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Comparative Study of Urine Albumin Creatinine Ratio v/s Intima Media Thickening as a Marker of Atherogenicity in Ischaemic Heart Diseases

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Abstract: ***This study was done to detect better marker of atheroginicity among urine albumin creatinine ratio & carotid intima media thickening in ischaemic heart disease. Albumin creatinine ratio outcome has more correlation with comorbidities that exist with ischaemic heart disease like diabetes mellitus& hypertension which themselves can cause albumin excretion by causing nephropathy. Intima media thickness has direct association more with the progress of atherogenesis when comorbidities exist.***

Keywords: Albumin creatinine ratio, Intima media thickness, Ischaemic heart disease, atheroginicity

1. Introduction

Atherosclerosis is the main cause of myocardial infarction that is causing more & more deaths over the period. This study intends to detect if there is any relationship that exists between two different markers of atherogenicity viz.

1) Carotid intima media thickness (IMT)
2) Urine microalbumin : creatinine ratio (ACR)

Ischaemic heart disease is the most common cause of death in the world[1]. In India, ischaemic heart disease has become a leading cause of death, by 2004 accounting to 1.46 million deaths & is expected to double by 2015[2] .Limitation of blood flow to the heart causes ischaemia (cell starvation secondary to a lack of oxygen) of the myocardial cells. Myocardial cells may die from lack of oxygen and this leads to ischaemic heart disease. There are certain predisposing factors like hypercholesterolemia, smoking, alcoholism, hypertension etc. Ischaemic heart disease may present as stable angina, unstable angina, acute coronary syndrome, myocardial infarction etc.[3]

Microalbuminuria i.e albumin: creatinine ratio(albumin creatinine ratio 30 to 300 mg/lit) is an independent predictor of cardiovascular disease[4, 5]. Detecting microalbuminuria is an important screening tool to identify people who are at the risk of cardiovascular events & who needs more intensive therapy compared with subjects having normal albumin excretion rates[6]. According to American Diabetic Association the gold standard for measuring urine microalbumin excretion is 24 hours urinary collection[7]. However, a more convenient method to detect microalbuminuria is urine albumin (mcg): creatinine(mg) ratio (albumin creatinine ratio) measured in random sample[6].

Currently the National Kidney foundation recommends the use of spot urine albumin creatinine ratio obtained under standardized conditions (first voided, morning, midstream sample) to detect microalbuminuria. Albumin creatinine ratio is acquired by this technique for our study.

Intima media thickness (IMT) is measurement of thickness of tunica media & tunica intima, the innermost two layers of arterial wall. The measurement is usually made by external Doppler & occasionally by internal,invasive ultrasound catheters. Carotid intima media thickness is strongly associated with atherosclerosis. Intimal thickening is a complex process; depending on a variety of factors including local hemodynamics, blood pressure etc. intima media thickness greater than 0.9 mm is almost certainly indicative of atherosclerosis & increased risk of cardiovascular disease[6] .The carotid artery is the usual site of measurement of intima media thickness& the American Society of Echocardiography published a consensus statement on measurement of carotid intima media thickness in 2007 [8].Key advantages of external ultrasound method are

1) Low cost
2) Comfortable & convenient for patient
3) Lack of invasive methods
4) Lack of radiation.

Intima media thickness & albumin: creatinine ratio have been studied in past as markers of atherogenicity in various diseases like diabetes mellitus , smokers, renal failure, hypertension etc. However superiority of one technique over other in already established pathologies like proven ischaemic heart disease & myocardial infarction have not been studied. Hence present study is undertaken.

2. Aims & Objectives

- To record & analyse the presence of Micro albuminuria (Albumin: creatinine ratio> 30 ug/mg) as a measure of atherogenicity in patient of ischaemic heart disease.
- To record & analyse the presence of intima media thickening using carotid doppler study as a measure of atherogenicity in patients of ischaemic heart disease.
- To correlate the observed values of carotid intima media thickening with presence of albumin: creatinine ratio in studied subjects.

