European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 01, 2020

SPOT URINE ALBUMIN CREATININE RATIO WITH 24 HOUR URINE PROTEIN FOR ESTIMATION OF PROTEINURIA AMONG DIABETICS FOR DETECTING NEPHROPATHY

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Abstract: Albumin is the main protein that is usually located in the blood, but when the kidneys are functioning well, virtually no albumin is found in the urine. When the blood flows into balanced kidneys it flushes excess products and provides the items that the body requires, such as protein. Our study aimed to assess and standardize the spot (random) urinary albumin creatinine ratio (UACR) method for the proteinuria assessment. A urine albumin test (formerly known as microalbumin) detects and measures the amount of albumin in the urine for kidney disease checking. Based on spot urine albumin, 50 percent of patients had micro albuminuria and 40 % had normal urine albumin levels and remaining had macroalbuminuria. Mean urine albumin levels were 107.38 mg/dl.

Keywords: Urine albumin, Creatinine ratio, Urine protein, Proteinuria, Nephropathy, Blood urea

1. INTRODUCTION

When blood flows into balanced tissues, it typically cleans out the harmful material and brings only the items that the body wants, including proteins. Because of their large size, protein in the blood normally can't pass through the glomerular capsule. The easiest way to examine the kidneys is to check the substance they produce based on this fact it makes complete sense to consider one or more substances produced by the kidneys as a marker of systemic illnesses [1]. Exogenous as well as endogenous agents precipitating or contributing to the disease have to pass through the kidney circulation and cause glomerular injury. Following this hypothesis researches started to consider micro-albuminuria as a prognostic marker. Kidney proteinuria means renal malformation and / or inflammation of the

parenchymal kidney tissue, which is the cause of proteinuria. It can arise as a consequence of enhanced protein leakage via the glomerulus, either due to a deficiency in permselectivity causing glomerular proteinuria or due to abnormal tubular handling of the filtered protein causing tubular proteinuria, or both [2,3]. Within the standard model, the rise within glomerular permeability contributes to an improvement in the amount of albumin extracted every day as illustrated by the rising thickness and duration of the blue arrows [4]. Richard Bright, who first linked kidney failure (kidney granular degeneration-known as Bright failure) to albuminous urine [5].

2. AIM AND OBJECTIVES

Aim:

Comparison of the spot urine creatinine albumin ratio with 24 hour urine protein for proteinuria calculation in diabetics for diagnosis of nephropathy.

Objectives:

To study the relation between the protein content of a 24 hours collection of urine and the spot urine sample albumin creatinine ratio. To determine the superior diagnostic test in quantification of proteinuria in diabetic nephropathy patients.

3. REVIEW OF LITERATURE

The concentration of plasma albumin is calculated by nature by the intravascular albumin mass separated by the plasma volume [6]. The overall body albumin pool is roughly 3.5-5.0 g per kg body weight (250–300 g for a stable 70 kg adult). The plasma compartment comprises around 42% of this volume, the remainder are in extra-vascular compartments [7]. Another gene that was suggested to influence the outcome in type 2 diabetic patients and have an effect on RAAS blocking treatment was the ADAMTS13 gene (involved in highly thrombogenic mit Willebrand-factor proteolysis [vWF] ultra high-weight multimers). One version (version Ala 618) was correlated with less proteolytic behavior, higher risk of chronic renal disease and cardiovascular complications, and better response to ACE inhibitor (ACWI) therapy in a sub study of the Bergamo NEphrologic Diabetes Complications Trial (BENEDICT).

4. MATERIALS AND METHODS

The prospective study was performed among diabetic subjects in a rural tertiary care hospital admitted during the period of October 2014 to March 2016. The diabetes mellitus type 2 patients of both the gender admitted in medicine wards and Treatment criteria were selected based on the American Diabetes Association, National Diabetes Data and World Health Organization Diagnostic Criteria (after excluding the patients of below mentioned exclusion criteria) for the study. Informal approval has been given. The study was approved by the Ethics Committee. Brief background and surgical review have been performed. Each patients were subjected to routine laboratory investigations (complete haemogram, kidney function test, chest x-ray, ECG, etc.). Other investigations like 24 hours urine for estimation of proteins, random midstream urine for albumin and creatinine, blood for lipid profile etc were also obtained.

