

# CLINICAL EFFECTIVENESS OF DIURETICS FOLLOWING CONTINUOUS RENAL REPLACEMENT THERAPY

Do Hee Kim<sup>1</sup>, Jin Hae Kim<sup>1</sup>, Ji Hyeon Park<sup>1</sup>, Chi Ryang Chung<sup>2</sup>, Kyeongman Jeon<sup>2</sup>, Jung Eun Lee<sup>1</sup>,  
 Woosong Huh<sup>1</sup>, Gee Young Suh<sup>2</sup>, Yoon-Goo Kim<sup>1</sup>, Dae Joong Kim<sup>1</sup>, Ha Young Oh<sup>1</sup> and Hye Ryoung Jang<sup>1</sup>

<sup>1</sup>Division of Nephrology, Department of Medicine; <sup>2</sup>Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

## BACKGROUND & AIMS

### Background

- **Acute kidney injury (AKI)**  
: Major problem in intensive care unit, associated with high mortality
- **Continuous renal replacement therapy (CRRT)**  
: Preferred treatment option for severe AKI requiring RRT (renal replacement therapy) in critically ill patients, due to better hemodynamic tolerance and more steady solute control than other modality
- **Indicators of renal recovery** after AKI in previous reports  
: non-oliguric state, shorter renal replacement therapy (RRT) period, younger age  
→ clinically manageable with adequate administration of diuretics
- **No consensus regarding diuretic therapy in AKI patients at the time of discontinuing CRRT**

### Aims of this study

1. To investigate the effect of diuretics on the clinical course of critically ill patients with AKI focusing on urine output and renal function recovery following CRRT
2. To find the proper administration method of diuretics

## METHODS

### Study design

- Retrospective observational study at Samsung Medical Center, Sungkyunkwan University
- Duration : September 2009 – December 2014

### Patients selection

- 1176 adult AKI patients receiving CRRT in whom the discontinuation of CRRT was tried
- **Exclusion criteria**
  - Expired within 3 days after CRRT cessation
  - Patients with insufficient data
  - Preexisting end-stage renal disease
- **Categorization** depending on the restarting RRT within 3 days and the prescription of diuretics following CRRT cessation
  - ✓ CRRT cessation group
  - ✓ Hemodialysis (HD) start group
  - ✓ CRRT resume group
  - ✓ Control (no diuretics) group
  - ✓ Diuretics group

### Data collection and follow-up

- **Baseline characteristics**  
: age, sex, underlying disease, duration of CRRT, renal function
- **Follow-up** of urine output (UO, mL/day) and renal function (serum creatinine)  
: baseline (1 day before starting CRRT)  
D-1 (1 day before CRRT cessation)  
D0 (CRRT cessation)  
D1 → D2 → D3 (after CRRT cessation)
- **Prescription of furosemide**  
: Continuous intravenous infusion (Civ)  
Intermittent intravenous administration (Int.)  
Per oral administration (PO)  
Combination with other diuretics (Comb.)