3. Methods & Material

Type of study – Case control study
In present study 231 subjects were studied & these were divided in following three groups

Case Group: Patients of ischaemic heart disease. (n = 106)
Control Group I: Patients having hypertension, diabetes, alcoholism, obesity, dyslipidemia without evidence of ischaemic heart disease were considered as separate control group (n = 50)
Control Group II: Normal healthy individuals (n = 75)
Study Centre –
MGM medical college & hospital, Aurangabad, Maharashtra, India.

Inclusion Criteria

1) Case group : Subjects of ischaemic heart disease of age more than 18 years of both gender as per ECG[9], angiography[10] findings of ischaemic heart disease with or without diabetes, smoking, dyslipidemia, obesity, alcoholism etc. were included
2) Control group I : Subjects of age more than 18 years of both gender having associated co morbidities but without evidence of ischaemic heart disease
3) Control group II: Normal individuals of age more than 18 years & of both gender without evidence of ischaemic heart disease, diabetes mellitus, hypertension, dyslipidemia, alcoholism, smoking, obesity.

Exclusion Criteria
Patients of chronic renal failure were excluded from all 3 study groups.

Statistical Analysis
The collected data was compiled in MS excel sheet. For analysis of this data SPSS software (20th version) was used. The qualitative data was represented in form of frequency & percentiles & also it was shown on bar diagram. To check association between different study groups (Case group, control group I, control group II) with different parameters/ attributes the Chi-square test was applied.

The sensitivity, specificity, negative predictive value, positive predictive value was calculated for different parameters like albumin creatinine ratio&intima media thickness with Case group & control group I and Case group & control group II. The p value was checked at 5% level of significance.

All subjects were subjected to methods & examinations with special attention to following parameters –

1) Age (years)
2) Weight (kg)
3) Height (cm)
4) BMI (kg/m2)
5) BP (mm -Hg)
6) ECG
7) Micro – albuminuria – Creatinine ratio by immunoturbidimetry
8) Carotid doppler study
9) Lipid profile

4. Methodology

Carotid scan was done by using B mode ultrasound of GE volution with a duplex colour Doppler machine& an electric linear transducer having frequency of 13 MHz. A single specialist radiologist who had no idea about clinical data carried out all measurements. Scanning for carotid artery was done at 3 levels-

1) Common carotid artery 1cm proximal to the bulb.
2) Internal carotid artery 1cm distal to tip of the flow divider
3) Bifurcation bulb (distance of 1cm behind the tip of flow divider)

The intima media thickness was measured in mm as distance from leading echogenic line to second echogenic line.The first echogenic line represents the arterial lumen & second represents the collagen containing upper layer of tunica adventitia. For each patient measurement of both sides were taken.

Sensitivity of intima media thickness is 65% & specificity is 80%[11].

For the diagnosis of microalbuminuria, the morning, midstream sample was preferred. Patient was asked to refrain heavy exercises 24 hours prior to test. The morning, midstream sample was collected in sterile bulb.

Principles of the test –

- The microalbumin method (MALB) is based upon a particle enhanced turbidmetric inhibition immunoassay (PETINA) which allows direct quantification of albumin in urine sample.
- The MALB flex reagent cartridge contains a particulate reagent (PR) consisting of synthetic particles with human albumin bound to the surface.
- Aggregates of these particles are formed when a monoclonal antibody to human is introduced.
- Albumin present in the sample competes with the particles of the antibody thereby decreasing the rate of aggregation.
- Rate of aggregation is inversely proportional to the concentration of albumin in the sample.
- PR + Ab + Alb (sample) -----→ PR + Ab + Alb (sample)

Sensitivity of albumin creatinine ratio is 97% & specificity is 92%[12]

5. Observation and Results

This study was done in MGM Medical College, Aurangabad. The subjects were divided into three groups as follows.

Case Group: Patients of ischaemic heart disease. (n = 106)

Control Group I: Patients having hypertension, diabetes, alcoholism, obesity, dyslipidemia without evidence of ischaemic heart disease were considered as separate control group (n = 50)

Control Group II: Normal healthy individuals (n = 75)

Statistical analysis was done and data was represented in the form of various tables and bar diagrams.

