

Introduction

- Peritoneal dialysis (PD) is an attractive but underutilized option for renal replacement therapy among end-stage renal disease patients in the United States. A major barrier is the perceived need for advanced planning before patients can start PD, which precludes offering PD as an initial modality to unplanned patients, who account for up to 60% of all new dialysis starts.
- Several single-center studies have demonstrated the safety and feasibility of “urgent-start PD,” which includes PD catheter placement, rapid introduction of the modality, and concurrent patient training in unplanned patients.¹⁻⁶
- An Urgent-Start PD pilot undertaken at a large dialysis organization (LDO) demonstrated that as part of a structured program, PD could be successful in patients needing urgent dialysis initiation.⁷
- In April 2012, the LDO began offering Urgent-Start PD to a broader segment of its population in multiple dialysis clinics around the United States.

Objectives

- Objective 1** – To compare rates of mortality, hospitalization, and infection between Urgent-Start PD patients and matched controls who initiated in-center hemodialysis (HD) via a central venous catheter (CVC).
- Objective 2** – To compare rates of mortality, hospitalization, infection, peritonitis, bloodstream infection, and modality failure between Urgent-Start PD and matched controls who initiated traditional planned PD.

Methods

Staff Education

- Specific clinical protocols, guidelines, and processes to standardize the urgent-start process across different clinics were created and PD staff were trained in their use. These included:
 - Protocol to determine appropriate timing of dialysis initiation after PD catheter placement
 - Standardized initial urgent-start PD prescription (small volume, in-center, supine PD with volumes, frequency and times on therapy dictated by patient signs/symptoms, patient size, and residual kidney function)
 - Standardized process for patient PD training, delivery of in-center urgent-start PD, and transition to home PD after the urgent-start period
 - Guidelines for management of early complications

Populations

- Eligible patients were those who initiated dialysis at the LDO between April 2012 and March 2014:
 - Urgent-Start PD patients:** Enrolled in Urgent-Start PD program per enrollment records
 - In-center HD controls:** Began in-center HD via CVC at the LDO within 7 days of first-ever dialysis
 - Traditional PD controls:** Began PD at the LDO as an incident modality but were not part of the Urgent-Start PD program

Propensity Matching

- Urgent-Start PD patients were propensity score matched 1:1 separately with HD controls and with PD controls for age, race, sex, body weight, dialysis vintage, date of dialysis start at LDO, congestive heart failure, coronary artery disease, cerebrovascular disease, peripheral vascular disease, and Charlson Comorbidity Index score.

Methods continued

Statistical Analysis

- Patient characteristics were described as means, SDs, medians, p25s, p75s, counts and proportions as dictated by data type.
- Baseline differences between groups were assessed using standardized differences. Standardized differences >10% or ≤10% indicate substantial imbalance.
- Outcomes were considered in terms of incidence rates (events per time at risk). These were compared by Poisson regression models and were reported as incidence rate ratios (IRR) with 95% confidence intervals (CI).
- Because groups were matched, no covariate terms were added to the models. Robust variance estimators were used to account for matched study design.
- Planned sensitivity analyses were conducted within the following subgroups: diabetic patients, nondiabetic patients, high-volume Urgent-Start PD clinics (those enrolling ≥ 10 patients) and respective controls, and low-volume clinics and respective controls.

Results

- 690 Urgent-Start PD patients met criteria for inclusion in the analysis; of these:
 - 376 were successfully matched to HD controls
 - 317 were successfully matched to traditional PD controls

- Patient characteristics for Urgent-Start PD and matched controls are shown in Table 1.

Table 1. Patient Characteristics Among Propensity Score Matched Urgent-Start PD Patients and Controls

