ORIGINAL ARTICLE

A Prospective Follow-up Observational Study of Laparoscopic Insertion of CAPD Catheters as a Modality of Management of End-stage Renal Disease (CKD – Stage V)

Taskeen M Sikora[1], Ravi V Patel[2], Satish J Deshmane[3], Shrinivas Ambike[4]

Received on: 27 June 2022; *Accepted on*: 20 February 2023; *Published on*: 11 January 2024

Abstract

Aim: To study benefits and complications of continuous ambulatory peritoneal dialysis (CAPD) catheter placement laparoscopically with suture fixation technique.

Patients and methods: A total of 41 cases of end-stage renal disease [chronic kidney disease (CKD) – Stage V] were admitted in Jehangir Hospital, Pune. Patients were evaluated, after explaining the procedure, the risks and benefits they were prepared for the procedure. Patients were assessed for complications and mortality as well as the reason for discontinuation of CAPD.

Results: Of 41 cases studied, 39 (95.2%) had CAPD started, in 1 (2.4%) CAPD was not started and 1 (2.4%) did not have CAPD inserted. Of 41 cases studied, 28 (68.3%) had CAPD continued successfully for 2 years. Of 41 cases studied, 4 (9.8%) had catheter outflow block, 4 (9.8%) had peritonitis, 6 (14.6%) had ultrafiltration failure, 3 (7.3%) had exit site leak, 1 (2.4%) had catheter malposition/kinking, none had incisional hernia, 2 (4.9%) had hemoperitoneum. A total of 10 patients (24.4%) had catheter removed at the end of the study.

Conclusion: Approximately, 68% of patients, that is 28 patients out of 41 continued CAPD for 2 years after the catheter was inserted laparoscopically. Out of the 41 patients, 20 patients developed minor complications. Out of the 20 patients, 10 patients developed major complications and needed the catheter to be removed. Mortality was 9.8%, out of which two patients died of sepsis and 2 died of comorbidity-related complications.

Clinical significance: Laparoscopic CAPD catheter placement is an effective method and has good success rate with less complications and better patient tolerability.

Keywords: Continuous ambulatory peritoneal dialysis catheter, Laparoscopic, Tenckhoff catheter.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1593

Introduction

The deciding factors for choosing the type of renal replacement therapy is a critical point in decision making for end-stage renal disease (ESRD) patients and the different factors like age of the patient, comorbidities, ability to perform the procedure plays a significant role in patient's choice for either peritoneal dialysis or hemodialysis (HD). Both HD and continuous ambulatory peritoneal dialysis (CAPD) are the main modalities of treatment for ESRD patients. Continuous ambulatory peritoneal dialysis has emerged as a new era in the management of ESRD. Popovich et al.,[1] in their study, very simply described that CAPD uses the process where peritoneal dialysate fluid is present continuously (24 hours a day, 7 days a week) in the peritoneal cavity except for periods of drainage and fresh solution insertion 3–4 times per day. After every peritoneal dialysis cycle, all the tubing are disconnected and a cap is applied over the catheter tip. Patient can resume all his routine activities after that. Continuous ambulatory peritoneal dialysis has many social advantages like simple technique, no electrical equipment requirements, can be done at home, can be used even while long distance travel and an overall reduction in cost and many medical advantages, such as an increased weekly clearances of small and medium molecules, some dietary and fluid restrictions, and decrease in thirst, anemia and hypertension.[2] A successful peritoneal dialysis program depends on the properly positioned CAPD catheter which can be executed either by open surgical, or laparoscopic placements or percutaneously. In recent times, laparoscopic surgery has become first choice in peritoneal catheter placement with many techniques. Mechanical outflow obstruction is a major complication of post-PD catheter insertion probably due to catheter tip migration or by catheter kinking, seen in 4–34.5% of open surgical technique and 4.5–13% in laparoscopically inserted.[3–5]

[1–3]Department of General Surgery, Jehangir Hospital, Pune, Maharashtra, India

[4]Department of Nephrology, Jehangir Hospital, Pune, Maharashtra, India

Corresponding Author: Ravi V Patel, Department of General Surgery, Jehangir Hospital, Pune, Maharashtra, India, Phone: +91 8390986055, e-mail: dr.ravi1211@hotmail.com

How to cite this article: Sikora TM, Patel RV, Deshmane SJ, *et al*. A Prospective Follow-up Observational Study of Laparoscopic Insertion of CAPD Catheters as a Modality of Management of End-stage Renal Disease (CKD – Stage V). World J Lap Surg 2023;16(3):133–136.

