Carotid Intimal Medial Thickness (CIMT) in Patients of Chronic Kidney Disease (CKD) and its Association with CKD Staging

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ABSTRACT

Introduction: Association between Chronic kidney disease (CKD) and increased risk of cardiovascular disease (CVD) is well established. Relationships of carotid intima-media thickness (CIMT) as a measure of subclinical atherosclerosis in CKD patients is a matter of debate. Current research aimed to study the role of CIMT in CKD patients and its association with the CKD staging.

Material and Methods: Hundred CKD patients were studied and compared with 50 subjects without CKD in the Department of Medicine, G.R. Medical College & J.A. Group of Hospitals, Gwalior (M.P.) India. GFR was determined by MDRD (Modification of diet in renal study) equation. Study populations were subjected for high resolution B - mode Carotid ultrasonography.

Results: In case group, majority were males (68%) having age between 30-60 years (62%). Majority had stage V CKD (67%), 21% had stage III and 14% had stage IV CKD. Majority of the cases had CIMT between 0.9-1.0 mm (42%) followed by 0.7-0.8 mm (17%) as compared to 0.5-0.6 mm (42%) in control. Mean CIMT was significantly higher in cases (0.87±0.24) as compared to control (0.61±0.34) group ($p<0.001$). No significant difference in mean CIMT was found between different stages of CKD ($p=0.649$).

Conclusion: CKD patients have significantly more carotid arterial wall thickness in comparison to age matched controls. The CIMT does not differ in different stages of CKD.

Keywords: Atherosclerosis, chronic kidney disease, ultrasonography, cardiovascular disease

INTRODUCTION

There are no national or regional reports on incidence or prevalence of either CKD or end stage renal disease.[1,2] In a country with over 1.21 billion people, a number of ethnicities, widely divergent socio economic strata, rural-urban divide, different food habits and varying pattern of infections, the spectrum of CKD may not be uniform in terms of etiologies, patient demographics and clinical presentation. Lack of access to healthcare services, especially in the rural areas prevents diagnosis of CKD.[3]

Diabetic nephropathy is the commonest cause of CKD in all geographical areas. About half of case present in stage V with the remaining in decreasing order of frequency in lower stages.[4]

CIMT is commonly used as a surrogate end point in research trials as a marker of atherosclerosis.[5] More important from a clinical perspective, CIMT has been shown to correlate with cardiac risk factors,[6] to improve with therapy of known benefit in preventing atherosclerotic events,and to be an independent predictor of future myocardial infarction and stroke risk.[7]

Both the American Heart Association and the National Cholesterol Education Program, Third Adult Treatment Panel report, i.e. ATP III have encouraged the clinical use of CIMT, but with a caution that the procedure be done with accuracy and reliability. In present study we tried to evaluate the role of CIMT in CKD patients and its association with the CKD staging.

MATERIAL AND METHODS

The present study was conducted on 100 CKD patients in the Department of Medicine, G.R. Medical College & J.A. Group of Hospitals, Gwalior (M.P.) India. For comparison 50 subjects without CKD were enrolled.

Patients suffering from chronic kidney disease of all etiologies were included. Patients suffering from acute kidney injury were excluded from present study. Persistent decrease in GFR <60ml/min/1.73m2 is determined by MDRD (Modification of diet in renal study) equation.

In all the cases written inform consent was obtained from each subjects and detailed clinical history including complaints, past history, personal history, family history were taken. All the selected patients were subjected to routine investigations like CBC, RBS, blood urea, serum creatinine, urine Routine and microscopy, serum billirubin, SGPT, USG abdomen, Lipid profile, and X-ray Chest.

GFR was calculated on the basis of age, gender, serum creatinine by computer generated MDRD equation.

Estimated GFR (ml/min./1.73m2) = 1.86 x (PCR)-1.154 x (Age) -0.203. Multiply by 0.742 for women

All patients of chronic kidney disease were subjected for high resolution B - mode Carotid ultrasonography. Bilateral

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CIMT (mm)	Case (n=100)	Control (n=50)
0.3 -0.4	3 (3%)	9 (18%)
0.5 – 0.6	16 (16%)	21 (42%)
0.7 – 0.8	17 (17%)	13 (26%)
0.9 – 1.0	42 (42%)	5 (10%)
1.1 – 1.2	16 (16%)	2 (4%)
1.3-1.4	6 (6%)	0 (0%)

Table-1: Distribution of patients according to CIMT

	Case (n=70)	Control (n=35)	P value
Mean CIMT	0.87±0.24	0.61±0.34	<0.0001

Table-2: Mean CIMT of Case and Controls

	CKD stages			
CIMT Value (mm)	Stage III (n=13)	Stage IV (n=11)	Stage V (n=46)	p value
	0.92 ±0.33	0.88 ± 0.20	0.84 ±0.45	0.649

Table-3: Mean CIMT with Respect to Staging

assessment of intimal thickness was done in common carotid artery and higher CIMT value of any of the carotid artery was taken.

