Prevalence of Low Glomerular Filtration Rate (Low eGFR), Proteinuria and Associated Risk Factors in a Rural Area of Bangladesh using Cockcroft-Gault and Modification of Diet in Renal Disease Equation: An Observational, Cross-sectional Study.

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Abstract

Chronic kidney disease (CKD) has become a global public health concern. The adverse outcomes of CKD are enormous in developing countries due to paucity of facilities for renal replacement therapy and high cost of services for management of ESRD. Chronic kidney disease and its risk factors are common in Bangladesh, however community-based data on the subject is lacking. The purpose of this study to estimate and compare the prevalence of low GFR, proteinuria and associated risk factors using Cockcroft-Gault (CG) and Modification of Diet In Renal Disease (MDRD) equation based on serum creatinine (SCr) in a rural area of Bangladesh. An observational cross-sectional study performed on patients aged 18 years or older living in the rural area of Mymensingh were randomly selected from the database of the health care system and who gave informed consent to participate in the study. Subjects with nonresidents, pregnant, cognitive dysfunction that interfered with understanding and answering the study questionnaire were excluded from the study. The sample size was calculated with a formula for cross – sectional study and to meet the following criteria: a confidence level of 95%, acceptable error 15% and expected prevalence of CKD 15.7%. Therefore a sample size of 920 was considered appropriate for the study. The study was carried out for a period of 16 months between March 2014 and June 2015. Renal impairment was defined as eGFR less than 60 ml/min/1.73 m2. Thus stage 3, 4 and 5 of KDOQI were grouped as renal impairment. Renal function was estimated from serum creatinine using Cockcroft-Gault and MDRD (modification of diet in renal disease) equations. Data are presented as frequencies, percentages or mean ± standard deviation as appropriate. The Chi-square test was used for categorical variables and multivariate analyses was performed by binary logistic regression to identify the risk factors of CKD. All statistical tests were 2-sided. A p value lower than 0.05 was considered to be significant. All statistical analyses were done with SPSS Version 11.5 for Windows. Over half (51.7%) of the patients were male and rest 48.3% female with mean age 42.3 ± 13.2 years. Most (67.3%) of the patients were illiterate and only 22.8% engaged in salaried job. Over two-third (67.4%) of the patients were over weight and obese, 31.2% normal and very few (1.4%) under weight. The prevalence of low eGFR was 15.3% by Cockcroft-Gault and 15.9% by MDRD equation. The survey population had a 17% prevalence of proteinuria. Sex, illiterate, over weight & obese, obese by WC, hypertension, proteinuria, raised serum creatinine, diabetes mellitus, anaemia, family H/O CKD, low HDL cholesterol and raised total cholesterol were found to be the independent predictors of CKD. The prevalence of low eGFR in this rural population is common and an increase prevalence of proteinuria. The association between CKD and risk factors was also highly significant. There is an urgent need for more detailed measurement for these risk factors through a comprehensive survey to evaluate individuals with risk factors, to enable earlier detection and risk factor reduction through rising of awareness.

CBMJ 2016 July: Vol. 05 No. 02 P: 04-13

Keywords: CKD, risk factors, prevalence, Cockcroft-Gault formula; Modification of Diet in Renal disease equation.

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Introduction

Chronic kidney disease (CKD) defined as kidney tissue damage manifested by pathologic abnormalities or markers of damage with or without a reduction in the GFR, persisting for at least three months,[1] is a common non-communicable disease worldwide. Patients with reduced renal function represent a population at risk for progressive kidney disease, end-stage renal disease (ESRD) and cardiovascular disease. Unfortunately CKD is under-diagnosed and undetected resulting in lost opportunities for improving its clinical outcome.[2]

The burden of CKD is huge especially in developing countries where majority present in the late stages of the disease. The cost of managing ESRD and dialysis is simply prohibitive in some areas. The reasons for racial disparities in the prevalence, incidence and treatment of CKD are not fully understood, although they are explained partly by co-existing medical conditions and modifiable risk factors, such as socioeconomic, lifestyle and culture. It is likely, however, that the complete picture incorporates a complex interaction between sociocultural, genetic and environmental factors.[3,4]