Source of support: Nil

Conflict of interest: None

Patients and Methods

Study Type

Prospective follow-up observational study.

A study of 41 patients diagnosed with ESRD [chronic kidney disease (CKD) – Stage V], requiring renal replacement therapy

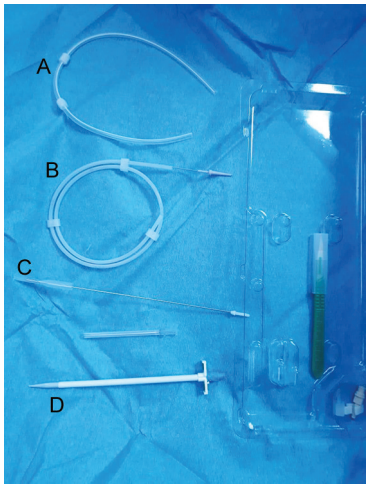

Fig. 1: Continuous ambulatory peritoneal dialysis (CAPD) catheter kit – A, CAPD catheter; B, Guidewire; C, Trocar; D, Sheath

in the form of CAPD and the CAPD catheter being inserted laparoscopically was conducted in our institute. It is a prospective follow-up study during the time period May 2019 to Dec 2020. The study also included patients in whom CAPD catheter was inserted 6 months before the commencement of our study but were fitting in our inclusion criteria. Inclusion criteria being, those with ESRD (CKD – Stage V), those who were compatible to undergo laparoscopic insertion of CAPD catheters and those whose age was >20 years. Exclusion criteria being, age >80 years, patients who don't need long-term dialysis, those with active peritonitis and those in whom CAPD catheter insertion beyond 2 years follow-up.

Statistical Methods

The data on categorical variables are shown as *n* (% of cases) and the data on continuous variables are shown as mean ± standard deviation (SD). As this study is a non-comparative observational only study, we didn't analyze the distributions of several categorical variables. The data were statistically analyzed after arranging it in MS Excel. All results are shown in both tabular and graphical format for better understanding of the frequency distributions of variables. The statistical analysis is done by using Statistical Package for Social Sciences (SPSS ver 22.0, IBM Corporation, USA) for MS Windows.

Criteria of Assessment of Outcome

- The benefits—patient has the benefit of doing dialysis at home, easy to self-usage and less expensive.
- Complication details—peritonitis, catheter block.
- Indications of replacement of catheter—catheter migration, catheter block, and kinking.

In our study, we used laparoscopic Tenckhoff catheter implantation (LTCI) technique. In many studies, the surgical technique involved was suture fixation with omentopexy. In our technique, we only used suture fixation without omentopexy. We used two trocar techniques (10 and 5 mm) (Figs 1 and 2).

Results

Results were considered on factors such as distribution of age, sex, comorbidities, previous operative history, CAPD catheter-related characteristics and complications, incidence of switching over to HD, incidence and cause of mortality and their association with comorbidities.

