Challenges Associated with Managing End-Stage Renal Disease in Extremely Morbid Obese Patients: Case Series and Literature Review

Faruk Turgut^a Emaad M. Abdel-Rahman^b

^aDivision of Nephrology, Department of Internal Medicine, Mustafa Kemal University, School of Medicine, Hatay, Turkey; ^bDivision of Nephrology, Center for Immunity, Inflammation, and Regenerative Medicine, University of Virginia Health System, Charlottesville, VA, USA

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Abstract

Obesity has grown into an epidemic across the globe. Mirroring this growth in the number of obese individuals in the general population, the prevalence of obesity and extremely morbid obesity (body mass index >50 kg/m²) is similarly rising in patients with end-stage renal disease (ESRD). Obesity, and more so, extremely morbid obesity, creates additional challenges for clinicians aiming at providing the best treatment options to patients with ESRD. Although literature is available regarding renal replacement therapy (RRT) for obese patients, literature about challenges facing clinicians managing ESRD in the extremely obese patients is lacking. Furthermore, the optimal strategies and goals for managing these patients with ESRD are not well defined. To our knowledge, no study has been done evaluating RRT options available to extremely morbid obese patients and the challenges associated with these options. Here, we report a case series and discuss the potential challenges faced by extremely obese patients with ESRD requiring RRT.

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Introduction

Obesity is an increasingly common health problem in most developed countries, particularly in the United States [1]. Obesity has grown to be an epidemic problem that continues to be on the rise, with the heaviest body mass index (BMI) groups increasing at the fastest rates [2]. Assessment of self-reported prevalence of obesity showed that the percentage of the population with a BMI over 50 kg/m² (extremely morbid obesity) has increased more than tenfold since 1986 [2].

A major concern for physicians who care for obese patients is the high risk of accompanying comorbid disorders. Morbid obese patients have a higher comorbidity burden and a shorter life expectancy compared to those of the general population [3]. Obesity has been shown to be associated with several risk factors; it influences the development and severity of comorbidities such as hypertension and diabetes. These comorbidities in turn may increase the risk of cardiovascular disease as well as chronic kidney disease (CKD).

Obesity may also have a direct impact on the development of CKD as well as faster progression of CKD to end-stage renal disease (ESRD) [4]. Correlating with the obesity epidemic, the prevalence of both obesity and morbid obesity has been increasing in patients with ESRD [4].

Extremely morbid obesity entails far more serious health consequences than moderate obesity; it can interfere with basic physical functions such as breathing or walking and creates additional challenges for clinicians aiming at providing the best therapeutic plan.

In spite of the fact that obesity is associated with hypertension, hyperlipidemia cardiovascular diseases [5], and higher risk of incident CKD [6], higher BMI or gaining solid weight has been shown to be protective and associated with better survival. This led to the coining of the term “Obesity Paradox” [7].

This concept has been well established in patients with CKD [8], ESRD on hemodialysis (HD) [9], and peritoneal dialysis [10] with studies suggesting that once CKD develops, overweight and obesity are paradoxically associated with longer longevity.

It is of note that BMI in these studies was described as $>30 \text{ kg/m}^2$ and thus it might be difficult to speculate if the extremely obese patients will exhibit similar protection and improvement in survival. Also, regardless of the potential survival advantage that obese patients may or may not acquire, nephrologists will still be facing the challenges of choosing a modality of renal replacement therapy (RRT) in these extremely obese patients.

Extremely morbid obese patients developing ESRD or acute kidney injury (AKI) may present challenges to their nephrology team and other care givers during the course of managing RRT. Friedman et al. [11] highlighted some of the challenges associated with the management of an extremely morbid obese patient with AKI. These challenges included longer hospital stay, difficult volume status assessments, difficulty in performing some investigations as renal ultrasound, achieving adequate drug dosing as well as challenges associated with transportation of these patients to the hospital [11].

While RRT for patients with ESRD has been studied in obese and morbid obese patients, to our knowledge there are no studies in the literature that explored the challenges associated with RRT in the extremely morbid obese patients. Here, we report case series and literature review of patients with extremely morbid obesity requiring RRT.

Case Presentations

We present 3 cases to demonstrate some of the challenges faced by the clinicians to ensure adequate care of extreme obese patients with ESRD. Two of the 3 patients had BMI $>75 \text{ kg/m}^2$. IRB was consulted and waived the requirement for consent as long as patients were followed by the authors and patients remained anonymous.