The presence of chronic kidney disease (CKD) is associated with an increased risk of a multitude of adverse health outcomes, including end-stage kidney disease (ESKD) as well as a substantial reduction in life expectancy.[5,6] Proper population based epidemiological studies on the exact prevalence of CKD in Bangladesh are lacking. The National Kidney Foundation, through its Kidney Disease Quality Outcome Initiative (K/DOQI) and other National institutions recommend glomerular filtration rate (GFR) estimates for the diagnosis, classification, screening and monitoring of CKD.[7,8] Without GFR measurements the clinical manifestations of kidney failure remain largely silent until renal function is so low that the patient may be in end stage renal disease.[9] Measuring serum creatinine is easier but this test cannot detect early kidney disease. In many clinical settings where creatinine clearance is not available decisions concerning drug dosing must be made based on estimations of creatinine clearance.[10] Accurate determinations of GFR can be done using inulin clearance or radionuclide-labeled markers. Since GFR determinations by inulin or radioisotope studies on large numbers of patients are impractical, cumbersome and expensive, clinicians also rely on GFR prediction equations on a daily basis. Cockcroft-Gault (CG) and Modification of Diet in Renal Disease (MDRD) formulae are the most widely used and recommended by K/DOQI guide-lines to estimate kidney function.[11] Though both these formulae have been validated in Western population and in patients with renal dysfunction, there is still a need to validate them in Asian population.[12,13]

Chronic kidney disease (CKD) is increasingly being recognized as an emerging public health problem in Bangladesh. However, community based estimates of low glomerular filtration rate (GFR) and the exact prevalence and cause of proteinuria as a marker of kidney disease is not known in our population. Validity of traditional serum creatinine based GFR estimating equations in South Asian subjects is also debatable. We intended to estimate and compare the prevalence of low GFR, proteinuria and associated risk factors in Bangladesh using Cockcroft-Gault (CG) and Modification of Diet In Renal Disease (MDRD) equation.

Methods

Patients aged 18 years or older living in the rural area of Mymensingh were randomly selected from the database of the health care system and who gave informed consent to participate in the study. Subjects with nonresidents, pregnant, cognitive dysfunction that interfered with understanding and answering the study questionnaire were excluded from the study. The sample size was calculated with a formula for cross – sectional study and to meet the following criteria: a confidence level of 95%, acceptable error 15%, and expected prevalence of CKD 15.7%.[14] Therefore a sample size of 920 was considered appropriate for the study. The study was carried out for a period of 16

months between March 2014 and June 2015. All subjects were assessed for biochemical and clinical variables using established guidelines and norms.

Weight and height were measured while patients wore light clothing and no shoes. With these data, body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Based on BMI, subjects were categorized as underweight (< 18.4), normal (18.5 – 22.9), overweight (23 – 24.9) and obese (>25).[15] Waist circumference (WC) was used to assess body fat distribution. WC was measured using smallest circumference between lower ribs and iliac crests. The mean of two measurements was taken as the final value. A WC > 85 cm and > 80 cm was used as the cutoff for men and women respectively.[16] Blood pressure was measured twice in the right or left arm using a calibrated sphygmomanometer (WelchAllyn, Germany) at the heart level. Hypertension was defined by a systolic blood pressure 140mmHg or diastolic blood pressure 90 mmHg (namely unknown hypertensive) and/or concomitant use of antihypertensive medications by self-report (known hypertensive).[17] The diagnosis of diabetes was established after two fasting glucose values of 126 mg/dl (namely unknown diabetic) using fingertip blood (accutrend glucometer) and/or concomitant use of antidiabetic medications by self-report (known diabetic).[18] Anaemia was defined as haemoglobin <12.0 g/dl (NKF-K/DOQI, 2006); Proteinuria was estimated using visually read dipsticks (Teco diagnostics, USA). None and trace urinary protein were classified as no proteinuria and rest (1+, 2+ and 3+) as proteinuria. Raised total cholesterol was measured >240 mg/dL, raised LDL cholesterol >130 mg/dL, low HDL cholesterol <40 mg/dL for men, <46 mg/dL for women and raised serum triglyceride >150 mg/dL. Serum creatinine was estimated using modified Jaffe's method on a Hitachi 911 auto analyzer. All samples were analyzed in the same laboratory on same equipment throughout the duration of study. Twice daily quality control checks were done. The upper limit for normal serum creatinine levels was 1.2 mg/dl.[19] Ccr (creatinine clearance rate) and estimated GFR (glomerular filtration rate) were calculated from serum creatinine (mg/dL) by using Cockcroft-Gault and MDRD (modification of diet in renal disease) equations.

