

# Prevalence of metabolic syndrome in dialysis and transplant patients

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Sameeha AlShelleh<sup>1</sup>  
Izzat AlAwwa<sup>1</sup>  
Ashraf Oweis<sup>2</sup>  
Saif Aldeen AlRyalat<sup>1</sup>  
Mohammad Al-Essa<sup>1</sup>  
Iyad Saeed<sup>1</sup>  
Hussein H Alhawari<sup>1</sup>  
Karem H Alzoubi<sup>3</sup>

<sup>1</sup>Department of Internal Medicine, The University of Jordan, Amman 11942, Jordan;

<sup>2</sup>Department of Internal Medicine, Jordan University of Science and Technology, Irbid, Jordan;

<sup>3</sup>Department of Clinical Pharmacy, Faculty of Pharmacy, Jordan University of Science and Technology, Irbid, Jordan

**Background:** Several epidemiological studies have assessed various components of Metabolic Syndrome (MS) in different populations, but only a few compared the prevalence of metabolic syndrome in dialysis and transplant patients.

**Aim:** The aim of this study is to compare the prevalence of MS in dialysis and transplant patients. Two groups of patients were included; hemodialysis patients and patients with transplanted kidneys.

**Methods:** Demographic and clinical history, and lab data were collected. A total of 108 patients were included in this study with a mean age of 52.3 ( $\pm 16.29$ ) years. Study groups included 61 (56.5%) dialysis patients, and 47 (43.5%) patients with transplanted kidneys.

**Results:** Upon comparing the prevalence of metabolic syndrome between the two study groups, transplant patients had significantly lower prevalence of metabolic syndrome (34%) compared to that of metabolic syndrome in patients on dialysis (55.7%;  $P=0.016$ ).

**Conclusion:** As metabolic syndrome plays an important role in the pathology of elderly patients, especially those with transplanted kidneys, such findings indicate the need for close monitoring of kidney transplant patients for the manifestations of metabolic syndrome.

**Keywords:** metabolic syndrome, renal transplant, chronic kidney disease, elderly

## Introduction

In the past few years, the concept of metabolic syndrome emerged to denote patients who have at least three of the following: hypertension, diabetes mellitus, central obesity, hypertriglyceridemia, and low high-density lipoprotein (HDL).<sup>1</sup> The metabolic syndrome basic theory indicates that every component is an independent predictor of disease where multiple factors combinations lead to synergistic risk, which is greater than the sum of risk from each component. It is now well-known that patients with metabolic syndrome have higher risk of cardiovascular and kidney diseases.<sup>2,3</sup> The Third National Health and Nutrition Examination Survey showed that metabolic syndrome is a risk factor for developing chronic kidney disease.<sup>4</sup>

The manifestations of metabolic syndrome extend beyond being a risk factor for chronic kidney disease, as shown in studies on patients on dialysis and transplants. In renal transplant patients, a complex interaction between metabolic syndrome and renal transplant factors was observed, as metabolic syndrome can deteriorate renal function and increase rejection rates. Moreover, transplant-related medications could further exacerbate metabolic syndrome components.<sup>5</sup> A complex relation with metabolic syndrome can also be observed in dialysis patients. For example, uremia that develops in the late stages in dialysis patients can lead to metabolic derangements, such as high

Correspondence: Sameeha AlShelleh  
Division of Nephrology, Department of  
Medicine, The University of Jordan,  
Queen Rania Street, Amman 11942,  
Jordan  
Tel +96 279 969 1928  
Email sameehaaalshelleh3@gmail.com

blood pressure and glucose intolerance.<sup>6</sup> Considering this complex role of metabolic syndrome in non-CKD, dialysis, and renal transplant patients, it is important to understand the prevalence of metabolic syndrome in each group, and to further explore which component plays the major role in metabolic syndrome development in each group. In this study, we aimed at studying the prevalence of metabolic syndrome in general, and each of its components in chronic kidney disease patients on hemodialysis versus those with renal transplant.

## Methods

### Participants

This cross-sectional study was approved by the institutional review board of Jordan University Hospital, Amman, and was conducted in concordance with the latest declaration of Helsinki. Written informed consent was obtained from all study participants. Hemodialysis patients and patients with transplanted kidneys were included. A survey was conducted via a one-on-one interview with recruits who were chosen during the period from January 2016 to April 2016. The interview included questions about demographic data, previous medical history in general, previous medical history related to the kidneys specifically (eg, kidney injury), medication history, and consent to participate in the study. Recruits were from the nephrology clinic, including; transplant clinic patients (transplant patients) and in-center chronic hemodialysis patients (dialysis patients) at Jordan University Hospital.

