Burden of Proteinuria and Risk Factors of Chronic Kidney Disease among Adult Population in Urban Puducherry, India

MANAN JHAWAR[1], VENKATACHALAM JAYASEELAN[2], RAMYA SELVARAJ[3]

ABSTRACT

Introduction: In the recent times, Chronic Kidney Diseases (CKDs) are emerging as a serious problem all over the world along with diabetes mellitus and hypertension. The presence of proteinuria is considered as an indicator of increased risk of progressive kidney diseases.

Aim: To determine the prevalence of proteinuria among an adult population of a tertiary care institute of Puducherry, India.

Materials and Methods: A cross-sectional study was carried out in the field practice areas of an urban health centre of a tertiary care institute, in Puducherry, India. A total of 215 study respondents were selected by systematic random sampling. All adults aged above 18 years who were residing for at least a year in Puducherry were included in the study. The study period was from July 2015 to October 2015. All the categorical variables were described as proportions. Chi square test was done to compare between two proportions. Univariate analysis was done to estimate the Odds Ratio (OR) with 95% CI.

Results: The mean age of the study participants was 38.5±12.8 years. Majority, 145 (67.4%) of the study participants were females. The prevalence of proteinuria was found to be 9.3%. While 4.7% and 11.2% of participants used tobacco and alcohol respectively, 13.5% and 27.9% had diabetes mellitus and hypertension respectively. Elderly age, diabetes mellitus and hypertension were found to be statistically significant predictors for proteinuria.

Conclusion: The prevalence of proteinuria was high in our study population (9.3%) and hypertension and diabetes mellitus were also found to be risk factors for CKD. Routine screening among the general population for proteinuria in community-based settings might be an effective step to bring down the rate of progression of CKD.

INTRODUCTION

There is a rise in the incidence of CKD in the world as well as in India [1]. It will be of major public health concern and will put an additional burden on both the healthcare and economy in the years to come. In India, it has been recently estimated that the age-adjusted incidence rate of End Stage Renal Disease (ESRD) is around 229 per million populations, and more than 100,000 new patients enter the renal replacement programs annually [2]. CKD is increasingly being recognised as an emerging public health problem in India. Patients with CKD are at a higher risk of progression to ESRD. Progress to kidney failure and other adverse outcomes can be prevented or at least delayed by early detection and treatment through population-based screening techniques. Proteinuria and glycosuria are early biochemical markers for kidney disease which can be used as a proxy measure to give clue to the clinician to diagnose and confirm presence of kidney disease at an early stage. In the resource poor settings of the developing countries including India, most patients cannot afford the treatment cost of renal replacement therapy for ESRD. Among the various predictors of progression of CKD to ESRD, proteinuria is the most potent predictor. A cross-sectional study was done among 5588 adults who were screened from 13 academic and private medical centres all over India of which prevalence of proteinuria was found to be 17.2% and hypertension and diabetes were found to be common risk factors among patients diagnosed with CKD [1]. Data from a nation wide health survey conducted in Korea revealed that diabetes, hypertension and smoking were significant risk factors for CKD [3]. In a person suffering from diabetes or hypertension, the blood vessels in the kidney get damaged which leads to inability of kidney to filter out fluid and waste from the body further increasing the intra glomerular pressure impairing glomerular filtration which leads to CKD. Another community-based cross-sectional study in a coastal area of Villupuram district of Tamil Nadu, India. was conducted amongst 1200 respondents aged 20 years and above. The study revealed the prevalence of proteinuria to be 12.3% using albumin specific dipstick method as a screening test [4]. Hence, early detection of this easily measurable marker in resource constraint setting is surely a cost-effective way to reduce the burden of CKD. Due to lack of community-based screening programmes for early detection of CKD, majority of the patients present with an advanced stage disease. As there is limited published literature on the burden of proteinuria in Puducherry [5], this study was conducted to estimate the prevalence of the same in our setting to get an insight into the prevailing situation.

MATERIALS AND METHODS

A cross-sectional study was conducted in the service area of an Urban Health Centre (UHC) and its neighbouring areas that had a population of approximately 35,000 people. This area is administratively divided into 4 regions- Kuruchikuppam, Vaithikuppam, Vazhaikulam and Chinnayapuram. The sample size was calculated using OpenEpi software based on the study done in Tamil Nadu, considering the prevalence of proteinuria as 12% [4], with 95% Confidence interval and a non-response rate of 10%. The estimated sample size was 180. However, we enrolled 248 study respondents of which 14% were non-responders. All adults aged above 18 years and residing for at least a year in Puducherry were included in the study. We got informed consent from 215 study participants. Interviews of the participants were taken after explaining the study procedure and obtaining the informed written consent. Confidentiality of the records was maintained.

