ISSN: 0975-3583,0976-2833 VOL13, ISSUE 01, 2022

ORIGINAL RESEARCH

Microalbuminuria: A novel risk indicator for cardiac morbidity and mortality

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Abstract

Background: There is a relative paucity of data on the link between urine microalbumin andIHD in non-diabetics as well as non-hypertensives compared to diabetics. Thisstudy was meant to look for the association between urine microalbuminandincardiacmorbidityandmortalityamongnon-diabeticandnon-hypertensives, which may further provide insight to the early diagnosis of microalbuminuria and its potential for predicting cardiac morbidity and thus neededinputs for better clinicalmanagement.

Aims and objectives: To assessthe relationshipbetween microalbuminuria and proven riskfactors and markersof cardiovascular disease in non-diabetic& non-hypertensiveischaemic heartdiseasepatients.

Materials and methods: Among the 200 patients which were taken in the study, 141 (69.8%)weremalesandthe rest29.2%were females. 34.5% each were from the ageof 41-50 years and51-60 yearsrespectively. Only 26 (13.0%) patients were from the age group of morethan60years.

Results: Themean ageofpatients was50.66 withaSDof9.33. Majorityofmaleswerefrom theagegroupof41-50years(38.3%),while42.4%of femaleswere fromthe age groupof51-60years. Meanageofmalepatientswasfoundtobe49.41±9.16,while female patientswasof 52.44±9.57. Chestpainremains themostcommoncomplaintamongthepatients(100%),followedbybreathlessnessin 55%andpalpitationin27.5%.

MostofthepatientswerehavingaBMIofmorethan23kg/sq.i.e.,107(53.5%),followedby44.5%wit hanormalvalue Mean serum cholesterol among patients was176.7 mg/dl, while meanserum TGs was 131.7 mg/dl. Mean blood sugar level was around 118.9mg/dl. Ejectionfractionoflessthan50%wasobservedin132patients,constituting to66.0%of the totalstudysubjects. Microalbuminuria detected in 73.0% of the patients as perthe criteria of30-300usingurinaryACR. Out of146 patients with microalbuminuria, 102 (69.9%) were males andtherest44(30.1%)were females. Among the patient having MA, 129 (88.4%) were fromless than 60 years ofage andtherestwere above 60 yearsofage. 45.9%ofthepatienthavingmicroalbuminuriawerehavingnormalBMI.

Around74%ofthepatientswithraised serumureahadincidenceof micro albuminuria. Among52patientswithelevatedserumcreatinine,37i.e.,71.1%hadmicro albuminuria. Among169patientswithTGlevelsmorethan125mg/dl,125(73.9%)werehavingmicroalbuminuria . Among26patientswithSerumcholesterollevelsmorethan200mg/dl,20 (76.9%)werehaving microalbuminuria. Among 63 patients with blood sugar levels above 126 mg/dl, 42

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(66.6%)werehavingMicroalbuminuria, EF of less than 50% was observed in 132 (66%) of the patients. In 146patients with micro albuminuria, 98 (67.1%) were having EF of less than50%.
Conclusion: Urinary MA can beusedas animportant isolatedindicatorforassessingmorbidityandmortalityandsurvivalincardiovascular diseases amongst the patients who are not a known case of HTNand diabetesanddevelopIschaemic heartdisease.
Keywords: Microalbuminuria, cardiovascular, cardiacmorbidityandmortality, non-diabeticandnon-hypertensive.

Introduction

Cardiovasculardisease (cvd)accountforlargeproportionofdeathsanddisabilities around the globe. Ischemic heart disease (IHD) has now become one of the leadingcausesof deathworldwide, whichaccountsfor more than 7.3million deaths in 2008 alone[1]. Moreover, around 80% of cardiovascular deathsnow occur from low- and middle-income countries[2]. As India is in the transitionstage, facingburden of bothcommunicable and non-communicable diseasesand 24% of deaths in India accounts tocardiovascular etiology[3]. Currently 31.8million Indians are living withIHD, and the death rate from cardiovasculardiseases in India has rose 111 time from 1990 to 2020, with Ischemic heartdisease(IHD) contributingthemajor share[4-5].

