Section: General Medicine

Original Research Article

CORRELATION OF 24 HOUR URINARY PROTEIN TO SPOT PROTEIN CREATININE RATIO AND ITS ASSOCIATION WITH HBA1C LEVELS IN DIABETIC PATIENTS

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Abstract

Background: Diabetes mellitus (DM) has reached epidemic proportions globally. Diabetic nephropathy is the leading cause of end stage renal disease worldwide. Proteinuria is recognized as an independent risk factor for cardiovascular and renal disease. The aim of the study is to determine the correlation of 24 hr urine protein with spot protein creatinine ratio (SPCR) in patients with type 2 diabetes mellitus and To study the association of glycated hemoglobin (HbA1c) with 24 hours urinary protein and spot urine protein creatinine ratio in patients with type 2 diabetes mellitus. **Materials and Methods:** In the present study, a total of 100 patients were considered, 50 patients were having HbA1C levels of more than or equal to 7 (Group A) and 50 patients were having HbA1C levels less than 7 (group B). 24 hour urinary protein, spot protein creatinine ratio and HbA1c were collected and correlated in each group. **Results:** There is a significant correlation of 24 hour urinary protein with spot protein creatinine ratio and also there is a significant correlation between HbA1C with 24 hour urinary protein. There is a significant association between duration of diabetes and 24 hour urine protein. **Conclusion:** There is a positive correlation of 24 hour urinary protein with spot protein creatinine ratio. there is a significant association of glycated hemoglobim level with the amount of proteinuria.

INTRODUCTION

Diabetes mellitus (DM) has reached epidemic proportions globally. Diabetic nephropathy is the leading cause of end stage renal disease worldwide. Proteinuria is recognized as an independent risk factor for cardiovascular and renal disease. 24 hour urine collection is the gold standard to measure proteinuria. However, in clinical practice 24 hour urine collection is cumbersome and associated with errors in the collection making it an unreliable measure of proteinuria. Diabetes Mellitus is a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of insulin.[1] Diabetes mellitus (DM) has reached epidemic proportions globally.[2,3] The World Health Organization (WHO) estimated that there were 135 million diabetic individuals in the year 1995 and it has been projected that this number will increase to 300 million by the year 2025.[4,5] India is often referred to as the diabetes capital of the world.[6]

India is home to 69.1 million people with DM and is estimated to have the second highest number of cases of DM in the world after China in 2015.2 Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. Diabetic nephropathy is the leading cause of end stage renal disease world wide.[7] Relation between hyperglycemia and proteinuria is not linear.[8] HbA1c of 8.1% (average blood glucose 200mg/dl) is a threshold above which risk of proteinuria increases logarithmically.[9]

This study is designed to see the association of HbA1c with 24 hour urinary protein and spot protein creatinine ratio among patients with type 2 diabetes mellitus.

MATERIALS AND METHODS

This cross sectional study will be conducted in Adichunchanagiri Hospital and Research Centre, BG Nagara for a period of 18 months (November 2017 to May 2019). Department of Medicine, in Adichunchanagiri Hospital and Research Centre.

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Sample Size

This study will be conducted on 100 patients with type 2 diabetes mellitus. In the study two groups are created based on the glycated haemoglobin values with group A having value more than 7 and group B having value less than or equal to 7. With type 2 diabetes mellitus in patients being 20%, level of significance 5%, admissible error as 2.5%, sample size was calculated to be 100.

Calculation based on the formula:

$n = f(\alpha/2,\beta)\times[p1 \times (100- p1) + p2 \times (100-p2)] / (p2 - p1)2$

Where p1 and p2 are the percent 'success' in the groups A and B, respectively

Inclusion Criteria

1. Type 2 Diabetes Mellitus patients
2. Age > 18 years
3. Patients willing to participate in the study.

Exclusion Criteria

Patients with

1. Acute febrile illness
2. Malignancies, collagen vascular disorders or any other systemic condition causing proteinuria and Immunocompromised diseases.

Method of Collection of Data

Data for the study will be collected by detailed history taking, patient evaluation, clinical examination and investigations of patients presenting with type 2 diabetes mellitus in a structured proforma in Adichunchanagiri Hospital and Research Centre of Medical Sciences, B.G. Nagara. Clearance was obtained from the ethical committee of the institution before the commencement of the study. Consent was obtained from the participating subjects before taking part in the study.

