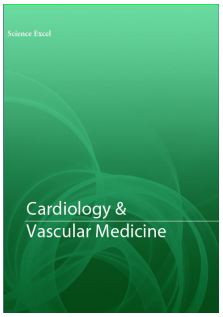
Cardiology and Vascular Medicine

Original Article



Role of albumin creatinine ratio in predicting of coronary artery disease

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Ischemic heart disease, micro albuminuria

Abstract

The present study was done to investigate the association between the level of micro albuminuria and the severity of coronary artery disease angiographically.
The study is conducted on 70 patients who underwent coronary angiography in many cardiac centres (NHI, PAMCC) in National heart Institute and Arar cardiac centre Saudi Arabia.
The population study was divided into 2 groups according to micro albuminuria.
Group (I) include 46 patients with angiographic evidence of coronary heart disease and without micro albuminuria.
Group (II) include 24 patients with angiographic evidence of coronary heart disease and having micro albuminuria.
Patients are subjected to full medical history, through physical examination. 12 lead ECG, fasting blood sugar, Lipid profile, blood urea and serum creatinine levels are obtained.
Urinary albumin was measured by Stanbio Total Protein LiquiColor based on the procedure developed by Watanabe et al. Creatinine was measured by creatinine jaffe`reaction.. The ratio of urine albumin to creatinine (ACR) was used to define microalbiminuria .The upper normal limit is 30 mg/g.
Conventional Echo Doppler study using (Vivid 7, General Electric-Vingmed) was done to assess EF%.
A diagnostic coronary angiogram was performed to assess the severity of CAD according to number of vessels affected and Gensini score estimation.
Our study group comprised 70 patients; 56% were men and 44% women;
64% of them were hypertensive, 68% of them were dyslipidemics, 58 of them were smokers, 43% of them were with high BMI and 48% of them have a positive family history of CHD. The mean age was 58.850 ± 11.949 years (ranges from 33 to 81 years).
As per Cath Results; 36% CA results were normal, 38% CA results had a one vessel disease and 26% CA results had multivessel disease.
For Albumin Creatinine ration 60% had normal results and 40% had abnormal albumin creatinine ratio; of those with high ALB/CR ratio 42% of them had a one vessel disease and 58% of them had multivessel disease.
It is also found that micro albuminuria is productive for CAD independently with other risk factors
It seems that micro albuminuria increase severity and number of CAD lesions and aggressive treatment of micro albuminuria may beneficial in CAD patients

Introduction

Coronary artery disease (CAD) is a major cause of death and disability in both developed & developing countries Atherosclerosis is responsible for almost all cases of CAD. Coronary artery disease is a multifactorial disorder with several different risk factors. Advancing age, male sex, hypertension, diabetes mellitus, cigarette smoking and dyslipidemia are the major and independent well known risk factors or CAD [1]. However, these risk factors do not entirely explain the variation in cardiovascular disease incidence and mortality between individuals and among populations. Therefore, additional risk factors have been proposed to better identify patients who are potentially at risk of CAD. Many individual biomarkers have been related to cardiovascular risk, including levels of high sensitivity CRP (C-reactive protein) B-type natriuretic peptide (BNP) fibrinogen, D-dimer and homocysteine [2]. Among these new biomarkers is microalbuminuria (MA), which is gaining recognition as a marker of an atherogenesis, owing to its association with several atherosclerotic risk factors and early systemic vascular endothelial damage [3]. An increasing number of studies in different patient populations have reported that MA is associated, independently of traditional risk factors, with all causes of cardiovascular morbidity and mortality in patients with diabetes, hypertension and in the general population [4].

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Although a 24-hours urine collection is the gold standard for the detection of microalbuminuria [5].

Urinary albumin to creatinine ratio gives a quantitative result that correlates with the 24-hour urine values over a wide range of protein excretion, it is cheap to perform, and repeat values can be easily obtained to ascertain that microalbuminuria [6].

Patients and methods

Patients were included in this cross sectional study; the patients were without history of known CAD and will undergo their first coronary angiography for suspected ischemia.

