Obese Family Members of Chronic Renal Failure Patients are at Higher Risk for Developing Kidney Diseases: In a Cross-sectional Study

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Abstract

Background: Previously it has been demonstrated that, the obesity is one of the strongest risk factors for incident chronic kidney diseases (CKDs). Currently we examine the association between Body mass index (BMI) and CKD in first degree relatives (FDRs) of renal failure patients on hemodialysis.

Materials and methods: In a cross-sectional study 135 FDRs of end stage renal disease (ESRD) patients on hemodialysis were included. Serum creatinine, urine creatinine and microalbumin were measured. Estimated glomerular filtration rate (e-GFR) and albumin to creatinine ratio (ACR) were calculated. The height in Cm, weight in Kg was measured, and the BMI was calculated.

Results: Females 64% were found to have higher frequency than males 36%. The frequency of BMI categories was found to be 26.7% obese, 26.7% overweight and 46.6% normal weight. The mean BMI was (26.0 ± 6.62). The prevalence of CKDs is 19.3% among relatives. CKDs were more frequent 42.3% in obese, followed by 30.8% in overweight and 26.9% in normal weight relatives. Obese and overweight relatives have significantly higher ACR than normal weight (P= 0.012). GFR found to be significantly lower in obese and overweight relatives than normal weight (P = 0.000). GFR was negatively correlated with BMI (R = - 0.430, P = 0.000).

Conclusion: Obese and overweight renal failure relatives had higher ACR and lower eGFR. Therefore, obese and overweight members are at higher risk for developing CKDs.

Keywords: CKDs, Family members, BMI, Obesity, ACR, eGFR.

1. Introduction

Chronic kidney disease (CKD) is a global public health problem (1,2), that increasing rapidly worldwide and is gaining much attention in both the developed as well as
developing countries (3, 4). It is found in 10% of the global population (5,6), and it affects 10-16% of the adult population in China, Asia, Australia, Europe and the United States (7). In Sudan, as it was reported by Hassan Abu Aisha in his pilot study at 2009, the prevalence range was 7.7 - 11% (8). CKD is considering as a health issue associated with increased morbidity, mortality and health care costs (5, 7).

Beside CKD, Obesity is another worldwide pandemic problem; it is associated with various metabolic disorders such as CKD and results in a shortened life span related to adverse health consequences (9). In Sudan, the high prevalence of obesity was observed, and it was found that; it is associated with diabetes and hypertension (10). Epidemiological studies have demonstrated that obesity, a family history of ESRD and high body mass index (BMI) are an essential risk factors for incident CKD and increased risk of ESRD (11, 12), and associated with an increased risk of CKD development among adult individuals in the general population (13).

Several studies showed that; the FDRs of ESRD patients with a family history are at risk to develop CKD (14, 15). Furthermore, increased stocktickerBMI and obesity were found to be having direct impact on the development of CKD and ESRD (12), through a compensatory mechanism of hyperfiltration occurs to meet the heightened metabolic demands of the increased body weight and the increase in intraglomerular pressure which can damage the kidney structure and raise the risk of developing CKD in long term (12,16). Recently, screening and early detection of CKDs researches have performed to decrease the prevalence of CKD, minimize the incidence of ESRD and to reduce their different health, social and economic effect (17, 18). Therefore, in this study we investigated whether the study variables (Age and BMI) associated with CKDs, indeed, early detection and management of CKDs in relatives at high risk.

2. Materials and Methods

In a cross-sectional hospital based study during May 2017 – May 2018, 135 randomly selected family members (first degree relatives) of chronic end stage renal failure patients on hemodialysis attending different centers in Khartoum State were included. Ages ranged between 17- 60 years old. After informed consent blood samples were collected, under aseptic condition from relatives. Subject with diabetes mellitus, hypertension, cancer, thyroid dysfunction, glucocorticoids therapy, HIV, pregnancy and hepatitis were excluded. The selection based on clinical history records. The demographic data were gathered using instructed questionnaire. The height in Cm and weight in Kg were
estimated, and then BMI was calculated. ACR and e-GFR were measured. Elevated ACR (>30 mg/g) and/or reduced e-GFR (< 60 ml/min/1.73m²) considered as CKDs.

2.1. Ethical approval

The study was approval by the local ethical committee of Al-Neelain University and Ministry of Health. Written informed consent was obtained from all participants.

2.2. Calculation of urine albumin to creatinine ratio (U. ACR)

Brief according to manufacturer, mid-stream single spot urine sample was collected. Urine albumin was measured by immunoturbidmetric assay method, which based on reaction of anti-albumin antibodies with antigen in the sample to form antigen/antibody complexes. The assay was performed using Cobas auto analyzer instrument at central laboratory of East Nile Hospital. The concentration of albumin was calculated automatically by Cobas c system turbidimetry assay. Urine creatinine was estimated by kinetic Jaffe reaction without deproteinization method, using Cobas auto analyzer instrument. The creatinine concentration was calculated automatically by Cobas c system and expressed in mg/dl. Albumin - creatinine ratio (ACR) was calculated by Medical, Scy-med calculator, and expressed in mg/g. ACR > 30 mg/gm was considered as albuminuria (19).