Case 1

A 51-year-old male with a long history of type 2 diabetes mellitus, hypertension, obstructive sleep apnea, and CKD stage 3 with serum creatinine 1.6 mg/dL checked a year prior to admission. Patient was admitted with severe edema, shortness of breath, nephrotic syndrome, with worsening renal function and serum creatinine was found to be 3.6 mg/dL . Patient was immobile; bringing him to the hospital took several hours and the help of several emergency staff personal. His weight on admission was 277.1 kg (594.2 pounds) with BMI 80.6 kg/m^2 .

Trial to perform a renal biopsy to delineate etiology of the nephrotic syndrome and the worsening of renal function failed twice because of technical difficulties related to his increased BMI. The kidney function continued to worsen, and thus a tunneled catheter was placed and HD was initiated.

Several problems complicated the HD procedure. Initial HD using optiflux 250 dialyzer for 5.5 h was associated with Kt/V of only 0.7. To achieve adequate HD, the dialysis time was increased to 6.0 h, with HD performed 6 days a week. The process of dialysis was also hampered by frequent clotting of the dialysis system. As the patient was nonambulatory making his transportation to and from an outside HD unit 6 days/week very challenging, it was difficult to discharge the patient to resume HD in an outside dialysis facility. Hence, the nephrology team approached the patient and his family with alternative options for RRT. Kidney transplantation was not an option unless the patient lost weight to a BMI $<40 \text{ kg/m}^2$, the highest acceptable BMI at our facility. Similarly, the bariatric surgeon deemed the patient a high surgical risk and not a surgical candidate unless he demonstrates his ability to lose significant weight on his own first.

The nephrology team further discussed the possibilities of home HD (HHD) and PD. A trial of HD using NxStage One S machine for 6 h yielded a Kt/V of 0.39. The frequent clotting of the system and the need to have a caregiver by his side for 6 h, 6–7 times per week led the patient and his family to decline this option.

As achieving dialysis adequacy by PD alone would be very difficult, the nephrology team entertained the idea of combining automated PD with less frequent HHD, to ultimately achieve adequate dialysis. A surgery consult was obtained to assess the feasibility of placing a PD catheter. The surgeon was reluctant to proceed with pre-sternal insertion of the peritoneal dialysis catheter. Furthermore, the patient and his family were very reluctant to proceed with that cumbersome option.

Today, 4 months later, patient remains in the hospital with no disposition plan. He continues to receive HD 6.0 h, 6 days/week.

Case 2

A 55-year-old female weighing 206.4 kg (455 pounds) with BMI 78.1 kg/m^2 , and who had a history of chronic hypercapnic respiratory failure, pulmonary hypertension with severe right-sided heart failure, and CKD stage 3, was admitted to the hospital with severe right-sided heart failure.

The patient developed AKI, and the etiology of AKI was believed to be due to cardio-renal failure syndrome. As the patient became refractory to diuretics, a tunneled internal jugular catheter was placed and HD was initiated.

With no recovery of AKI, the patient was declared ESRD. Discussion with the patient and her family about the best RRT option was held. The nephrology team believed that PD would not offer the patient a reasonable dialysis adequacy, and the patient declined

the frequent HHD option, and thus, the decision was to discharge patient to an outside HD unit to resume HD. Patient remains on HD requiring 5 h of dialysis, using optiflux 250 dialyzer, to achieve and sustain adequate dialysis.

Case 3

A 53-year-old male with CKD stage 5 secondary to focal segmental glomerulosclerosis was seen in the renal clinic. The patient has been slowly progressing to ESRD. Patient weighed 190.9 kg (421 pounds) with BMI 55.5 kg/m². Patient worked full time as a technician in a hospital and wanted to continue to work.

He was interested in receiving kidney transplantation, and hence was evaluated by the transplant team who suggested that he loses weight till he achieves their goal of BMI <40 kg/m². The patient was further declined by the PD program noting that it will be very challenging to achieve target dialysis adequacy with his extremely morbid obesity.

The patient ended up on in-center HD, a choice inconvenient with his work schedule. His dialysis adequacy on 4-h dialysis was below acceptable target. Thus, his dialysis time was increased to 5.5 h, using optiflux 250 dialyzer, in order to achieve dialysis adequacy.

Discussion

Extremely morbid obesity in patients with ESRD presents several challenges to the nephrology teams. To our knowledge, no study has been done evaluating RRT options to extremely morbid obese patients with ESRD. We present 3 cases of patients with ESRD with BMI >50 kg/m², with 2 out of the 3 patients having BMI >75 kg/m².

