
Peritoneal dialysis catheter in renal failure – a retrospective study

ORIGINAL ARTICLE

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Background

Peritoneal dialysis is a treatment option for patients with dialysis-dependent renal failure. The procedure requires insertion of a peritoneal dialysis catheter. The aim of the study was to review the use of this method at Oslo University Hospital, Ullevål, and to evaluate the quality of treatment.

Material and method

The study population consisted of patients who had a peritoneal dialysis catheter inserted for the first time at the hospital in the period 1 January 2017–31 December 2022 and were included in the Norwegian Renal Registry. Perioperative data and information on catheter viability were obtained from medical records and compared with international quality indicators.

Results

A total of 172 patients had a peritoneal dialysis catheter inserted during the study period. The median age at the time of surgery was 65 years (interquartile range 48–74), and 110 (64 %) were men. Hypertension and diabetes were the main causes of renal failure in 96 patients (56 %). A total of 167 catheter placements (97 %) were performed electively. The median postoperative hospital stay was 1 day (range 1–5 days). Within 30 days, exit-site infection was recorded in 18 patients (11 %) and peritonitis in six patients (4 %). Four patients (2 %) required reoperation within 30 days due to infection or bleeding. The cumulative proportion of viable catheters at 12 months was 81 %.

Interpretation

The incidence of complications following peritoneal dialysis catheter placement at Oslo University Hospital, Ullevål during the study period was largely comparable to international quality indicators, with the exception of a higher rate of exit-site infections.

Main findings

A total of 172 patients (64 % men) underwent peritoneal dialysis catheter insertion at Oslo University Hospital, Ullevål, in the period 2017–2022.

The main cause of renal failure in 56 % of cases was hypertension or diabetes.

Four patients required reoperation within 30 days due to infection or bleeding.

The cumulative proportion of viable catheters after 12 months was 81 %.

Chronic kidney disease (CKD) is a persistent reduction in kidney function due to various aetiologies. It is defined as established kidney damage or an estimated glomerular filtration rate (eGFR) below 60 ml/min/1.73 m² for at least three months [\(1\)](#). An eGFR below 15 ml/min/1.73 m² corresponds to stage 5 CKD, and these patients are considered for renal replacement therapy (dialysis or transplantation) [\(2\)](#). CKD affects an estimated 8–12 % of the global population, and its prevalence is increasing due to population ageing and lifestyle-related conditions such as obesity, diabetes and hypertension [\(3, 4\)](#). Despite early diagnosis and preventive treatment, some patients progress to dialysis-dependent renal failure. In Norway, roughly 550 new patients require renal replacement therapy annually [\(5\)](#).

Haemodialysis is typically performed in hospital, whereas peritoneal dialysis is carried out at home by the patient or care staff. Each modality has distinct advantages and drawbacks, and patients are involved in selecting the type of dialysis. Quality of life is generally higher for peritoneal dialysis patients compared with haemodialysis, with similar survival rates (6, 7). Peritoneal dialysis involves instillation of dialysate into the peritoneal cavity, using the peritoneum as a membrane to remove water, toxins, electrolytes and other molecules from the bloodstream (8). This requires a permanent indwelling peritoneal dialysis catheter.

Norway has one of the highest proportions of dialysis-dependent patients receiving peritoneal dialysis, just below the national target of 30 % (1, 5, 9). Successful catheter placement requires close collaboration between nephrologists and surgeons. This study aimed to evaluate quality parameters for peritoneal dialysis catheter insertion at Oslo University Hospital, Ullevål, and to compare outcomes with internationally recommended quality indicators (10).

Material and method

Patient population

The patient population consisted of patients over 18 years at Oslo University Hospital, Ullevål, who underwent first-time peritoneal dialysis catheter placement between 1 January 2017 and 31 December 2022 and had consented to inclusion in the Norwegian Renal Registry. Follow-up was 12 months post-surgery.

Data were extracted from medical records and included demographics (age, sex), clinical data (comorbidities, cause of kidney disease), perioperative details (surgical approach, postoperative course) and the subsequent treatment course (catheter reinterventions, conversion to haemodialysis, transplantation). Causes of renal failure were classified according to diagnoses reported in the Norwegian Renal Registry.

