Original Article

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Utility of Automated Urine Analysis in Patients with Diabetes Mellitus

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Abstract

Introduction: The prevalence of Diabetes mellitus is growing rapidly worldwide and is reaching epidemic proportions. It is estimated that there are 285 million people with diabetes worldwide and this number is set to increase to 438 million by the year 2030. *Methodology:* 250 out patients of type 2 diabetes mellitus were selected at random. Based on levels of albuminuria the patients were categorized into normo albuminuria with <30 mg/gm of creatinine, microalbuminuria with 30-300mg/gm of creatinine, and macroalbuminuria with >300mg/gm of creatinine. *Results:* In the present study it was noted that among 250 patients studied, microalbuminuria was common in males, prevalence of microalbuminuria was 20%. *Conclusion:* Testing for microalbuminuria should be standardized in type 2 diabetes mellitus patients from time of first diagnosis of diabetes because early intervention helps in delaying the progression of diabetic nephropathy.

Keywords: Albuminuria; Body Mass Index; Dyslipidemia.

Introduction

Diabetes mellitus is not a single disease entity but rather a group of metabolic disorders sharing the common underlying feature of hyperglycemia [1]. Diabetes is perhaps as old as mankind. By 400 BC, Sushruta an astute clinician and a deft surgeon supplemented the earliest information and presented a comprehensive picture of diabetes, its possible predisposing factors, clinical features, course and complications along with principles of medical care and surgical intervention wherever necessary [2]. The disorder was named Madhumeha (rain of honey) because of the sweet taste of urine attracting ants and insects [3].

The term 'Diabetes" coined by Celsus in 1st century AD means "as if passing through a siphon" was used to describe polydypsia and polyuria [4]. Cullen (1710-90) added mellitus (mel-honey) to diabetes to constitute the full name of the disorder [5].

Diabetes is one of the first diseases described in an Egyptian manuscript mentioning "too great emptying of the urine" [6]. Description of important symptoms of diabetes have been ascribed to the Chinese physician Neizling and in greater detail by Celsis of Greece(30-50BC) [7].

The prevalence of Diabetes mellitus is growing rapidly worldwide and is reaching epidemic proportions. It is estimated that there are 285 million people with diabetes worldwide and this number is set to increase to 438 million by the year 2030 [8].

Type 2 Diabetes known as Non Insulin Dependent Diabetes (NIDDM) accounts for 85 to 95% of patients with Diabetes in various populations of the world. Among the microvascular complications of Diabetes Diabetic Nephropathy is an important complication which is the leading cause of End Stage Renal Disease. The earliest manifestation of Diabetic Nephropathy being microalbuminuria can be present in NIDDM patients at the time of diagnosis. But prompt recognition helps in intervention and delay in progression of nephropathy

Methodology

250 out patients of type 2 diabetes mellitus were

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selected at random. Based on levels of albuminuria the patients were categorized into normoalbuminuria with <30 mg/gm of creatinine, microalbuminuria with 30-300mg/gm of creatinine, and macroalbuminuria with >300mg/gm of creatinine. Hypertension defined as blood pressure of >130/80 mmHg or those on antihypertensive treatment, Ischemic heart disease defined by presenting complaint or history of angina/ myocardial infarction, Diabetic neuropathy defined by signs and symptoms of neuropathy and Diabetic retinopathy defined by signs of retinopathy on slit lamp biomicroscopy.

Inclusion Criteria

- Already diagnosed adult type 2 diabetes mellitus (NIDDM) patients.

Exclusion Criteria

- Gestational diabetes mellitus and Type 1 diabetes mellitus (IDDM) patients.
- Cases of urinary tract infection, haematuria,intake of Vit. B-complex, Jaundice, urinary antiseptic which interfere with urine strip analysis were excluded from the study.

Type 2 diabetes mellitus patients with nitrite, leukocyte and blood positivity on the dipsticks were eliminated from the study and were asked to enroll again at a fresh date after control of infection.