Inclusion criteria

All the selected patients will have:

Angina or angina like chest pain and evidence of ischemia (ischemic ECG changes, positive stress test or other noninvasive tests)

Exclusion criteria

1. Frank diabetic patients according the following criteria:

- Fasting blood glucose >126mg/dl

2. hour post-prandial blood glucose >200mg/dl

- Hemoglobin A1c >6.5mg/dl. (According to American diabetic association, 2010)
- Hemoglobin <11 mg/dl
- Concomitant systemic disease such as autoimmune disease, cancer or active infection or previous know renal disease (Nephrotic syndrome)

Methods

Patients will be subjected to the following:

1. Detailed history taking.
2. Thorough clinical evaluation.
3. A spot morning urine samples were taken for detection of microalbuminuria by Immuno turbidimitric method and micro- albuminuria were diagnosed if urinary albumin / creatinine ratio 30 - 300 mg/gm.
4. 12 lead resting ECG.
5. Routine Laboratory testing will include:
    - Fasting blood sugar
    - Serum creatinine and blood urea
    - Liver enzymes
    - Lipid profile
6. Elective coronary angiography to detect coronary lesions and extent

Albumin Creatinine ratio in relation to IHD

Defects in the glomerular capillary endothelium, basement membrane or podocytes are manifested as proteinuria. The proteins, hormones, growth factors (insulin-like growth factor), lipoproteins and transferrin that leak into the urinary space and flow to the tubules have been postulated to cause tubulointerstitial injury and inflammation [7]. Eventually, this injury pathway leads to parenchymal damage, renal fibrosis and progressive decline in eGFR [8]. This mechanism partly explains the specific association between proteinuria and progression to ESRD and death related to renal disease, and suggests that the protein in the urinary space is a potential renoprotective treatment target.

Table 1. Demographic data of studied groups between CAD and micro albuminuria

Descriptive Statistics		
	Range	**Mean**
Age	33 - 81	58.85 ± 11.949
Renal Cr	0.4 - 1.3	0.842 ± 0.222
Cath Result %	30 - 90	69.565 ± 18.21
Alb/CR ratio	302 - 1000	464.625 ± 169.469
GENSINI	0 - 72	20.95 ± 29.145

Table 2. Number of CAD between studied groups

Cath Result		
	N	%
Normal	24	36.67
One vessel	26	38.33
Multi vessel	20	25.00
Total	70	100.00

Table 3. Comparison of Coronary Artery disease between studied groups

Cath Result		
	N	%
Normal	24	36.67
LAD	14	20.00
LCX	6	8.33
RCA	6	10.00
MVD	20	25.00
Total	70	100.00

Table 4. Comparison of number of diseased vessels (extent of CAD) between study groups

Cath Result	Alb/CR ratio						Chi-Square	
	Normal		High		Total			
	N	%	N	%	N	%	X^2	P-value
Normal	23	61.11	0	0.00	26	36.67	32.560	<0.001*
One vessel	14	36.11	14	41.67	24	38.33		
Multi vessel	2	2.78	17	58.33	20	25.00		
Total	39	100.00	31	100.00	70	100.00		

Table 5. Number of diseased vessels (extent of CAD) between study groups

Cath Result	Alb/CR ratio						Chi-Square	
	Normal		High		Total			
	N	%	N	%	N	%	X^2	P-value
Normal	24	61.11	0	0.00	24	36.67	33.403	<0.001*
LAD	9	19.44	5	20.83	14	20.00		
LCX	3	5.56	4	12.50	7	8.33		
RCA	6	11.11	3	8.33	8	10.00		
MVD	1	2.78	15	58.33	17	25.00		
Total	43	100.00	27	100.00	70	100.00		

Table 6. Coronary Artery disease in relation to Alb/CR , 38% CA results had a one vessel disease

Cath Result	Alb/CR ratio		T-Test	
	Range	Mean ± SD	t	P-value
One vessel	302 -581	358.3 ± 84.312	-3.022	0.006*