Variousnew biomarkersof IHD such as,lipoproteins (a) levels,plasmahomocysteine,elevatedplasmafibrinogenlevels,plasminogenactivatinginhibitor(PAI),C-reactiveprotein(CRP),differentcytokinesandmicroalbuminuria(MA) have emerged over a period of time. The excretion ofalbumin in urine, in the range of 20-200 µg/min (30-300 mg/day) is often calledas Microalbuminuria. This range of albumin is not detected in routine testsofurine.MicroalbuminuriaisbeingassociatedwithDiabetesMellitus(DM)(Type 1 and 2) for a long time. Microalbuminuria is defined as theUAERbetween30-300mg/24hour[6].Microalbuminuria(MA)asamarkernow a day is also considered a risk factor for IHD in diabetic and non-diabeticindividuals. Patients with MA and concomitant diabetes have higher deaths dueto IHDdevelopment. Since the firstdescriptionin 1974,[7] the presence of subclinicalincreaseinexcretionofurinealbumingotattentionbutMAinnondiabeticsstillneedstobe studied. Greater excretion of urinary albumin leading to increased morbidityand mortalityhas beenreported several yearsago,[8].

Microalbuminuria (MAU) can also be defined as urine albumin excretionat ratesthataremorethannormalbutlessthanvaluesdetectedbyconventionalmethods likedipsticks[9]. In clinical practice MAU helps to know about kidneyimpairment in patients suffering from hypertension (HTN) and diabetes (DM).MAUisassociatedwithcardiovasculardisease (Cvd)factorssuchasage,smoking,hypertension,diabetes,dyslipidaemiaandlackofphysicalactivity[10-12.]

Inhealthy individuals, the normal range for urinary albumin excretionisusuallylessthan30mg/day.UAErateincreaseswithexercise,proteinintake, pregnancyandurinarytractinfection.Albuminexcretiononanaverage is 25% higher during the day than at night, with 40 % day to day variation.Albuminuriaof300mg/dayormoreindicatesmicroalbuminuria.

Inclinicallyhealthysubjectstheatherogenicriskfactorsareraisedwhenassociated with microalbuminuria. It is also observed that the patients with MAhave more severe angiographic CAD than those without MA[13]. MA is evaluatedasanearlyresponsetomyocardialinfarction(MI)andurinaryexcretionofmicroalbuminis proportionaltothesizeofinfarctsize[14].AstudybyBertonetal. showed that microalbuminuria occurs in AMI and predicts early mortality[15].Moreover, MA is independently associated with Cvd morbidity, after adjustingthe known risk factors of the prevalence of CAD in men and

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 01, 2022

women. The closerelationshipbetweenMA andCoronary disease isgreatlyexplained by thesharedpathogeneticmechanismsofendothelialdysfunction,systemicinflammationandvascularinjury[16];itisreasonabletoassumethatsucharelationship should exist regardless of the simultaneous presence or absence ofdiabetes.

Aims and objectives

To assessthe relationshipbetween microalbuminuria and proven riskfactors and markersof cardiovascular disease in non diabetic& nonhypertensiveischaemic heartdiseasepatients.

Materials and methods

AProspective(Hospitalbased)ObservationalStudywas conducted on 200 patients. Nondiabeticandnon-hypertensiveadultsagedbetween28-70years in theDepartmentofMedicine,GandhiMedicalCollege&associated Hospitals (HamidiaHospital) Bhopal, fromDecember2019 to August2021.

Methodology

After approval of the study protocol by the Institutional Ethics Committee,written consenttaken.The study wasdone in Department of Medicine (cardiology), Gandhimedical collage &Hamidia hospital Bhopal to investigate thecourse ofmicro albuminuria and its relation with CVD in a large group drawn fromthegeneralpopulation.All the patients fulfilling the inclusion criteria were subjected to detailedclinical history, systemic examination,routine investigation, and ECGand ECHO. Patientsfrom thecardiology department ofHamidia hospital, Bhopalaged28-70yearsaround200subjectsweregivenaquestionnaireanda vialtocollectearlymorningurinesampleandtheadministeredquestionnaire provided information whetherestablished risk factors forcardiovasculardisease and morbiditywerepresent.

Subjects were considered being diabetic and they had physician diagnosisofdiabeteswhetheron medicationornotandwereexcluded.Those who reported taking antihypertensive or lipid lowering drugs wereregardedashypertensivesandhyperlipidicrespectivelyandwereexcluded.

Myocardial infarction(MI)wasconsideredpresentif subject reportedwith ECG and ECHO findings consistent with myocardial infarction andwereincludediftheywerenotaknowncaseofhypertensionanddiabetes.

AlltherelevantdatawasthenenteredinMSExcel.

Inclusioncriteria

PatientsofIschaemicheartdisease(diagnosedby ECG and ECHO findings), Non-DiabeticPatients, Non-HypertensivePatients

Investigation

CBC(Hb,TLC), LFT, RFT, LipidProfile, BloodSugar, BloodPressure, RenalFunctiontest, ECG, ECHO.

