Hypertension and Decreased Glomerular Filtration Rate Among Commercial Drivers

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Introduction. Chronic Kidney Disease (CKD) is of high clinical importance due to cost of outcomes such as kidney transplantation. However, CKD is an overlooked disorder among commercial drivers. The present study aimed to evaluate hypertension and Glomerular Filtration Rate (GFR) among commercial drivers.
Methods. In this cross-sectional study, a total of 903 commercial drivers referred for obtaining their health license were recruited. After obtaining informed consent, a questionnaire consisted of demographic characteristics was completed. Blood pressure, level of lipid profile, blood sugar, blood urea nitrogen, and plasma creatinine were measured. Chi-square and independent T-test were used for data analysis.
Results. All participants were male. The mean (± SD) age and Body mass index were 42 ± (10) years and 27 ± (4) kg/m2, respectively. Of 903 studied cases 40 (4%) had GFR < 60. Increased age and high blood pressure had a significant association with reduced GFR ($P < .0001$). The ones with sleep apnea were more likely to have GFR < 60, however, the association was not statistically significant after adjusting for related risk factors.
Conclusion. Older age and hypertension are considered as risk factors for CKD among commercial drivers. Obstructive sleep apnea also should be kept in mind as a possible risk factor that requires further elucidation and management.

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INTRODUCTION

Chronic Kidney Disease (CKD) is of high clinical importance due to cost of treatment for adverse outcomes such as kidney transplant.[1-3] Incidence and prevalence of this disease is reported to have an increasing trend in recent years.[4]

In developing countries, the economic burden of CKD is significant as it is estimated that after 10 years, almost 15% of the whole world economy will be consumed for management of this disease.[1,5] Thus, screening and early management of CKD would be a wise approach for avoiding high burden of the disease on health care systems and suffered individuals.[1]

Incidence and prevalence of CKD is variable throughout different populations. In Japan, current prevalence of end stage renal disease (ESRD) is 2000 in one million population. Glomerular filtration rate (GFR) < 60 cc/min/ 1.73m^2 presents in over 20% of adult population. In some countries like Japan, national program for screening kidney disease has decreased incidence of CKD.[1] A systematic review on prevalence of CKD in general population, estimates that 7% of over 30-years and up to 36%

of older age individuals have CKD.[6] Moreover, CKD has higher prevalence and mortality among low socio-economic populations. Different health policies had led to a variety of screening programs in health care systems. Variety of programs exists for management of CKD and its costly outcomes in health care system of different countries. Prevalence of ESRD in Iran has reached to 357,63.8 per million population.[7] However, current available facilities are not sufficient to meet the demand of health care system in this regard.[1]

Commercial drivers are known for less attention to their personal health and high prevalence of chronic diseases such as diabetes, hypertension, and overweight.[8,9] Frequency of diabetes, hypertension, and obesity in commercial drivers are estimated as 33%, 23%, and 45%, respectively but there are limited studies on CKD among this population.[8] According to an available national guideline on occupational health, drivers should have periodic physical examinations in which renal function tests are included. In a study on 32000 taxi drivers in Tehran, about 6% had a GFR below 60 cc/ min/ 1.73m^2. In this study, factors like age, LDL cholesterol, high blood pressure, blood sugar, and BMI were reported as risk factors of CKD.[1] In another study from Iran, about 9% of adult population s hypertension, and heart disease had significant relationship with CKD.[10] Another study revealed that female gender, higher BMI and waist circumference, hypertension, and disturbed lipid profile were related risk factors for CKD.[11]

Considering limited studies among commercial drivers in the world and Iran regarding CKD, this study was performed to evaluate CKD and its related risk factors especially high blood pressure among this group. Screening programs will detect high-risk groups in earlier stages and refer them to health care system for early management. Results of this study will provide information for authorities in charge for development screening and management programs on CKD among commercial drivers.