Spot urine sample was collected in clean dry glass or plastic containers free from detergents and traces of proteins by investigator/residents/nurses and stored at 2-8°C, for quantification of ACR (Albumin : Creatinine Ratio). The collected samples was then sent to Biochemistry Clinical Laboratory, where the ACR was then measured based on the principle

of agglutination reaction adapted on the dimension of clinical chemistry system which allows direct quantification of albumin in urine samples.

The values observed for urinary microalbumin is in mg/L which is then converted to mg/gm. From the same sample Urinary Creatinine was also measured using a modified kinetic Jaffe reaction. The value observed for urinary creatinine was in mg/dL using simple arithmetic calculation mentioned as below the albumin/creatinine ratio was converted from mg/dL to mg/gm.

5. OBSERVATION AND RESULTS

Table 1: Patients distribution based on duration of DM

Duration of DM	**No. of patients**	**%**
1-6 months	24	20.0
7-12 months	23	19.2
1-2 years	53	**44.2**
3-5 years	17	14.2
>5 years	3	2.5
Total	**120**	**100.0**

Table no. 1 shows that, maximum patients under study had diabetes in the duration of 1-2 yrs (44.2 %), approximately 20 percent patients were diabetics since one year and least no of patients in the duration of >5yrs (2.5 percent).

Table 2: Distribution of patient based on treatment received

Treatment	**No. of patients (n=120)**	**%**
No	3	2.5
Yes	117	97.5
• INSULIN	6	5.0
• OHA	111	92.5

***OHA= Oral hypoglycemic agent**

As shown in table no. 2, among 120 patients about 117 (97.5 %) patients were on treatment for diabetes mellitus. Most of them were on Oral hypoglycemic agents (92.5%) and small no of patients were on insulin injections (5 %)

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Table 3: 24 hr Urine Protein distribution of patients studied

24 hr Urine Protein	No. of patients	%
<150	49	40.8
150-300	18	15.0
300-1000	42	35.0
>1000	11	9.2
Total	**120**	**100.0**

As shown in table no. 3, out of 120 patients 49 patients (40.8%) had normoalbuminuria i.e urine albumin <150

mg/24 hrs, 18 patients (15%) had microalbuminuria (150-300 mg/24hrs), 42 patients (35 %) had macroalbuminuria (300-1000 mg/24hrs), remaining 11 patients had albumin of more than 1000/24hrs.

Table 4: Urine Albumin (of spot samples) distribution of patients studied-

Urine Albumin in mg/dl	No. of patients	%
<30	48	40.0
30-300	60	50.0
300-1000	12	10.0
>1000	0	0.0
Total	**120**	**100.0**

As shown in table no. 4, out of 120 patients 48 patients (40%) had normoalbuminuria i.e urine albumin <30 mg/dl, 60 patients (50%) had microalbuminuria (30-300 mg/dl), 12 patients (10 %) had macroalbuminuria (300-1000 mg/dl).

Table 5: Urine albumin creatinine ratio (UACR) distribution of patients studied

UACR	No. of patients	%
<30	70	58.3
30-300	26	21.7
300-1000	24	20.0
>1000	0	0.0

Total	**120**	**100.0**

Mean ± SD: 361.21±449.83

As shown in table no. 5, according to the distribution of patients based on urine albumin creatinine ratio in mg/gm which is equivalent to urine albumin excretion rate, 58.3 % of patients of diabetes mellitus had normal urine albumin excretion rate, 21.7 % had microalbuminuria i.e urine albumin excretion rate in the range of 30-300 mg/gm, and 20 % had macroalbuminuria.

