Ref: Ro J Med Pract. 2024;19(1)
DOI: 10.37897/RJMP.2024.1.9

Outcomes and trends in continuous ambulatory peritoneal dialysis: a retrospective analysis at Najaf Centers (2014-2022)

Laith Fathi SHARBA[1], Yasir Fathi SHARBA[2], Mahmood Shaker JASIM[3], Nazar JASIM[4]

[1]Medical College, Jabir Ibn Hayyan Medical University, Najaf, Iraq
[2]Middle Euphrates Nephrology Center, Najaf Health Directorate, Najaf, Iraq
[3]Faiha Specialized Diabetes Endocrine and Metabolism Center, Basrah, Iraq
[4]Al-Gadeer Hospital, Najaf, Iraq

ABSTRACT

Introduction. *Continuous ambulatory peritoneal dialysis (CAPD) offers an alternative renal replacement therapy for patients with end-stage renal disease (ESRD), combining the benefits of mobility and a home-based treatment regime. Since its introduction at Najaf Center's Al-Sader Nephrology Center in 2011, techniques have evolved from open laparotomy to laparoscopic methods, starting officially in 2018. This study aims to evaluate patient outcomes, trends in CAPD techniques, and factors contributing to mortality.*

Methods. *This retrospective study collected data from 643 patients who initiated CAPD between 2014 and 2022 at Najaf Governate's three centers. The study focused on demographic data, technique survival, transitions to other dialysis modalities, patient outcomes, mortality, and trends and complications associated with various CAPD catheter insertion techniques (open laparotomy, percutaneous insertion, and laparoscopic). Out of these, 211 patients died, and 432 continued with CAPD or switched to other modalities. Twenty patients received a kidney transplant, 189 transitioned to hemodialysis and 130 remained on CAPD.*

Result. *Technique-wise, laparoscopic insertions showed higher patency rates and fewer early complications, while percutaneous insertions had higher instances of needing revisions, and open methods were most associated with infection complications. The technique success rate was highest for laparoscopic CAPD (79.5%), followed by percutaneous CAPD (45.6%) and open laparotomy (46.5%).*

Conclusion. *CAPD is a vital renal replacement therapy, yet it carries risks, including mortality. This study's insights into the causes of death, technique efficiency, and patient outcomes are crucial for enhancing patient care and clinical practices in CAPD. The shift from open laparotomy to laparoscopic techniques at Najaf Centers mirrors a broader trend in medical practice favoring minimally invasive procedures, which have shown better outcomes in this study.*

Keywords: CAPD, Najaf Centers, kidney transplant, laparoscopic CAPD, percutaneous CAPD, homedialysis

INTRODUCTION

CAPD is a renal replacement therapy for patients with renal failure, an alternative to hemodialysis [1]. CAPD has been recognized as a viable dialysis method for ESRD. It offers the convenience of mobility and a home-based treatment regime [2]. Since CAPD was introduced at Najaf Center in 2011 at Al-Sader Nephrology Center, the facility has evolved its practices from open laparotomy to laparoscopic techniques, which

Corresponding author:
Laith Fathi Sharba
E-mail: ayam.mohammad@yahoo.com

Article History:
Received: 14 February 2024
Accepted: 27 March 2024

officially started in 2018. This study aims to provide an overview of the patient outcomes, trends in CAPD techniques, and factors contributing to mortality.

METHODS

Data were retrospectively collected for patients who initiated CAPD between 2014 and 2022. The study included demographic data, technique survival, transitions to other dialysis modalities, and patient outcomes, including mortality. The techniques for CAPD catheter insertion (open laparotomy, percutaneous insertion, and laparoscopic) were also analyzed for their trends and associated complications.

RESULTS

Patient demographics and survival

A total of 643 patients were analyzed, with age distributions as follows: 1-13 years (121 patients), 14-29 years (92 patients), 30-44 years (110 patients), 45-64 years (194 patients), and more than 65 years (126 patients). Most of our patients in the last years underwent laparoscopic CAPD catheter insertion (Figure 1).