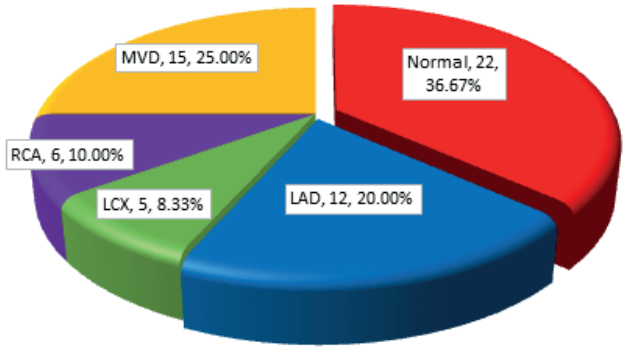

Figure 1. Severity of Coronary Artery disease in studied groups

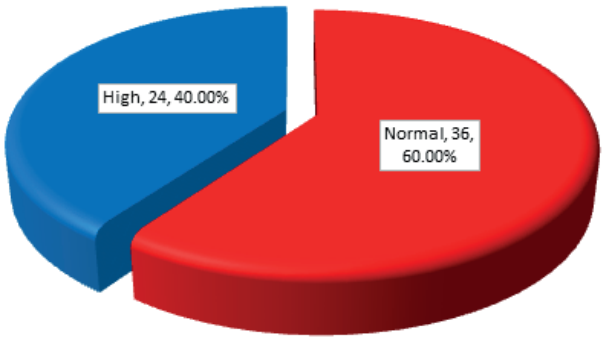

Figure 2. Frequency of micro albuminuria among the studied groups, Albumin Creatinine ration 60% had normal results and 40% had abnormal Albumin Creatinine ratio

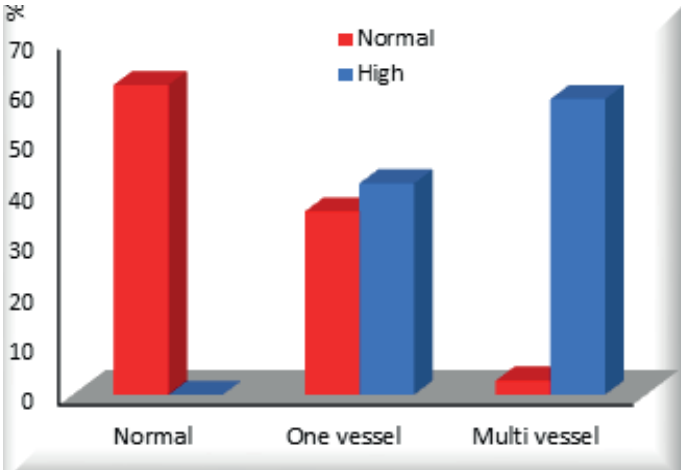

Figure 3. Number of diseased vessels with micro albuminuria 36% CA results were normal , 38% CA results had a one vessel disease and 26% CA results had multivessel disease.

Here, notably, the described mechanistic links only represent associations: they are not yet coupled with definitive data that shows a causal relationship. Indeed, patients with CKD and with eGFR <60 ml/min/1.73 m2 often have proteinuria and much of the evidence for mechanisms described in this section was found in patients with reduced renal filtration function. Numerous pathways in CKD—including extracellular fluid volume overload, hypertension, abnormal calcium and phosphorus metabolism resulting in vascular calcification, endothelial dysfunction, systemic inflammation, oxidative stress and activation of sympathetic system and renin–angiotensin–aldosterone system (RAAS)—have been implicated to increase CVD risk [9].

Table 7. Impact of Alb/CR on coronary Artery disease , prevalence of two and three vessels disease increased in patients with micro albuminuria

Cath Result	Alb/CR ratio		ANOVA		
	Range	Mean	F	P-value	
LAD	302 - 350	320.4 ± 18.188	3.117	0.049*	
LCX	310 - 581	413.667 ± 146.289			
RCA	330 - 410	370 ± 56.569			
MVD	360 - 1000	540.571 ± 176.02			
TUKEY'S Test					
LAD& LCX	LAD& RCA	LAD& MVD	LCX& RCA	LCX& MVD	RCA& MVD
0.829	0.978	0.048*	0.988	0.556	0.454

