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**Original Article**

**Effect of BMI on outcome in peritoneal dialysis patients: a single Saudi center review**

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## ABSTRACT

**Objective:** To evaluate effect of obesity on PD including technique survival, incidence of complications, and mortality

**Design:** Retrospective cohort analysis

**Settings:** Nephrology unit at King Saud University in Riyadh, Saudi Arabia, between January 1<sup>st</sup>, 2005 and December 31<sup>st</sup>, 2014

**Subjects:** 98 patients, treated in the peritoneal dialysis unit. Out of these, 36 had healthy weight, 28 were overweight while 34 patients were obese.

**Intervention:** As a retrospective study, no intervention in patient medication or dialysis was performed.

**Main outcome measure:** The main outcome measure was patient mortality, or cessation of PD (transplant or transfer to HD). Other measures included infection and complications.

**Results:** The mean age was, 52.14 (16-77) years for obese patients, compared with overweight, 49.83(16–84 years) and normal weight patients 47.53(19-86 years). Peritonitis rate was 0.38 per patient years in normal weight, 0.22 in overweight and 0.35 in obese patients. The mortality rate was 0.09 per patient years in normal, 0.07 in overweight and 0.06 in obese patients. 6 (15%) of patients in normal weight group shifted to HD, compared to 7 (25%) overweight and 14 (32.5%) obese patients (p value 0.045). 6 (15%) patients in normal underwent renal transplant, compared to 2 (7.1%) overweight and 4 (9.3%) obese patients (p value 0.020).

**Conclusion:** Our results revealed no significant differences in terms of infections, complications and patient mortality. However, obese patients had higher transfer to HD and lower renal transplant

**KEY WORDS:** dialysis, end stage renal disease, obesity

## INTRODUCTION

Peritoneal dialysis (PD) as a mode of renal replacement therapy (RRT) has witnessed a rapid evolution in the last decade<sup>[1]</sup>. However, in most countries, only a small percentage of end stage renal disease (ESRD) patients are using PD<sup>[2]</sup> compared to hemodialysis (HD), even as the outcomes for PD patients continue to improve and are comparable to HD<sup>[3,4]</sup>. Obesity has been recognized as a worldwide problem affecting all populations including end stage renal disease (ESRD) patients. Studies have shown obesity, as measured by an increasing body mass index (BMI), is linked to a number of adverse metabolic effects, as well as increasing the risk of coronary heart disease, ischemic stroke and type 2 diabetes mellitus in the general population<sup>[5-7]</sup>. It has also been postulated to have an effect on kidneys, leading to chronic kidney disease (CKD), either directly or through the increased presence of hypertension and diabetes in people with a higher BMI<sup>[8,9]</sup>.

### Obesity and dialysis patients

A number of studies of patients undergoing hemodialysis have demonstrated that increasing body mass index (BMI) is correlated with decreased mortality risk<sup>[10-12]</sup>. However, similar studies have shown varied and often opposing results among patients treated with peritoneal dialysis (PD)<sup>[13-16]</sup>. The population

of ESRD patients in Saudi Arabia has enlarged exponentially in the preceding decades, largely due to rise in the incidence of Diabetes mellitus and metabolic syndrome<sup>[17,18]</sup>. PD has been used increasingly in the Middle East as an effective renal replacement therapy with good results<sup>[19]</sup>. In Saudi Arabia, PD was started in King Saud University and has shown to have outcomes and complications comparable to International guidelines<sup>[20]</sup>. However the number of patients on PD is still a small fraction of ESRD population, as shown by Saudi center for organ transplant (SCOT) reports<sup>[21]</sup>. There have been very few studies on the effect of obesity in hemodialysis patients from Middle East<sup>[9]</sup>. and almost none relating to the peritoneal dialysis patients.

## SUBJECTS AND METHODS

This study conducted in behalf of the Nephrology unit at King Saud University in Riyadh, Saudi Arabia with full support and no objection from the unit or the department of medicine.