Comparison between various types of CAPD catheter insertion

Laparoscopic CAPD from 439 operations was all successful immediately, with 4 cases needing re-intervention within 30 days post-insertion, which was resolved by the second intervention. Laparoscopic CAPD was done for 439 patients 395 of them underwent omentopexy five with omentectomy; the rest left without because of not seen obviously, except in one case where redo was done after ten days because of a small part of omentum of the transverse colon where omentopexy was done in the second time. Suprapubic fixation was done for 340 and 45 with subcutaneous tunneling; the rest were left without. **Percutaneous CAPD** from 135 operations, 35 failed patency, and 10 underwent laparoscopic CAPD where omentum was found to be wrapped around the catheters. At the same time, the rest refused and sought other modalities. **Open laparotomy** from 69 cases all are patent immediately, with only six of them closed within the first month, two of six closed mechanically, and the remaining four with severe infection (Figure 2).

Surgical CAPD techniques

Open laparotomy insertions started early since 2011 before even being statistically recorded, then decreased from 20 in 2015 to 2 by 2021 and nil in 2022. Percutaneous insertions began at 8 in 2014, peaked at 37 in 2017, and stabilized at ten from 2018 to now, which is mainly used for hepatitis B or C +ve, where our hospital's policy prohibits laparoscopy. They, however, are sometimes used in highly comorbid patients who could not anesthetized by any means to undergo laparoscopy. Notably, laparoscopic insertions were absent until 2018, then rapidly increased to more than 100 patients yearly. Technique-wise, laparoscopic insertions demonstrated higher patency rates, whereas percutaneous insertions had higher instances of needing revisions. Open methods were most associated with infection complications.

