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Mechanical complications of peritoneal dialysis in a newly established Tunisian center: a single-center retrospective study

(Complications mécaniques de la dialyse péritonéale dans un centre tunisien nouvellement créé : étude rétrospective monocentrique)

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Summary

Peritoneal dialysis (PD) is an effective alternative to hemodialysis for patients with end-stage renal disease. However, its success depends on proper peritoneal catheter function, and mechanical complications remain a major cause of technique failure. We conducted a retrospective analysis of 38 patients who initiated PD between October 2022 and March 2025 in a newly established Tunisian center. All catheters were implanted by mini-laparotomy. Mechanical complications occurring during a minimum follow-up period of three months were recorded. Fourteen patients (37%) experienced at least one mechanical complication, mainly catheter dysfunction, including migration, obstruction, and drainage failure. The incidence of catheter replacement or reinsertion was 2.16 per 100 patient-months. All complications were successfully managed with conservative measures or catheter reinsertion, and no patient required permanent transfer to hemodialysis. These findings suggest that, although mechanical complications are frequent in newly established PD programs, they can be effectively managed through close monitoring and standardized protocols.

Keywords: peritoneal dialysis, mechanical complications, peritoneal catheter, technique survival

Résumé

La dialyse péritonéale (DP) est une alternative efficace à l'hémodialyse pour les patients atteints d'insuffisance rénale terminale. Cependant, son succès dépend du bon fonctionnement du cathéter péritonéal, et les complications mécaniques restent une cause majeure d'échec de la technique. Nous avons mené une analyse rétrospective portant sur 38 patients ayant commencé une DP entre octobre 2022 et mars 2025 dans un centre tunisien nouvellement créé. Tous les cathéters ont été implantés par mini-laparotomie. Les complications mécaniques survenues au cours d'une période de suivi minimale de trois mois ont été enregistrées. Quatorze patients (37 %) ont présenté au moins une complication mécanique, principalement un dysfonctionnement du cathéter, notamment une migration, une obstruction et une défaillance du drainage. L'incidence du remplacement ou de la réinsertion du cathéter était de 2,16 pour 100 mois-patients. Toutes les complications ont été prises en charge avec succès par des mesures conservatrices ou une réinsertion du cathéter, et aucun patient n'a nécessité un transfert définitif vers l'hémodialyse. Ces résultats suggèrent que, bien que les complications mécaniques soient fréquentes dans les programmes de DP nouvellement mis en place, elles peuvent être gérées efficacement grâce à une surveillance étroite et à des protocoles standardisés.

Mots-clés : Dialyse péritonéale, complications mécaniques, cathéter péritonéal, survie de la technique

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Introduction

Peritoneal dialysis (PD) is an effective treatment for patients with end-stage renal disease, based on the peritoneal membrane as a semi-permeable exchange surface [1]. In Tunisia, PD has been known since the early 1960s, when it was introduced as the first method of extrarenal purification, highlighting a long-standing but evolving experience with this technique [2].

Compared with hemodialysis, PD offers several advantages, including greater patient autonomy, flexibility in treatment schedules, and better preservation of residual renal function [3]. Nevertheless, its success depends on multiple factors, including patient training, prevention of infectious complications, and the proper function of the peritoneal dialysis catheter, with mechanical complications remaining a major source of morbidity, technique failure, and occasional conversion to hemodialysis [4].

Mechanical complications may also result from increased intra-abdominal pressure—leading to conditions such as hernias, hemoperitoneum, or hydrothorax—or from catheter-related issues, including dialysate leakage, migration, obstruction, or drainage failure. The incidence and types of these complications vary according to catheter insertion technique, center experience, patient characteristics, and the level of training of healthcare teams [4, 5].

The aim of this study was to describe the frequency, types, and management of mechanical complications in patients treated with peritoneal dialysis in a newly established Tunisian center, with particular emphasis on technique survival during the early phase of program implementation.

Material and Methods

Study Design and Population

We conducted a retrospective, single-center cohort study including all consecutive adult patients who initiated PD between October 1, 2022, and March 31, 2025. Patients with a follow-up period of less than three months were excluded.

Data Collection

Demographic and clinical data were obtained from medical records, including age, sex, underlying nephropathy, body mass index, duration of peritoneal dialysis, and time between catheter insertion and initiation of dialysis. Information regarding the occurrence, type, and management of mechanical complications was also collected.