Equations Developed to Predict GFR in Adult Based on Serum Creatinine. (1) Cockcroft-Gault equation (1976)

Ccr (mL/ min) = {(140 – age) × Weight (Kg)/ (72 × S. creatinine (mg/dL)} × 0.85 if female.(1)

(2) Original MDRD equations (2000) estimated GFR = 186.3 × (S. creatinine) $^{1.154}$ × (age) $^{0.203}$ × 0.742 (if female).

Normalization of Ccr or GFR for Body Surface Area (BSA). Normalization of Ccr for BSA allows more accurate evaluation of renal function. Traditionally, 1.73m2 is used as standard BSA. As in our population average BSA is low, it needs to be corrected by 1.73/BSA:[20]

Ccr corrected by BSA = {Ccr (mL/ min) × 1.73m^2} / BSA (m2). (2)

Body surface area can be determined from height and weight using a monogram found in standard references:

BSA (m2) = {Height(cm) × Weight(Kg) /3600} (3)

The estimated GFR (eGFR) was then used to classify subjects into Kidney Disease Outcomes Quality Initiative (K/DOQI) stages of CKD. Renal impairment was defined as eGFR less than 60 ml/min/1.73 m2. Thus stage 3, 4 and 5 of KDOQI were grouped as renal impairment. Data are presented as frequencies, percentages or mean ± standard deviation as appropriate. The Chi-square test was used for categorical variables and multivariate analyses was performed by binary logistic regression to identify the risk factors of CKD. All statistical tests were 2-sided. A p value lower than 0.05 was considered to be significant. All statistical analyses were done with SPSS Version 11.5 for Windows (Chicago, IL, USA).

Results

Over half (51.7%) of the patients were male and rest 48.3% female with mean age was 42.3 ± 13.2 years and youngest and oldest patients were 18 and 76 years respectively. Most (67.3%) of the patients were illiterate and only 22.8% engaged in salaried job (Table I). Over two-third (67.4%) of the patients were over weight and obese, 31.2% normal and very few (1.4%) were under weight in terms of body mass index (BMI). The mean BMI was 24.9 ± 3.2 kg/m^2 and lowest and highest BMI were 17.7 and 24.9 kg/m^2 (Table II). The prevalence of stage 3 – 5 of eGFR using CG and MDRD equation was shown in Table III. Depending on the method to estimate the low eGFR using Cockcroft-Gault was 15.3% (16.6% male and 14% female) and according to MDRD equation was 15.9% (9.5% male and 22.3% female). The prevalence of proteinuria was 17% defined by CG and MDRD equation. Patients with renal impairment were compared with those without impairment, stratified according to gender. Patients with renal impairment in male had close relatives with age 50 years, salaried job, smoker, obese by WC, hypertension, proteinuria1+, raised serum creatinine, haemoglobin <12g/dl, NSAID intake, family H/O DM, raised total cholesterol, raised LDL cholesterol and raised triglyceride more frequently than patients without impairment (Table IV). Similar associations were also found for females in table V and showed that age 50 years, illiterate, over wt & obese, hypertension, proteinuria1+, haemoglobin <12g/dl, family H/O CKD, family H/O HTN, family H/O DM, raised total cholesterol, low HDL cholesterol, raised triglyceride were significantly associated with renal impairment (p>0.05). In multivariate analysis, over weight & obese, proteinuria1+, raised serum creatinine, haemoglobin <12g/dl and low HDL cholesterol were found to be the independent predictors of CKD with ORs being 1.75, 0.23, 0.01, 3.94 and 0.36 respectively by Cockcroft-Gault equation (Table VI). In MDRD equation, sex, obese by WC, illiterate, hypertension, proteinuria1+, raised serum creatinine, diabetes mellitus, family H/O CKD and raised total cholesterol were found to be the independent predictors of CKD with ORs being 0.36, 0.59, 1.78, 0.04, 0.01, 0.01, 0.05, 1.81 and 0.03 respectively (Table VII).

