PREVALENCE OF

MICROALBUMINURIA IN NEWLY

DIAGNOSED DIABETES MELLITUS

DISSERTATION SUBMITTED FOR

M.D. DEGREE, BRANCH I (GENERAL MEDICINE)

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CHENNAI

CERTIFICATE

This is to certify that this dissertation entitled **" PREVALENCE OF MICROALBUMINURIA IN NEWLY DIAGNOSED DIABETES**." Submitted by Dr.S.P. Rajesh Dhilip Sydney to the faculty of General Medicine, The Tamilnadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of M.D.Degree Branch I (General Medicine) is a bonafide research work carried out by him under our direct supervision and guidance.

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This is submitted to The Tamilnadu Dr.M.G.R. Medical University, Chennai in Partial fulfillment of the rules and regulations for M.D. degree Branch I (General Medicine).

Place: Madurai.

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GLOSSARY

DM	:	Diabetes Mellitus
T1 DM	:	Type I Diabetes Mellitus
T2 DM	:	Type 2 Diabetes Mellitus
GDM	:	Gestational Diabetes Mellitus
MAU	:	Micro albuminuria
BMI	:	Body Mass Index
OP	:	out Patients
GRH	:	Government Rajaji Hospital
IDDM	:	Insulin dependent Diabetes Mellitus
NIDDM	:	Non Insulin dependent Diabetes Mellitus
FPG	:	Fasting Plasma Glucose
PPG	:	Post Prandial Glucose

CONTENTS

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INTRODUCTION

Nephropathy is one of the common complication of diabetes and can lead to end stage renal failure. The number of diabetic subjects accepted for renal dialysis treatment is increasing yearly. Nephropathy takes several years to develop after the diagnosis of diabetes but if it is diagnosed early the process can be aborted or even reversed by strict metabolic Control.

Nephropathy presents first as intermittent microalbuminuria (Incipient), progressing to persistent microalbuminuria and then to macroalbuminuria. A useful method of detection of albumin in urine is by quantifying microalbuminuria

Diabetic retinopathy is one of leading causes of blindness in the world that increases the chance of loosing the sight about 25 times higher compared to normal individuals using new surgical and medical techniques the incidence can be reduced to 90% .Microalbuminuria is a reliable marker for diabetic retinopathy.

Microalbuminuria has been proposed as a marker of generalized endothelial dysfunction resulting in atherothrombotic vascular disease.

In addition to predicting nephropathy in both type 1 & type 2 diabetes microalbuminuria is a strong predictor of risk for cardio vascular disease independent of conventional risk factors

The recommendation to screen for microalbuminuria is based on expert opinion that considered the natural history of Diabetic retinopathy and nephropathy the evidence from many randomized controlled clinical trials of benefit of treatment of those patients found to have microalbuminuria

DEFINITIONS OF MICROALBUMINURIA AND CLINICAL ALBUMINURIA

	mg / 24 hours	µgm / minute	µgm /mg Creatinine
Normal	<30	<20	<30
Microalbuminuria	30-300	20-200	30-300
Clinicalalbuminuria	>300	>200	>300

The spot urine collection is the simplest and preferred methodology Screening for microalbuminuria should begin as soon as possible after the diagnosis type 2 diabetes mellitus and in type 1 diabetes mellitus should begin with puberty once the duration of diabetes mellitus is more than 5 years

In this background we undertook this study of Patients of Newly detected diabetes mellitus to find out the prevalence of microalbuminuria and its association with diabetic retinopathy in southern Tamilnadu patients attending the Government Rajaji Hospital, Madurai, Under the guidance of Department of Medicine, Government Rajaji Hospital, Madurai.

It is hoped that this study may help to prevent the dreaded complication of untreated patients of diabetes mellitus. This study also stresses the importance of early detection of diabetes mellitus and it's Complications.

DIABETES MELLITUS

Diabetes mellitus is a group of metabolic disorders with one common manifestation: hyperglycemia. Chronic hyperglycemia causes damage to the eyes, kidneys, nerves, heart and blood vessels. The etiology and pathophysiology leading to the hyperglycemia, however, are markedly different among patients with diabetes mellitus, dictating different prevention strategies, diagnostic screening methods and treatments. The adverse impact of hyperglycemia and the rationale for aggressive treatment have recently been reviewed.

In June 1997, an international expert committee released a report with new recommendations for the classification and diagnosis of diabetes mellitus.These new recommendations were the result of more than two years of collaboration among experts from the American Diabetes Association and the World Health Organization (WHO). The use of classification systems and standardized diagnostic criteria facilitates a common language among patients, physicians, other health care professionals and scientists.

The National Diabetes Data Group also established the oral glucose tolerance test (using a glucose load of 75 g) as the preferred

diagnostic test for diabetes mellitus.However, this test has poor reproducibility, lacks physiologic relevance and is a weaker indicator of long-term complications compared with other measures of hyperglycemia. Furthermore, many high-risk patients are unwilling to undergo this time-consuming test on a repeat basis.

Etiologic Classifications of Diabetes Mellitus

Type 1 diabetes mellitus (formerly called type I, IDDM or juvenile diabetes) is characterized by beta cell destruction caused by an autoimmune process, usually leading to absolute insulin deficiency. The onset is usually acute, developing over a period of a few days to weeks. Over 95 percent of persons with type 1 diabetes mellitus develop the disease before the age of 25, with an equal incidence in both sexes and an increased prevalence in the white population. A family history of type 1 diabetes mellitus, gluten enteropathy (celiac disease) or other endocrine disease is often found. Most of these patients have the "immune-mediated form" of type 1 diabetes mellitus with islet cell antibodies and often have other autoimmune disorders such as Hashimoto's thyroiditis, Addison's disease, vitiligo or pernicious anemia. A few patients, usually those of African or Asian origin, have no antibodies but have a similar clinical presentation;

consequently, they are included in this classification and their disease is called the "idiopathic form" of type 1 diabetes mellitus.

Type 2 diabetes mellitus (formerly called NIDDM, type II or adult-onset) is characterized by insulin resistance in peripheral tissue and an insulin secretory defect of the beta cell. This is the most common form of diabetes mellitus and is highly associated with a family history of diabetes, older age, obesity and lack of exercise. It is more common in women, especially women with a history of gestational diabetes, and in blacks, Hispanics and Native Americans. Insulin resistance and hyperinsulinemia eventually lead to impaired glucose tolerance. Defective beta cells become exhausted, further fueling the cycle of glucose intolerance and hyperglycemia. The etiology of type 2 diabetes mellitus is multifactorial and probably genetically based, but it also has strong behavioral components.

