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Emergent Start Peritoneal Dialysis for End-Stage Renal Disease: Outcomes and Advantages

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Keywords
Emergent start peritoneal dialysis · Urgent start peritoneal dialysis · Unplanned peritoneal dialysis · Urgent start hemodialysis · Peritoneal dialysis in intensive care unit

Abstract
Background/Aims: Initiating renal replacement therapy in late referred patients with central venous catheter (CVC) hemodialysis (HD) causes serious complications. In urgent start peritoneal dialysis, initiating peritoneal dialysis (PD) within 14 days of catheter insertion still needs HD with CVC. We initiated Emergent start PD (ESPD) with Automated PD (APD) at our center within 48 h from the time of presentation. ***Methods:*** A prospective, case-controlled, intention-to-treat study with 56 patients was conducted between March 2016 and August 2017. Group A (24 patients) underwent conventional PD 14 days after catheter insertion. Group B (32 patients), underwent ESPD with APD. Exit site leak (ESL), catheter blockage, and peritonitis at 90 days were primary outcomes. Technique survival was secondary outcome. ***Results:*** Baseline characteristics were similar with 3 episodes of ESLs (9.4%) in the study group and none in the control group (p = 0.123). Catheter blockage (16.7%-Group A, 25%-Group B) and peritonitis (none vs. 9.4% in study group) were similar in terms of statistical details just as technique survival (95%-Group A, 88.2%-Group B at 90 days). ***Conclusion:*** ESPD with APD in the unplanned patient is an appropriate approach.

Introduction

Urgent start peritoneal dialysis (USPD) has been gaining ground worldwide as an approach that obviates the need for urgent start hemodialysis (HD). Eighty percentage of HD patients are initiated with a central venous catheter (CVC) [1]. HD with temporary vascular access causes the risk of vascular catheter-associated blood stream infection, higher incidence of hospitalization, more surgical procedures including AV fistulae, long-term sequelae, such as subclavian venous stenosis and more mortality in the first year of treatment compared to peritoneal dialysis (PD) [1–8]. Patients on PD have lifestyle flexibility, preservation of residual renal function, and economic benefits compared to HD [9–13]. Despite the disadvantages, HD is promoted by a complex set of factors, which includes industrialization of HD by entrepreneurs [14]. Published literature [15–24] has generally shown USPD to be a good approach to initiate renal replacement therapy (RRT) in the unplanned patient apart

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from increasing long-term uptake of PD as treatment for end-stage renal disease (ESRD).

USPD is defined as starting PD within 14 days of PD catheter insertion. In our opinion, USPD is unable to reduce significantly the need to intervene with urgent start HD and CVC insertions, as patients have immediate need for RRT in the first 48 h due to extenuating comorbidities. In such a setting of patients presenting late with uremic complications, the most appropriate approach would be to start on emergent start PD (ESPD). ESPD implies starting PD within 48 h of the patient presenting, most of the times in the intensive care unit (ICU) and within 24 h. Some patients may need a couple of sessions of HD to control comorbidities such as hyperkalemia, metabolic acidosis, or pulmonary edema after which they can still be started on ESPD (bimodal approach). Hypercatabolic patients may not be amenable to ESPD, whereas hemodynamically unstable patients may be suitable for either ESPD or continuous RRT (CRRT). Recovery of residual renal function, more uptake of long-term PD as an RRT option are other likely advantages with ESPD. Patients needing ESPD are unlikely to be fit to undergo laparoscopic PD catheter insertion or any other catheter insertion approach needing general anesthesia. ESPD would need an experienced surgeon capable of performing the procedure under local anesthesia with minimal sedation if needed. Song et al. [22] performed as early as 2 decades back, immediate start, full-volume PD in an ESRD cohort using manual exchanges with good results. However, performing manual exchanges in the present day scenario, especially in the ICU, is untenable due to the labor-intensive nature of the treatment, more incidence of leaks due to poor control on dwell volumes, and increased chances of peritonitis due to multiple spiking during bag changes. Thus, automated PD (APD) would be the better option.