Statisticalanalysis

Data was analysed using appropriate statistical software. Frequency distributionand cross tabulation was used to prepare the tables. Quantitative variables wereexpressedasthemeanandstandarddeviation.Categoricaldatawasexpressedas percentage. Microsoft office was used to prepare the graphs. Student t- test isbeing used to compare the means. Chi Square test has been usedto compare thecategoricaldata.P valueof <0.05is consideredas significant.

Observation and results

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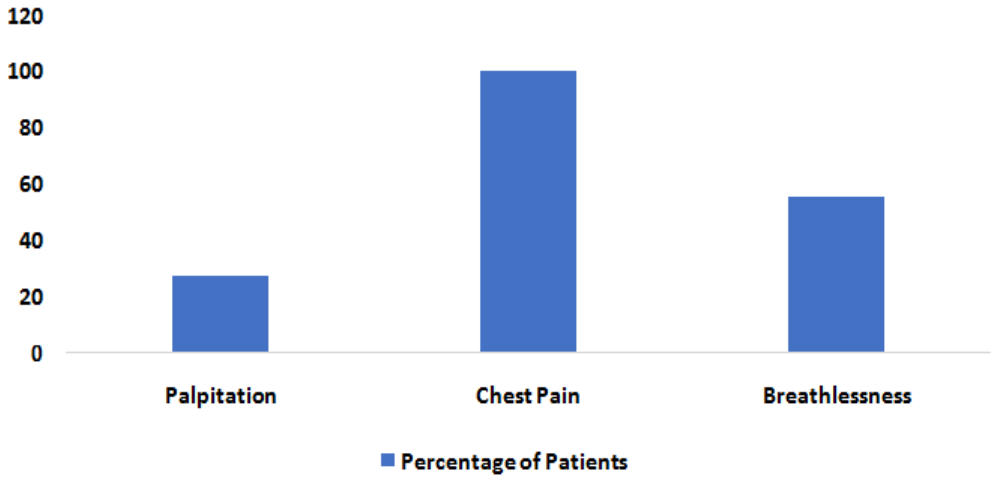
Table1 Distributionofpatients according toageandgender

AgeGroup	Sex		Total	Chi SquarestatisticPValue
	Male	Female		
	n (%)	n (%)	n (%)	
≤40	26 (18.4)	10 (16.9)	36 (18.0)	3.88
41-50	54 (38.3)	15 (25.4)	69 (34.5)	
51-60	44 (31.2)	25(42.4)	69 (34.5)	0.275
>60	17 (12.1)	9 (15.3)	26 (13.0)	
Total	141(100.0)	59(100.0)	200(100.0)	

Distribution of patients according to age and gender reveals that majority ofmales were from the age group of 41-50 years (38.3%), while 42.4% of femaleswere from the age group of 51-60 years. The above distribution of patientsaccordingtoageandgenderwasfoundtobestatisticallyinsignificant(pvalue>0.05)

Fig1Distributionofpatientsaccordingtopresentingcomplaints



Chest pain remainsthe most common complaint among the patients (100%),followedbybreathlessnessin55%andpalpitationin27.5%ofthestudysubjects

Table 2 Distributionofpatientsaccordingtofindingsincardiovascularsystemexamination

SNo	Parameter	Mean(S.D)	Median(IQR)	Range
1	PulseRate	75.79(7.69)	75(68-82)	99-47
2	SBP	109.1(11.84)	110(90-130)	140-80
3	DBP	69.75(2.54)	70	90-50

The mean PR of the patients was75.7 with a SD of 7.7 beats/min. Mean SBPwas foundtobe109.1mmHg,whilemeanDBPwas 69.7 mmHg.

Table 3 Distribution of patients according to Serum Urea andMicroalbuminuria

Serum Urea(ingm/dl)	Microalbuminuria		Total	Chi SquarestatisticP Value
	Absent	Present		
	n(%)	n(%)	n(%)	
<45	48 (88.9)	129(88.4)	177(88.5)	0.011
≥45	6 (11.1)	17 (11.6)	23 (11.5)	
Total	54(100.0)	146(100.0)	200(100.0)	0.917

Around 74% of the patients with elevated serum urea had incidence of microalbuminuria, which shows the relation between urinary albumin excretion withrenal markers.