Table I. Demographic variables of the patients (n = 920)

Characteristics	Frequency	Percentage
Age (years)		
<30	198	21.5
30 - 50	431	46.8
50 - 70	273	29.7
≥70	18	2.0
Sex		
Male	476	51.7
Female	444	48.3
Educational status		
Illiterate	619	67.3
Literate	301	32.7
Salaried job	210	22.8

Table II. Distribution of patients according to Body Mass Index (n = 920)

Body Mass Index (Kg/m^2)	Frequency	Percentage
Under weight	13	1.4
Normal	287	31.2
Over weight & obese	620	67.4

Table III. Prevalence of low eGFR and proteinuria in study population (n = 920)

eGFR (ml/min/1.73 m2)	Cockcroft-Gault	MDRD
eGFR (ml/min/1.73 m2)	119(12.9)	103(11.2)
30 - 59	15(1.6)	34(3.7)
15 - 29	7(0.8)	9(1.0)
<15	141(15.3)	146(15.9)
eGFR <60 ml/min/1.73 m2		
Proteinuria (≥1+): prevalence by eGFR strata		
30 - 59	12(10.1)	18(17.5)
15 - 29	9(60.0)	16(47.0)
<15	5(71.4)	6(66.7)
eGFR <60 ml/min /1.73 m2	26(18.4)	40(27.4)
Proteinuria (≥1+): prevalence in total population	157(17.0)	157(17.0)

Table IV. Characteristics of males with and without renal impairment (n = 476)

Variables	eGFR < 60 ml/min/1.73 m2 (n= 79)	eGFR > 60 ml/min/1.73 m2 (n= 397)	P value
Age ≥ 50 years	49(62.0)	139(35.0)	<0.001
Education: Illiterate	55(69.6)	249(62.7)	0.244
Salaried job	15(19.0)	123(31.0)	0.032
Smoker	42(53.2)	159(40.1)	0.031

Exercise (≥60 min/day)	10(12.7)	342(86.1)	0.068
Over wt &obese	44(55.7)	227(57.2)	0.808
Obese by WC	29(36.7)	102(25.7)	0.045
Hypertension	49(62.2)	32(8.1)	<0.001
Proteinuria ≥1+	49(62.0)	24(6.0)	<0.001
Raised serum creatinine (mg/dl)	45(57.0)	8(2.0)	<0.001
Haemoglobin <12g/dl	75(94.9)	111(28.0)	<0.001
Diabetes mellitus	4(5.1)	00	-
NSAID intake	79(100.0)	320(80.6)	<0.001
Family H/O CKD	14(17.7)	94(23.7)	0.248
Family H/O HTN	59(74.7)	292(73.6)	0.835
Family H/O DM	54(68.4)	333(83.9)	0.001
Family H/O MI	19(24.1)	122(30.7)	0.235
Raised total cholesterol	39(49.4)	10(2.5)	<0.001
Low HDL cholesterol	15(19.0)	58(14.6)	0.324
Raised LDL cholesterol	30(38.0)	24(6.0)	<0.001
Raised Triglyceride	29(36.7)	27(6.8)	<0.001

Figure in the parentheses denoted corresponding percentage

***Data were analysed using Chi-square (c2) Test**

Table V. Characteristics of females with and without renal impairment (n = 444)

Variables	eGFR<60 ml/min/1.73m^2 (n= 62)	eGFR>60 ml/min/1.73m^2 (n= 382)	P value
Age ≥ 50 years	35(56.5)	68(17.8)	<0.001
Education: Illiterate	57(91.9)	258(67.5)	<0.001
Salaried job	00	72(18.8)	-
Smoker	10(16.1)	00	-
Exercise (≥60 min/day)	5(8.1)	155(40.6)	0.071
Over wt &obese	36(58.1)	316(82.7)	<0.001
Obese by WC	25(40.3)	141(36.9)	0.607
Hypertension	34(54.8)	25(6.5)	<0.001
Proteinuria ≥1+	53(85.5)	31(8.1)	<0.001
Raised serum creatinine (mg/dl)	37(59.7)	00	-
Haemoglobin <12g/dl	55(88.7)	63(16.5)	<0.001
Diabetes mellitus	14(22.6)	00	-
NSAID intake	62(100.0)	375(98.2)	0.283
Family H/O CKD	24(38.7)	89(23.3)	0.010
Family H/O HTN	43(69.4)	329(86.1)	0.001
Family H/O DM	43(69.4)	350(91.6)	<0.001
Family H/O MI	19(30.6)	97(25.4)	0.383
Raised total cholesterol	38(61.3)	3782(100.0)	<0.001
Low HDL cholesterol	19(30.6)	21(5.5)	<0.001
Raised LDL cholesterol	14(22.6)	00	-
Raised Triglyceride	25(40.3)	11(2.9)	<0.001

Figure in the parentheses denoted corresponding percentage.