We, in our renal ICU have been practicing ESPD using APD as the routine default therapy to treat late-referred patients with ESRD. We compare our ESPD patients on APD with the conventional start PD with a break-in period of 14 days as is our center's policy, as to their various short-term outcomes.

Materials and Methods

Study Design and Setting

This is a single-center, prospective, case-controlled, intention-to-treat study performed in the department of nephrology and medical intensive care unit of a tertiary care hospital over an 18-month period between March 2016 and August 2017.

Selection of Participants

All patients admitted to the hospital with severe uremia, requiring immediate RRT, with no established access, between March 2016 and August 2017 were enrolled for the study. ESPD was defined as the initiation of PD within 48 h of Tenchkoff catheter insertion, which was done at the earliest (usually <6 h) after decision to start RRT in the patient. All patients were mandatorily initiated on APD. Institutional review board approval and patient informed consent was obtained prior to PD catheter insertion. Exclusion criteria were hypercatabolic status due to ongoing sepsis, severe shock, patients on anti-platelet agents, previous multiple abdominal surgeries, and those who did not consent for the study. Patients whose initial presentation along with uremia was hyperkalemia or metabolic acidosis, were included in the study after correction with 1 or 2 emergency HD sessions and then shifted to ESPD within 48 h ("Bimodal approach"). Eligible patients assigned to 2 groups: in the first group (Group A) were patients who were started on HD using a CVC and had a conventional initiation of PD, with break-in after 14 days of catheter insertion. Tenchkoff catheter insertion was done by an experienced surgeon using a surgical approach with local anesthesia, general, or regional anesthesia (spinal), with an open or the laparoscopic method. Group B was initiated on ESPD immediately after PD catheter insertion by the same surgeon under local anesthesia or within 48 h after correction of comorbidities (hyperkalemia, uremic acidosis or pulmonary edema). A Swan neck, double cuff Tenchkoff catheter was used in all patients (Covidien AG, Mansfield, MA, USA). Since the same surgeon performed the procedure with the same type of PD catheter, a procedural uniformity was maintained. The procedure is performed under local anesthesia with mild sedation if needed. Infra-umbilical midline skin incision 5–6 cm in length is taken and subcutaneous fat dissected till the rectus sheath. A keyhole incision of 0.5–1 cm was made on the rectus sheath. After placing the catheter tip in the true pelvis, the peritoneum is closed with purse string suture around the catheter with reabsorbable suture with the deep cuff in the preperitoneal space. Posterior and anterior rectus sheath layers are also closed with reabsorbable sutures ensuring not to tighten the catheter and at the same time preventing PD fluid leakage.

ESPD patients were prescribed PD fluid fill volume per cycle ranging between 500 and 750 mL and dwell time of 30–45 min depending on their individualized need. Total PD fluid fill volume per day was usually 10–15 L with total duration of therapy being 8–10 h/day on a daily basis using a APD cycler (mCycler, Mitra Industries, New Delhi, India). Ambulation of patient after last bag drainage was advised, so that the tip of the PD catheter gravitated to the true pelvis. Last bag fill was avoided to prevent exit site leak (ESL), and the patient remained in the supine position while APD therapy was in progress. Seven days of APD therapy on initiation was performed in all patients, subsequent to which, cycler-based PD was discontinued in those who opted for manual PD, for which, training was initiated. Others continued to perform APD in the hospital and on discharge in their homes as shown in the flowchart (Fig. 1).

Outcome Measures

Primary Outcomes

ESL, catheter block, and peritonitis at 90 days since PD initiation were the primary outcomes of the study.

