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EFFICACY OF PERITONEAL DIALYSIS IN THE TREATMENT OF REFRACTORY HEART FAILURE

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Résumé

L'insuffisance cardiaque (IC) est une maladie progressive, même avec un traitement adéquat. La soustraction hydrique peut aider à la prise en charge de ces patients. Nous avons évalué l'efficacité de la dialyse péritonéale (DP) dans le traitement de l'IC réfractaire.

Patients et Méthodes : Étude prospective non randomisée impliquant des patients atteints d'IC congestive réfractaire à un traitement médicamenteux maximum tolérable. Tous ont été traités par DP. Nous avons analysé les données cliniques et l'état fonctionnel. Pour déterminer l'efficacité, nous avons comparé l'état de santé perçu aux patients atteints de la maladie de Parkinson par rapport à ceux rapportés avec des thérapies conservatrices. Enfin, nous avons effectué une évaluation coût-bénéfice.

Résultats : Soixante-dix-huit patients (68% d'hommes, 66 ± 10 ans) ont été inclus et 14 étaient encore en DP à la fin de la période de suivi (22 ± 9 mois). Soixante-dix patients ont eu seulement un échange nocturne quotidien; le reste, 2 ou 3 échanges selon la fonction rénale résiduelle. Tous ont amélioré leur statut fonctionnel NYHA, (4% trois classes, 63% deux, 33% une, P <0,001), avec une réduction de leur pression artérielle systolique pulmonaire (48 ± 13 vs 28 ± 10 mmHg, p = 0,007) . Les taux d'hospitalisation ont subi une réduction spectaculaire (de 63 ± 16 à 9 ± 7 jours / patient / an, p = 0,002). L'espérance de vie en DP était de 88% après 12 mois de traitement, et 72% et 54% après 18 et 24 mois. La DP était associée à un état de perception de la santé supérieur à celui de la thérapie conservatrice (0,416 ± 0,218 vs 0, 658 ± 0,114, P <0,02). La DP est rentable par rapport aux régimes diurétiques.

Conclusions : La DP est une bonne option pour les patients avec IC réfractaire; elle améliore l'état fonctionnel et la qualité de vie, réduit la morbidité, la mortalité et les coûts des soins de santé.

Mots clés : insuffisance cardiaque, dialyse péritonéale, diurétiques, qualité de vie, coût utilité

Abstract

Heart failure (HF) is a progressive disorder even with adequate treatment. Fluid removal may aid in the management of these patients. We evaluated the efficacy of peritoneal dialysis (PD) in the treatment of refractory HF.

Patients and Methods : Prospective, non-randomized study involving patients with congestive HF refractory to maximun tolerable drug treatment. All of them were treated with PD. We analysed clinical data and functional status. To determine efficacy we compared the perceived state of health to PD patients respect to those reported with conservative therapies. Finally, we carried out a cost-utility evaluation.

Results : Seventy-eight patients (68% men, 66±10 years) were included and 14 were still undergoing PD at the end of the follow-up period (22±9 months). Seventy patients underwent only one daily nocturnal exchange; the rest, 2 or 3 exchanges according to different degrees of renal failure. All of them improved their NYHA functional status, (4% three classes, 63% two, 33% one; p<0.001), with a reduction in their pulmonary artery systolic pressure (48±13 vs 28±10 mmHg; p=0.007). Hospitalization rates underwent a dramatic reduction (from 63±16 to 9±7 days/patient/year; p=0.002). Life expectancy on PD was 88% after 12 months of treatment, and 72% and 54% after 18 and 24 months. PD was associated with a perceived state of health higher than with conservative therapy, (0,416±0,218 vs 0, 658±0,114, p <0.02). PD is cost-effective compared with the diuretic regimens.

Conclusions : PD is a good option for patients with refractory HF; it improves the functional status and quality of life, reduces morbidity, mortality and health care costs.