Table 1: Table showing Subjects according to gender

Gender	Case Group	Control Group I	Control Group II	Total
Male	76 (71.7%)	20 (40.0%)	25 (33.3%)	121 (52.4%)
Female	30 (28.3%)	30 (60.0%)	50 (66.7%)	110 (47.6%)
Total	106 (100%)	50 (100%)	75 (100%)	231 (100%)

Table 2: Table showing Subjects according to Age –Groups & mean age:

Age-Group	Case Group n=106	Control Group I n=50	Control Group II n=75	Total
<30	02 (1.88%)	01 (2%)	00	03 (1.2%)
31-40	20 (18.8%)	10 (20%)	13 (17.33%)	43 (18.61%)
41-50	31 (29.34%)	16 (32%)	34 (45.33%)	81 (35.06%)
51-60	37 (34.9%)	12 (24%)	15 (20%)	64 (27.7%)
61-70	16 (15.09%)	09 (18%)	07 (9.33%)	33 (14.28%)
>70	00	02 (4%)	06 (8%)	08 (3.46%)
Total	106 (100%)	50 (100%)	75 (100%)	231 (100%)
Mean ± SD	50.59±10.41	50.36±11.72	50.64±11.20	50.55±10.93

Table 1&2 show age & sex distribution of subjects in the study. Case group included predominantly males from 51 to 60 age group. Control group I & II included predominantly females from 41 to 50 age group. The mean age of subjects from case group was 50.59±10.41 years, mean age of subjects from control group I was 50.36±11.72 years & mean age of subjects from control group II was 50.64±11.20 years. The overall mean age was 50.55±10.93 years. The male: female ratio in Case group was 2.53, in control group I was 0.66, in control group II was 0.5 & overall male: female ratio was 1.1

Table 3: Table showing Co-morbidities in 3 studied groups

		Case Group n=106	Control Group I	Control Group II	Chi-square value	p-value
Diabetes mellitus	Present	01 (0.94%)	03 (6%)	00	7.06	P=0.026 S
	Absent	105 (99.05%)	47 (94%)	75		
Hypertension	Present	30 (28.30%)	28 (56%)	00	51.1	P=0.000 S
	Absent	76 (71.69%)	22 (44%)	75		

Table 3 shows distribution of Co morbidities present in the groups were diabetes mellitus& hypertension, among which 1 (0.9%) subject from case group, 3 (6%) persons from control group I had diabetes mellitus. 30 (28.3%) subjects from case group & 28 (56%) subjects from control group I had hypertension. This suggests that hypertension was the most prevalent co morbidity in this study. Both diabetes mellitus& hypertension were found to be statistically significantly associated with different study groups.

Table 4: Table showing Family history of Co-morbidities in 3 studied groups:

		Case Group n=106	*Control Group I*	*Control Group II*	*Chi-square value*	*P-value*
Family History Diabetes mellitus	Present	46 (43.3%)	22 (44%)	21 (28%)	21.89	P=0.000 S
	Absent	60 (56.7%)	28 (56%)	54 (72%)		
Family History Hypertension	Present	25 (23.5%)	16 (32%)	08 (10.66%)	8.83	P=0.012 S
	Absent	81 (76.5%)	34 (68%)	67 (89.34%)		

Table 4 shows the presence of family histories of diabetes mellitus& hypertension in the subjects. 46 (43.3%) subjects from case group had family history of diabetes mellitus& 25 (23.5%) had that of hypertension. 22 (44%) subjects from control group I had family history of diabetes mellitus& 16 (32%) had that of hypertension. 21 (28%) subjects from control group II had family history of diabetes mellitus& 8 (10.66%) that of hypertension. Family histories for both diabetes mellitus& hypertension were statistically significant.

