

## Original Article

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

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## ABSTRACT

**Objective:** To evaluate the effect of obesity on peritoneal dialysis (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:** Ninety-eight patients treated in the PD unit. Out of these, 36 had healthy weight and 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 hemodialysis (HD)). Other measures included infection and complications.

**Results:** The mean age was 52.14 years (range: 16-77 years) for obese patients compared with 49.83 years (range: 16-84 years) in overweight and 47.53 years (range: 19-86 years) in normal weight patients. 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. Six (15%) patients in the normal weight group shifted to HD, compared to 7 (25%) overweight and 14 (32.5%) obese patients ( $P=0.045$ ). Six (15%) patients in normal weight group underwent renal transplant, compared to 2 (7.1%) overweight and 4 (9.3%) obese patients ( $P=0.020$ ).

**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 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 ESRD patients. Studies have shown that 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, 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 HD have demonstrated that increasing 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 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

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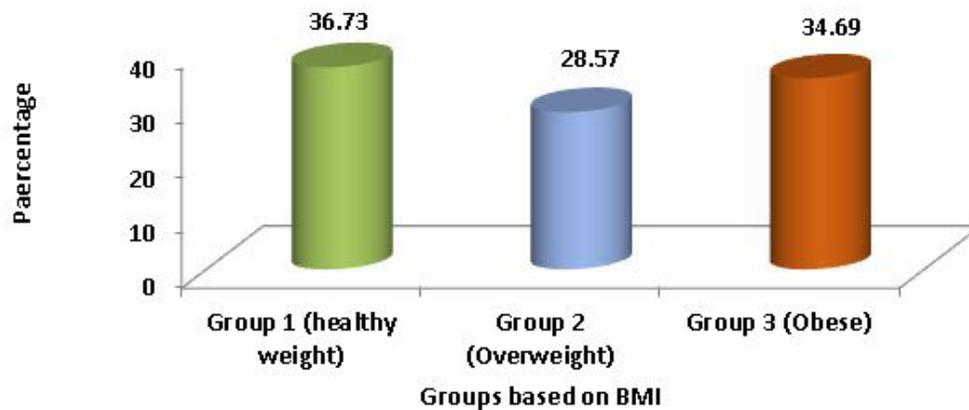


Fig 1: Distribution of groups

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 the ESRD population, as shown by Saudi Center for Organ Transplant reports<sup>[21]</sup>. There have been very few studies on the effect of obesity in HD patients from Middle East<sup>[9]</sup> and almost none relating to PD patients.

## SUBJECTS AND METHODS

This study was conducted on 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 PD 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 six months. All patients who were less than 16 years of age, had significant growth retardation due to renal or other metabolic disease, or had discontinued PD before completing the initial six months of dialysis were excluded from the study.

The BMI was calculated at the start of PD therapy. Body weight was assessed without PD fluid in the

Table 1: Patient demographics in different BMI group

Demographics	Group 1 Healthy weight	Group 2 Overweight	Group 3 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
Primary Renal Disease (%)			
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

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

Variables	Healthy weight	Overweight	Obese	P
Peritonitis (no. of episodes)	40	28	43	.76
ESI (no. of episodes)	18	11	16	.417
Catheter migration (no. of episodes)	7	7	2	.496
Catheter leak (no. of episodes)	1	1	1	.991
Catheter replacement (no. of episodes)	4	2	5	.341
Deaths (no of patients died)	9	7	8	.822
Outcome- renal transplant	6 (15%)	2 (7.1%)	4 (9.3%)	.020
Outcome- shifted to HD	6 (15%)	7 (25%)	14 (32.5%)	.045

ESI: exit site infections; HD: hemodialysis

abdominal cavity. Patients were divided into three groups (Fig 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 classification<sup>[20]</sup> as 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 up at regular appointments in the PD clinic. Any episode of peritonitis or exit site infection (ESI) was managed according to International Society for Peritoneal Dialysis guidelines and recommendations. Different variables were compared between the groups including time on PD, episodes of peritonitis, ESI and PD catheter related complications. In this study, the primary patient outcome was death and the secondary outcomes included transfer to HD, renal transplant, peritonitis, ESI and catheter complication. Twenty-five 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 years; range: 16-77 years) compared with overweight (49.83 years, range: 16-84years) and normal weight patients (47.53 years, 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 the basis of peritonitis rates (calculated according to International Society for Peritoneal Dialysis 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 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 different between groups in ESI rates. The ESI 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 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 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, PD has increasingly been used in patients with a higher BMI in current years<sup>[14]</sup>.