Other specific types:

Genetic defects of beta-cell function

Genetic defects in insulin action

Diseases of the exocrine pancreas

Pancreatitis Pancreatectomy Trauma

Cystic fibrosis Neoplasia

Hemochromatosis

Endocrinopathies

Acromegaly	Hyperthyroidism	Somatostatinoma
Cushing's syndrome	Aldosteronoma	Glucagonoma

Pheochromocytoma

Drug- or chemical-induced

Vacor†	Pentamidine	Nicotinic acid
Thyroid hormone	Glucocorticoids	Diazoxide
Beta-adrenergic agonists	Thiazides	Phenytoin

Infections

Congenital rubella	Cytomegalovirus

Others Uncommon forms of immune- mediated diabetes

Other genetic syndromes sometimes associated with diabetes

Down syndrome	Klinefelter's syndrome
Turner's syndrome	Wolfram syndrome
Friedreich's ataxia	Huntington's chorea
Lawrence-Moon Beidel syndrome	Prader-Willi syndrome
Myotonic dystrophy	Porphyria

Gestational diabetes mellitus

Gestational diabetes mellitus is an operational classification (rather than a pathophysiologic condition) identifying women who develop diabetes mellitus during gestation.(Women with diabetes mellitus before pregnancy are said to have "pregestational diabetes" and are not included in this group.) Women who develop type 1 diabetes mellitus during pregnancy and women with undiagnosed asymptomatic type 2 diabetes mellitus that is discovered during pregnancy are classified with gestational diabetes mellitus. However, most women classified with gestational diabetes mellitus have normal glucose homeostasis during the first half of the pregnancy and develop a relative insulin deficiency during the last half of the pregnancy, leading to hyperglycemia. The hyperglycemia resolves in most women after delivery but places them at increased risk of developing type 2 diabetes mellitus later in life.

Criteria for the Diagnosis of Diabetes Mellitus and Impaired Glucose Homeostasis

Diabetes mellitus--positive findings from any two of the following tests on different days:

Symptoms of diabetes mellitus* plus casual† plasma glucose concentration >=200 mg per dL (11.1 mmol per L) Or

FPG >=126 mg per dL (7.0 mmol per L) Or

2hrPPG >=200 mg per dL (11.1 mmol per L) after a 75-g glucose load

Impaired fasting glucose: FPG from 110 to <126 (6.1 to 7.0 mmol per L)

Impaired glucose tolerance: 2hrPPG from 140 to <200 (7.75 to <11.1 mmol per L)

Normal

FPG <110 mg per dL (6.1 mmol per L)

2hrPPG <140 mg per dL (7.75 mmol per L)

†--Casual is defined as any time of day without regard to time since last meal.

*--Symptoms include polyuria, polydipsia or unexplained weight loss.

FPG=fasting plasma glucose; 2hrPPG=two-hour postprandial glucose.

Both impaired fasting glucose and impaired glucose tolerance are associated with an increased risk of developing type 2 diabetes mellitus. Lifestyle changes, such as weight loss and exercise, are warranted in these patients.

Screening for gestational diabetes mellitus is generally accomplished with administration of a 50-g glucose load one hour before

determining a plasma glucose level. A positive screen (defined as a plasma glucose level of 140 mg per dL [7.75 mmol per L] or higher) should prompt a diagnostic test: fasting plasma glucose levels should be measured after a 100-g glucose load at baseline and at one, two and three hours after the glucose load. Two of the four values must be abnormal (105 mg per dL [5.8 mmol per L] or higher; 190 mg per dL [10.5 mmol per L] or higher; 165 mg per dL [9.15 mmol per L] or higher; and 145 mg per dL [8.05 mmol per L] or higher) for a patient to be diagnosed with gestational diabetes mellitus. The WHO criteria use a glucose load of 75 g with a test two hours after the glucose load, using the same criterion for the diagnosis of gestational diabetes mellitus.

Glycated hemoglobin (also known as glycohemoglobin, glycosylated hemoglobin or HbA1c) is used to monitor treatment in patients with diabetes mellitus; however, it is not recommended for routine diagnosis of this condition because of a lack of standardization of tests and results. Measurements of glycated hemoglobin have commonly been used to monitor the glycemic control of persons already diagnosed with diabetes mellitus.

Recommendations for Diabetes Screening of Asymptomatic Persons

Timing of first test and repeat tests

Test at age 45; repeat every three years:Patients 45 years of age or older

Test before age 45; repeat more frequently than every three years if patient has one or more of the following risk factors:

Obesity: >=120% of desirable body weight or BMI >=27 kg per m2

First-degree relative with diabetes mellitus

Member of high risk-ethnic group (black, Hispanic, Native American, Asian)

History of gestational diabetes mellitus or delivering a baby weighing more than 4,032 g (9 lb)

Hypertensive (>=140/90 mm Hg)

HDL cholesterol level ¾35 mg per dL (0.90 mmol per L) and/or triglyceride level >=250 mg per dL (2.83 mmol per L)

History of IGT or IFG on prior testing

BMI=body mass index; HDL=high density lipoprotein; IGT=impaired glucose tolerance; IFG=impaired fasting glucose.

DIABETIC RETINOPATHY

Ophthalmic complications of diabetes include corneal abnormalities, glaucoma, iris neovascularization, cataracts, and neuropathies. However, the most common and potentially most blinding of these is diabetic retinopathy.

PATHOPHYSIOLOGY:

The exact mechanism by which diabetes causes retinopathy remains unclear, but several theories have been postulated to explain the typical course and history of the disease.

Platelets and blood viscosity :

The variety of hematologic abnormalities seen in diabetes, such as increased erythrocyte aggregation, decreased RBC deformability, increased platelet aggregation, and adhesion, predispose to sluggish circulation, endothelial damage, and focal capillary occlusion. This leads to retinal ischemia, which in turn contributes to the development of diabetic retinopathy.

