A Patient with Type 1 Diabetes Continuing on Peritoneal Dialysis After More Than 15 Years

Editor:

We present the clinical case of a 72-year-old woman who was diagnosed with type 1 diabetes when she was 30 [characterized by presentation before the age of 35 years in the absence of obesity, with sudden onset and a need for insulin treatment at onset (1)]. Her disease was associated with diabetic retinopathy, treated by laser, and microangiopathic complications, with amputation of toes in the right foot. She developed chronic kidney disease, probably in relation to the diabetes and the associated vascular disease, with very poor glycemic control using subcutaneous insulin in the pre-dialysis period.

This woman required renal replacement therapy because clinical symptoms of uremia and serum urea 6.32 mg/dL and creatinine 275 mg/dL. She chose

continuous ambulatory peritoneal dialysis (CAPD), beginning treatment 15 years before the time of the present report. Her treatment began with an incremental CAPD regime of 2 – 3 daily exchanges and a volume of 1.5 – 2 L per exchange. In the beginning, she had a glomerular filtration rate of 7.3 mL/min, and she maintained residual renal function (RRF) of about 6.46 – 14.6 mL/min over the years. Her mean of residual renal function was 10.8 mL/min (Table 1), and her weekly Kt/V never fell below 2.4, nor her weekly creatinine clearance below 120 L/1.73 m². During the course of her treatment, her dialysate-to-plasma creatinine was maintained at about 0.59 – 0.72, with fairly constant peritoneal protein losses (Table 1). Table 1 shows the remaining adequacy parameters for this patient.

During her follow-up, the patient had 4 episodes of peritonitis. In most of those infections, good results were obtained with intraperitoneal antibiotics. In 1 episode, resolution of effluent turbidity required removal and replacement of the peritoneal catheter, a unique occurrence during her 15 years on therapy. Her 4 hospitalizations during those 15 years included 2 for peritonitis, 1 for replacement of the peritoneal catheter, and 1 for an umbilical hernia surgery. Her retinopathy stabilized at the same visual acuity during follow-up.

From the onset of CAPD, the excellent blood pressure control that this woman achieved eliminated her need

TABLE 1
Parameters of Adequacy in a Diabetic Peritoneal Dialysis Patient During 15 Years

Year	GFR (mL/min)	Weekly Kt/V	CCr (mL/min per 1.73 m ² BSA)	Daily nPCR (g/kg)	D/P Cr	PPL (g/L)	PPL (g/24 h)
1997	7.3	3.4	140	1.8	0.71 (HA)	0.79	5.37
1998	8.2	3.3	149	1.8	0.66 (HA)	0.4	7.2
1999	6.46	2.9	120	1.9	0.66 (HA)	0.5	3.2
2000	9.1	3.6	128	1.8	0.61 (LA)	—	—
2001	9.5	3.6	156	1.7	0.59 (LA)	—	—
2002	8.9	4.2	157	1.5	0.67 (HA)	0.62	3.86
2003	8.9	2.8	149	1.32	0.67 (HA)	—	—
2004	9.0	—	—	—	—	0.84	5.12
2005	9.5	—	—	—	—	—	—
2006	11.2	—	—	—	—	—	—
2007	14.6	5.6	208	2.2	0.63 (LA)	0.74	4.2
2008	8.6	2.4	128	1	0.72 (HA)	0.95	3.4
2009	10.8	3.2	149	1.18	0.68 (HA)	0.84	2.85
2010	10	—	—	—	—	0.76	2.85
2011	10.2	2.8	148	1.2	0.55 (LA)	—	—

GFR = glomerular filtration rate; CCr = creatinine clearance; BSA = body surface area; nPCR = normalized protein catabolic rate; D/P Cr = dialysate-to-plasma ratio of creatinine; PPL = peritoneal protein losses; HA = high average transport; LA = low average transport.

for antihypertensive drugs. Starting in 2000, she was prescribed icodextrin solution for use in the overnight exchange and lactate–bicarbonate 1.36% glucose solution for the daytime exchanges. She has never needed a higher glucose concentration. Since the start of CAPD, her diabetes has been controlled with intraperitoneal insulin. Before then, she had needed high doses of subcutaneous insulin (about 18 – 20 IU daily); however, during her time on CAPD, her IP dose of regular insulin has been 3 – 6 IU daily, with her HbA1c holding at less than 7.5% throughout almost her entire follow-up. Her serum intact parathyroid hormone has always been below 90 pg/mL, with normal serum calcium and phosphate levels. Her serum albumin has been approximately 3.3 g/dL, and her hemoglobin, approximately 12.2 g/L during the last 15 years.

DISCUSSION

The case reported here is exceptional and relevant in the peritoneal dialysis (PD) field. Recent studies show that diabetic patients on PD experience a higher rate of cardiovascular events and hospitalizations, and worse blood pressure control. They also experience lesser patient and technique survival (2–4).

Our patient's case is also special for the technique duration. Several years ago, the usefulness of the peritoneum as a dialysis membrane was considered time-limited for any patient, and even more so for a diabetic patient. In 1984, in an article in the *Peritoneal Dialysis Bulletin* (now *Peritoneal Dialysis International*), Dr. Dimitrios Oreopoulos asked himself whether a natural membrane such as the peritoneal membrane could bear the damage produced during PD. He presented a patient with more than 10 years on CAPD, suggesting the possibility of a normal life for many PD patients around the world (5).

Our patient probably represents a unique case: a diabetic patient with a long duration on PD. In this particular case, the good results might be related to the early CAPD start, because compared with a late start, early onset of dialysis can provide better survival on PD, at least for diabetic patients (6). In addition, this patient's PD initiation delayed her loss of RRF compared with her pre-dialysis evolution (7). This good preservation of RRF might be a result of the use of icodextrin, a low peritonitis rate, very good blood pressure control, and excellent blood sugar control—all of which are known to contribute to a reduction in RRF decline. The maintenance of RRF, with high daily diuresis, allowed us to prescribe fewer daily exchanges and low-glucose PD fluid, factors that contribute to preservation of the peritoneal membrane. Today, the patient continues on

a schedule of 2 – 3 CAPD exchanges daily, as she has throughout her time on CAPD.

The low glucose load and (eventually) the use of icodextrin probably contributed to the optimal glycemic control in this diabetic patient (8). We were therefore able to use a minimal dose of intraperitoneal insulin in an individual who was having difficulty achieving glycemic control with subcutaneous insulin before PD start.

Like elderly patients, diabetic patients on PD have a higher prevalence of adynamic bone disease than is seen in other chronic kidney disease patients (9), a situation that is associated with low levels of parathyroid hormone. The parathyroid hormone level in our patient remained low at all times, but was associated with no clinical consequences during her long follow-up. In 2002, Dimkovic *et al.* described the minimal clinical impact of low levels of parathyroid hormone in patients maintained on PD (10).

Before our patient entered the PD program, she presented microangiopathic complications; however, throughout her time on PD, she has manifested no further micro- or macro-angiopathic complications of diabetes, and her preexisting conditions have stabilized. This favorable evolution and low morbidity could be a result of effective dialysis, with a Kt/V above 2.4 (she has a low body surface area) and maintenance of RRF, excellent glycemic control, and effective protection of the peritoneal membrane.

This patient continues on CAPD without clinical symptoms.

CONCLUSIONS

We presented the case of a diabetic patient who can be considered exceptional because a long duration on PD, continuous dialysis efficacy, maintenance of RRF, very low morbidity, and excellent blood sugar control with intraperitoneal insulin.

DISCLOSURES

The authors have no financial conflicts of interest to declare.

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doi:10.3747/pdi.2011.00331