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Refractory Heart Failure Treated with Peritoneal Dialysis: A Single-Center Experience with Eleven Patients

(Insuffisance cardiaque réfractaire traitée par dialyse péritonéale : expérience monocentrique de onze patients)

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Summary

Introduction
Refractory heart failure, particularly when associated with chronic kidney disease, poses a major therapeutic challenge. In this context, peritoneal dialysis offers a treatment option that allows for gradual and continuous ultrafiltration, which may improve congestion management and reduce hospitalizations related to episodes of cardiac decompensation.
Objective
To report the Carcassonne Hospital Center's experience with the use of peritoneal dialysis for refractory heart failure and to describe the stepwise treatment strategy developed at our center.
Methods
We conducted a retrospective, descriptive, single-center study of 11 patients with refractory heart failure associated with chronic kidney disease who were treated with peritoneal dialysis between September 2021 and September 2024.
Results
The mean age of the patients was 77 years. All patients had advanced heart failure (NYHA III–IV) associated with stage 4 chronic kidney disease. During a mean follow-up of 15 months, an improvement in congestive symptoms and/or NYHA functional status was observed in nine patients. At the end of the follow-up period, the glomerular filtration rate (GFR), which was initially 20 to 25 mL/min/1.73 m², ranged from 10 to 20 mL/min/1.73 m² in the majority of patients; two patients reached 8 mL/min/1.73 m² and required an increase to four daily exchanges. Urine output remained preserved in 10 patients. Two patients were hospitalized for cardiac decompensation. Seven patients died, although their deaths were not directly attributable to peritoneal dialysis.
Conclusion
Peritoneal dialysis is a viable treatment option for carefully selected patients with refractory heart failure associated with advanced chronic kidney disease. Our experience highlights the feasibility of this approach and the value of multidisciplinary care based on gradual adjustment of the treatment strategy.

Keywords: Peritoneal dialysis; refractory heart failure; cardiorenal syndrome; ultrafiltration; bimodal dialysis; hybrid dialysis

Résumé

L'insuffisance cardiaque réfractaire, notamment lorsqu'elle est associée à une insuffisance rénale chronique, constitue un défi thérapeutique majeur. Dans ce contexte, la dialyse péritonéale représente une option thérapeutique permettant une ultrafiltration progressive et continue, susceptible d'améliorer le contrôle de la congestion et de réduire les hospitalisations liées aux épisodes de décompensation cardiaque.
Objectif
Présenter l'expérience du Centre Hospitalier de Carcassonne concernant l'utilisation de la dialyse péritonéale dans l'insuffisance cardiaque réfractaire et décrire la stratégie thérapeutique graduée développée dans notre centre.
Méthodes
Nous avons réalisé une étude rétrospective, descriptive et monocentrique incluant onze patients pris en charge par dialyse péritonéale entre septembre 2021 et septembre 2024 pour une insuffisance cardiaque réfractaire associée à une insuffisance rénale chronique.
Résultats
L'âge moyen des patients était de 77 ans. Tous présentaient une insuffisance cardiaque avancée (NYHA III–IV) associée à une insuffisance rénale chronique de stade 4. Au cours d'un suivi moyen de 15 mois, une amélioration des signes congestifs et/ou du statut fonctionnel NYHA a été observée chez neuf patients. Le DFG, initialement compris entre 20 et 25 mL/min/1,73 m², était compris entre 10 et 20 mL/min/1,73 m² en fin de suivi chez la majorité des patients ; deux patients ont atteint 8 mL/min/1,73 m² et ont nécessité une intensification à quatre échanges quotidiens. La diurèse est restée conservée chez dix patients. Deux patients ont présenté un épisode d'hospitalisation pour décompensation cardiaque. Sept patients sont décédés, sans décès directement imputable à la dialyse péritonéale.
Conclusion
La dialyse péritonéale constitue une option thérapeutique envisageable chez des patients soigneusement sélectionnés présentant une insuffisance cardiaque réfractaire associée à une insuffisance rénale chronique avancée. Notre expérience souligne la faisabilité de cette approche et l'intérêt d'une prise en charge multidisciplinaire reposant sur une adaptation progressive de la stratégie thérapeutique.