Catheter Insertion Technique

All double-cuff Tenckhoff catheters were implanted by an experienced digestive surgeon under general or local anesthesia using a mini-laparotomy technique. In cases requiring catheter reinsertion or repositioning, a laparoscopic approach was used to allow direct visualization of the peritoneal cavity.

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Definition of Mechanical Complications

Mechanical complications were classified into two categories: catheter-related complications (catheter dysfunction), including migration, obstruction, drainage failure, and dialysate leakage; and other mechanical complications related to increased intra-abdominal pressure, including hernia, hemoperitoneum, and hydrothorax.

Mechanical complications were recorded regardless of their timing after catheter insertion, and both initial events and recurrences were included. Early complications were defined as those occurring within the first 30 days after catheter insertion, while late complications were defined as those occurring thereafter.

Statistical Analysis

Data were analyzed using a descriptive approach. Continuous variables were expressed as means with ranges, and categorical variables as numbers and percentages. No adjustment for confounding factors was performed, as the study was purely descriptive. Missing data were minimal and were not imputed. No comparative statistical analysis was performed between groups.

Results

Patient Characteristics

A total of 38 patients were included in the study. The mean age at initiation of peritoneal dialysis (PD) was 40.1 years (range 18–82). All patients were treated with automated peritoneal dialysis (APD), and the mean duration of PD therapy was 12.2 months.

The most frequent causes of end-stage renal disease were primary glomerulonephritis (26%) and diabetic nephropathy (23%).

During follow-up, 14 patients (37%) experienced at least one mechanical complication. The demographic and clinical characteristics of patients according to the occurrence of mechanical complications are summarized in *Table I*.

Table I. Baseline characteristics of patients according to the occurrence of mechanical complications

Characteristic	Patients without mechanical complication (N = 24)	Patients with mechanical complication (N = 14)
Mean age at PD initiation (years)	38, 6	42, 5
Gender		
- Male	16 (67%)	11 (79%)
- Female	8 (33%)	3 (21%)
Underlying nephropathy		
- Primary glomerulonephritis	8	5
- Diabetic nephropathy	6	4
- Chronic interstitial nephropathy	6	3
- ADPKD	0	1
- Other causes	4	1
BMI (kg/m²)	24, 5	23, 9
Delay between catheter insertion and first use (days)	10, 4	9, 5
Mean PD duration (months)	11, 5	13, 9

PD, peritoneal dialysis; ADPKD: autosomal dominant polycystic kidney disease; BMI, body mass index

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Mechanical Complications

1. Catheter dysfunction

Catheter dysfunction occurred in 12 patients (31.5%), with a mean delay of 167.5 days after catheter insertion (range 8–740 days). Only two events occurred within the first 30 days after catheter insertion, while most complications were observed during the late period.

Catheter migration was the most frequent cause of dysfunction, followed by intraluminal obstruction and drainage failure. The main causes of catheter dysfunction are detailed in Table II.

Table II. Causes of peritoneal dialysis catheter dysfunction

Cause of dysfunction	Number of cases
Catheter migration	6
Obstruction by fibrin or clot	2
Omental obstruction	1
Dialysate leakage	1
Drainage failure due to constipation	2
Total	12

Two episodes of drainage failure were secondary to constipation and resolved after laxative treatment. Overall, 10 patients required catheter replacement or reinsertion performed laparoscopically.

The overall incidence of catheter replacement or reinsertion was 2.16 per 100 patient-months. The mean time between catheter insertion and replacement or reinsertion was 217 days (range 25–780). Two patients required a second catheter replacement after a mean delay of 92.5 days.

2. Other mechanical complications

Other mechanical complications were less frequent. One case of hemoperitoneum of gynecological origin was observed and resolved with conservative management. No cases of hydrothorax were reported.

An inguinal hernia occurred in one patient after eight months of peritoneal dialysis and required surgical repair.

Importantly, no patient required permanent transfer to hemodialysis, and peritoneal dialysis technique survival was preserved in all patients during follow-up.

