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OPIS PRZYPADKU / *CASE REPORT*

Diuretic-resistant congestive heart failure treated successfully with peritoneal ultrafiltration

Skuteczne leczenie niewydolności serca opornej na diuretyki za pomocą ultrafiltracji otrzewnowej

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Abstract

We present a case of successful peritoneal ultrafiltration (pUF) treatment in a 60 year-old patient diagnosed with diuretic-resistant congestive heart failure fulfilling the criteria for type 2 cardio-renal syndrome. Six months of pUF treatment with one daily dialysis exchange with icodextrin as an osmotic agent resulted in better functional status (from IV to II/III NYHA class), quality of life and improvement of haemodynamic parameters measured by impedance cardiography. During the follow-up (six months), pUF was well tolerated by the patient and he did not require hospitalisation for decompensated heart failure.

Key words: peritoneal ultrafiltration, congestive heart failure, diuretic resistance

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INTRODUCTION

Decompensated chronic heart failure (HF) remains one of the main reasons for admission to the non-invasive cardiology ward. Moreover, the majority of such patients present with type 2 cardio-renal syndrome characterised by chronic HF accompanied by decreased glomerular filtration rate (GFR) below 60 mL/min/1.73 m^2 (according to the classification of cardio-renal syndrome established by Ronco et al. [1]).

Deteriorating renal function contributes to subsequent resistance to diuretics, increasing overhydration and progressing of HF. Recent European Society of Cardiology guidelines recommend ultrafiltration or haemodialysis as a supportive treatment in such patients [2]. However, both therapeutic approaches are potentially burdened with several haemodynamic complications, including further decline of cardiac function. Depending on the degree of existing renal failure, either peritoneal ultrafiltration (pUF), or one of the variants of peritoneal dialysis i.e. continuous ambulatory peritoneal dialysis or automated peritoneal dialysis, becomes the viable alternative [3].

CASE REPORT

A 60 year-old patient was admitted to the Department of Internal Diseases, Nephrology and Dialysis of Military, Institute of Medicine in December 2010. He had been diagnosed with: advanced biventricular HF (NYHA class IV) in the course of dilated cardiomyopathy, established atrial fibrillation, secondary pulmonary hypertension, post-pulmonary embolism state, and type 2 diabetes treated with insulin and hospitalised in the Department of Cardiology and Internal Diseases several times a year because of HF decompensations resistant to diuretics. In September 2010, the patient had been provided with an implantable cardioverter-defibrillator device (ICD) with the cardiac resynchronisation function.

On admission, his general condition was serious, with dyspnoea at rest, cardiac arrhythmia, features of pulmonary haemostasis, ascites, enlarged liver and significant peripheral oedema. Moderate depression was diagnosed using Beck Depression Inventory (BDI, 23 points). Charlson Comorbidity Index (CCI) was 12, while one- and two-year survival estimates based on serum albumins concentration and CCI were

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52 ± 9% and 30 ± 10%, respectively. Overhydration was estimated at 30 kg, and daily diuresis did not exceed 500 mL, in spite of the administration of intravenous diuretics. Due to the detected iron deficiency anaemia, the patient received a total of 300 mg of Venofer (ferric hydroxide sucrose complex).

Electrocardiography determined the presence of atrial fibrillation and ventricular rate at approximately 80 bpm, while chest X-ray revealed enlarged heart and features of pulmonary haemostasis. Subsequent echocardiography detected cardiomegaly, generalised disturbances in left ventricular contractility reflected by the decrease in left ventricular ejection fraction (LVEF 25%), as well as significant tricuspid valve insufficiency and features of pulmonary hypertension with right ventricular systolic pressure (RVSP) of 55 mm Hg and dilated pulmonary artery (pulmonary flow acceleration time 66 s). At that time, impedance cardiography (ICG) — a non-invasive method of haemodynamic monitoring — was performed in order to properly assess the patient's haemodynamic status. Several haemodynamic parameters were measured, including low initial stroke index (SI) at 32 mL/m^2, low Heather Index (HI) — the parameter characterising cardiac inotropism — 4.5 Ohm/s^2, high thoracic fluid content (TFC) — 49.7 1/kOhm and moderate systemic vascular resistance index (SVRI): 2080 dyn × s × cm^{-5}/m^2.