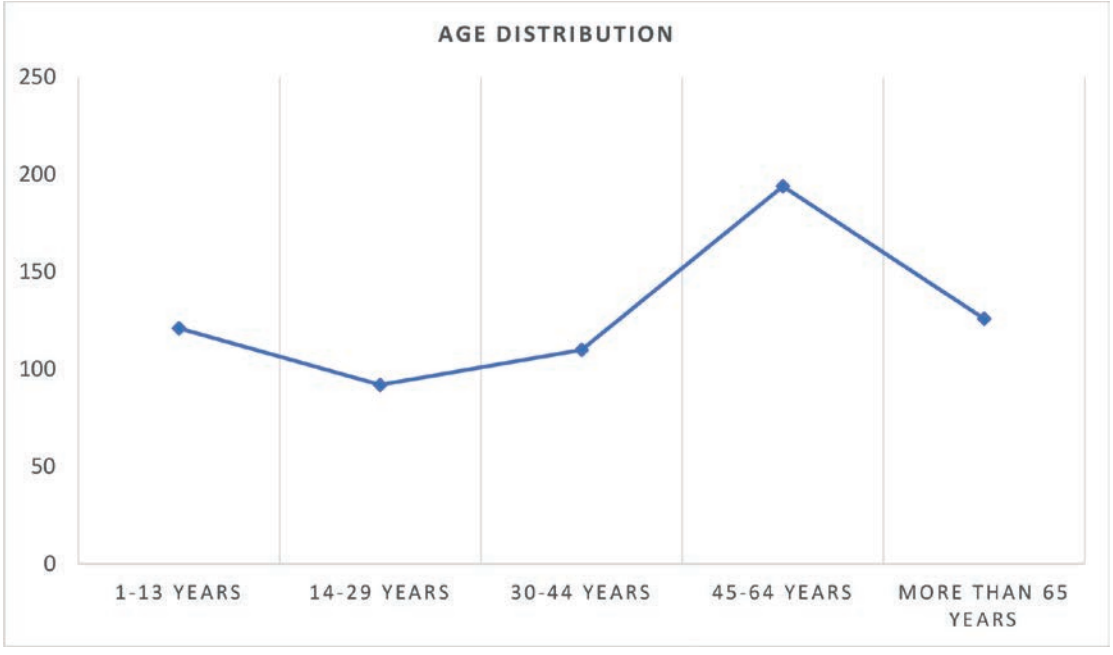

FIGURE 1. *Age group distribution*

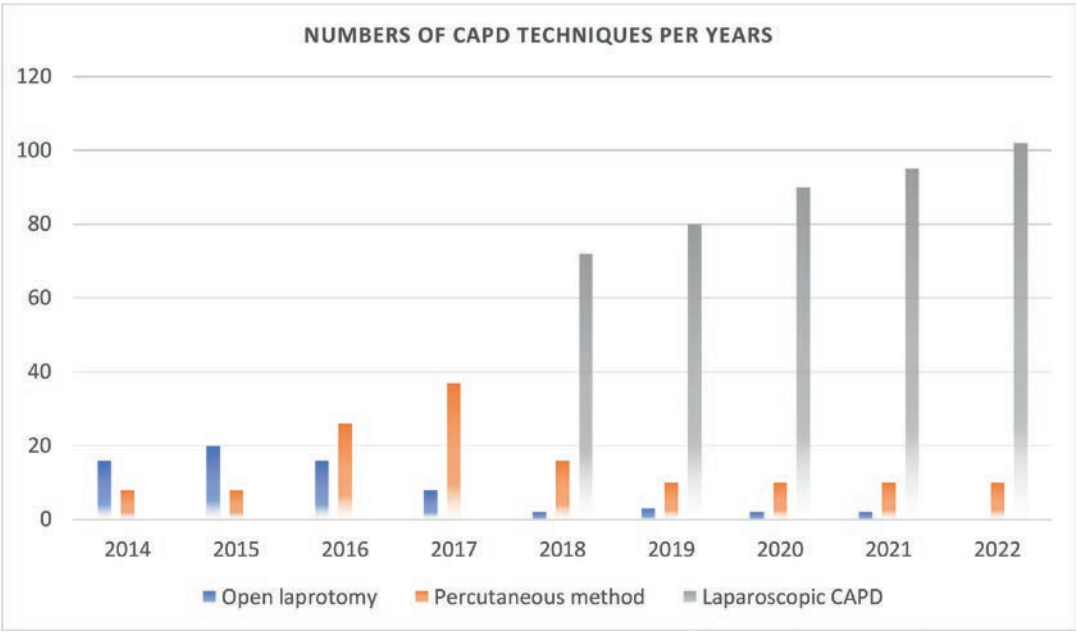

FIGURE 2. *CAPD distribution in relation to years*

Surgical laparoscopic technique

The surgical procedure commenced after administering anesthesia and marking the site for catheter insertion. The initial step involved creating an incision in the left upper quadrant, typically utilizing a 10 mm port to introduce a camera. Occasionally, a Veress needle was employed to insufflate the abdomen, particularly in awake patients, to reduce dyspnea. This was done to a minimal extent. A 5 mm port was also established on the left side, positioned approximately one-third of the distance above the midpoint between the catheter exit site and the symphysis pubis. The preparation of the abdominal cavity for catheter insertion involved several steps: Adhesiolysis, omentopexy, omentectomy, and occasionally, suprapubic catheter fixation to prevent future migration. A vertical incision, measuring approximately 7 cm, was made at the predetermined site for the catheter inlet. Depending on availability, either an introducer sheath or a 7.5 mm port was used. Following the procedure, the catheter was flushed with heparinized saline to ensure optimal functionality before closing the surgical site.

Anesthesia

In the realm of anesthetic practice for patients who underwent laparoscopic CAPD, the following stratification is proposed for patients based on age, physical status, and specific contraindications:

1. General Anesthesia for Patients Below 50 Years: For patients under 50 years who exhibit no contraindications to general anesthesia (GA), it is feasible to administer GA, albeit with reasonable modifications to the dosing regimen.
2. Deep Sedation for Patients Below 50 Years Unfit for GA: In cases where patients under 50 years are deemed unsuitable for GA, the administration of deep sedation while maintaining spontaneous respiration is a viable alternative.
3. Spinal Anesthesia for Non-Muscular or Non-Obese Patients Above 50 Years: For patients exceeding 50 years of age who are neither muscular nor obese, spinal anesthesia in conjunction with sedation is an appropriate approach.
4. If patients are unfit for spinal anesthesia, a unique formula of deep sedation with local anesthesia can be done. This regimen is tailored to each patient's individual characteristics and medical needs.
5. Cardiac echo study was done for all patients with more than 40 years preoperatively, as patients with a history of a heart problem at any age; EF plays an essential role in our decision about the kind of anesthesia.