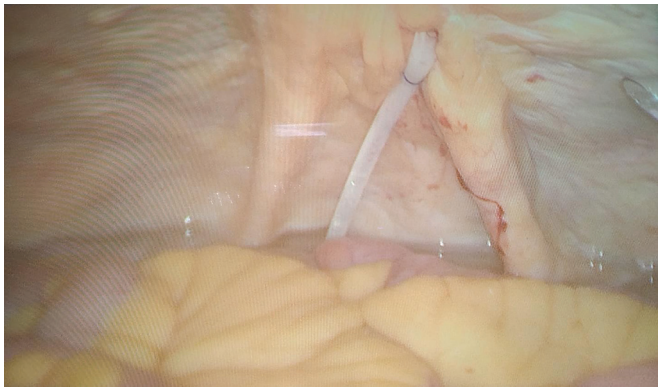

Fig. 2: Catheter fixation using polypropylene suture

Of 41 cases studied, 3 (7.2%) had age less than 50 years, 9 (22.0%) had age between 50 and 59 years, 18 (43.9%) had age between 60 and 69 years, 9 (22%) had age between 70 and 79 years, 2 (4.9%) had age of 80 years in the study. The mean ± SD of age of cases studied was 63.8 ± 10.1 years and the minimum–maximum age range was 32–80 years. In this study group, 28 (68.3%) were male and 13 (31.7%) were female with male to female sex ratio being 2.15:1.00. Of 41 cases studied, 1 (2.4%) had no co-morbidity, 2 (4.9%) had diabetes, 13 (31.7%) had hypertension, 17 (41.5%) had both diabetes and hypertension, 3 (7.3%) had hypertension and ischemic heart disease and the rest 5 (12.2%) had diabetes, hypertension and ischemic heart disease. A total of 25 (61.0%) out of 41 patients had no history of previous surgery out of which for 1 (0.2%) patient CAPD could not be started after insertion as patient had cardiac arrest and expired, the rest 24 (58.5%) had CAPD done for more than 1 year without any complications. Out of the 16 (39%) who had undergone previous surgery, in 1 (0.2%) patient, the CAPD catheter could not be inserted due to adhesions, 15 (36.6%) out of 41 patients had CAPD for more than 1 year without complications out of which 4 (26.6%) patients could not complete dialysis for 2 years due to complications, the rest 10 patients (66.6%) completed 2 years of successful CAPD. Out of 41 patients, 39 (92.5%) had CAPD for more than 1 year, 28 (68.3%) completed 2 years of CAPD. The complications were recorded and it was found that of the 41 cases studied, 4 (9.8%) had catheter outflow block, 4 (9.8%) had peritonitis, 6 (14.6%) had ultrafiltration failure, 3 (7.3%) had exit site leak, 1 (2.4%) had catheter malposition/kinking, none had incisional hernia, 2 (4.9%) had hemoperitoneum, and 10 (24.4%) had catheter removed at the end of the study (Tables 1 and 2).

Of 41 cases studied, 12 (29.3%) switched over to HD. The rate of mortality was 9.8% (4 out of 41). Of the 4 cases who expired, 2 (50.0%) expired due to cardiac arrest, 1 (25.0%) expired due to septic shock (non-CAPD catheter-related) and 1 (25.0%) expired due to peritonitis and septic shock (CAPD catheter-related).

Discussion

Studies done earlier suggest the benefits of laparoscopic PD catheter insertion technique against open method, the advantages of laparoscopy being high catheter acceptance >1 year, reduced catheter migration, better patient convenience and reduced morbidity.[6] The first year failure-free rate of the CAPD catheter was

Table 1: Distribution of CAPD catheter-related characteristics in the study group

Characteristics	*No. of cases*	*% of cases*
CAPD started		
Yes	39	95.2
Not started	1	2.4
Not inserted	1	2.4
CAPD done for >1 year		
Yes	39	95.1
NA	2	4.9
CAPD done for >2 years		
Yes	28	68.3
No	11	26.8
NA	2	4.9
CAPD discontinued within 2 years		
Yes	10	24.4
No	29	70.7
NA	2	4.9

NA, not applicable as CPD was not inserted or not started

Table 2: Distribution of CAPD catheter-related complications in the study group

Complications	*No. of cases*	*% of cases*
Catheter outflow block		
Yes	4	9.8
No	36	87.8
NA	1	2.4
Peritonitis		
Yes	4	9.8
No	36	87.8
NA	1	2.4
Ultrafiltration failure		
Yes	6	14.6
No	34	82.9
NA	1	2.4
Exit site leak		
Yes	3	7.3
No	37	90.2
NA	1	2.4
Catheter malposition/kinking		
Yes	1	2.4
No	39	95.1
NA	1	2.4
Incisional hernia		
Yes	–	–
No	41	100
Hemoperitoneum		
Yes	2	4.9
No	39	95.1
Catheter removed		
Yes	10	24.4
No	31	75.6

NA, not applicable as CAPD was not inserted or not started

80.8% as studied by Khanna et al.[2] In our study, we found 95.2% patient had CAPD catheter for >1 year.