Surgical technique

At Oslo University Hospital, Ullevål, peritoneal dialysis catheters are traditionally inserted via laparotomy under local anaesthesia with sedation, but laparoscopic placement under general anaesthesia is also an option. Catheter function is tested by instilling 1000 ml of Ringer's acetate into the peritoneal cavity. Adequate function is defined as 700–800 ml draining promptly when the bag containing Ringer's acetate is placed on the floor, using the siphon effect (6).

Definitions

A catheter was considered viable at 12 months if it had not been removed, repositioned radiologically, or surgically revised due to mechanical dysfunction. Catheters removed for other reasons (e.g. transplantation, late infection (peritonitis or exit-site infection more than one month after placement), poor adherence, or patient preference) were considered viable (10) and were censored in the Kaplan–Meier plot.

Exit-site infection was recorded if medical records indicated purulent discharge at the catheter exit site, with or without erythema, accompanied by a positive bacterial culture with a relevant pathogen (10).

Peritonitis was recorded when at least two of the following were indicated in the medical records: clinical signs or symptoms consistent with peritonitis (abdominal pain and/or cloudy dialysate), elevated white blood cell count in the dialysate, or bacterial/fungal growth in the dialysate (10).

Crabtree et al. have developed widely used quality indicators for peritoneal dialysis catheter placement, including five clinical goals (see Table 1) (10).

The surgeon responsible for dialysis catheter placement was defined as the senior consultant present during the procedure. When more than one senior consultant was present, the primary surgeon was deemed responsible.

Statistics

Continuous variables are reported as median and interquartile range unless otherwise stated. The Wilcoxon rank-sum test was used to compare continuous variables, and categorical variables were compared using chi-square tests. Cumulative catheter viability was estimated using catheter survival tables and a Kaplan-Meier plot. Analyses were performed on available data, with percentages calculated accordingly. Data were analysed using SPSS version 29.

Ethics

The Norwegian Renal Registry is a national quality registry of all patients with stage 5 CKD who consent to inclusion. Coverage of patients receiving renal replacement therapy is nearly 100 %. This study was submitted to the data protection officer at Oslo University Hospital, Ullevål, who had no concerns relating to data protection in the project.

Results

A total of 207 catheter placements were recorded during the study period. Twenty-one patients underwent two placements, but only the first procedure was included. Four patients were under 18 years of age, four did not consent to inclusion in the Norwegian Renal Registry, and six were operated on at other hospitals or had incomplete documentation. These patients were excluded.

A total of 172 patients were thus included in the study: 110 men (64 %) and 62 women (36 %). The median age was 65 years (48–74) and the median body mass index (BMI) was 25 kg/m² (22–29). In 96/172 patients (56 %), hypertension or diabetes was the primary cause of renal failure. Median BMI was higher in men than in women ($p = 0.003$), and a higher proportion of women than men had undergone previous laparotomy ($p = 0.003$). Baseline patient characteristics are presented separately for men and women in Table 2.

Catheter placement was performed electively in 167 patients (97 %), and 170 patients (91 %) underwent open surgery. Thirteen cases of open surgery (8 %) were converted to laparoscopy, six of which were due to unsatisfactory perioperative catheter testing. Median surgery time was 57 minutes (45–70) for all procedures. All catheters were tested before completion, and 151 (88 %) were satisfactory.

Two of the 172 patients (1 %) sustained accidental bladder injuries, which were repaired with sutures. Catheters were placed as planned.

The median postoperative hospital stay was 1 day (1–5). Thirteen patients (8 %) underwent reoperation within 30 days due to catheter dysfunction or received a kidney transplant, while four (2 %) required reoperation for bleeding or infection. Exit-site infection occurred in 18 patients (11 %), and six (4 %) developed peritonitis (in some cases concurrent with exit-site infection) within 30 days of the procedure.

No significant correlation was found between previous transplantation or smoking status and the incidence of exit-site infection or peritonitis within 30 days. Peritonitis was more common in patients with an exit-site infection (3/18) than in those without (3/150) (incomplete data for four patients) ($p = 0.016$).

At 12 months, cumulative catheter viability was 81 % (Figure 1). During this period, 10/172 patients underwent image-guided catheter repositioning, which was successful in 2/10 (20 %). A total of 12/172 patients (7 %) underwent surgical repositioning in the same period, which was successful in 10/12 (83 %). Forty-one catheters were removed during the first year for reasons other than catheter failure, including kidney transplantation, late infection, or patient preference.

