ISSN: 1607-8322, e-ISSN: 2220-5799 **Anaesthesia, Pain & Intensive Care**

Vol 28(2); April 2024 DOI: 10.35975/apic.v28i2.2417

CASE REPORT **INTENSIVE CARE**

The issues with early continuous renal replacement therapy for National Health Insurance patients: a case report

Anne Suwan Djaja[1*], Adhrie Sugiarto[2], Vera Irawany[3]

Author affiliations:

1. Anne Suwan Djaja, Fellow of Anesthesiology & Intensive Care Department, Faculty of Medicine, University of Indonesia, Jakarta, Indonesia; E-mail: anne.suwan11@ui.ac.id
2. Adhrie Sugiarto, Department of Anesthesiology & Intensive Care Cipto Mangunkusumo General Hospital, Faculty of Medicine, University of Indonesia, Jakarta, Indonesia; E-mail: adhrie@gmail.com
3. Vera Irawany, Department of Anesthesiology & Intensive Care Fatmawati General Hospital, Jakarta, Indonesia; E-mail: bundavea@gmail.com

Correspondence: Anne Suwan Djaja, Jalan Pangeran Diponegoro No 71. Jakarta, Indonesia; E-mail: anne.suwan11@ui.ac.id; Telephone: +6285781000218

ABSTRACT

Sepsis is the leading cause of patient admission to the intensive care unit (ICU). Most of the sepsis patients experience multi-organ failure, such as respiratory and kidney failure, that require specific support. Continuous renal replacement therapy (CRRT) is one of the modalities performed in the ICU to help ameliorate cytokine levels, maintain fluid balance, and remove toxins. CRRT allows early ventilator weaning, a reduction in vasopressor or inotropic administration, and early discharge from the ICU. We report an experience of initiating an early CRRT in a patient with septic shock and acute kidney injury with fluid overload. During CRRT, the patient showed significant improvement in ventilation, hemodynamic, and fluid balance. However, the CRRT had to be discontinued due to limited resources and the infection rebounded. The patient in this case study died on the 14th day following admission. Early CRRT may be an effective therapy in septic shock patients; however, it requires continuous application that may not be possible in low-resource setting. Alternatively, sustained low-efficiency daily dialysis (SLEDD) has no major disadvantages compared to CRRT and may be a feasible option.

Keywords: Blood purification; Continuous renal replacement therapy; CRRT; Low-resource setting; Sepsis

Citation: Djaja AS, Adhrie Sugiarto A, Irawany V. The issues with early continuous renal replacement therapy for National Health Insurance patients: a case report. Anaesth. pain intensive care 2024;28(2):380−383; **DOI:** 10.35975/apic.v28i2.2417

Received: February 22, 2023; **Revised:** January 30, 2024; **Accepted:** January 31, 2024

1. INTRODUCTION

Sepsis is the most common condition experienced in daily practice in the intensive care units (ICU) worldwide, and it is the leading cause of mortality and morbidity.[1] In addition to the administration of antibiotics, fluid resuscitation, ventilation support, and vasopressors, CRRT is a common modality for treating sepsis patients.[2,3] In particular, CRRT is useful for removing cytokines, regulating fluid balance and removing body wastes.

However, for patients with National Health Insurance (BPJS), it is challenging to manage CRRT, as the available financial resources are limited. A quick comparison between four BPJS-based hospitals and two private hospitals, shows that most of the former only provide one filter and 10 packs of replacement fluid. Some only provide CRRT to certain types of BPJS patients. Meanwhile, in private hospitals, CRRT is available based on the patients' needs and adjusted to fit private insurance coverage.

This naturally causes a treatment disparity between patients with BPJS and patients with private insurance. Consequently, BPJS patients are deprived of optimal CRRT treatment when they need it the most. This is a very common occurrence in the ICU, and yet the issue has not been given the attention it warrants and remains unresolved. Through this case study, the authors wish to bring this issue into the spotlight in a hope of fostering positive changes in the future.

2. CASE REPORT

The patient was a 68-year-old woman. She experienced dyspnea without coughing in the three days prior to her admission to the emergency department (ED). She had diabetes mellitus for 10 y, arrhythmia, and kidney disease without hemodialysis. Her urine output had been decreasing during the previous three days before admission, and she developed swelling all over her body.

The patient had hypotension, blood pressure upon admission was 71/53 mmHg, and the heart rate was 140 bpm. She also had a fever of 38 ºC, rapid shallow breathing, 32 times per min, and 99% oxygen saturation without supplementary oxygen. Rales could be heard at both lung fields.

We performed tracheal intubation, central venous catheter was inserted in the left jugular vein, and double lumen catheter was inserted in her right jugular vein. Subsequently, CRRT was initiated to optimize her condition. Her hemodynamic prolife, vasopressor use, and ventilatory support during CRRT, were continuously recorded. CRRT lasted for 38 h in the ICU.