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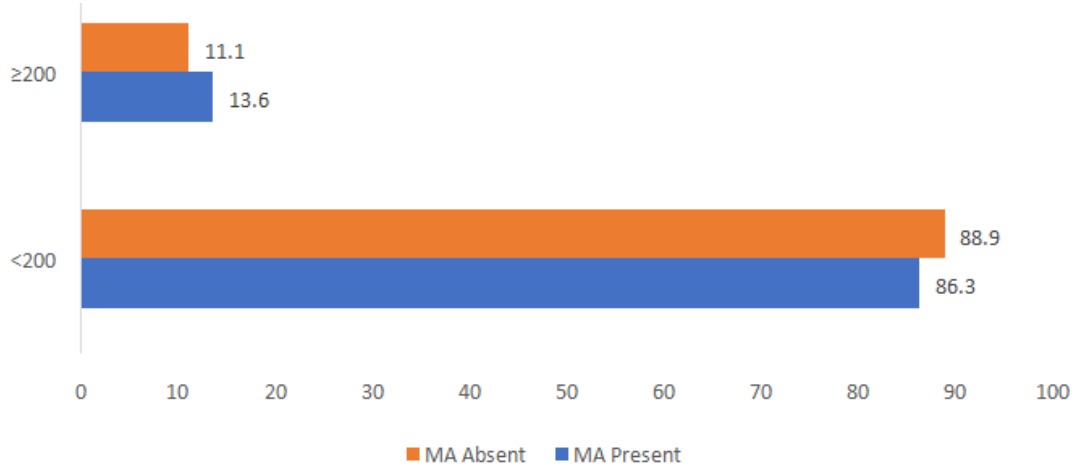
Table 4 Distribution of patients according to Serum Creatinine and Microalbuminuria

Serum Creatinine(In gm/dl)	Microalbuminuria		Total	Chi SquarestatisticP Value
	Absent	Present		
	n (%)	n (%)	n (%)	
<1.2	39 (72.2)	109(74.7)	148(74.0)	0.122
≥1.2	15 (27.8)	37 (25.3)	52 (26.0)	
Total	54(100.0)	146(100.0)	200(100.0)	0.727

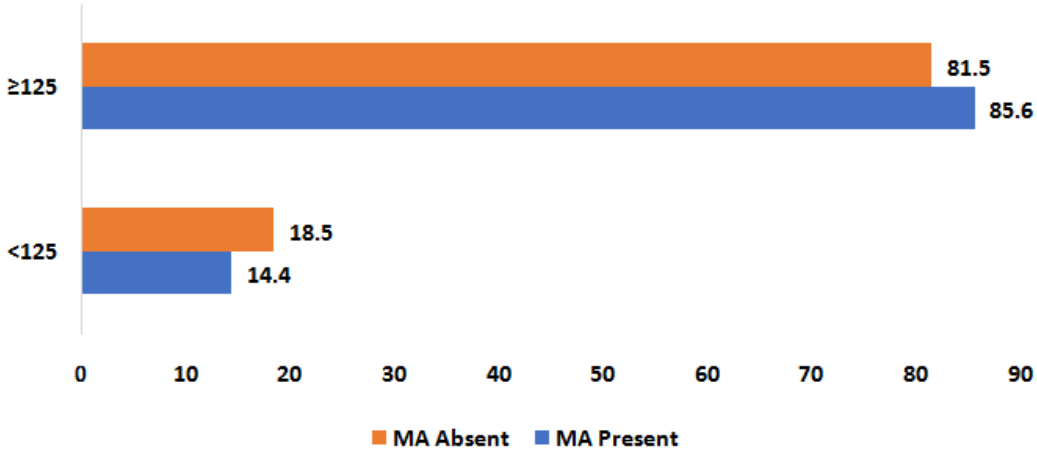
Among52patientswithelevatedserumcreatinine,37i.e.,71.1%hadmicroalbuminuria,whiletheres t 29.9%patientswerehavingnormoalbuminuria

Fig 2 Distribution of patients according to Serum Cholesterol levels andMicroalbuminuria



87.0% of the patients were having cholesterol levels below 200 mg/dl. Among26 patients with levels more than 200 mg/dl, 20 (76.9%) were having microalbuminuria

Fig 3DistributionofpatientsaccordingtoSerumTriglyceridelevels and Microalbuminuria



85.6% of the patients were having triglyceride levels above 125 mg/dl. Among169 patients with levels more than 125 mg/dl, 125 (73.9%) were having microalbuminuria,

Table 5 Distribution of patients according to Blood Sugar levels andMicroalbuminuria

Blood SugarLevel(inm	Microalbuminuria		Total	Chi SquarestatisticP
	Absent	Present		

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g/dl)	n (%)	n (%)	n (%)	Value
<126	33 (61.1)	104(71.2)	137(68.5)	1.872
≥126	21 (38.9)	42 (28.8)	63 (31.5)	
Total	54(100.0)	146(100.0)	200(100.0)	0.171

Among 63 patients with blood sugar levels above 126 mg/dl, 42 (66.6%) werehaving Micro albuminuria, which clearly depicts the role of elevated bloodsugars inalbuminuria.