This is a single center, retrospective cohort analysis comparing groups of patients on the basis of BMI. A total of 98 patients, treated in the peritoneal dialysis unit between January 1<sup>st</sup>, 2005 and December 31<sup>st</sup>, 2014 were included in the study. All patients had used regular PD for at least 6 months. All patients who were aged less than 16 years, had significant growth retardation due to renal or other metabolic disease, or had discontinued PD before completing the initial 6 months of dialysis were excluded from the study.

The BMI was calculated on the start of PD therapy. Body weight was assessed without PD fluid in the abdominal cavity. Patients were divided into three groups (Figure 1) on the basis of BMI (calculated as weight in kilograms divided by the square of height in meters ( $\text{kg}/\text{m}^2$ ) and categorized according to the World Health Organization (WHO) classification<sup>[20]</sup>: underweight ( $<18.5 \text{ kg}/\text{m}^2$ ), normal weight ( $18.5\text{--}24.9 \text{ kg}/\text{m}^2$ ), overweight ( $25.0\text{--}29.9 \text{ kg}/\text{m}^2$ ), and obese ( $>30.0 \text{ kg}/\text{m}^2$ ).

The patients were followed at regular appointments in PD clinic. Any episode of peritonitis or exit site infection was managed according to ISPD guidelines and recommendations. Different variables were compared between the groups including; Time on PD, Episodes of peritonitis, Episodes of Exit site infections (ESI), and PD catheter related complications. In this study the primary patient outcome was death and the secondary outcomes included transfer to HD, and renal transplant, Peritonitis, ESI, and Catheter Complication. 25 patients were continuing PD till end of study period. The Mortality and infection rates were calculated in accordance with the international recommendations, by calculating the total time on dialysis as patient months.

## RESULTS

The mean age of obese patients was higher (52.14 range: 16-77 years) compared with overweight (49.83, range: 16–84 years) and normal weight patients (47.53, range: 19-86 years).

The frequency of diabetes mellitus as primary renal disease was higher (53.57%) in overweight patients compared with other groups. On the other hand, Hypertension was more frequent in normal weight patients (25%) compared with other groups. The patient demographics are summarized in Table 1.

Table 2 shows the results of the complications and outcomes among patients in different groups. The results revealed that there was no significant difference between different groups on base of Peritonitis

rates (calculated according to ISPD guidelines) as the overall peritonitis rate was 0.38 episodes per patient years in normal weight patients, 0.22 per patient years among overweight patients and 0.35 per patient years among obese patients. For exit site infection (ESI), the overall rate was 0.17 episodes per patient years in normal weight patients, 0.11 per patient years among overweight patients and 0.13 per patient years among obese patients.

The results also showed that there was no significant difference between groups in ESI rates. The Exit site infection rate was 0.17 episodes per patient years among normal weight patients, 0.11 per patient years among overweight patients and 0.13 per patient years among obese patients (Table 2).

## DISCUSSION

Obesity is recognized as an increasingly common health issue worldwide, and it affects the morbidity and mortality in all age groups<sup>[6]</sup>. Furthermore, in ESRD patients, presence of uremia and uremic complications including fluid retention, protein–energy wasting, inflammation, and oxidative stress further contribute to a metabolic syndrome like picture in these patients<sup>[8,14]</sup>. Especially susceptible are the PD patients exposed to glucose-based PD fluids, which further enhance the risk of developing metabolic complications<sup>[8]</sup>. A number of studies of patients undergoing hemodialysis have demonstrated that increasing body mass index (BMI) is correlated with decreased mortality risk<sup>[10-12]</sup>. Obesity was previously considered a relative contraindication to PD due to increased risk of metabolic and mechanical complications (including catheter migration, hernia) hypertriglyceridemia, poor solute clearance, and infections, however in current years PD has been increasingly used in patients with a higher BMI<sup>[14]</sup>.

The current study focuses on local Arab population in Saudi Arabia, which has seen an exponential increase in patients with ESRD during the preceding decades, attributed largely to increasing incidence of Diabetes mellitus and metabolic syndrome<sup>[18,19]</sup>.