Mots-clés : dialyse péritonéale ; insuffisance cardiaque réfractaire; syndrome cardio-rénal ; ultrafiltration ; dialyse bimodale ; dialyse hybride

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Introduction

Heart failure is a major public health problem due to its increasing prevalence, its high morbidity and mortality rates, and the aging population. Despite recent therapeutic advances and the optimization of medical treatment, a proportion of patients progress to advanced or refractory heart failure, characterized by persistent severe symptoms, chronic congestion, and repeated hospitalizations [1].

The combination of heart failure and chronic kidney disease is common and characterizes cardiorenal syndrome. The bidirectional interactions between cardiac and renal dysfunction promote fluid and sodium retention and congestion, while impaired renal function can limit the effectiveness of certain heart failure treatments and contribute to resistance to diuretics [2,3]. Persistent congestion is thus a major determinant of decompensation and rehospitalizations in patients with these conditions.

When congestion persists despite optimized medical treatment, an ultrafiltration strategy may be considered in selected patients. In this context, peritoneal dialysis (PD) offers several potential advantages. Specifically, it allows for slow and gradual ultrafiltration with minimal hemodynamic impact and can be performed at home. Available studies primarily report improvements in functional status and congestion control as well as a reduction in hospitalizations for heart failure, while the effect of PD on survival remains less clearly established [4].

The objective of this article is to report the Carcassonne Hospital Center's experience with the use of PD for refractory heart failure, framing our observations in the context of the published data. We also describe the stepwise treatment strategy developed by our team, based on a gradual adjustment of PD parameters according to clinical progression and renal function.

Patients and Methods

We conducted a retrospective, descriptive, single-center study including all patients treated with peritoneal dialysis for refractory heart failure in the Nephrology Department of the Carcassonne Hospital Center between September 2021 and September 2024.

The decision to initiate peritoneal dialysis was made following a multidisciplinary consultation involving nephrologists and cardiologists. Patients presented with advanced, symptomatic heart failure despite optimized medical therapy tailored to their tolerance, and their condition was accompanied by recurrent episodes of congestion and advanced chronic kidney disease.

Demographic, cardiovascular, and nephrological data were collected retrospectively from medical records. The studied parameters included age, sex, comorbidities assessed using the Charlson score, NYHA functional class, etiology of heart disease, left al ejection fraction, renal function, residual urine output, available NT-proBNP levels, and cardiological treatments at enrollment.
Peritoneal dialysis modalities and any adjustments made during follow-up were also recorded. The assessment of clinical outcomes was based on the control of congestion, changes in NYHA functional class, the occurrence of hospitalizations for cardiac decompensation, changes in renal function, complications related to peritoneal dialysis, and patient outcomes at the end of follow-up.

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Results

Population Characteristics

A total of 11 patients were included. The mean age was 77 years (range: 58–93 years), with seven men (63.6%) and four women (36.4%). The burden of comorbidities was significant, with a mean Charlson score of 8.

All patients had advanced heart failure, NYHA functional class III or IV, associated with stage 4 chronic kidney disease. At the start of peritoneal dialysis, the glomerular filtration rate ranged from 20 to 25 mL/min/1.73 m².

The main demographic and clinical characteristics of the study population are presented in *Table 1*.

Table 1. Demographic and Clinical Characteristics of the Study Population

Characteristic	Value
Number of patients	11
Mean age, years (range)	77 (58–93)
Men, n (%)	7 (63.6%)
Women, n (%)	4 (36.4%)
Mean Charlson score	8
NYHA class	III–IV
CKD	Stage 4
GFR, mL/min/1.73 m²	20–25

Cardiovascular Characteristics and Treatments at Enrollment

The cohort had a severe cardiovascular profile (*Table II*). The main causes of heart failure were ischemic heart disease (n = 5), hypertension (n = 3), and cardiac amyloidosis (n = 2), while one patient had valvular heart disease. Atrial fibrillation was present in nine patients, and three patients had dilated cardiomyopathy.

Among the 10 patients with interpretable echocardiograms, six had an impaired left ventricular ejection fraction (LVEF), and four had a preserved LVEF.