After detailed history and clinical examination, The following investigations were done:

A. EDTA blood samples were collected for the following:

1. Fasting blood glucose
2. Postprandial Blood Glucose and
3. Glycosylated Haemoglobin (HbA1C)

B. Serum samples were collected for Lipid profile after overnight fast including serum Total cholesterol, serum Triglycerides, HDL and LDL

C. Urine Analysis

An early morning midstream urine spot sample was obtained in a sterile aseptic dry wide mouthed container. After noting down the physical characteristics chemical analysis was done by the 11 parameter Reagent strips on a urine analyser for further chemical analysis. Urine sediment examination was done in all cases. Culture was done wherever necessary.

Results

Of the 250 patients studied the following observations were made based on the Albumin creatinine ratio: 164 patients were grouped under Normalbuminuria having Albumin creatinine ratio <30mg/gm of creatinine (ACR <0.03). This group included 64.4% of the total cases.

50 patients were grouped under Microalbuminuria having Albumin creatinine ratio 30-300 mg/gm of creatinine (ACR 0.03 – 0.3). This group included 20% of the total cases.

36 patients were grouped under Macroalbuminuria having Albumin creatinine ratio >300 mg/gm of creatinine (ACR >0.3). This group included 14.4% of the total cases.

Table 1: Distribution of cases based on the albumin Creatinine ratio (acr)

Group	Acr	Number	Percentage
Normalbuminuria	<0.03	164	64.4
Microalbuminuria	0.03-0.3	50	20
Macroalbuminuria	>0.3	36	14.4

Table 2: Age group &albuminuria groups

Age group	Albuminuria Groups						Total	
	Macroalbuminuria		Microalbuminuria		Normalbuminuria			
	No.	%	No	%	No	%	No	%
30-40	4	11.10	6	12.00	19	11.60	29	11.60
41-50	8	22.20	15	30.00	44	26.80	67	26.80
51-60	14	38.90	12	24.00	65	39.60	91	36.40
61-70	4	11.10	12	24.00	27	16.50	43	17.20
71-85	6	16.70	5	10.00	9	5.50	20	8.00
Total	**36**	**100**	**50**	**100**	**164**	**100**	**250**	**100**

X^2=10.227, df : 8 p=0.249 (not significant)

In the present study total number of 250 NIDDM patients were studied involving 168 male patients (67.2%) and 82 female patients (32.8%). Males being the highest even among Microalbuminurics (54%) The age group from 41-50years showed maximum percentage of Microalbuminurics(30%), 51-60 yr group showed maximum of macroalbiminuria cases (38.9%).

Table 3: Sex Group& Albuminuria Groups

Sex	Macro		Alb Groups				Total	
			Micro		Normalbum			
	No.	%	No	%	No	%	No	%
Female	7	19.40	23	46.00	52	31.70	82	32.80
Male	29	80.60	27	54.00	112	68.30	168	67.20
Total	**36**	**100**	**50**	**100**	**164**	**100**	**250**	**100**
X^2=6.955,	df : 2			p=0.031(significant)				

Of the 250 patients 168 were males and 82 were female. In the individual normoalbumiria, microalbuminuria and macroalbuminuria groups also males were higher in number when compared to females.

Physical Analysis

The following characteristics were noted Volume- of the spot urine sample ranged from 30-50ml Colour- In 147 cases the samples showed colorless urine,30 cases showed cloudy urine and 50 cases showed yellow urine, 20 cases showed yellow orange urine and 3 cases showed milky urine.

Odour-In 240 cases the samples had ammoniacal odour and in 10 cases the samples had fruity odour.

Chemical Analysis

Urine analysis by using 11 parameter chemical reagent strips-Multistiks showed the following results

Parameter	No. of Positive Cases
Urobilinogen	0
Bilirubin	0
Ketones	10
Blood	0
Protein	88
Microalbumin	50
Nitrite	0
Leucocytes	0
Glucose	109
Specific gravity	250
pH 7	15
Acidic Ph	225
Alkaline Ph	10

Among 88 Protein positive cases , 36cases had 1+ (0.3g/l) positivity, 42 cases had 2+(1g/l) positivity and 10 cases had 3+(3g/l)positivity

Among 109 Glucose positive cases 35 cases had1+ (0.1g%) positivity, 21 cases had 2+(0.25g%)positivity and 26 cases had 3+(0.5g%) positivity.

Urine microscopy revealed 36 cases with hyaline casts, 3 cases with fatty cast, 3 cases with fine granular cast, 4 case with coarse granular cast, 3 cases with waxy casts.