	Objective 1			Objective 2		
	Urgent-Start PD N = 376	HD Controls N = 376	Std Diff	Urgent-Start PD N = 317	Traditional PD N = 317	Std Diff
Age, (years), mean ± SD	54.0 ± 16.4	54.0 ± 16.9	0.0%	55.0 ± 15.7	55.0 ± 15.7	+4.4%
Female, n (%)	166 (44.2)	164 (43.6)	+1.2%	131 (41.3)	131 (41.3)	+6.5%
Race, n (%)						
White	179 (47.6)	173 (46.0)	+3.2%	174 (54.9)	174 (54.9)	-3.8%
Black	94 (25.0)	105 (27.9)	-6.6%	63 (19.9)	63 (19.9)	+6.8%
Hispanic	72 (19.2)	67 (17.8)	+3.6%	54 (17.0)	54 (17.0)	-1.6%
Other/unknown	31 (8.2)	31 (8.2)	0.0%	26 (8.2)	26 (8.2)	-1.1%
Vintage, (days), n (%)						
0	369 (98.1)	369 (98.1)	0.0%	316 (99.7)	316 (99.7)	0.0%
1-7	7 (1.9)	7 (1.9)	0.0%	1 (0.3)	1 (0.3)	0.0%
Body weight, (kg), mean ± SD	83.5 ± 21.5	84.2 ± 25.2	-2.38%	82.3 ± 20.5	82.3 ± 20.5	+5.3%
Etiology of ESRD, n (%)						
Diabetes	128 (34.0)	130 (34.6)	-1.3%	130 (41.0)	130 (41.0)	-13.0%
Hypertension	125 (33.2)	108 (28.7)	+9.7%	85 (26.8)	85 (26.8)	+13.8%
Other/unknown	123 (32.7)	138 (36.7)	-8.4%	102 (32.2)	102 (32.2)	0.0%
Diabetes, n (%)	206 (54.8)	206 (54.8)	0.0%	178 (56.2)	178 (56.2)	0.0%
Congestive heart failure, n (%)	47 (12.5)	37 (9.8)	+8.6%	26 (8.2)	26 (8.2)	+5.6%
Coronary artery disease, n (%)	7 (1.9)	7 (1.9)	0.0%	7 (2.2)	7 (2.2)	0.0%
Cerebrovascular disease, n (%)	5 (1.3)	6 (1.6)	-2.5%	4 (1.3)	4 (1.3)	0.0%
Peripheral vascular disease, n (%)	16 (4.3)	20 (5.3)	-4.7%	15 (4.7)	15 (4.7)	-7.7%
Charlson Comorbidity Index score, median [p25, p75]	5 [3, 6]	4 [3, 6]	p = 0.65	5 [3, 6]	5 [3, 6]	p = 0.80
Year initiation						
2012	107 (28.5)	107 (28.5)	0.0%	90 (28.4)	90 (28.4)	0.0%
2013	209 (55.6)	209 (55.6)	0.0%	176 (55.5)	176 (55.5)	0.0%
2014	60 (16.0)	60 (16.0)	0.0%	51 (16.1)	51 (16.1)	0.0%
USPD dialysis center, n (%) enrolled ≥ 10 patients	200 (53.2)	NA		NA	NA	

Abbreviations: ESRD, end-stage renal disease; HD, hemodialysis; NA, not applicable; p25, 25th percentile; p75, 75th percentile; PD, peritoneal dialysis; SD, standard deviation; Std Diff, standard difference; USPD, United States peritoneal dialysis.

Results continued

Table 2. Comparative Incident Rate Ratios Between Urgent-Start PD Patients and Matched Controls

	Objective 1		Objective 2	
	Urgent-Start PD	Matched HD Controls	Urgent-Start PD	Matched Traditional PD Controls
N	376	376	317	317
At-risk time, (100 pt-yrs)	2.61	2.45	2.19	2.58
Deaths				
Events	21	40	18	22
Crude rate (per 100 pt-yrs)	8.04	16.30	8.23	8.54
IRR (95% CI)	0.49 (0.29, 0.84)	1 (ref)	0.96 (0.52, 1.79)	1 (ref)
p-value	p = 0.009		p = 0.91	
Hospitalizations				
Events	381	629	319	287
Crude rate (per 100 pt-yrs)	145.95	256.36	145.87	111.43
IRR (95% CI)	0.61 (0.49, 0.77)	1 (ref)	1.45 (1.13, 1.87)	1 (ref)
p-value	p < 0.001		p = 0.004	
Infections				
Events	54	87	50	41
Crude rate (per 100 pt-yrs)	20.69 ^a	35.46 ^b	22.86	15.92
IRR (95% CI)	0.58 (0.39, 0.87)	1 (ref)	1.44 (0.88, 2.36)	1 (ref)
p-value	p = 0.008		p = 0.15	
Peritonitis				
Events	46	0	45	40
Crude rate	17.62 ^d	0	20.58	15.53
Bloodstream infections				
Events	8	87	5	1
Crude rate	3.06	35.46	2.29	0.39

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; ref, referent; pt-yrs, patient-years.