Table 2. Cardiovascular Characteristics of the Cohort

Characteristic	n
Ischemic heart disease	5
Hypertensive heart disease	3
Cardiac amyloidosis	2
Valvular heart disease	1
Atrial fibrillation	9
Dilated cardiomyopathy	3
Preserved LVEF	4
Impaired LVEF	6

**LVEF available and usable in 10 patients.*

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Regarding medical treatment (*Table III*)for heart failure at enrollment, all patients were treated with a loop diuretic, and nine of them were receiving a beta-blocker. Three patients were treated with an angiotensin-converting enzyme inhibitor or an angiotensin II receptor antagonist (ACEI/ARA2), six with a mineralocorticoid receptor antagonist, and two with a sodium-glucose cotransporter 2 inhibitor (SGLT2i).

Table III Medical Treatment at Enrollment

Treatment	n (%)
Loop diuretics	11 (100)
Beta-blockers	9 (81.8)
ACE inhibitors/ARBs2	3 (27.3)
Mineralocorticoid receptor antagonists	6 (54.5)
iSGLT2	2 (18.2)
Hydrochlorothiazide	3 (27.3)

Peritoneal Dialysis Modalities

Peritoneal dialysis regimens were tailored to each patient based on the degree of congestion, residual renal function, and clinical course.

The majority of patients were initially treated with continuous ambulatory peritoneal dialysis (CAPD), following a regimen consisting of a daily exchange using an icodextrin bag (Extraneal®) left in place for 12 hours. If fluid and sodium overload persisted, the regimen could be intensified by adding a bag of hypertonic glucose solution to increase ultrafiltration.
When volume control remained inadequate, a bimodal peritoneal dialysis strategy could be implemented on an ad hoc basis for a few days in the outpatient unit of our department. The implementation of this strategy at home was limited by the lack of specific training for private practice nurses in this modality.

Automated peritoneal dialysis (APD), which combined short dwells of 30 to 45 minutes with a hypertonic solution to promote ultrafiltration and a long dwell with icodextrin, was used in two patients.

Finally, one patient underwent a hybrid dialysis strategy combining peritoneal dialysis with a weekly hemodialysis session.

Complications

During follow-up, several complications related to peritoneal dialysis were observed. Three patients experienced an episode of peritonitis. Two patients developed a parietal leak, and two experienced a hemorrhagic episode. A loss of ultrafiltration efficiency was observed in two patients, leading to an adjustment of the peritoneal dialysis prescription. Finally, one patient developed an inguinal hernia. The complications observed during follow-up are presented in *Table IV*.

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TableIV. Complications Observed During Follow-Up

Complication	Number of patients
Peritonitis	3
Parietal leak	2
Bleeding	2
Loss of ultrafiltration	2
Inguinal hernia	1

Clinical Course and Outcome

During a mean follow-up of 15 months (range: 1–36 months), an improvement in congestive symptoms and/or NYHA functional class was observed in nine patients. Two patients were hospitalized for cardiac decompensation after initiation of peritoneal dialysis.

At the end of the peritoneal dialysis follow-up period, the GFR ranged from 10 to 20 mL/min/1.73 m² in the majority of patients. Two patients experienced a more marked decline, with a GFR as low as 8 mL/min/1.73 m², requiring an increase in treatment frequency to four exchanges per day. Residual urine output was maintained in ten patients; one female patient became oliguric. NT-proBNP was monitored longitudinally in only two patients, with a marked decrease in both individuals. In the other patients, the lack of repeated measurements—particularly due to the sometimes short follow-up period—prevented a reliable analysis of NT-proBNP trends.

At the end of the observation period, seven patients had died. None of the deaths were considered directly attributable to peritoneal dialysis. One patient was transferred to hemodialysis, and three patients were continuing treatment with continuous ambulatory peritoneal dialysis at the end of follow-up. The main findings regarding the clinical course and outcomes of the patients are presented in *Table V*.

Table V. Clinical Course and Patient Outcomes During Follow-Up

Parameter	Result
Mean follow-up duration	15 months (1–36 months)
Hospitalization for cardiac decompensation	2 patients (1 episode each)
Improvement in signs of congestion and/or NYHA class	9 patients
Worsening of renal function	2 patients (eGFR at 8 mL/min/1.73 m²)
Increased PD (4 exchanges/day)	2 patients
Deaths during follow-up	7 patients
Transfer to hemodialysis	1 patient
Patients still on CAPD at the end of follow-up	3 patients
Residual diuresis preserved	10 patients
Oliguria during follow-up	1 patient
Longitudinal follow-up of NT-proBNP	2 patients, with a marked decrease

Discussion

Our experience suggests that peritoneal dialysis may be a therapeutic option for carefully selected

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patients with refractory heart failure associated with advanced chronic kidney disease. The study population was particularly frail, with a mean age of 77 years, and had a high burden of comorbidities (mean Charlson score of 8) and advanced heart failure (NYHA Class III–IV).