Procedure

Patients were instructed to collect 24 hour urine starting from second urine sample in the morning (i.e. after discarding the first morning sample) till the first urine sample the next day morning. A single voided urine specimen was obtained soon after the 24 hour urine collection. Samples were sent to biochemistry lab where:

- The urine protein was measured using immunoturbidimetric method. Test was performed on an automated analyzer.
- Urine creatinine was measured by Jaffe's reaction and the test was performed on am automated analyzer. Under aseptic precautions about 6 mL of venous blood was drawn from ante- cubital vein of study subjects into EDTA vacuum evacuated tubes for estimation of glycated haemoglobin using nephlometric method.

Statistical Analysis

The data thus collected were analyzed using appropriate statistical methods. The mean and standard deviations were computed. Pearson's Correlation Coefficient which is expressed as r. Student chi square test expressed as p. A value of $p<0.05$ has been considered to be statistically significant. SPSS version 22 (IBM SPSS statistics, Somers NY, USA) was used to analyze data.

RESULTS

Table 1: Age distribution of study subjects

Age	Group A	Group B	Total
40-50	6	11	17
51-60	20	21	41
61-70	19	17	36
71-80	5	1	6
Total	**50**	**50**	**100**

As per table 1 mean age of all study subjects=59.2±8.2 Mean age of Group A=51±8.6 Mean age of Group B=57.3±7.3. In the study the mean age of patients in group A is 51±8.6 and group B is 57.3±7.3 which is having a significant association with the total study group's mean age of 59.2±8.2.

Table 2: Sex distribution of study subjects

	Male	Female	Total
Group A	26	24	50
Group B	28	22	50
Total	54	46	100

As per table 2 the male to female sex ratio in group A is 1.08:1 and group B is 1.27:1 which is having a significant association with the total study group's sex ratio of 1.17:1. The study was male preponderance.

Table 3: Distribution of study subjects according to duration of diabetes

Duration	Group A	Group B
<5 yrs	1	35
>5 yrs	49	15
Total	50	50

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Table 3 shows the mean duration of diabetes in total study group is 6.9±2.7yrs which is less when compared with the mean duration of diabetes in group A i.e. 9.2±3.2 years and more when compared with the mean duration of diabetes in group B is i.e. 4.6±2.7yrs.

Table 4: Comparison of FBS, PPBS, Glycated Hb, 24-hr urine Protein, Spot urine PCR between two groups

	No of subjects		FBS (gm/dl)	PPBS (gm/dl)	Glycosylated Hb	24-hr urine protein(mg/day)	SPCR (spot protein creatinine ratio)
Group A	50	Mean±SD	232±76	345±72	8.8±0.6	2432±312	2.42±0.32
Group B	50	Mean±SD	109±21	160±26	6.0±0.5	93±40	0.09±0.04
		p- value	<0.001(HS)	<0.001 (HS)	<0.001 (HS)	<0.001 (HS)	<0.001 (HS)

According to table 4 there is high significant difference of FBS, PPBS, Glycosylated Hb, 24-hr urine Protein, Spot urine PCR between two groups with p value less than 0.001. Mean FBS in Group A is 232±76, in Group B is 109±21 and of all study subjects is 170.8±83.4. Mean PPBS in Group A is 345±72, in Group B is 160±26 and of all study subjects is 254.3±106.9. Mean HBA1C in Group A is 8.8±0.6 in Group B is 6.0±0.5 and of all study subjects is 7.5±1.4. Mean 24 hr urine protein in Group A is 2432±312 in group B is 93 ± 40 and of all study subjects is 1263.2±1195.4. Mean SPCR in group A 2.42±0.32 is in group B 0.09±0.04 is and of all study subjects is 1.25±1.1.

Table 5: Correlation of 24HUP with SPCR

	r- value	p-value
Correlation between 24hr urine protein and spot urine PCR	0.98	0.00001

As per table 5 r-value (Pearson correlation coefficient) 0.98 shows high correlation between 24hr urine protein and spot urine PCR. In the present study there is a significant correlation of 24 hour urinary protein with spot protein creatinine ratio with a correlation coefficient of 0.98.

