

## What is the Best Method of Treatment for Comorbid Diabetic with end-Stage Renal Disease? Case Report

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### Abstract

Although hemodialysis (HD) and peritoneal dialysis (PD) together with transplantation are complementary methods for the treatment of patients with end-stage renal disease (ESRD), most patients complete their treatment with dialysis. For a long time there was a dilemma about the most effective dialysis treatment, especially for diabetics. Today, it is known that the two dialysis techniques, HD and PD, are comparable in terms of their effectiveness, but also that PD offers some benefits, especially for patients with residual renal function (RRF), the elderly and people with inadequate blood vessels for HD. Also, there are relative contraindications for PD such as blindness, physical incapacity, changes in the peritoneal membrane. A patients with diabetic nephropathy (as the main cause of ESRD), impaired

vision and amputated lower legs is presented. This case report indicates that knowledge of the dialysis technique, cooperation with the patient and individualization of treatment is a prerequisite for the long-term success of renal replacement therapy (RRT), as well as the possibility of combining dialysis therapy when necessary in fragile populations suffering from diabetes.

**Keywords:** Diabetes mellitus; End-stage renal disease; Peritoneal dialysis; Hemodialysis

### Introduction

During the last decades, End-Stage Renal Disease (ESRD) has shown a rapid growth trend worldwide and has become a public health issue of global concern [1]. Kidney Transplantation (KT) proved to be the best modality of treatment for patients with

ESRD. Still, more than 75% of patients do need dialysis for several reasons: unsuitability for KT, shortage of a kidney donor, and failed KT. For those patients, dialytic therapy is a successful alternative. The choice between PD and HD has remained a subject of debate. Despite significant advantages of PD over HD, PD remains an underutilised modality of treatment for kidney failure all over the world. Apart from Hong Kong that has the highest utilisation of PD (over 75% of the patients are on PD), in majority of European countries and in the United States of America, the PD utilisation rate is under 15% [2]. ESRD are a heterogeneous population that differs from each other in terms of age, gender, etiological diagnosis and comorbidity. Among all ESRD patients, diabetics are the most vulnerable, in part due to their high burden of cardiovascular diseases. It is difficult to decide which is the most favorable modality for treating kidney failure in these comorbid patients. The data in the literature are inconsistent. In the U.S.A., diabetic ESRD patients over 45 years of age have better survival with HD than PD, whereas in Canada and Denmark, there is no survival difference between PD and HD in this group [3]. Using a nationwide, multicenter, prospective cohort in South Korea, authors studied hazard rate of mortality in 2207 patients with ESRD by comparing two modalities, PD and HD. The PD group had a significantly higher hazard rate of mortality than the HD group among patients under 65 years after 4- and 5- year follow-up. A similar pattern was observed among those with diabetes mellitus [4]. Dutch authors developed Cox regression models with 16,643 patients from the Dutch End-Stage Renal Disease Registry (RENINE) adjusting for age, gender, primary renal disease, center of dialysis, year of start of renal replacement therapy. They concluded

that the survival advantage for Dutch PD compared with HD patients decreases over time, with age and in the presence of diabetes as primary disease [5]. Considering the increasing number of people with diabetes and the delicacy of their treatment, we present a patient whose primary renal disease is diabetic nephropathy and who also has other complications of diabetes which makes him less suitable for any method of Renal Replacement Therapy (RRT).

### **Case Presentation**

Patient Dj.G, 1968, DM primary disease since childhood, blind due to diabetic retinopathy and cataracts, bilateral leg amputation, coronary artery disease (hypo- to akinesia of the distal third of the septum). In August 2016, he was treated by HD via Central Venous Catheter (CVK) due to acute deterioration of renal function. In September 2016, he developed ESRD and decision was made for a chronic PD program (continuous ambulatory peritoneal dialysis-CAPD modality). The initial CAPD prescription included three isotonic and one hypertonic 2 liter exchange. Although it was difficult for the patient to initially decide on PD due to immobility and blindness, the decision was made by his desire and the willingness of the assistant (sister) to help him and perform the so-called assisted PD. After the cataract surgery, vision was partially restored in both eyes, and after being educated, he performed the dialysis exchanges by himself. At that time, both lower leg prostheses were enabled and he was rehabilitated to walk independently, even doing all the work related to landscaping his garden. The patient was satisfied with his quality of life as well as the method of treatment. After 6 months of CAPD treatment, in March 2017, he was transferred to

