

Effects of Cigarette Smoking on Glomerular Filtration Rate in Apparently Healthy Individuals Studied at Gandhi Medical College and Hamidia Hospital Bhopal

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ABSTRACT

Introduction: Glomerular hyperfiltration and albuminuria accompanied by early-stage diabetic kidney disease predict future renal failure. Cigarette smoking has reported to be associated with elevated GFR in cross-sectional studies and with renal deterioration in longitudinal studies. Study aimed to check the relationship between cigarette smoking and GFR in apparently healthy males, and to study effect of cigarette smoking on urinary albumin excretion.

Material and methods: 50 smokers and 50 non smokers were studied in Gandhi Medical College and hamidia hospital Bhopal from December 2014 to December 2015. Patient went a detailed clinical evaluation and laboratory investigation. Participants included in study were non hypertensive, non diabetic and without any prior or primary renal disorders.

Results: The present study included 100 smokers and 100 non smokers. The mean age of the studied patients was 39.85 ±8.15 among smokers and 39.80±7.28 among non smokers. Among smokers 49% smokers have proteinuria. Proteinuria was significantly associated with pack years among current smokers (p=0.011). Smokers with >40 pack years were found to be significantly associated with proteinuria. Among smokers 67% have high gfr. As compared to non smokers, current smokers have high GFR (mean=120.06±18.53) High GFR was significantly correlated in smokers with pack year>40 (p=0.025). The average GFR in current smokers is 120.06±18.53.

Conclusion: In our study it was found that current smokers have glomerular hyperfiltration and proteinuria as compared to non smokers. Glomerular hyperfiltration, proteinuria, high systolic and high diastolic blood pressure correlates significantly with pack years.

Keywords: Cigarette Smoking, Glomerular Filtration

INTRODUCTION

Smoking has emerged as one of the major risk factor of renal injury but has not been extensively studied. Although smoking is related to ESRD in the long term¹, the effect of cigarette smoking on renal function in early-stage kidney disease is unclear. Chronic kidney disease (CKD) causes a large number of morbidity and mortality, cardiovascular disease (CVD) being the most common cause of mortality among them. This rise is expected to continue, particularly in developing countries, where smoking and other cardiovascular risk factors are increasing substantially^{2,3}, and will be paralleled by rising CKD- and ESRD-related costs.^{4,5}

Detailed investigation has not been done, how smoking effects the kidney. In recent years, it has become apparent that smoking has a negative impact on renal function, being one of the most important remediable renal risk factors.⁶

In this study, we examined the effects of cigarette smoking on

renal function and albuminuria in apparently healthy participants who were not on antihypertensive and/or antidiabetic medication, and we investigated whether the relation between filtration rate of kidney (GFR) and smoking was modified by the renal functional, age, blood pressure, fasting serum glucose, and albuminuria

MATERIAL AND METHODS

The present study included 100 smokers and 100 non smokers based on inclusion and exclusion criteria from December 2014 to December 2015 conducted in hamidia hospital Bhopal, India. The research work was approved by ethical committee, Barkatullah University. Eligible participants included for the current study were male aged between 20 to 50 years, who are current smokers, coming to hamidia hospital on OPD basis, having normal liver functions and were non hypertensive non diabetic. Those were excluded who had diabetes, hypertension, pulmonary disease and primary renal disorder at the time of presentation or diagnose later in the study.

The clinical examination consisted of relevant medical history, physical examination measurement like height and weight. Self reported questionnaire on life style characteristics such as smoking habit frequency of alcohol drinking. Blood sampling for the measurement of RFT, LFT, CBC, FBS, PPBS sand urinalysis r/m and dipstick urinalysis. Early morning blood samples were drawn. Serum creatinine was estimated by jaffe method. We calculated estimated GFR by using Gault Cock and Croft equation. Urine samples were collected as clean catch mid stream, early morning specimens. The result of dipstick urinalysis was interpreted as +1,+2,+3. After 5 minutes of rest BP was measured in a sitting room. BP was measured in supine position right arm with a standard sphygmomanometer.