Table 6: Association of 24 hour urine protein with duration of diabetes

Duration of diabetes	24 hr urine protein		p-value#
	<150	>150	
<5 yrs	33	03	<0.5
>5 yrs	12	52	

As per table 6 in the present study there is a significant association between duration of diabetes and 24 hour urine protein with chi square value of 49.4.

DISCUSSION

In the present study the age distribution is from 40 to 80 years. Majority of the patients were in the age group of 51 - 60 years. The mean age of the patient is 59.2±8.2. The mean age of the present study was compared with other studies, the mean age in the others studies are 58.8±7.7 years in Sandeep et al[10], 61 ±17 years in Shona et al[12], 50±4.9 years in Nazmia et al[11].Significant association is observed with Sandeep et al[10] study.

In the present study male to female ratio is 1.17:1 which is compared with study conducted by Shona et al[12] where the ratio is 1.04:1,Chaudari et al[13] where the ratio is 2.2:1, Pallavi et al[14] where the ratio is 1.77:1, Vyankatesh et al[15] where the ratio is 1.38:1.Significant association is observed with study conducted by Shona et al.[12]

In the present study duration in years since the diagnosis of diabetes is 6.9±3.8 which is comparable with study conducted by Sandeep et al[10] where the mean duration is 10.1±3.46, Nazmia et al[11] where the mean duration is 6.36±1.65. Significant association is observed with study conducted by Nazmia et al.[11]

The range of 24 hour urine protein in present study is 0.09 – 2.9 g/l which is compared with the study conducted by Rodby et al[16] which is 0.05 – 13 g/day and study conducted by Sunitha et al,[17] the value is 0.09 – 2.9 g/day. Significant association is observed with study conducted by Sunitha et al.[17]

The mean fasting blood sugar in present study is 170 ± 83.4mg/dl which is compared with the study conducted by Sandeep et al[10] where the mean fasting blood sugar was 122±21.32mg/dl, Sunitha et al[17] it was 197±89.5mg/dl and Nazmin et al[11] it was 188±75.6mg/dl. Significant association is observed with study conducted by Sunitha et al[18] and Nazmin et al.[11]

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Glycosylated hemoglobin in present study is 7.5 ± 1.4 as compared to study conducted by Sandeep et al[19] where it is 7.68 ± 1.31, Nazmia et al[11] where it is 9.42±3.04 and Sunitha et al.[17] Significant association is observed with the study conducted by Sunitha et al[17] and Sandeep et al.[10] The mean protein creatinine ratio in present study is 1.25 ± 1.1 which is comparable to study conducted by Sunitha et al[17] where the mean protein creatinine ratio is 1.08±1.28 and Mohammed et al[18] where the mean is 1.18 ± 1.8. Significant association is observed with the study conducted by Mohammed et al.[18]

The correlation co-efficient of 24 hour urinary protein with protein creatinine ratio in the present study is 0.98 which is compared with study conducted by Chitalia et al[18] where the coefficient was 0.97 and Chaudhari et al[13] where the correlation coefficient was 0.8. Significant association is observed with the study conducted Chitalia et al[18] and Sunitha et al.[17]

Correlation of urinary protein with HbA1c is significant in the present study which is compared with other studies by Nazmin et al,[11] Sunitha et al[17] and Chaudhari et al[13] where HbA1c shows significant correlation with urinary protein. In the present study duration of diabetes showed a significant correlation with the proteinuria which is compared with other studies conducted by Sunitha et al[17] which showed the similar result.

CONCLUSION

There is a positive correlation of 24 hour urinary protein with spot protein creatinine ratio, so spot urine protein creatinine ratio can be used as an alternative tool to 24 hour urinary protein estimation. Proteinuria is risk factor for progression of diabetic nephropathy and for the cardiovascular complications. Thus early detection of proteinuria and timely management of progression of proteinuria is the corner stone to prevent the chronic kidney disease and cardiovascular complications in diabetic patient.