Age and Sex Distribution of Cases Studied

In a study conducted by Öğünç[7] the mean age was 46 years. There was no morbidity or malfunction in CAPD during the follow-up from 20 days to 9 months. In the study conducted by us, the mean age was 63 years. Fenton's data from the Canadian registry are unique in that they describe a lower mortality in PD patients than in HD, for all age ranges.[8]

Comorbidities

Malberti et al. published data from the Lombardy Registry that was dedicated to elderly people. In this study, mortality risk was higher in PD than in HD (RR 1.31), but they recognized that comorbid conditions have less survival. They found a similar hospitalization rate, and they suspected that this result may involve a hidden negative selection of patients for PD.[9]

In this study, 41% of the patients had comorbid conditions, and of the 41 cases, selected 90.2% survived till the period of study with 30 having complications. In this study, comorbid conditions did not reduce survival.

Complications

In this study, we found 9.8% incidence of catheter outflow block against Khanna et al. who found 10 (30%) cases of catheter plugging.[2]

In a series by Khanna et al., they observed that in 132 patients, CAPD was discontinued in 48 patients (36.4%), 14 died (10%) and the remaining 70 were still on CAPD. In this study, the rate of discontinuation was 24.4% (10 patients), mortality rate was 9.8% (four patients).[2]

In this study, conversion rate from PD to HD was 29.3% (12 patients out of 41) which is comparable with the study conducted by Jaar et al.[10] who observed 24.8%.

In our patient, we experienced 7.3% of peri catheter leak which correlates with the finding reported by Ma et al.[6] which was 7.4% incidence.

Complications of CAPD catheter can be either infectious or mechanical. Chances of infections (tunnel site as well as exit site) after laparoscopic CAPD catheter insertion are less common than open procedure.[11] In different studies, the incidence of infection was differed, however, our 14.7% incidence was comparable to the data reported by Öğünç et al. (19%).[12] Post-CAPD catheter insertion, peritonitis pose a major concern. Even though there is availability of various disconnect systems, the severe infections like *Staphylococcus aureus, Pseudomonas* sp., and fungal infection still account a major problem. However, we could eliminate the episodes of mild peritonitis with this disconnect systems. The causative factors of peritonitis can be skin or nasal carriage of bacteria or fungi, diabetes, previous treatment with antibiotics and exit site infections, etc.[13] In this study, 24 out of 41 (58.2%) patient had diabetes which correlates with the data by Harel et al.[14] The most frequently encountered mechanical complications of LTCI are catheter migration, peri-catheter leak, and outflow obstruction. As in laparoscopic surgery, tissue dissection is minimal, the incidence of the later has declined sharply to 6% as compared to 32% in open technique for Tenckhoff catheter implantation.[15,16] Poor dialysate fluid drainage frequently occurs as a result of displacement of the catheter at operation, omental wrapping,

or post-operative adhesion formation. These complications may cause malfunction immediately or may manifest several months after implantation.[5] This can be eliminated by suture fixation of catheter which will reduce the chances of migration as was done in this study and we reported 2.4% cases (one patient only) which was supported by a study done by Ko et al.[17] also showed better results when a polypropylene suture was used to fix the catheter at the lower abdominal wall. In their report, only one late migration of the catheter occurred (2.6%). We found that previous operative history was not significant factor for complication as only one patient out of 16 patients (6%) had complication which is supported by the study conducted by Talwar et al., which stated that there was no statistically significant difference between previous abdomen surgery and complication.[18]

Conclusion

Approximately, 68% of patients, that is 28 patients out of 41 continued CAPD for 2 years after the catheter was inserted laparoscopically. Out of the 41 patients, 20 patients developed minor complications. Out of the 20 patients, 10 patients developed major complications and needed the catheter to be removed. Mortality was 9.8%, out of which two patients died of sepsis and two died of comorbidity-related complications. Thus, we can conclude that laparoscopic CAPD catheter placement is an effective method and has a better success rate with less complications and better patient tolerability. The suture fixation prevents catheter migration. Catheter insertion is done under vision. It had a better acceptance rate for up to 2 years. Omentopexy or omentectomy benefits the patient by preventing catheter block due to omental wrapping which cannot be done in a blind procedure.