This framework underscores the necessity for a patient-specific approach in anesthetic management, emphasizing the importance of individual medical history, physical status, and diagnostic evaluations in informing anesthetic choices.

The fate of CAPD patients

Among these, 211 patients died, and the remaining 432 were either still on CAPD or had transitioned to another modality. Twenty patients received a kidney transplant, 189 transitioned to hemodialysis, and 130 continued CAPD in our center with a reportedly good quality of life. The remaining 93 transfers will be followed in newly established centers in their governorate (Figure 3).

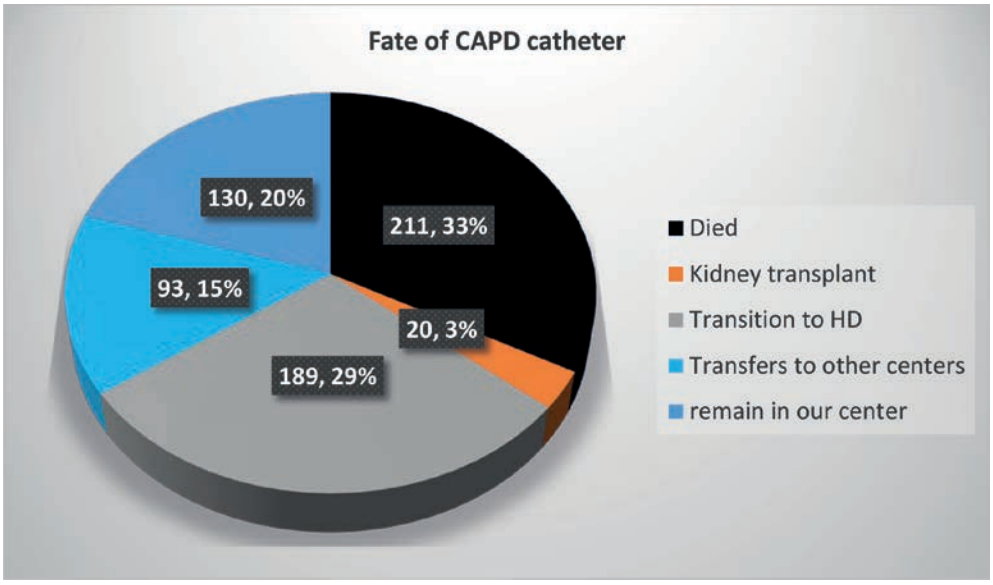

FIGURE 3. *The fate of CAPD catheter*

Most of our patients underwent laparoscopic CAPD catheter insertion because of its higher rate of patency and lower need for redo intervention because of dysfunction in the early post-insertion period within the first 30 days.

- **Early complications (within 30 days):**
  A. Patency: early closure is around 1% in laparoscopic CAPD, so patency is about 99%, while in the percutaneous method, it is 38.5%, and patency is 61.5%. However, open laparotomy is 11.5%, and patency is 88.5%.
  B. Infection and Migration of catheters not seen in all types of surgical insertion
- **Late complications (after 30 days):** infection, migration, obstruction and fluid leakage. (Table 1)
- **Catheter survival at one year:** follow-up of patients extends from at least one-year post insertion (minimum follow) up to more than 13 years (before cases were recorded routinely at the specialized center and still being followed)

Technique success rate: Laparoscopic CAPD 79.5% vs. Percutaneous CAPD 45.6% vs. Open laparotomy 46.5% (Figure 4).

Causes of death

CAPD is an essential renal replacement therapy, yet, like any medical procedure, it carries associated risks, including mortality. Investigating and comprehending the causes of death following CAPD insertion is imperative to enhance patient care and clinical practices. This scientific note delves into the analysis of causes of death, highlighting specific data. Other Causes: A diverse range of different reasons led to the demise of 36 patients. This category encompasses various factors, such as infections, procedural complications, and comorbid conditions that might not fit into the categories mentioned earlier. Further analysis is required to delineate the specific nature of these causes and develop strategies to mitigate the (Figure 5).

