SUCCESS OF URGENT-START PERITONEAL DIALYSIS IN A LARGE CANADIAN RENAL PROGRAM

Ali M.A. Alkatheeri,^{1,3} Peter G. Blake,¹ Daryl Gray,² and Arsh K. Jain¹

Division of Nephrology,¹ Department of Medicine, Western University, London, Ontario, Canada; Division of General Surgery,² Department of Surgery, Western University, London, Ontario, Canada; and Department of Medicine,³ Umm Al-Qura University, Makkah, Saudi Arabia

◆ **Background:** Many patients start renal replacement therapy urgently on in-center hemodialysis via a central venous catheter, which is considered suboptimal. An alternative approach to manage these patients is to start them on peritoneal dialysis (PD). In this report, we describe the first reported Canadian experience with an urgent-start PD program. Additionally we reviewed the literature in this area.

◆ **Methods:** In this prospective observational study, we report on our experience in a single academic center. This program started in July 2010. We included patients who initiated PD urgently, that is within 2 weeks of catheter insertion. We followed all incident PD patients until October 2013 for mechanical and infectious complications. Peritoneal dialysis catheters were inserted either percutaneously or laparoscopically and dialysis was initiated in either an inpatient or outpatient setting.

◆ **Results:** Thirty patients were started on urgent PD during our study period. Follow-up ranged from 28 to 1,050 days. Twenty insertions (66.7 %) were done percutaneously and 10 (33.3%) were laparoscopic. Dialysis was initiated within 2 weeks (range: 0–13 days, median = 6 days). Twenty-four patients (80%) started PD in an outpatient setting and 6 patients (20%) required immediate inpatient PD start. Three patients (10%) developed a minor pericatheter leak during the first week of training that was managed conservatively. There were no episodes of peritonitis or exit-site/tunnel infection during the first 4 weeks post-insertion. Four patients (13.3 %) from the percutaneous insertion group and 2 patients (6.7%) from laparoscopic insertions developed catheter dysfunction due to migration, which was managed by repositioning, without need for catheter replacement or modality switch.

◆ **Conclusions:** Our results are consistent with other studies in this area and demonstrate that urgent-start PD is an acceptable and safe alternative to hemodialysis in patients who need to start dialysis urgently without established dialysis access.

Mendelssohn *et al.* demonstrated that many renal patients (56%) initiate dialysis suboptimally, which is defined as initiation of dialysis as an inpatient and/or with a central venous catheter (CVC) despite early nephrologist referral (1). In the US and Canada, over 80% of patients who start hemodialysis (HD) start with a CVC (2,3). In the urgent setting, in-center HD using a CVC has been the default way to deliver renal replacement therapy. This is despite the fact that starting HD with a CVC is independently associated with increased mortality and high rates of bacteremia (4–8).

To decrease rates of suboptimal start, some centers have developed programs to start patients on peritoneal dialysis (PD). A few studies have described various approaches to urgent-start PD. Some reports have compared urgent-start HD to PD and found that urgent-start PD is a safe and effective alternative to HD for suboptimal dialysis starts (9,10).

To date, none of the urgent-start PD studies have described a program that uses both percutaneous and surgical PD catheter insertion. In this report, we review our program of urgent-start PD using both the aforementioned insertion techniques in both the inpatient and outpatient settings.

METHODS

DESCRIPTION OF OUR PROGRAM

Our program has about 130 patients. We are situated in a busy academic center with a catchment area of about one million people. Most of our patients start on automated PD and only a few (about 10%) are on continuous ambulatory PD. Prior to July 2010, all our incident PD patients were planned. They would commence PD 4 to 6 weeks after surgical or percutaneous catheter insertion. Patients who needed urgent dialysis with no established access prior to that date would be started on HD via temporary or tunneled CVC. In July 2010, we initiated an urgent-start PD program that involved an interventional nephrologist, a surgeon, an urgent-start PD case manager and a dialysis access coordinator. Nephrologists were made aware and were encouraged to contact the urgent-start PD team when a suitable patient was identified. Our urgent-start PD team would then assess the patient within 24 hours and if they deemed the patient eligible, urgent-start PD was offered.

