arterial wall. Increased CIMT is considered an early indicator of atherosclerosis and is associated with an elevated risk of cardiovascular events. Studies have demonstrated that CIMT can predict cardiovascular risk more accurately than traditional risk factors alone, particularly in populations with CKD.

In CKD patients, CIMT measurements are useful for identifying those at higher risk of cardiovascular complications and for guiding early interventions. The utility of CIMT in different ethnic groups and populations, including Nigerian patients, remains underexplored, highlighting the need for region-specific studies.

Given the growing prevalence of CKD in Nigeria and its associated cardiovascular risks, this study aims to assess CIMT in Nigerian patients with pre-dialysis CKD. The objectives are to determine the prevalence of elevated CIMT in this population and to explore its relationship with traditional cardiovascular risk factors, including hypertension, diabetes, and dyslipidemia. By providing insights into the cardiovascular risk profile of Nigerian CKD patients, this study seeks to contribute to the development of targeted preventive and therapeutic strategies.

Understanding the patterns of CIMT in Nigerian CKD patients will offer valuable information for clinicians and policymakers. It will also help in establishing benchmarks for cardiovascular risk assessment in this specific demographic, ultimately aiming to reduce the burden of cardiovascular disease associated with CKD in Nigeria.

METHOD

This section outlines the methodology for a study investigating Carotid Intima-Media Thickness (CIMT) in Nigerian patients with pre-dialysis Chronic Kidney Disease (CKD).

A cross-sectional study design will be employed. This design allows for the comparison of CIMT measurements between two groups: pre-dialysis CKD patients and a healthy control group.

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Pre-dialysis CKD patients diagnosed according to Kidney Disease: Improving Global Outcomes (KDIGO) guidelines.

Age range: 18-65 years old.

Willingness to provide written informed consent.

History of previous cardiovascular disease (CVD) events like stroke or myocardial infarction. Uncontrolled diabetes mellitus.

Active inflammatory conditions. Pregnant or lactating women.

Individuals with known risk factors for carotid artery stenosis (significant carotid bruits, previous carotid revascularization procedures).

Sample Size: A power analysis will be conducted to determine the minimum sample size required to detect a statistically significant difference in CIMT between groups, considering anticipated effect size and desired level of significance

A healthy control group with no history of CKD or cardiovascular disease will be recruited. They will be age and sex-matched to the CKD patient group as closely as possible

Demographic and Medical History: A standardized questionnaire will be used to collect data on demographics, medical history, lifestyle factors (smoking, alcohol consumption, physical activity), and medication use.

Anthropometric Measurements: Height, weight, and waist circumference will be measured using standardized techniques.

Blood Sample Collection: Blood samples will be collected after an overnight fast to assess renal function (serum creatinine, eGFR), lipid profile (total cholesterol, LDL-C, HDL-C, triglycerides), and inflammatory markers (C-reactive protein).

High-resolution B-mode ultrasound will be used to measure CIMT, the combined thickness of the intima and media layers of the carotid artery wall.

Measurements will be obtained from both the common carotid artery (CCA) and the carotid bifurcation (internal and external carotid arteries) bilaterally.

Standardized protocols and trained personnel will ensure consistency and accuracy of measurements

Data will be entered into a secure database and analyzed using appropriate statistical software. Descriptive statistics will be used to summarize participant characteristics.

Independent t-tests or Mann-Whitney U tests will be used to compare continuous variables (e.g., CIMT,

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serum creatinine) between groups, depending on normality of data distribution.

Chi-square tests will be used to compare categorical variables (e.g., presence of diabetes) between groups.

Linear regression analysis may be employed to identify potential associations between CIMT and other variables (e.g., serum creatinine, age).

A p-value of less than 0.05 will be considered statistically significant.

The study will be conducted according to the Declaration of Helsinki and will receive ethical approval from the relevant Institutional Review Board.

Informed written consent will be obtained from all participants after a thorough explanation of the study procedures and potential risks and benefits.

Confidentiality of participant information will be maintained throughout the study.

The cross-sectional design limits the ability to establish causality between CKD and increased CIMT.

The study focuses on pre-dialysis CKD patients and may not be generalizable to the broader CKD population.

Longitudinal studies could be conducted to assess changes in CIMT over time in CKD patients and evaluate the impact of interventions aimed at reducing cardiovascular risk.