During a mean follow-up of 15 months, nine of the eleven patients showed improvement in congestive symptoms and/or their NYHA functional status, and only two patients were hospitalized for an episode of cardiac decompensation after initiation of peritoneal dialysis. These results are particularly noteworthy in a population characterized, prior to the initiation of peritoneal dialysis, by recurrent congestion despite optimized medical treatment. They should nevertheless be interpreted with caution due to the retrospective nature of the study, its small sample size, and the absence of a control group.

These observations are consistent with published data regarding the use of peritoneal dialysis for refractory heart failure. Courivaud et al. reported a significant reduction in the number of hospital days following the initiation of peritoneal dialysis [5]. Sánchez et al. also observed clinical improvement and a reduction in hospitalizations among patients with refractory congestive heart failure [6]. Comparable results were reported by Grossekettler et al., particularly regarding functional status and hospitalizations [7], while Papasotiriou and others demonstrated an improvement in NYHA functional class following the initiation of peritoneal dialysis [8].

Taken together, these data suggest that the potential benefit of peritoneal dialysis for this indication lies primarily in the control of congestion, symptomatic improvement, and reduced hospitalizations. However, its effect on survival remains uncertain given the predominantly observational nature of the available studies and the high frailty of the study populations.

In our cohort, renal function generally deteriorated over the course of follow-up, with eGFR declining from a range of 20–25 mL/min/1.73 m² at the start of PD to 10–20 mL/min/1.73 m² at the end of follow-up in the majority of patients. Two patients reached an eGFR of 8 mL/min/1.73 m² and required four daily exchanges. Despite this progression, residual diuresis was preserved in 10 patients. The decrease in NT-proBNP observed in the only two patients with longitudinal follow-up is consistent with clinical improvement, but the sample size is insufficient to draw a conclusion.

The low proportion of patients treated with ACE inhibitors/ARBs or SGLT2 inhibitors should be interpreted in the context of this elderly cohort with advanced chronic kidney disease. In our series, these treatments were discontinued by cardiologists due to worsening GFR and the occurrence of episodes of arterial hypotension.

Pathophysiological Rationale and Benefits of Peritoneal Dialysis

The potential benefit of peritoneal dialysis in refractory heart failure stems primarily from the control of congestion, a central component of the cardiorenal syndrome. While a decrease in cardiac output and renal perfusion has long been considered the primary mechanism underlying impaired renal function in heart failure, the role of renal venous congestion is now also recognized. Increased renal venous pressure contributes to a decrease in the glomerular filtration gradient, promoting fluid and sodium retention and thereby perpetuating the vicious cycle of cardiac dysfunction, renal dysfunction, and congestion [9,10].

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Persistent congestion despite increased doses of diuretics poses a major challenge in patients with advanced heart failure. Resistance to diuretics results from multiple mechanisms, including pharmacokinetic and pharmacodynamic alterations and a compensatory increase in distal tubular sodium reabsorption during prolonged exposure to loop diuretics [11]. When optimized diuretic strategies no longer achieve satisfactory decongestion, the use of an ultrafiltration strategy may then be considered in selected patients.

In this context, peritoneal dialysis has several characteristics that are particularly well suited for patients with cardio-renal syndrome. It allows for slow and gradual ultrafiltration with minimal hemodynamic impact and promotes steady removal of water and sodium. The use of icodextrin specifically during prolonged stasis enables sustained ultrafiltration and sodium removal, explaining its value for this indication [4]. The ability to gradually adjust the number and composition of exchanges based on congestion and renal function also allows for individualized treatment.

These physiological properties form the rationale for the strategy used in our cohort, which initially relied on a prolonged daily icodextrin exchange, followed by a gradual intensification of the regimen when congestion control became inadequate.

Patient Selection and Organization of the Care Pathway

Selecting patients likely to benefit from peritoneal dialysis is a critical step. This strategy should not be considered systematically for all patients with heart failure associated with chronic kidney disease. Rather, it should be discussed on a case-by-case basis as part of a multidisciplinary consultation.