Perit Dial Int 2016; 36(2):171–176 epub ahead of print: 15 Sep 2015
<http://dx.doi.org/10.3747/pdi.2014.00148>

KEY WORDS: Peritoneal dialysis; urgent-start peritoneal dialysis; acute-start peritoneal dialysis; suboptimal start.

Correspondence to: Arsh K. Jain, Kidney Clinical Research Unit, Room: ELL-108, London Health Science Centre, 800 Commissioners Road East, London, ON Canada N6A 4G5.

arsh.jain@lhsc.on.ca

Received 16 December 2014; accepted 17 January 2015.

Peritoneal dialysis catheter insertions were performed either *percutaneously* by an interventional nephrologist (AKJ) or *laparoscopically* by a general surgeon (DG). Our interventional nephrology team would do an initial assessment to determine if a patient was suitable for fluoroscopic-guided percutaneous insertion. If not, the patient was sent for surgical laparoscopic insertion under general anesthesia. Once a PD catheter was inserted, the patient would start PD urgently as either an inpatient or outpatient. All patients started PD within 2 weeks of insertion depending on their condition and need for dialysis. All inpatient starts remained hospitalized until there was symptomatic improvement (e.g. improved shortness of breath, reduced nausea, etc.).

Patients received 4 days of in-center training, followed by a home visit (i.e. on day 5). However, at the end of the week, if there were concerns about the patient transitioning to independent dialysis (i.e. independent at home), the patient was given a second week of training. During training, the patients received daily exchanges at reduced dwell volumes. Initially, the dwell volume was 1,000 to 1,200 mL in all patients, which was gradually increased up to 1,900 mL by the end of 3 to 4 weeks if there was no complication. Only when patients had reached full dwell volumes (1,900 mL) was dialysis adequacy assessed and PD prescription adjusted. All patients were dialyzed in supine position using a cyclor for the initial 2 weeks and no day dwell was permitted for 4 to 6 weeks. All inpatient starts were trained as outpatients once they were able to leave the hospital.

STUDY DESIGN

As a quality assurance project, we reviewed all urgent PD starts from July 10, 2010, to September 13, 2013. We excluded all patients who required any HD prior to starting PD. We followed these patients for evidence of mechanical and infectious complications. Mechanical complications included leaks (peri-catheter and other), catheter dysfunction and/or catheter migration. Infectious outcomes were defined in accordance with the 2010 International Society for Peritoneal Dialysis (ISPD) guidelines and included exit-site infections, tunnel infections and/or peritonitis (11). Follow-up was censored at the time of permanent modality switch (e.g. to HD or transplantation). Table 1 shows patient demographics.

RESULTS

A total of 30 patients started PD urgently from July 2010 to September 2013. The follow-up period ranged from 28 days to 1,050 days (median: 201, interquartile range (IQR): 92.5 – 509.75). Twenty insertions (66.7%) were done percutaneously and 10 (33.3%) were laparoscopic. Dialysis was initiated within 2 weeks in all patients (range: 0 – 13 days, median: 6 days, IQR: 8 – 11). Twenty-four patients started PD in outpatient setting and 6 patients required immediate inpatient PD start. Three patients (10%) developed a minor peri-catheter

TABLE 1
Patient Demographics

Patients	n=30
Male: Female	19:11
Age	
Range	18–85 years
Median	60.5 years
Weight (kg)	
Range	46–120
Median	72
IQR	58.5–87.75
BMI (kg/m ²)	
Range	17–43
Median	25
IQR	21–29
Diabetes (n (%))	12 (40)
Cause of ESRD (n (%))	
Glomerulonephritis	10 (33.3)
Diabetes	9 (30)
Hypertension	4 (13.3)
Reflux	2 (6.6)
Others ^a	5 (16.6)
Median eGFR (Modified MDRD)	5.55 mL/min/1.73 ²

IQR = interquartile range; BMI = body mass index; ESRD = end-stage renal disease; eGFR = glomerular filtration rate; MDRD = Modification of Diet in Renal Disease; ADPKD = autosomal dominant polycystic kidney disease.

