The Comparison of Circuit Lifespan between Integration and Separation Approach in Extracorporeal Membrane Oxygenation Patient Requiring Continuous Renal Replacement Therapy Support, A Randomized Controlled Trial (E-CRRT Trial)

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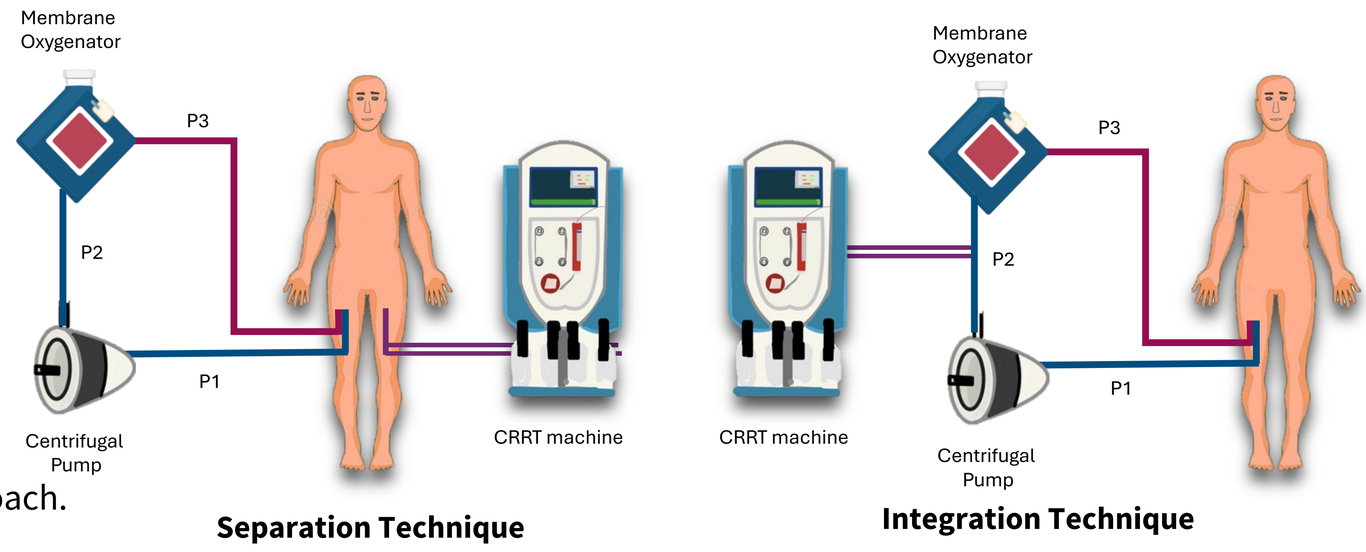
Background

The estimated incidence of acute kidney injury (AKI) requiring continuous renal replacement therapy (CRRT) in patients necessitating extracorporeal membrane oxygenation (ECMO) is approximately 50%. Currently, two well-known techniques, separation and integration are utilized for combining CRRT and ECMO circuits, neither of which is considered a standard treatment.

Objectives

To compare CRRT-circuit lifespan between integration and separation approach.



Materials and Methods

Multicenter, open-label RCT (1:1) was conducted in ICU of two tertiary referral centers in Thailand King Chulalongkorn Memorial Hospital (KCMH) and The Central Chest Institute of Thailand (CCIT)