Keywords : Heart failure, peritoneal dialysis, diuretics, ultrafiltration, quality of life, cost-utility

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INTRODUCTION

Heart failure (HF) is a growing health problem in developed countries, being the final phase of many pathological processes such as valvular heart disease or ischemic heart disease. There are causes that promote the increase in prevalence such as the aging of the population, the longer survival after a myocardial infarction, the advances in the treatment of HF itself and the improvement in the diagnosis and control of cardiovascular risk factors such as high blood pressure, diabetes or dyslipidemia (1). It is estimated that in Spain, as well as in the rest of the western countries, the prevalence can reach 6% in the population over 40 years old; but also, it increases as the decades of life pass until reaching 16% in subjects older than 75 years (2). HF also conditions a high comorbidity. It is estimated that it is the cause of more than 80,000 hospitalizations per year in our country, being the first cause of hospital admission in patients over 65 years of age and responsible for approximately 5% of total income (3). Finally, HF is an important cause of mortality. It is estimated that it is the third leading cause of death of cardiovascular origin, only behind ischemic heart disease and stroke (4).

HF and renal failure are phenomena that almost always go hand in hand. More than 80% of patients with HF may develop renal failure (5). This association leads to an increase in mortality rates.

HF is a progressive, lethal disorder, even in well-treated patients. One of the characteristics of the HF is the existence of a vicious circle that magnifies and magnifies the problem. As a consequence of the reduction in renal perfusion due to forward failure in patients with HF, there is an increased activation of the renin–angiotensin and sympathetic nervous systems. This leads to renal vasoconstriction and increased proximal tubular sodium and water reabsorption. Due to these phenomena, the distal sodium and water delivery is reduced, develops resistance to the effects of atrial natriuretic peptide and increases the sensitivity of the distal nephron to the actions of aldosterone (6). These mechanisms explain, in part, the occurrence of diuretic resistance. The concomitant fluid accumulation may worsen the congestive HF and reduce cardiac output or the left ventricular inflow due to an increase in right ventricular diastolic volume. In addition, renal function is compromised as a result of decreased perfusion (7), and also because of the damage caused by the activation of neurohormonal systems (glomerulosclerosis and tubulointerstitial fibrosis) (8). Some authors (9(describe the existence of the cardio-renal-anaemia syndrome due to the intimate relationship between the three pathologies.

One of the current theories about the pathophysiology of cardiorenal syndrome is the «venocentric». It seems that the venous congestion developed by HF is in itself a hemodynamic and inflammatory stimulus for the progression of the syndrome; and it does so through the endothelium, which in response to stretching associated with venous congestion is activated and produces inflammatory cytokines (TNFα, Endothelin 1, Interleukin 6 or Angiotensinogen); at kidneys, venous congestion reduces perfusion and increases sodium reabsorption and finally, at the heart, it promotes subendocardial ischemia, remodeling of the left ventricle and decreases the threshold for arrtimies (10).
In this situation of volume overload, any action aimed at reducing excess of fluid will be beneficial for the patient. Some of the advantages that we are going to produce with it are the improvement of the cardiac output (thanks to the Frank-Starling mechanism), the increase in the filling of the left ventricle, and the respiratory capacity (11).
The objective of the present study was to evaluate the efficacy of PD in the treatment of HF refractory to diuretics in terms of functional status, according to the classification of the New York Heart Association (NYHA), complications of the technique and hospitalization and mortality rates. We also evaluated the differences in the state of health perceived by the patient with the use of PD and carried out a cost-utility study, defined as the cost of the therapy per year of life adjusted for quality of life. Finally, we also took into account the economic consequences of its use since there is little information on this.

PATIENTS AND METHODS

From December 2004 to January 2010 we conducted a non-randomized prospective study in a single center that included patients with symptoms and signs of severe HF refractory to optimized medical treatment, which included restriction of water and salt in the diet, diuretics (loop diuretics sometimes associated with thiazides and / or spironolactone), inhibitors of the renin-angiotensin-adosterone system, beta-blockers, digoxin (in case of atrial fibrillation), sildenafil (if pulmonary hypertension exists), erythropoiesis stimulating agents (in case of anemia) and placement of a resynchronizer in case of systolic dysfunction and biventricular desynchronization.