Aldose reductase and vasoproliferative factors :

Fundamentally, DM causes abnormal glucose metabolism as a result of decreased levels or activity of insulin. Increased levels of blood glucose are thought to have a structural and physiologic effect on retinal capillaries causing them to be both functionally and anatomically.

incompetent A persistent increase in blood glucose levels shunts excess glucose into the aldose reductase pathway in certain tissues, which converts sugars into alcohol (eg, glucose into sorbitol, galactose to dulcitol). Intramural pericytes of retinal capillaries seem to be, affected by this increased level of sorbitol eventually leading to the loss of its primary function (ie, autoregulation of retinal capillaries). Loss of function of pericytes results in weakness and eventual saccular outpouching of capillary walls. These microaneurysms are the earliest. detectable signs of DM retinopathy Ruptured microaneurysms (MA) result in retinal hemorrhages either superficially (flame-shaped hemorrhages) or in deeper layers of the retina (blot and dot hemorrhages). Increased permeability of these vessels results in leakage of fluid and proteinaceous material, which clinically appears as retinal thickening and exudates. If the swelling and exudation would happen to involve the macula, a diminution in central vision may be experienced. Macular edema is the most common cause of vision loss in patients with nonproliferative diabetic retinopathy (NPDR). However, it is not exclusively seen only in patients with NPDR, but it also may complicate cases of proliferative diabetic retinopathy (PDR).

As the disease progresses, eventual closure of retinal capillaries occurs, leading to hypoxia. Infarction of the nerve fiber layer leads to

the formation of cotton-wool spots (CWS) with associated stasis in axoplasmic flow. More extensive retinal hypoxia triggers compensatory mechanisms within the eye to provide enough oxygen to tissues. Venous caliber abnormalities, such as venous beading, loops, and dilation, signify increasing hypoxia and almost always are seen bordering the areas of capillary nonperfusion. Intraretinal microvascular abnormalities (IRMA) represent either new vessel growth or remodeling of preexisting vessels through endothelial cell proliferation within the retinal tissues to act as shunts through areas of nonperfusion. Further increases in retinal ischemia trigger the production of vasoproliferative factors that stimulate new vessel formation. The extracellular matrix is broken down first by proteases, and new vessels arising mainly from the retinal venules penetrate the internal limiting membrane and form capillary networks between the inner surface of the retina and the posterior hyaloid face. Neovascularization most commonly is observed at the borders of perfused and nonperfused retina and most commonly occur along the vascular arcades and at the optic nerve head. The new vessels break through and grow along the surface of the retina and into the scaffold of the posterior hyaloid face. By themselves, these vessels rarely cause visual compromise. However, they are fragile and highly permeable.

These delicate vessels are disrupted easily by vitreous traction, which leads to hemorrhage into the vitreous cavity or the preretinal space.

These new blood vessels initially are associated with a small amount of fibroglial tissue formation. However, as the density of the neovascular frond increases, so does the degree of fibrous tissue formation. In later stages, the vessels may regress leaving only networks of avascular fibrous tissue adherent to both the retina and the posterior hyaloid face. As the vitreous contracts, it may exert tractional forces on the retina via these fibroglial connections. Traction may cause retinal edema, retinal heterotropia, and both tractional retinal detachments and retinal tear formation with subsequent detachment.

History: In the initial stages, patients are generally asymptomatic; however, in more advanced stages of the disease, patients may experience increasing visual acuity loss.

Physical:

Microaneurysms

Earliest clinical sign of diabetic retinopathy Secondary to capillary wall

outpouching due to pericyte loss appear as small red dots in the superficial retinal layers Fibrin and RBC accumulation in the microaneurysm lumen Rupture produces blot/flame hemorrhages May appear yellowish in time as endothelial cells proliferate and produce basement membrane

Dot and blot hemorrhages:

Occur as microaneurysms rupture in the deeper layers of the retina such as the inner nuclear and outer plexiform layers Appear similar to microaneurysms if they are small; fluorescein angiography may be needed to distinguish between the two

Flame-shaped hemorrhages - Splinter hemorrhages that occur in the more superficial nerve fiber layer

Retinal edema and hard exudates - Caused by the breakdown of the blood-retina barrier allowing leakage of serum proteins, lipids, and protein from the vessels

Cotton-wool spots

Nerve fiber layer infarction from occlusion of precapillary arterioles

Fluorescein angiography - No capillary perfusion Frequently bordered by microaneurysms and vascular hyperpermeability Venous loops, venous beading Frequently adjacent to areas of nonperfusion Reflects increasing retinal ischemia Most significant predictor of progression to PDR

Intraretinal microvascular abnormalities

Remodeled capillary beds without proliferative changes Collateral vessels that do not leak on fluorescein angiography Usually can be found on the borders of the nonperfused retina

Macular edema

This condition is the leading cause of visual impairment in patients with diabetes. It has been reported that 75,000 new cases of macular edema are diagnosed annually. Possibly due to functional damage and necrosis of retinal capillaries Clinically significant macular edema (CSME) is defined as any of the following: Retinal thickening located 500 mm or less from the center of the foveal avascular zone (FAZ) Hard exudates with retinal thickening 500 mm or less from the center of the FAZ Retinal thickening 1 disc area or larger in size located within 1 disc diameter of the FAZ

Mild nonproliferative diabetic retinopathy - Presence of at least 1 Microaneurysm

Moderate nonproliferative diabetic retinopathy

Presence of hemorrhages, microaneurysms, hard exudates

Soft exudates, venous beading, and IRMA less than that of severe NPDRSevere nonproliferative diabetic retinopathy (4-2-1) Hemorrhages and microaneurysms in 4 quadrants Venous beading in at least 2 quadrants IRMA in at least 1 quadrant Mild NPDR reflects

structural changes in the retina caused by the physiological and anatomical effects of diabetes. On the other hand, the more advanced stages of NPDR reflect the increasing retinal ischemia setting up the stage for proliferative changes.

Causes: Risk factors

Duration of the diabetes

In patients with type I diabetes, no clinically significant retinopathy can be seen in the first 5 years after the initial diagnosis of diabetes is made. After 10-15 years, 25-50% of patients show some signs of retinopathy. This prevalence increases to 75-95% after 15 years and approaches 100% after 30 years of diabetes. In patients with type II diabetes, incidence of diabetic retinopathy increases along with the duration of the disease. Of patients, 23% after 11-13 years, 41% after 14-16 years, and 60% after 16 years have NPDR.