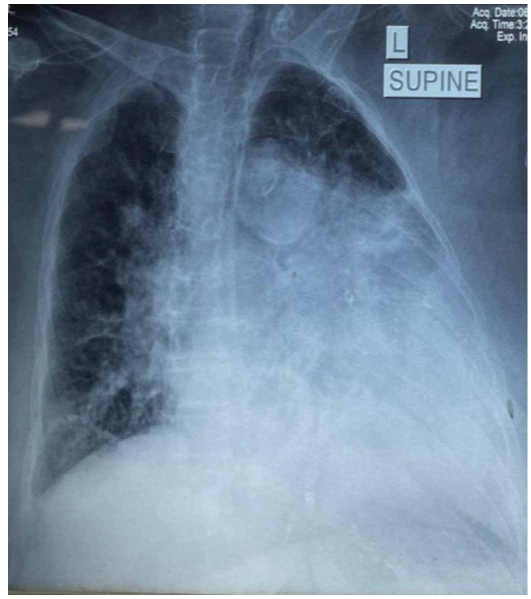

Figure 1: The patient's chest X-ray upon admission

The patient experienced swelling of whole of her body and had rales in both lung fields on auscultation. The laboratory findings showed low hemoglobin level (9.9 mg/dL), leucocytes 6800/µL, elevated blood urea nitrogen (BUN) 122.6 mg/dL and creatinine 2.99 mg/dL, high blood sugar - 221 mg/dL, and hyperlactatemia - 2.3

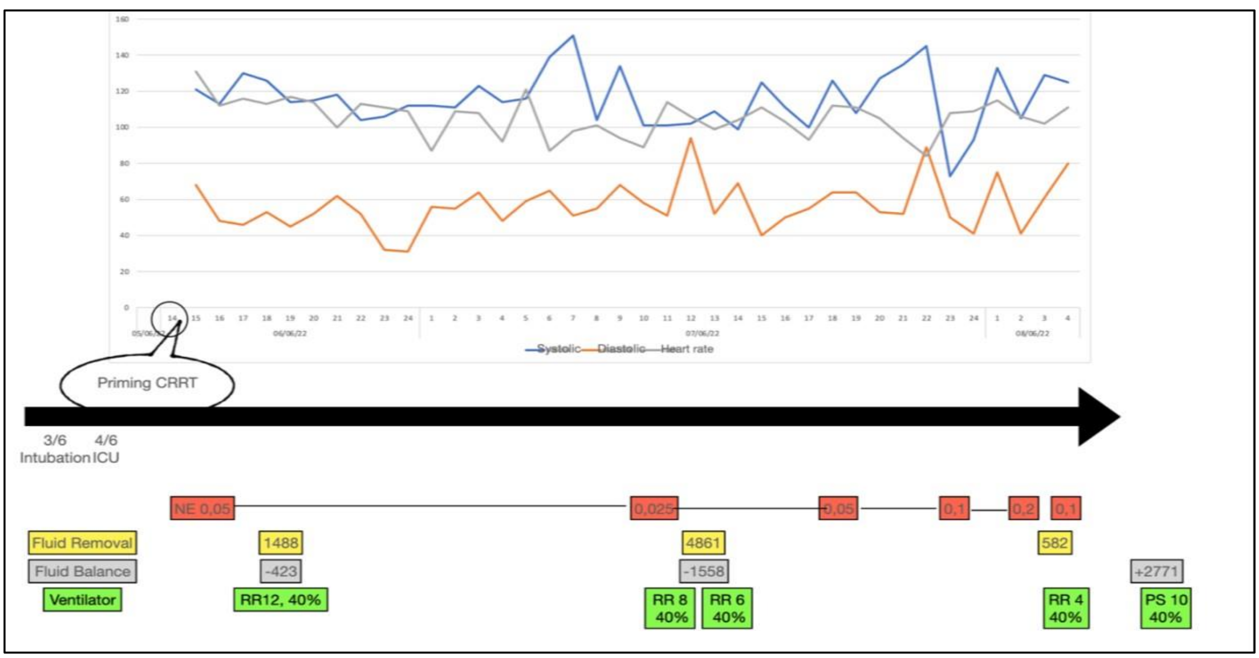

Figure 2. Hemodynamics, fluid balance, vasopressor dose, and ventilator setting during the CRRT.

mmol/L. Blood gas analysis showed respiratory acidosis characterized as marked hypercapnia (76.3 mmHg). The strong ion difference (SID) was 35 (sodium 131 mmol/L, chloride 96 mmol/L), with hyperkalemia of 6.1 mmol/L and normal albumin levels (3.87 g/dL). The chest X-ray revealed cardiomegaly with bilateral infiltrate and left pleural effusion.