Table 5: Table showing Addictions in subjects in 3 studied groups

		Case Group n=106	*Control Group I*	*Control Group II*	*Chi-square value*	*P-value*
Addiction of Smoking	YES	48 (45.28%)	06 (12%)	04 (5.33%)	43.1	P=0.000 S
	No	58 (54.72%)	44 (88%)	71 (94.67%)		
Addiction of Alcohol	YES	22 (20.75%)	2 (4%)	1 (1.33%)	20.2	P=0.000 S
	No	84 (79.25%)	48 (96%)	74 (98.67%)		

Table 5 shows prevalence of addictions in study subjects. 48 (45.28%) subjects from case group had been found addicted to smoking & 22 (20.75%) were addicted to alcohol. 6 (12%) subjects from control group I were addicted to smoking & 2 (4%) to that of alcohol. 4 (5.33%) subjects from control group were addicted to smoking, whereas 1 (1.33%) was alcoholic from control group II. Both addictions namely smoking & alcoholism were statistically significant.

Table 6: Table showing distribution of Body Mass Index among 3 studied groups:

		Case Group n=106	Control Group I n=50	Control Group II n=75	Chi-square value	P-value
Body mass index	Normal	52 (49.05%)	21 (42%)	40 (53.33%)	4.53	P=0.339
	Overweight	46 (43.39%)	28 (56%)	32 (42.66%)		
	Obese	08 (7.5%)	01 (2%)	03 (4%)		

Table 6 shows BMI of subjects from various study groups. 52 (49.05%) subjects had normal BMI, 46 (43.39%) are overweight & 8 (7.5%) were obese from case group. 21 (42%) subjects had normal BMI, 28 (56%) were overweight & 1(2%) was obese from control group I. 40 (53.33%) subjects from case group had normal BMI, 32 (42.66%) were overweight & 3 (4%) were obese. The outcome of BMI was not significantly associated with study group.

Table 7: Table showing Lipid profile parameters in 3 studied groups:

		Case Group n=106	Control Group I n=50	Control Group II n=75	Chi-square value	P-value
Cholesterol	Normal	93 (87.73%)	49 (98%)	68 (90.66%)	4.34	P=0.114 NS
	Abnormal	13 (12.26%)	01 (2%)	07 (9.34%)		
Triglycerides	Normal	76 (71.69%)	38 (76%)	63 (84%)	3.72	P=0.155 NS
	Abnormal	30 (28.31%)	12 (24%)	12 (16%)		
High density lipoprotein	Normal	96 (90.56%)	47 (94%)	75 (100%)	7.38	P=0.025 S
	Abnormal	10 (9.44%)	03 (6%)	00		
Low density lipoprotein	Normal	104 (98.11%)	49 (98%)	75 (100%)	1.46	P=0.146 0.481
	Abnormal	02 (1.89%)	1 (2%)	00		

Table 7 shows parameters from lipid profile in various study groups. Among Parameters from lipid profile like cholesterol, HDL, LDL, triglycerides only the HDL was found to be statistically significant.10(9.44%) from case group, 03(6%) from control group I & none from control group II had abnormal HDL values.13 (12.26%) subjects from case group, 01 (2%) subjects from control group I, 07 (9.34%) subjects from control group II had raised cholesterol levels. 30 (28.31%) subjects from case group, 12 (24%) subjects from control group I, 12 (16%) subjects from control group II had raised triglyceride levels. 02 (1.89%) subjects from case group, 1 (2%) subjects from control group I & none from control group II had raised LDL levels.

Table 8: Table showing albumin creatinine ratio Outcome in 3 studied groups:

		Case Group n=106	Control Group I n=50	Control Group II n=75	Chi-square value	P-value
Albumin creatinine ratio	Positive	62 (58.49%)	07 (14%)	04 (5.33%)	66.6	P=0.000 S
	Negative	44 (41.59%)	43 (86%)	71 (94.67%)		

Table 8 shows albumin creatinine ratio outcome in various study groups. 62 (58.49%) individuals from case group had positive albumin: creatinine ratio (>30 mcg/mg), 7(14%) from control group I & 4 (5.33%) from control group II also had albumin creatinine ratio positive. This parameter was found to be statistically significant in current study.