## RESULTS

**Table 1. Baseline characteristics depending on restarting RRT in 3 days**

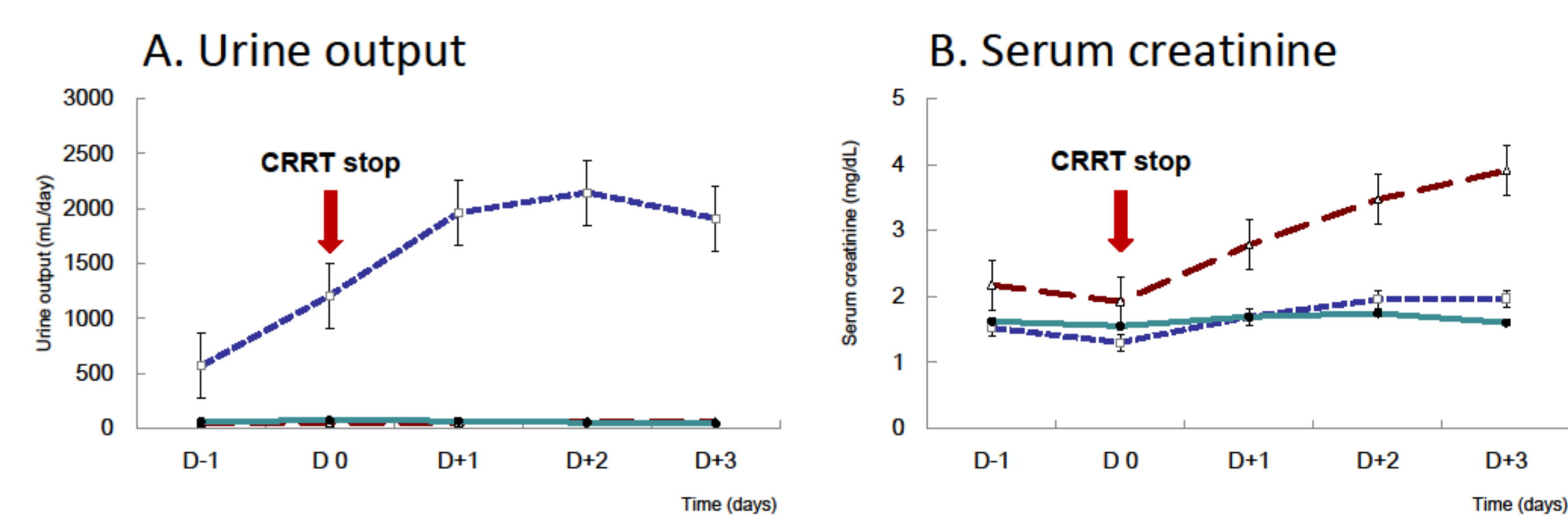
Variables	CRRT cessation group (n=517)	HD start group (n=310)	CRRT resume group (n=349)	P value
Age (years)	62.1 ± 15.2	61.0 ± 14.9	61.9 ± 14.8	P = 0.613
Male, n (%)	330 (63.8 %)	197 (63.5 %)	222 (63.6 %)	P = 0.996
Hypertension, n (%)	185 (35.8 %)	142 (45.8 %)	95 (27.2 %)	P < 0.001
Diabetes mellitus, n (%)	136 (26.3 %)	94 (30.3 %)	81 (23.2 %)	P = 0.118
Ischemic heart disease, n (%)	36 (7.0 %)	17 (5.5 %)	17 (4.9 %)	P = 0.408
Liver cirrhosis, n (%)	31 (6.0 %)	24 (7.7 %)	34 (9.7 %)	P = 0.123
Heart failure, n (%)	22 (4.3 %)	19 (6.1 %)	15 (4.3 %)	P = 0.420
Baseline BUN (mg/dL)	58.8 ± 34.0	61.1 ± 30.2	55.8 ± 30.3	P = 0.106
Baseline serum creatinine (mg/dL)	2.58 (1.64-3.98)	4.00 (2.53-6.20)	2.55 (1.67-3.82)	P < 0.001
Baseline eGFR (mL/min/1.73m <sup>2</sup> )	22.8 (14.3-37.5)	13.3 (8.3-24.1)	23.7 (14.1-36.8)	P < 0.001
Baseline urine output (mL/day)	570 (180-1308)	116 (0-361)	244 (32-835)	P < 0.001
D-1 BUN (mg/dL)	37.4 ± 25.5	38.1 ± 22.2	37.6 ± 21.7	P = 0.924
D-1 serum creatinine (mg/dL)	1.52 (1.04-2.37)	2.17 (1.39-3.42)	1.62 (1.12-2.54)	P < 0.001
D-1 eGFR (mL/min/1.73m <sup>2</sup> )	42.5 (26.4-65.9)	28.7 (15.7-44.9)	39.1 (24.5-56.1)	P < 0.001
D-1 urine output (mL/day)	565 (252-1250)	45 (5-190)	60 (10-289)	P < 0.001
D-1 mean blood pressure (mmHg)	79.4 ± 15.1	78.5 ± 15.4	79.6 ± 15.0	P = 0.631
D-1 vasopressor use, n (%)	342 (66.2%)	202 (65.2 %)	241 (69.1 %)	P = 0.530
Duration of CRRT (days)	3.4 ± 2.6	4.8 ± 5.1	4.8 ± 5.0	P < 0.001
Post CRRT diuretics use, n (%)	388 (75.0 %)	129 (41.6 %)	102 (29.2 %)	P < 0.001

Age, duration of CRRT, BUN and mean blood pressure: presented as means ± standard deviation  
 Serum creatinine, eGFR and urine output: presented as median (interquartile range)  
 BUN, blood urea nitrogen; D-1, 1 day before stopping CRRT; eGFR, estimated glomerular filtration rate.