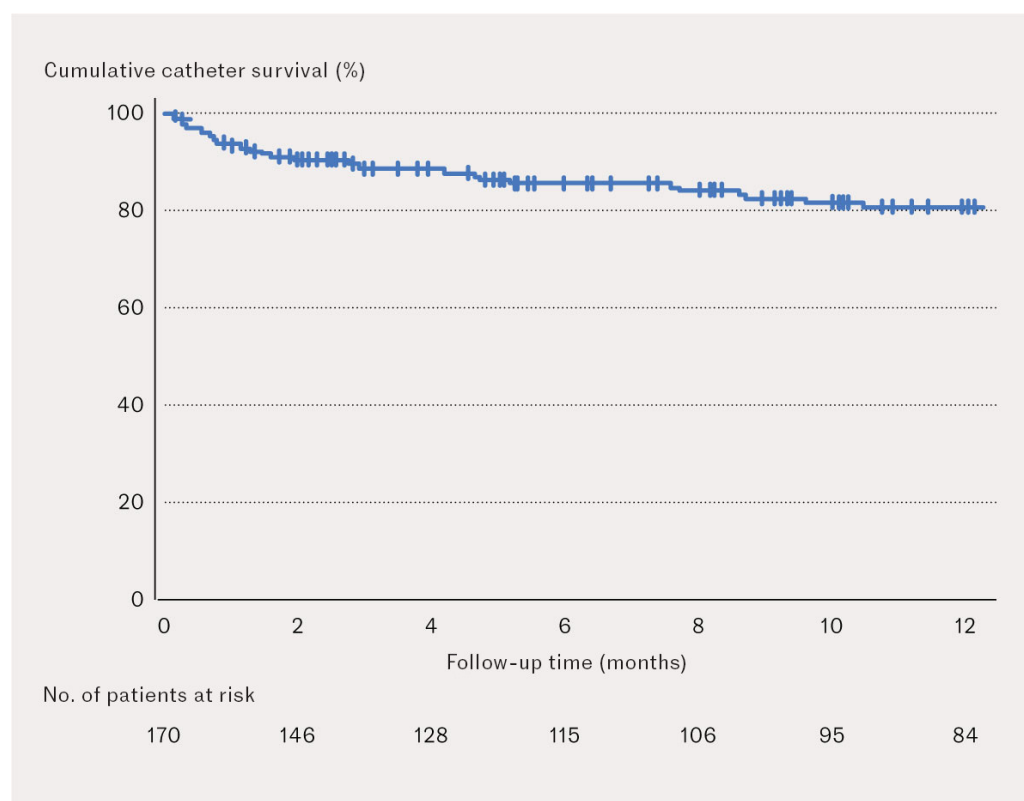


Figure 1 Twelve-month cumulative catheter survival in 172 patients who underwent peritoneal dialysis catheter placement at Oslo University Hospital, Ullevål, in the period 1 January 2017–31 December 2022. Catheter removals due to kidney transplantation, late infection, poor adherence, or patient request were censored.

Sixteen senior consultants were responsible for a median of 10 procedures each (1–28). A total of 78 senior consultants and specialty registrars participated in these operations during the study period.

Results are compared with quality indicators reported by Crabtree et al. (10) and are summarised in Table 1.

Discussion

In the cohort of 172 adults undergoing first-time peritoneal dialysis catheter placement at Oslo University Hospital, Ullevål, cumulative catheter survival, peritonitis incidence, hollow-organ injury, and bleeding were largely consistent with international quality indicators (10). However, the rate of exit-site infection was somewhat higher than the recommended indicator.

Within 30 days, 11 % of patients developed an exit-site infection, which exceeded the suggested threshold of 5 % (10). Although diagnostic criteria are clearly defined for exit-site infection, variability between treatment centres is inevitable, as assessments of erythema and secretion are subjective. Many more patients than those with a relevant exit-site infection are likely to have a positive bacterial culture from the site. Some patients may therefore receive a diagnosis based on colonisation and moderate clinical findings, while others may not be diagnosed even in the presence of infection. Other Norwegian studies indicate that exit-site infections are relatively common, particularly at later time points, with an incidence of approximately 20 % (11, 12).