Patients with advanced heart failure (NYHA Class III–IV) despite optimized medical therapy, repeated episodes of congestive decompensation, resistance to diuretics, or a cardio-renal syndrome with persistent fluid and sodium overload are the primary potential candidates for this approach [4].

At our center, this approach has led to the implementation of a cardio-nephro-geriatric care pathway designed to identify patients both in the outpatient setting and during hospitalization. In the outpatient setting, referral to this pathway is discussed specifically for patients who remain symptomatic despite optimized medical therapy and who experience repeated episodes of cardiac decompensation. For patients hospitalized for heart failure refractory to diuretics, the indication for an ultrafiltration strategy is discussed in a multidisciplinary setting.
When the clinical situation requires rapid decongestion before peritoneal dialysis is actually initiated, temporary extracorporeal ultrafiltration may be used as a transitional strategy. However, the goal remains, whenever possible, to transition to a peritoneal technique that allows for long-term management at home.

This local care pathway is summarized in *Figure 1*.

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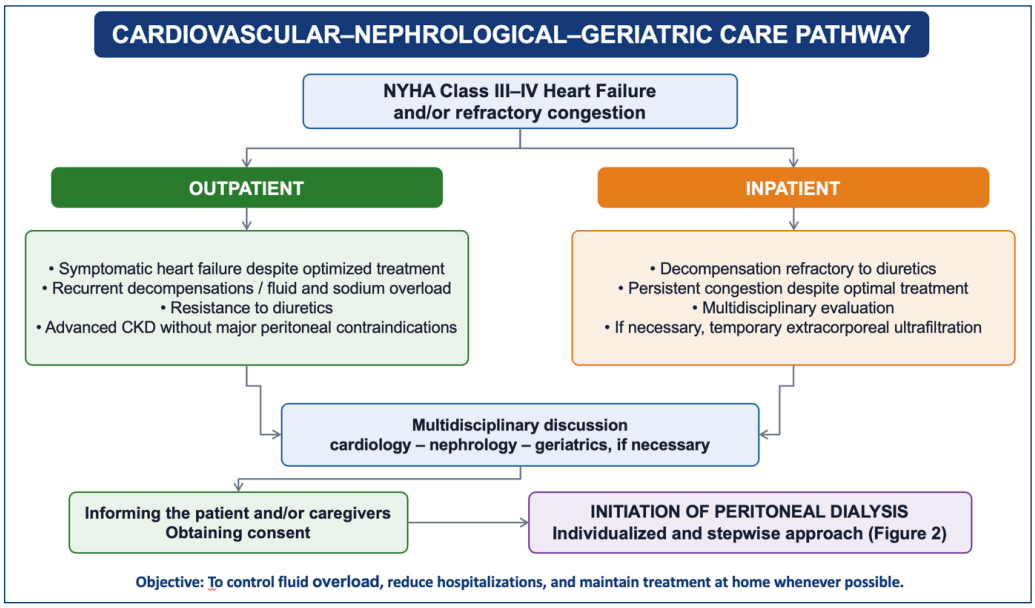

Figure 1. Cardiovascular–Nephrology–Geriatric Care Pathway for the Identification and Referral of Patients with Refractory Heart Failure Who May Benefit from Peritoneal Dialysis

Graduated Treatment Strategy

One of the distinctive features of our approach is the implementation of a graduated treatment strategy, aimed at adapting the intensity of peritoneal dialysis to changes in fluid overload and renal function while prioritizing, whenever possible, the continuation of home treatment.

Treatment was first initiated with CAPD consisting of a daily exchange of icodextrin (Extraneal®), with a 12-hour dwell time. In the absence of persistent congestion, this regimen was continued with regular clinical reassessment.

If congestion persisted, the regimen could be intensified by adding a bag of hypertonic glucose solution. In cases of impaired renal function requiring increased clearance and/or ultrafiltration, the number of exchanges could be increased to four per day, with adjustments to volumes and solutions. In our cohort, this intensification to four daily exchanges was necessary in two patients. In cases of inadequate volume control, a bimodal peritoneal dialysis strategy could be proposed. This approach combines, within the peritoneal prescription, a glucose-containing crystalloid solution and an icodextrin colloid solution. It aims to optimize volume control by utilizing the complementary ultrafiltration profiles of the two types of solutions while limiting exposure to glucose [12].