She was administered empirical antibiotics and an antifungal drug, as it was determined that the patient had a high risk of multidrug-resistant organism infection. The CRRT was started in less than 12 h after the patient was transferred to the ICU. We used the continuous venous-to-venous hemodiafiltration (CVVHDF) mode, with an initial blood flow rate of 100 mL/h, a pre-filter replacement flow rate of 1500 mL/h, a dialysate flow of 01 L/h, and fluid removal of 80 mL/h; increasing the rates as the patient's hemodynamic profile improved as mentioned in the guidelines. To avoid premature CRRT termination—which is commonly caused by filter clotting—we kept the filtration fraction within 20–25% and used pre-filter replacement.

During CRRT, the ventilatory support was successfully weaned off, the cumulative fluid balance was reduced, and the vasopressor dose was decreased. The patient's condition was improving. However, due to the limited filter and replacement fluid quota available for BPJS patients, the CRRT only lasted for 38 h, as we ran out of replacement fluids.

At the start of CRRT, the blood flow rate was set at 100 mL/h; increased when the hemodynamic profile improved. The patient was successfully weaned from ventilatory support and the vasopressor dosage was reduced, indicating the success of the therapy.

The ventilator setting at the time the CRRT was started to when it was ended were compared. The first setting was synchronized intermittent mandatory ventilation (SIMV), with a respiratory rate of 12 and an oxygen fraction (FiO_2) of 40%, and the last setting was pressure support (PS). Although hemodynamic instability still occurred, the need for the vasopressor was decreased after 24 h. A negative fluid balance was achieved during CRRT. However, due to low urine output, nonexistent fluid removal, and intravenous medications, the fluid balance increased after CRRT was stopped.

Hemodynamic instability worsened after CRRT was stopped. On the 12th day, the patient had a fever of 38ºC, and the need for a vasopressor and fluid balance was increased. The positive fluid balance made the volume distribution larger than before. This lowered the blood concentration of the antimicrobial agent given to the patient and made the therapy less effective. Conventional dialysis was done every two days, but no clinical improvement could be seen. The accumulation of proinflammatory cytokines, which cannot be removed by conventional dialysis, promoted vasodilatation, and the need for vasopressor was increased to maintain good perfusion.

The patient expired on 14th day following admission in the ICU due to perfusion failure and uncontrolled sepsis.

3. DISCUSSION

Blood purification, renal support, and fluid regulation were the indications to perform CRRT in this patient. The very low blood draw rate, ability to purify blood, and ability to remove cytokines were the reasons we choose CRRT instead of conventional dialysis. CRRT's blood draw rate can be as low as 80 mL/kg/h, in contrast to 300–400 ml/kg/h for conventional dialysis, so it is suitable for patients with unstable hemodynamics.[4]

There is a wide array of opinions about the appropriate CRRT initiation timing.[5,6] Christiansen et al. stated that early RRT should be initiated in the event of acute kidney injury (AKI) stage 2 or below, including patients who do not meet the AKI criteria, while late RRT is started at AKI stage 3.[7] Another study found a higher mortality rate at 28 days for late-initiated CRRT than for early initiated CRRT. This study used a cut-off time of 16.5 h.[5]

Early CRRT—as described in the 'Artificial Kidney Initiation in Kidney Injury' (AKIKI) trial—is a strategy, whereby CRRT is started immediately when the patient reaches the third stage of AKI as classified by KDIGO (Kidney Disease: Improving Global Outcomes), and it has potentially fatal complications related to renal failure. Meanwhile, in the delayed CRRT strategy, renal replacement therapy is started if any of the following criteria are met: oliguria exceeds 72 h, metabolic acidosis, lung edema, severe hyperkalemia, or a BUN level higher than 112 mg/dL.[6]

For this patient, we chose to apply the early CRRT strategy. Among other CRRT modes, we chose CVVHDF with pre-filter replacement to extend the filter's lifetime. We expected that excess cytokines and fluid would be removed by hemofiltration and that blood urea would be decreased by dialysis, and it worked.

However, CRRT requires considerable financial support, which the national health insurance does not provide. This caused the CRRT treatment for this patient to be terminated, which ultimately led to her death.