Table 6ComparisonofMeansofvariousparameters

SNo	Parameter	Microalbuminuria		P value
		Absent	Present	
		Mean (SD)		
1	Age	50.9(10.1)	50.5(9.1)	0.81
2	PulseRate	75.11(6.9)	76.0(7.9)	0.42
3	SBP	110.8(11.8)	108.4(11.9)	0.20
4	DBP	69.8(1.36)	69.7(2.9)	0.77
5	BMI	22.7(2.1)	24.5(1.8)	0.24

Oncomparisonofvariousparametersinpatientswithandwithoutmicroalbuminuria using unpaired t test, none of them were found to be significantstatistically.

Table 7 ComparisonofMeansofvariouslaboratoryparameters

SNo	Parameter	Microalbuminuria		P value
		Absent	Present	
		Mean (SD)		
1	Hb	11.8(1.4)	11.8(1.4)	0.95
2	TLC	8386.9(1469.6)	8073.4(1456.4)	1.34
3	SerumUrea	34.5(6.7)	33.9(8.0)	0.54
4	SerumCreatinine	0.9(0.2)	0.9(0.3)	1.81
5	SerumSGOT	47.2(3.9)	46.5(6.9)	0.47
6	SerumSGPT	47.393.6)	46.9(4.9)	0.58
7	SerumCholesterol	177.8(14.8)	176.2(18.9)	0.55
8	Serumtriglycerides	132.2(7.9)	131.4(10.8)	0.58
9	BloodSugarlevel	121.1(12.9)	118.0(14.4)	0.15
10	LVEF	44.7(7.0)	45.1(5.9)	0.78

On analysis of various lab parameters pertaining to the patients, who werehaving/ not having Micro albuminuria by using appropriate statistical tests, nooneoftheparametershowedanysignificantdifferenceinbetweentwogroups.

Discussion

Studies of previous researchers concluded independent role of MAand itsconnectionwithcardiovascularmorbidityandmortalityinpatientswithdiabetesmellitusandHTN.Itisperhapspropertoremarktoevaluatemicroalbuminuria in the non-diabetic, non-hypertensive patients especially inIndia few studied have been conducted. In this study an attempt has been made to find if MA has an association with cardio vascular morbidity even in non-diabetic, non-hypertensive IHDpatients.

BaselineCharacteristics

Patient's mean agewas 50.66 with a SD of 9.33 in the present study. The findingswere similar to the studies conducted by **Johan Arnlov et.al[16] (2005),** wherethe55 was the mean age andin the study by **HilalBahjet Al-Saffar et.al[17](2015**) mean age was 56 ± 12

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years.**DharmeshGamit et.al[18] (2017)** reportedthe mean age to be51.32 ± 11.25years, while **Md JahirulHaque et.al[19] (2020)**reported it to be 57.17±11.2 years. A finding of study by G Berton et.al41 (2000) was contrarytoours.

Abdul GhaffarMemon et.al[20] (2015) reported the patientsage distribution tobe 42.5 ± 10.8, while **AbhijitBasu et.al[21] (2015)** reported mean to be(48.76 ±6.97)and**MarwaKamalAbdoKhairallahet.al[22](2016)**as42.93 ± 15.60years.

34.5%eachpatientwasfromtheagegroupof41-50yearsand51-60years in the presentstudy.**MarwaKamalAbdoKhairallahet.al[22](2016)**reportedthat26, 18, 18, 19, 13, and 5% patients were in the age range less than 30 yearsold, from 30 to less than 40 years old, from 40 to less than 50 years old, from 50to less than 60 years old, and from 60 years to less than 70, and more than 70respectively.

In the present study, the range of age of participants was found to be 28 to 75years of age.**Abdul GhaffarMemon et.al[20] (2015)**reported the range of age **to**be20 to 80 years, while **DharmeshGamit et.al[18] (2017)** asrange of 30 to 70years.