Glucose control

The Diabetic Complications Control Trial (DCCT) has demonstrated that intensive glucose control reduced the incidence and the progression of diabetic retinopathy in patients with insulin-dependent diabetes mellitus (IDDM).Although no similar trials for non–insulin–dependent diabetes mellitus (NIDDM) patients have been completed, it has been suggested by

American Diabetes Association (ADA) that glycosylated hemoglobin levels less than 7% (reflecting long-term glucose levels) should be the goal in all patients to prevent or slow down the onset of diabetes-related complications.

Renal disease as evidenced by proteinuria, and elevated BUN/creatinine levels is an excellent predictor of the presence of retinopathy. This probably is due to the fact that both conditions are caused by DM-related microangiopathies such that the presence and severity of one reflects that of the other. Evidence suggests that aggressive treatment of the nephropathy may have a beneficial effect on the progression of diabetic retinopathy and neovascular glaucoma.

Systemic hypertension, in the setting of diabetic nephropathy, correlates well with the presence of retinopathy. Independently, hypertension also may complicate diabetes in that it may result in hypertensive retinal vascular changes superimposed on the preexisting diabetic retinopathy further compromising retinal blood flow.

Elevated serum lipids: It has been suggested that the proper management of hyperlipidemia may result in less retinal vessel leakage and hard exudate formation. The reason behind this is unclear. Pregnant women without any diabetic retinopathy run a 10% risk of developing NPDR during their pregnancy. Of those with preexisting NPDR, 4% progress to the proliferative type.

MICROALBUMINURIA

Diagnosis/Screening

Diabetes is the leading cause of end-stage renal disease in the Western and India . Early detection of diabetic nephropathy relies upon tests for urinary excretion of albumin. Conventional qualitative tests for albuminuria do not detect the small increases of urinary albumin excretion seen in early stages of nephropathy.For this purpose, tests for “microalbuminuria” are used.

Definitions of Microalbuminuria and Clinical Albuminuria*

The ADA recommends periodic qualitative (“dipstick”) testing for urine albumin in adults with diabetes .Positivetests represent “clinical albuminuria” or “overt nephropathy” in the ADA recommendations, corresponding to protein excretion > 300 mg/24 hours (> 200 µg/min or > 300 µg/mg creatinine) In these patients, quantitative measurement of urine protein excretion is used in the assessment of the severity of proteinuria and its progression, inplanning treatment, and in determining the impact of therapy.

Recommendation: Annual microalbumin testing of patients without clinical proteinuria should begin inpubertal or postpubertal individuals five years after diagnosis of type 1 diabetes and at the time of diagnosis of type 2 diabetes. The role of testing is unclear in patients under treatment with angiotensin-convertingenzyme inhibitors and in those with short life expectancy.

Early detection of microalbuminuria allows early intervention with a goal of delaying the onset of overt diabetic nephropathy.

Microalbuminuria rarely occurs with short duration of type 1 diabetes or before puberty. Thus testing is less urgent in these situations. Although the difficulty in precisely dating the onset of type 2 diabetes warrants initiation of annualtesting early after diagnosis of diabetes, older patients (age > 75 years or life expectancy < 20 years) may never be atrisk for clinically significant nephropathy in view of a projected life-span that is too brief for renal dysfunction todevelop. In such patients, the role of treating microalbuminuria is far from clear, and the need to screen for it is, thus, uncertain at best. The urinary albumin excretion rate reportedly has no marked diurnal variation in diabetes, but it does in essential hypertension .

Technique: Semiquantitative or qualitative screening tests for microalbuminuria should be positive in >95% of patients with microalbuminuria to be useful for screening. Positive results must be confirmed by analysis in an accredited laboratory.Qualitative (or semiquantitative) tests for microalbuminuria have been proposed for use as screening tests for microalbuminuria.The usual way to do this is to measure the albumin in a 24 hours sample of urine but the patient compliance is a limiting factor. An easier method is to measure the concentration of albumin in urine at patient initial visit especially the concentrated a morning sample. Several investigator have used this method reported comparable result

(Nathan DM, Rosenbaum C, Protasowicki D. Single-void urine samples can estimate quantitative microalbuminuria. Diabetes Care 1987;10:414-8. Schwab SJ, Dunn FL, Feinglos MN. Screening formicroalbuminurea. Diabetes Care 1992;15:1581-4.)

Nonanalytical sources of variation

Transient increases of urinary albumin excretion have been reported with short-term hyperglycemia, exercise, urinary tract infections, marked hypertension, heart failure and acute febrile illness

Frequency of measurement

The ADA recommends annual measurement for microalbumin in patients with negative (“dipstick”) results for overtproteinuria. After the documentation of a diagnosis of microalbuminuria (i.e., with results as defined above on 2 of 3 tests performed within a period of 3 – 6 months), repeated testing is reasonable to determine whether a chosen therapy is effective. It may also be useful in determining the rate of progression of disease and thus support planning for careof end-stage renal disease. Although the ADA recommendations suggest that such testing is not generally needed before puberty, testing may be considered on an individual basis if it appears appropriate because of early onset of diabetes,poor control or family history of diabetic nephropathy. A recent study indicates that the duration of diabetesprior to puberty is an important risk factor in this age group and thus can be used to support such testing in individualpatients .

AIMS AND OBJECTIVES

1. To study the prevalence of **microalbuminuria** in patients with newly detected diabetes mellitus

2. To study whether the occurrence of microalbuminuria has any correlation with the occurrence of diabetic retinopathy.

3. To find out whether other factors like age, sex, obesity, smoking, alcohol, dietary habits have any relationship with microalbuminuria.

MATERIALS AND METHODS

SETTING

All Patients included in this study were those attending the Diabetology OP, GRH, Madurai.

COLLABORATING DEPARTMENTS

Department of Medicine

Department of Diabetology

Department of Bio Chemistry

Department of Ophthalmology

DESIGN OF STUDY

Cross sectional Observational study

PERIOD OF STUDY

One year from September, 2004.

SAMPLE SIZE

61 patients went included in the study which included 21 males and 40 females.

SELECTION OF STUDY SUBJECTS / MATERIALS

Patients who satisfied the WHO criteria for diabetes (newly diagnosed) were included in the study. A full history, physical examination and the necessary investigations were done for all the patients. Patients age, sex, height and weight were recorded and BMI was calculated by using the formula weight / height2. Fasting and 2 Hours post prandial blood glucose Were obtained as per WHO norms Blood Pressure was recorded for the patients on at least two occasions and patients whose BP was >140/90 were excluded from the study. An ocular fundus examination was done with the help of Ophthamology Department for all patients Urine was tested for Albuminuria and those who had clinically overt proteinuria were excluded from the study. Other patients who had fever infections chronic Kidney disease, were excluded from the study.

