CASE REPORT

Peritoneal dialysis as a therapeutic approach in congestive heart failure resistant to pharmacological treatment

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KEY WORDS

congestive heart failure, peritoneal dialysis, peritoneal ultrafiltration

ABSTRACT

This report describes the use of continuous peritoneal dialysis (PD) as an alternative to hemodialysis (HD) in a patient with type 2 cardiorenal syndrome in the course of congestive heart failure resistant to standard pharmacological treatment. A 39-year-old man presented with a 24-year history of progressive heart failure. Ineligibility for heart transplant and previous inefficient treatment with different modifications of HD reduced his treatment options to PD. After 7 months of continuous PD (1 overnight exchange with icodextrin and 2 daily standard continuous ambulatory PD exchanges) his overall condition significantly improved compared with his status while on HD. An increase from NYHA class IV to class II, increase in left ventricular ejection fraction from 50% to 55%, decrease in right ventricular systolic pressure from 73 to 53 mmHg, and improvement in the quality of life enabled him to resume his daily activities.

INTRODUCTION As the treatment of heart disease becomes increasingly advanced and life expectancy of patients is getting longer, patients with end-stage heart failure refractory to standard pharmacotherapy are identified more often. Such patients are usually treated using various modifications of standard hemodialysis (HD) as supportive therapy.[1] This refers especially to patients with type 2 cardiorenal syndrome (CRS) who have chronic cardiac abnormalities and progressive chronic kidney disease (CKD) characterized by a decrease in glomerular filtration rate (GFR) below 60 ml/min/1.73 m^2.[2] A comprehensive review of the pathogenesis of type 2 CRS in the course of congestive heart failure (CHF) as well as our own clinical experience with continuous ambulatory peritoneal dialysis (CAPD) as an alternative to HD have been presented in the current issue of the *Polish Archives of Internal Medicine*.[3] Here, we describe the case of a patient with CHF who had met the criteria for type 2 CRS and address several clinical problems of renal replacement therapy encountered in such patients.

CASE REPORT A 39-year-old man with CHF was referred to our department in December 2008. He was previously treated at the Institute of Cardiology in Warsaw and was diagnosed with advanced heart failure (mainly right ventricular) NYHA class IV. His medical history covered the period since 1985, when he was diagnosed with mitral insufficiency in the course of endocardial fibrosis, and mitral valve replacement was performed. During the next 24 years, he developed secondary pulmonary hypertension, established atrial fibrillation, paravalvular leak around the grafted mitral valve, and significant tricuspid valve insufficiency.

The disease developed in 1985, when at the age of 15, completely healthy and actively involved in sports, the patient started to complain of decreased exercise tolerance, increased abdominal circumference, and lower limb edema. Severe (+++) mitral valve insufficiency with signs of

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Received: October 17, 2009.
Revision accepted: November 20, 2009.
Conflict of interest: none declared.
Pol Arch Med Wewn. 2009; 119 (12): 834-837

heart failure, NYHA class II, was diagnosed. Despite mitral valve replacement, a progression of heart failure had been observed over the following years. Due to an advanced stage of the disease (NYHA class IV) and the signs of irreversible secondary pulmonary hypertension, the patient was considered ineligible for heart transplant. His medical records indicated that from 1985 until 2008 he had been hospitalized 19 times due to CHF exacerbation, with the total hospitalization time of 296 days.

Due to a gradually decreasing renal function (GFR as per the Modification of Diet in Renal Disease [MDRD] formula – 50 ml/min/1.73 m^2) in the course of CHF exacerbation, the patient has required, since 2008, periodic hospitalizations in the Nephrology and Dialysis Unit of another hospital, where either HD or sequential ultrafiltration procedures has been performed on demand, depending on the clinical signs of hyperazotemia and/or overhydration.

In early December 2008, due to another exacerbation of CHF and symptoms of HD intolerance, the patient was referred to our department to consider his eligilibility for peritoneal dialysis (PD) as an alternative procedure providing daily continuous ultrafiltration.