MATERIALS AND METHODS

This cross-sectional study was conducted in 2017 to 2018 among drivers attending Baharloo Hospital Clinic for receiving their occupational health license. To measure blood pressure, participants were asked to stay calm in seated position for 5 minutes. Then blood pressure was measured from right arm by manometer (GAMMA G7 Heine, Germany). Measurement was performed twice with 5 minutes' rest in between. The mean of measured blood pressure between two measurements was recorded as subject's blood pressure. Cases with systolic blood pressure more than 140 mmHg and diastolic above 90 mmHg and those receiving medications for hypertension were considered as subjects with high blood pressure.

Blood sample was taken after 12 to 24 hours fasting from each subject to assess fasting blood sugar, total cholesterol, and Triglyceride. Those with fasting blood sugar above 126 mg/dL or those taking medication for high blood sugar were considered as diabetics.

BMI of 30 kg/m^2 or above was considered as obesity. Those who stated daily or occasionally use of cigarette, pipe, or hookah were defined as smokers.

GFR was calculated based on this formula and levels below 60 cc/min/ 1.73m^2 were considered as abnormal.

MDRD equation: GFR (ml/min./ 1.73 m^2) = 186 * (serum creatinine mg/dL) -1.154 * (age) -0.203 * (0.742 if female)

For description of quantitative variables, mean and standard deviation and for qualitative variables (2 or more categories) frequency and percent were used. For comparison of quantitative variables between two groups T test and for qualitative variables chi-square test were used. To determine major risk factors for CKD, logistic regression was performed. Considering low power of the study, forward logistic regression was used. Analysis performed with STATA software and P value less than .05 was considered as significant.

RESULTS

In total, 903 drivers with mean age of 42.84 and standard deviation of 10.10 years participated in the study, 40 subjects (4.42%) had GFR below 60 cc/ min/ 1.73m^2 and considered as CKD cases. Table 1 represents characteristics of study participants divided by their CKD condition. As it is shown in the table, mean age had a significant difference between two groups; 52.60 and 42.39 among CKD and non-CKD patients respectively (P < .0001).

Systolic and diastolic blood pressures among CKD patients were 123.12 and 82 and in non-CKD group were 117.49 and 76.91, respectively.

Table 1. Characteristics of Participants Based on CKD

Variables	Total	GFR < 60 (n = 40)	GFR ≥ 60 (n = 863)	*P*
	Mean (SD)	Mean (SD)	Mean (SD)	
Age, y	42.84 (10.10)	52.60 (7.51)	42.39 (9.98)	< .0001
BMI	27.03 (4.04)	27.46 (3.84)	27.01 (4.05)	> .05
SBP	117.74 (16.43)	123.12 (17.99)	117.49 (16.32)	< .05
DBP	77.14 (9.40)	82.00 (11.97)	76.91 (9.21)	< .05
FBS	5.44 (1.02)	5.84 (1.83)	5.42 (0.96)	< .05
TG	1.83 (1.40)	2.31 (3.27)	1.81 (1.25)	< .05
TC	4.80 (1.87)	5.00 (0.88)	4.79 (1.91)	> .05
Cr	1.19 (3.39)	1.43 (0.10)	1.06 (0.13)	< .0001
	Frequency (%)	Frequency (%)	Frequency (%)	
Current Smoker	264 (29.2)	10 (25)	254 (29.4)	> .05
Hypertension	153 (17)	16 (40)	137 (15.9)	< .0001
Diabetes	52 (5.8)	5 (12.5)	47 (5.4)	> .05
STOPBANG ≥ 3	210 (23.3)	15 (37.5)	195 (22.6)	< .05
BMI ≥ 30	202 (22.4)	10 (25)	192 (22.2)	> .05
Dyslipidemia	240 (26.6)	11 (27.5)	229 (26.5)	> .05

Differences were significant in either variables. Prevalence of hypertension in CKD group was 40% and in non-CKD group reached15.9%.

Assessment of blood sugar also determined that mean FBS had significant difference between CKD and non-CKD group with 5.84 and 5.42 respectively, whereas prevalence of diabetes was 12.5% and 5.4%. Assessment of lipid profile revealed significant difference of Triglyceride between two groups but not for total cholesterol. Evaluation of Tobacco use showed that 29.2% of total study population was smokers, 25% among CKD and 29.4 among non-CKD group.

