The Relationship of Chronic Renal Failure and Body Mass Index in Patients without Diabetes

Spomenka Kristic, Sandra Vegar Zubovic, Fuad Zukic
Clinic of Radiology, Clinical Center of Sarajevo University, Sarajevo, Bosnia and Herzegovina

**1. INTRODUCTION**

Chronic renal failure (CRF) represents a serious medical problem. Numerous studies have shown increased body mass index (BMI) as an independent risk factor when it comes to the occurrence and development of CRF. **Material and methods:** The sample in our prospective study presents a total of 150 patients: 30 for each CRF stage (stages I-IV) and 30 patients in the control group. This study did not include patients in the terminal stage of chronic renal failure (stage V), as well as patients with newly diagnosed diabetes. Body mass index—BMI was calculated using the formula BMI=weight/height² (kg/m²). According to the classification of nutritional status based on BMI, proposed by the World Health Organization (WHO), the subjects of the study were classified into different groups of the nutritional status (6). The classification of patients according to stages of chronic renal insufficiency was performed in accordance with the criteria of Kidney Disease Outcomes Quality Initiative (K/DOQI) (1).

Results of the study were analyzed using descriptive statistics which includes determining the mean, standard deviation and standard error. Pearson correlation was used to assess the correlation. Statistically significant was considered values of the test with p<0.05.

**2. MATERIAL AND METHODS**

One-year prospective clinical study (January 2011 to January 2012) conducted at the Clinical Center University of Sarajevo, Bosnia and Herzegovina, included 150 patients who were in various stages of chronic renal failure (stage I to IV). Each study group consisted of 30 patients, also with the control group of 30 healthy individuals. The study included all the information about age, complete laboratory analysis of patients with chronic renal failure and 30 individuals who does not have chronic renal failure. Patients who are excluded from the study were as follows: patients in the terminal stage of chronic renal insufficiency (stage V), patients with kidney transplant, patients with unstable renal function, patients with newly diagnosed diabetes, polycystic kidney disease, hydronephrosis, renal anomalies, renal tumors and accompanying decompensating disease.

In the study, we used the medical records of patients that contained the necessary clinical, laboratory and demographic data. At admission to each patient were taken demographic and anthropometric data (gender, age, height and weight) as well as possible comorbidities. Estimate of creatinine clearance was performed using Cockcroft-Gault formula (5). BMI is calculated using the formula: BMI=weight/height² (kg/m²). According to the classification of nutritional status based on BMI, proposed by the World Health Organization (WHO), the subjects of the study were classified into different groups of the nutritional status (6). The classification of patients according to stages of chronic renal insufficiency was performed in accordance with the criteria of Kidney Disease Outcomes Quality Initiative (K/DOQI) (1). Results of the study were analyzed using descriptive statistics which includes determining the mean, standard deviation and standard error. Pearson correlation was used to assess the correlation. Statistically significant was considered values of the test with p<0.05.

**3. RESULTS**

Of the total number of subjects (N=150) 71 were male and 79 female. The mean age of patients was 55.43 years, and the age structure of the sub-
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Table 1. Mean age of patients involved in the study by each group. U=9.616; DF = 4; p=0.0001

| Group   | N   | Mean | SD  | SEM  | Minimum | Maximum |
|---------|-----|------|-----|------|---------|---------|
| Control | 30  | 45.63| 15.062| 2.750| 20     | 75      |
| I stage | 30  | 48.43| 12.800| 2.337| 20     | 67      |
| II stage| 30  | 59.07| 10.712| 1.956| 32     | 80      |
| III stage| 30 | 61.03| 14.327| 2.616| 19     | 81      |
| IV stage| 30  | 63.00| 15.872| 2.898| 27     | 83      |
| Total   | 150 | 55.43| 15.397| 1.257| 19     | 83      |

Table 1. Mean age of patients involved in the study by each group.

| BMI       | N   | %   |
|-----------|-----|-----|
| <20 underweight | 2  | 1.7 |
| 20-25 normal weight | 39 | 32.5 |
| 25-30 overweight | 53 | 44.2 |
| >30 obesity | 26 | 21.7 |
| Total     | 120 | 100.0  |