^a ADPKD, myeloma, tuberous sclerosis, cyclosporine toxicity and unknown.

leak during the first week of training (2 in the laparoscopic group). These were managed conservatively with lower dwell volumes. There were no episodes of peritonitis or exit-site/tunnel infection in the first 4 weeks post-urgent start. Two patients developed late exit-site infections at 6 months (1:159 patient months). One patient developed peritonitis at 12 months (1:319 patient months). Six patients (20%) developed catheter dysfunction due to migration (4 were percutaneous insertions and 2 were laparoscopic). Six required repositioning with 4 being corrected laparoscopically and 2 by interventional nephrology using a guidewire. All migrations occurred in 5 to 30 days after PD catheter insertion. At end of follow-up, 24 (80%) patients are still doing PD and 4 (13.3%) were transplanted. The remaining 2 patients (6.7%) switched to HD due to psychosocial reasons and severe infusion/drain pain.

Six patients (20%) started PD immediately (within 24 hours of catheter insertion) as an inpatient due to either severe uremic symptoms or significant volume overload or both. Table 2 shows characteristics of these patients. The other 24 (80%) were symptomatically uremic or volume overloaded but were deemed stable enough to allow between 2 and 14 days for healing before PD was initiated. Between the initiation of this urgent-start PD program in July 2010 and October 2013, the size of our PD program grew from 90 to 133 patients.

TABLE 2
Characteristics of Immediate-Start Patients

Age	Weight	Cause of ESRD	Indication for dialysis	K ⁺ (mEq/L)	HCO ₃ ⁻ (mEq/L)	Urea (mmol/L)	Creatinine (μmol/L)	Follow-up time (days)	Leak	Infection	Dysfunction	Type of insertion
25	46	GN	Uremia	6	11	45	1460	776	No	No	No	Laparoscopic
79	83	GN	Uremia	5.4	16	47	800	273	No	No	No	Percutaneous
41	64	GN	Uremia	5.5	21	33	760	204	No	No	No	Laparoscopic
65	68	Hypertension	Uremia	4	12	40	744	129	Yes	No	No	Laparoscopic
77	58	Cardio-renal	Overload	4	18	33	364	130	No	No	No	Percutaneous
61	120	Diabetes	Overload	3.8	30	45	530	28	No	No	No	Percutaneous

ESRD = end-stage renal disease; GN = glomerulonephritis.

DISCUSSION

Urgent-start PD offers a welcome alternative to HD via venous catheter for uremic or fluid overloaded patients requiring unplanned initiation of dialysis. We have described our unique integrated urgent-start PD program, where catheters are inserted surgically or percutaneously and patients can initiate PD in less than 2 weeks in either the inpatient or outpatient setting. We found the strategy to be feasible and safe. The complication rate in our patients was low. These findings concur with previous reports in this regard.

Other investigators have reported early initiation of PD using a catheter immediately or very soon after insertion (9,10,12–18). However, we think our approach differs in that we are doing this not only in outpatients but also in acutely unwell hospital inpatients. Six of our patients were started during urgent admissions to hospital. Such patients are almost always treated with HD via a CVC in the modern era.

Our program has a number of advantages. Growing PD is an identified priority in many jurisdictions and an urgent-start PD program brings PD to patients who would have invariably gone to HD in the past. Many centers have great difficulty converting urgent-start HD patients to PD. We have seen a growth of 48% in our PD program census since introducing this initiative. While all this growth cannot be attributed solely to urgent-start PD, we believe it has been a major factor. This growth has significant economic advantages. Peritoneal dialysis in Canada is estimated to be approximately 60% less expensive than conventional HD (19). Of course, an urgent PD start may incur greater up-front costs than a conventional PD start, but so does urgent HD start. The economics of urgent-start dialysis require detailed assessment.