Similar challenges were previously noted in AKI patients [11]; identifying the cause of ESRD in our first patient was hindered by our inability to perform a renal biopsy as well as limitation of available dialysis modality choices that would have allowed earlier hospital discharge to outside dialysis facilities resulting in one patient remaining in the hospital for more than 4 months with no foreseen discharge plans. As extremely morbid obese patients with ESRD introduce a more individual problem, the several aspects of RRT options deserve further elaboration.

Peritoneal Dialysis in Extremely Morbid Obese Patients

Although PD may have some advantages over HD in selected patients, morbid obese patients with ESRD, generally, are less likely to initiate PD [12]. Conflicting results have been reported while evaluating survival in obese patients on PD [10, 12–17]. McDonald et al. [18], analyzed data of all new adults who underwent PD in Australia or New Zealand between April 1, 1991 and March 31, 2002.

Patients were classified into categories based on their BMI; ≥30, 25.0–29.9, 20–24.9, or <20 kg/m². They demonstrated increased hazard risk (HR) for death and technique failure in the higher BMI group. Furthermore, they showed BMI as a continuous predictor of mortality with a J-shaped relationship between BMI and patient mortality rates [18].

Contrary to their results, Prasad et al. [14] found no changes in HR for mortality between incident patients with BMI >25 kg/m² compared to BMI 18.5–22.9 kg/m² and 23–24.9 kg/m², with the group of patients with BMI <18 kg/m² having an increased HR for mortality. Furthermore, Mehrotra et al. [15] performed a study comparing outcomes of continuous ambulatory versus automated PD. One of the covariables studied was the BMI, which they divided in quintiles. They showed a protective effect of larger BMI. Unfortunately, their result cannot be extended to the extremely morbid obese patients, as the BMI in both groups studied were only 26.9 ± 6.5 and 26.8 ± 6.4 kg/m². Similar results were shown by Snyder et al. [12] with the highest BMI studied 25.4 ± 5.9 kg/m².

Challenges associated with PD in obese patients included the risks of catheter leak, exit site infections and higher rate of peritonitis [19]. Changing exit site or placing the catheter at different sites, such as pre-sternal area, can decrease these risks. Nonetheless, technical failure rates of PD remains higher in obese PD patients due to mechanical and/or infectious complications [18]. This was noted in our case where surgeons were reluctant to proceed with placement of the PD catheter being a risky intervention in patients with very high BMI. Mild obese patients may have inadequate solute clearance or ultrafiltration, but, the larger dwell volumes or cycler-assisted automated overnight exchanges may improve PD outcomes [20].

While data on the feasibility of PD in extremely morbid obese patients are lacking, it is safe to assume that PD is not to be a viable option for these patients, as they probably will fail to achieve targeted dialysis adequacy.

HD in Extremely Morbid Obese Patients

While HD seems to be the most accepted method of dialysis in morbid and extremely morbid obese patients with ESRD, it is still associated with numerous challenges. These challenges start as early as identifying an adequate vascular access.

Clinical practice guidelines recommend arteriovenous (AV) fistula as the preferred vascular access for HD. Because of the increased fat tissue between the surface and the central vasculature, the successful establishment of

vascular access can be technically challenging in extremely morbid obese ESRD patients [21]. The risk of primary and secondary vascular access failure seems to be greater in these individuals [22]. Extremely morbid obese individuals may require additional surgical procedures for cannulation due to the depth of the cannulation sites and these surgical procedures may improve functionality of autogenous vascular access [23]. Placement of an AV graft may be appropriate in selected extremely morbid obese individuals.

Because of some patients denial, or late consideration for dialysis access placement, or failure of AV fistula placement, many obese patients have to be started on HD using a dual lumen catheter. Still, morbid and extremely morbid obesity are widely believed to be associated with difficult catheter placement [24]. Ultrasound guidance for vascular access has been part of the clinical practice for a long time. Ultrasound can be helpful in locating central veins and reducing the complications associated with the procedure in extremely morbid obese individuals. However, the use of bedside ultrasonography may be limited due to the loss of anatomic landmarks from excess adipose tissue in extremely morbid obese patients. Moreover, longer length catheters should be considered for these morbid obese patients. Catheters should be checked to confirm intravascular position after placement. Additionally, catheter position can change with movement, so position should be reconfirmed periodically in these patients.

The issue of assessing and delivering adequate dialysis dose is less clear in extremely morbid obese patients requiring HD. Traditionally, the adequacy of HD is assessed by urea clearance, expressed as Kt/V . Large body size and the associated increase in body water (V) suggest the need for an increase in dialysis time to achieve a higher dialysis dose [25]. Thus, extremely morbid obese individuals are less likely to receive adequate doses of dialysis with average dialysis time, which seems to cause a negative influence on their survival [26]. In order to achieve adequate fluid and metabolic control, the time and/or frequency of dialysis needs to be increased. Our extremely morbid obese patients required longer dialysis times, and one of the patients also required more frequent dialysis to achieve adequate dialysis. This increase in time as well as frequency of dialysis impacts negatively on the quality of lives of these patients.