The study was conducted over a period of four months from July 2015 to October in 2015. The protocol was approved by JIPMER Scientific Advisory Committee (JSAC) and by the Institute Ethics Committee (human studies), before the start of the study. Assuming that the population of the four regions is equally distributed and this assumption was concurrent with health centre annual data, 53 respondents from each region were randomly selected by systematic random sampling technique. Each of the four regions had approximately 1000 to 1500 houses. First house was selected randomly and after that every tenth house was chosen till the required sample size was fulfilled. In case a house was locked, it was revisited and if it was still locked the next house was chosen. One individual was selected from each house randomly. Informed written consent was obtained from the study respondent and a survey using a pre-designed, pre-tested proforma was conducted. Proteinuria was estimated by using visually read dipstick method. The participant was asked to collect their urine in a container and the dipstick was immersed in it. Based on the colour change, the results were graded as negative, trace (15 to 30 mg/dL), 1+ (30 to 100 mg/dL), 2+ (100 to 300 mg/dL), 3+ (300 to 1000 mg/dL) or 4+ (more than 1000 mg/dL). Negative and trace urinary proteins were classified as 'no proteinuria' and others depending on the amount of urinary proteins based on the colour coding were classified as 1+, 2+, 3+ and 4+ 'proteinuria' [6]. The variables included in the data collection proforma were sociodemographic variables like name, age, gender, history of high blood pressure, diabetes, tobacco and alcohol use; under physical examination: height, weight and blood pressure; under lab investigations: grade of proteinuria and glycosuria. Body Mass Index (BMI) was calculated by dividing weight in kg by square of height in metre. Blood Pressure (BP) was measured by Omron blood pressure apparatus and according Joint National Committee (JNC) guidelines, individuals was diagnosed with hypertension if systolic BP>140 mmHg and/or diastolic BP>90 mmHg on at least two occasions. History of diabetes was confirmed by case sheets, treatment card or medicines that the patient was taking and according to American Diabetic Association (ADA) guidelines, two abnormal blood sugar values (fasting blood sugar≥126 mg/dl or post-prandial blood sugar≥200 mg/dl) or random blood sugar≥200 mg/dl with classical symptoms of diabetes (polyphagia, polyuria, polydipsia) was diagnostic of diabetes.

STATISTICAL ANALYSIS

The data collected were entered in MS Excel and analysis was done using statistical software IBM SPSS version 20.0. All the categorical variables were described as proportions. Chi square test was done to compare between two proportions. Univariate analysis was done to estimate the OR with 95% CI.

RESULTS

A total of 215 participants were interviewed. The mean age of the study participants was 38.5±12.8 years. The maximum proportion of study participants were from the age group of 18-30 years (30.7%) followed by the age group of 31-40 years (28.8%) while only 17.2% were from the age group of more than 50 years. With respect to gender, majority, 145 (67.4%) of the study participants were females. While 4.7% and 11.2% of participants used tobacco and alcohol respectively, 13.5% and 27.9% had diabetes mellitus and hypertension respectively [Table/Fig-1]. The prevalence of proteinuria was 9.3% (95% CI: 5.9-13.7). Out of the 20 study participants who had proteinuria, 12 of them had Grade 1, six of them had Grade 2 while two of them had Grade 3 proteinuria [Table/Fig-2]. The prevalence of glycosuria was found to be 13.5% (95% CI: 9.6-18.7). [Table/Fig-3] shows the bivariate analysis showing association between proteinuria with selected risk factors. In our study, there was no significant association found between gender, tobacco use, and alcohol use and BMI with proteinuria. In our study, we found that age more than 50 years is a risk factor for proteinuria

Variable	Number (%) (n= 215)
Age category (in years)	
<30	66 (30.7)
31-40	62 (28.8)
41-50	50 (23.3)
>50	37 (17.2)
Gender	
Female	145 (67.4)
Male	70 (32.6)
Risk Factors:	
Smoking	
Present	10 (4.7)
Absent	205 (95.3)
Alcoholic	
Present	24 (11.2)
Absent	191 (88.8)
Hypertension	
Present	60 (27.9)
Absent	155 (72.1)
Diabetes Mellitus	
Present	29 (13.5)
Absent	186 (86.5)

[Table/Fig-1]: Sociodemographic characteristics of participants.
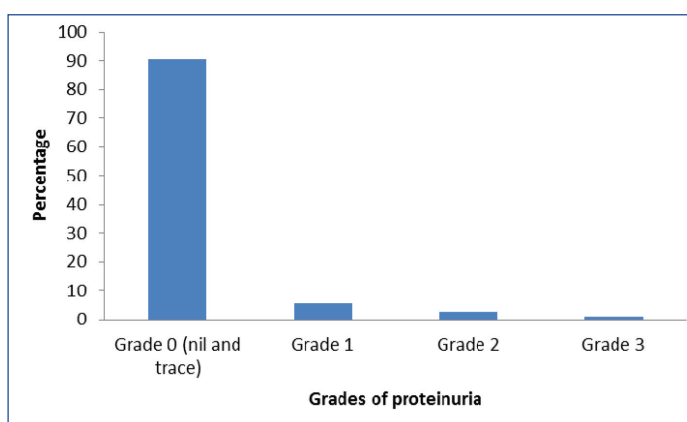
[Table/Fig-2]: Grade of proteinuria among study participants (n=215)