***Data were analysed using Chi-square (c2) Test**

Table VI. Factors associated with CKD in patients by Cockcroft-Gault equation

Variables of interest	Univariate analysis (p-value)	Multivariate analysis	
		Odds Ratio (95% CI of OR)	P value
Age ≥ 50 years	<0.001	0.25(0.17-0.36)	0.441
Smoker	<0.001	2.28(1.55-3.34)	0.334
Education: Illiterate	0.001	2.07(1.34-3.19)	0.388
Salaried job	<0.001	0.36(0.20-0.62)	0.783
Over wt &obese	0.002	1.75(1.22-2.53)	<0.001
Hypertension	<0.001	2.26(1.86-2.28)	0.152
Proteinuria ≥1+	<0.001	0.23(0.02-0.05)	<0.001
Raised serum creatinine (mg/dl)	<0.001	0.01(0.01-0.02)	<0.001
Haemoglobin <12g/dl	<0.001	3.94(1.14-4.63)	<0.001
Diabetes mellitus	<0.001	0.14(0.12-0.16)	0.872
NSAID intake	<0.001	0.83(0.81-0.86)	0.997
Family H/O HTN	0.049	0.66(0.44-1.00)	0.356
Family H/O DM	<0.001	0.31(0.21-0.47)	0.581
Raised total cholesterol	<0.001	0.02(0.01-0.03)	0.987
Low HDL cholesterol	<0.001	0.36(0.23-0.56)	0.011
Raised LDL cholesterol	<0.001	0.07(0.04-0.12)	0.211
Raised Triglyceride	<0.001	0.08(0.05-0.13)	0.832
Awareness of renal impairment	0.035	1.19(1.15-1.22)	0.659

Table VII. Factors associated with CKD in patients by MDRD equation

Variables of interest	Univariate analysis (p-value)	Multivariate analysis	
		Odds Ratio (95% CI of OR,	P value
Sex	<0.001	0.36(0.25-0.53)	0.001
Obese by WC	0.005	0.59(0.41-0.86)	<0.001
Education: Illiterate	0.006	1.78(1.17-2.69)	0.002
Salaried job	0.033	0.59(0.37-0.96)	0.786
Exercise (≥ 60 min/day)	<0.001	6.23(4.06-9.55)	0.102
Hypertension	<0.001	0.04(0.03-0.06)	<0.001
Proteinuria ≥ 1+	<0.001	0.01(0.01-0.02)	<0.001
Raised serum creatinine (mg/dl)	<0.001	0.01(0.01-0.02)	<0.001
Haemoglobin <12g/dl	<0.001	10.16(6.67-15.48)	0.832
Diabetes mellitus	<0.001	0.05(0.02-0.15)	0.049
NSAID intake	<0.001	0.83(0.80-0.85)	0.997
Family H/O CKD	0.002	1.81(1.23-2.66)	0.017
Raised total cholesterol	<0.001	0.03(0.01-0.05)	0.019
Low HDL cholesterol	<0.001	0.26(0.17-0.39)	0.096
Raised LDL cholesterol	<0.001	0.07(0.04-0.12)	0.916
Raised Triglyceride	<0.001	0.08(0.05-0.14)	0.452
Awareness of renal impairment	0.032	1.19(1.16-1.23)	0.989

Discussion

The Modification of Diet in Renal Disease (MDRD) and Cockcroft-Gault (CG) equations are the most widely used formulas to assess renal function and have been proposed by the K/DOQI guidelines for the estimation of GFR.[21] This study examined the performance of prevalence of low glomerular filtration rate (low eGFR) using both equations in rural Bangladeshi adults.