It is important to emphasize that a successful urgent-start PD program requires a lot of commitment and co-operation by many people. First, there is the interventional nephrologist and/or surgeon who has to be able and willing to do catheter insertion at short notice. There is the PD nursing team who has to be prepared to perform PD and to train the patient also at short notice and this can result in the disruption of previous elective PD training and other PD unit activities. If the patient

is ill enough to require hospitalization, the urgent PD must be performed by ward nurses. A coordinating person is required to make everything happen in a timely manner and this can be very demanding. Often, urgent patient evaluation by renal social workers or other specialized staff is required to ensure suitability for home PD. Another requirement is that there be 'buy-in' from referring nephrologists who typically have used urgent HD via a CVC in this sort of patient and who may find the rather gradual correction of blood test abnormalities frustratingly slow. Lastly, and very importantly, this approach requires commitment from the patient and their family. It follows that for all this to work well, there has to be commitment from both administrative and physician leadership within the renal program concerned.

The results of our study are consistent with the other studies that have been published in this field. We have identified 9 studies assessing urgent-start PD programs (9,10,12–18). Table 3 summarizes these studies. A few key areas have been addressed in these studies and we have summarized these findings.

Seven of the studies assessed the risk of leak in urgent-start PD (12–18). In these studies, patients were followed for variable lengths of time, from 1 to 6 months. The risk of leak ranged from 1.9 – 33.3%. Three studies compared the risk of leak in urgent-start PD patients to non-urgent-start PD patients and found no significant difference (14,16,18).

Seven of the studies assessed the percentage or rate of PD-related infections (12–18). The duration of assessment was variable and ranged from 1 to 6 months. Peritonitis occurred in 2.4 – 15.4% and exit-site/tunnel infection ranged from 1.3 – 11%. Ghaffari *et al.* was the only study to report a rate which was low for both exit-site infection (ESI) and peritonitis (1/55 patient months and 1/110 patient months respectively) (18). Three studies compared the number of infections (peritonitis, exit-site, and tunnel) between urgent-start and non-urgent-start groups. There was no significant difference in infectious complications between the 2 groups (14,16,18).

Seven of the studies looked at catheter dysfunction which includes primary failure, malfunction, migration, and/or poor drain (12–18). The studies had variable follow-up times (2 weeks to 6 months). The risk of catheter dysfunction

ranged from 2.4 – 22.1%. Povlsen and Ivarsen showed that total mechanical complications occurred significantly more in urgent-start than conventional start PD (14). They noted that there was an increased need for surgical replacement of PD catheter in the urgent group. We noted a high rate of catheter dysfunction due to migration in our urgent-start

patients (26%). We believe that this is because an early start gives us little time to wait for the catheter to migrate spontaneously. In the non-urgent setting, we prescribe bowel care to help with spontaneous repositioning, but this is not possible in the urgent setting and results in a high need for repositioning. However, the primary failure rate for PD