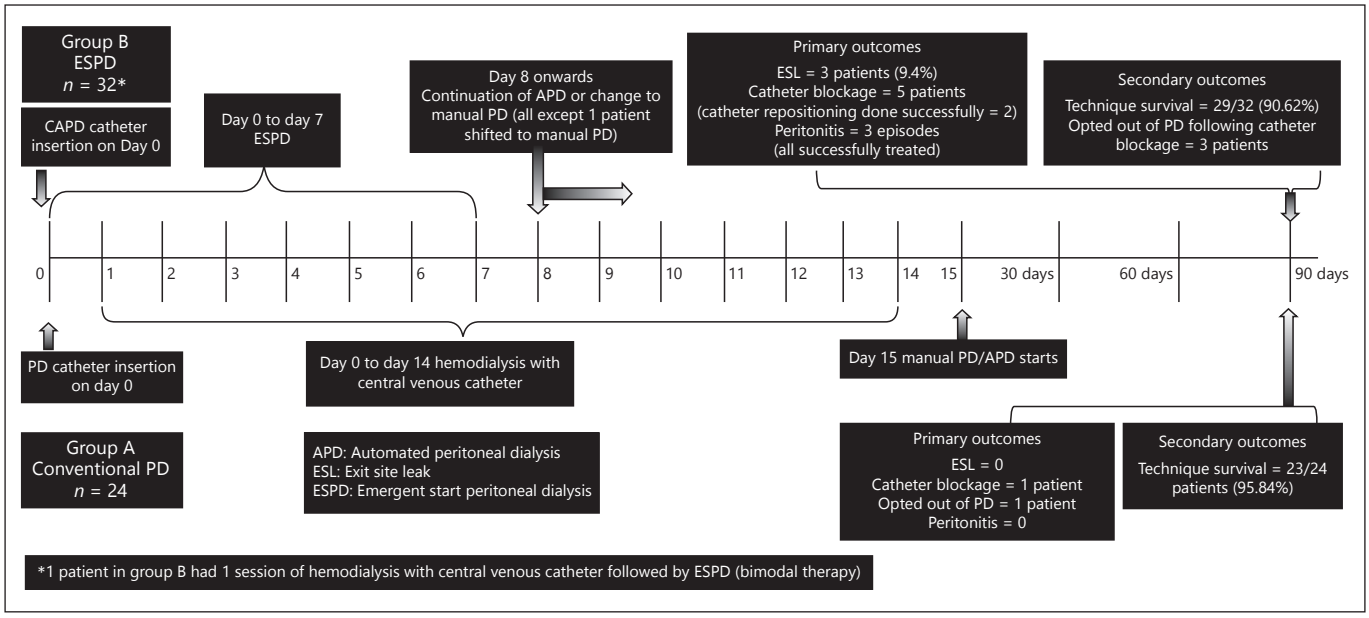

Fig. 1. Flowchart describing the overview of study details.

Secondary Outcomes

Technique survival at 90 days was the secondary outcome. All patients who had ESL were temporarily put on HD for 2 weeks. Catheter block due to migration was resolved initially by soap and water rectal enema twice a day for 3 days with a daily attempt to recommence APD followed by surgical repositioning of the catheter if necessary. Peritonitis was resolved by using the International Society for PD guidelines [23]. Outcomes were compared with equal number of age, sex, renal disease etiology, and comorbidity matched controls who underwent 2 weeks of HD followed by manual PD cycles commenced 2 weeks after CAPD catheter insertion. Concentration of Dextrose was 1.5, 2.5, and 4.5% depending on ultrafiltration needs.

Statistical Analysis

Baseline characteristics were presented as descriptive analysis. Categorical variables are presented as frequency *n* (%) and continuous variables in terms of mean (±SD). Comparisons between groups were performed using chi-square test and/or Fisher's exact test for categorical variables and by independent *t* test for continuous variables. ESL, peritonitis episodes, and technique survival were evaluated by Kaplan-Meier method. Data were analyzed using Statistical Package of Social Sciences (SPSS) version 23.0. A $p < 0.05$ was considered statistically significant.

Results

The period of study was from March 2016 to August 2017. Group A consisted of conventional PD and group B of patients initiated on ESPD. A total of 56 patients were included in the study with 24 patients in Group A (control group) and 32 of them in Group B (study group). Out of total 56 cases recruited, 24 cases were in Group A and 32 in Group B.

Causes of CKD (Table 1)

Diabetic Nephropathy and Chronic Tubulo interstitial Nephritis were equally common in Group A (37.5%) and Diabetic Nephropathy was most common (50%) in Group B.