In PD patients, studies based on BMI have not shown a clear relation BMI and patient outcome and survival, unlike HD population. We compared our results to a 2014 study in India, by Narayan Prasad, Archana Sinha and Amit Gupta<sup>[15]</sup> including 328 incident patients on PD. Their results showed that death-censored technique survival was statistically similar in all BMI categories. In comparison with the reference category, peritonitis occurrence was 1.8 (95% CI: 0.9 to 3.4;  $p = 0.086$ ) for underweight patients; 1.7 (95% CI: 0.9 to 3.2;  $p = 0.091$ ) for overweight patients; and 3.4 (95% CI: 1.8 to 6.4;  $p < 0.001$ ) for obese patients. We did not find any statistically significant difference in peritonitis and ESI between patient groups, but as seen in the aforementioned study our analysis did not reveal any significant difference in patient mortality. Additionally, the results from our study are somewhat similar to a 2009 study in the Netherlands, by De Mutsert, Renée<sup>[14]</sup>, which included 688 patients with ESRD starting with PD. The researchers concluded that PD patients who are obese at the start of dialysis do not have a worse survival compared with PD patients with a normal BMI. However, PD patients with a low BMI during dialysis have a twofold increased mortality risk. Our study did not include patients with a low BMI, as very few of our patients had a BMI less than 18.5.

On the other hand, other authors have found worse outcomes in obese patients using PD<sup>[16]</sup>. A 2003 study by McDonald, Stephen P., John F. Collins, and David W. Johnson studied 9679 new adult patients, using

data from the Australia and New Zealand Dialysis and Transplant Registry, between April 1, 1991, and March 31, 2002. They found that obesity was independently associated with death during PD treatment ( $P < 0.05$ ) and technique failure ( $P < 0.01$ ).

The results of our study showed no statistically significant differences between the 3 groups in terms of mortality and infection rates (Table 2). Diabetes Mellitus was the most common primary disease in the overweight group (53%) whereas about one third of the obese and normal weight patients were diabetic. Adequacy studies showed a slightly higher Kt/V in normal and overweight patients compared to obese patients but that can be due to higher body surface as well differences in the residual renal function. Still the average adequacy rates were above 1.7 in all groups.

Obesity is often considered to be a risk factor for catheter related complications including migration of catheter, however there was no statistically significant differences found among the groups, with obese patients having the lowest number of episodes of catheter migration.

The patients in the obese category had a higher likelihood of PD technique failure and transfer to hemodialysis as compared to the other 2 groups (p value 0.02) and fewer renal transplants (p value 0.045). This can be due to relatively older age and presence of comorbidities.

## CONCLUSION

We can conclude that obesity should not be treated as a contraindication to peritoneal dialysis therapy and such patients can be started on PD provided no absolute contraindications are present. Moreover the chances of developing infectious as well as catheter related complications are similar to patients with a lower BMI.

However, the results cannot be considered absolute as this was a retrospective study with a small number of patients in a single center. Larger multi center trials are needed to fully understand the effect of obesity and increased BMI in ESRD patients especially the PD population where weight control is considerably difficult because of universal use of glucose-based fluids.

