Does Peritoneal Dialysis Catheter Insertion by Interventional Nephrologists Enhance Peritoneal Dialysis Penetration?

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ABSTRACT

Traditionally peritoneal dialysis (PD) catheter was implanted by surgeons using mini-laparotomy or open technique in Malaysia. We introduced peritoneoscopic Tenckhoff catheter insertion technique since the beginning of our PD program. Data were collected from the start of our PD program in February 2006 until April 2008. All Tenckhoff catheters were inserted by nephrologists using the peritoneoscope technique. We also compare the penetration rate of PD versus hemodialysis (HD) in our center, as well as comparing to national PD penetration rate. There were 83 patients who underwent 91 peritoneoscope Tenckhoff catheter insertion procedures from March 2006 until April 2008. The patients were mostly female (66%) with the mean age of 51.99 ± 1.78 years and the majority (67%) of them were diabetics. All together there were 749.7 patient-months at risk and the overall peritonitis rate was 1 in 93.7 patient-months. The 1-year catheter survival was 86.5%. Primary catheter failure (defined as failure of the catheter within 1 month of insertion) occurred in 16 procedures (17.6%). The main cause of catheter malfunction was catheter tip migration and omentum wrap. The penetration ratio of PD when compared with HD in our center is 44.8%, which is about 4.5 times the national average. With our integrated care approach where nephrologist was heavily involved from the outset of renal replacement therapy discussion, PD access implantation to the assistance of spoke person to whom new patient can identify with, we were able to achieve PD penetration rate which far exceeds that of the national average.

Peritoneal dialysis (PD) was first introduced in Malaysia in 1981. Even though it has established itself as an effective mode of renal replacement therapy (RRT), the national penetration rate for PD in Malaysia remains low at 10% of all modes of RRT over the last decade (1,2). This is similar to the situation in the United States where PD is still underutilized and it was reported that only 6.4% of patients were on PD in 2006 (3). PD in this country is often considered by patients and caregivers alike as the inferior cousin of hemodialysis (HD). This is despite the overwhelming evidence on the advantages of PD in terms of preservation of residual renal function and consequent improved middle molecule clearance, reduced incidence of left ventricular hypertrophy, cost effectiveness, and reduced cardiovascular events (4–21).

Peritoneal dialysis catheter is the lifeline of PD patients and PD catheter survival remains the Achilles' heel of PD program in this country. Hence, as in anywhere in the world, the timely and effective insertion of the Tenckhoff catheter, as well as prompt management of complications arising from catheter insertion remains crucial in the success of PD program in this country (22–30). Traditionally, PD catheter was implanted by surgeons using mini-laparotomy or open technique in Malaysia. This invariably resulted in long waiting times and inherent delay where potential patients were exposed to HD and lost interest in PD while waiting for the procedure to be performed. There was also a lack of continuity in the care and a lack of respect for the catheter as the lifeline of the PD patient by surgical colleagues compare with nephrologists. Patients who ran into complications such as catheter malfunction were often forced into long waiting times before catheter-related problems can be solved.

Our hospital is unique in the sense that our PD and HD program began almost concurrently and we have employed an "Integrated Care Approach" from the outset of our PD program to promote PD as the preferred first mode of RRT in our patients. We also introduced peritoneoscopic Tenckhoff catheter insertion technique since the beginning of our PD program here at Serdang Hospital.

The purpose of this paper is to evaluate the impact of nephrologist initiated PD catheter program on the PD utilization.

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Seminars in Dialysis—Vol 21, No 6 (November–December) 2008 pp. 561–566
DOI: 10.1111/j.1525-139X.2008.00478.x

Methods

Patients Selection

Patients approaching end-stage renal failure are all exposed to discussion regarding PD as a mode of RRT. Counseling is performed both by nephrologists and PD nurses in the Chronic Kidney Disease Clinic, where benefits of PD and the Tenckhoff catheter insertion process is explained to patients, caregivers, and family members. This method has been shown to be effective in improving selection of PD as a choice of RRT treatment (29–35). The situation in Malaysia as in most parts of Asia is unique in that family members often play an important role in the selection of the RRT modality for the patient and as such the extended family often needs to be involved in counseling, even those family members may not be directly involved in caring for the patient. Our PD staff will conduct a separate session at the PD unit where patients and their caregivers are given demo and further explanation of the practical aspects of the process. Furthermore, we often have our PD patients (spoke persons) to talk about their experiences with PD to this new group of patients as well as answering their concerns and queries, especially those related to day to day chores. These "spoke persons" are selected to match the age group, social background, and ethnicity of the patient if possible.