DISCUSSION

Our study's findings at Najaf Centers align with the global trends highlighted by Li and Chow. They emphasize the evolving landscape of CAPD, noting its increasing adoption in various parts of the world. This mirrors our observation of rising CAPD usage in Najaf, which

TABLE 1. *The complications in this study*

Type of intervention	Infection sites	Catheter migration	Fluid leakage	Obstruction Peritonitis	Total
Open laparotomy	15(21.7%)	10(14.5%)	8(11.6%)	30(43.5%)	63(91.3%)
Percutaneous CAPD	30(22.2%)	35(25.9%)	2(1.48%)	60(44.4%)	127(94%)
Laparoscopic CAPD	50(11.38%)	52(11.84%)			
0% with fixation	60(13.7%)				
Only 2(0.5%)	90(20.5%)	252(57.4%)			
Total	95(14.8%)	97(15%)	70(10.9%)	180(28%)	442(68.7%)

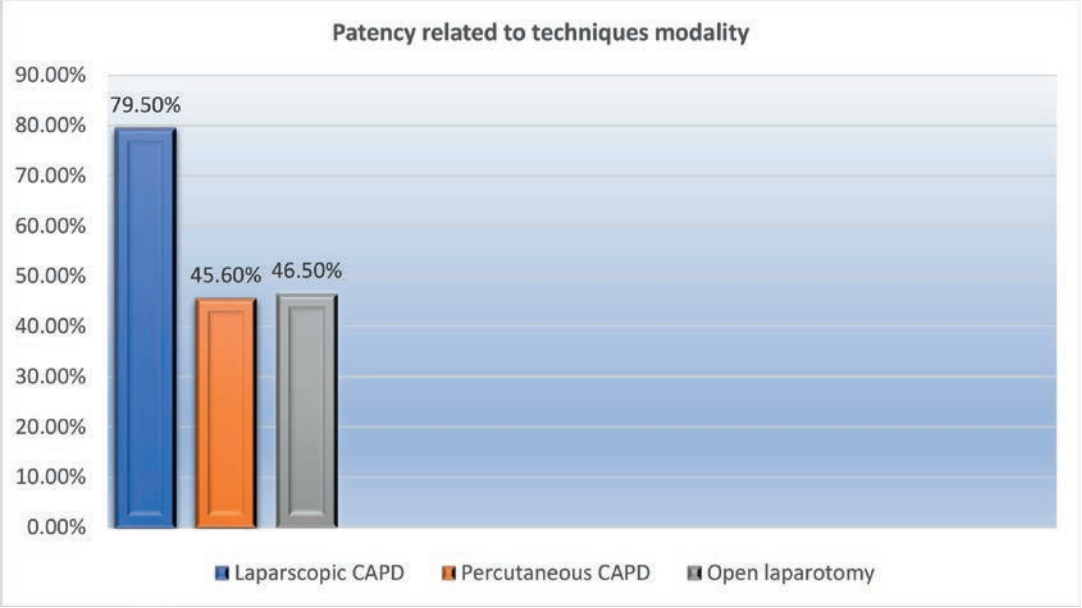

FIGURE 4. *The patency in relation to modalities*

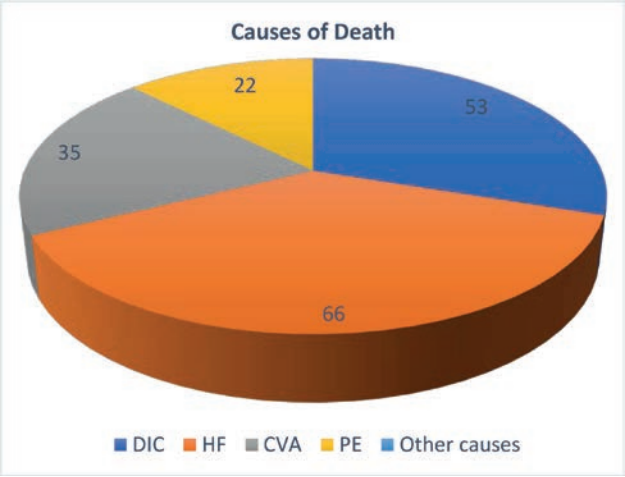

FIGURE 5. *Death causes in this study*

suggests a global shift towards this modality. The future of CAPD, as projected by Li and Chow, also resonates with our study's implications, particularly in terms of technological advancements and procedural innovations that could enhance patient outcomes and technique survival [2].