69.8% patients were males and rest 29.2% were females in the present study.Male predominance was observed in studies by **HilalBahjet Al-Saffar et.al[17](2015)andAbdulGhaffarMemonet.al[20](2015).DharmeshGamitet.al[19](2017)** reported the gender distribution as 97 males (80.8%) and 23 females(19.2%).Findings contrary to the presentstudy were reported by **Aida Jimenez Corona et.al[24] (2005)** and **Johan Arnlovet.al[17] (2005).Marwa Kamal AbdoKhairallah et.al[22] (2016)** described thatmenrepresent33%ofthestudiedgroupwhilewomenrepresent67%,while **Peter Kangwagye et.al[25] (2018)**reported that 208 (62.3%) of the patients werefemales intheirstudy.

The mean age of male patients was49.41±9.16, while that of female patientswasof52.44±9.57inthepresentstudy.

ClinicalPresentation

Chestpainwasthemostcommoncomplaintamongthepatients(100%),followedbybreathlessnessin 55%andpalpitationin27.5%ofthestudysubjects.

Descriptionofsalientvariables

The mean PR of the patients was75.7 with a SD of 7.7 beats/min. Mean SBPwas foundtobe 109.1 mmHg,whilemean DBP was 69.7 mmHg.

Mostof the patients were having a BMI of more than 23 kg/sq. i.e., 107(53.5%),followedby44.5%with anormalvalue.MAis associated with IHD irrespective of BMI. 36 people with BMI >25 ofthese 72.22% (n=26) fall among cases and only 27.77% (n=10) were controls.There were 26 people with microalbuminuria and BMI >25. Of these 80.76%(n=21)wereamongcasesandonly19.23%(n=5)amongcontrols.Thiswasnot significantstatisticallyX2=3.41,P>0.05accordingtothestudybyAbhijitBasuet.al[21](2015).

Mean serum cholesterol among patients was found to be 176.7 mg/dl, whilemeanserumTGswas131.7mg/dl.Meanbloodsugarlevelwasfoundtobe118.9 mg/dl in the present study. While in the study by **Sowjanya Naha et.al[26](2016)** the Mean fasting blood glucose (mg/dL) was 107.31±13.8 and Meantriglycerides (mg/dL) was 107.21±46.7. Mean serum cholesterol was reported tobe176.53±40.5mg/dl.RandomPlasmaGlucoseconcentration±standarddeviation (SD) of 104.54 ± 21.64, ranging from 78 mg/dl to 141 mg/dl wasreportedby**Asif Mustafa[27] (2020).**

Ejection fraction of less than 50% was observed in 132 patients, constituting to66.0% of the total study subjects.No statistically significant differences foundin gender, systolic or diastolic BP, left ventricle ejection fraction, smokingstatus,ordiabeteswasreportedinthestudyby**MustafaTaskiranet.al[28](2010).**

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Microalbuminuria was associated with a similar risk of death as a leftventricleejectionfractionbelow40%.

Microalbuminuria was present in 73.0% of the patients according to the criteriaof30-300usingurinaryalbumincreatinineratiointhepresentstudy.**AbdulGhaffarMemonet.al[20](2015)** reportedthatafterdiagnosisoutof126patients77patientswerefoundwithmicroalbuminuria,whilei nthestudyby**DharmeshGamit et.al[18] (2017)** 79 (65.8%) of the cases were found withmicroalbuminuriaand**PeterKangwagyeet.al[25](2018)**estimatedtheprevalenceofmicroalbu minuriaas(ACR:30–300mg/g)was59.3%.Contraryto ourstudywerethefindingsof**H.L.Hillegeet.al[10](2001)**,wheretheprevalence was 7.2%, **Yon Su Kim et.al[29] (2013)** with prevalence of 14.1% and**HilalBahjetAl-Saffaret.al[17](2015**)with30%.**PravinKumarJhaet.al(2017)[30]**reported that out of 90 CAD patients who were not a known case ofDM, 62 (68.9%) belonged to group I (MAU negative) and 28 (31.1%) belongedtogroupII(MAUpositive).

Among 146 patients with microalbuminuria, 102 (69.9%) were males and therest 44 (30.1%) were females. The distribution according to gender and urinaryalbumin excretion was found to be insignificant statistically in this study. 129(88.4%) were from the age group of less than 60 years and the rest were above60 years of age. Around 74% of the patients with elevated serum urea hadincidenceofmicroalbuminuria,whichshowstherelationbetweenurinaryalbuminexcretionswi threnalmarkers.Bloodureawasraisedin20patients from them 17/13.4% having MA. Raised serum creatinine was found in16 ofcases, out of them 12/9.5% were noted with MA according to the study by**AbdulGhaffarMemonet.al[20](2015).**Among52patientsinthisstudywithelevated serum creatinine, 37 i.e., 71.1% had micro albuminuria, while the rest29.9%patientswerehavingnormoalbuminuria.