Table 9: Table showing intima media thickness Outcome in 3 studied groups:

		Case Group n=106	Control Group I n=50	Control Group II n=75	Chi-square value	P-value
Intima Media thickness	Positive	36 (33.96%)	02 (4%)	05 (6.66%)	30.6	P=0.000 S
	Negative	70 (66.04%)	48 (96%)	70 (93.34%)		

Table 9 shows intima media thickness outcome in various study groups 36 (33.96%) individuals from case group had raised intima media thickness (>0.9mm), 2 (4%) from control group I & 5 (6.66%) from control group II also show raised intima media thickness. This parameter was found to be statistically significant in current study.

Sensitivity of albumin creatinine ratio among cases & control group I was 89.86% & specificity was 49.43% as per this study. Positive predictive value was 58.49% & negative predictive value was 86%. Sensitivity of albumin creatinine ratio among cases & control group II was 93.94% & specificity was 61.74% as per this study.

Positive predictive value was 58.49% & negative predictive value was 94.47%. Sensitivity of intima media thickness among cases & control group I was 94.78% & specificity was 40.68%.Positive predictive value was33.96% & negative predictive value was 96%. Sensitivity of intima media thickness among cases & control group II was 87.80% & specificity was 50%.Positive predictive value was33.96% & negative predictive value was93.33%.

Intima media thickness had more sensitivity (94.78%) & negative predictive value (96%); whereas albumin creatinine ratio had more specificity (49.43%) & positive predictive value (58.49%). After comparative analysis of statistical parameters among case group & control group II based on albumin creatinine ratio&intima media thickness outcomes.Albumin creatinine ratio had more sensitivity (93.94%), specificity (61.74%), positive predictive value (58.49%) & negative predictive value (94.47%).

6. Discussion

The present study was undertaken to evaluate the association between increased urinary albumin: creatinine ratio (ACR) & carotid intima media thickness (IMT) as marker of atheroginicity in patients of ischaemic heart disease. Ischaemic heart disease was diagnosed on the basis of electrocardiogram (ECG).

Ischaemic heart disease is the most common cause of death in the world[1]. In India, ischaemic heart disease has become a leading cause of death, by 2004 accounting to 1.46 million deaths & is expected to double by 2015[2] .Limitation of blood flow to the heart causes ischaemia (cell starvation secondary to a lack of oxygen) of the myocardial cells. Myocardial cells may die from lack of oxygen and this leads to ischaemic heart disease. There are certain predisposing factors like hypercholesterolemia, smoking, alcoholism, hypertension etc. Ischaemic heart disease may present as stable angina, unstable angina, acute coronary syndrome, myocardial infarction etc.

Microalbuminuria i.e albumin: creatinine ratio(ACR 30 to 300 mg/lit) is an independent predictor of cardiovascular disease [4,5]. Detecting microalbuminuria is an important screening tool to identify people who are at the risk of cardiovascular events & who needs more intensive therapy compared with subjects having normal albumin excretion rates[6]. According to American Diabetic Association the gold standard for measuring urine microalbumin excretion is 24 hours urinary collection[7.] However, a more convenient method to detect microalbuminuria is urine albumin (mcg) : creatinine(mg) ratio (ACR) measured in random sample[6]. Currently the National Kidney foundation recommends the use of spot urine albumin creatinine ratio obtained under standardized conditions (first voided, morning, midstream sample) to detect microalbuminuria. Albumin creatinine ratio is acquired by this technique for our study.

Intima media thickness (IMT) is measurement of thickness of tunica media & tunica intima, the innermost two layers of arterial wall. The measurement is usually made by external Doppler & occasionally by internal, invasive ultrasound catheters. Carotid intima media thickness is strongly associated with atherosclerosis. Intimal thickening is a complex process; depending on a variety of factors including local hemodynamics, blood pressure etc. intima media thickness greater than 0.9 mm is almost certainly indicative of atherosclerosis & increased risk of cardiovascular disease[6] .The carotid artery is the usual site of measurement of intima media thickness& the American Society of Echocardiography published a consensus statement on measurement of carotid intima media thickness in 2007[8].

The current study investigated the prevalence of microalbuminuria (ACR) and carotid intima media thickness & the association with Smoking, Hypertension, Abnormal lipid profile, BMI, and Diabetes in subjects of ischaemic heart disease, subjects with comorbidities but without ischaemic heart disease (control group I) & normal individuals (control group II).