A number of studies have focused on the prevalence of stage 3–5 CKD based on GFR <60 mL/min/1.73 m2 and calculated GFRs using Cockcroft-Gault and MDRD equations. A distinctly different GFR estimates using the equations with the MDRD equation giving higher values of GFR than the CG equation. The prevalence of low eGFR in our study using Cockcroft-Gault equation was 15.3% is lower compared with disadvantageous population in Bangladesh (16%) and AusDiab kidney study (16%)[22] and for the MDRD equation it was obtain in our study 15.9% compared to 13.1% in Bangladesh,[23] 11% in USA, 5.2% in Turkey, 6.4% in Italy, 8.1% in Switzerland, 7.2% in Iceland, 4.2% in India and 2.5% in China.[24]

Assessing the prevalence of chronic kidney disease, these figures are comparable two community – based studies in India. While one placed the prevalence around 0.79%,[25] the other estimated it to be 1.39%.[26] The former study assessed CKD prevalence in an urban setting of South Delhi using a serum creatinine cutoff of > 1.8 mg/dl to define renal failure. The latter study assessed CKD prevalence primarily in a rural setting using MDRD equation. Both studies had their limitations. Estimates of CKD based on serum creatinine cutoffs are confounded by many covariates and are generally considered crude for epidemiological studies, besides causing significant underestimation of prevalence.[27,28] The other study though used MDRD equation, had a major limitation of being based in a rural population, which is known to have a significantly lower prevalence of CKD associated risk factors.[29] Also in that study only those subjects with urinary abnormalities or a positive response to a risk factor assessment questionnaire underwent blood testing, thus raising concerns of an ascertainment bias. Moreover, both population-based studies did not comment on distribution of CKD prevalence across gender and age groups.

Our study partly overcomes these limitations and gives an assessment of prevalence of low eGFR in rural area using eGFR cutoffs established by K/DOQI guidelines. We used both Cockcroft-Gault equation corrected for body surface area (CG/BSA) and Modification of Diet in Renal Disease (MDRD) equation for estimating prevalence of renal impairment in our study population. Though the validity of these equations to estimate GFR in Bangladeshi population has been questioned by few hospital based studies.[30,31] There is no community-based study which compares the GFR estimates derived from these two equations. The use of serum creatinine based GFR estimating equations also ensured crude comparisons with prevalence data from other countries.

This study describes a remarkably high prevalence of proteinuria (17%) in the study population. Two previous population-based studies had examined the prevalence of proteinuria in adults. Iseki et al.[32] detected proteinuria that was defined by a dipstick result of trace or greater in 4 to 6% of men and 2.5 to 7% of women in a study of 1,07,192 Japanese volunteers. A similar prevalence ranging from 1% in 34–44-year-old to 6% in 55–64-year-old men was found in the US volunteers in Framingham study.[33] One cross-sectional study from a rural population in India estimated a lower prevalence (0.47%),[34] while another cross-sectional study from an urban locale estimated prevalence (4.41%).[35] The presence of proteinuria significantly associated with low eGFR. There was an increasing prevalence of proteinuria as GFR decreased, thus corroborating proteinuria as a marker of kidney disease progression. This suggests that subjects with proteinuria should be worked up adequately for an underlying renal impairment as proteinuria is a significant mortality predictor.[36]

Risk factors for development of CKD, particularly chronic kidney failure, would comprise susceptibility factors and initiation factors. Prevention of adverse outcomes of CKD could be facilitated by evaluating individuals with risk factors, to enable earlier detection and by risk factor reduction in individuals without CKD, to prevent or slow the development of the disease. The difficulty of detecting the early stages of chronic kidney disease makes it difficult to determine whether the risk factors so far identified relate more to susceptibility, initiation, or progression.[37]

In experimental studies, male rodents were more susceptible to age-related glomerulosclerosis than females, an effect that was independent of glomerular hemodynamics or hypertrophy and was attributable to a specific androgen effect.[38] Data regarding the role of gender in determining renal risk in humans are somewhat contradictory. Many studies suggest that male gender is associated with worse renal outcomes. In our survey, chronic kidney disease (CKD) was found to be associated with gender (51.7% male and 48.3% female, p = 0.001) in our targeted respondents in MDRD equation. But contradictory in AusDiab kidney study demonstrated the risk of stage 3 to 5 CKD was greater in women (P = 0.002 for difference between genders). The prevalence of CKD was also higher in females (12.5%) than males (7%) in Iceland study.[23] Another remarkable observation was the association between renal impairment and low educational status. Many studies across nations[15,39] and also studies from India[40] have found similar associations.