StatisticallysignificantdifferenceinserumtotalcholesterolandLDLcholesterol and urine microalbumin between cases and controls was seen. Atrend towards higher fasting blood glucose was also observed in the cases ascompared to the controls, and the number of individuals with impaired fastingglucose was significantly higher among the cases (OR: 4.70; 95% CI, 1.93–11.42;P<0.001).BinarylogisticregressionconfirmedurinemicroalbumintobeassociatedwithIHD independentoffastingbloodsugar,totalandLDL-cholesterol (P = 0.015). 100% specificity but only 32% sensitivity of urinemicroalbuminforthepresenceofconcomitantIHDwhenusingtheconventional cut-off of 30 mg/g was demonstrated on ROC curves as per thestudyby**SowjanyaNahaet.al[26](2016).**

Conclusion

In the present study. Micro albuminuria was found in 73.0% of the non-diabeticand non-hypertensive individuals presenting with cardiac morbidity. The levelsof serum cholesterol and Serum Triglycerides along with blood sugar wasonhigher side in individuals with micro albuminuria. Clear association was alsoobserved between level of serum urea and creatinine as well as MA. It's clearly evidentthatmicroalbuminuriaandtheestablishedriskindicatorsofcardiovascular morbidity have a positive correlation and can also be used toassess cardiovascularmorbidity.

Cardiac morbidity was stratified in terms of the ejection fraction findings inechocardiography. Patientswithejectionfraction(EF)>50%haveabetterprognosis in terms of survival and treatment response when compared with thepatients having EF<50% who have a comparatively bad prognosis.It was clearlyevident that microalbuminuria was more with patient's having left ventricleEF<50%whichcanbeusedtoprognosticatepatientsofcardiovascularmorbidity.

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References

1. World Health Organization (WHO). Cardiovascular diseases, fact sheetnumber317[Internet].Geneva,Switzerland:WHO;2013,Availablefrom:http://www.who.int/mediacentre/factsheets/fs317/en/[Lastaccessed in2015].
2. Alwan A, Maclean DR, Riley LM, et al. Monitoring and surveillance ofchronicnon-communicablediseases:Progressandcapacityinhigh-burden countries.Lancet.2010;376:1861–8.
3. AlwanA,ArmstrongT,CowanM,etal.Noncommunicablediseasescountryprofiles2011[Internet]2011.[Lastaccessedin2015].Availablefrom:http://whqlibdoc.who.int/publications/2011/9789241502283_eng.pdf.
4. Gaziano TA, Bitton A, Anand S, et al. Growing epidemic of coronaryheartdisease inlow-andmiddle-incomecountries.CurrProblCardiol.2010;35:72–115.
5. Smith SC, Jr. Reducing the global burden of ischemic heart disease andstroke: A challenge for the cardiovascular community and the UnitedNations.Circulation.2011;124:278-9.
6. Jensen JS, Borch JK, Jensen G, Feldt RB (1995) Atherosc-lerotic riskfactors are increased in clinically healthy subjects with microalbuminuria.Artherosclerosis112:245-252
7. Parving HH, Jensen HA, Mogensen HA, Evrin PE. Increased urinaryalbumin excretion rate in benign essential hypertension. Lancet 1974; i:1190–93.
8. Levitt JI. The prognostic significance of proteinuria in young collegestudents.AnnInternMed1967;66:685–96.
9. Mogensen CE, Chachati A, Christensen A, Christensen CK, et al. Micro-albuminuria:anearlymarkerofrenalinvolvementindiabetes.UremInvestig.1985;9:85–95.
10. HillegeHL,JanssenWM,BakAA,etal.Prevendstudygroup.Microalbumi-nuria is common, also in a nondiabetic, nonhypertensivepopulation, and an independent indicator of cardiovascular risk factorsandcardiovascularmorbidity.J Intern Med.2001;249:519–26.
11. Hao G, Wang Z, Zhang L, et al. Prevalence of microalbuminuria amongmiddle-agedpopulationofChina:Amultiplecentercardiovascularepidemological study.Angiology.2015;66(1):49–56.
12. Wang Y, Yuan A, Chen Y. Correlation between microalbuminuria andcardiovascularevents.Int JClinExp Med.2013;6(10):973–8
13. Sukhija R, Aronow WS, Kakar P, Garza L, Sachdeva R, et al. Relation ofmicroalbuminuriaandcoronaryarterydiseaseinpatientswithandwithoutdiabetes mellitus.AmJCardiol2006;98:279-281.
14. Hartland A Gosling P. Microalbuminuria: Yet Another CardiovascularRiskFactor?.AnnalsofClinicalBiochemistry:Aninternationaljournalofbiochemistryandlaboratorymedicine.1999;36:700-703
15. Berton G. Microalbuminuria during acute myocardial infarction; a strongpredictor for 1-year mortality. European Heart Journal. 2001;22:1466-1475
16. ArnlövJ,EvansJC,MeigsJB,WangTJ,FoxCS,LevyD,etal.Low-grade albuminuria and incidence of cardiovascular disease events innonhypertensiveandnondiabeticindividuals:TheFraminghamHeartStudy.Circulation2005;112:969-75
17. Al-Saffar HB, Nassir H, Mitchell A, Philipp S. Microalbuminuria in non-diabeticpatientswithunstableangina/nonST-segmentelevationmyocardialinfarction.BMCresearchnotes.2015 Dec;8(1):1-7.
18. GamitD,VananiB,PatelC,MishraA,PatelA.Evaluationofmicroalbuminuriainnon-diabeticandnon-hypertensivepatientswithacutemyocardialinfarction.Alcohol.;7:5-8
19. Haque MJ, Islam MN, Al Aziz MZ, Ashrafuzzaman SM, Banik