Automatic Peritoneal Dialysis (APD) due to the personal wish (he wanted to have free time during the day for his activities), but also due to the transport characteristics of the peritoneal membrane (high transporter-HA, prescription: 6x1600 ml 1.36%+2.27% glucose concentration, during 10h nightly + icodextrin 2000 ml daily exchange).

In December 2020, the patient was infected with the Corona virus, had a severe clinical presentation, with bilateral Covid pneumonia (Total Severity Score 20/25). He was hospitalized for two months (from 02.12.2020 to 21.01.2021). As a complication, he had pneumomediastinum gravis et colli, emphysema subcutaneum thoracis l.dex. He was treated with intensive antibiotic therapy, corticosteroids, low molecular weight heparin, proton pump inhibitors, vitamins, Favipiravir and was on non-invasive ventilation. Due to severe general condition and high catabolism, he was treated with transit HD via a vascular catheter. All the time, the PD catheter was maintained by short-term lavages with isotonic solution, for a total duration of up to 8 hours/day. Immediately after recovering from Covid, he insisted on a short re-education and was again returned to APD. From June 2023, the patient was transferred from APD to CAPD (3 daily isotonic changes and a long night change with icodextrin-Extraneal) due to a small ultra filtration.

**Table 1** shows the relevant laboratory values during the performance of CAPD, APD and HD.

Throughout PD treatment, diuresis was preserved, the patient was clinically stable with controlled uremic parameters in accordance with the underlying disease. Since September 2023, he had two episodes of peritonitis along with tunnel infection, and the peritoneal catheter was taken out. Transfer to HD was difficult due to the characteristics of blood vessels, but brachial Arteriovenous Graft (AVG) was successfully implanted and the patient was transferred to HD in October 2023. Laboratory findings after transfer to HD indicated higher urea and creatinine values, most likely as a result of anuria that occurred in the early course of HD treatment (**Table 1**). He lived on HD for another 14 months and died due to cardiac failure in November 2024. In conclusion, a patient whose underlying disease was DM and who had serious comorbid conditions that made him unsuitable for long-term and successful dialysis treatment is presented. Nevertheless, with good motivation and adequate training and monitoring of the patient, successful treatment of kidney failure was possible by combining RRT modalities over a period of 8 years, with good correction of uremic parameters. By combining methods and with joint decisions between the nephrologists and the patient, successful treatment of patients at high risk for RRT is possible.

**Table 1:** Laboratory values during the treatment with different modalities. Analyses were done during the stable periods/adaptation to a new modality.

Feb.2017 CAPD		March2018 APD	May2019 APD	May2020 APD	May2021 APD	Feb2024 HD
Hb, g/dL	114	117	118	119	122	108
Urea, mmol/l	15.5	17.6	13	15.3	18.7	32.4
Cr. umol/L	471	472	416	538	668	917
TP, g/L	55	58	62	68	68	65
Albumin, g/L	26	31	35	35	39	35
Glukoza, mmol/l	10.1	14.9	4.2	9.57	6.2	10.1
sFe, umol/L	16	4.8	16.7	15.8	24	8.4
Feritin ug/L	242	190	137	nd	90.4	90
Potassium, mmol/L	3.5	4.4	3.6	4.6	3.5	5.1
Na, mmol/L	139	138	139	136	137	133
Phosphorus, mmol/L	1.08	1.1	1.18	1.38	1.24	1.09
Ca, mmol/L	2.09	2.09	2.13	2.33	2.33	2.28
HCO <sub>3</sub> , mmol/L	20	17	22	23	20	1.29
iPTH, pg/mL	241	456	542	229	nd	176
Diuresis, ml/24h	1500	1200	1500	1200	1200	100
UF, ml/day	700	900	600	500	450	On HD
BW, kg	74	72.5	72	71	67.2	66
BP, mmHg	150/90	170/90	140/80	130/80	110/60	140/80