CoMorbidities (Table 1)

Comorbidities included diabetes mellitus 48.3%, hypertension 87.9%, ischemic heart disease (36.2%), and peripheral vascular disease (13.8%). Diabetes mellitus was more common in Group B ($p = 0.054$), whereas peripheral vascular disease was more common in Group A ($p = 0.006$).

Complications Related to PD (Table 2)

Treatment-oriented complications seen included ESL, catheter blockage, and peritonitis (primary outcomes; Fig. 2). ESL was seen only in Group B –9.4% (3) cases. Catheter blockage was seen in 16.7% (4) cases of Group A and 25% [8] cases in Group B, but the difference was not statistically significant ($p = 0.452$). None had peritonitis in Group A and only 3 cases (9.4%) had in group B. The difference was not statistically significant ($p = 0.123$; Fig. 3). Technique survival at 90th day (sec-

Table 1. Baseline characteristics of control and study groups

	All (n = 56)	Conventional PD (n = 24)	Emergent PD (n = 32)	p value
Gender, M:F, n (%)	40 (71.4):16 (28.6)	20 (83.3):04 (16.7)	22 (64.7):12 (35.3)	0.118‡
Age, years	55.5±10.4	55.9±10.6	55.3±10.3	0.826#
Comorbidities, n (%)				
DM	27 (48.2)	08 (33.3)	19 (59.4)	0.054‡
HTN	49 (87.5)	19 (79.2)	30 (93.8)	0.102‡
IHD	20 (35.7)	09 (37.5)	11 (34.4)	0.809‡
PVD	08 (14.3)	07 (29.2)	01 (3.1)	0.006‡
Diagnosis, n (%)				
ADPKD	01 (1.8)	00	1 (3.1)	0.382‡
CGN	12 (21.4)	06 (25.0)	06 (18.8)	0.573‡
CIN	18 (32.1)	09 (37.5)	09 (28.1)	0.457‡
DN	25 (44.6)	09 (37.5)	16 (50.0)	0.352‡

Group comparisons were performed by independent t test.
‡ Group comparisons were performed by chi-square test, Fisher's exact test.
M:F, male:female; DM, diabetes mellitus; HTN, hypertension; IHD, ischemic heart disease; PVD, peripheral vascular disease; ADPKD, autosomal dominant polycystic kidney disease; CGN, chronic glomerulonephritis; CIN, chronic interstitial nephritis; DN, diabetic nephropathy; PD, peritoneal dialysis.

Table 2. Complications in the control and study groups

	All (n = 56)	Conventional PD (n = 24)	Emergent PD (n = 32)	p value‡
Exit site leak	03 (5.4)	00	03 (9.4)	0.123
Block at start	00	00	00	–
Block due to cath migration	12 (21.4)	04 (16.7)	08 (25.0)	0.452
Block cleared by enema (n = 12)	07 (58.3)	04 (100)|(n = 4)	03 (37.5)|(n = 8)	0.038
Cath-repositioned (n = 05)	03 (60.0)	00	03 (60.0)|(n = 5)	–
Peritonitis	03 (5.4)	00	03 (9.4)	0.123
Technique survival at 90 days	52 (92.9)	23 (95.8)	29 (90.6)	0.454

Values are expressed in n (%).
‡ Group comparisons were performed by chi-square test, Fisher's exact test.

ondary outcome), (Graph 3) 95% (23 out of 24) cases in Group A had successful continuation of PD at the end of 90 days. One case had technique failure due to peritoneal adhesions.

In Group B, technique survival was seen in 88.2% (31 out of 34) cases. Three patients had opted out of PD following catheter blockage due to catheter migration and did not accept catheter repositioning. Difference in technique survival amongst both groups was not statistically significant (p = 0.31; Table 3; Fig. 4). The results of the study group were comparable favorably with the control group.