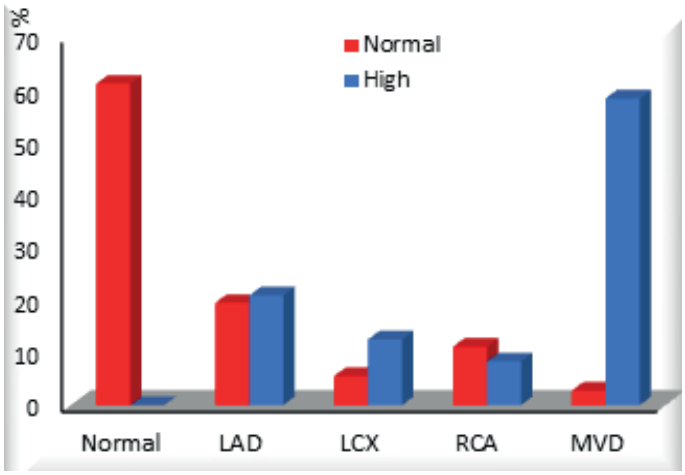

Figure 4. Comparison between coronary Artery disease in studied groups

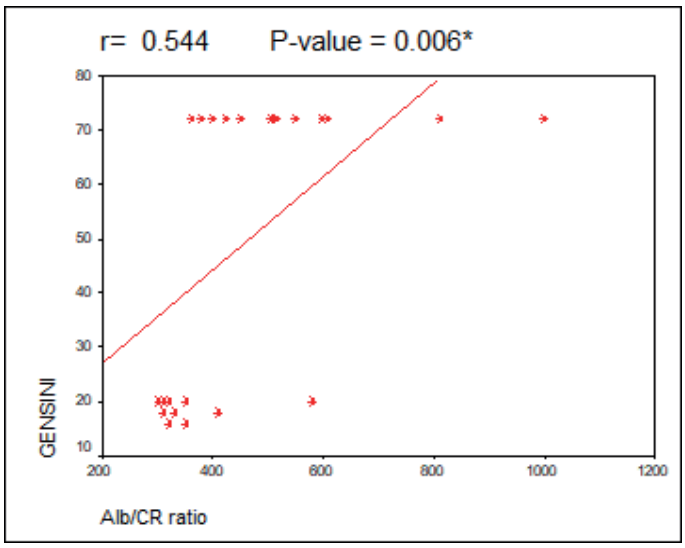

Figure 5. Role of Alb/CR in Predicting CAD).Group I :patients had this ratio < 30mg/g and group II :patients had it > 30 mg/g.

Table 8. Comparison of Alb/CR with Gensini

Correlations		
	Alb/CR ratio	
	r	P-value
GENSINI	0.544	0.006*

Hypertension

Proteinuria is also associated with hypertension—an established cardiovascular risk factor. A study of patients with CKD (creatinine clearance <70 ml/min) in a renal clinic revealed a high prevalence of blood pressure >140/90 mmHg (60.5%), and the degree of proteinuria was found to be a significant determinant of the presence of hypertension in the study population [10]. Proteinuria is also a predictor for future development of hyper tension among normotensive individuals [11]. A cross-sectional study of 232 veterans affairs patients with CKD (eGFR <90 ml/min/1.73 m2) showed degree of proteinuria to be the most significant correlate for systolic blood pressure [12]. Furthermore, increased arterial stiffness, as assessed by pulse wave velocity, was shown to be associated with presence of dipstick-positive proteinuria, creatinine clearance and systolic blood pressure in the general population of Okinawa, Japan (n = 3,387) [13].