On admission, the patient was in a life--threatening condition, immobilized, with physical and radiological signs of pulmonary edema, orthopnea, ascites, and generalized body edemas. Physical examination revealed the following abnormalities: cardiac arrhythmia, signs of pulmonary congestion, ascites, marked hepatomegaly, and massive lower limb edema. The overhydration compared to his proper body weight was estimated at about 25 kg. Urine volume was below 500 ml/day. Laboratory tests showed normocytic and normochromic anemia (hemoglobin – 10.9 g/dl, mean corpuscular volume – 86 μm^3, mean cell hemoglobin concentration – 48 g/dl). Urinalysis showed specific weight of 1010. Abnormalities typical of CKD included serum creatinine at 1.7 mg/dl and blood urea nitrogen at 40 mg/dl. The GFR estimated (eGFR) using the MDRD formula was approximately 47 ml/min/1.73 m^2 (stage 3 CKD). Electrocardiography revealed atrial fibrillation with ventricular rate of 100/min. Chest X-ray showed a marked right ventricular enlargement in the transverse dimension, lower intrapulmonary densities, and signs of massive hemostasis in pulmonary circulation. On echocardiography the following abnormalities were found: atrial enlargement, right ventricular enlargement with impaired contractibility, decreased left ventricle diameter with impaired contractibility. Left ventricular ejection fraction (LVEF) was estimated at approximately 40%. The initial treatment involved reduction in fluid intake, oral β blocker (metoprolol), intravenous aldosterone receptor antagonist (spironolactone), and intravenous loop diuretic (furosemide) at gradually increased doses to 240 mg daily. Because there was no improvement after a few days of this regimen, we decided on peritoneal ultrafiltration. At this time, however, the patient's state was extremely grave for severe dyspnea at rest with obligatory sitting position. Therefore, the surgical procedure of implanting the Tenckhoff catheter into the peritoneal cavity posed a significant risk. Instead, access to the right external jugular vein was obtained by a central venous catheter followed by HD and ultrafiltration with artificial kidney on alternate days, and subsequently 3 times per week on an outpatient basis. Slight improvement was observed (NYHA IV to NYHA III and an increase in ejection fraction from 40% to 50%). However, satisfactory dehydration and clinically assessed target weight (67 kg) were unfeasible at this point. Moreover, as the dialysis program progressed, the patient endured several episodes of intradialysis hypotension, which aggravated arrhythmia. Unfortunately, the patient lost his motivation to continue the HD treatment, exhausted by the tiresome commuting to the hospital during the week and inability to lead a normal life. He did not perceive the HD as a method able to restore him to good health. In our assessment, it was extremely difficult to maintain relative euvolemia in this patient because of the "narrow window" between hypervolemia between the dialysis procedures (weight gain of 4–5 kg within 2–3 days) and hypovolemia during the procedures. Therefore, once a relative hemodynamic improvement was achieved, we pursued the option of initiating PD, since the implanting of the Tenckhoff catheter as well as sedation and local anesthesia were considered as a safe therapeutic strategy.

In early March 2009, the surgical implantation of Tenckhoff catheter was uneventful. During the following 2 weeks, the patient and his wife underwent training in CAPD while the HD program was continued. Two weeks after the implantation of catheter, the CAPD program was initiated. Given glomerular filtration impairement corresponding to stage 3 of CKD (eGFR as per MDRD 36 ml/min/1.73 m^2), the following CAPD exchange regimen was employed: 2 day-time exchanges with dialysis solution containing 1.36% glucose and 1 overnight exchange with solution containing glucose polymer, icodextrin, with the total 6.0 l of daily volume. The daily ultrafiltration and diuresis averaged 1970 ±500 ml and 400 ml a day, respectively. During the following months of CAPD, the patient experienced one adverse event, i.e.an episode of hypovolemia, accompanied by uncontrolled weight loss (to 62 kg, while the target weight for this patient in the course of PD was assessed as 64/65 kg). It resulted from the patient's miscalculation of a relative dialysis solution composition.