Patients

All patients referred to our PD consultation for HF refractory to diuretics between 2004 and 2017 were evaluated. All of them had data of pulmonary hypertension, assessed by echocardiography. All also suffered some degree of impairment of renal function. According to the

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current criteria, none of these patients was a candidate for heart transplantation. This study was approved by the Hospital Ethics Committee. All patients signed informed consent.

Therapeutic scheme

All patients were initially treated with a single overnight exchange with 2 liters of Icodextrin. With the passing of time it was necessary to make changes in the dialysis schedule, which went from the reduction in the number of days to perform the exchange or the increase in the number of dialysis solutions to be infused daily by the development of different degree of renal disease.

Determinations

Anamnesis, exploration and routine analysis were performed before the beginning of the study and at 3, 6 and 12 months after the start of the PD therapy. In addition, a baseline echocardiogram was performed at 6 months. Any type of incidence or side effects of the technique was recorded. Those patients who did not complete the study period due to death or abandonment of the technique were excluded from the longitudinal study but the baseline results were analyzed by «intention to treat». Parameters analyzed throughout the study were: weight, daily diuresis, daily PD, glomerular filtration rate, ejection fraction (EF), pulmonary artery systolic pressure (PSAP), hematocrit, functional grade (NYHA criteria), days of hospitalization and mortality.

Assessment of quality of life

We value the state of health perceived by the patient at the beginning of the therapy with PD and at 6 months. The tools we used were the Euroquol 5D (EQ-5D) (12) and the health questionnaire SF 36 (13). The utility indexes of the HRQOL were transformed from the visual analogue scale and were determined over time. We compared these data with those obtained from «conservative treatment», defined as the costs of medical treatment, resynchronization therapy (if necessary), days of hospitalization and mortality rates in patients with refractory HF not treated with PD.

Cost-utility analysis

The quality-adjusted life year (QALY) (14) is a measure of disease burden, including both the quality and the quantity of life lived. It is used as a means of assessing the value for money of a medical intervention. To calculate the QALY, we multiplied the change in the utility value induced by the treatment by the duration of the treatment effect to provide then the number of QALYs gained.

Costs were assessed in terms of year 2007 Euros from the perspective of the Hospital. All costs incurred by the PD treatment, including patient care and hospitalization costs, were included in the study. Costs were obtained from the hospital Registry data. Fully allocated costs were determined by prospectively recording resource use for all patients.

A case–control design involving only cases may be used when in a brief period of time, the disease changes and has a high risk. The design resembles a retrospective non-randomized, cross-over study but differs in having only a sample of the base population-time. Self-matching of cases eliminates the threat of control-selection bias and increases efficiency. So, we defined two periods of time, PRE (conservative therapy) and POST treatment with PD; the latter set being the only control group available to provide the investigator with a base from which results could be compared, and the effects of the test therapy deciphered. Control treatment period was the period that occurred just before (PRE) the treatment period, while the cases were the patients receiving standard treatment. Therefore, the costs of follow-up and pre-treatment would likely be included. Costs averaged were separated by periods collected (PRE and POST). The costs of the patients before the clinical study and the costs of the patients who received PD treatment were compared.

The cost-utility was estimated by the ratio of the difference in mean costs of our intervention programme compared to the conservative therapy by the difference in their mean utility score, producing an incremental cost–effectiveness ratio, which was placed in one of the quadrants of a cost-effectiveness plane. The size of the ratio was also included. New therapies in the southeast quadrant are both more effective and less costly than their alternative. They are referred to as dominant strategies and are usually accepted as superior to the alternative (15).

Statistical analysis

All data were presented as mean ± standard deviation. Differences between two groups of continuous variables were analysed using the Mann–Whitney test. An analysis of differences between proportions was performed by means of Fisher's exact test. Finally, a general linear model was carried out to assess any repeated measurements of the same variable. A value of $P < 0.05$ was considered statistically significant.