Finally, when CAPD remains inadequate despite optimization of the treatment regimen, two strategies could be considered depending on the patient's profile: switching to APD, with an individualized regimen combining short dwells with a hypertonic solution and a long dwell with icodextrin, or a hybrid dialysis strategy combining CAPD with a weekly hemodialysis session. APD was used in two patients, without any further improvement in ultrafiltration compared to the previous CAPD regimen.

This stepwise approach allows for individualized treatment adjustment based on clinical

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progression, congestion control, renal function, and tolerance. It constitutes a pragmatic strategy developed at our center and, in the absence of a prospective evaluation, cannot be considered a generalizable protocol.
This therapeutic strategy is summarized in *Figure 2*.

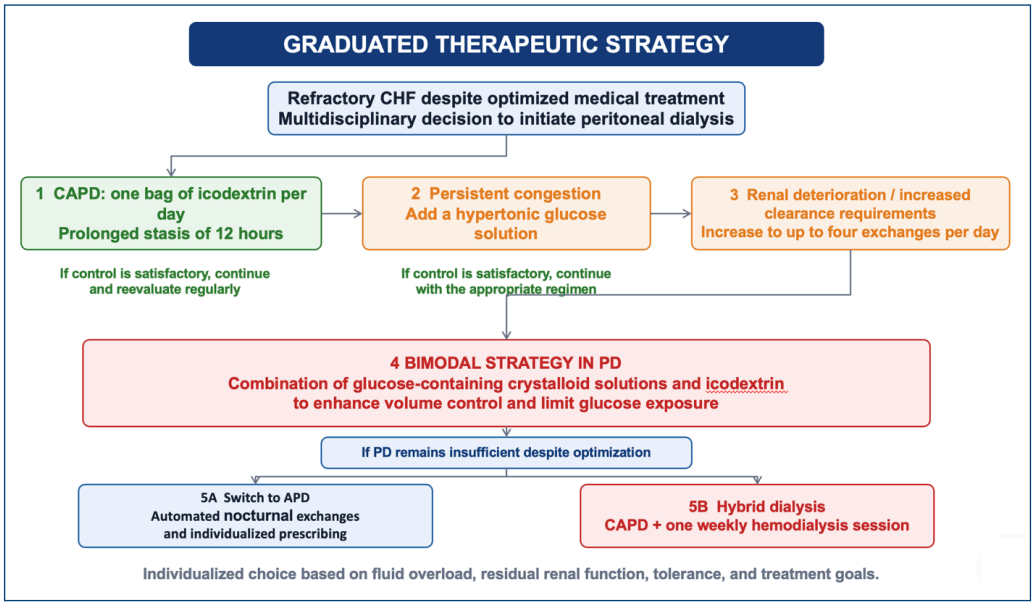

Figure 2. Stepwise Peritoneal Dialysis Treatment Strategy Used at the Carcassonne Hospital Center for Patients with Refractory Heart Failure

Tolerance and Complications

Tolerance to peritoneal dialysis is an important factor to consider in this elderly population with significant comorbidities. In our cohort, the main complications observed were peritonitis (n = 3), parietal leaks (n = 2), bleeding episodes (n = 2), ultrafiltration losses (n = 2), and an inguinal hernia.

Peritonitis remains one of the main infectious complications of peritoneal dialysis. In studies focusing on PD in patients with refractory heart failure, the incidence of peritonitis varies. A systematic review of 21 studies and 673 patients reported an average annual peritonitis incidence of 14.5% [13]. A more recent meta-analysis also highlights the significant heterogeneity in the rates reported across studies [14]. These data make a direct comparison with our series difficult, especially since our dataset does not allow us to express the incidence of peritonitis as episodes per patient-year.

The recommendations of the International Society for Peritoneal Dialysis (ISPD) emphasize the importance of standardized monitoring of infectious episodes. Additionally, the ISPD specifically recommends tracking the overall peritonitis rate expressed as episodes per patient-year [15]. This standardization should be incorporated into the prospective evaluation of our care pathway.
The mechanical complications observed in our cohort—notably, parietal leaks, bleeding, and inguinal hernias—are known complications of the technique. The ultrafiltration losses observed in two patients led to an adjustment of the treatment regimen. Regular assessment of ultrafiltration efficacy is particularly important in this population, since the primary goal of PD is precisely to maintain satisfactory volume control.

