Validation of the prediction model for successful discontinuation of continuous renal replacement therapy from multicenter temporal and external cohorts

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Introduction

Continuous renal replacement therapy (CRRT) is a preferred modality of renal replacement therapy (RRT) in critically ill patients with acute kidney injury (AKI). However, the decision to discontinue CRRT is not based on a consensus criterion. By examining one temporal cohort and four external cohorts, we evaluated the usefulness of the prediction model developed in the previous study.

Methods and Materials

The validation included 1517 critically ill patients with AKI who received CRRT in Samsung medical center (SMC) and five medical centers between 2018 and 2020. Patients who underwent CRRT for less than 3 days and died within 7 days after CRRT discontinuation were excluded. Successful discontinuation of CRRT was defined as not restarting any RRT for 7 days after CRRT discontinuation. The prediction model was composed of four variables.

Table 1. Variables and scores of prediction model for successful discontinuation of CRRT

Variables		Score
Urine output, D-1, mL/24hr	≥ 300 mL/24hr	4
	< 300 mL/24hr	0
MAP on D0, mmHg	50-78 mmHg	1
	> 78 mmHg	0
BUN on D0, mg/dL	< 35 mg/dL	2
	≥ 35 mg/dL	0
Potassium on D0, mmol/L	< 4.1 mmol/L	1
	≥ 4.1 mmol/L	0

Results

Table 2. Patients' characteristics in temporal and external validation set by cohorts

| Characteristics	SMC (N = 540)	A (N = 678)	B (N = 113)	C (N = 100)	D (N = 86)	P value
Age, years	64 (53–72)	64 (52–75)	73 (66–82)	67 (54.5–78)	77 (62–83)	< 0.01
Male sex	342 (63.3%)	419 (61.8%)	66 (58.4%)	63 (63%)	48 (55.8%)	0.65
Primary diagnosis						< 0.01
Cancer	240 (44.4%)	405 (59.7%)	77 (68.1%)	80 (80%)	66 (76.7%)	
Heart failure	189 (35%)	184 (27.1%)	28 (24.8%)	7 (7%)	4 (4.7%)	
Others	111 (20.6%)	89 (13.1%)	8 (7.1%)	13 (13%)	16 (18.6%)	
Variables at CRRT discontinuation						
Urine output on D-1, mL/day	114 (20–482.5)	263 (35–1120)	235 (50–665)	275 (35–1062.5)	418 (140–1045)	< 0.01
MAP on D0, mmHg	78 (69–88)	85 (73–95)	90 (77–101)	83 (74–99)	93 (81–103)	< 0.01
BUN on D0, mmol/L	20.9 (14.3–27.9)	25.2 (18.4–34.5)	25.4 (17.5–33.9)	17.15 (11.7–25.9)	21.1 (15.9–31.2)	< 0.01
Potassium on D0, mmol/L	4.1 (3.8–4.4)	3.8 (3.4–4.1)	3.9 (3.7–4.3)	3.6 (3.4–3.8)	4.0 (3.7–4.3)	< 0.01
Score	4 (3–6)	4 (3–7)	4 (2–6)	4 (3–7)	6 (3–7)	< 0.01
Success	216 (40%)	324 (47.8%)	47 (41.6%)	46 (46%)	44 (51.2%)	0.05