RESULTS

Finally, 85 patients were evaluated to be included in the peritoneal ultrafiltration program. Seven of them re-

fused to receive this therapy, despite being informed that we thought it was their best therapeutic option. Six of these patients died before 6 months and the other after 11 months of having contacted him. PD was successfully implanted in the remaining 78 patients (53 men, 25 women). Mean age was 66±10 years. The etiology of HF was valvular pathology in 36 cases, ischaemic in 24, dilated cardiomyopathy in 16, and two cases of congenital heart disease. One third of them were diabetics. The Charlson comorbidity index was 7.3±1.7 (range between 4 and 10). All of them had been rejected for heart transplantation due to pulmonary hypertension or comorbidity.

At the beginning of the study, renal function was moderately affected with a range of glomerular filtration between 18 and 65 ml/minute. The deterioration of renal function was attributed to Nephrosclerosis in 37 patients, renal hypoperfusion due to hypotension (with sodium in urine less than 5 mEq/liter) in 22 cases, diabetic nephropathy in 15 and in 4 cases due to chronic nephrotoxicity caused by calcineurin inhibitors. Fourteen patients continued in the PD program at the end of the follow-up period, which was 22±9 months (range 4-63).
Twenty-eight of the 78 patients required at the initial moment to shed volume through an extracorporeal ultrafiltration circuit (hemodialysis type) because they presented with symptoms of dyspnea with radiological evidence of pulmonary venous congestion and cardiomegaly, together with generalized edema and recent increase in less 5 kilos of weight associated with acute renal failure. According to the criteria of the RIFLE classification, 19 of the patients were considered as renal failure (class 3) and the remaining 9 as renal damage (class 2). Ultrafiltration was performed using a hemodialysis monitor (Fresenius Medical Care 4008-S) and a 1.6 m2 surface polysulfone dialyzer (Fresenius, BadHomburg, Germany). Patients in class 3 required not only ultrafiltration but also hemodialysis due to the importance of renal failure. The rest were treated exclusively with isolated ultrafiltration technique. These patients required an average of 8±5 sessions (range 5-12) to improve their symptoms; the average duration of each session was 175±18 minutes and the weight reduction was 11.7±4.2 kg.

PD regimen was modified over time, due to recovery of its clinical situation or due to worsening renal function. Eight patients required an increase in the number of daily exchanges; 5 of them came to require 3 daily exchanges (two exchanges with Glucose solutions and one with Icodextrin, the other 3 required 2 daily exchanges (Glucose and Icodextrin). Of the remaining 70 patients, almost a third reduced the number of exchanges to 3 weekly, keeping the rest with a daily exchange with icodextrin.

With the DP technique we achieved a daily average ultrafiltration of 565±220 ml, maintaining a diuresis of 1220±415 ml / day. There were no significant changes in the weight of the patients once the PD started (72 Kg of initial weight and 73, 73 and 71 Kg after 3, 6 and 12 months of treatment). The renal function measured did not change during the follow-up period (39 ml/min at baseline and 42, 38 and 34 ml/min after 3, 6 and 12 months, respectively). Something similar happened with the level of hematocrit, the needs of stimulating agents of erythropoiesis or serum albumin (Table 1). There were no changes in the diuretic treatment that patients received. Initially 69 patients received furosemide (average dose 96±54 mg/day), 48 received spironolactone (38±34 mg/day) and only 7 were prescribed torasemide (5 mg/day). At the end of the study period, 57 patients were receiving furosemide (100±50 mg/day), 45 spironolactone (34±28 mg/day) and 6 torasemide (5 mg/day).

Table 1: Evolution of clinical variables

	baseline	3 m	6 m	12 m	P
Weight (kg)	69 ± 6	71 ± 7	71 ± 6	72 ± 6	0.658
CrCl (ml/min)	35 ± 6	40 ± 7	35 ± 5	24 ± 3	0.379
Albumin (g/dl)	3.4 ± 0.9	3.4 ± 0.6	3.6 ± 0.8	3.5 ± 1.0	0.556
Hematocrit (%)	38 ± 4	39 ± 4	37 ± 4	40 ± 5	0.725
EPO dosage (UKS)	62 ± 21	59 ± 19	58 ± 20	60 ± 18	0.489
EF (%)	33 ± 3		36 ± 4		0.076
PASP (mm Hg)	44 ± 12		27 ± 9		0.007

Abbreviations: m, months;CrCl, creatinine clearance;EPO, erythroAbbreviations: m, months; CrCl, creatinin clearance; EPO, α or β-epoetin; UKS, international units per kilo per week; EF, eyection fraction; PASP, pulmonary artery systolic pressure.