At the time of the publication, 7 months after initiating the CAPD, the patient was free of complications, particularly dialysis-associated peritonitis. His overall health, as assessed by the NYHA classification, improved from NYHA III while on HD to NYHA I/II. Several cardiac function parameters improved significantly; LVEF increased to

55%, while right ventricular systolic pressure decreased from 75 to 53 mmHg (norm <25 mmHg). Hemoglobin concentration stabilized at 9.1 g/dl, eGFR 20 ml/min/1.73 m^2, and residual urine volume at 100 ml/24 h. The patient remains in good physical and mental condition, self-declares improved exercise capacity, and a much better tolerance of PD compared with HD. The patient admits that PD allows him to live a relatively normal life, remain active at work, and to spend more time at home with his family instead of travelling to the dialysis center several times a week.

DISCUSSION PD, as an approach to provide efficient ultrafiltration, should be considered as an alternative to HD in patients with hemodynamic instability in the course of CHF. In the present case, HD did not prove to be efficient enough because it was associated with development of intolerance and intradialysis hypotension episodes. PD had much more beneficial effects. However, it has to be emphasized that introduction of a PD program into routine clinical practice in patients with CHF poses several challenges. Firstly, despite access to the data on the beneficial cardiovascular effects of PD, the patient and his or her family may not consent to it, because they may not trust their own ability to manage daily dialysis at home. A patient that is well prepared for a home dialysis program and cooperates with a therapeutic team has a good prognosis in terms of a longer life expectancy. Secondly, optimal timing of the catheter implantation and related anesthesia has to be chosen, so that it does not aggravate the circulatory instability. Pretreatment and preparation of patients for PD usually involves HD. Nevertheless, it may be cumbersome because a variety of individual modifications not included in standard HD protocols are required in such cases. From a practical point of view, our ability to assess and obtain target weight in the patient was compromised by the lack of proper equipment to measure bioimpedance.

Our promising results presented in this paper, together with other reports describing beneficial cardiovascular effects of PD in CHF patients,[4-10] suggest that soon it will be feasible to provide patients with CHF ineligible for heart transplant with a PD strategy of optimal efficiency.

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Dializa otrzewnowa jako metoda leczenia zastoinowej niewydolności serca opornej na leczenie farmakologiczne

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dializa otrzewnowa, ultrafiltracja otrzewnowa, zastoinowa niewydolność serca

STRESZCZENIE

Artykuł opisuje zastosowanie ciągłej dializy otrzewnowej jako alternatywy do hemodializy u pacjenta z typem 2 zespołu sercowo-nerkowego w przebiegu zastoinowej niewydolności serca opornej na standardowe leczenie farmakologiczne. Był to 39-letni mężczyzna z 24-letnią historią postępującej niewydolności serca. Niemożność wykonania u tego pacjenta przeszczepu serca oraz poprzednie nieefektywne leczenie hemodializą z różnymi modyfikacjami, zmniejszyło jego opcje terapeutyczne do ultrafiltracji otrzewnowej. Po 7 miesiącach ciągłej dializy otrzewnowej (1 wymiana w ciągu nocy z ikodekstryną oraz 2 standardowe dzienne wymiany podczas ciągłej ambulatoryjnej ultrafiltracji otrzewnowej) jego ogólny stan poprawił się znacznie w porównaniu z okresem leczenia hemodializami. Przejście z klasy NYHA z IV na II, zwiększenie lewokomorowej frakcji wyrzutowej z 50% do 55%, spadek prawokomorowego ciśnienia skurczowego z 73 do 53 mm Hg oraz poprawa jakości życia umożliwiła pacjentowi ponowne wykonywanie codziennych czynności życiowych.

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Praca wpłynęła: 17.10.2009.
Przyjęta do druku: 20.11.2009.
Nie zgłoszono sprzeczności interesów.
Pol Arch Med Wewn. 2009;
119 (12): 834-837