Procedure

All Tenckhoff catheters were inserted by nephrologists in our hospital using the peritoneoscope method described previously (36–40). The procedure was carried out in a daycare operating theater. Patients were admitted a day before the procedure. They were given a Hibitane bath the evening before the procedure. On the day of the procedure they were asked to empty their bladders prior to being called to the operating theater. Patients were also given 1.5 g of cefuroxime IV prior to the operation. Majority of the procedures were performed under local anesthesia and sedation. Sedation was administered by the nephrologist performing the procedure with the aid of nurses. We used a combination of intravenous midazolam and fentanyl for their anxiolytic and amnesic effects. The level of sedation was titrated to achieve moderate sedation, where the patient was still able to respond and cooperate with the physician performing the procedure when called but was semi asleep otherwise. The procedure is carried out using Y-Tec® peritoneoscope (Medigroup, Naperville, IL, USA) with the use of VP-210STD disposable pack (Medigroup). All catheters used were double cuffed coiled Tenckhoff catheters of either 57 or 62 cm length depending on patient's body habitus. Skin preparation for the operation was performed using povidone iodine and the abdomen draped as per the usual surgical procedure. Lignocaine 2% was infiltrated into the skin as local anesthesia and the procedure was performed as described previously. The standard chronic catheter care with povidone iodine was employed. Patients were routinely put on few cycles of manual PD immediately post-op until the PD fluid was clear, and discharged home the next morning in the absence of complications. Catheter break-in for initiation of treatment was usually performed within 2 weeks after insertion of the catheter. In the event that the training of patients and caregivers were delayed, patients were placed on PD cyclers on a weekly basis aiming for a weekly creatinine clearance of 60 l/week/1.73 m^2 while waiting for training, which was usually performed within 2–4 weeks.

Results

There were 83 patients who underwent 91 peritoneoscope Tenckhoff catheter insertion procedures from March 2006 until April 2008 for PD treatment in our center. The baseline characteristics of the patients were shown in Table 1. The patients were mostly female (66.3%) with the mean age of 51.99 ± 1.78 years and the majority of them were diabetics (67.5%).

Figure 1 showed the cumulative number of PD patients compared with HD patients since the beginning of our dialysis program in January 2006. When plotted on a quarterly basis from January 2006 (Fig. 1), our PD penetration in Serdang Hospital far exceeded that of the national average (Fig. 2). The penetration ratio of PD when compared with HD in our center was 44.8%, which was about 4.5 times the national average. We

TABLE 1. Baseline characteristics of patients

Number of patients	83
Age	51.99 ± 1.78
Males	33.7%
Cause of ESRD	
Diabetes mellitus	67.5%
Chronic GN	6.0%
Hypertension	6.0%
NSAIDs	2.4%
Reflux nephropathy	1.2%
Unknown	16.9%

Baseline characteristics of patients undergoing peritoneoscope Tenckhoff catheter insertion at Hospital Serdang. Diabetics contribute to more that 2/3 of our patients. GN, glomerulonephritis; ESRD, end-stage renal disease.

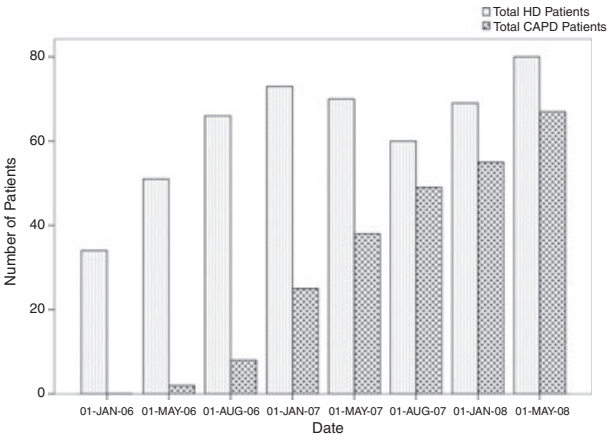


FIG. 1. Graph showing the growth of HD and PD in Hospital Serdang after starting the integrated care approach to CAPD.