Variable	Present Number (%)	Absent Number (%)	p-value	Odds Ratio With 95% CI		
Age						
> 50	9 (24.3)*	28 (75.7)	0.005**	4.88	1.67	14.19
< 50	11 (6.2)	167 (93.8)		1		
Gender						
Males	8 (11.4)	62 (88.6)	0.24	1.43	0.56	3.68
Females	12 (8.3)	133 (91.7)		1		
Smoker						
Present	2 (20.0)	8 (80.0)	0.11	2.60	0.51	13.17
Absent	18 (8.8)	187 (91.2)		1		
Alcoholic						
Present	4 (16.7)	20 (83.3)	0.17	2.19	0.67	7.19
Absent	16 (8.4)	175 (8.4)		1		
Diabetes Mellitus						
Present	11 (37.9)	18 (62.1)	0.001**	12.02	4.40	32.85
Absent	9 (4.8)	177 (95.2)		1		
Hypertension						
Present	12 (20.0)	48 (80.0)	0.001**	4.59	1.77	11.90
Absent	8 (5.2)	147 (94.8)		1		
Body Mass Index						
Overweight (BMI ≥ 23)	12 (12.1)	87 (87.9)	0.41	1.52	0.56	4.13
Normal (BMI < 23)	8 (6.9)	108 (93.1)		1		

[Table/Fig-3]: Association of proteinuria with selected risk factors in study participants. *Figures in parenthesis are row percentages. Chi square test was applied to compare the proportions, **p-value less than 0.05 is considered statistically significant.

{OR: 4.88, 95% CI: 1.67-14.19}. Similarly, we found that diabetes mellitus was also found to be a risk factor for proteinuria {OR: 12.02, 95% CI: 4.40-32.85} and participants with hypertension also had a higher odds of proteinuria {OR: 4.59, 95% CI: 1.77-11.90}.

DISCUSSION

The prevalence of proteinuria in our study population was 9.3%. Similarly a cross-sectional study carried out in a coastal area of Villupuram district of Tamil Nadu, showed a prevalence of 12.3% [4]. The latter study was done in an area with predominant Muslim peri-urban population where the risk of CKD was more; therefore in our present study, we find relatively less prevalence of proteinuria. A cross-sectional survey was carried out at certain selected slum areas of Mirpur at Dhaka city in Bangladesh which showed proteinuria prevalence of 7.7% by the dip stick method [7] which is low compared to our study. It could be due to the fact that the other study was conducted among a younger population as the mean age of their study population was 34.4 years while the mean age of our study population was 38.5 years.

Our study also observed the proportion of participants with diabetes mellitus and hypertension were 13.5% and 27.9% respectively. Similarly, a cross-sectional study done in Villupuram district of Tamil Nadu reported the prevalence of diabetes mellitus and hypertension to be 18% and 24.3% respectively [4] and a study done by Singh NP et al., showed that the study population had 31.2% prevalence of hypertension and 7.3% prevalence of diabetes mellitus [8], while a study carried out by Gupta SK et al., had 23.3% prevalence of hypertension [5]. Our study also focussed on the determinants of proteinuria. In the present study, the prevalence of proteinuria increased with increase in age. Studies conducted by Singh NT et al., showed a similar pattern [8]. According to the studies done by Modesti PA et al., and Ishigami T et al., the prevalence of proteinuria was more in men as compared to women similar to the present study finding [9,10]. Though in our study, smoking was not found to be a significant predictor of proteinuria, few studies conducted by Yamada Y et al., and Briganti EM et al., showed that cigarette smoking is a risk factor for proteinuria [11,12]. The study by Ishigami T et al., showed that subjects with higher serum Gamma-Glutamyl-Transpeptidase (GGT) level had a higher probability of proteinuria irrespective of alcohol consumption [10]. While study done by Cheungpasitporn W et al., showed no significant association between high alcohol consumption and risk for developing proteinuria similar to the observation in our study [13]. The present study showed that diabetes mellitus and hypertension were significant risk factors for proteinuria. Studies done by Modesti PA et al., and Yamada Y et al., also show the same [9,11]. The findings in this study and other similar studies across India show that the prevalence of risk factors for CKD is strikingly increasing day by day across the country. Individuals with these comorbidities are more prone for CKD compared to the general population. The participants who had proteinuria, hypertension and diabetes mellitus were counselled and further referred to higher health facilities for diagnosing kidney diseases and for their due treatment.