According to the scale of the NYHA to evaluate the functional grade, at the time of the start of PD, 52 patients were in class 4 and the remaining 26 in class 3. With PD, 4% of patients improved 3 degrees, 63% two degrees and the remaining 33% 1 degree (figure 1). EF increased an average of 8%, although the difference did not reach statistical significance. We observed a reduction in the PASP measured by echocardiography after 6 months of treatment with PD (48±13 versus 28±10 mm Hg, P = 0.004). The only complication associated with the PD technique was peritoneal infection. Its presentation was very infrequent (only 0.02 episodes per patient and year at risk), well below our rate of peritonitis recorded in the peritoneal dialysis program (0.46 episodes per patient per year) and in relation to the performance of fewer exchanges (P = 0.002).

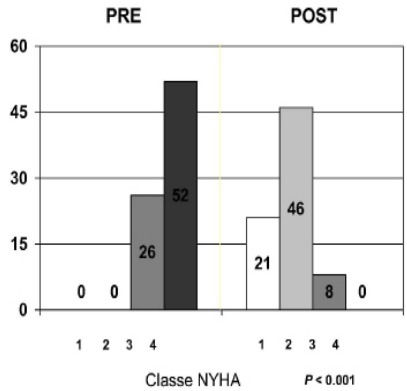

Figure 1: Evolution of NYHA functional class before and after PD.

We compared the hospitalization rate, calculated by the number of days admitted/patient/year, between two periods of time, 12 months before the start of the PD technique and the following 12 months. There was a dramatic decrease in the days of admission, going from 63±16 to 9±7 days/ patient/year (P = .006).

Sixty-four patients dropped out before the end of the study. Six of them improved their functional grade to grade 1 of the NYHA classification, which allowed them to abandom the treatment. The other 58 patients died, three of them due to neoplastic processes and the rest due to cardiac causes (36 of them suffered a sudden death at home).The use of ultrafiltration in the PD technique revealed a life expectancy 88% a year and 72 and 54% at 18 and 24 months respectively (Figure 2).

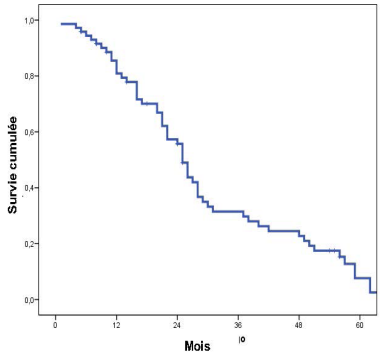

Fig 2: Kaplan–Meyer survival curve for overall mortality

In relation to the SF36 questionnaire, the improvement occurred in all the dimensions (reaching statistical significance in all of them except in general health, P = 0.088) and in the two summary scores. The HRQoL before the start of treatment was well below the scores given by the general population (scores below 45); but it became similar to that of the general population at 6 months of treatment (scores above 45), except in the general health dimension. The prevalence of depression defined as a mental summary score less than or equal to 42, became 79% before the start of the technique and was reduced to only 11% only after 6 months in this ultrafiltration modality.
Regarding the size of the effect, almost all the dimensions of the SF36 and the values of the EQ-5D had a large size, except the dimensions of general health, mental health and the mental summary component, whose size was moderate; all this indicates a very significant significance derived from this therapy.

Quality of life

Every patient completed the EQ5D and the SF36 questionnaires. PD was associated with a higher perceived state of health than the conservative therapy (0.416±0.218 vs 0.658±0.114, P < 0.02); this data was also reflected in the visual analog scale, which went from 36.5±20.3 to 58.9±23.7, P = 0.007). The baseline variables significantly correlated with lower utility scores, lower functional status, morbidity (as the number of hospitalization days) and survival.