REFERENCES

1. Das AK, Madhu V, Mohan V, Rao PV. Definition, Diagnosis and classification of diabetes. Chapter 6. In: Textbook of diabetes mellitus. 3rd ed. New Delhi. Jaypee Brothers Medical Publishers (P) Ltd; 2014. p87.
2. International Diabetes Federation. IDF Diabetic Atlas. 7th ed. Retrieved from http://www.idf.org/idf-diabetes-atlas-seventh-edition.
3. Iyer SR. Type 2 diabetes express highway, where is the 'U' turn? J Assoc Physicians India. 2003;51:495-500.
4. US Renal Data System. 1989 Annual data report. Bethesda, MD: National Institute of Diabetes and Digestive and Kidney Diseases; 1989.
5. Barnas U, Schmidt A, Haas M, Kaider A, Tillawi S, Wamser P, et al. Parameters associated with chronic renal transplant failure. Nephrol Dial Transplant 1997;12(2):82-5.
6. Ruggenenti P, Perna A, Mosconi L, Pisoni R, Remuzzi G. Urinary protein excretion rate is the best independent predictor of ESRF in non-diabetic proteinuric chronic nephropathies. Gruppo Italiano di Studi Epidemiologici in Nefrologia (GISEN). Kidney Int. 1998;53:1209-16.
7. Chitalia VC, Kothari J, Wells EJ, Livesey JH, Robson RA, Searle M, et al. Cost-benefit analysis and prediction of 24-hour proteinuria from the spot urine protein-creatinine ratio. Clin Nephrol 2001;55:436-47.
8. Ginsberg JM, Chang BS, Matarese RA, Garella S. Use of single voided urine samples to estimate quantitative proteinuria. N Engl J Med. 1983;309:1543-6.
9. eymsfield SB, Arteaga C, McManus C, Smith J, Moffitt S. Measurement of muscle mass in humans: Validity of the 24-hour urinary creatinine method. Am J Clin Nutr. 1983;37:478-94.
10. Kundu SK, Biswas IB, Roy N, Basu N. Correlation of HbA1c with urinary ACR, eGFR and serum creatinine in type 2 diabetes mellitus. J Evol Med Dent Sci. 2017 Apr 10;6(29):2353-7.
11. Haque N, Debnath BC, Ibrahim M, Sirajuddin K, Majumder M, Hossain MS. Association of HbA1c with urinary ACR and eGFR in Type-2 diabetes mellitus. Pulse. 2014;5(1):6-11.
12. Methven S, Macgregor MS, Traynor JP, O'Reilly DS, Deighan CJ. Assessing proteinuria in chronic kidney disease: protein creatinine ratio versus albumin- creatinine ratio. Nephrol Dial Transplant. 2010;25(9):2991-6.
13. Chaudhari RK, Niraula A, Thapa S, Sherchand O, Pradhan B, Lamsal M, et al. Assessment of proteinuria using protein creatinine ratio in spot urine sample versus 24 hours sample. International Journal of Therapeutic Applications. 2018;35
14. Shah PP, Shah V. Comparison of spot urine protein creatinine ratio with 24 hour urine protein for estimation of proteinuria. J Assoc Physicians India. 2014;62(5):406-10
15. Anchinmane VT, Sankhe SV. Evaluation of protein: creatinine ratio on random urine sample in assessment of proteinuria. Int J Res Med Sci. 2016 Dec; 4(12):5201-3.
16. Rodby RA, Rohde RD, Sharon Z, Pohl MA, Bain RP, Lewis EJ. Collaborative Study Group. The urine protein to creatinine ratio as a predictor of 24-hour urine protein excretion in type 1 diabetic patients with nephropathy. American Journal of Kidney Diseases. 1995 Dec 1;26(6):904-9.
17. Thirumalasetti S, Thatty VB. Association of Glycemic Control with Urinary Protenuria and Protein: Creatine Ratio in Type II Diabetic Subjects. Journal of Evolution of Medical and Dental Sciences. 2015 Sep 28;4(78):13609-14.
18. Mohammed S, Anees S, Nazki F. Correlation of 24 hour urinary protein,urine protein: creatinine ratio and HbA1c in type 2 diabetes with and without nephropathy. MedPulse International Journal of Biochemistry. 2017 Aug; 3(2):29-3

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