Patients on hemodialysis with the following criteria were included in the study: had dialysis three-times per week for the past year, never had kidney transplant, and not pregnant (for women). Transplant patients were included in the current study if they had at least one transplanted kidney, were not currently on dialysis, and not pregnant (for women). Notably, most transplant patients included in the current study were on dialysis before transplant (95.7% previously on dialysis versus 4.3% who had a preemptive renal transplant).

### Measurements

At the end of the interview, which was done before dialysis session on the day of dialysis, the following were recorded for each patient: weight in kilograms by digital scale, height in meters, waist circumference in centimeters, and blood pressure. The blood pressure was measured using a Microlife validated blood pressure device for clinic

use,<sup>7</sup> with a suitable size cuff. This was done in a separate quiet room, with a confirmed sitting and relaxed state for at least 10 minutes, and confirmation of no stimulant use in the past hour. An average of three readings was considered for all previous measurements. Additionally, all patients were instructed to fast for 12 hours to do the following labs: kidney function test, fasting blood sugar, fasting lipid profile, and HbA1C.

### Data reporting and statistical analysis

The absolute value for all the previously mentioned measurements was reported. Moreover, values of blood pressure, fasting blood glucose, waist circumference, triglyceride, and HDL were transformed into dichotomous (yes/no or 1/0) variables based on the definition of metabolic syndrome, and according to the harmonized definition of metabolic syndrome.<sup>1</sup> Based on that, a new variable that represents the sum of all metabolic syndrome components, and another dichotomous variable that defines metabolic syndrome as having three or more components of the metabolic syndrome were produced.

SPSS 21.0 (IBM corporation, Armonk, NY, USA) was used for data analysis. Data were expressed as mean ( $\pm$ standard deviation) for continuous variables, and count (frequency) for descriptive variables. Independent sample *t*-test was used to compare gender mean age difference. The Chi-square test followed by Z-test of proportion were used to compare groups as per the presence of metabolic syndrome.

### Ethics statement

Informed consent was obtained from all individual participants included in the study.

### Results

Patients ( $n=108$ ) were included in this study with a mean age of 52.3 ( $\pm 16.29$ ) years, consisting of 71 (65.7%) men with a mean age of 54.03 ( $\pm 16.18$ ) years, and 37 (34.3%) women with a mean age of 48.9 ( $\pm 16.19$ ) years ( $P>0.05$ ). Dialysis patients (61; 56.5%) and patients with transplanted kidneys (47; 43.5%) were not different with regard to age or gender. Among the studied kidney transplant patients, the mean $\pm$ SD time since transplant was 17.6 $\pm$ 7.4 years. Table 1 details the characteristics of the study sample.

Upon comparing the prevalence of metabolic syndrome between both study groups, transplant patients had significantly lower prevalence of metabolic syndrome (34%), compared to that of metabolic syndrome

**Table 1** General patients' characteristics

Variable	Dialysis (Mean±SD)	Transplant (Mean±SD)
Age (years)	53.90±17.76	50.17±14.07
Height (cm)	164.11±8.93	169.13±8.50
Weight (kg)	71.50±18.17	78.91±16.84
Waist circumference (cm)	94.75±17.85	98.26±15.47
Systolic blood pressure (mmHg)	137.18±19.93	123.49±14.39
Diastolic blood pressure (mmHg)	76.64±13.73	75.81±7.28
Fasting blood glucose (mg/dL)	116.84±50.79	122.23±49.66
Triglyceride	151.57±88.42	161.19±72.08
Low density lipoprotein	87.09±32.79	97.45±29.05
Total cholesterol	146.80±38.79	167.59±33.65
High density lipoprotein	42.39±24.27	50.02±20.15

**Table 2** Comparisons of metabolic syndrome components between kidney transplant versus kidney dialysis patients

Components of metabolic syndrome	Dialysis, n (%)	Transplant, n (%)	P-value
Hypertension			0.001
Yes	37 (60.7%)	12 (25.5%)	
No	24 (39.3%)	35 (74.5%)	
High waist circumference			0.001
Yes	26 (42.6%)	24 (51.1%)	
No	35 (57.4%)	23 (48.9%)	
Low HDL			0.003
Yes	42 (68.9%)	17 (36.2%)	
No	19 (31.1%)	30 (63.8%)	
Elevated FBG			0.732
Yes	35 (53.9%)	26 (55.1%)	
No	30 (46.1%)	21 (44.9%)	
Elevated triglyceride			0.352
Yes	33 (50.8%)	27 (57.1%)	
No	32 (49.2%)	20 (42.9%)	