Costing study results

Total health care costs for the PD group compared to the conservative therapy group were lower (16.440€ versus 27.551€; P= 0.095). Specifically, staffing and hospitalizations were significantly less costly for PD. In contrast, direct PD materials, depreciation, laboratory tests and imaging were all significantly more expensive for PD.

Cost-utility analysis

PD was associated with a higher utility than the conservative therapy (0.6727 versus 0.4305, P< 0.01). Coupled with the lower costs of PD, the cost-utility for PD was 23.305€/quality-adjusted life-year (QALY), while for conservative treatment was 81.053€/QALY. PD was the dominant strategy, with a difference of 46.237€ per QALY (Table 2).

DISCUSSION

The present study demonstrates the benefits of peritoneal ultrafiltration in patients with refractory HF, in terms of improvement in functional grade, reduction in the number of hospital admissions, improvement in quality of life and survival, and at a reasonable cost.
The different ultrafiltration techniques have a prominent role in the treatment of HF refractory to diuretics. The ultrafiltration modalities that use an extracorporeal blood circuit require an expensive infrastructure, considering both the consumables and personnel expenses, which make them unsuitable for the treatment of non-hospita-

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Table I: Cost-utility results

	Mean	SD	US	P
Conservative management				
Cost	27,551€	20,802	5,200	n.s.
Utility	0.456	0.213	0.062	
Peritoneal dialysis				
Cost	16,441€	10,933	2,733	n.s.
Utility	0.675	0.078	0.023	
Increments				
Cost	-26,767€		8,760	0.095
Utility	0,227		0.041	0.000
Cost-utility ratios				
Conservative management	81,053€			
Peritoneal dialysis	23,305€			
Incremental cost-effectiveness ratio	-61,081			

Abbreviations: SD, standard desviation, US, utility score

lized patients. The DP technique is a very simple and domiciliary form of ultrafiltration. It is also associated with the preservation of residual renal function, hemodynamic stability, adequate sodium management with maintenance of normonatremia and clearance of some medium-sized molecules. It is interesting to note that some cytokines and humoral factors have been implicated in the development and progression of HF. Some of them are atrial and cerebral natriuretic peptides, TNF-α, myocardial depressant factor or interleukins 1 and 6 (16). In addition, serum levels of atrial natriuretic peptide have been related to left ventricular mass and function, and predicts general mortality and cardiovascular causes (17). All these molecules have a medium molecular weight and the peritoneum is permeable to them. Perhaps the elimination by the peritoneal effluent of these depressant molecules has a positive impact on myocardial contractility and therefore also on the evolution of the patient. The ultrafiltration rates of our patients were modest, but may be sufficient when added to the volume of diuresis.

The use of peritoneal ultrafiltration was associated with an improvement in functional class. Only after 3 months of treatment did we already appreciate how all the patients had improved their functional class in at least one degree. Although the EF improved by about 10%, this change was not statistically significant. Takane (18) reported an increase in the EF of around 40% after 12 months of continuous ambulatory PD (CAPD) treatment, in 16 patients treated with 4 daily exchanges of 2 liters of dextrose solution at 1, 5 or 2.5%. Hébert (19) treated 10 patients also using CAPD with dextrose-based solutions and observed an increase in the EF around 30% after 7 months, comparing their evolution with isotopic ventriculography. Courivaud (20) found a recovery of the EF of 30% in those with a worst baseline situation (EF less than 30%) in its series of patients with refractory HF treated with PD.

Our stydy was carried out in the «Icodextrin era» and only 8 patients needed to make more than one daily exchange. Different patterns of peritoneal ultrafiltration have been published for patients with refractory HF, ranging from 2 to 4 manual exchanges with Glucose solutions at different concentrations to the use of cyclers to perform automated DP 3 or 4 days a week. In our experience, performing a daily exchange with Icodextrin produces adequate ultrafiltration, is comfortable, simple and has a lower cost than other treatment modalities.