Targeting the RAAS with ACEIs or angiotensin II receptor blockers (ARBs) is an effective strategy to reduce proteinuria

Improvement in CVD outcomes with RAAS blockers, however, is limited. In the RENAAL trial, 1,513 patients with type 2 diabetes and nephropathy (serum creatinine 1.3–3.0 mg/dl) were randomly assigned to receive treatment with losartan or placebo for 3.4 years [14]; morbidity and mortality from cardiovascular causes was similar in both groups, though the rate of first hospitalization for heart failure was significantly lower in the losartan group (11.9%) than in the placebo group (16.7%, P = 0.005). A posthoc analysis from the RENAAL trial showed that proteinuria reduction by 30% or more after 6 months of losartan was associated with significant adjusted relative risk reductions of 49%, 23% and 34% over the length of the study for heart failure, non-heart-failure CVD and composite CVD end points, respectively, compared with no proteinuria reduction (Figure 2) [15]. Every 50% reduction in proteinuria reduced the risk for heart failure and CVD end points by 27% and 18%, respectively [16]. Given the variability in proteinuria measurements, however, it is also possible that a 30% or greater reduction in proteinuria is in part a result of regression to the mean. Furthermore, results of posthoc analyzes are well known to be far from definitive.

Coronary Artery Calcification

Coronary artery calcification, as assessed by electron beam CT and cardiac CT angiography, identifies subclinical atherosclerotic plaque burden in all layers of the vessel wall, but its reliability in patients with CKD is inadequate [17,18]. In the Pittsburgh epidemiology of Diabetic Complications cohort of 302 adults with type 1 diabetes, patients with coronary artery calcification score >400 had significantly greater prevalence of diabetic CKD (proteinuria >200 μg/min or serum creatinine >2 mg/dl) [19]. In another study of 122 patients with type 2 diabetes (including patients with microalbuminuria and macro albuminuria), log albumin:creatinine ratio was a significant predictor of the extent of coronary artery calcification [20]. A cross-sectional study that compared coronary artery calcification in 90 patients with diabetic nephropathy (urine protein:creatinine ratio >0.5 g/g), with 30 patients with diabetes and normoalbuminuria, found a greater prevalence of calcification (93% versus 63%, P <0.001), as well as an increased degree of calcification (calcification score 66 versus 4, P <0.001), in patients with proteinuria. Though the mean eGFR was 39 ± 4 ml/min/1.73 m^2 among patients with diabetic nephropathy, no difference in the presence or extent of calcification across the various CKD stages was noted. Interestingly, greater coronary artery calcification score in patients with diabetic nephropathy was associated with the presence of severe hypertension (as studied by the number of antihypertensive medications used), female gender and age <60 years, which suggests that these factors further accelerate coronary calcification in patients with diabetic nephropathy [21].

Hyperlipidaemia

Hyperlipidemia is another risk factor for increased cardiovascular mortality, and an abnormal lipid profile is commonly observed in individuals with proteinuria. Among individuals with proteinuria, the prevalence of total cholesterol >6.22 mmol/l (240 mg/dl), LDL >3.37 mmol/l (130 mg/dl), HDL <0.91 mmol/l (35 mg/dl), and triglyceride >2.26 mmol/l (200 mg/dl) has been reported to be 88%, 86%, 62%, 62%, respectively [22]. In addition, lipoprotein (a), a prothrombotic protein attached to apolipoprotein B100 on LDL particles, has been reported to be elevated (>1.07 μmol/l [30 mg/dl]) in 60% of patients with proteinuria [23]. In general, the severity of the dyslipidemia correlates with the severity of proteinuria [24].

Some small studies have shown reduction in proteinuria with statin therapy over a limited follow-up period, although others have not. Furthermore, clear evidence for improved CVD and CKD outcomes with use of statins in patients with proteinuria is lacking. In a prospective, double-blind study of 63 patients with proteinuria (with serum creatinine <1.5 mg/dl), normolipemia (total cholesterol <6.22 mmol/l) and controlled hypertension (<140/90 mmHg), participants were randomly assigned to treatment with pravastatin or placebo [25]; after 6 months of treatment, patients on statin therapy demonstrated reduced proteinuria that correlated with reduction in urinary endothelin 1, but not with change in lipid profile, and creatinine clearance remained stable. In a similar study, the research group reported further improvement in proteinuria in patients on statins and losartan therapy, which was lost with withdrawal of statin [26]. Another prospective, controlled, open-label study in 56 patients with proteinuria (secondary to idiopathic glomerulo nephritis, baseline creatinine clearance 50 ml/min) and hyperlipidemia, demonstrated significant proteinuria reduction and slower decline in creatinine clearance with atorvastatin after one year of ACEI–ARB antihypertensive therapy [27]. However, these effects on albuminuria and GFR were not seen in three other studies, which included 26 patients with type 1 diabetes with nephropathy who were treated with simvastatin [28], 30 adults with nephrotic syndrome or proteinuria >1 g daily who were randomly assigned to simvastatin or placebo [29], and, despite improvement in hyperlipidemia, in 10 patients with nephrotic syndrome who were treated with simvastatin and cholestyramine [30]. A meta-analysis of randomized, placebo-controlled trials of statins in patients with CKD (presence of proteinuria or eGFR <60 ml/min/1.73 m2) showed an overall significant reduction in proteinuria (n = 311 patients, 6 studies), unchanged GFR, and an interesting significant reduction in CVD events [31].