20 cases with cholesterol crystals, 14 cases with triple phosphate crystals, 10 cases with calcium oxalate crystals and 13 cases with uric acid crystals.

20 cases of bacteruria were found ,when sent for culture showed growth of Escherisia coli in 14 cases, Staphylococci in 4 cases and Proteus in 2 cases. Fungal organisms were noted in 11 cases which revealed yeast forms of Candida.

Based on colony morphology, gram stain and biochemical reactions the organisms were isolated as follows:

1. Escherisia coli- showing non-mucoid pink colonies on Macconkey agar motility on hanging drop, Gran negative bacilli on gramstain and Methyl red and Indole reaction positivity.
2. Proteus vulgaris- showing pink colonies on Macconkey agar with swarming growth, fishy odour motile under hanging drop, Gram negative bacilli on gram stain showing urease positivity
3. Staphylococcus aureus-showing pinhead sized golden yellow colonies on Blood agar with b-hemolysis,Catalase and coagulase positivity. Gramstain showing Grampositive cocci in clusters.
4. Candida albicans-showing smooth creamy white colonies on Sabourauds Dextrose agar and budding grampositive yeast on gramstain

Discussion

A Total number of 250 patients were involved in this study involving 168 male patients (67.2%) and 82 female patients (32.8%). Males being the highest even

among Microalbuminurics (54%).

They were further grouped into three broad categories based on the albuminuria levels as Normoalbuminurics, Microalbuminurics and Macroalbuminurics.

The largest group was that of the Normoalbuminurics comprising of 164 cases making the maximum of 65.6% of the total case followed by Microalbuminurics 50 in number with a 20% of the total cases and Macroalbuminurics were 36 with a 14.4 % of the total cases.

Sex Distribution and Microalbuminuria in Different Studies

Sex	Male (%)	Female (%)
Present study	67.2	32.8
Mohammed Yakoob et al [9]	57	43
Microalbumiurics in present study	54	46
Microalbumiurics in Mohammed Yakoob et al [9]	37.1	29.9

Prevalence rates for microalbuminuria were estimated in the present study and compared as shown in the table [10].

Prevalence Rates in Different Studies

Study	Year of Study	Prevalence rate%
Present study n=250	2013	20
Gupta et al n=64	1991	27
Dasmahapatra et al n=116	1994	31
Alazid et al n=211	1994	36
Damsgaard et al n=211	1986	36
Schmitz et al n=503	1987	30
Gall et al n=557	1991	27
Olivarius et al	1993	30
Standl et al	1993	19
Klein et al n=798	1993	26

Age of The Subjects in Different Studies (Mean ±Sd)

	Present study	Mohammed et al[9]	Stenodiabetes study
	2013	2003	1984-1987
Mean±SD	54.2±10.4	53.1±11.9	52±2

Urine Analysis

Physical Examination

Colour of the urine was predominantly colourless (147 cases) followed by yellow urine (50 cases), cloudy urine(30 cases), yellow orange urine (20 cases) and milky urine(3 cases).

Chemical Analysis

Among urine reagent strip analysis glucosuria (109) was the predominant positive parameter followed by proteinuria(88), microalbuminuria(50) and ketones (10 cases).

Urine Sediment

Casts

Hyaline casts were the predominant cast(36 cases) followed by coarse granular cast(4 cases), fine granular cast(3 cases), fatty casts(3 cases) and waxy casts(3 cases).

Crystals

In this study cholesterol crystals were the most predominant crystals (20 cases) followed by triple phosphate crystals (14 cases), uric acid crystals(13 cases) and the calcium oxalate crystals(10 cases).

Organisms

Among 20 cases of bacteruria, culture revealed Escherisia coli as the predominant bacterial isolate (14 cases) followed by the Staphylococcus aureus (4 cases) and lastly the Proteus vulgaris (2 cases). Among the 11 fungal yeast forms noted culture revealed isolates of Candida albicans.

Conclusion

The largest group was that of the Normoalbuminurics comprised of 164 cases making the maximum of 65.6% of the total case followed by Microalbuminurics were 50 in number with a 20% of the total cases and Macroalbuminurics were 36 with a 14.4% of the total cases. Prevalence rates for microalbuminuria in the present study was 20%.

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