



COMPARISON OF URINE ALBUMIN CREATININE RATIO TO SERUM CREATININE IN THE EARLY PREDICTION OF CHRONIC KIDNEY DISEASE IN DIABETIC PATIENTS

Arundhathy Soman

Department of Biochemistry, Amrita Institute of Medical Science and research centre, Amrita Viswa Vidyapeetham, Kochi, Kerala, India.

Mrudula E.V

Department of Biochemistry, Amrita Institute of Medical Science and research centre, Amrita Viswa Vidyapeetham, Kochi, Kerala, India.

S. Meghana

Department of Biochemistry, Amrita Institute of Medical Science and research centre, Amrita Viswa Vidyapeetham, Kochi, Kerala, India.

ABSTRACT **Background:** Diabetes mellitus is a metabolic disorder that presents with an elevated blood glucose level, which in long term may cause systemic complications like chronic kidney disease. High blood pressure with DM increases the risk of having CKD.

Aim & Objective: To compare urine albumin creatinine ratio to serum creatinine in the early prediction of chronic kidney disease in diabetic patients.

Materials & Method: A total of 250 clinically diagnosed diabetic patients within the age group of 30-70 years, from January 2021 – March 2021 were studied. Data on serum creatinine, urine albumin creatinine ratio and presence of hypertension were collected & subjected to statistical analysis.

Result And Discussion: Out of 250 patients analysed 63 (25.2%) presents with microalbuminuria with an increased excretion of albumin in urine. In these patients, 87.3% of them have shown normal serum creatinine & 12.69% have shown elevated creatinine levels.

Conclusion: Urine albumin creatinine ratio can be used as a more sensitive renal marker than serum creatinine in the early prediction of CKD in diabetic patients.

KEYWORDS : Diabetes mellitus, serum creatinine, urine albumin creatinine ratio, chronic kidney disease.

INTRODUCTION

Diabetes mellitus is a group of metabolic disease characterized by hyperglycemia. This can be due to defect in insulin action, insulin secretion or both. Number of cases and prevalence of diabetes is steadily increasing over past decades. Symptoms of DM include polyuria, polyphagia, polydipsia, weight loss, blurry vision. This results in long term damage, dysfunction & failure of various organs like eyes, kidneys, nerves, heart & blood vessels.

Chronic kidney disease (CKD) is a common complication seen in DM. Kidney contains delicate blood vessels for filtration. Long term duration of DM can damage these filtration systems and increases the pressure. High blood pressure cause further damage by increasing pressure in these delicate filtering systems.

Symptoms of this include proteinuria, fluid retention, nausea, headache, vomiting. Diagnosis is usually by evaluating serum creatinine. CKD is a potentially devastating complication of DM. Early detection of CKD allows for the implementation of therapeutic interventions, facilitates dosing of medicines, and thus complete renal damage and associated risk factors can be avoided.

In our study, we compare the most commonly used renal marker serum creatinine and urine albumin creatinine ratio for the early diagnosis of chronic kidney disease.

MATERIAL

This retrospective study was conducted at Amrita Institute of Medical Science (AIMS) during the period of January 2021 - March 2021. The patients clinically diagnosed with Diabetes Mellitus presented to the Endocrinology department were included in this study. Data for the study were collected from the Clinical Biochemistry Laboratory attached to the hospital.

250 clinically diagnosed diabetic patients between the ages of 30 – 70 were included in the study. Patients with autoimmune diseases, hormonal imbalance (other than diabetes mellitus), malignancies and those below 30 years and above 70 years were excluded from this study.

METHOD

Serum creatinine and urine albumin creatinine ratio were estimated using Fully Automated Analyzer System Cobas C 8000. Creatinine is estimated by kinetic colorimetric assay and microalbumin by Immunoturbidimetric assay.

RESULT

Statistical analysis was performed using IBM SPSS version 20.0 software. Numerical variable UACR were represented using mean and standard deviation. To test the statistical significance of the association of categorical variables such as hypertension with UACR, Chi Square test was applied. A p value of <0.05 was considered to be statistically significant.

Table1: Percentile Distribution Of Diabetic Patients In UACR Categories.

UACR categories	Normal(C1) (<30mg/g)	Microalbuminuria (C2) (30-300mg/g)	Macroalbuminuria (C3) (>300mg/g)
Percentage of patients	66.00%	25.20%	8.80%

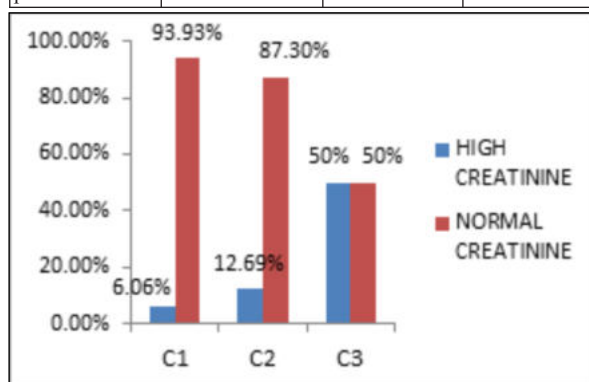


Figure 1: Graph Representing Comparison Of Serum Creatine To UACR Values In All The 3 Categories.

Table2: Comparison Of Hypertension In UACR Categories.