Discussion

The success of PD relies on the placement of a functional and long-lasting peritoneal catheter. Mechanical complications remain a major cause of catheter loss and technique failure [6]. In this retrospective study conducted in a newly established Tunisian PD center, mechanical complications occurred in 37% of patients, with catheter dysfunction being the most frequent event. Despite this relatively high incidence, PD technique survival was preserved, as no patient required permanent transfer to hemodialysis.

The overall rate of mechanical complications in our cohort is consistent with previously reported data, with frequencies generally ranging between 20% and 40% [7, 8]. Catheter dysfunction, particularly migration and obstruction, represents the leading cause of early and late technical

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failure in PD [9]. In this study, the overall incidence of catheter replacement or reinsertion was 2.16 per 100 patient-months. This incidence appears comparable to previously reported data, although variations exist depending on center experience and catheter insertion techniques [7]. Intraluminal obstruction caused by fibrin, clots, or epiploic adhesions was less frequent, while functional obstruction due to constipation was successfully managed with conservative treatment. For this reason, routine prevention and early treatment of constipation are recommended in PD patients, as bowel distension may displace the catheter tip and impair dialysate flow [3]. In our practice, preventive measures include systematic patient education, dietary advice to prevent constipation, and regular clinical monitoring of catheter function. Imaging is performed when dysfunction is suspected.

Catheter placement technique plays a critical role in preventing mechanical complications. In our center, initial catheter insertions were performed via mini-laparotomy, while laparoscopic techniques were reserved for reinsertion or repositioning, allowing direct visualization of the peritoneal cavity. This combined approach may have contributed to effective management of catheter-related complications. Published meta-analyses support laparoscopic insertion as associated with a lower risk of catheter migration and improved catheter survival at 12 and 24 months, compared with open surgery. Percutaneous insertion, often performed by nephrologists, has also shown comparable outcomes with fewer early peritonitis episodes and periprocedural complications [10].

Other mechanical complications were less frequent in our cohort. Dialysate leakage, hernia, and hemoperitoneum were rare and successfully managed with conservative or surgical treatment when required. Hernia formation is influenced by intra-abdominal pressure, which is affected by dialysate volume, exchange frequency, patient positioning, and individual anatomical factors [11,12]. This highlights the need for patient-specific preventive measures, particularly in individuals with prior abdominal surgery, weakened abdominal wall, or central obesity.
The implementation of peritoneal dialysis programs in resource-limited settings, particularly in African countries, is often challenged by limited infrastructure, variability in training, and restricted access to surgical expertise. In this context, the early phase of PD program development is considered critical, with a potentially higher risk of complications and technique failure [13]. Although data specifically focusing on mechanical complications in such settings remain scarce, several reports have highlighted the feasibility of establishing PD programs with acceptable outcomes when appropriate training, organization, and multidisciplinary collaboration are ensured [14].

This study has several limitations, including its retrospective design, small sample size, and relatively short follow-up period, which limit the generalizability of the results and preclude the identification of risk factors for mechanical complications. In addition, the single-center nature of the study and the absence of a comparative group further limit the external validity of our findings. Nevertheless, this work represents one of the first single-center Tunisian experiences focusing specifically on mechanical complications of PD in a newly established program.

Our findings emphasize that, even in resource-limited settings, PD can be successfully implemented with acceptable complication rates and preserved technique survival when appropriate surgical expertise, close monitoring, and multidisciplinary collaboration between nephrologists, surgeons, and PD nurses are ensured.

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Conclusion

Mechanical complications remain an important challenge in peritoneal dialysis, particularly during the early phase of newly established programs. Ensuring meticulous catheter insertion, early recognition of complications, and structured multidisciplinary follow-up is essential to maintain catheter function and preserve technique survival. Our experience supports the feasibility of developing peritoneal dialysis programs in emerging centers when appropriate surgical expertise and standardized management strategies are implemented.

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Authors' Contributions

Conceptualization: SH, HG

Data collection: SH, HG

Data analysis: SH

Manuscript drafting: SH

Manuscript revision: RG, MJ, RA, MK, AB

Final approval: All authors approved the final version of the manuscript.

Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki. Given the retrospective nature of the study and the use of anonymized data, formal ethical committee approval was not required according to institutional policy.

Conflicts of Interest

All authors have no conflicts of interest to declare.

Data availability

The data used are available from the author upon reasonable request.

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