Another challenge for extremely morbid obese patients with ESRD on HD is transportation and seating for the dialysis session. While obese and morbid obese patient can be transported with minimal problems, and

these patients can sit for the HD session in regular to large chairs, these issues may add another layer of challenges when dealing with the extremely obese patients [27]. As noted in the first case; not only was the patient not able to ambulate on his own, it required multiple personnel to bring him to the hospital initially. Unit infrastructure and dialysis staff should be prepared well in advance when delivering HD to this special population. Outpatient dialysis units may not be a feasible option for morbid obese individuals with their very limited mobility, and relatively smaller chairs.

HHD has shown to be a feasible RRT option for morbid obese patients with ESRD allowing longer and more frequent dialysis, resulting in better hemodynamic stability and improved quality of life [28]. HHD option can be considered and discussed with these extremely morbid obese patients. Unfortunately, to achieve adequate dialysis using HHD in extremely morbid obese patients, longer and more frequent HD sessions up to 7 times/week will be required, which will add a significant burden on the patients' quality of life as well as their care givers who should be available in case of emergency.

Renal Transplantation in Extremely Morbid Obese Patients

Because of increased perioperative risk and poorer transplant outcomes, obese patients who reached ESRD requiring RRT are excluded from renal transplantation until they lose weight in many centers [29]. The survival benefit of renal transplantation over dialysis might be considered for these patients. Although studies performed over the past 2 decades report better clinical outcomes of kidney transplantation for mild obese patients, the survival advantage of transplantation over dialysis is still uncertain in these patients with morbid and extremely morbid obesity [30, 31]. Fortunately, with the noted increase in the prevalence of obesity and extremely morbid obesity, some of the transplantation centers are currently accepting patients with higher BMI as potential candidates for renal transplantation. This has led to a shift in the acceptance rate of obese patients as transplant recipient. While in the early 1990s, less than 20% of renal transplant candidates were classified as having any level of obesity ($BMI \geq 30 \text{ kg/m}^2$), in 2011, 23% of US recipients were classified as obese ($BMI 30\text{--}34.9 \text{ kg/m}^2$), 9.4% were morbidly obese ($BMI 35\text{--}39.9 \text{ kg/m}^2$), and 2.1% were very morbidly obese ($BMI \geq 40 \text{ kg/m}^2$) [32, 33]. Currently, many transplant centers use BMI as a selection criterion with a range of $35\text{--}45 \text{ kg/m}^2$ as the upper limit to initiate evaluation for renal transplantation [34]. A recent meta-

analysis showed that graft and patient survival are worse in renal transplant recipients with a higher BMI [35]. Losing weight prior to renal transplantation has great importance and intentional weight loss can be recommended. Unfortunately, losing weight with conservative management will be inefficient for the vast majority of patients [36]. An effective method to lose weight prior to transplantation is bariatric surgery. Nevertheless, there are many key questions such as surgery techniques, the ideal sequence between the bariatric surgery and the kidney transplantation etc. remain to be unanswered [36]. Extremely morbid obese patients can be referred to tertiary referral centers for bariatric surgery, but success rates with medical weight loss are also very low in morbid obese patients [37].

In conclusion, as shown in our clinical cases, many unique challenges surround the care of extremely morbid obese patients with ESRD. Limitation of RRT options remain a major obstacle in caring for these patients. Even when resources and different RRT modalities are available, managing extremely morbid obese patients with ESRD remains challenging. The optimal management strategy (vascular access, timing, dosing and modality) for

RRT remains uncertain. With the increasing prevalence of extremely morbid obesity, it is clear that we have to rethink the management of these patients with ESRD, especially identifying the best RRT option. While in-center HD seems to be the best option for RRT for these extremely morbid obese patients as noted in our cases, HHD needs to be further studied in these patients. Similarly, advances in renal transplantation surgery may be able to eventually offer this modality to extremely morbid obese patients. No data were available in the literature about novel approaches to deal with extremely morbid obese patients with ESRD. Further clinical trials are essential to establish the ideal RRT option and the best ways to achieve adequate RRT to these patients. Prospective clinical studies of bariatric surgery may help to answer key questions in the management of these patients. Additionally, the accurate prevalence of extremely morbid obese patients with ESRD is lacking and epidemiological studies are also required.

Disclosure Statement

The authors have no conflicts of interest to declare.

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