Table 6: Blood urea and Serum Creatinine distribution of patients studied

Parameter	**No. of patients (n=120)**	**%**	**Mean ± SD**
Blood Urea (mg/dl)			
• <25	26	21.7	
• 25-50	85	70.8	**33.92±12.09**
• >50	9	7.5	
Serum Creatinine (mg/dl)			
• <1	20	16.7	
• 1-1.4	64	53.3	**1.28±0.36**
• >1.4	36	30.0	

As shown in table no. 6, in our study 26 patients (21.7%) had blood urea <25 mg/dl, 85 patients (70.8%) had blood urea between 25-50 mg/dl, and remaining (7.5 %) had >50 mg/dl. Mean blood urea levels were approximately 33.92 mg/dl. Similarly 64 patients (53.3%) had Sr creatinine in the range of 1-1.4 mg/dl, 36 patients (30%) had creatinine more than 1.4 mg/dl. Mean creatinine levels were approximately 1.28 mg/dl.

Table 7: Urine glucose findings distribution of patients studied

U.GLUCOSE	**No. of patients**	**%**
-	35	29.2
+	32	26.7
++	25	20.8
+++	17	14.2
++++	11	9.2
Total	120	100.0

As shown in table no. 7, the distribution of patients based on urine glucose detection by dip stick method. It shows 29.2 % of patients were negative for glycosuria, 26.7% had just one plus glucose in urine, and very minimal no of patients

i.e 9.2 % had four plus glucose in urine.

6. DISCUSSION

The study was performed in diabetic topics in tertiary care hospitals. The study was accepted by the Ethics Committee. This study identified patients with type 2 diabetes mellitus who visited the outpatient clinic and were classified on the basis of the American Diabetes Association, the National Diabetes Report and the WHO Diagnostic Criteria. This selected a total number of 130 patients for the analysis. Ten participants were omitted from the analysis owing to insufficient 24-hour urine processing, and eventually treated 120 patients with type 2 diabetes. Creatinine levels were estimated in spot urine sample and 60.8% of patients had normal urine creatinine levels i.e between 300- 600 mg/dl , 35.8 % of the patients had, 300 mg/dl of urine creatinine levels and remaining had >600 mg/dl of creatinine levels in urine.

Urine glucose was detected by dip stick method. It shows 29.2 % of patients were negative for glycosuria, 26.7% had just one plus glucose in urine, and very minimal no of patients i.e 9.2 % had four plus glucose in urine. Ultrasonography screening was done in all the patients to look for kidney size and rule out any other abnormalities. Many patients had fatty liver accounting to about 30% of the cases, 22.5 % had grade 1 medical renal disease, and minority had grade 2 medical renal disease and liver cirrhosis and cystitis changes. About 37.5 % of the patients had unremarkable findings in USG. Creatinine clearance was estimated by Cockcroft Gault equation. Maximum patients of diabetes are in the stage 3 nephropathy (51.7 percent) followed by stage 2 accounting to 34.2 percent. None of the patients were in the end stage renal disease.

7. CONCLUSION

The excretion of protein in the urine varies with stress, exercise, hydration status, posture and completely [8]. The gold standard test is quantitative estimation of proteins made on urine over 24 hours [9]. But estimation of urinary protein by 24 hr collection is a cumbersome task with many errors including incomplete collection, bacterial growth, incorrect timing, and incomplete bladder. Urine creatinine and UACR were compared with different levels of 24 hour Urine Albumin, presenting significant correlation, UA is increasing with increased levels of 24 hr. Urine protein, UACR mean levels significantly correlated with 24 hr urine proteins levels with increasing trend with $P<0.001$. Various parameters like body mass index, fasting and post prandial blood sugar, glycosylated hemoglobin and renal functions were compared with 24 hr urine proteins. Among these only postprandial blood sugar (p value 0.083) and serum creatinine (p value 0.038) are statistically significant. Hence PP blood sugar and serum creatinine correlate with 24 hr urine proteins. Study concludes that the spot/random UA/C ratio is a accurate, easy method to be implemented and used in daily macro albuminuria testing work. This procedure may be a safe alternative to obtaining a 24-hour urine examination to diagnose severe proteinuria in patients with type 2 diabetes mellitus.

8. REFERENCES

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