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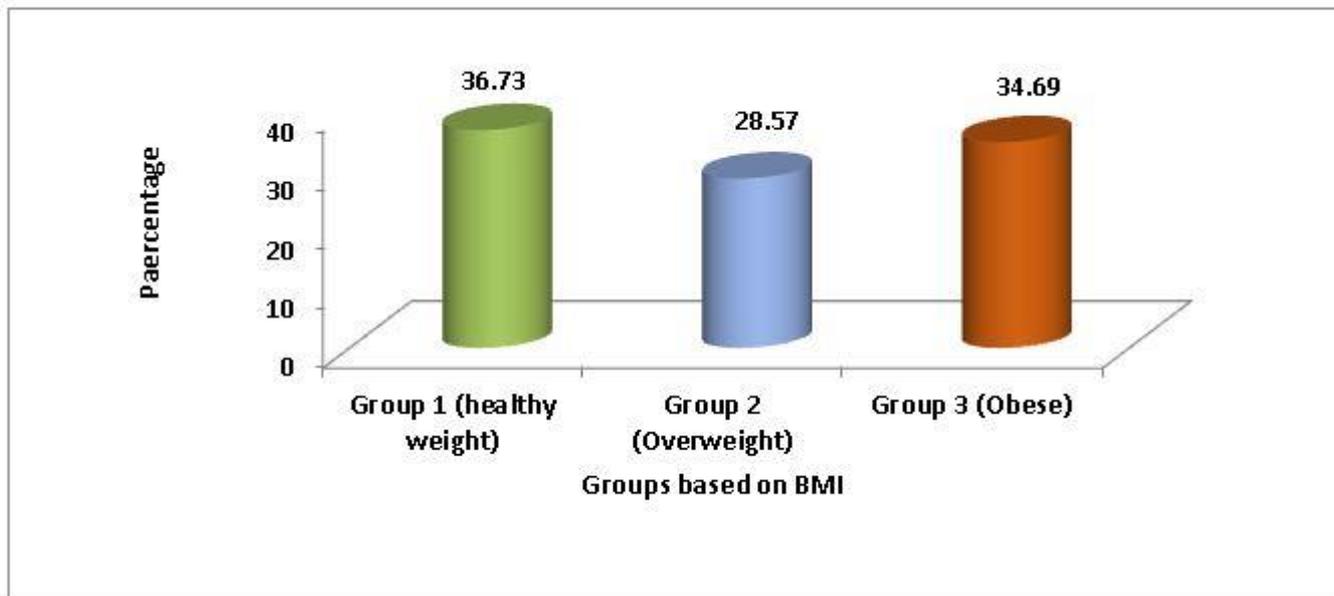
**Table 1:** Patient demographics in different BMI group

Demographics	GROUP 1	GROUP 2	GROUP 3
	Healthy weight	Overweight	Obese
No of patients	36	28	34
Male to female ratio (M:F)	20:16	13:15	14:20
Age (years)	47.53 (19-86)	49.83 (16–84)	52.14 (16-77)
Time on PD (patient years)	103.78	100.14	122.97
Mode of Dialysis			
CAPD	20	7	6
APD	16	21	28
<b>Primary Renal Disease (%)</b>			
Diabetes Mellitus	11 (30.56%)	15 (53.57%)	11 (32.35%)
Glomerulonephritis	10 (27.78%)	5 (17.86 %)	8 (23.53%)
Hypertension	9 (25 %)	4 (14.28%)	8 (23.53%)
Nephrolithiasis	0	0	4 (11.76%)
Solitary Kidney	1 (2.78%)	1 (3.57%)	0
Sickle Cell Disease	2 (5.56%)	0	0
APCKD	0	0	1 (2.94%)
Chronic Pyelonephritis	0	1(3.57%)	1 (2.94%)
Reflux nephropathy	0	1(3.57%)	0
Multiple Myeloma	1 (2.78%)	0	0
Unknown	2 (5.56%)	1(3.57%)	1 (2.94%)
MEAN BMI (kg/m <sup>2</sup> )	22.16	27	33.2
MEAN ALBUMIN (g/L)	29.3	30.61	30.27
MEAN KT/V	2.23	2.34	1.98

PD- peritoneal dialysis, CAPD – Continuous Ambulatory Peritoneal Dialysis, APD – Automated Peritoneal Dialysis, APCKD – Adult polycystic Kidney disease, BMI – Body mass index, Kt/V weekly urea clearance, nPCR – normalized protein creatinine ratio

**Table 2:** Frequency of patients' complications and outcomes in different BMI groups

<b>Variables</b>	<b>Healthy weight</b>	<b>Overweight</b>	<b>Obese</b>	<b>P</b>
PERITONITIS (no of episodes)	40	28	43	0.76
ESI (no of episodes)	18	11	16	0.417
Catheter Migration (no of episodes)	7	7	2	0.496
Catheter Leak (no of episodes)	1	1	1	0.991
Catheter Replacement (no of episodes)	4	2	5	0.341
Deaths (no of patients died)	9	7	8	0.822
Outcome- Renal Transplant	6 (15%)	2 (7.1%)	4 (9.3%)	0.020
Outcome- shifted to HD	6 (15%)	7 (25%)	14 (32.5%)	0.045



**Figure 1:** Distribution of groups