**Abbreviation:** FBG, fasting blood glucose; HDL, high density lipoprotein.

in patients on dialysis (55.7%;  $P=0.016$ ). The prevalence of each component of metabolic syndrome between both study groups was compared (Table 2). For hypertension, the prevalence of being hypertensive was significantly higher in patients on dialysis compared to transplant patients ( $P=0.001$ ). For waist circumference ( $P<0.001$ ), the prevalence of having increased waist circumference consistent with metabolic syndrome definition was significantly higher in transplant patients. For HDL ( $P=0.003$ ), the prevalence of having low HDL

was significantly higher in dialysis patients compared to transplant patients. For fasting blood sugar and triglyceride, there were no significant differences between study groups ( $P=0.732$ ,  $P=0.352$ , respectively).

## Discussion

Findings of this study showed a higher prevalence of metabolic syndrome in dialysis patients compared to patients with transplanted kidneys. Only three out of five components of the metabolic syndrome were statistically significant between dialysis patients and patients with transplanted kidneys; they were hypertension, waist circumference, and HDL levels.

Previous studies showed that patients suffer more frequently from metabolic syndrome after renal transplantation.<sup>8</sup> This increase in metabolic syndrome after kidney transplantation was proposed to be related to medication-induced effects on metabolic syndrome components, particularly dyslipidemia, glucose intolerance, and hypertension.<sup>5</sup> In the current study, it was found that only a third of transplant patients had metabolic syndrome, compared to more than half of dialysis patients. In accordance with the current study, which showed a prevalence of 55.7% for metabolic syndrome in dialysis patients, a study on a US population showed a prevalence of 69.3% for metabolic syndrome among dialysis patients.<sup>9</sup> Another study from Greece showed a prevalence of 56.3% of metabolic syndrome among dialysis patients.<sup>10</sup> Among normal elderly patients, previous studies estimated that the prevalence of metabolic syndrome worldwide ranged from <10% to as much as 84% (57.3% in the present study), depending on individual factors including sex, age, race, and ethnicity; region, and environment of the population studied.<sup>11</sup> In that respect, in two studies from France and Spain, patients had almost similar prevalence (32% and 37.7%) of metabolic syndrome after transplant.<sup>8,12</sup>

A recent meta-analysis showed that different components in the metabolic syndrome negatively affect the kidney in different proportions in terms of proteinuria, and it showed their effect in descending order to be hypertension, hypertriglyceridemia, low HDL, abdominal obesity, and impaired glucose intolerance.<sup>13</sup> In the current study and upon comparing each component of the metabolic syndrome, a varying contribution of each component was observed where transplant patients had significantly low prevalence of hypertension (only 25.5%), low prevalence of low HDL (only 36.2%), but high prevalence of high waist circumference (51.1%). In a US study, an increase in the prevalence of all metabolic syndrome

components after 1 year of transplantation was reported compared to pre-transplant status.<sup>8,14</sup> For dialysis patients, current results showed high prevalence of hypertension (60.7%), high prevalence of low HDL (68.9%), but low prevalence of high waist circumference (only 42.6%). Young et al<sup>14</sup> found high prevalence of hypertension (99%) and low HDL (66%) in dialysis patients, but, unlike the current study, higher prevalence of elevated fasting blood sugar (59%) was reported in that study along with a comparable prevalence of abdominal obesity (42%). These discrepancies in the results of different studies could be attributed to the different population and health-care settings between these studies and the current study.

The current study has some limitations, as it did not assess the metabolic syndrome status before renal transplantation or dialysis initiation (ie, longitudinal study design). Based on current findings, this is in fact a highly encouraged future study to assess the metabolic syndrome status before and after renal transplantation and dialysis initiation, which would further characterize the risk of metabolic syndrome induced by these two events. Moreover, future studies should consider including larger samples to confirm and further generalize current results.

Metabolic syndrome plays a major role in the progression of CKD in transplant patients with increased risk of proteinuria and eventually loss of graft function. The presence of metabolic syndrome could increase the risk for cardiovascular disease in both transplant and dialysis patients, which contributes to increased morbidity and mortality. The two most common factors found in the dialysis group (hypertension and low HDL) are well reported complications of chronic kidney disease where there is an interplay of both CKD factors and metabolic factors that affect whether these patients meet criteria for metabolic syndrome.

In conclusion, and as far as the prevalence of metabolic syndrome is concerned, patients with transplanted kidneys have lower metabolic syndrome prevalence compared to dialysis patients. Targeting hypertension and low HDL components in dialysis patients, and increased waist circumference in transplant patients could decrease the prevalence of metabolic syndrome and may further decrease morbidity and mortality.

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## Disclosure

The authors report no conflicts of interest in this work.

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