Questions still remain as to whether there is a dose-dependent response of statin therapy on urine protein and if different statins cause varying beneficial effect on proteinuria. It is also unclear if the tubular proteinuria from reduced receptor mediated endocytosis at the proximal tubule observed with use of statin (rosuvastatin 80 mg daily) is injurious or protective to the kidney [32].

Nevertheless, the National Cholesterol Education Project Adult Treatment Panel 4 guideline recommendations on use of statins for goal LDL <1.81 mmol/l and non-HDL <2.59 mmol/l should be adhered to in patients with CKD (proteinuria or eGFR<60 ml/min/1.73 m^2) (Table 2). American Diabetic Association/ACC recommendations published in 200848 include a third lipid goal—an apolipoprotein B100 level <0.8 g/l—which addresses the problem of residual risk related to increases in LDL particle number in the setting of low HDL and high triglycerides.

Inflammation

Inflammatory biomarkers of vascular changes and endothelial dysfunction are being actively studied to define their role as markers of atherosclerotic burden, mediators of vascular damage, or both. C-reactive protein (CRP) is a large pentameric protein produced by the liver in response to adipokine signals from intra-abdominal fat stores; this protein is probably not pathogenic itself, but has been associated with impaired endothelial function [33]. CRP measured by high sensitivity CRP (hs-CRP) testing correlates with the degree of global cardiometabolic risk associated with adipose tissue [34]. Hs-CRP measures are elevated in asymptomatic patients with nephroticrange proteinuria and are associated with impaired microvascular endothelial function as assessed by acetylcholine iontophoresis [35]. Moreover, significant correlation between the severity of proteinuria and level of hs-CRP has been demonstrated [36]. Proteinuria is also associated with asymmetric dimethylarginine, another inflammatory biomarker that inhibits production of nitric oxide (NO), and thus causes endothelial dysfunction and atherosclerosis [37].

Thrombotic Mechanisms

Thrombogenic factors and blood viscosity might predict CVD events in patients with proteinuria. In a prospective study of 328 individuals, von Willebrand factor, tissue type plasminogen activator, soluble vascular cell adhesion molecule, soluble eselectin and fibrinogen were found to correlate with increased urinary albumin excretion [38]. Plasma prekallikrein, a modulator of vascular tone and structure, was found to be high in patients with diabetes with macroalbuminuria [39]. Monocyte chemoattractant protein 1, a chemokine that recruits monocytes into atherosclerotic plaques and produces a local inflammatory response, was also found to be elevated in patients with diabetes with macroalbuminuria [40]. Finally, elevated factor VII, plasminogen activator inhibitor type 1, platelet adhesiveness, and erythrocyte aggregability in patients with diabetes and proteinuria [41,42] could be indicative of high thrombosis risk in the setting of plaque rupture, and the development of thrombi as a result of stasis in the arterial system.