The important reduction in PASP was striking in our group of patients. Right ventricular dysfunction seems to be a prominent prognostic factor only when associated with high PASP. The adequate management of right ventricular dysfunction in patients without elevated PASP does not confer a reduction in risk. The importance of the elevation of the PASP was detailed in a prospective study conducted in 1134 patients, followed for more than 4 years and who underwent a catheterization and an endomyocardial biopsy. Cappola (21) described that PASP was the hemodynamic factor with a more important predictive value of death. It also showed how the reduction of PASP is associated with a better prognosis. In the same way as other authors, we did not find changes in renal function or in the degree of anemia that could justify the improvement in functional grade.

Our study demonstrates that PD has a positive impact on the morbidity of patients with refractory HF. Both the number of hospital admissions and the days of stay are reduced in an important way during the follow-up period. This data is repeated in all patient series of patients published up to now and included in the systematic review of the literature by the Ronco (22). It was not necessary to admit any patient due to problems related to the ultrafiltration technique. The rate of peritoneal infections was very low (contrary to that published by Hébert (19)), but probably this is due to the fewer number of exchanges per day performed by our patients.

A worrying fact in these patients is the high mortality observed. It must be borne in mind that this study was carried out in severely ill patients. Due to the confluence of a bad cardiac situation and a high comorbidity, it is not expected that any of them have a survival of more than one year. In patients with refractory HF undergoing conservative management (only with different diuretic regimens), it has been reported an average survival at 6 months is

50%, and a year it barely exceeds 25% (23). Given this dark outlook, any steps we can take to improve the prognosis of patients should be welcome. The use of PD in our patients implied an improvement in survival until reaching 88% at 12 months of treatment, and 54% at 2 years. These rates are similar to those published by Hébert (19), Bertoli (24) or Koch (25). Nuñez (26) compares the evolution of a cohort of patients with refractory HF treated with PD with another group of patients with the same diagnosis who did not undergo the technique because they did not give their consent or for some contraindication for PD. Patients treated with peritoneal ultrafiltration had a better survival and spent less time admitted to the Hospital.

In our study, we not only analyzed the clinical evolution of the patients, but we also analyzed their quality of life, compared with those subjects who received conservative management. The results obtained indicate a clear improvement in the quality of life, as measured by the SF36 questionnaire, with scores on both the physical and mental scales that approximate those of the general population. Similar data were published by other groups (26,27). On the other hand, we also carry out a cost-utility study. This is the first time that a useful study has been carried out in patients with HF undergoing a PD program. The utility is a measure of the relative preference for a particular effect or state of health that will provide us with a summary of all the positive and negative aspects of the quality of life (according to how the subject lives and feels) once the attitudes have been incorporated regarding the risk and the duration of life. Because each person with a particular state of health may feel different in relation to the desirable of that situation, the measures of utility have a greater variability than the psychometric instruments. The tool used was the EuroQuol 5D questionnaire; it is a standard gambling method that is commonly used to study preferences in chronic health conditions, in a context of choice under risk conditions. There is some controversy regarding the decision of which is the best way to measure utility, since every method is susceptible to bias. Despite this, the size and direction of the effect (in terms of the use of PD) is of such magnitude that it makes it very unlikely that the correction of supposed biases will cause a significant change in our results. It should be noted, from the economic perspective, that the cost of the PD that we calculate is similar to that of other studies conducted in our country (28).

This study has some limitations, mainly derived from the size of the sample. A study, probably multicentric with a larger number of subjects included, must confirm these results to ensure that the benefit is obtained by the technique itself and not because some selection defect occurs.

We conclude that PD is an adequate therapeutic option for the treatment of patients with HF refractory to diuretics since it produces a functional improvement, reduces the hospitalization and mortality rates, improves the quality of life and all this at a reduced cost with respect to conventional treatments. Heart failure units should consider offering this treatment modality to the appropriate patients to provide them with the aforementioned benefits and with a reduced health cost.

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