Table 2. BMI of the patients

| Group * BMI | Total |
|-------------|-------|
| Control     |       |
| N           | 1     |
| %           | 50.0  |
| <20 underweight | 6 | 12 |
| 20-25 normal weight | 11 | 22.6 |
| 25-30 overweight | 4 | 25.0 |
| >30 obesity | 11 | 30 |
| N           | 30    |
| %           | 50.0  |
| I stage     |       |
| N           | 0     |
| %           | 28.2  |
| <20 underweight | 15 | 28.3 |
| 20-25 normal weight | 11 | 15.4 |
| 25-30 overweight | 4 | 25.0 |
| >30 obesity | 4  | 30 |
| N           | 30    |
| %           | 50.0  |
| II stage    |       |
| N           | 0     |
| %           | 0     |
| <20 underweight | 12 | 28.3 |
| 20-25 normal weight | 11 | 15.4 |
| 25-30 overweight | 3 | 25.0 |
| >30 obesity | 3  | 30 |
| N           | 30    |
| %           | 50.0  |
| III stage   |       |
| N           | 0     |
| %           | 0     |
| <20 underweight | 12 | 28.3 |
| 20-25 normal weight | 11 | 15.4 |
| 25-30 overweight | 3 | 25.0 |
| >30 obesity | 3  | 30 |
| N           | 30    |
| %           | 50.0  |
| IV stage    |       |
| N           | 1     |
| %           | 1,7   |
| <20 underweight | 6 | 12 |
| 20-25 normal weight | 11 | 22.6 |
| 25-30 overweight | 12 | 42.3 |
| >30 obesity | 11 | 30 |
| N           | 28   |
| %           | 32.5  |

Table 4. Relationship between BMI and stage of CRF. x² =11.398; DF = 12; p=0.249. Rho=-0.166; p=0.070

The mean BMI of subjects clearly indicates a link between older age of patients and progression of chronic renal failure, which also corresponds to the literature data, according to which the prevalence of chronic renal failure varies significantly with age and was higher in the elderly (8).

The mean BMI of our patients was 27.1547 kg/m², values range from 17.21 to 38.10 kg/m². In our study, we concluded that the BMI values decrease with the development of chronic renal insufficiency. Review of the available literature revealed that many authors suggest that there is a clear correlation between obesity and the development of chronic renal failure and that obesity is a risk factor for development of chronic renal failure, which can directly or indirectly lead to renal failure (9).

In our study, we did not demonstrate a correlation between increased BMI and the occurrence of renal failure nor have we found significant correlation between increased BMI and the progression of chronic renal failure, which corresponds to the study by Brown et al (10).

We did not demonstrate a significant correlation between increased body mass index and the occurrence or development of renal failure in patients who do not have diabetes.

CONFLICT OF INTEREST: NONE DECLARED

REFERENCES
1. National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification and stratification. Am J Kidney Dis. 2002; 39(2 Suppl 1): S1-266.
2. Zoccali C, Kramer A, Jager KJ. Epidemiology of CKD in Europe: an uncertain scenario. Nephrol Dial Transplant. 2010; 25: 1731-1733.
3. Hallan SI, Vikse BE. Relationship between chronic kidney disease prevalence and end-stage renal disease risk. Curr Opin Nephrol Hypertens. 2008; 17: 286-291.
4. Fox CS, Larson MG, Leip EP, Culleton B, Wilson PW, Levy D. Predictors of new-onset kidney disease in a community-based population. JAMA. 2004 Feb 18; 291(7): 844-850.
5. Cockcroft D, Gault M. Prediction of creatinine clearance from serum creatinine. Nephron. 1976; 16: 31-41.
6. http://www.who.int/ifeatures/factfiles/obesity/facts/en/index.html
7. Zhang QL, Rothenbacher D. Prevalence of chronic kidney disease in population-based studies: Systematic review. BMC Public Health. 2008; 8: 117.
8. Bae KT, Grantham JJ. Imaging for the prognosis of autosomal dominant polycystic kidney disease. Nature Reviews Nephrology. 2010; 96-106.
9. Wang Y, Chen X, Song Y, Caballero B, Cheskin LJ. Association between obesity and kidney disease: A systematic review and meta-analysis. Kidney Int. 2008; 73: 19-33.
10. Brown BN, Mohsen A, Green D, Hoffer RA, Summers LK, Middleton RJ. et al. Body mass index has no effect on rate of progression of chronic kidney disease in non-diabetic subjects. Nephrol Dial Transplant. 2012; 27(7): 2776-2780.