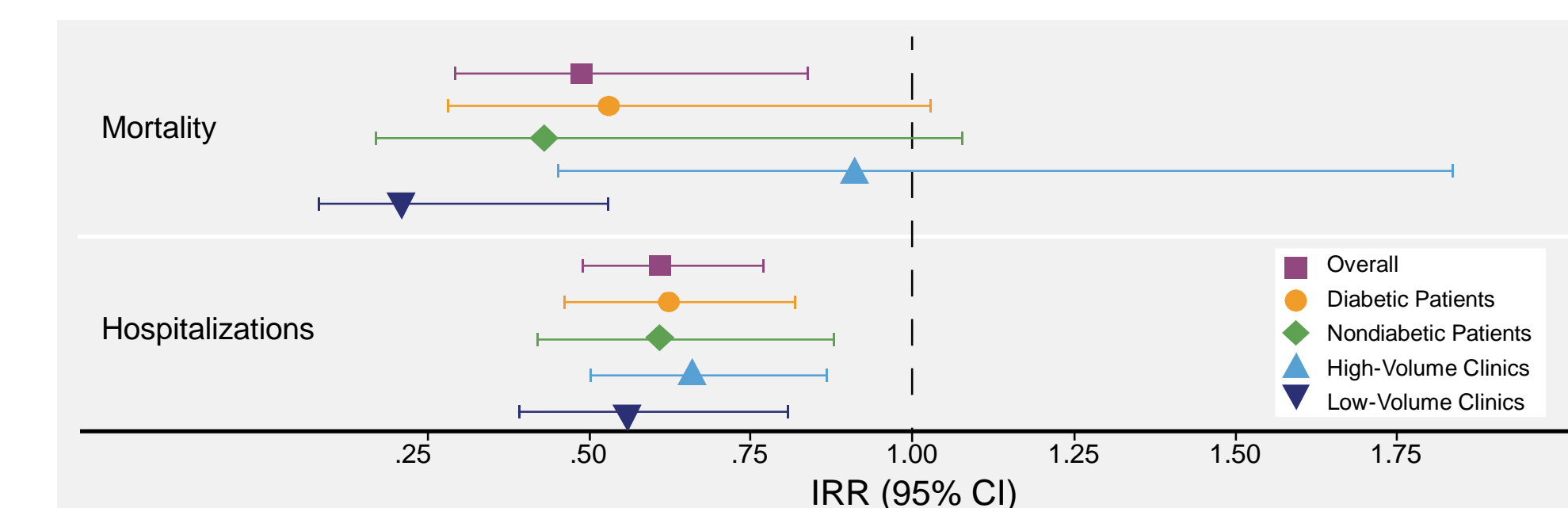
Discussion

- Compared to HD controls, Urgent-Start PD patients had:
 - 51% lower mortality (p = 0.009)
 - 39% lower hospitalizations (p < 0.001)
 - 42% fewer infections (p = 0.008)
 - Infection rate (20.69 per 100 patient-years) was comparable to ~1 infection every 60 months compared to ~1 infection every 34 months among HD controls
 - There were comparatively more cases of peritonitis than bloodstream infections
- Compared to traditional PD controls, Urgent-Start PD patients had:
 - Equivalent mortality (p = 0.91)
 - 45% higher hospitalizations (p = 0.004)
 - Non-significant 44% higher infection rates (p = 0.15)
 - In both groups bloodstream infection rates were extremely low
- Urgent-Start PD patients were more likely than PD controls to have modality failure:
 - This effect was greater among low-volume Urgent-Start PD centers than high-volume Urgent-Start PD centers
 - The reasons for the modality failure are currently being investigated

Sensitivity Analyses

- When Urgent-Start PD patients and their respective controls were analyzed with regard to the subgroups for sensitivity analyses, consistent results were found. Mortality and hospitalization rates for Urgent-Start PD patients and HD controls are shown in Figure 1.

Figure 1. Comparative Rates For Death and Hospitalization in the Urgent-Start PD Group versus the HD Controls



Conclusions

- Urgent-Start PD, as part of a structured program, provides superior short-term survival, fewer hospitalizations, and lower infection rates compared to HD with central venous catheters.
- Urgent-Start PD provides similar short-term survival and infections and hospitalization rates compared to traditional planned PD, despite a higher rate of technique failure.
- Urgent-Start PD could be more broadly implemented, allowing more unplanned end-stage renal disease patients the option of starting PD while optimizing outcomes.

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