Orcid

Taskeen M Sikora https://orcid.org/0000-0001-9714-3902
Ravi V Patel https://orcid.org/0000-0003-3206-8379

References

1. Popovich RP, Moncrief JW, Nolph KD, et al. Continuous ambulatory peritoneal dialysis. Ann Intern Med 1978;88(4):449–456. DOI: 10.7326/0003-4819-88-4-449.
2. Khanna R, Oreopoulos DG, Dombros N, et al. Continuous ambulatory peritoneal dialysis (CAPD) after three years: Still a promising treatment. Perit Dial Int 1980;1(4):1–1. DOI: https://doi.org/10.1177/0896860880001004.
3. Crabtree JH, Fishman A. Laparoscopic omentectomy for peritoneal dialysis catheter flow obstruction: A case report and review of the literature. Surg Laparosc Endosc Percutan Tech 1999;9(3):228–233. PMID: 10804009.
4. Crabtree JH, Fishman A. Videolaparoscopic implantation of long-term peritoneal dialysis catheters. Surg Endosc 1999;13(2):186–190. DOI: 10.1007/s004649900936.
5. Garcia MAV, Urena MAG, Carnero F, et al. Omental entrapping of the peritoneal dialysis catheter solved by a laparoscopic approach. Perit Dial Int 1997;17(2):194–195. PMID: 9159842.
6. Ma JJ, Chen XY, Zang L, et al. Laparoscopic peritoneal dialysis catheter implantation with an intra-abdominal fixation technique: A report of 53 cases. Surg Laparosc Endosc Percutan Tech 2013;23(6):513–517. DOI: 10.1097/SLE.0b013e31828fa6ae.
7. Öğünç G. Videolaparoscopy with omentopexy: A new technique to allow placement of a catheter for continuous ambulatory peritoneal dialysis. Surg Today 2001;31(10):942–944. DOI: https://doi.org/10.1007/s005950170042.
8. Fenton S, Schaubel DE, Desmeules M, et al. Hemodialysis vs. peritoneal dialysis: A comparison of adjusted mortality rates. Am J Kidney Dis 1997;30(3):334–342. DOI: 10.1016/s0272-6386(97)90276-6.
9. Malberti F, Conte F, Limido A, et al. Ten years' experience of renal replacement treatment in the elderly. Geriatr Nephrol Urol 1997;7(1):1–10. DOI: 10.1023/a:1008251929636.
10. Jaar BG, Plantinga LC, Crews DC, et al. Timing, causes, predictors and prognosis of switching from peritoneal dialysis to hemodialysis: A prospective study. BMC Nephrol 2009;10(1):1–2. DOI: 10.1186/1471-2369-10-3.
11. Tsimoyiannis EC, Siakas P, Glantzounis G, et al. Laparoscopic placement of the Tenckhoff catheter for peritoneal dialysis. Surg Laparosc Endosc Percutan Tech 2000;10(4):218–221. PMID: 10961749.
12. Oğünç G, Tuncer M, Oğünç D, et al. Laparoscopic omental fixation technique vs open surgical placement of peritoneal dialysis catheters. Surg Endosc 2003;17(11):1749–1755. DOI: 10.1007/s00464-002-8586-3.
13. Oreopoulos DG. Pathogenesis and management of complications of chronic peritoneal dialysis. Nephrol Dial Transplant 2001;16(Suppl 6):103–105. DOI: https://doi.org/10.1093/ndt/16.suppl_6.103.
14. Harel Z, Wald R, Bell C, et al. Outcome of patients who develop early onset peritonitis. Adv Perit Dial 2006;22:46–49. PMID: 16983938.
15. Lu CT, Watson DI, Elias TJ, et al. Laparoscopic placement of peritoneal dialysis catheter: 7 years experience. ANZ J Surg 2003;73(3):109–111. DOI: 10.1046/j.1445-2197.2003.02651.x.
16. Ortiz AM, Fernandez MA, Troncoso PA, et al. Outcome of peritoneal dialysis: Tenckhoff catheter survival in a prospective study. Adv Perit Dial 2004;20:145–149. PMID: 15384816.
17. Ko J, Ra W, Bae T, et al. Two-port laparoscopic placement of a peritoneal dialysis catheter with abdominal wall fixation. Surg Today 2009;39(4):356–358. DOI: 10.1007/s00595-008-3877-5.
18. Talwar R, Jha A, Madhu G, et al. Comparative study of outcomes following laparoscopic versus open peritoneal dialysis catheter insertion at a tertiary care centre. J Urol Surg 2021;8(1):40–45. DOI: https://doi.org/10.4274/JUS.GALENOS.2020.3845.