Results
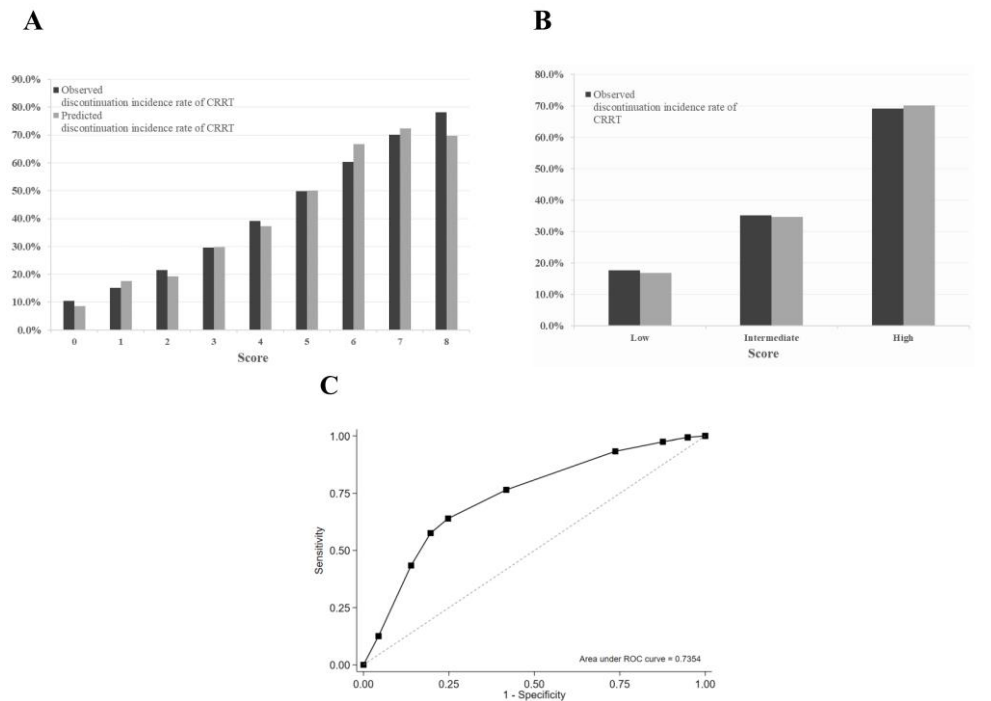
Figure 1. Predicted and predicted probabilities of successful discontinuation of CRRT in (A) each score and (B) each score groups (low 0-2 scores, intermediate 3-5 score, and high 7-9 score groups). (C) ROC curve of whole cohort.
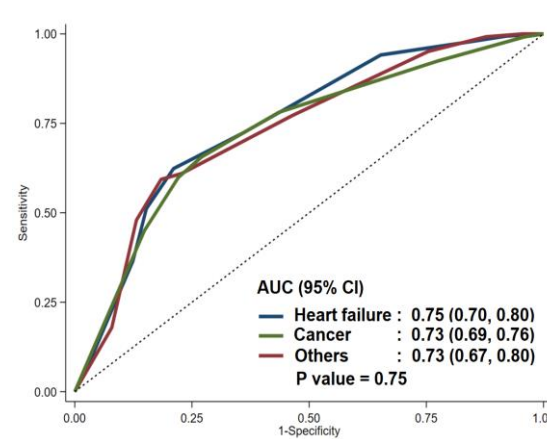

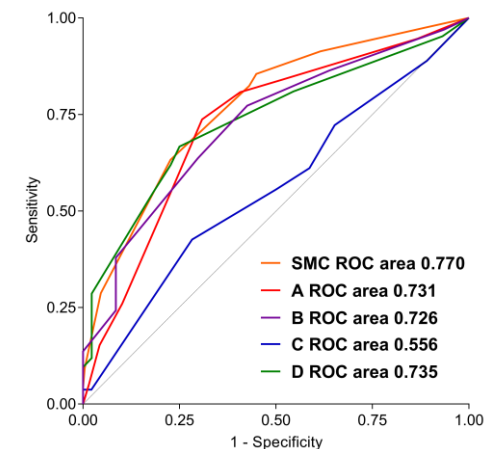Figure 2. ROC curve of subgroups according to primary diagnosis

AUC (95% CI)
Heart failure : 0.75 (0.70, 0.80)
Cancer : 0.73 (0.69, 0.76)
Others : 0.73 (0.67, 0.80)
P value = 0.75

Figure 3. ROC curve of each institution

SMC ROC area 0.770
A ROC area 0.731
B ROC area 0.726
C ROC area 0.556
D ROC area 0.735

Conclusions

Our prediction model for successful discontinuation of CRRT in critically ill patients showed good performance overall and in one temporal and three external cohorts, while poor performance in one external cohort. The results of this study support the need for protocols for proper CRRT operation.