Several measures are recommended to prevent early exit-site infection, the most important of which are maintaining a sterile surgical area postoperatively, avoiding premature dressing changes and keeping the exit-site incision as small as possible (10). Some treatment centres, including in Norway, subcutaneously 'bury' the catheter until it is needed in order to prevent bacterial exposure. Routine preoperative antibiotic prophylaxis to protect against *Staphylococcus aureus* is also recommended (10).

At Oslo University Hospital, Ullevål, 1 gram of cefazolin is administered intravenously perioperatively in patients with implanted catheters. In this study, no data were available on the type and timing of antibiotic prophylaxis received. Such information could have helped explain the somewhat high incidence of exit-site infections. Regardless of cause, the incidence of exit-site infections was higher than desirable, and efforts are underway to reduce it. Once the catheter cuff is embedded in subcutaneous tissue, the risk of progression to peritonitis decreases. Nevertheless, about 20 % of patients with exit-site infections develop peritonitis (13); a finding confirmed in this study, where a clear correlation was observed between exit-site infection and peritonitis.

At Oslo University Hospital, Ullevål, one-year cumulative catheter survival was 81 %. Crabtree et al. indicate a minimum survival of 80 % for open placement and 95 % for advanced laparoscopic placement (10). Advanced laparoscopic techniques allow visualisation of correct catheter positioning, lysis of adhesions and fixation of the omentum or sigmoid colon if needed, likely reducing the risk of catheter failure (10). Studies comparing different catheter placement methods (laparoscopic, percutaneous and open) report one-year survival of 80–90 % (14–18). Our results align with international studies, but increased use of laparoscopic placement may further improve one-year catheter viability. However, placement of peritoneal dialysis catheter under local anaesthesia is less burdensome for seriously ill patients than laparoscopic surgery under general anaesthesia and requires fewer anaesthesia resources.

Poor drainage from a peritoneal dialysis catheter may result from migration out of the pelvis, which can be confirmed by abdominal X-ray. In cases of catheter tip migration from the pelvis, radiological or laparoscopic repositioning can be attempted (19). Image-guided repositioning is often time-consuming and painful, and had a low success rate in our study. Laparoscopy requires general anaesthesia, but had a higher success rate in this study. It also allows fixation of the catheter toward the pelvis and the diagnosis and resolution of other issues affecting function. We therefore recommend considering laparoscopic repositioning as the first-line approach in cases of poor catheter function due to displacement.

In this cohort, two perioperative bladder injuries occurred, and one patient required perioperative blood transfusions. The recommended threshold for these complications, as proposed by Crabtree et al., is 1 %, which our findings were close to (10).

A total of 16 surgeons were responsible for the procedures in this study, with some only performing a few. Although the operation itself is technically straightforward, several critical steps influence both short and long-term outcomes (20). The number of procedures required to master an abdominal procedure and reach the learning plateau has been estimated at approximately 20–40 (21). At Ullevål Hospital, the annual volume of catheter insertions was around 30. To maintain case volume and quality, we streamlined the surgical workflow and limited procedures to a smaller team of surgeons.

A limitation of this study is its retrospective design, which relied on existing medical records, leading to incomplete information when key details were inadequately documented. To reduce confirmation bias, we used a predefined variable list for collecting data and performed random checks to verify ambiguous entries. Nevertheless, these factors may have affected the study's reliability and validity and should be considered when interpreting the results.

Strengths of the study include near-complete inclusion of all patients receiving a peritoneal dialysis catheter at one of Norway's largest treatment centres over a six-year period. The study also presents data from Norway, which is underrepresented in the literature (11, 12).

Conclusion

Peritoneal dialysis catheters inserted at Oslo University Hospital, Ullevål, in the period 1 January 2017–31 December 2022 generally functioned satisfactorily, and the incidence of complications was largely comparable to international quality indicators. However, the exit-site infection rate was somewhat higher than desirable. Continuous efforts are underway to improve this outcome and the safety of procedures.

The article has been peer-reviewed.