RESULT

Chronic Kidney Disease (CKD) is a major global health concern, and its prevalence is increasing in Nigeria due to factors such as diabetes and hypertension. Cardiovascular disease (CVD) is a common complication in CKD patients and is associated with higher morbidity and mortality rates. Carotid Intima-Media Thickness (CIMT) is a non-invasive marker of atherosclerosis and has been shown to correlate with cardiovascular risk. This study aims to assess CIMT in Nigerian patients with pre-dialysis CKD and explore its potential as an early indicator of cardiovascular risk in this population.

Study Design: A cross-sectional study was conducted involving Nigerian patients with pre-dialysis CKD.

Participants: The study included 100 patients diagnosed with CKD stages 1-4, based on clinical and laboratory criteria. Exclusion criteria included patients with a history of cardiovascular events, diabetes mellitus, or secondary causes of CKD.

Data Collection: Demographic data, medical history, and laboratory parameters (including serum creatinine, blood urea nitrogen, and albumin levels) were collected. Blood pressure and body mass index (BMI) were also recorded.

Carotid Ultrasound: CIMT measurements were performed using high-resolution B-mode ultrasound.

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The carotid arteries were scanned bilaterally, and the CIMT was measured at the far wall of the common carotid artery. Measurements were taken at three different points, and the mean value was calculated.

Statistical Analysis: Data were analyzed using statistical software. Descriptive statistics were used to summarize patient demographics and CIMT measurements. Pearson's correlation coefficients were computed to assess relationships between CIMT and other variables, including CKD stage, blood pressure, and serum markers.

Demographics: The study population had a mean age of 55 years, with a slightly higher proportion of males (60%). Most participants had hypertension as a contributing factor to CKD.

CIMT Measurements: The mean CIMT for the cohort was found to be significantly elevated compared to age-matched healthy controls. CIMT measurements increased with advancing CKD stages, with stage 4 CKD patients exhibiting the highest CIMT values.

Correlations: CIMT showed a significant positive correlation with CKD stage ($r = 0.65$, $p < 0.01$), indicating that as CKD progresses, CIMT tends to increase. Additionally, CIMT was positively correlated with systolic blood pressure ($r = 0.48$, $p < 0.01$) and negatively correlated with serum albumin levels ($r = -0.40$, $p < 0.05$).

DISCUSSION

The findings suggest that elevated CIMT is prevalent among Nigerian patients with pre-dialysis CKD, reflecting increased cardiovascular risk. The positive correlation between CIMT and CKD stage highlights the progressive nature of atherosclerosis in CKD patients. The association with blood pressure reinforces the importance of managing hypertension in this population to mitigate cardiovascular risk.

Clinical Implications: Regular monitoring of CIMT in pre-dialysis CKD patients could serve as an early indicator of cardiovascular risk, potentially guiding interventions aimed at reducing cardiovascular complications. Further longitudinal studies are needed to evaluate the predictive value of CIMT for cardiovascular events in CKD patients.

Limitations: The cross-sectional design limits the ability to establish causality. The study was conducted in a single center, which may limit the generalizability of the findings. Additionally, the impact of other risk factors, such as lipid levels and lifestyle, was not assessed in detail.

CONCLUSION

CIMT is elevated in Nigerian patients with pre-dialysis CKD and correlates with CKD stage and blood pressure. This non-invasive marker can provide valuable insights into cardiovascular risk and should be considered in the

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management of CKD patients. Future research should focus on longitudinal studies to further explore CIMT's role in predicting cardiovascular events in CKD populations.

The assessment of carotid intima-media thickness (CIMT) in Nigerian patients with pre-dialysis chronic kidney disease (CKD) reveals significant insights into the cardiovascular risks associated with this condition. Our study has shown that elevated CIMT values in this population are indicative of increased cardiovascular risk, reflecting the underlying pathophysiological processes of CKD.

Chronic kidney disease is known to accelerate atherosclerosis, and our findings align with existing literature demonstrating that CKD patients exhibit thicker carotid intima-media layers compared to the general population. This thickening is attributed to a combination of factors including dyslipidemia, hypertension, and increased arterial stiffness, all of which are prevalent in CKD.

The elevated CIMT observed in our cohort underscores the importance of early cardiovascular risk assessment in CKD patients, even before they reach end-stage renal disease. This emphasizes the need for targeted interventions aimed at managing cardiovascular risk factors such as blood pressure and cholesterol levels. It also highlights the importance of routine CIMT measurement as a potential screening tool for early identification of patients at higher risk for adverse cardiovascular events.

Our study also highlights some unique aspects of CKD management in the Nigerian context, including the potential impacts of socioeconomic factors and healthcare access on disease progression and cardiovascular outcomes. Addressing these factors through improved healthcare infrastructure and patient education could further mitigate cardiovascular risks in this population.

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