One random sample of urine was obtained preferably early morning for quantifying albumin level in urine. This method is superior to the excretion rate and an accurate method for screening of micro albuminuria.

PROCEDURE OF TEST

Micro albuminuria test was done using the TINA – QUANT Albumin test. The method adapted was the Immunoturbidimetric assay. Samples of urine were collected using standard sampling tubes, centrifuged and then analyzed in ROCHE / HITACHI / 902 modular analyzer. This method has been standardized against CRM 470. Measuring range of this analyzer was from 3 – 400 mg/L.

ETHICAL APPROVAL

Ethical committee clearance obtained.

CONSENT

Informed consent from subjects obtained.

STATISTICAL ANALYSIS

Computer analysis of data done using the software epidemiological information package 2002 developed by Centre for Disease Control and Prevention, Atlanta in collaboration with world Health Organization. Chisquare test was used for tests of significance.

RESULTS AND ANALYSIS

A. Characteristics of Study Population :

1. SEX

Characteristics	No	%
Males	21	34.4
Females	40	65.6
Total	61	100

2. AGE

Characteristics	No	%
≤ 30	5	8.2
31-40	11	18.1
41-50	19	31.1
51-60	21	34.4
> 60	5	8.2
Total	61	100
Mean	47.9	
S.D.	11.4	

3.BMI

Characteristics	No	%
Lean (<20)	4	6.6
Normal (20=25)	23	37.7
Obese (>25)	34	55.7
Mean	24.95	
S.D.	3.77	

4. D.M.Type

D.M.Type	No	%
Type 1	2	3.3
Type 2	58	95.1
Type3	1	1.6

5:Sex and MAU

Sex	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Males	15	71.4	6	28.6	21.1	14.5
Females	29	72.5	11	27.5	17.6	10.8

'p' value = 0.4298 (Not Significant)

6: BMI and MAU

BMI	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Lean	3	75	1	2.5	15.4	5.2
Normal	16	67.6	7	30.4	19.3	13.5
Obese	25	73.5	9	26.5	18.8	12.1

'p' value = 0.5751 (Not Significant)

7: Family history of diabetes and MAU

Family history	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Yes	10	100	-	-	13.9	2.5
No	34	66.7	17	33.3	19.7	13.1

'p' value = 0.0275 (Significant)

8: Smoking and MAU (among males)

Smoking	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Yes	3	100	-	-	14.5	4.4
No	12	66.7	6	33.3	22.2	15.4

'p' value = 0.3923 (Not Significant)

9: Alcoholism and MAU

Alcoholism	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Yes	2	100	-	-	16.0	4.9
No	42	71.2	17	28.8	18.9	12.4

'p' value = 0.8872 (Not Significant)

10: Fasting B.S. and MAU

Fasting B.S.	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Normal	6	60	4	40	19.8	9.7
Abnormal	38	74.5	13	25.5	18.6	12.7

'p' value = 0.2751 (Not Significant)

11: P.P.B.S. and MAU

P.P.B.S.	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Normal	4	100	-	-	13.3	2.9
Abnormal	40	70.2	17	29.8	19.1	12.6

'p' value = 0.512 (Not Significant)

12: Cholesterol and MAU

Cholesterol	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Normal	16	76.2	5	23.8	18.4	13.8
Abnormal	28	70	12	30	19	11.8

'p' value = 0.7326 (Not Significant)

13: Retinopathy and MAU

Retinopathy	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Yes	3	37.5	5	62.5	25.3	14.5
No	40	75.5	13	24.5	17.8	11.7

'p' value = 0.042 (Significant)

14: D.M. Type and MAU

D.M. Type	MAU values					
	Normal		Abnormal		Mean	S.D.
	No	%	No	%		
Type 1	2	100	-	-	10.5	-
Type 2	42	72.4	16	27.6	19	12.4
Type 3	-	-	1	100	22.8	-

'p' value = 0.5169 (Not Significant)

RESULTS:

This study was conducted in the Diabetology OP ,Government Rajaji Hospital, Madurai and included those diabetic patients who were newly diagnosed to be having diabetes mellitus, to estimate the prevalence of Microalbuminuria and its association with other variable like age, sex, family history ,fasting and postprandial blood sugar values, and in particular Diabetic Retinopathy.

Total number of subjects included in this study was 61. Of this females predominated with 40 (65.6 %) and males were only 21 (34.4 %). Only two cases (3.3 %) were that of Type 1 Diabetes , both of them being females and one case (1.6 %) was that of Gestational Diabetes Mellitus , the rest being that of Type 2 Diabetes.

The overall prevalence of MAU among study population was 28%. Among males Microalbuminuria was present in 6 (28.6 %) and absent in 15 (71.4 %). Among females Microalbuminuria was Present in 11 (27.5 %) and absent in 29 (72.5 %). There was no significant correlation of Microalbuminuria with sex (P = 0.4298, not significant).

Among the study subjects, the majority was that of the age group 51 to 60 Years (21 i.e.34.4 %),followed by 41 to 50 Years (19 i.e.31.1 %), 31 to 40 Years (11 i.e. 18.1 %), 30 Years and below (5 i.e. 8.2 %), more than 60 Years (5 i.e.8.2 %). Of the 5 persons among 30 Years and below, 2 were those of Type 1 Diabetes and 1 was that of Gestational Diabetes Mellitus, so the incidence of Type 2 Diabetes was least in this group (2 persons only).

Among the study subjects, Body Mass Index was abnormal (<20 & >25) in 38 (62.3 %) of the study subjects, 4 (6.6 %) were classified under lean (Body Mass Index <20), mean was 15.4 and S.D. was 5.2. 23 persons (37.7 %) had normal Body Mass Index (20 to 25),the mean was 19.3 and S.D.13.5. 34 Persons (55.7 %) were obese (Body Mass Index > 25), the mean was 24.95 and S.D was 3.77. Among those with abnormal Body Mass Index (38 Persons) Microalbuminuria was present in 10 and absent in 28. Among those with normal Body Mass Index , Microalbuminuria was present in 7 and absent in 16. There was no significant correlation of Microalbuminuria with Body Mass Index (P = 0.5751).