Albumin creatinine ratio in the Study Group

Out of the 106 subjects in the study, the prevalence of microalbuminuria was in 58% of studied subjects show in table no. 9. 14% from control group I & 5.33% from control group II also had albumin creatinine ratio positive. The prevalence was higher in case group in relation to control group I & control group II. The prevalence in the present study is relatively similar to number of studies. The i-SEARCH global study 2007 also reported the overall prevalence of microalbuminuria in more than 20,000 individuals from 26 countries as 58%.[9] this high prevalence could be due to several factors. Microalbuminuria was detected on single occasion using urine sample in both studies. The other factor that might lead to the increased prevalence of microalbuminuria reported in the i-SEARCH study and our study is that the population studied had complex comorbidities diabetes, hypertension, dyslipidemia.

Albumin creatinine ratio and Diabetes

The current study had 0.9% diabetic out of 106 subjects& 6% are diabetic from control group I, Microalbuminuria was found in 50% of patients with diabetes in our study. Diabetic subjects in Case group with Microalbuminuria are 100% and in control group I are 33% as seen in table no 4 which is statistically significant .This prevalence was more in our study than in HOPE and Micro- HOPE studies of 2000, only 33% diabetics had microalbuminuria[10]. The prevalence in patients with diabetes (n= 10,640) in the Advance study 2009, was 27%[11]. The Advance and HOPE studies, the selection criteria of patients enrolled involved the presence of cardiovascular disease in addition to diabetes mellitus, hence the prevalence of microalbuminuria tends to be high in these patients, similar observation was seen in the present study[12]. The low percentage of patients with 4 diabetes in the current study undoubtedly affects the microalbuminuria prevalence. In the I-DEMAND study 2010 (n=3534), 37% of the participants in the cohort had diabetes mellitus compared with 2.5% in my study.

Albumin creatinine ratio and ischaemic heart disease

The prevalence of raised albumin creatinine ratio in studied subjects is 31.6% .The prevalence of microalbuminuria in significant ischaemic heart disease subjects is higher 58.49% in comparison to control groups 8%.This difference observed in table no. 9 is statistically significant .Several

epidemiological studies like Life 2003, The Cardiovascular Health 2006, Aloft 2011 suggested similar significant association between microalbuminuria (positive albumin creatinine ratio) and cardiovascular diseases.[13, 14, 15]

Albumin creatinine ratio and Hypertension:
In this study 25.1% of subjects were hypertensive. The prevalence in case group was 28.3% and 56%in control group I as seen in table no. 4. Microalbuminuria was seen in 73% of subjects with hypertension and 53.57% of control group I hypertensive patients which is statistically significant. Microalbuminuria was strongly associated with hypertension in Case group, a finding that agrees with most reported studies on hypertensive subjects[16,17,18] A causal relationship is supported by the observation of Secret 2009, and Road Map 2012 that strict control of blood pressure prevents the development of microalbuminuria and that blood pressure control reduces albuminuria.[19,20]

Albumin creatinine ratio and Dyslipidemia:
Dyslipidemia was defined as cholesterol value > 200 mg/dl[21] or triglyceride value >150 mg/dl or subjects on anti-lipid drugs[22]. In this study 32.46% of subjects were having dyslipidemia. The prevalence in case group is 44.33% and 26% from control group I & 25.33% from control group II. Microalbuminuria was seen in 72.09% of case group dyslipidemia subjects and 38.46% of control group I dyslipidemia subjects& 31.57% of control group II which is statistically as seen in table No. 8. There is a significant association in the dyslipidemia and microalbuminuric individuals in case group in present study. The study are similar with those reported in several epidemiological studies like Gubbio Population Study 1998 where the prevalence of dyslipidemia was frequent in subjects with microalbuminuria.[23,24,25]

Albumin creatinine ratio and Smoking:
In the present study there are 25.1% smokers, case group had 45.28%, control group I had 12% & control group II had 5.33% smokers. Microalbuminuria in case group smokers is 26.41% and 16.66% in control group I & none from control group II shown in table no 6, significant association is seen in microalbuminuria and smoking in both groups . This finding is consistent with findings that reported in i–SEARCH 2010 a positive association between cigarette smoking and the prevalence of microalbuminuria.[26, 27]

Albumin creatinine ratio and Alcohol:
In our study no significant association was seen in microalbuminuria and alcohol in both groups (A and B).The prevalence is 10.82% in study, but only 20.24% in case group, 4% from control group I and 1.33% in control group II .The sample size is too small for any correlation.