At that point, as the failure of all non-invasive treatment options was becoming more and more evident, the patient was enrolled in the pUF programme. Due to the advanced degree of kidney damage (3rd stage of chronic kidney disease and GFR 47 mL/min/1.73 m^2, according to the MDRD formula) one 12-hour night-time dialysis exchange with 2.0 L of glucose polymer — icodextrin as an osmotic agent, was scheduled. Mean ultrafiltration rate was 1,000 ± 500 mL, diuresis was 1,000 mL/24 hours.

After three and six months of continuing such protocol at home, the patient was readmitted to our Institute to assess the efficiency of the designed treatment programme. He reported an overall improvement in his well-being, and stated that the introduction of the new treatment modality allowed him to have a fulfilling personal and professional life. His exercise tolerance improved from NYHA class IV to class II/III. Physical examination revealed persisting established atrial fibrillation and ventricular rate of 80 bpm, no ascites, mild degree of pulmonary haemostasis and slightly pronounced peripheral oedema. Reduction in body weight compared to the December 2010 value reached 30 kg. In laboratory tests, serum concentration of haemoglobin had significantly increased after six months without erythropoietin stimulating agent (ESA), and renal function improved, as reflected by the increase in GFR (Table 1). Importantly, the treatment was able to restore the patient's sensitivity to oral diuretics. Administration of 320 mg of furosemide resulted in a diuresis of 1,400–2,000 mL per 24 hours. Increase in ejection fraction from 25 to 32%, decrease in the size of left atrium (from 5.4 to 4.7 cm) and decrease in RVSP from 55 to 45 mm Hg were observed on echocardiography. A follow-up ICG was performed after three and six months and revealed the increase in SI (after three months: 33 mL/m^2, after six months: 37 mL/m^2) and HI (5.5 Ohm/s^2 and 11.4 Ohm/s^2) with concurrent significant progressive decrease in TFC (35.7 1/kOhm and 30.7 1/kOhm). The increase in SVRI after three months to 2,182 dyn × s × cm^{-5}/m^2 compelled us to add low dosage of inhibitor of angiotensin converting enzyme as a precaution (ramipril 1.25 mg) that resulted in acceptable decrease of SVRI after six months: 1,802 dyn × s × cm^{-5}/m^2. A significant improvement in the patient's well-being was observed in SF-36 Health Survey and his depression was downgraded from moderate to mild (15 points in BDI).

Importantly, it has to be emphasised that no technical or clinical complications, such as dialysis-related peritonitis, occurred during the above described treatment.

DISCUSSION

Our 30-year experience of performing continuous ambulatory peritoneal dialysis as the only option for at home-dialysis currently available in Poland [4], has resulted in a research programme focusing on pUF in diuretic-resistant congestive HF. This has been running in our Institute since 2009. This is the first case report from Poland reporting the effects of such therapeutic approach estimated using various diagnostic methods.

To date, approximately 300 cases of treating decompensated congestive HF with peritoneal dialysis or isolated pUF (with icodextrin) have been described. Similarly to our report, the authors of most of the published case report studies have observed improvements in the patient's quality of life, NYHA classification, LVEF and shorter hospitalisation rates. We reviewed and discussed these reports in our previous original paper [3]. Sanchez et al. [5] described use of various peritoneal dialysis methods applied in a group of 17 patients with HF that resulted in better quality of life. A possibility of improving the kidney function as a direct result of pUF suggested by some authors seems to be of crucial importance. Basile et al. [6] described three HF patients treated with one nightly peritoneal exchange with icodextrin and followed up for an average of 13 months. Concentration of serum creatinine clearly decreased from 3.55 ± 1.12 to 2.37 ± 0.35 mg/dL, a result which, unfortunately, did not reach the level of statistical significance.