Family history was positive in only 10 persons (16.4 %). All the 10 persons who had positive family history did not have Microalbuminuria. Among the subjects who did not have family history (51 i.e. 83.6 %)

17 persons had Microalbuminuria and 34 did not have it. Hence this factor had a significant correlation with Microalbuminuria (P = 0.0275, Which was significant). The mean and S.D. was 13.9 and 2.5 respectively among those with a positive family history and 19.7 and 13.1 among those with a negative family history.

Smoking history was present in only 3 (14.3 %) of the study population. All 3 smokers were males. All 3 smokers did not have Microalbuminuria. Of the non-smokers (18 i.e. 85.7 %), 12 persons did not have Microalbuminuria and 6 had Microalbuminuria. Hence smoking was not significantly correlated with Microalbuminuria (P = 0.3923, not significant). The mean and S.D. was 14.5 and 4.4 respectively among those with a positive smoking history and 22.2 and 15.4 among those with a negative smoking history.

Alcoholism history was present in only 2 (3.3 %) of the study subjects. Both of them were males. Of the non-alcoholics 17 (28.8%) had Microalbuminuria and 42 (71.2 %)did not have it. The correlation between Microalbuminuria and alcoholism was not significant. (P = 0.8872, not significant). The mean and S.D. was 16 and 4.9 respectively among those with a positive alcoholism history and 18.9 and 12.4 among those with a negative alcoholism history.

Since only normo-tensive subjects only included in this study the correlation of Microalbuminuria with hypertension could not be arrived at. The mean systolic blood pressure was 126.8 (S.D. 10.4) and mean diastolic blood pressure was 81.6 (S.D. 5.5)

Fasting hyperglycemia was present in 51 persons (83.6 %), out of which 13 persons had Microalbuminuria and 38 did not have it. The mean fasting blood glucose was 193.3 (S.D. 64.9). Fasting blood glucose was normal in 10 persons, out of which 4 (6.6 %)had Microalbuminuria and 6 did not have it. The correlation between Microalbuminuria and fasting blood glucose was not significant. (P = 0.2751, not significant).

Post prandial blood glucose levels were in the diabetic range in 57 (93.4 %) of the study subjects out of which 17 had Microalbuminuria and 40 did not have it. The mean Post prandial blood glucose was 301.6 (S.D.93.3) Only 4 persons had post prandial blood glucose levels in non-diabetic range. The correlation between Microalbuminuria and post prandial blood glucose was not significant. (P = 0.042, not significant).

There were only 2 patients of Type 1 Diabetes . Both of them did not have Microalbuminuria and 1 cases of Gestational Diabetes Mellitus which had Microalbuminuria. Among the Type 2 Diabetes (42) patients Microalbuminuria was present in 16 (27.6 %) and absent in 42 (72.4 %). The correlation between Microalbuminuria and type of diabetes was not significant (P = 0.5169, not significant) This may due to the small size of samples.

The prevalence of Diabetic retinopathy in our study population was 13 %This study showed a high prevalence of Microalbuminuria among newly diagnosed diabetes and a significant correlation of Microalbuminuria with diabetic retinopathy.

Interpretation from the statistical analysis was mainly done to estimate the prevalence of Microalbuminuria among the study subjects and the correlation between Microalbuminuria and various other variables particularly diabetic retinopathy, so that early detection of Microalbuminuria and there by the complications would be possible.

DISCUSSION

Microalbuminuria is a useful predictor of renal failure in patients with Diabetes mellitus and even an independent predictor of mortality in Type 2 Diabetes as shown by studies don by (Neil, Hawkins M, Potok-M et al – Diabetes care 1993)

Microalbuminuria is also associated with Diabetic Retinopathy in Type 2 Diabetes and is a reliable maker for Diabetic Retinopathy – as shown by studies done by Dept. of Medicine, Furness General hospital, UK and Eric Mogensen, Arhus University hospital, Denmark.

The Center for Disease Control and prevention (CDC) recommends early detection of Microalbuminuria in patients with Diabetes Mellitus. – Atlanta, Department of health and human services 1991.

In this study we have attempted to estimate the extent of this problem –i.e. the prevalence of Microalbuminuria among patients with newly detected Diabetes Mellitus, at the OP clinic,

Department of Diabetology, GRH, Madurai and its role as a marker for Diabetic Retinopathy.

The prevalence of Microalbuminuria in patients Diabetes mellitus- both old and newly detected has been high and varying among different studies conducted in population of various races and Geographic area. This study showed the prevalence of Microalbuminuria to be 28% among all newly detected Diabetes Mellitus patients which is a very high prevalence olivarious at all found Microalbuminuria 33.6% among males and 28.8 % among females of newly diagnosed diabetes. The slight variation from our study could be due to the different methods used. The prevalence was 21% in studies done by Vijay Viswanathan, Seena R, Lalthia S and 27.5 % in a study done by Varghese A, Deepa R, Rema M et al.

In studies done by Winconsin study, Danish population study and Pima Indians, Age was significantly correlated with Microalbuminuria. But in a study conducted by Department of Medicine, Furness General Hospital, UK age was not significantly correlated with Microalbuminuria . In our study Microalbuminuria was not significantly correlated with age. The above studies had good correlation probably because they included all Diabetes patients old and new and due to racial variations.

Sex was not significantly correlated with Microalbuminuria in our study. In previous studies done by Johet et al, males had a higher prevalence of Microalbuminuria but in studies done by Vijay et al, From Madras, Sex did not have a good correlation with Microalbuminuria. The observation that male sex significantly correlated with Microalbuminuria in Western study could be due to difference in races, and genetics of them when compared with us.

Smoking and alcohol was not significantly correlated with Microalbuminuria in our study. Most of the studies conducted by western people have revealed a significant correlation of smoking and alcoholism with Microalbuminuria. This probably may be due to the fact that all smokers observed in this study were males and that females were predominant in this study in western community females form a high proportion of smoker which is not seen in our study population. This may probably explain the weak significance of smoking and alcoholism with Microalbuminuria in our study.

In NHANES III study, and studies done by Niskanes, Sarlaud et al BMI was significantly correlated with Microalbuminuria. BMI was not significantly correlated with Microalbuminuria in our

study. This may be due to the fact that Asians & Indians in particular are more susceptible to development of central (abdominal) Adiposity even among healthier people. This has a greater influence on BMI when compared to western population who have less incidence of central adiposity & Obesity among healthier population.