Hypertension was defined as blood pressure > 140 mmHg systolic and/or > 90 mmHg diastolic. Dyslipidemia was defined as LDL cholesterol > 100 mg/dl or total cholesterol > 200 mg/dl or HDL in males < 40 mg/dl or HDL in females < 30 mg/dl, triglycerides level > 200 mg/dl or VLDL > 30 mg/dl.

STATISTICAL ANALYSIS

Analysis was done using SPSS ver. 20 software, t test was applied to compare the CIMT of cases and controls. ANOVA was applied to compare the variability of CIMT in between different stages and different number of risk factors among the cases and controls.

RESULTS

Out of 100 patients included in the study majority were males (68%) followed by females (32%). Majority had age between 30- 60 years (62%). Among the 50 control subjects also, male preponderance (58%) was reported. Majority of the subjects in control group had age <60 years (65%).

Among the patients, majority had anemia (86%), oedema (66%) and decreased urine output (48%) as the most common complaints.

Most common co-morbidity among patients was hypertension (71%) followed by dyslipidemia (28%), 24% were diabetics and 14% were smokers. Among the control subjects, 58% had dyslipidemia, hypertension was present in 32%, 16% patients were diabetic and 32% were smokers.

Out of 100 patients, 67% of patients were in stage V CKD, 14% of patients were in stage IV CKD and 21% of patients were in stage III CKD. Majority of the cases had CIMT between 0.9-1.0 mm (42%) followed by 0.7-0.8 mm (17%) as compared to 0.5-0.6 mm (42%) in control (table-1).

DISCUSSION

Patients with Chronic Kidney Disease (CKD) are associated with increased morbidity, mortality, and increased healthcare expenditures as they are at high risk for developing cardiovascular disease (CVD). Carotid intimal medial thickness (CIMT) has been found to correlate with atherosclerosis which is a major risk factor of CVD.

In Case group, majority were males (68%) having age between 30-60 years (62%). In agreement to present study Hinderliter et al studied 198 subjects and reported that the mean age of the study participants was 61 ± 14 years, with a range of 18 – 89 years. In a similar study of Chhajed et al,[8] higher prevalence of CKD among males (n=39 out of 70) with a mean age of 44.5 years (range 20-75 years) was reported.[9]

In present study majority of patients had stage V CKD (67%), 21% had stage III and 14% had stage IV CKD. In the reports of Hinderliter et al nearly equal numbers had stage 3 (n = 86) and stage 4 (n = 88) CKD; 24 had stage 5 CKD. Kawamato et al[8] examined CIMT in 428 men and 582 women from a single center in Japan; 49% had stage 2 CKD, and 32% had stage 3 CKD.[10]

In the reports of Hinderliter et al diabetes (30%), hypertension (99%), and CVD (42%) were common comorbidities[8] which is in agreement to present study findings where most common co-morbidity among patients was hypertension (71%) followed by dyslipidemia (28%), 24% were diabetics and 14% were smokers.

Mean CIMT was significantly higher in Cases (0.87±0.24) as compared to Control (0.61±0.34) group (p<0.001) (table-2). Hinderliter et al studied 198 subjects and reported that the CIMT were significantly associated with clinical CVD and with other markers of subclinical CVD.[8] In agreement to present study findings CIMT was significantly increased in the patient group (CIMT 0.86 ± 0.21 mm compared with the control group (0.63 ± 0.17 mm). Adesun et al demonstrated that IMT was a predictor of self-reported CVD, with a c-statistic of 0.64, in an ancillary study of the chronic renal insufficiency cohort (CRIC).[11] Szeto et al followed 203 Chinese patients with stage 3 or 4 CKD for an average of 52

months and reported similar findings.[12] Kuswardhani et al did a cross-sectional study enrolling 68 subjects (41 men, 27 women) on mHD reported that subjects with CVD had higher CIMT values than those without CVD (0.7288±0.1152 mm vs 0.6494±0.1272, P=0.026).[13] CIMT has been found to be higher in patients with end-stage renal disease than in healthy controls.[14]

In present study no significant difference in mean CIMT was found between different stages of CKD (p=0.649) (table-3). In agreement to present study findings Chhajed et al found that mean CIMT did not directly correlate with eGFR (r = -0130, *P* <0.283).[9] Preston et al[15] reported that patients with stage 3 to 4 CKD had increased CIMT compared with normotensive volunteers. Lu Xia Zhang et al,[16] in their study on stage 2-3 CKD patients (i.e., mild and moderate renal insufficiency), found significantly increased CIMT in these patients and concluded that arterial change might occur in the course of CKD earlier than previously believed.

Cross sectional nature and small sample size were the main limitations of the study; a large randomized clinical trial is needed to provide strength to present study findings.

CONCLUSION

CKD patients are at high risk of developing the cardiovascular complications. Increased cardiovascular risk can be determined by measuring the carotid arterial wall thickness. So, a clinician should advise the CKD patients for serial measurement of CIMT so that cardiovascular complication risk can be assessed. CKD patients have significantly more carotid arterial wall thickness in comparison to age matched controls. The CIMT does not differ in different stages of CKD.

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