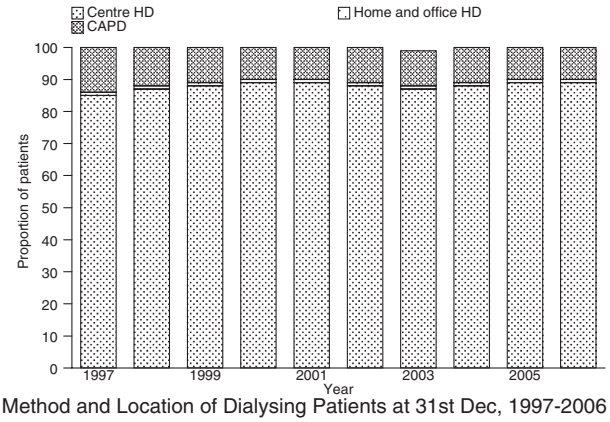


FIG. 2. Mode and location of dialysis patients at 31st December in Malaysia 1997–2006. Source: Malaysian National Renal Registry Report 2006.

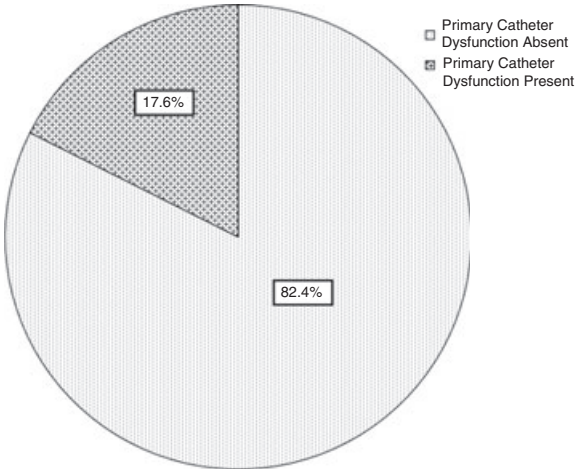


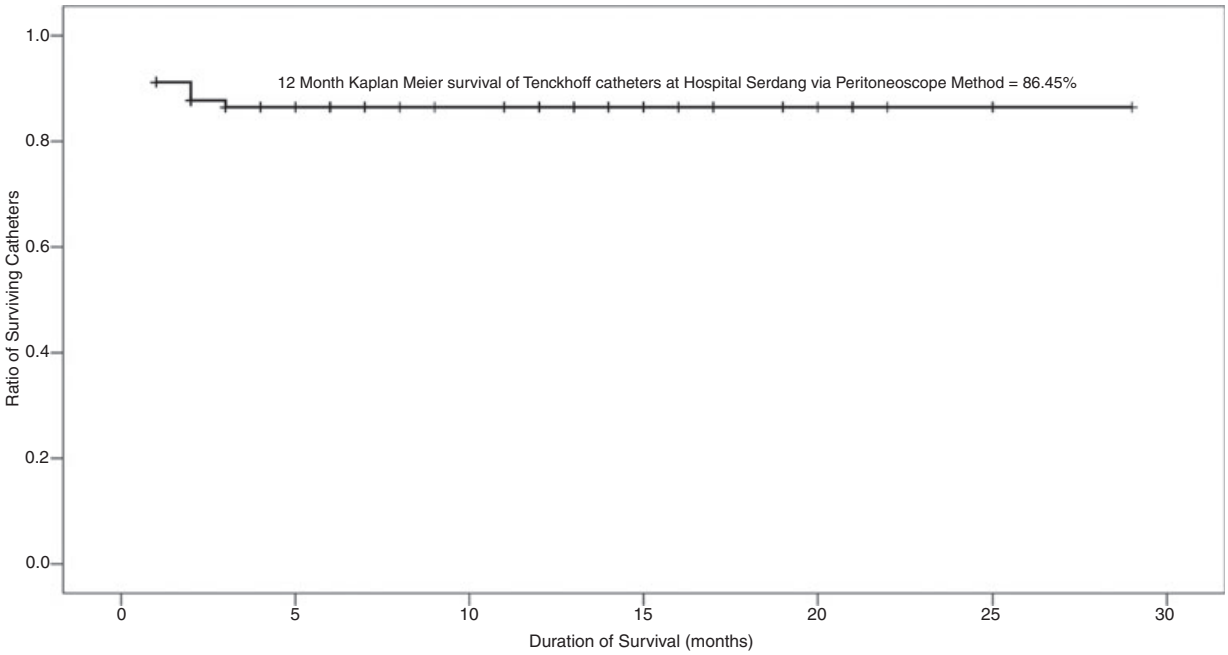
FIG. 4. Showing percentage of Tenckhoff catheters inserted via peritoneoscope method with primary catheter dysfunction between February 2006 and April 2008 at Hospital Serdang for our center CAPD patients. The rate of primary catheter dysfunction was 17.6% or 16 patients.