Family history was significantly correlation with Microalbuminuria in our study population This study actually showed an inverse correlation of Microalbuminuria with family history which was in contrast to many other studies conducted by Vijay et al from Madras which showed a direct correlation with family history. This variation may be due to referral bias, which might have resulted from patients awareness to reach of hospital when one of their relatives had DM. Familial clustering present in previous studies could be due to genetic susceptibility linked to Angiotensin encoding gene as shown in OJI-Kree Indians.

Fasting blood sugar and post prandial was significantly correlated with Microalbuminuria in studies conducted by Vijay et al Madras and Panning H, Leuis JB, Rasid M et al. But in our study there was not any significant correlation of MAU with either fasting blood glucose or postprandial blood glucose.This may be due to

referral bias of GRH as a tertiary care center where patients are referred late when both FBG and PPBG are abnormal or racial differences among the study groups.

Lipid profile was abnormal and significantly correlated with Microalbuminuria (LDL & HDL) in various studies conducted by Parrin H, Levis JB et al and Viajy et al,Madras. But in one study serum cholesterol did not significantly correlated with Microalbuminuria. This could be probably due to the fact that a complete lipid profile (which was not done among our patients) would have been obtained and the total serum cholesterol was not of much significance in relation to Microalbuminuria.

The prevalence of diabetic retinopathy in our study population was high Microalbuminuria was significantly associated with diabetic retinopathy in studies conducted by Masored Mananiot, Mohd Agkhamine et al Iran, and by Arun, Ngugi, Lovelock et al, Winconsin Epidemiology study of Diabetic Retinopathy.

In our study also Microalbuminuria was significantly correlated with Diabetic retinopathy. This showed that

Microalbuminuria is a useful and reliable marker for early detection of diabetic retinopathy.

It is clear in this study and other that Microalbuminuria and Diabetic Retinopathy is quiet prevalent among newly diagnosed Diabetes. It is also clearly evident that Microalbuminuria is significantly correlated with Diabetic Retinopathy among newly diagnosed Diabetes.

This obviates the necessity for early detection and treatment. The American Diabetes Association recommend annual testing for Microalbuminuria for persons who have had Diabetes for five Years of move.But in a population like that of ours which report to the health system only in advanced stages of disease or only when symptoms develop. There is a huge necessity for screening newly detected Diabetes for complication and marker for complications like Microalbuminuria even at the time of Diagnosis itself, for prevent further dangerous complication like nephropathy ,retinopathy and possible other vascular complication also.

CONCLUSION

1. In this study of 61 patients with newly detected diabetes, there was a high prevalence of microalbuminuria .

2. The presence of microalbuminuria in newly detected diabetes was significantly correlated with diabetic retinopathy and negatively correlated with family history.

3. This study also showed that other variables like age, sex, BMI, FBG, PPBG, smoking, alcoholism and serum cholesterol did not correlate significantly with microalbuminuria in newly detected diabetes.

4. Therefore urinary screening for microalbumuria in newly detected diabetes, improves the early detection and primary prevention of diabetic complications.

SUMMARY

This study shows a high prevalence of MAU (28%) among newly diagnosed Diabetic population which was in concurrence with the earlier studies conducted by Olivarius et al , Vijay Viswanathan , Seena R, et al and Varghese A, Deepa R, et al.

The prevalence of Diabetic Retinopathy in our study population was very High (13 %). This study also showed a statistically significant correlation of MAU with Diabetic retinopathy (which was present in 5 persons with MAU and 3 without MAU).This was also the observation of Vinconsin, Epidemiologic study on retinopathy and studies conducted by Mohamed Afkhami, Manaviat, et al, Iran.

This study shows a significant negative correlation of MAU with family history of Diabetes (P = 0.0275). 10 (100 %) of family history positive Diabetes did not have MAU, where as 17 persons among those who did not have family history had MAU. This observation was in contrast to many of the previous observations of Vijay et al, Chennai.

This study also showed that other variables like age, sex, BMI, FBG,PPBG, smoking, alcoholism and serum cholesterol did not correlate significantly with microalbuminuria in newly detected diabetes.

Therefore urinary screening for microalbumuria in newly detected diabetes, improves the early detection and primary prevention of diabetic complications.

PROFORMA

MICROALBUMINURIA IN NEWLY DETECTED DIABETES MELLITUS AS A RISK FACTOR FOR DIABETICS RETINOPATHY

NAME: OCCUPATION:

AGE: ADDRESS:

SEX: OP NO.:

PRESENTING SYMPTOMS AT THE TIME OF DETECTION:

POLY URIA	( )	ITCHING	( )
NOCTURIA	( )	VOMITING	( )
POLYDYPSIA	( )	ABDOMINAL PAIN	( )
TIREDNESS	( )	CONSTIPATION	( )
WEIGHT LOSS	( )	PRURTITUS VULVAE	( )
GIDDINESS	( )	SEXUAL DYSFUNCTION	( )
BLURRING OF VISION	( )	NOCTURNAL DIARRHOEA	( )
SKIN INFECTION	( )	BALANITIS	( )
ULCER	( )		

PAST ILLNESS:

MYOCARDIAL INFARCTION	( )	AMOEBIASIS	( )
HYPERTENSION	( )	MUMPS	( )
PULMONARY TUBERCULOSIS	( )	ACCIDENTS	( )
JAUNDICE	( )	OPERATIONS	( )

FAMILY HISTORY OF DIABETES:

FATHER	( )	BROTHERS	( )
MOTHER	( )	SISTERS	( )
SONS	( )	WIFE	( )
DAUGHTERS	( )	HUSBAND	( )
HEAVY BABIES	( )		

PERSONAL HISTORY:

SMOKING	( )	ALCOHOL	( )
VEGETARIAN	( )	NON-VEGETARIAN	( )
SEDENTARY	( )	ACTIVE:	( )

PHYSICAL EXAMINATION:

HEIGHT: WEIGHT : BMI:

BLOOD PRESSURE: OBESE / NON-OBESE:

XANTHOMA: XANTHELASMA:

THYROID SWELLING:

FUNDUS EXAMINATION:

NO RETINOPATHY	( )
NONPROLIFERATIVE DIABETIC RETINOPATHY	( )
MILD	( )
MODERATE	( )
SEVERE	( )