The current study focuses on the 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 between BMI and patient outcome and survival, unlike HD population. We compared our results to a 2014 study in India by Prasad *et al*<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: 0.9-3.4;  $P=0.086$ ) for underweight patients; 1.7 (95%CI: 0.9-3.2;  $P=0.091$ ) for overweight patients and 3.4 (95%CI: 1.8-6.4;  $P < 0.001$ ) 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 *et al*<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 *et al* 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 three 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 as 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 were 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 HD as compared to the other two groups ( $P = .02$ ) and fewer renal transplants ( $P = .045$ ). 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 PD therapy and such patients

can be started on PD, provided that 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 multicenter 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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## REFERENCES

1. Jain AK, Blake P, Cordy P, Garg AX. Global trends in rates of peritoneal dialysis. *J Am Soc Nephrol* 2012; 23(3):533-544.
2. Mujais S, Story K. Peritoneal dialysis in the US: evaluation of outcomes in contemporary cohorts. *Kidney Int* 2006; 70:S21-S26.
3. Sanabria M, Munoz J, Trillos C, Hernandez G, Latorre C, Diaz CS, *et al*. Dialysis outcomes in Colombia (DOC) study: a comparison of patient survival on peritoneal dialysis vs hemodialysis in Colombia. *Kidney Int Suppl* 2008; (108):S165-S172.
4. Mehrotra R, Chiu YW, Kalantar-Zadeh K, Bargman J, Vonesh E. Similar outcomes with hemodialysis and peritoneal dialysis in patients with end-stage renal disease. *Arch Intern Med* 2011; 171(2):110-118.
5. World Health Organization. Global database on Body Mass Index: BMI Classification. 2006.
6. Masters RK, Reither EN, Powers DA, Yang YC, Burger AE, Link BG. The impact of obesity on US mortality levels: the importance of age and cohort factors in population estimates. *Am J Public Health* 2013; 103(10):1895-1901.
7. Dixon JB. The effect of obesity on health outcomes. *Molecular and Cellular Endocrinology* 2010; 316(2):104-108.

8. Mathew AV, Okada S, Sharma K. Obesity related kidney disease. *Curr Diabetes Rev* 2011; 7(1):41-49.
9. Wickman C, Kramer H. Obesity and kidney disease: potential mechanisms. *Semin Nephrol* 2013; 33(1):14-22.
10. Kalantar-Zadeh K, Abbott KC, Salahudeen AK, Kilpatrick RD, Horwich TB. Survival advantages of obesity in dialysis patients. *Am J Clin Nutr* 2005; 81(3):543-554.
11. Gorsane I, Mahfoudhi M, El Euch M, Younsi F, Abdallah TB. Obesity in hemodialysis patients. *Int J Clin Med* 2015; 6(9):667-671.
12. Huang CX, Tighiouart H, Beddhu S, Cheung AK, Dwyer JT, Eknoyan G, *et al.* Both low muscle mass and low fat are associated with higher all-cause mortality in hemodialysis patients. *Kidney Int* 2010; 77(7):624-629.
13. Park SH, Lindholm B. Definition of metabolic syndrome in peritoneal dialysis. *Perit Dial Int* 2009; 29 Suppl 2:S137-S144.
14. de Mutsert R, Grootendorst DC, Boeschoten EW, Dekker FW, Krediet RT. Is obesity associated with a survival advantage in patients starting peritoneal dialysis? *Peritoneal Dialysis-From Basic Concepts to Clinical Excellence. Contrib Nephrol. Basel, Karger, 2009, vol 163, pp 124-131.*
15. Prasad N, Sinha A, Gupta A, Sharma RK, Bhadauria D, Chndra A, *et al.* Effect of body mass index on outcomes of peritoneal dialysis patients in India. *Perit Dial Int* 2014; 34(4):399-408.
16. McDonald SP, Collins JF, Johnson DW. Obesity is associated with worse peritoneal dialysis outcomes in the Australia and New Zealand patient populations. *J Am Soc Nephrol* 2003; 14(11):2894-2901.
17. Al-Sayyari AA, Shaheen FA. End stage chronic kidney disease in Saudi Arabia. A rapidly changing scene. *Saudi Med J* 2011; 32(4):339-346.
18. Alwakeel JS, Isnani AC, Alsuwaida A, AlHarbi A, Shaikh SA, AlMohaya S, *et al.* Factors affecting the progression of diabetic nephropathy and its complications: a single-center experience in Saudi Arabia. *Ann Saudi Med* 2011; 31(3):236-242.
19. Najafi I. Peritoneal dialysis in Iran and the Middle East. *Perit Dial Int* 2009; 29 Suppl 2:S217-S221.
20. Alwakeel JS, Alsuwaida A, Askar A, Memon N, Usama S, Alghonaim M, *et al.* Outcome and complications in peritoneal dialysis patients: A five-year single center experience. *Saudi J Kidney Dis Transpl* 2011; 22(2):245-251.
21. SCOT annual data report 2015.