Intima- media thickening and ischaemic heart disease:
Out of the 106 subjects in the study, the prevalence of raised intima media thickness was in 33.96% of studied subjects show in table no. 9. 4% from control group I & 6.66% from control group II also had intima media thickness positive. The similar observations were found in other studies.[28,29]The studies carried by Howard NH et al & Petra C.G.Simmons et al are suggestive of definite relationship between increased intima media thickness& ischaemic heart disease.

Intima- media thickening and diabetes mellitus:
The study had 0.9% diabetic out of 106 subjects& 6% are diabetic from control group I. 23 studies including 24111 subjects, 4019 with diabetes showed that intima media thickness was greater in diabetics than control group[30] .

Intima- media thickening and hypertension:
In this study 25.1% of subjects were hypertensive. The prevalence in case group was 28.3% and 56%in control group I as seen in table no. 4. 23.5% from case group & 44% from control group I hypertensives had raised intima media thickness. Prevalence of carotid artery wall alterations among the hypertensive subjects randomly allocated to treatment in the ELSA trial was very high: 82% had T_{max} > 1.3 mm (‗plaques' according to protocol) and 17% had T_{max} > 1.0 and < 1.3 mm (‗thickening').Analysis of baseline data from the ELSA has shown that there is an extremely marked prevalence of carotid artery wall alterations among mild-to-moderate, middle-aged hypertensive patients[31].

Intima- media thickening and dyslipidemia:
In this study 32.46% of subjects were having dyslipidemia. The prevalence in case group is 44.33% and 26% from control group I & 25.33% from control group II. Raised intima media thickness is seen in 46.66% of case group and 23.52% of control group I dyslipidemia subjects& 10.52% of control group II which is statistically as seen in table No. 8**.** The combination of FRS with Max-intima media thickness measurement can be used in routine clinical practice to greatly enhance the predictability of cardiovascular events in the large number of patients who fall into the intermediate-risk category, which currently does not call for aggressive preventive measures.In Kaplan–Meier analysis, the Max-intima media thickness significantly improved the predictive value of the Framingham risk score[32].

7. Conclusion and Summary

Both albumin creatinine ratio & intima media thickness were found to be highly significant after analysis of all the study groups (p = 0.000).Sensitivity of albumin creatinine ratio among subjects& control group I is 89.86% & specificity is 49.43% as per this study. Positive predictive value is 58.49% & negative predictive value is 86%.Sensitivity of albumin creatinine ratio among cases & control group II is 93.94% & specificity is 61.74% as per this study. Positive predictive value is 58.49% & negative predictive value is 94.47%.Sensitivity of intima media thickness among cases & control group I is 94.78% & specificity is 40.68%. Positive predictive value is 33.96% & negative predictive value is 96%.Sensitivity of intima media thickness among cases & control group II is 87.80% & specificity is 50%. Positive predictive value is 33.96% & negative predictive value is 93.33%.The association between intima media thickness and albumin creatinine ratio outcome in ischaemic heart disease is found statistically significant($p<0.05$).

Other factors like age, sex, diabetes mellitus, hypertension, addiction to smoking & alcohol, family history of diabetes mellitus& hypertension were also found to have significant

association ($p < 0.05$) with albumin creatinine ratio & intima media thickness outcomes.

Intima media thickness is more sensitive marker of atheroginicity among case group & control group I &albumin creatinine ratio is more sensitive marker of atheroginicity among case group & control group II suggesting that albumin creatinine ratio outcome has more correlation with comorbidities that exist with ischaemic heart disease like diabetes mellitus& hypertension which themselves can cause albumin excretion by causing nephropathy. Intima media thickness has direct association more with the progress of atherogenesis when comorbidities exist.

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