TABLE 3
Literature Review

Author	Year	Insertion technique	Intervention and number of patients	Leak ^a	Peritonitis ^b	Exit-site infection ^b	Dysfunction ^c	Survival ^d
Song <i>et al.</i> (12)	2000	Percutaneous	Group 1 (<i>n</i> =21): gradual increase in exchange volume	9.5% ^e	23.8% ^e	9.5% ^e	4.8% ^e	85.7% ⁱ
			Group 2 (<i>n</i> =38): full exchange volume (2 L) PD-initiated <24 h in both groups	10.5% ^e	15.8% ^e	5.3% ^e	5.3% ^e	84.2% ⁱ
Banli <i>et al.</i> (13)	2005	Percutaneous	Early initiation of PD (<i>n</i> =41);	4.8%	2.4%	—	2.4%	—
Povlsen and Ivarsen (14)	2006	Surgical	Group 1 (<i>n</i> =52): acute automated PD (started <24 h)	7.7% ^f	15.4% ^f	3.9% ^f	15.4% ^f	86.7% ^j
			Group 2 (<i>n</i> =88): planned-start group	0% ^f	15.4% ^f	3.8% ^f	5.8% ^f	90% ^j
Jo <i>et al.</i> (15)	2007	Percutaneous	Early initiation PD (<i>n</i> =51) (immediate)	2% ^e	4% ^e	4% ^e	12% ^e	—
Lobbedez <i>et al.</i> (9)	2008	Not specified	Group 1 (<i>n</i> =34): unplanned patients initiated on PD	—	—	—	—	Actuarial patient survival at 1 year: 79% on HD 83% on PD
			Group 2 (<i>n</i> =26): unplanned patients initiated on HD	—	—	—	—	
Yang <i>et al.</i> (16)	2011	Surgical	Group 1 (<i>n</i> =226): early start of incremental PD (2.0–2.7 days)	2.2% ^g	4% ^g	1.3% ^g	3.1% ^g	—
			Group 2 (<i>n</i> =84): late-start (41–43 days)	2.4% ^g	2.4% ^g	0% ^g	2.4% ^g	—
Ghaffari A (18)	2012	Percutaneous	Group 1 (<i>n</i> =18): urgent PD start (<2 weeks after catheter insertion)	33.3%	1:110 ^{h,f}	1:55 ^{h,f}	11.2%	—
			Group 2 (<i>n</i> =9): planned-start 2–4 weeks after PD catheter insertion	11.1%	1:42 ^{h,f}	1:42 ^{h,f}	22.2% ^f	—
Casaretto <i>et al.</i> (17)	2012	Surgical	Early-initiation PD (<i>n</i> =11) <2 days	0	0	0	9%	—
Koch <i>et al.</i> (10)	2012	Surgical	Acute unplanned PD (<i>n</i> =66) Acute unplanned HD (<i>n</i> = 57)	—	—	—	—	Mortality ^g : PD: 30.3% HD: 42.1%; (<i>p</i> =0.19)

TABLE 3 (cont'd)

Author	Year	Insertion technique	Intervention and patient number	Leak ^a	Peritonitis ^b	Exit-site infection ^b	Dysfunction ^c	Survival ^d
This study	2015	Percutaneous and Laparoscopic	Urgent-start PD (n=30)	3 (10%)	1:319 ^h	1:159 ^h	6 (20%)	Patient survival: 100% ^f Technique survival: 93.3% ^f

PD = peritoneal dialysis; HD = hemodialysis.

^a Peri-catheter or incision-site leaks.

^b Reported as percentage or rate.

^c Dysfunction including primary failure, malfunction, migration, and/or poor drain.

^d Either patient, catheter, or technique survival.

^e At 1 month.

^f At 3 months.

^g At 6 months.

^h Patients months.

ⁱ 1-year catheter survival.

^j Technique survival at 3 months.

catheter insertion (percutaneous or surgical) at our center is less than 2 %.

Four studies assessed survival (9,10,12,14). Povlsen and Ivarsen looked at technique survival at 3 months in their urgent-start PD group compared to their planned-start patients and found no difference (86.7 vs 90 %) (14). Song *et al.* followed 2 groups of urgent-start PD patients, differing only in PD prescription (12). Catheter survival in both groups at 1 year was about 85%. Lobbedez *et al.* compared urgent-start HD with urgent-start PD and found the actuarial patient survival at 1 year to be 79% on HD compared with 83% on PD (9). The 2 groups were not significantly different. Koch *et al.* compared the survival rates in urgent-start HD vs urgent-start PD patients. There was no significant difference in mortality at 6 months between the 2 groups (30.3% for PD and 42.1% for HD; $p = 0.19$) (10).

Our study does have some limitations. This is a single-center non-randomized study with a relatively small sample size and no control group, making it difficult to generalize our results to other centers. However, our patient population was diverse and included patients who were very ill requiring immediate start on dialysis. The main findings of this study, we believe, are robust in that we have demonstrated that urgent PD start is a safe and effective option for treating patients and can be implemented in patients who traditionally would have been suboptimal HD starts.

ACKNOWLEDGMENTS

AJK is supported by a salary award from Academic Medical Organization of Southwestern Ontario.

DISCLOSURES

PB and AJK have received speaking honoraria and research grants from Baxter Healthcare.