- CRRT cessation group had shorter duration of CRRT, showed greater urine output compared with other groups 1 day prior to starting CRRT and 1 day prior to stopping CRRT.
- In the CRRT cessation group, the proportion of patients receiving diuretics after discontinuation of CRRT was higher compared with other groups.

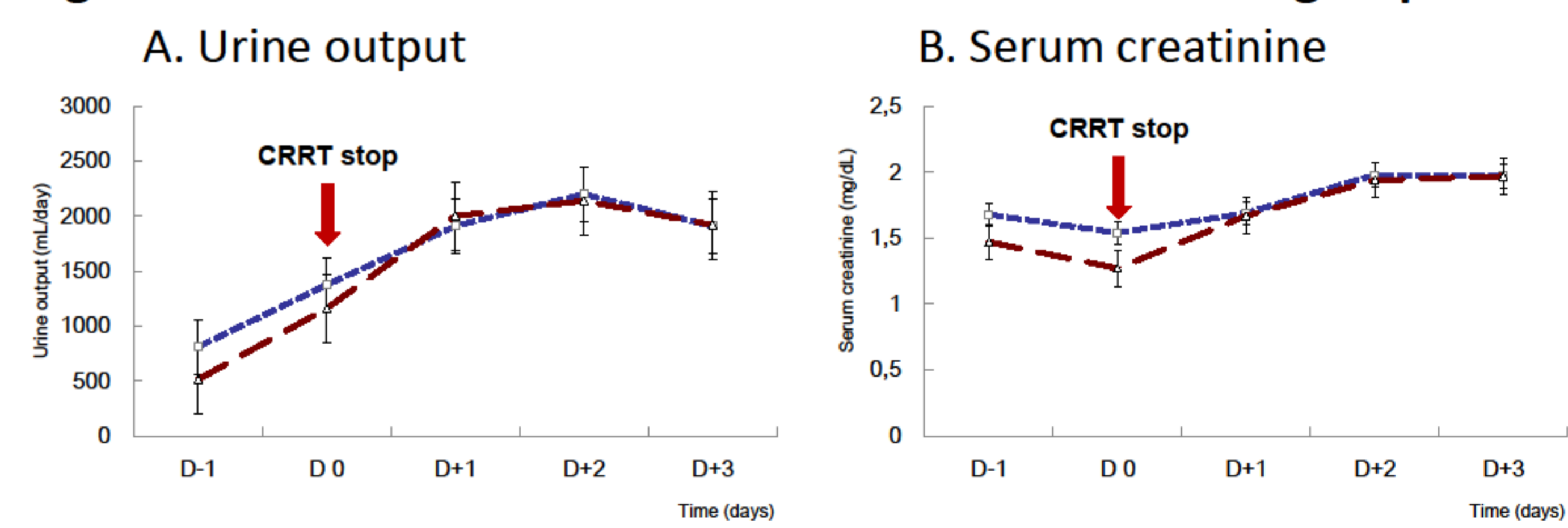
- ✓ Overall, high D-1 urine output (p<0.001), prescription of diuretics (p<0.001) and duration of CRRT (p=0.0002) were predictive factors for successful cessation of CRRT.
- ✓ In patients who were treated with diuretics, high D-1 urine output (p<0.001) and duration of CRRT (p=0.03) were predictive factors for effectiveness of diuretics which was defined as successful cessation of CRRT and UO > 400 mL/day following CRRT.
- ✓ Cut off value of D-1 urine output for prediction of successful cessation of CRRT in oliguric (urine output ≤ 400 mL/day) patients of diuretics group : **125 mL/day**

