Outcomes of Continuous Renal Replacement Therapy Versus Peritoneal Dialysis as a Renal Replacement Therapy Modality in Patients Undergoing Extracorporeal Membrane Oxygenation

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Introduction

Acute kidney injury (AKI) in patients undergoing extracorporeal membrane oxygenation (ECMO) support was a common complication, leading to a high number of patients in this group subsequently required renal replacement therapy (RRT). Given the hemodynamically unstable nature of ECMO-supported patients, continuous renal replacement therapy (CRRT) and peritoneal dialysis (PD) appear as two potential suitable RRT modalities, with different advantages and disadvantages for each mode shown in **Table 1**. Although CRRT is widely used in such scenarios, there is limited available data on the utilization of PD in adult patients undergoing ECMO.

Our objective was to conduct a comprehensive evaluation and comparison of outcomes among ECMO-supported patients who have undergone either CRRT or PD.

Table 1: Comparing each RRT modality during ECMO

Modality	Advantages	Disadvantages
CRRT	Hemodynamic stability Continuous toxin removal Joinable to ECMO circuit Easy control of fluid balance	Patient immobilization Increase risk of hypothermia High cost
PD	Hemodynamic stability Technically simple Low cost	Risk of peritonitis Unpredictable solute and fluid clearance Potentially prolong weaning from ECMO

Methods and Materials

A single-center retrospective cohort study was conducted using data from patient records between February 2018 and October 2023 at the Central Chest Institute of Thailand. ECMO-supported patients who subsequently received RRT within one week after ECMO initiation were included.

The patient cohort was categorized into two groups based on the RRT modality employed: CRRT and PD. Patient profiles and outcomes, including hospital mortality, length of stays, RRT and ECMO durations, and RRT complications, were analyzed and compared.

Table 2: Baseline characteristic of the patients

Baseline characteristic	Total (N=43)	CRRT (N=21)	PD (N=22)	*p*-value
Age, y	58.2±15.7	59.7±14.2	56.9±17.2	0.56
Gender, male, n (%)	31 (72.1)	14 (66.7)	17 (77.3)	0.44
BMI, kg/m^2	23.7±5.8	25.6±6.5	21.9±4.4	0.035
Comorbidity, n (%)				
Diabetes mellitus	12 (27.9)	7 (33.3)	5 (22.7)	0.44
Hypertension	22 (51.2)	13 (61.9)	9 (40.9)	0.17
Dyslipidemia	20 (46.5)	11 (52.4)	9 (40.9)	0.45
Chronic kidney disease	11 (25.6)	7 (33.3)	4 (18.2)	0.26
Coronary artery disease	19 (44.2)	10 (47.6)	9 (40.9)	0.66
LVEF<40%	20 (46.5)	10 (47.6)	10 (45.5)	0.89
Clinical at RRT initiation				
MAP, mmHg	69.7±15.6	68.6±16.9	70.9±14.6	0.64
APACHE II scores	25.6±6.4	26.0±6.3	25.3±6.6	0.73
IABP use, n (%)	35 (81.4)	14 (66.7)	21 (95.5)	0.015
Fluid balance, mL	2170 (909,3218)	2700 (1214,3104)	1781 (642,3614)	0.81
Urine output, mL	367.5 (115,640)	420 (245,725)	310 (75,500)	0.14
ECMO Prescription				
Pump speed, RPM	2790.7±484.2	2812.9±498.1	2769.5±482.2	0.77
Blood flow rate, L/min	3.3±1.3	3.3±1.1	3.3±1.5	0.95
Cardiac index, L/min/m^2	2.0±0.6	1.9±0.7	2.1±0.5	0.47
Indication for ECMO, n (%)				0.25
Cardiogenic shock	11 (25.6)	4 (19.1)	7 (31.8)	
Post-cardiotomy	30 (69.8)	15 (71.4)	15 (68.2)	
Other	2 (4.7)	2 (9.5)	0 (0)	
Indication for RRT, n (%)				0.33
Volume overload/ control	33 (76.7)	15 (71.4)	18 (81.8)	
Refractory metabolic acidosis	8 (18.6)	4 (19.1)	4 (18.2)	
Uremia	2 (4.6)	2 (9.5)	0 (0)	

Results

Forty-three patients were included in the study, consisting of twenty-one in the CRRT group and twenty-two in the PD group. The baseline characteristics of the patients in this study are shown in **Table 2**.