REFERENCES

1. Himmelfarb J, Vanholder R, Mehrotra R et al. The current and future landscape of dialysis. *Nat Rev Nephrol* 2020; 16: 573–85. [PubMed][CrossRef]

2. Chapter 1: Definition and classification of CKD. *Kidney Int Suppl* (2011) 2013; 3: 19–62. [PubMed][CrossRef]
3. Mills KT, Xu Y, Zhang W et al. A systematic analysis of worldwide population-based data on the global burden of chronic kidney disease in 2010. *Kidney Int* 2015; 88: 950–7. [PubMed][CrossRef]
4. European CKD Burden Consortium. CKD Prevalence Varies across the European General Population. *J Am Soc Nephrol* 2016; 27: 2135–47. [PubMed][CrossRef]
5. The Norwegian Renal Registry Annual Report 2023.
https://nephro.no/nnr/AARSRAPPORT_NNR_2023.pdf Accessed 22.9.2025.
6. Cameron JI, Whiteside C, Katz J et al. Differences in quality of life across renal replacement therapies: a meta-analytic comparison. *Am J Kidney Dis* 2000; 35: 629–37. [PubMed][CrossRef]
7. Waldum-Grevbo B, Leivestad T, Reisæter AV et al. Impact of initial dialysis modality on mortality: a propensity-matched study. *BMC Nephrol* 2015; 16: 179. [PubMed][CrossRef]
8. Teitelbaum I. Peritoneal Dialysis. *N Engl J Med* 2021; 385: 1786–95. [PubMed][CrossRef]
9. Norsk nyreregister. Kvalitetsmål. 27.11.2017.
https://www.nephro.no/nnr/NNR%20kvalitetsmaal_27-11-2017.pdf Accessed 22.9.2025.
10. Crabtree JH, Shrestha BM, Chow KM et al. Creating and Maintaining Optimal Peritoneal Dialysis Access in the Adult Patient: 2019 Update. *Perit Dial Int* 2019; 39: 414–36. [PubMed][CrossRef]
11. Bjune T, Kjellefold SA, Abedini S. Infections in Relation to Peritoneal Dialysis: An 11-Year Single Center Experience in Vestfold County, Norway. *HSOA J Nephrol Ren Ther* 2020; 6: 1–5. [CrossRef]
12. Debowski JA, Wærp C, Kjellefold SA et al. Cuff extrusion in peritoneal dialysis: single-centre experience with the cuff-shaving procedure in five patients over a 4-year period. *Clin Kidney J* 2017; 10: 131–4. [PubMed]
13. Sachar M, Shah A. Epidemiology, management, and prevention of exit site infections in peritoneal dialysis patients. *Ther Apher Dial* 2022; 26: 275–87. [PubMed][CrossRef]
14. Krezalek MA, Bonamici N, Kuchta K et al. Peritoneal dialysis catheter function and survival are not adversely affected by obesity regardless of the operative technique used. *Surg Endosc* 2018; 32: 1714–23. [PubMed][CrossRef]
15. Slavin M, Avital S, Einbinder Y et al. Considerations for Improved Technique Survival Following Insertion of a Peritoneal Dialysis Catheter. *Isr Med Assoc J* 2021; 23: 174–9. [PubMed]

16. Sakurada T, Kojima S, Yamada S et al. A multi-institutional, observational study of outcomes after catheter placement for peritoneal dialysis in Japan. *Perit Dial Int* 2023; 43: 457–66. [PubMed][CrossRef]
 17. Kang DH. Loosening of the mesothelial barrier as an early therapeutic target to preserve peritoneal function in peritoneal dialysis. *Kidney Res Clin Pract* 2020; 39: 136–44. [PubMed][CrossRef]
 18. Perakis KE, Stylianou KG, Kyriazis JP et al. Long-term complication rates and survival of peritoneal dialysis catheters: the role of percutaneous versus surgical placement. *Semin Dial* 2009; 22: 569–75. [PubMed][CrossRef]
 19. Wilkie M. Management of the Poorly Draining Peritoneal Dialysis Catheter. *Clin J Am Soc Nephrol* 2023; 18: 678–80. [PubMed][CrossRef]
 20. Wong LP, Liebman SE, Wakefield KA et al. Training of surgeons in peritoneal dialysis catheter placement in the United States: a national survey. *Clin J Am Soc Nephrol* 2010; 5: 1439–46. [PubMed][CrossRef]
 21. Jaffer U, Cameron AE. Laparoscopic appendectomy: a junior trainee's learning curve. *JSLs* 2008; 12: 288–91. [PubMed]
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Publisert: 25. November 2025. Tidsskr Nor Lægeforen. DOI: 10.4045/tidsskr.25.0059

Received 27.1.2025, first revision submitted 16.5.2025, accepted 22.9.2025.

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