**Figure 1. Overall changes in urine output and renal function after discontinuation of CRRT**



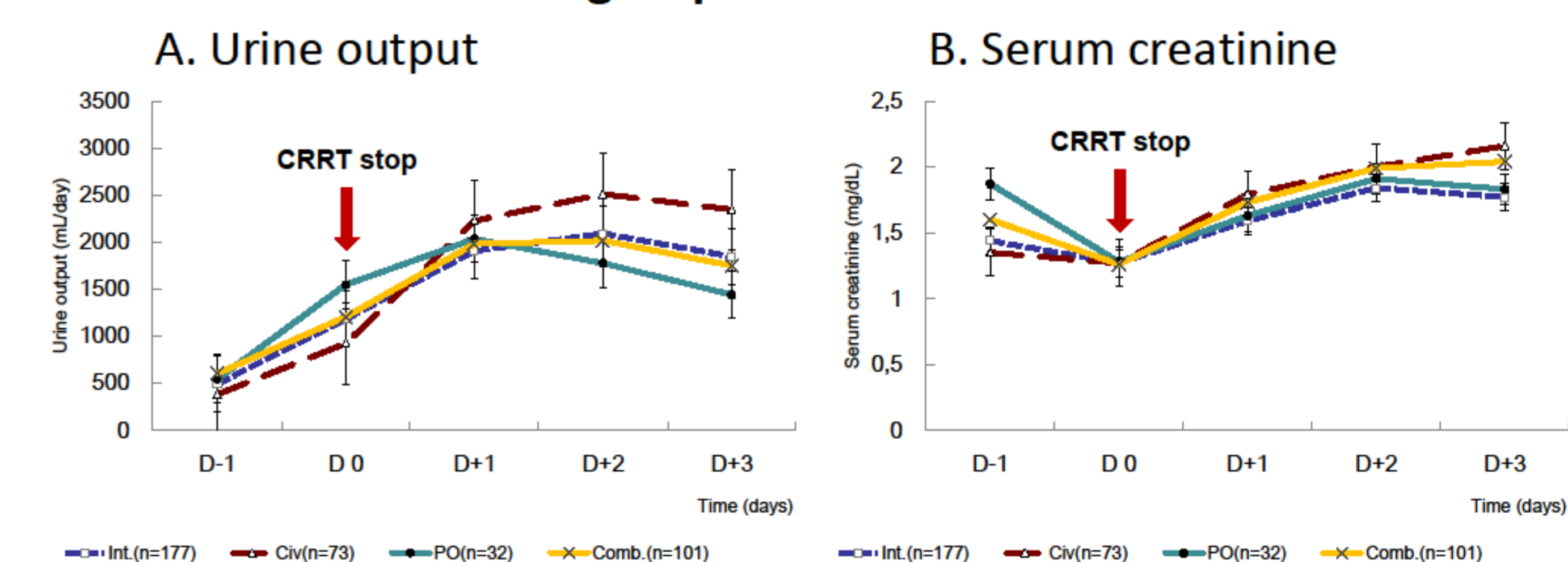
- Urine output was significantly higher in the CRRT cessation group after discontinuation of CRRT compared with other groups.

**Figure 2. Effectiveness of diuretics in the CRRT cessation group**



- In the CRRT cessation group, patients treated with diuretics showed greater increase in urine output and mild elevation of serum creatinine after stopping CRRT compared to non-diuretic subgroup.

**Figure 3. Comparison of furosemide prescription methods in the CRRT cessation group**



- Furosemide Civ group showed a tendency towards greater urine output and higher serum creatinine compared to other methods.

## CONCLUSION

- Diuretic therapy following CRRT significantly increased urine output although it caused mild elevation of serum creatinine.
- Continuous infusion of furosemide showed a tendency to increase urine output more effectively, but also further increased serum creatinine when continued for more than 1 day.
- D-1 urine output, administration of diuretics, and duration of CRRT were significantly related with successful CRRT cessation.
- Our study suggests that the clinical effectiveness of diuretic therapy in critically ill patients with AKI, especially who need aggressive volume control after cessation of CRRT.

## REFERENCES

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