REFERENCES

- Mendelssohn DC, Curtis B, Yeates K, Langlois S, Macrae JM, Semeniuk M, *et al.* Suboptimal initiation of dialysis with and without early referral to a nephrologist. *Nephrol Dial Transplant* 2011; 26:2959–65.
- United States Renal Data System [Internet]. 2013 p. 235. Available from: <http://www.usrds.org/atlas.aspx>
- Proportion of incident hemodialysis patients by vascular access type [Internet]. Available from: http://www.renalnetwork.on.ca/ontario_renal_plan/vascular_access/ckd_data/incidence_and_prevalence/#.UzNQ8IV0ySA
- Astor BC, Eustace JA, Powe NR, Klag MJ, Fink NE. Type of vascular access and survival among incident hemodialysis patients: The Choices for Healthy Outcomes in Caring for ESRD (CHOICE) Study. *J Am Soc Nephrol* 2005; 16:1449–55.
- Ishani A, Collins AJ, Herzog CA, Foley RN. Septicemia, access and cardiovascular disease in dialysis patients: the USRDS Wave 2 Study. *Kidney Int* 2005; 68:311–8.
- Johnson DW, Dent H, Hawley CM, McDonald SP, Rosman JB, Brown FG, *et al.* Associations of dialysis modality and infectious mortality in incident dialysis patients in Australia and New Zealand. *Am J Kidney Dis* [Internet]. National Kidney Foundation, Inc.; 2009; 53(2):290–7.
- Lorenzo V, Martin M, Rufino M, Hernandez D, Torres A, Ayus JC. Predialysis nephrologic care and a functioning arteriovenous fistula at entry are associated with better survival in incident hemodialysis patients: an observational cohort study. *Am J Kidney Dis* 2004; 43(6):999–1007.
- Patel PR, Kallen AJ, Arduino MJ. Epidemiology, surveillance, and prevention of bloodstream infections in hemodialysis patients. *Am J Kidney Dis* [Internet]. Elsevier Inc.; 2010; 56(3):566–77.
- Lobbedez T, Lecouf A, Fichoux M, Henri P, Ligny BH De, Ryckelynck J. Is rapid initiation of peritoneal dialysis feasible in unplanned dialysis patients? A single-centre experience. *Nephrol Dial Transplant* 2008; 23:3290–4.
- Koch M, Kohnle M, Trapp R, Haastert B, Rump LC, Aker S. Comparable outcome of acute unplanned peritoneal dialysis and haemodialysis. *Nephrol Dial Transplant* 2012;27: 375–80.
- Li PK, Szeto CC, Piraino B, Bernardini J, Figueiredo AE, Gupta A, *et al.* ISPD guidelines /recommendations. *Perit Dial Int* 2010; 30:393–423.
- Song JH, Kim GA, Lee SW, Kim M. Clinical outcomes of immediate full-volume exchange one year after peritoneal catheter implantation for CAPD. *Perit Dial Int* 2000; 20:194–9.

13. Banli O, Altun H, Oztemel A. Early start of CAPD with the Seldinger technique. *Perit Dial Int* 2005; 25:556–9.
14. Povlsen JV, Ivarsen P. How to start the late referred ESRD patient urgently on chronic APD. *Nephrol Dial Transplant* 2006; 21:ii56–9.
15. Jo Y, Shin SK, Lee J, Song J, Park J. Immediate initiation of CAPD following percutaneous catheter placement without break-in procedure. *Perit Dial Int* 2007; 27(11):179–83.
16. Yang Y, Wang H, Yeh C, Lin H, Huang C. Early initiation of continuous ambulatory peritoneal dialysis in patients undergoing surgical implantation of Tenckhoff catheters. *Perit Dial Int* 2011; 31(5):551–7.
17. Casaretto A, Rosario R, Kotzker WR, Groenhoff C, Guest S. Urgent-start peritoneal dialysis: report from a U.S. private nephrology practice. *Adv Perit Dial* 2012; 28:102–5.
18. Ghaffari A. Urgent-start peritoneal dialysis: a quality improvement report. *Am J Kidney Dis* 2012; 59(3):400–8.
19. Chui BK, Manns B, Pannu N, Dong J, Wiebe N, Jindal K, *et al.* Health care costs of peritoneal dialysis technique failure and dialysis modality switching. *Am J kidney Dis* 61(1):104–11.