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 01, 2022

GC,RahmanAS,BiswasS,AhasanHN.AssociationofCardiovascular DiseasewithMicroAlbuminuriainType2DiabetesMellitus-StudyinATertiaryCareHospital.JournalofMedicine.2020 Nov9;21(2):76-81.
20. MemonAG,KolachiM.RelationshipofMicroalbuminureainNon-DiabeticandNon-HypertensivePatientswithAcuteMyocardialInfarction.JClinExpCardiolog.2015;6(403):2.
21. Basu A, Jhala JS. Association of microalbuminuria in non-diabetic andnon-hypertensivepatientswithmyocardialinfarction.InternationalJournal ofAdvances inMedicine.2015Jul;2(3):196.
22. Khairallah MK, Ibrahim WH. Frequency and possible associations ofalbuminuriainpatientswithessentialhypertension:asingle-centerexperience. Journal of Current Medical Research and Practice. 2019 Sep1;4(3):373.
23. SandheepJ. *RelationshipofMicroalbuminuriawithischaemicHeartDiseaseinNonDiabetics* (Doctoraldissertation,ThanjavurMedicalCollege,Thanjavur).
24. CoronaAJ,MartinezDR,AvilaMH,HaffnerS,WilliamsKE,VillalpandoME,SimonJ,SternM, Gonzalez-VillalpandoC.Microalbuminuriaasapredictorofmyocardialinfarctioninamexican population: the Mexico City Diabetes Study. Kidney International. 2005Aug1;68:S34-9.
25. Kangwagye P, Rwebembera J, Wilson T, Bajunirwe F. Microalbuminuriaand Retinopathy among Hypertensive Nondiabetic Patients at a LargePublic Outpatient Clinic in Southwestern Uganda. International journal ofnephrology.2018Jun6;2018
26. NahaS,NahaK,PanditVR,BalasubramanianR.Associationofmicroalbuminuriawithischemic heartdiseaseinnon-diabeticAsian-Indians:Acasecontrolstudy.Avicennajournalofmedicine.2015Jan;5(1):6.
27. Mustafa A. Study of Microalbuminuria in Non-Diabetic and Non- Hypertensive Patients with Acute Myocardial InfarctionInternational Journal of Contemporary Medical Research 2020;7(3):C1-C3.
28. TaskiranM,IversenA,KlausenK,JensenGB,JensenJS.Theassociationofmicroalbuminuriawithmortality inpatientswithacutemyocardial infarction. A ten-year follow-up study. Heart international.2010 Jun23;5(1).
29. Kim YS, Kim HS, Oh HY, Lee MK, Kim CH, Kim YS, Wu D, Johnson-Levonas AO, Oh BH. Prevalence of microalbuminuria and associated riskfactorsamongadultKoreanhypertensivepatientsinaprimarycaresetting.HypertensionResearch.2013Sep;36(9):807-23.
30. JhaPK,EteT,MalviyaA,DasCK,SahaSK,NathD,KapoorM,Mishra A Microalbuminuria:correlationwithprevalenceandseverityofcoronaryarterydiseaseinnon-diabetics.Journalofclinicalmedicineresearch.2017Oct;9(10):838.