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Despite these adverse events, no deaths were directly attributed to peritoneal dialysis in our series. Advanced age, severe heart failure, chronic kidney disease, and a high burden of comorbidities must be taken into account when interpreting the long-term outcomes of these patients.

Limitations and Future Directions

Our study has several limitations. It is a retrospective, descriptive, single-center study involving a small sample size of 11 patients, with no control group. These characteristics do not allow us to establish a causal relationship between the initiation of peritoneal dialysis and the observed clinical outcomes.

Furthermore, although a small number of hospitalizations for cardiac decompensation were observed after the initiation of peritoneal dialysis, we do not have a standardized comparison of the number of hospital days or the hospitalization rate before and after the start of the treatment. Clinical improvement was based primarily on changes in signs of congestion and NYHA functional class, without a standardized assessment of quality of life.

The retrospective data collection also did not allow for the evaluation of all complications using standardized indicators. In particular, episodes of peritonitis were not expressed as episodes per patient-year, limiting comparison with published data and international guidelines. Furthermore, urine output was not quantified in a standardized manner, and NT-proBNP was monitored longitudinally in only two patients; these laboratory data can therefore be interpreted only descriptively.

The high mortality rate observed during follow-up must be interpreted in the context of a particularly frail population, characterized by advanced age, severe heart failure, advanced chronic kidney disease, and a high burden of comorbidities. No deaths were considered directly attributable to peritoneal dialysis.

Despite these limitations, this single-center study demonstrates the feasibility of structured peritoneal dialysis management in patients with refractory heart failure and cardio-renal syndrome. It also led our team to formalize a cardio-renal-geriatric care pathway and a graduated treatment strategy that allows for the adaptation of ultrafiltration parameters to patients' clinical and renal progression.

A prospective evaluation of this care pathway now appears desirable. It could include a standardized comparison of hospitalizations before and after the initiation of peritoneal dialysis; changes in NYHA functional class, renal function, and signs of congestion; a validated measure of quality of life; and standardized data collection on complications. A multicenter study would also allow for an assessment of the reproducibility of this strategy and help clarify the role of peritoneal dialysis in the current management of refractory heart failure.

Conclusion

Peritoneal dialysis is a therapeutic option worth considering in carefully selected patients with refractory heart failure associated with advanced chronic kidney disease, particularly when

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congestion persists despite optimized medical treatment.

In our series of 11 patients, the use of peritoneal dialysis was associated with an improvement in signs of congestion and/or functional status in the majority of patients and a low number of hospitalizations for cardiac decompensation during follow-up. These results should nevertheless be interpreted with caution given the retrospective, single-center, and uncontrolled nature of our study.

Our experience has led us to formalize a cardio-nephro-geriatric care pathway as well as a stepwise treatment strategy, based on adapting peritoneal dialysis modalities to changes in congestion and renal function, with the use of complementary strategies when necessary. This approach underscores the importance of close collaboration between cardiologists and nephrologists and of individualized care for these complex patients.

A prospective, multicenter evaluation, incorporating standardized criteria for hospitalization, quality of life, renal function, and complications, is needed to better define the role of this strategy in the current management of refractory heart failure.

Authors' Contributions

IG: study design, data collection and analysis, manuscript drafting. NF and VC: patient care and data collection. MA and ZB: supervision and critical review. All authors read and approved the final version of the manuscript.

Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki. Patient identities were anonymized. The retrospective data were analyzed in aggregate form, without the possibility of individual identification. In accordance with the local regulations applicable to this retrospective study using anonymized data, review by an ethics committee was not required.

Patient Consent

These findings were described retrospectively based on the hospital records of patients following their discharge or death. The data were processed in a strictly anonymized manner. No specific written consent for this retrospective study was obtained.

Funding

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Conflicts of Interest

The authors declare that they have no conflicts of interest related to this work.

Data availability

This study is based on data from patient records maintained by the institution. Local legislation does not permit the disclosure of individual records.

Originality of the figures

Originality of Figures. Figures 1 and 2 are original creations by the authors and were not reproduced from another article.

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Use of Artificial Intelligence

A generative artificial intelligence tool was used as a writing aid for linguistic reformulation, structuring the manuscript, and improving its readability. The scientific content, data analysis, interpretation of the data, verification of references, and final validation of the manuscript are the sole responsibility of the authors.

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