A study by Kavanagh and colleagues provides similar results to our study in that their analysis of the United States Renal Data System and literature show the difference in understanding the modality and longevity of renal failure patients. Compared to our findings, CAPD, while growing in popularity, still competes with hemodialysis. As discussed by Kavanagh et al., the longevity of these modalities needs continued research and improvement in CAPD techniques to ensure its viability as a long-term treatment option [3].

Our study's focus on catheter insertion techniques and associated complications finds a broader perspective in the work of Htay and colleagues. Their systematic review of catheter type, placement, and infection prevention strategies is crucial in understanding the global variations in CAPD practice. The findings of Htay et al. suggest that the choice of catheter and insertion technique significantly impacts infection rates and patient outcomes. This is particularly relevant to our study, highlighting the importance of optimizing catheter insertion techniques at Najaf Centers to align with global best practices [4].

An analysis done by Leung and Li to compare CAPD and hemodialysis modalities in treating renal failure is instrumental in placing our findings within a larger framework. Long-term outcomes, complications, and patient survival were the main lines of their study, which are nearly similar to our study; however, comparison with hemodialysis shows that there is completion rather than competitive measure and helps patients decide which modality suits them [5].

Our local work in the Najaf center shows comparable results to other advanced and sophisticated centers in developed countries regarding techniques [6-11]; however, our large numbers of cases create unique ways to modify routes and deal with complications. Although laparoscopic CAPD improves patency and decreases complications in our study and other studies [12,13]. Other techniques are still widely used and have a place in CAPD catheter insertion despite decreasing numbers compared to the laparoscopic one [14-16].

This study highlights several key findings:

1. **Increasing Adoption of CAPD:** Our data reflects a growing trend in the adoption of CAPD at Najaf Centers. This mirrors global trends, suggesting a broader shift in preference towards CAPD as a viable dialysis modality.

2. **Technique Survival and Patient Outcomes:** The study underscores the importance of technique survival in CAPD, particularly emphasizing catheter insertion methods. Our findings reveal that specific insertion techniques and post-procedural care significantly impact patient outcomes, including infection rates and overall technique efficacy.
3. **Compare to Hemodialysis modality:** Our study contributes to looking for the most suitable modalities for patients with renal failure. Although both have advantages, CAPD in our research will grow further to improve patients' lifestyles.
4. **Continue Research and Instrumental improvement:** Our study shows an increasing need for manufacturer improvement in catheters and tools to improve the insertion technique and decrease fluid leakage and infections with the ability to involve a wide range of patients, which previously could not have been done.
5. **Training program and continued family education and practicing:** Our center training program for a two-week intensive course, in addition to the constant connection to net media and monthly one-visit schedule, play an important role in longevity and improving the lifestyle of patients by encouraging patients to choose the suitable modality for his life and social media.

CONCLUSION

Our retrospective analysis at Najaf Centers, spanning from 2014 to 2022, provides significant insights into the practice, outcomes, and trends of CAPD in a specific regional context.

Our study at Najaf Centers shares valuable data and parameters at a global level, and we wish to change the guidelines of renal failure centers and some nephrologists who are still fighting to use CAPD modality as only a part of hemodialysis.

We hope we convince doctors and patients to use this modality as number one or at least equally with hemodialysis. We are invested in guiding its development and ensuring it remains a beneficial treatment option for patients with renal failure worldwide.

Acknowledgments:
We also appreciate the hard work of our staff of the Najaf Centers for their participation in this study, and we thank our patients for their cooperation in providing missing pieces of information.