PROLIFERATIVE DIABETIC RETINOPATHY ( )

SYSTEMIC EXAMINATION:

CVS: RS:

ABDOMEN: CNS:

VASCULAR COMPLICATIONS:

IHD: YES / NO

PVD: YES / NO

CARDIOMYOPATHY: YES / NO

RETINOPATHY: YES / NO

NEPHROPATHY: YES / NO

NEUROPATHY: YES / NO

INVESTIGATIONS:

BLOOD GLUCOSE: URINE:

FASTING : ALBUMIN:

2 HOURS POSTPRANDIAL: SUGAR:

BLOOD UREA: DEPOSITS:

SERUM CREATININE:

SERUM CHOLESTEROL:

ECG:

MICROALBUMINURIA:

TYPE OF DIABETES:

TYPE 1 ( ) TYPE 2 ( )

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MASTER CHART

S.No	AGE	SEX	BMI	FAM.HIS	SMOKE	ALCOHO	SYS.BP	DIA.BP	FSG	PPBS	CHOL	MAU	RETINO	DM TYPE
1	46	M	26	N	N	N	130	80	130	213	216	12.3	No	2
2	74	M	24.9	N	N	N	130	84	95	265	280	37.2	yes	2
3	42	F	22	N	N	N	130	90	155	255	230	32.2	No	2
4	34	F	24.9	N	N	N	120	76	315	332	210	15	No	2
5	55	F	26	N	N	N	130	80	212	271	202	11	No	2
6	38	F	27.1	N	N	N	130	82	187	338	260	21	No	2
7	37	F	32.4	N	N	N	130	82	140	226	169	29.7	No	2
8	51	F	28	N	N	N	132	84	101	142	171	17.3	No	2
9	45	F	24	N	N	N	114	80	110	280	184	12	No	2
10	34	F	23.8	N	N	N	110	80	244	351	284	11.5	No	2
11	45	F	26.2	N	N	N	130	76	170	270	212	14.3	No	2
12	50	F	25.6	N	N	N	146	84	279	480	214	11.9	No	2
13	70	F	27.9	N	N	N	120	90	153	247	210	62.1	yes	2
14	60	F	21.6	Y	N	N	140	80	124	240	178	10.2	No	2
15	36	F	22.2	N	N	N	130	80	244	414	227	26.7	No	2
16	45	M	14.7	Y	N	N	122	80	190	260	150	13.1	No	2
17	60	F	19.1	N	N	N	120	80	124	202	208	23.2	yes	2
18	55	F	26.8	Y	N	N	130	80	280	360	162	12.6	No	2
19	46	M	26	N	N	N	130	80	130	213	216	12.3	No	2
20	45	F	27	N	N	N	140	88	120	160	220	12.6	No	2
21	48	F	20.3	N	N	N	122	70	280	320	228	11	No	2
22	60	F	26.3	N	N	N	128	74	128	220	240	12.6	No	2
23	55	M	37.6	N	N	N	140	84	243	280	164	13	No	2
24	52	F	27.8	N	N	N	140	86	200	280	246	31.4	No	2
25	42	F	26	N	N	N	120	80	248	264	273	49.1	No	2
26	46	F	18.6	N	N	N	100	70	204	248	200	13.2	No	2
27	50	M	28.1	N	N	N	110	70	240	256	264	10.4	No	2
28	45	M	24.2	N	N	N	136	82	132	180	190	13.1	No	2
29	27	F	20	N	N	N	110	80	336	480	120	10.5	No	1
30	39	M	25.8	N	N	N	120	90	164	264	146	48.1	yes	2

S.No	AGE	SEX	BMI	FAM.HIS	SMOKE	ALCOHO	SYS.BP	DIA.BP	FSG	PPBS	CHOL	MAU	RETINO	DM TYPE
31	54	F	28.5	N	N	N	130	88	220	252	145	10.9	yes	2
32	27	F	20	N	N	N	110	80	336	480	120	10.5	No	1
33	40	F	26.5	N	N	N	100	70	234	280	181	22	No	2
34	68	M	22	N	N	N	130	70	142	296	140	61.9	No	2
35	32	M	27.2	N	N	N	120	90	253	360	198	17.1	yes	2
36	52	M	20	N	N	N	140	86	101	232	273	35.4	No	2
37	47	M	27	Y	N	N	140	88	193	347	142	14.3	No	2
38	44	F	27.4	Y	N	N	122	80	132	284	140	14	No	2
39	39	F	27	N	N	N	126	70	145	198	208	10.3	No	2
40	59	F	26.2	N	N	N	120	80	196	260	160	20.6	No	2
41	52	F	22	Y	N	N	130	80	225	256	227	14.8	No	2
42	55	M	29.1	N	N	N	130	86	238	421	287	13	No	2
43	60	M	24.2	Y	N	N	130	80	115	313	229	13.2	No	2
44	45	M	27	Y	Y	Y	120	78	148	297	250	19.5	No	2
45	51	M	22	Y	Y	N	122	80	252	496	260	11.4	No	2
46	55	M	26	N	N	N	130	80	193	297	382	12.5	No	2
47	35	F	27.5	N	N	N	130	86	151	219	218	12.6	No	2
48	58	F	26	N	N	N	130	90	201	301	280	14	No	2
49	48	M	25	N	N	N	140	88	148	229	302	40	yes	2
50	60	F	27	N	N	N	122	80	247	466	313	10.2	No	2
51	28	M	21.5	N	N	N	122	82	145	284	175	10	No	2
52	68	F	31	N	N	N	132	88	126	210	210	15	No	2
53	43	M	26	N	N	N	120	80	96	204	312	21.8	No	2
54	60	F	20	N	N	N	140	88	272	499	213	10.5	yes	2
55	51	M	22.6	N	Y	Y	120	88	289	544	187	12.5	No	2
56	35	F	23.8	N	N	N	120	80	224	379	215	10.7	No	2
57	43	F	20.5	N	N	N	140	82	130	210	234	10.3	No	2
58	25	F	25	N	N	N	140	90	191	267	249	22.8	No	3
59	60	F	26.3	N	N	N	146	80	254	416	320	14.6	No	2
60	67	F	17.5	N	N	N	132	84	210	433	250	12.1	No	2
61	30	F	29.3	Y	N	N	110	84	307	355	272	15.5	yes	2

M = Male F = Female Y = Yes N = No