Endothelial Dysfunction and Nitric Oxide

Proteinuria might reflect not only renal injury but also a systemic increase in endothelial permeability, though clear evidence

is lacking for this hypothesis. The vascular endothelium has an important role in regulating transport of proteins across microvascular walls through intercellular clefts [43], transcellular holes [44], and possibly, caveolae [45]. Endothelial dysfunction is an attractive mechanism that might link proteinuria with the pathogenesis of atherosclerosis, as endothelial dysfunction, in response to sheer stress and the deposition of lipoproteins in the subendothelial space, is an early event in atherogenesis and is hypothesized to accelerate atherosclerotic plaque formation [46]. Increased transvascular leakage as a result of endothelial permeability could allow the gradient-dependent entry of apolipoprotein B100 containing lipoproteins into the vessel wall, where they would become trapped. In addition, injury to the endothelium results in increased cell and platelet adhesiveness, greater permeability to proteins and inflammatory cells, and altered production of vasoactive mediators, specifically NO.

Against the hypothesis that proteinuria is a marker of increased systemic permeability, transcapillary escape rate of albumin was observed to be increased among patients with diabetes, compared with control participants, to a similar extent in patients with and without proteinuria (urine albumin >300 mg/day) [47]. However, macrovascular endothelial function, as assessed by flow-associated dilation, has been shown to be impaired in individuals with nephroticrange proteinuria [48]. This process is thought to occur though the loss of vasoregulatory effects of NO. In addition to maintaining vasodilatory tone, NO also prevents platelet adhesion and aggregation, inhibits vascular smooth muscle proliferation and leukocyte adhesion, antagonizes lipoprotein flux into the subendothelium, and attenuates the oxidative modification of the trapped cholesterol. Indeed, decreased NO activity in individuals with nephrotic syndrome is thought to be responsible for their atherosclerosis [49].

Nephrotic range proteinuria is associated with deranged NO activity through indirect mechanisms. Dyslipidemia is commonly seen in individuals with nephrotic syndrome, and increases in very low-density lipoprotein, and LDL is believed to further worsen NO-mediated vasodilation (endothelial dysfunction) [50]. An interesting hypothesis to explain this link involves lysophosphatidylcholine. In patients with nephrotic syndrome, abnormally low serum albumin levels results in diminished binding of lysophosphatidylcholine to albumin, thus leading to sequestration and increased levels of lysophosphatidylcholine in LDL cholesterol [51]. The lysophosphatidylcholine probably affects endothelial function through NO dependent and independent pathways, in addition to its proinflammatory and oxidative effects [52]. There is a lack of evidence for endothelial dysfunction in patients with milder degree of proteinuria, but it is possible that the aforementioned mechanism occurs in nonnephrotic proteinuria.

Vascular Endothelial Growth Factor

Another interesting potential mechanism that links proteinuria and hypertension is being studied in patients receiving vascular endothelial growth factor (VEGF) inhibitors for treatment of cancer. In a meta-analysis of 7 trials (1,850 patients), use of a VEGF antagonist (bevacizumab) was associated with an increased incidence of proteinuria and hypertension [53]. These adverse effects were reversed when the anti-VEGF therapy was stopped [54]. The pathogenesis of proteinuria that results from VEGF antagonism is not clear, but endothelial dysfunction is a potential cause. VEGF is expressed by the podocytes and is important in glomerular development (angiogenesis), maintenance of endothelial function and endothelial repair after injury [55]. Increased hemodynamic stress from the associated hypertension might also be implicated in the proteinuria. Studies have not assessed whether anti-VEGF-associated endothelial dysfunction occurs only at the glomerular level, or also at a systemic level to result in increased atherosclerosis and cardiovascular risk.

Results

Our study group comprised 70 patients; 56% were men and 44% women; 64% of them were hypertensive, 68% of them were dyslipidemics, 58 of them were smokers, 43% of them were with high BMI and 48% of them have a positive family history of CHD. The mean age was 58.850 ± 11.949 years (ranges from 33 to 81 years).

As per Cath results; 36% CA results were normal, 38% CA results had a one vessel disease and 26% CA results had multivessel disease.

For Albumin Creatinine ration 60% had normal results and 40% had abnormal Albumin Creatinine ratio; Of those with high ALB/CR ratio 42% of them had a one vessel disease and 58% of them had multivessel disease.