Measurement of Cigarette Smoking

The questionnaire about the smoking habit consisted of smoking status, average number of cigarettes smoked per day and duration of cigarette smoking for current smokers, and years since quitting for past smokers. Then participants were divided into two groups: non-smokers AND current smokers. The number of pack-years of exposure (that is, the number of

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packs of cigarettes smoked per day multiplied by the number of years smoked) is also calculated to see the long-term adverse effect of smoking on renal function.

Outcomes

GFR was calculated and proteinuria was estimated. Glomerular hyperfiltration was diagnosed if estimated GFR was more 120 ml/min per 1.73 m². Proteinuria was defined as 1+ or higher (30 mg/dl or higher) for dipstick examination.

STATISTICAL ANALYSIS

The quantitative data expressed as standard deviations qualitative data were expressed in percentages. The data was analyzed by using chi square test and the difference in means were analyzed by using student T Test. Significance level for tests was set as (P< 0.05).

RESULTS

The present study included 100 smokers and 100 non smokers. All were male. The mean age of the studied patients was 39.85 ±8.15 among smokers and 39.80±7.28 among non smokers. Maximum number of patient were in age group of 41 -50. Among smokers 49 % smokers had proteinuria and in non smokers 7% had proteinuria. Proteinuria was significantly associated with pack years among current smokers (p=0.011). Smokers with >40 pack years were found to be significantly associated with proteinuria (Table-1). Among smokers 67% have high GFR. As compared to non smokers, current smokers have high GFR (mean=120.06±18.53.). High GFR was significantly correlated in smokers with pack year>40 (p=0.025) (table-3). The average GFR in current smokers is 120.06±18.53. High systolic and diastolic blood pressure is found among current smokers as compared to non smokers (table-2).

DISCUSSION

The present study included 100 smokes and 100 non smokers from December 2014 to December 2015 conducted in hamidia hospital Bhopal. Out of 100 current smokers (all male) ranging from 20 to 50 years (mean age= 39.85±8.15), high GFR (>120ml/min/1.73m²) was found in 67% which is significantly correlated with pack years (p<0.01) as compared to non smokers. This data correlates well with Ekberg et al⁷ who reported a significantly higher prevalence of glomerular hyperfiltration (41% vs. 18%) in the smokers than in the non-smokers. Among these current smokers, high GFR was significantly more common among smokers with pack year ≥40. (p=0.025) these result were also shown in the study done by Ishizaka N et al.⁸ Cross-sectional in 7,078 Japanese male participants in whom they found high eGFR (>90.73ml/min/1.73 m²) current smokers consuming 20-39 cigarettes per day.

Among 100 current smokers, GFR was found to highest among 41 to 50 age group smokers. and age was insignificantly correlated with GFR (p=0.61). There was significantly higher prevalence of glomerular hyperfilterarion (67% vs. 20%) among current smokers than in the non smokers, and is related to amount of cigarette smoking. Pintosiestsma et al⁹ Cross sectional study, in 7476 adults in a dutch community found elevated eGFR (>Mean±2SD) in current smokers consuming up to 20 cigarettes per day and in those consuming more vs. never smokers was 1.82 (1.31~2.53) and 1.84 (1.12~3.02) respectively

| Pack year | U. Albumin | | | | Total |
|-----------|------------|-------|-------|-------|--------|
| | 0 | 1 | 2 | 3 | |
| 1—20 | 26 | 5 | 2 | 0 | 33 |
| | 78.8% | 15.2% | 6.1% | 0.0% | 100.0% |
| 21-40 | 21 | 21 | 8 | 3 | 53 |
| | 39.6% | 39.6% | 15.1% | 5.7% | 100.0% |
| >40 | 4 | 3 | 4 | 3 | 14 |
| | 28.6% | 21.4% | 28.6% | 21.4% | 100.0% |
| Total | 51 | 29 | 14 | 6 | 100 |
| | 51.0% | 29.0% | 14.0% | 6.0% | 100.0% |

P=0.003, High proteinuria was significantly more in cases with pack year >40.