Another possible risk factor, which was studied in this study, was obstructive sleep apnea. As it is shown in Table 1, 37.5% of CKD group and 22.6% of non-CKD group was at risk of obstructive sleep apnea ($P < .05$).

Risk factor analysis of CKD in subjects with logistic regression (forwarded method) revealed two major risk factors as the most related ones to CKD. Results are reflected in Table 2. As it is shown, only age and blood pressure remained in the model with corresponding odds ratio of 1.11 and 2.51, respectively.

Table 2. Forward Logistic Regression Analysis (Association Between GFR and Traditional Risk Factors)

	Odds Ratio	CI (95%)	*P*
Age	1.11	1.06 to 1.15	< .0001
Hypertension	2.51	1.24 to 5.05	< .05

DISCUSSION

In this study, frequency of decreased GFR and hypertension among drivers was 4.4%. Considering life style and socio-economic situation, we hypothesized that GFR decrease would be more frequent in this population compared with general population. Since available national guideline for commercial drivers considers only advanced renal failure and patients with kidney transplant as disqualifications of commercial driving,[12] little attention is paid to assessment of renal function in this group. Thus, evaluation of this group is more focused on diabetes, hypertension, and obesity.[8,9] As we mentioned above, frequency of GFR < 60 cc/min/ 1.73m^2 was 4.4%, whereas in a same study on taxi drivers in Tehran, frequency of CKD was about 8%.[1] Considering higher frequency of risk factors for CKD (hypertension, obesity, dyslipidemia and diabetes) in this population,[8,9] it is expected to see higher rate of CKD in commercial drivers compared with general population. In one community based study in Iran, prevalence of CKD was 19% and obesity, hypertension, female gender, and disturbed lipid profile were indicated as risk factors for CKD. Estimates of prevalence in other parts of the world also indicate higher prevalence of CKD among older age reaching up to 36% in some studies.[11] In this study, all of the enrolled participants were male but in a survey of taxi drivers,[1] participants were from both genders[1] and they reported prevalence of decreased GFR

13% and 6% in women and men, respectively. Furthermore, this study found higher frequency of CKD among < 40 years old population (38%) that may be due to heterogeneous distribution of age groups in our study. Most studies have reported higher frequency of abnormal GFR in elderly.[6] Explanations of lower prevalence may be younger age of drivers in our study as well as the gender of participants. Despite sedentary lifestyle of commercial drivers as a risk factor, their annual health assessments may detect risk factors earlier, thus early management of risk factors may decrease frequency of advanced and chronic diseases. Accordingly, prevalence of CKD in commercial drivers who attend occupational health clinics may be estimated lower than general population because drivers with advanced renal failure and history of renal transplant are disqualified for driving.[12]

One of the novel findings of this study was assessment of obstructive sleep apnea as a risk factor for CKD. Sleep apnea is a point of interest in many studies among commercial drivers and the prevalence had been estimated around 35% (13, 14). This is important risk factor for CKD.[15-17] However, as far as we know, there is no study assessing sleep apnea as a risk factor for CKD among drivers.[18] In current study, frequency of sleep apnea was 23%, but using multi variant adjusted model, significant association was not shown. Insignificant results in this regard may be due to under-report of subjective signs of sleep apnea and/or low power of the study due to small sample size.[13]

High blood pressure and age, showed the highest association with CKD compared with other risk factors in multivariate adjusted regression model. Thus, regarding aforementioned discussion and considering sensitivity of safety for this job, special attention should be given to the health issues of commercial drivers especially the overlooked aspects by clinicians. Limited studies in this area have addressed kidney diseases in drivers.

Current study has some limitations amongst are self-reporting and lack of objective assessments for sleep apnea, which could be confirmed by polysomnography in future studies.

CONCLUSION

This study indicated age and hypertension as risk factors for CKD in commercial drivers and this requires more attention by health care providers. In addition, we found an increasing statistically non-significant trend for CKD among drivers with sleep apnea. This finding warrants attention of health authorities towards new risk factors of CKD among commercial drivers. Future studies with larger sample size are recommended for further investigation of sleep apnea role in CKD of commercial drivers.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interests.

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