predicted that we would have more patients on PD compared with HD by the end of year 2008.

Altogether there were 749.7 patient-months at risk from the start of our program from March 2006 until April 2008 and the overall peritonitis rate was 1 in 93.7 patient-months.

Figure 3 showed the Kaplan–Meier survival of Tenckhoff catheters inserted for PD patients at our center and the 1-year catheter survival was 86.5%. Sixteen catheters (17.6%) failed to function within 1 month after insertion (primary failure) (Fig. 4). Out of the 16 patients who had primary catheter failure, nine had malposition of the catheters, one catheter was found to be kinked in the subcutaneous layer, and the other six had omentum wrap (Table 2).

The average waiting time for catheter insertion in our center was under 3 weeks. Any catheter-related



Month	0	1	2	3	4	5	6	7	8	9	10	11	12
Remaining Cases	91	83	76	67	61	58	53	47	46	45	44	42	41
Cumulative Events	0	8	11	12	12	12	12	12	12	12	12	12	12
Cum Percentage Survival(%)	100	91.2	87.7	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5

FIG. 3. Kaplan–Meier plot showing survival of Tenckhoff Catheters inserted via peritoneoscope method for CAPD patients at Hospital Serdang. One-year Tenckhoff catheter survival for patients in our center is 86.45%.

TABLE 2. Causes of primary catheter failure

Causes	Number	Percentage
Intrabdominal primary malposition	9	56.25
Subcutaneous catheter kink	1	6.25
Omentum wrap	6	37.5

Causes of primary catheter failure after peritoneoscope Tenckhoff catheter insertion at Hospital Serdang. Primary catheter failure is defined by our center as failure of inflow or outflow within 1 month of catheter insertion. The main cause of catheter dysfunction is primary malposition followed by omentum wrap.

TABLE 3. Procedures performed to resolve the problem of primary catheter failure

Procedure performed	Success (%)	Failure (%)
Peritoneoscope removal and reinsertion	7 (77.8)	2 (23.3)
Laproscopic salvage	4 (100)	0 (0)