Discussion

Though there is a heightened interest in urgent start PD, most studies have addressed only those patients being initiated on PD in the first 14 days after catheter insertion. A study by Lobbedez [20] mentions that "a few of their patients" were initiated on an emergent start. Non-emergent urgent-start patients will still have to go through the CVC route and undergo HD in the unplanned start patients with attendant infections and other complications. The full benefit of totally avoiding CVC and HD in the unplanned start patients can be had only when we initiate PD immediately on their presentation with an ur-

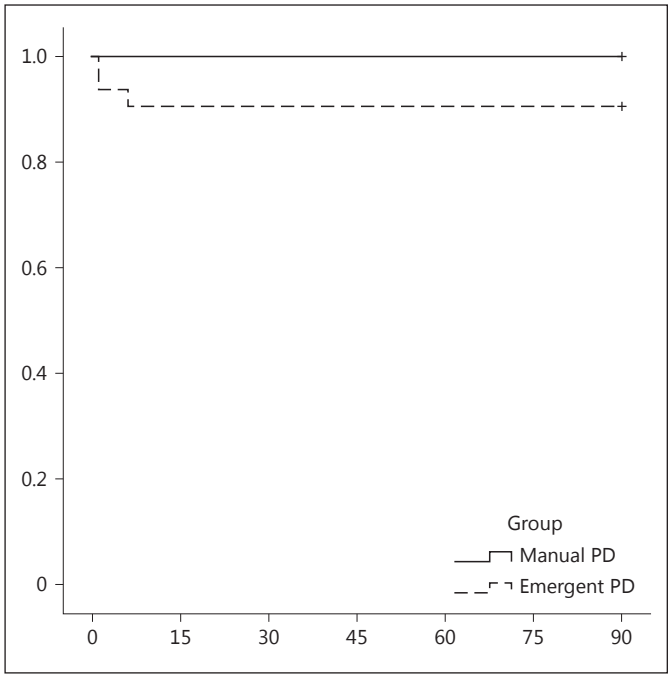

Fig. 2. Exit site leak-free patients over 90 days. No exit site leak event happened in the Manual PD group in comparison to 3 events in the Emergent PD group.

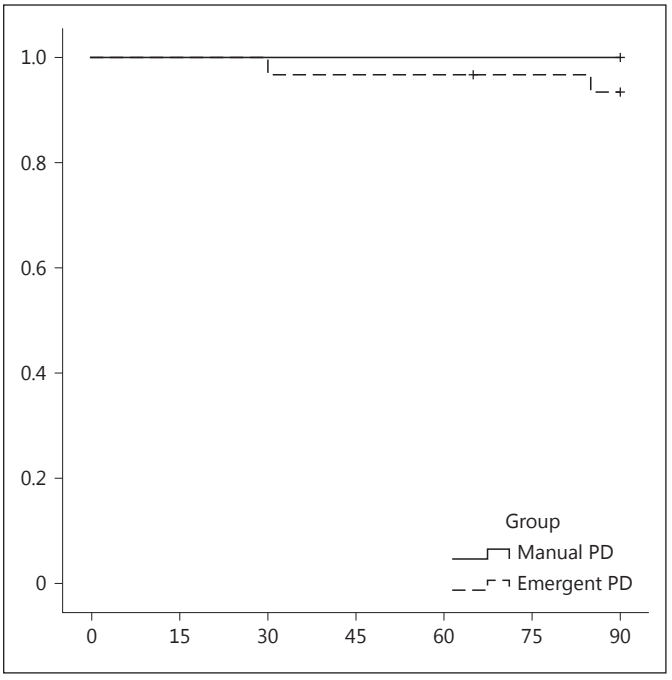

Fig. 3. Peritonitis-free patients over 90 days. No peritonitis episodes occurred in the Manual PD group in comparison to 2 events in the Emergent PD group.