Discussion

The risk of coronary artery diseases (CAD) is predicted by traditional risk factors including age, sex, smoking, diabetes mellitus, hypertension and dyslipidemia. However, these factors don't entirely explain the variation of CAD incidence and mortality in individuals and populations [1].

This fact has led to studies on non-traditional cardiovascular risk factors and reside concentration of urinary albumin is one of these factors. albuminuria is predictive, independent of classical risk factors of cardiovascular diseases and is associated with all–cause mortality and cardiovascular morbidity and mortality in patients with Diabetes, hypertension and in the general population [2].

Despite the assisociation between albuminuria and cardiovascular events is well described ,few studies had examined the correlation of angiographic severity of CAD with microalbuminuria. So, the purpose of this study is to investigate relationship between microalbuminuria and presence and extent of coronary artery disease . Urinary albumin to creatinine ratio does not require early morning or timed collections, it gives a quantitative result that correlates with the 24-hour urine values over a wide range of protein excretion, it is cheap to perform, and repeat values can be easily obtained to ascertain that microalbuminuria, if present, is persistent [6].

In the present study the albumin/ creatinine ratio (ACR) was estimated in 70 patients with angiographically- evident CAD to show if there is any correlation between microalbuminuria and severity of CAD.

Patients with diabetes , renal failure , heart failure , liver insufficiency and anaemic patients were excluded .

Urinary albumin was measured by Stanbio Total Protein LiquiColor based on the procedure developed by [27]. Creatinine was measured by creatinine jaffe`reaction [28]. The ratio of urine albumin to creatinine (ACR) was used to define microalbiminuria .The upper normal limit is 30 mg/g [51].

In addition , patients were evaluated as regard to presence of coronary risk factors , echocardiographic (EF), extent of CAD (number of vessels affected and Gensini score)

The studied population were classified into two groups according to the presence of abnormal ACR (>30mg/g). Group I: patients had this ratio < 30mg/g and Group II: patients had it > 30 mg/g.

In the present study, about one third of studied patients had abnormal ACR (group II), while the other two-third had their ratio normal (Group I). Group I included 36 patients (60%) and Group II 24 patients (40%) (Figure 7).

This was concordant with that reported by Parsa et al., [33] who enrolled 77 patients,16 patients (21 %) had microalbuminuria and

61 (79%) of patients were normal regarding microalbuminuria .

Also, concordant with the results of the present study, Hashim et al., [20] found that 37% of their ischemic heart patients, had microalbuminuria and 63% had normoalbuminuria .

On the other hand Parvizi et al., [35] studied 228 ischemic heart patients and found that the level of albumin in all the studied patients was >300mg/24h. The cause of the discrepancy between the results of the present study and later study may attributed to different no. of patients studied, different methods of evaluation or the different types of population studies.

The present study showed that 23 patients (38%) had only one vessel affected and 15 patients (25%) had two or more vessels affected and remaining 32 patients showed a normal CA (36%).

Those with normal ALB/CR ratio were 36 patients (60%) and Abnormal ALB/CR ratio were 24 patients (40%)

Similar results were exhibited by Sukhija et al., [37] who found that the prevalence of two and three vessels disease increased in patients with micro albuminuria compared with the controls independent of other risk factors (p value <0.001).

Another study performed by Aziz et al., [21] who found that patients with MA had much greater atherosclerotic burden in the form of multi-vessel CAD than those without, triple-vessel CAD was present in 8 of 12 patients (66.6%) with MA and in 4 of 12 patients without MA (33.3%), double-vessel CAD was found in 36 of 48 patients (75%) in the group with MA and in 12 of 48 Patients (25%) without MA.

Finally, Parvizi, et al., [35] who studied 228 patients, all of them had albumin level >300mg/24h, found that 114 patients with two diseased vessels and 114 patients with three diseased vessels.

Conclusion

About one-third of patients with angiographically evident CAD, have microalbuminuria. This group of patients were found to have more severe coronary artery disease compared to those with normal albumin excertion.

The albumin/creatinine ratio is an independent risk factor for presence and severity of CAD in this study. Larger studies involving multicentre and a large number of patients are needed to confirm these results and to consider this ratio among coronary risk factors.

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