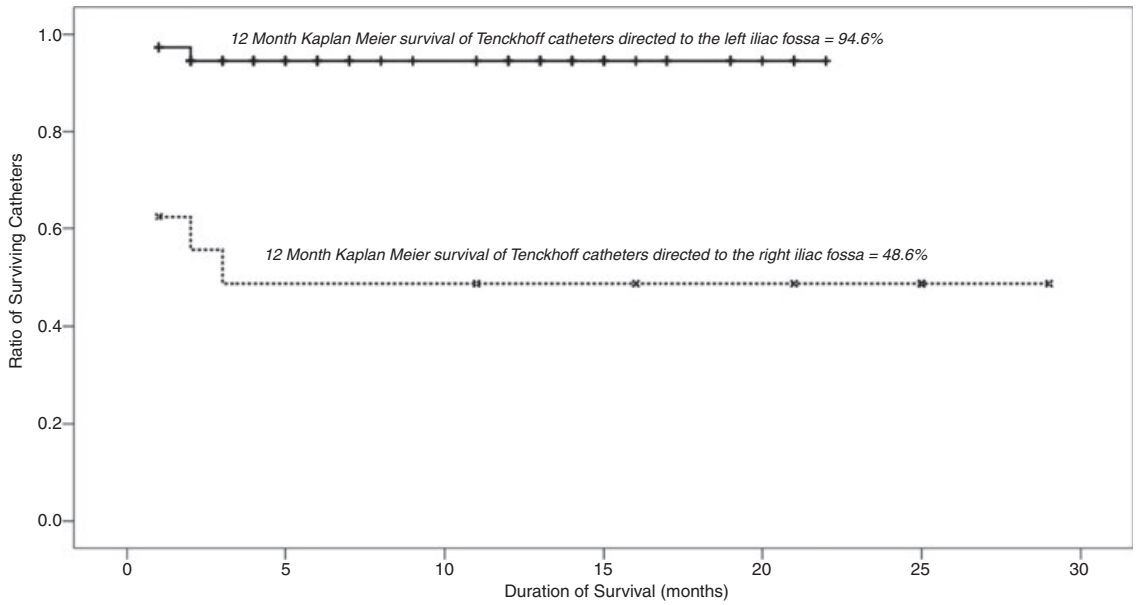
Procedures performed to resolve the problem of primary catheter failure. The small numbers of cases in each mode of treatment mean that it is not amenable to tests of significance. However, we feel that both methods are equal in resolving the problem of catheter dysfunction. The selection of the mode of management of primary catheter dysfunction should be determined by the resources available at the center practicing Tenckhoff catheter insertion.

problems were dealt with immediately, and the longest waiting time for patients with catheter dysfunction was 2 weeks prior to either laparoscopic salvage (by surgeon) or removal and reinsertion by peritoneoscope technique. Table 3 showed that either method was of equal efficacy in dealing with primary catheter failure in our center. One patient passed away prior to salvage and two others opted for other modalities of RRT. Nine patients underwent catheter removal and reinsertion, out of which seven were successful, four underwent laparoscopic salvage, and all were successful.

We also noted early in our program that Tenckhoff catheters directed to the right iliac fossae had poorer survival when compared with catheters directed to the left iliac fossae (Fig. 5). Survival of catheters directed to the left iliac fossae was 94.6% while the survival for catheters directed to the right iliac fossae was 48.6% ($p < 0.05$) (Table 4). We have since made left iliac fossae placement of catheter our first choice.

Discussion

Peritoneal dialysis is found to be underutilized in both developed countries like USA and developing counties like Malaysia (1–3). The reasons for the poor penetration of PD as a modality of RRT in Malaysia are multifactorial, which include the long waiting time for



Month	0	1	2	3	4	5	6	7	8	9	10	11	12
Cumulative Events Left Iliac Fossae(LIF)	0	2	4	4	4	4	4	4	4	4	4	4	4
Remaining Cases (LIF)	75	73	68	59	56	53	50	45	39	38	37	37	35
Cumulative Percentage Survival LIF (%)	100	97.3	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6
Cumulative Events Right Iliac Fossae(RIF)	0	6	6	6	6	6	6	6	7	8	8	8	8
Remaining Cases(RIF)	16	10	10	10	10	10	10	10	8	7	6	5	4
Cumulative Percentage Survival LIF(%)	100	62.5	62.5	62.5	62.5	62.5	62.5	62.5	55.6	48.6	48.6	48.6	48.6

FIG. 5. Kaplan–Meier plot showing survival of Tenckhoff catheters inserted via peritoneoscope method for CAPD patients at Hospital Serdang based on placement direction of catheter. One-year Tenckhoff catheter survival for patients in our center for catheters directed to the left iliac fossae is 94.6%. For catheters directed to the right iliac fossae, our catheter survival is 48.6%.

TABLE 4. Right versus left placement of Tenckhoff catheters

Direction of catheter	Primary catheter failure (%)	
	Yes	No
Right iliac fossae	8 (50.00)	8 (50.00)
Left iliac fossae	8 (10.67)	67 (89.33)

Placement of catheters directed towards the left iliac fossae in patients undergoing peritoneoscope Tenckhoff catheter insertion is associated with lower rates of primary catheter failure. Realizing our initial results we switched to placing most catheters directed to the left iliac fossae of our patients with far better results. Chi-squared test $p < 0.01$.

insertion of the Tenckhoff catheter by the surgeon under general anesthesia, the need for an in center nephrologist to monitor a PD program, shortage of trained PD staff, physician, and dialysis staff bias due to better reimbursement with HD in the private sector, patient perception that PD is an inferior modality compare with HD as HD is associated with "high technology" and the more technology involved, the better the treatment, the perception that peritonitis is extremely common and the assumption that any treatment that needs to be carried out by one's self instead of trained staff is risky. Thus, the adult PD population in our country often is limited to patients who have numerous comorbidities and those who inherently are unable to tolerate HD. This again adds to the image problem that PD is inferior to HD.