2.3. Calculation of estimated glomerular filtration rate (eGFR)

Estimated GFR was calculated by modification of diet in renal disease (MDRD) equation, using a 4-variable version (MDRD-4) that included age, sex, ethnicity, and serum creatinine, this 4-variable version was expressed using serum creatinine values that were standardized to reference methods (20 , 21). (Reduced GFR was detected when eGFR < 60 ml/min/1.73m²).

\[
GFR = 175 \times \text{Serum creatinine (mg/dl)}^{-1.154} \times \text{age (years)}^{-0.203} \times 1.212 \text{ (if patient is black)} \times 0.742 \text{ (if female)}
\]

The serum creatinine was measured by photometric modified Jaffe kinetic method (22), in which the concentration of creatinine was calculated automatically by Mind ray BS200 auto analyzer.
2.4. Statistical analysis

The Statistical Package for Social Sciences (SPSS), version 21.0 (SPSS Inc., Chicago, USA) was used for data analyses. Results are presented as frequencies, percentage, Mean ± SD and regression coefficient. The student’s t-test was used to compare mean levels between groups. Chi-esquire was used for qualitative data. Person’s correlation was employed to determine the association between continuous variables. P-value ≤ 0.05 was considered as the statistical significance.

3. Results

In this study 135 family members were participated. Table 1 show the demographic and characteristics data, Table 2 show the frequency and distribution of CKD and Table 3 show the mean levels of ACR and e-GFR according to BMI categories, while Figure 1 show association of BMI with ACR and e-GFR. 64% were Females and 36% males. Their mean age was (32.3 ± 14.1). The frequency of BMI categories was found to be 26.7% obese, 26.7% overweight, 39.2% normal weight and 7.4% underweight. The mean BMI was (26.0 ± 6.62). The prevalence of CKDs is 19.3% among relatives. CKDs were more frequent 42.3 % in obese, followed by 30.8 % in overweight and 26.9% in normal weight relatives. Obese and overweight relatives have significantly higher ACR than normal weight (P = 0.012). GFR found to be significantly lower in obese and overweight relatives than normal weight (P = 0.000). GFR was negatively correlated with BMI (R = -0.430, P = 0.000).

Figure 1: A: Correlation between BMI and estimated -GFR, B: Correlation between BMI and ACR.
4. Discussion

Concurrent with several previous studies that showed increased prevalence of CKDs (23, 24). This study has demonstrated higher prevalence (19.3%) of CKDs among family members of renal failure patients. Moreover, the frequency data showed that, CKDs is more frequent in adults followed by adolescence and youngest. Meanwhile, in 135
of first-degree relatives, higher frequency of obesity was noted, followed by overweight and normal weight. Several previous studies have reported similar findings, that increased BMI was independent risk factor for CKDs in general population, diabetes and hypertension (25, 26, 27, 28, 29). Indeed, obesity is known to affect hemodynamic, insulin resistance, adipokines changes, low grade inflammation, oxidative stress and endothelial dysfunction, therefore has been suggested to be a risk factor of CKDs. Previous studies have shown that, obesity lead to intraglomerular pressure, which damage the kidneys structure and raise the risk of developing CKD in long term (30, 31). Whereas adiponectins from adipocyte are postulated to be involved in the pathogenesis and progression of CKD (32).

In contrast few studies demonstrated an insignificant association between increased BMI and CKD (33, 34). This contradiction attributed to obesity paradox, which suggested to have a protective effect against CKD progression and mortality (35).

Comparison analysis revealed that, obese and overweight relatives had significantly higher ACR and lower e-GFR levels than normal weight, therefore, have been suggested as potential risk factors of CKDs among family members. These findings similar from those reported that, albumin excretion rate is increased in obese subjects, also obese non diabetic subjects had a greater risk for microalbuminuria (36, 37, 38). Since the obesity increased renal plasma flow, hyperfiltration and promote renal injury, consequently proteinuria (39, 40, 41, 42). On the other hand the reduced level of e-GFR among individuals with increased BMI, in addition some data in support of this finding that, the BMI of 30 kg/m$^2$ or more is associated with rapid loss of kidney function in patients with eGFR of at least 60 mL/min/1.73 m$^2$ (43, 44).

### Table 3: The mean levels of ACR and e-GFR based on BMI categories in total first-degree relatives.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>BMI categories</th>
<th>Mean ± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACR (mg/gm.)</td>
<td>Normal weight</td>
<td>12.0 ± 6.60</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>16.5 ± 9.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Obese</td>
<td>21.6 ± 8.90</td>
<td></td>
</tr>
<tr>
<td>GFR - MDRD</td>
<td>Normal weight</td>
<td>90.7 ± 20.2</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>77.4 ± 21.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Obese</td>
<td>77.7 ± 25.8</td>
<td></td>
</tr>
</tbody>
</table>
In the present study, the comparison analysis was further reinforced by person’s correlation of eGFR and BMI that, eGFR positively associated with BMI. In fact, the association of obesity with an increased ACR-based CKD risk was previously reported (45). In contrast our results differ from those demonstrated that, the BMI is independent factor of CKD (46).

5. Conclusion

In conclusion, the prevalence of CKDs is 19.3% among relatives. Obese and overweight relatives had higher ACR and Lower eGFR. Meanwhile, BMI inversely associated with eGFR. Therefore, obese and overweight chronic renal failure relatives are at increased risk for developing CKDs.

6. Limitation of the Study

Limited number of relatives, the diagnosis of albuminuria based on single laboratory measurement.

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Conflict of Interest

The authors declare no conflict of interest.

Authors’ Contribution

All authors contribute equally
References