## Discussion

We present a patient who, despite the underlying disease (long-lasting diabetes) and comorbidities, was successfully treated and rehabilitated thanks to adequate and timely use of suitable dialysis technique. The optimal method for starting dialysis treatment is not easy to define. Although there are no absolute contraindications for PD, situation where PD is not preferred but possible with some special considerations include obesity, multiple hernias, severe backache, multiple abdominal surgeries,

impaired manual dexterity, blindness, lack of social and family support and depression. Relative contraindications include patients with severe malnutrition, multiple abdominal adhesions, ostomies, heavy proteinuria above 10 g/day, advanced COPD, ascites, upper limb amputation with no help at home and those who are homeless [6,7]. In a large Dutch study, only 17% of ESRD patients had a medical contraindication to PD; the most common was previous major abdominal surgery. Many patients in this study had a social contraindication to

PD, the most common was an inability to perform PD exchanges by themselves. In a recent U.S. study, only 23% of ESRD patients had a medical contraindication to PD, this was consistent with the 17% to 21% seen in studies from other countries [8]. In the meantime, some of the mentioned contraindications have been overcome, especially by the expansion of home treatment methods and the introduction of assisted PD with the help of the family member or visiting nurse [9].

Our patient was a poor candidate for both dialysis techniques: severe peripheral vascular disease precluded the formation of a successful arteriovenous fistula, and blindness and immobility precluded independent PD. After we gave him detailed information, we respected his wish to choose home treatment (assisted CAPD). By partially correcting his vision and placing both lower leg prostheses, the patient was able to independently perform PD and return to his hobby (working in the garden). This was especially favored by APD, which allowed him free time for daily activities. In the further course of the disease, it was necessary to adapt the treatment according to the control of uremic parameters and volemia, so the patient was transferred to CAPD. The concept of 'indications and contraindications' for PD and HD seems to have been overcome nowadays. In 2018 KDIGO held a controversies conference on dialysis initiation and modality choice, access, and prescription. The authors identified the need to move away from a "one-size-fits-all" approach and provide more individualized or personalized care. Achieving patient-centered goals is now recognized as an important component of dialysis care [10]. Indeed, for most people, both the main dialysis modalities, HD and PD are feasible and a long life lived on kidney replacement therapy may well be best

achieved by integrating more than one modality over time [11]. Therefore, the choice of treatment modality should be less affected by absolute or relative medical indications than is perhaps perceived by many clinicians. This should be focus on the individuals' lived life and how this is accommodated by an appropriate and well supported modality choice [12]. In addition to the initial method of choice, it is more difficult to determine which method provides longer survival. By analyzing the Cochrane Kidney and Transplant Register of Studies from 2000 to June 2024, Ethier et al. identified a total of 84 studies. They searched for all trials that compared PD vs. HD for people with kidney failure starting dialysis. The small number of randomized studies (only two) was the major limitation of this review and it was not possible to draw a conclusion with certainty [13]. The only randomised study (NECOSAD), comparing HD to PD as a first treatment showed no differences in 5 year mortality, but the number of patients randomised was insufficient to generalize this observation. PD had a significant technique failure rate, so patients need to be able to switch treatment modality (to either temporary or permanent HD) in a timely manner [14].

Finally, transitory changes in RRT modality should be considered as was the case during our patient's severe Covid infection. Due to immobility and high catabolism, PD would be insufficient to correct his uremic/volemia status along with the new condition, so the patient was transferred to HD for about 2 months. At the same time, the PD catheter was properly maintained. After the period of recovery, the patient successfully continued his CAPD and APD treatment until the infection (peritonitis and tunnel infection), which is why he was transferred to HD, where he lived for additional 14 months. This case

report indicates that knowledge of the dialysis technique, cooperation with the patient and individualization of treatment is a prerequisite for the long-term success of RRT, as well as the possibility of combining dialysis therapy when necessary in fragile populations suffering from diabetes.

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