The inverse association between BMI and renal impairment seems paradoxical. Since BMI assesses the entire body mass including: central and peripheral fat, muscle mass and fluid, it is generally believed to be a less sensitive estimate of obesity in CKD patients.[41] Since it is the central obesity which determines the cardiovascular and renal risk, a measure that assesses visceral fat will be preferable in these subjects. Waist circumference (WC) and waist:hip ratio (WHR) are two such markers. These markers of central obesity have been shown to be better associated with of renal and cardiovascular risk than BMI in longitudinal and cross-sectional studies.[42,43] Indeed our study shows an association between over weight & obese in CG equation and obese by WC in MDRD equation with renal impairment.

Hypertension and diabetes are both a common cause as well as a major consequence of CKD in this study. Our results are similar to the study of Huda et al.[23] in Bangladesh showed that diabetes mellitus and hypertension were present in significant proportions in CKD group compared to the normal population (P < 0.001). The AusDiab kidney study demonstrated that reduced GFR <60 mL/min/1.73m2 was fivefold more prevalent in those with hypertension compared to those without HTN (P<0.001). The association of decreased kidney function using Cockcroft-Gault equation with hypertensive and diabetic individuals was similar to decreased kidney function using the MDRD equation.[44] Two hundred diagnosed cases of DM and/or HTN were reviewed by the clinical pharmacists in primary care clinics of Columbus, OH. They demonstrated a total of 68.9% who met CKD criteria, indicating that CKD prevalence was high among the hypertensive and/or diabetic patients.[45] Besides, renal disease is also increasing in Australian aboriginals who have serious comorbidities, reflecting their poor health of them in general, including poor nutrition, infections, uncontrolled diabetes and hypertension.[46]

As kidney function declines during CKD progression from stage 1 to stage 5, the risk of developing anemia increases dramatically.[47] Findings of current study showed anaemia and raised serum creatinine (Scr) are the risk factors associated with renal impairment. The combination of anaemia and CKD confers a particularly high-risk group for adverse outcomes. Several, but not all, studies have suggested that anaemia may be a risk factor for adverse outcomes in different populations and that the risk may be modified by the presence of CKD.[48,49]

Dyslipidemia is common in patients with CKD and the lipid profile varies widely depending on the level of kidney function and the degree of proteinuria. All stages of CKD are considered a coronary heart disease (CHD) risk equivalent (similar to diabetes mellitus); therefore, all patients with CKD should be considered in the highest risk group for CHD. The common pattern of late-stage CKD includes hypertriglyceridemia, low or normal levels of low-density lipoprotein (LDL), low lipoprotein (a) and low high-density lipoprotein (HDL).[50] Our result showed that low HDL cholesterol found to be the independent predictor of CKD with OR being 0.36. Similar to studies Fried et al.[51] reported that TG and low HDL cholesterol has been identified as independent risk factors for CKD progression[52] and in the study of Crowe et al.,[53] low HDL has been shown to predict an increased risk of renal dysfunction.

Family history of kidney disease genetic predisposition plays a key role in many forms of CKD. In the present study family history of CKD is an independent predictor of CKD (OR 1.81, 95% CI: 1.23 – 2.66). Freedman et al.[54] reported a family history of end-stage renal disease (ESRD) in first and second degree relatives of 20% of all incident dialysis patients treated in Georgia, North Carolina and South Carolina (ESRD Network 6) in 1994. Another observational cohort study of 177,570 individuals from a large integrated health care delivery system in northern California reported that family history of kidney disease was independently associated with de novo end-stage kidney disease (HR, 1.40, 95% CI 1.02-1.90).[55] There have been few studies examining the prevalence and predictive value of a family history of kidney disease in screening programs.[56]

Finally, there was low awareness (2.6%) found in our patients about chronic kidney disease. This necessitates screening programs to be launched for early recognition and prevention of complications of this disease, especially targeting CKD in high-risk populations. A clinical prediction score model can be developed to help in identifying high-risk populations.

Conclusion

The prevalence of low eGFR in this rural population is common and an increase prevalence of proteinuria. The association between CKD and risk factors was also highly significant. The present study, therefore, proposes that a nationwide survey is inevitable and suggests to be conducted encompassing the entire cross-section of population to find out the prevalence of CKD and its associated risk factors, so that a preventive strategy or an entire defensive framework could be adopted or planned to reduce the disease in the community.

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