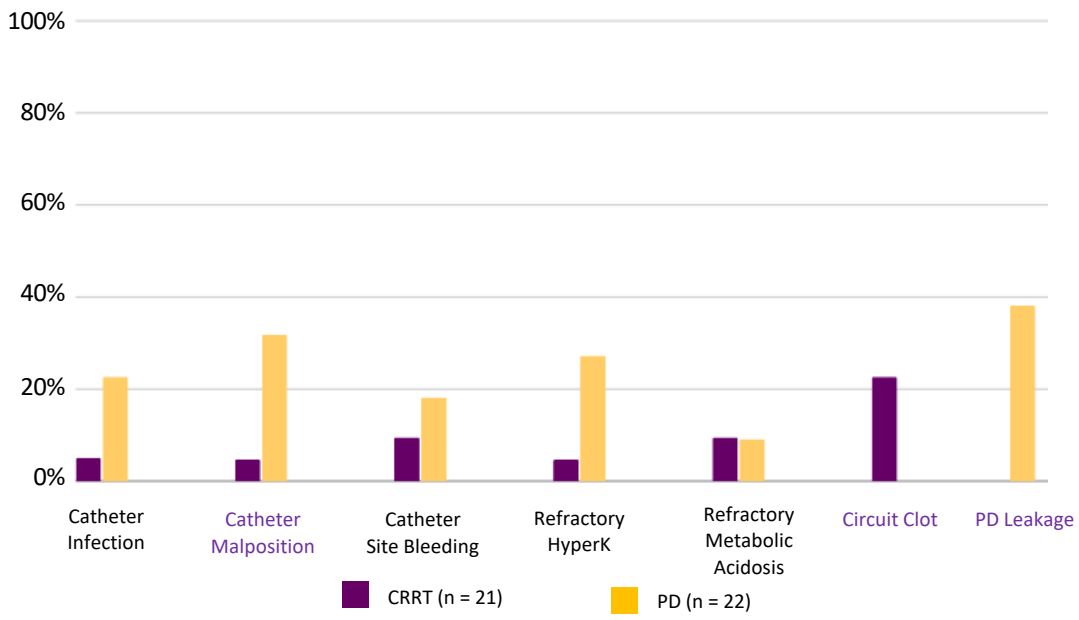
Outcomes and complications between the two groups are shown in **Table 3**. There was no statistically significant difference in in-hospital mortality rates between the two groups (80.9% in CRRT vs 90.9% in PD, p = 0.35). CRRT exhibited a significantly shorter median RRT duration compared to PD (4 days vs. 7.5 days, p = 0.0007) and demonstrated a markedly lower rate of catheter malposition (4.7% vs. 31.8%, p = 0.046). The rates of catheter infection and catheter site bleeding were not statistically significant (4.7% in CRRT vs. 22.7% in PD, p = 0.19, and 9.5% in CRRT vs. 18.2% in PD, p = 0.66, respectively). Additionally, circuit clotting was observed in 38.1% of CRRT patients, while the incidence of PD leakage was 22.7%.

Table 3: Outcomes and Complication of CRRT and PD during ECMO

Outcome	CRRT (N=21)	PD (N=22)	*p*-value
In-hospital mortality, n (%)	**17 (80.9)**	**20 (90.9)**	**0.35**
60-days mortality, n (%)	18 (85.7)	21 (95.45)	0.27
ICU lengths of stay, days	11 (6,15)	15 (9,25)	0.14
Hospital lengths of stay, days	18 (9,28)	24.5 (18,31)	0.22
RRT durations, days	4 (3,5)	7.5 (5,14)	0.0007
ECMO durations, days	6 (4,8)	5 (4,7)	0.63
Weaning from ECMO, n (%)	8 (38.1)	10 (45.5)	0.63
Complications, n (%)			
Catheter infection	1 (4.7)	5 (22.7)	0.19[f]
Catheter malposition	1 (4.7)	7 (31.8)	0.046[f]
Catheter site bleeding	2 (9.5)	4 (18.2)	0.66[f]
PD leakage	0 (0)	5 (22.7)	0.048[f]
Circuit clot	8 (38.1)	0 (0)	0.034[f]
Refractory hyperkalemia	1 (4.7)	6 (27.3)	0.10[f]
Refractory metabolic acidosis	2 (9.5)	2 (9.1)	0.61[f]

Data are presented as median (IQR) for continuous variables, and n (%) for categorical variables
p-value were calculated by Mann-Whitney U test, Chi-squared test, or Fisher's exact test (ƒ) as appropriate

Figure 1: Comparing complications of CRRT and PD



Conclusions

Among ECMO-supported patients receiving RRT, there was **no difference between CRRT and PD in terms of in-hospital mortality and hospital length of stay**. However, PD did exhibit a higher incidence of catheter-related complications.

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