Other potential benefits are also important. Patients with cardio-renal syndrome are often diagnosed with anaemia and prescribed ESA [7]. In the case of our patient, we observed an improvement in blood morphology without ESA. Nakayama et al. [8] described 12 patients treated with various peritoneal dialysis modalities who achieved a significant increase in the level of haemoglobin, also in three patients who did not receive any ESA. Patients undergoing extracorporeal or pUF require constant and extremely thorough monitoring. Our report underlines the diagnostic value of ICG in such patients. This method, in contrast to standard bioimpedance, allows the estimation of thoracic fluid content, as well as

Table 1. Results of laboratory tests before and during the course of ambulatory peritoneal ultrafiltration treatment

	Before	Three months of at-home-dialysis	Six months of at-home-dialysis	Normal values
NT-proBNP [pg/mL]	12 ,853	5,798	8,411	< 194
HbA1c [%]	7.5	7.5	8.1	< 6.5
Haemoglobin [g/dL]	11.2	13.8	15.0	14–18
Haematocrit [%]	36.4	44.30	45.70	42–52
MCV [μm^3]	76.0	80.0	85.0	80–94
MCH [pg]	23.4	25.0	27.8	27–32
MCHC [g/dL]	31.88	31.1	32.8	33–38
WBC [$\times 10^3/mm^3$]	11.0	7.50	7.20	4.0–8.0
Platelets [$\times 10^3/mm^3$]	279	257	176	150–350
Na^+	128	133	136	136–145
K^+	4.9	4.4	3.9	3.5–5.0
Creatinine [mg/dL]	1.8	1.3	1.2	0.7–1.5
GFR (MDRD) [mL/min/1.73 m^2]	39	60	66	
Urea [mg/dL]	125	85	104	15–40
Ca^{2+} [mg/dL]	10.3	8.5	8.6	8.5–10.5
P [mg/dL]	5.5	4.1	3.9	3.0–5.0
Total protein [g/dL]	5.9	6.6	6.3	6.0–8.0
Albumins [g/dL]	3.2	3.1	3.3	4.0–5.0
Fibrinogen [mg/dL]	474	490	350	200–500
hsCRP [mg/dL]	6.23	3.51	2.26	< 0.3
Troponin [ng/mL]	0.048	–	0.046	< 0.1

several other haemodynamic parameters characterising cardiac systolic function and vascular resistance. The change of haemodynamic status of our patient emphasises the positive effect of pUF. Starting with low SI (< 35 mL/m^2) and high TFC (> 35 1/kOhm) after six months, the patient improved in both parameters. Referring to the study of Packer et al. [9], such improvement decreases the short-term risk of HF worsening almost seven-fold. The usefulness of ICG in the monitoring of dialysed patients was also observed by Gotloib et al. [10]. In 20 HF patients who were systematically tested with ICG during 12 months, TFC gradually decreased in all of them as cardiac haemodynamic function improved significantly.

Importantly, pUF protocol offers a chance for relatively normal life by giving the patient an option of at-home peritoneal dialysis and by significantly decreasing the number of dialysis-related complications, especially peritonitis. A six month observation period did not allow us to establish any long-term prognosis for our patient. However, our experience and that of other centres should encourage the introduction of similar treatment modalities in a larger number of patients with HF resistant to diuretics.

CONCLUSIONS

This report proves that the use of pUF as a life-saving procedure in patients with congestive HF resistant to pharmacological treatment can significantly improve clinical state of HF patients confirmed by ICG — a modern method of noninvasive haemodynamic monitoring. This observation encourages further studies in this area.

Conflict of interest: *none declared*

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