LIMITATION

Though dipstick method is easy and rapid, false negative and false positive results are unavoidable and limit its utility. The study was carried out among adult population in service area of a tertiary care institute in Puducherry, India. So the study result cannot be generalised to the entire population of Puducherry as the study population (35,000) is very small as compared to the total population of Puducherry (around 13 lacs). We need more population based studies to generalise the result.

CONCLUSION

The prevalence of proteinuria was high in our study population and was found to be 9.3% (95% CI: 5.9 to 13.7). The study concludes that diabetes mellitus, hypertension and age more than 50 years were found to be statistically significant risk factors for proteinuria. Due to the high burden of CKD prevailing in the community, early detection of kidney disease through simple screening technique like urine dipstick method which is an easy and an economical way to screen for kidney disease in primary healthcare setting can prove to be of immense help in early diagnosis of CKD. Further research can help in exploring the strategies that can be recommended in various settings to bring down the rising burden of CKD.

ACKNOWLEDGEMENTS

REFERENCES

[1] Singh AK, Farag YM, Mittal BV, Subramanian KK, Reddy SRK, Acharya VN, et al. Epidemiology and risk factors of chronic kidney disease in India – results from the SEEK (Screening and Early Evaluation of Kidney Disease) study. BMC Nephrol. 2013;14(1):114.

[2] Modi GK, Jha V. The incidence of end-stage renal disease in India: a population-based study. Kidney Int. 2006;70(12):2131-33.

[3] Lee SJ, Chung CW. Health behaviors and risk factors associated with chronic kidney disease in Korean patients with diabetes: The Fourth Korean national health and nutritional examination survey. Asian Nursing Research. 2014;8(1):08-14.

[4] Jayaseelan V, Murugan N, Abraham SB, Singh Z, Purty AJ, Sathya GR, et al. Prevalence of risk factors for chronic kidney disease in a coastal area of Tamil Nadu, South India. Journal of Medical and Dental Sciences. 2012;2(4):29-33.

[5] Gupta SK, Varshney A, Mathew JT, Gaur N, Purty AJ, Joy B, et al. A study of renal diseases in the rural community of Pondicherry, India. Journal of Pharmaceutical and Biomedical sciences. 2012;23(23):01-03.

[6] Assessment of proteinuria [Internet]. Last updated: Jul 29, 2016. Available from: http://bestpractice.bmj.com/best-practice/monograph/875.html

[7] Huda MN, Alam KS. Prevalence of chronic kidney disease and its association with risk factors in disadvantageous population. International Journal of Nephrology. 2012:01-07.

[8] Singh NP, Ingle GK, Saini VK, Jami A, Beniwal P, Lal M, et al. Prevalence of low glomerular filtration rate, proteinuria and associated risk factors in North India using Cockcroft-Gault and modification of diet in renal disease equation: an observational, cross-sectional study. BMC Nephrol. 2009;10(1):4.

[9] Modesti PA, Bamoshmoosh M, Rapi S, Massetti L, Bianchi S, Al-Hidabi D, et al Relationship between hypertension, diabetes and proteinuria in rural and urban households in Yemen. Journal of Human Hypertension. 2013;27:572–79.

[10] Ishigami T, Yamamoto R, Nagasawa Y, Isaka Y, Rakugi H, Iseki K, et al. An association between serum γ-glutamyltransferase and proteinuria in drinkers and non-drinkers: a Japanese nationwide cross-sectional survey. Clin Exp Nephrol. 2014;18(6):899-910.

[11] Yamada Y, Noborisaka Y, Ishizaki M, Honda R, Tsuritani I, Yamada S, et al. Association between cigarette consumption and proteinuria in healthy Japanese men and women from an occupational population. J Occup Health. 2004;46(5):365-73.

[12] Briganti EM, Branley P, Chadban SJ, Shaw JE, McNeil JJ, Welborn TA, et al. Smoking is associated with renal impairment and proteinuria in the normal population: the AusDiab kidney study. Australian Diabetes, Obesity and Lifestyle study. Am J Kidney Dis. 2002;40(4):704-12.

[13] Cheungpasitporn W, Thongprayoon C, Kittanamongkolchai W, Brabec BA, O'Corragain OA, Edmonds PJ, et al. High alcohol consumption and the risk of renal damage: a systematic review and meta-analysis. QJM. 2015;108(7):539-48.

PARTICULARS OF CONTRIBUTORS:
1. Student, Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India.
2. Assistant Professor, Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India.
3. Senior Resident, Department of Community Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Karaikal, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Venkatachalam Jayaseelan,
Assistant Professor, Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry-605006, India.
E-Mail: drvenkatpgi@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.