Table-1: Correlation of pack year and urine albumine

| Variables | | Mean | ± Std. Deviation |
|-------------|----------|--------|------------------|
| Age | Cases | 39.85 | 8.15 |
| | Controls | 39.80 | 7.28 |
| Hb | Cases | 11.41 | 0.93 |
| | Controls | 10.84 | 0.87 |
| S.Creatnine | Cases | 0.62 | 0.12 |
| | Controls | 0.66 | 0.13 |
| GFR | Cases | 120.06 | 18.53 |
| | Controls | 115.19 | 16.42 |
| SYS.BP | Cases | 129.06 | 10.42 |
| | Controls | 128.66 | 8.14 |
| DIA.BP | Cases | 74.88 | 5.49 |
| | Controls | 73.30 | 5.10 |

Table-2: Variables and their means and standard deviation

| Pack yr | GFR | | Total |
|---------|-------|-------|--------|
| | >120 | <120 | |
| 1—20 | 20 | 13 | 33 |
| | 60.6% | 39.4% | 100.0% |
| 21-40 | 34 | 19 | 53 |
| | 64.2% | 35.8% | 100.0% |
| >40 | 13 | 1 | 14 |
| | 92.9% | 7.1% | 100.0% |
| Total | 67 | 33 | 100 |
| | 67.0% | 33.0% | 100.0% |

Table-3: Correlation of pack year with glomerular filtration rate (GFR)

adjusted for age, gender, BMI, BP, PG and alcohol. Similar results were obtained by Yoon HJ et al.¹⁰ (Cross-sectional) in 35,228 Korean participants in a health screening program (III) Mean eGFR was significantly higher in current smokers than in former and never smokers.

Several mechanism may have played a role in contributing this association. Hyperfiltration is supposed to be an early manifestation of kidney disease. The nicotine induced increase in blood pressure and heart rate via sympathetic activation and vasopressin release probably explains this. Cadnapaphorchai et al¹¹ reported that nicotine increases vasopressin release by altering cervical parasympathetic tone.

Another key finding in our study was the relationship between cigarette smoking and proteinuria. We found that Out of total current smoker 49 % have proteinuria, which is compatible with results obtained by Zhang L et al.¹² 2008 (Cross-sectional) in 13,925 OR for albuminuria in current smokers vs. Non smokers adjusted for age, gender, obesity, DM, hyper tension

and hyperlipidemia. Proteinuria is significantly more common in current smokers ($p < 0.001$). We found that proteinuria was significantly more in current smokers with pack year ≥ 40 ($P = 0.03$). Out of total current smokers 10% have proteinuria with pack year ≥ 40 and is significantly correlated with pack years 32% of current smokers have proteinuria with pack years ranging between 21-40. This relationship was concordant with Ishizaka N et al.⁸ Cross-sectional in 7,078 Japanese male participants in health screening (III) OR for albuminuria (≥ 30 mg/gCr) in current smokers consuming 20-39 cigarettes per day and those consuming more was 1.56 (1.17-2.08) and 1.88 (0.99-3.55) respectively in comparison with never smokers adjusted for age, BP and FPG.

Mean systolic blood pressure among current smokers is 129.06 ± 10.42 , mean systolic BP among non smokers is 128 ± 8.14 . High systolic BP (> 140 mmHg) was significantly more common among smokers with pack years > 40 ($p = 0.001$). 18 % of current smokers have high systolic blood pressure.

Mean diastolic Blood pressure among smokers is 74.88 ± 5.49 which is significantly ($p = 0.0001$) higher as compared to non smokers mean 73.30 ± 5.10 . Out of total smoker 21.4% have high diastolic blood pressure (> 90 mmHg). High diastolic blood pressure (> 90 mmHg) is significantly more common in smokers with pack year > 40 , as compared to non smokers.

CONCLUSION

In our study it was found that current smokers have glomerular hyperfiltration and proteinuria as compared to non smokers. Proteinuria and increased GFR can be considered as surrogate marker of chronic kidney disease in smokers. Thus, Even if ESRF is reached, smoking should be discontinued. Patients should be motivated to quit smoking, because it is the most effective and beneficial strategy against the whole spectrum of CKD.

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