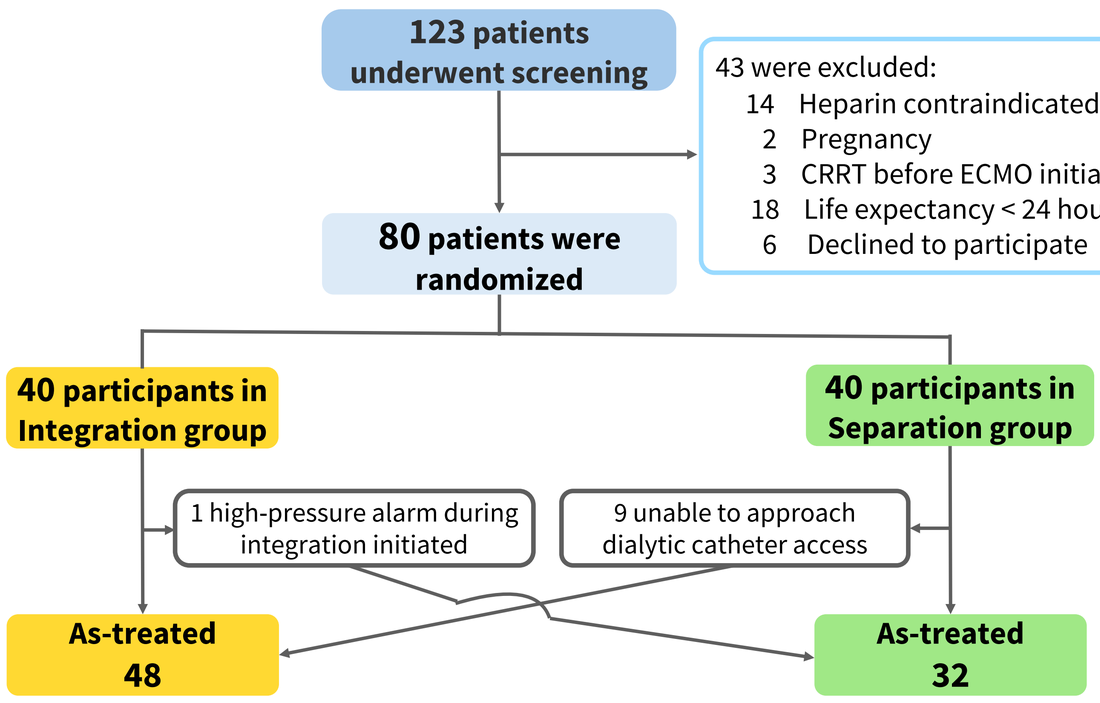
Inclusion Criteria: > 18 year-old adults requiring ECMO with AKI necessitating CRRT

Exclusion Criteria: Pregnancy, Contraindication to heparin, AKI due to bilateral renal artery thrombosis, vasculitis, glomerulonephritis, or post-obstructive causes

Primary Outcomes:
CRRT circuit lifespan

Secondary Outcomes:
28-day mortality, serious adverse events, pressures in the CRRT circuit, and CRRT machine alarms.

Results



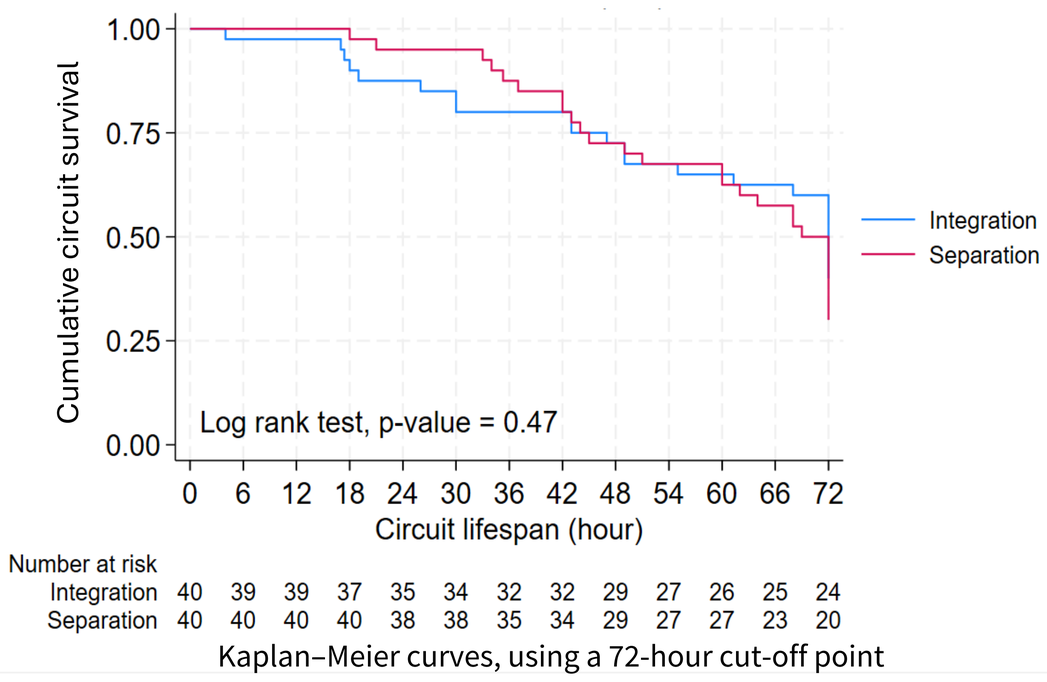
Between May 1, 2021, and March 10, 2025, a total of **80 patients**