Tenckhoff catheter survival remains the main Achilles' heel of a successful PD program in both developed and developing countries. It has been demonstrated previously that catheter insertion by nephrologists improves PD penetration in the centers where it is practiced (27,28,31). Similarly in this study, we demonstrated that with an interventional nephrologists initiated PD access program, we are able to achieve a PD penetration rate, which is 4.5 times the national average. The main reason for this is with the direct involvement of the nephrologists; this will not only improve patients' confidence in continuous ambulatory peritoneal dialysis (CAPD), but also allows PD catheters to be placed in a timely manner. Waiting times for Tenckhoff catheter insertion in our center is kept to less than 3 weeks and the waiting time to manage primary catheter failure is less than 2 weeks. The relationship between nephrology placement of PD catheters and an increase in the PD population seen in the study suggest a direct causal relationship.

We also believe that by adopting our "Integrated Care Approach," which is patient centered from the outset of the RRT counseling, this has made a positive impact to enhance PD utilization in our center and has been clearly shown to have increased PD penetration far above the national average. This patient education program has also been shown to be effective in improving PD penetration in other countries (36–40). We found that the selection of the spoke persons who have positive image and to whom the new patients can identify with is crucial to the success of our program. This is similar to the branding and spoke person used successfully by commercial sectors. We found that the participation and involvement of the most motivated patients to help with counseling of new patients deciding on an RRT option has improved our PD acceptance rate.

Despite the fact that CAPD was first introduced in this country in 1981, the acceptance rate remains to be low. The ever growing population of end-stage renal disease eventually is going to put on severe economic strain in the national health financing scheme in this country. As the transplant rate continues to be miserable at less than one donor per million population, CAPD provides temporary relieve to this potential financial strain. The cost of running HD is compounded by the lack of trained staff as well as lack of HD centers, this is worsened by the increasing cost of office space. Hence home-based therapy where office space is unnecessary will become increasingly more popular. Home-based HD is less of an option because of costs in terms of equipment, water, and dialyzers. Center-based HD tends to be a more attractive proposition primarily due to aggressive marketing by persons with a vested financial interest in HD. In addition, in the Malaysian context, as in much of the developing world, shortage of trained dialysis staff is an ever acute and recurring problem. One trained HD staff can handle an average of four to six patients, whereas a single trained PD staff can cope with around 20–30 patients. In our HD unit, we have 15 staff looking after 85 HD patients at the present moment. On the other hand, we only require three PD nurses to handle 75 PD patients. Generally, we allow each PD nurse to handle up to 30 patients as our center's peritonitis rate is only 1 in 93.7 patient-months. With the possibility the PD treatment is becoming the first choice RRT in the coming years due to the limited and increasingly expensive "office space," escalating cost of HD and limited number of trained HD staff, we believe that catheter placement by nephrologists is going to be a critical component to increase the popularity of PD treatment in this country.

Conclusion

We have shown that in our center, the nephrologist placement of PD catheter and "Integrated Care Approach" in our center has improved PD penetration when compared with the national average. With our integrated care approach where nephrologist was heavily involved from the outset of RRT discussion, PD access implantation to the assistance of spoke person to whom new patient can identify with, we were able to achieve PD penetration rate which far exceeds that of the national average. We feel that such an approach, where nephrologists and the PD team take part in every stage of care of the patient from counseling for RRT to insertion of the Tenckhoff catheter to continued care postinsertion benefits the patient and care providers. This approach will encourage patients and family members to make PD as their preferred mode of RRT. In Malaysia, as nephrologists in a developing country, we have a vested interest in promoting PD as the preferred mode of dialysis. Staffing shortage, limited and expensive "office space" mean there is a natural cap on the number of HD patients we can support in this country.

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