gent insertion of PD catheter insertion. Undergoing manual exchanges after PD catheter insertion is not a feasible option in the ICU, if an emergent study PD is contemplated. All our study group patients had PD initiation with APD within 24–48 h of PD catheter insertion under local anesthesia. A recent study [24] from Brisbane, Australia, using manual exchanges at initiation 7 days after catheter insertion in a subgroup of their patients found a statistically higher incidence of catheter leak, while one more study from Brisbane [15], presumably using APD, had favorable results for USPD. The usage of manual exchanges in the earlier mentioned study could have been responsible for the increased incidence of leaks. Information on peritonitis rates is not available in detail, apart from the fact that the ESPD group had a higher incidence of infections (presumably peritonitis), probably attributable again to the usage of manual exchanges, impacting technique survival. There was also a confounding issue, poorly explained of significantly poor technique survival in those who started PD 4 weeks after catheter insertion. This study was prematurely stopped due to higher complication rates in the ESPD group. The study has been objectively analyzed regarding its shortcomings by Crabtree and Burchette [25]. A retrospective analysis of ESPD

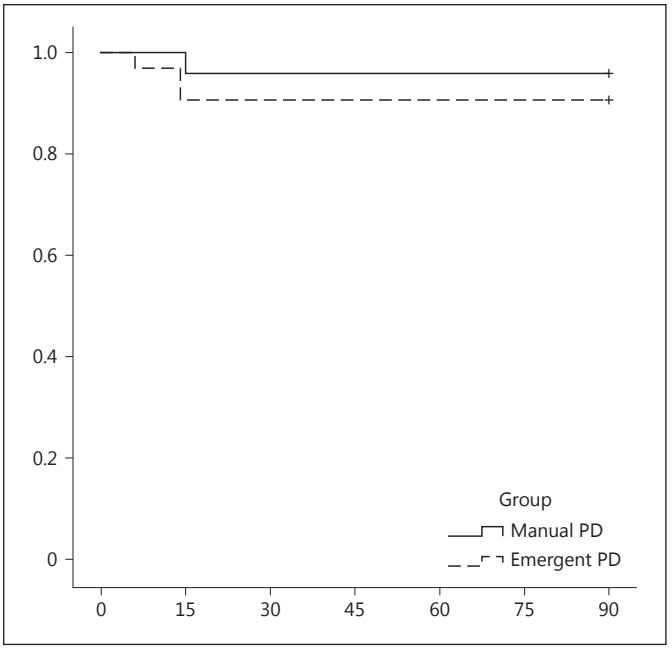

Fig. 4. Technique survival at 90 days from initiation. One technique failure occurred in the Manual PD group in comparison to 2 in the Emergent PD group. The estimated mean time until event was 86.9 days in the Manual PD group and 82.6 days in the Emergent PD group.

Table 3. Primary and secondary outcomes in control and study groups

Group	Total number	Number of events	Censored, *n* (%)
Exit site leak episodes			
Manual PD	24	0	24 (100.0)
Emergent PD	32	3	29 (90.6)
Overall	56	3	53 (94.6)
Peritonitis-free patients			
Manual PD	24	0	24 (100.0)
Emergent PD	31	2	29 (93.5)
Overall	55	2	53 (96.4)
Technique survival			
Manual PD	24	1	23 (95.8)
Emergent PD	32	3	29 (90.6)
Overall	56	4	52 (92.9)

with APD showed a high incidence of mechanical complications probably due to deficiencies in the surgical approach in catheter placement [26].

The success of an ESPD program is dependent on a multidisciplinary approach to ensure smooth initiation, proper monitoring of the APD therapy, and seamless transition to long-term PD therapy. This requires teamwork with PD nurses coordinating with the ICU staff, surgical team, renal nutritionists, and the ancilliary hospital resource staff including pharmacy. A minimum of 2 cycler machines and at least one PD nurse are dedicatedly needed for a busy ESPD program. The assessment of the patient and family support for long-term PD needs are to be assessed on an urgent basis. Training of the patient and designated "care giver" begins concurrently, before the end of the first week on APD, and depends on whether the choice is of manual PD or APD as the long-term RRT. However, central to the success of an ESPD program is the passionate nephrologist team, which believes in the utility of such an approach to the treatment of the unplanned RRT initiation in the uremic patient. The advantages of ESPD are manifold and in addition, have seen a quantum leap of long-term PD uptake at our center subsequent to starting the ESPD program.

Disclosure Statement

The authors report no conflicts of interest.

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