Conflict of interest: none

Funding support: none

Disclosure: none

REFERENCES

1. Vonesh EF, Snyder JJ, Foley RN, Collins AJ. Mortality studies comparing peritoneal dialysis and hemodialysis: What do they tell us? *Kidney Int Suppl.* 2006 Nov:(103):S3-11. doi: 10.1038/sj.ki.5001910
2. [Relevant literature on CAPD outcomes and techniques] Li PK, Chow KM. Continuous ambulatory peritoneal dialysis (CAPD): Its current status and future. *Am J Kidney Dis.* 2017;69(5):675-88.
3. Kavanagh NT, Schiller B, Saxena AB, Thomas CP, Kurella Tamura, M. Modality longevity and trends in end-stage renal disease: A review of the United States Renal Data System and published literature. *Clin J Am Soc Nephrol.* 2021;16(2):287-297.
4. Htay H, Johnson DW, Wiggins KJ, Badve SV, Craig JC, Strippoli GFM, Cho Y. Catheter type, placement and insertion techniques for preventing peritoneal dialysis-related infections. Cochrane Database Syst Rev. 2018;4:CD005680.
5. Chow KM, Szeto CC, Law MC, Wong TY, Leung CB, Li PK. The long-term outcomes of patients on continuous ambulatory peritoneal dialysis and hemodialysis. *Clin J Am Soc Nephrol.* 2018;3(3):889-97.
6. Brown EA, Blake PG. The spectrum and scope of peritoneal dialysis (PD) in the 21st century: A systematic review of outcomes. *Kidney Int.* 2019;96(3):593-608.
7. Zhou Y, Yang Q, Xie X, Xue J. Surgical techniques and interventions for peritoneal dialysis catheter placement to manage end-stage renal disease: A global perspective. *J Nephrol.* 2020;33(1):9-16.
8. Figueiredo AE, Bernardini J, Bowes E, Hiramatsu M, Price V, Su C et al. A syllabus for teaching peritoneal dialysis to patients and caregivers. *Perit Dial Int.* 2016;36(6):592-605. doi: 10.3747/pdi.2015.00277
9. Mehrotra R, Devuyst O, Davies SJ, Johnson, DW. The current state of peritoneal dialysis. *J Am Soc Nephrol.* 2016;27(11):3238-52. doi: 10.1681/ASN.2016010112
10. See EJ, Hedley J, Agar JWM. Long-term outcomes in patients undergoing peritoneal dialysis: A comparative analysis of peritoneal dialysis catheter insertion techniques. *Perit Dial Int.* 2020;40(4):361-9.
11. Gupta S, Wadhwa NK, Bukhari SS. Comparison of survival outcomes between peritoneal dialysis and hemodialysis: A systematic literature review. *Int Urol Nephrol.* 2017;49(5):857-70.
12. Tullavardhana T, Akranurakkul P, Ungkitphaiboon W, Songtish D. Laparoscopic versus open peritoneal dialysis catheter insertion, the first randomized controlled trial. *Surg Endosc.* 2016;30(9):3821-8.
13. Crabtree JH, Burchette RJ. Effective use of laparoscopy for long-term peritoneal dialysis access. *Am J Surg.* 2009;198(1):135-41. doi: 10.1016/j.amjsurg.2008.10.019
14. Perl J, Wald R, McFarlane P, Bargman JM, Vonesh E, Na Y, Jassal SV, Jain AK. Hemodialysis vascular access modifies the association between dialysis modality and survival. *J Am Soc Nephrol.* 2011;22(6):1113-21. doi: 10.1681/ASN.2010111155
15. Oliver MJ, Quinn RR, Richardson EP, Kiss AJ, Lamping DL, Manns BJ. Home care assistance and the utilization of peritoneal dialysis. *Kidney Int.* 2007;71(7):673-8. doi: 10.1038/sj.ki.5002107
16. Woodrow G, Turney JH, Brownjohn AM. Technique survival and technique failure in peritoneal dialysis patients: The influence of age and gender. *Perit Dial Int.* 1997;17(6):544-50.