UACR categories	Normal (C1) (<30mg/g)	Microalbuminuria (C2) (30-300ng/g)	Macroalbuminuria (C3) (>300mg/g)
Hypertensive	52.60%	33.70%	13.70%

DISCUSSION

This retrospective study involves 250 clinically diagnosed diabetic patients, between the ages of 30 – 70, who have visited the

endocrinology department, were included in our study. This included 149 males and 101 females. Serum creatinine and urine albumin creatinine ratio in all these patients are analyzed. A ratio of albumin (mcg/L) to creatinine (mg/L) of less than 30 is normal; a ratio of 30-300 signifies microalbuminuria and values above 300 are considered as macroalbuminuria.

All these 250 patients were grouped into 3 categories based on UACR values as depicted in table 1, about 25.20% patients belong to microalbuminuria category & 8.80% to macroalbuminuria categories respectively.

We then compared serum creatinine values to UACR values in all the 3 categories. From figure 1 it is evident that in patients having microalbuminuria, only 12.69% shows a clear increase in serum creatinine values whereas 87.30% presents with normal serum creatinine values. This indicates that even though the patient starts increased elimination of albumin in urine due to defective kidney tubules, serum creatinine level remains normal or mildly elevated. The kidney reserve is such that about 50% kidney function must be lost before creatinine level in blood is raised. So examining serum creatinine values alone in prolonged diabetic patients can miss out microalbuminuria. Thus evaluating urine albumin creatinine ratio can help us identify albuminuria which is an important early marker of CKD.

Serum creatinine is the most common measurement used to monitor CKD in progress and treatment response due to the ease of estimation. An abnormally high level of creatinine thus warns of a possible malfunction or failure of kidneys. From our study we noticed that serum creatinine is a poor marker to detect early renal failure as 87.30% of patients with microalbuminuria showed normal serum creatinine levels.

Comparison of hypertension with UACR values are shown in Table 2, which shows that 33.70% of hypertensive patients belong to microalbuminuria category & 13.70% of hypertensive patients, belongs to macroalbuminuria category. Hypertension (HTN) is a known risk factor in chronic kidney disease. The association between HTN & UACR was found to be statistically significant (p value =0.002) in this study too.

Detection of CKD in early stages is essential for its proper management. Estimating serum creatinine alone can miss out early detection of CKD. Thus another marker UACR can be used more effectively than serum creatinine. UACR values get increased before serum creatinine increases. Thus from our comparative study we conclude that evaluating UACR is better than serum creatinine in the early prediction of chronic kidney disease.

Our study has its own limitations. The total number of males and females taken in the study were not equal, so we were not able to determine the prevalence of disease among gender. We haven't noted when the onset of diabetes occurred due to short period of study.

CONCLUSION

Diabetes mellitus a metabolic disorder in which the amount of sugar in the blood is elevated. Chronic kidney disease is a potentially devastating microvascular complication of DM. Diabetic patients are at high risk for kidney disease if they have hypertension. Early detection of CKD can prevent its progression and associated complications. Elevated serum creatinine is a well known marker of CKD but this does not provide early detection. Thus it is important to have a more sensitive marker to detect CKD as early as possible. This comparative study pointed out that estimation of urine albumin creatinine ratio is a better diagnostic test than serum creatinine for the early diagnosis of chronic kidney disease in diabetic patients.

REFERENCES

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes care*. 2014 Jan 1; 37(Supplement 1):S81-90.
2. Molitch ME, DeFronzo RA, Franz MJ, Keane WF. Nephropathy in diabetes. *Diabetes care*. 2004; 27:S79.
3. McFarlane P, Cherney D, Gilbert RE, Senior P. Chronic kidney disease in diabetes. *Canadian journal of diabetes*. 2018 Apr 1; 42:S201-9.
4. Perrone RD, Madias NE, Levey AS. Serum creatinine as an index of renal function: new insights into old concepts. *Clinical chemistry*. 1992 Oct 1; 38(10):1933-53.
5. Park JI, Baek H, Kim BR, Jung HH. Comparison of urine dipstick and albumin: creatinine ratio for chronic kidney disease screening: A population-based study. *PLoS one*. 2017 Feb 2; 12(2):e0171106.
6. Momin AR, Pankaja SN, Gouri MB. Albumin/creatinine ratio, as predictor of microalbuminuria, a risk factor for nephropathy in type 2 diabetes mellitus patients. *Int.*

7. J. Health Sci. Res. 2011; 1:34-40.
7. Jafar TH, Chaturvedi N, Hatcher J, Levey AS. Use of albumin creatinine ratio and urine albumin concentration as a screening test for albuminuria in an Indo-Asian population. *Nephrology Dialysis Transplantation*. 2007 Aug 1; 22(8):2194-200.
8. Bendig JJ, Keen H, Viberti GC. Creatinine is a poor marker of renal failure. *Diabetic medicine: a journal of the British Diabetic Association*. 1985 Jan; 2(1):65-6.
9. Shemesh O, Golbetz H, KRIs JP, Myers BD. Limitations of creatinine as a filtration marker in glomerulopathic patients. *Kidney international*. 1985 Nov 1; 28(5):830-8.
10. Rao MV, Qiu Y, Wang C, Bakris G. Hypertension and CKD: Kidney Early Evaluation Program (KEEP) and National Health and Nutrition Examination Survey (NHANES), 1999-2004. *American Journal of Kidney Diseases*. 2008 Apr 1; 51(4):S30-7.
11. Horowitz B, Miskulin D, Zager P. Epidemiology of hypertension in CKD.
12. Perrone RD, Madias NE, Levey AS. Serum creatinine as an index of renal function: new insights into old concepts. *Clinical chemistry*. 1992 Oct 1; 38(10):1933-53.