Baseline Characteristics

	Total (N = 80)	Integration (n = 40)	Separation (n = 40)
Chronic kidney disease, n(%)	24 (30)	9 (22.5)	15 (37.5)
APACHE II score, median (IQR)	30 (26 - 35)	31.5 (27 - 35.5)	30 (25 - 34.5)
SOFA score, median (IQR)	16 (14 - 19)	16.5 (14 - 19)	15 (13 - 19)
VV ECMO, n(%)	13 (16.3)	8 (20)	5 (12.5)
VA ECMO, n(%)	67 (83.8)	32 (80)	35 (87.5)
ECMO indication, n(%)			
Cardiogenic shock	23 (28.8)	13 (32.5)	10 (25)
Postcardiotomy	23 (28.8)	9 (22.5)	14 (35)
ARDS	10 (12.5)	5 (12.5)	5 (12.5)
Cause of AKI, n(%)			
Cardiorenal syndrome	44 (55)	23 (57.5)	21 (52.5)
Prerenal cause	5 (6.3)	2 (5)	3 (7.5)
Sepsis-associated	8 (10)	5 (12.5)	3 (7.5)
CRRT indication, n(%)			
Anuria or oliguria	16 (20)	9 (22.5)	7 (17.5)
Refractory acidosis	20 (25)	9 (22.5)	11 (27.5)
Refractory volume overload	37 (46.3)	19 (47.5)	18 (45)
Reginal citrate anticoagulation, n(%)	24 (30)	13 (32.5)	11 (27.5)

Primary Outcomes

Circuit lifespan (hour)	**Integration**	**Separation**	**p-value**
Intention-to-treat	n=40	n=40	**0.52**
Median (IQR)	**72 (45-96.5)**	**71 (45-84)**	
As-treated	n=48	n=32	**0.39**
Median (IQR)	**70 (48-97)**	**70 (44-83)**	



Kaplan–Meier curves, using a 72-hour cut-off point

Secondary Outcomes

	Integration (n=40)	Separation (n=40)	p-value
28-day mortality, n (%)	13 (32.5)	14 (35)	0.81
Serious adverse events, n (%)			
Exit site bleeding	6 (15)	9 (22.5)	0.39
Systemic bleeding	6 (15)	10 (25)	0.26
Hemolysis	4 (10)	2 (5)	0.40
Blood transfusion need	24 (60)	27 (67.5)	0.48
Air embolism	0	0	
CRRT machine alarm, n (%)	14 (35)	13 (32.5)	0.81
High access pressure alarm	2 (5)	1 (2.5)	0.56
Low access pressure alarm	3 (7.5)	7 (17.5)	0.31
High return pressure alarm	2 (5)	0 (0)	0.49
Low return pressure alarm	1 (2.5)	0 (0)	0.31
High TMP alarm	8 (20)	6 (15)	0.56
Blood leak alarm	0	0	
Air detect alarm	0	0	

Conclusion

Among critically ill ECMO patients with CRRT support integrated CRRT circuit into ECMO circuit shows **no significant difference in CRRT circuit lifespan and serious adverse events** when compared to separation technique.

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Trial registration: NCT05036616