A lack of urine production in the last three days, edema or anasarca, and a history of kidney disease without hemodialysis are indications of a severe positive fluid balance. The effluent flow rate divided by body weight is used to determine the CRRT dose. The effluent rate for CVVHDF is based on the total dialysate, fluid removal, and fluid replacement in one hour divided by body weight. The recommended effluent rate is 20–25 mL/kg/h. There are no advantages of using doses higher than 20 to 25 mL/kg/h.[6]

Intravenous medications, enteral and parenteral nutrition, and very low urine output contribute to creating a positive fluid balance after CRRT is stopped. A study reported that the cumulative fluid balance in the first 72 h was correlated to multiorgan dysfunction and mortality in patients with septic shock.[8] Beijing Acute Kidney Injury Trial (BAKIT) had proven that a group with lower trend of fluid balance had lower 28-day mortality.[9]

As the majority of Indonesian citizens use BPJS as their primary health insurance, the fact that it offers very limited resources for CRRT—which is one of the best methods for treating septic shock patients—is concerning. If the government cannot financially support CRRT, alternatives are needed. One potential alternative to CRRT is sustained low-efficiency dialysis (SLEDD), which uses a standard dialysis machine. SLEDD takes eight hours to complete water and waste removal, which is slower than usual dialysis, to prevent hemodynamic instability.[10] No statistically significant differences in outcome were found between SLEDD and CRRT in terms of the mortality rate, renal recovery, dialysis dependence, length of intensive care unit stay, and fluid removal rate.[10]

4. Patient's perspective

The patient died at the end of study, and the family shared their thoughts with the medical team. They conveyed their acceptance of the loss of their family member. They were well informed about the patient's condition in the ICU each day.

5. Conflict of interests

The authors declare no conflict of interests.

6. Ethical issues

We obtained informed consent from the patient's family to publish this case. We made all efforts to omit identifying information in respect to their consent.

7. Acknowledgments

This article was presented at the 7th International Conference and Exhibition on Indonesian Medical Education and Research Institute (7th ICE on IMERI), Faculty of Medicine, University of Indonesia.

8. Authors contribution

ASD: Concept of report, conduction of the study work, literature search, manuscript writing and editing. AS, VI: Conduction of the study work, literature search, manuscript writing

6. REFERENCES

1. Sakr Y, Jaschinski U, Wittebole X, Szakmany T, Lipman J, Ñamendys-Silva SA, et al. Sepsis in intensive care unit patients: Worldwide data from the intensive care over nations audit. Open Forum Infect Dis. 2018 Nov 19;5(12):ofy313. PMID: 30555852 PMCID: PMC6289022 DOI: 10.1093/ofid/ofy313
2. Lim CC. An Introduction to Extracorporeal Blood Purification in Critical Illness. Proceedings of Singapore Healthcare. 2012. Volume 21: Number 2;109-119 DOI: pdf/10.1177/201010581202100204
3. Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021. Crit Care Med. 2021 Nov 1;49(11):e1063-e1143. PMID: 34605781 DOI: 10.1097/CCM.0000000000005337
4. Karkar A, Ronco C. Prescription of CRRT: a pathway to optimize therapy. Ann Intensive Care. 2020 Mar 6;10(1):32. PMID: 32144519; PMCID: PMC7060300; DOI: 10.1186/s13613-020-0648-y
5. Yoon BR, Leem AY, Park MS, Kim YS, Chung KS. Optimal timing of initiating continuous renal replacement therapy in septic shock patients with acute kidney injury. Sci Rep. 2019 Aug 19;9(1):11981. PMID: 31427640; PMCID: PMC6700095; DOI: 10.1038/s41598-019-48418-4
6. Gaudry S, Hajage D, Schortgen F, Martin-Lefevre L, Pons B, Boulet E, et al. Initiation Strategies for Renal-Replacement Therapy in the Intensive Care Unit. N Engl J Med. 2016 Jul 14;375(2):122–33. PMID: 27181456; DOI: 10.1056/NEJMoa1603017; [Free Article]
7. Christiansen S, Christensen S, Pedersen L, Gammelager H, Layton JB, Brookhart MA, et al. Timing of renal replacement therapy and long-term risk of chronic kidney disease and death in intensive care patients with acute kidney injury. Crit Care. 2017 Dec 28;21(1):326. PMID: 29282093; PMCID: PMC5745999; DOI: 10.1186/s13054-017-1903-y
8. Huang ACC, Lee TYT, Ko MC, Huang CH, Wang TY, Lin TY, et al. Fluid balance correlates with clinical course of multiple organ dysfunction syndrome and mortality in patients with septic shock. PLoS One. 2019 Dec 2;14(12):e0225423. PMID: 31790451; PMCID: PMC6886786; DOI: 10.1371/journal.pone.0225423
9. Wang M, Zhu B, Jiang L, Luo X, Wang N, Zhu Y, et al. Association between Latent Trajectories of Fluid Balance and Clinical Outcomes in Critically Ill Patients with Acute Kidney Injury: A Prospective Multicenter Observational Study. Kidney Dis (Basel). 2021 Jul 15;8(1):82-92.PMID: 35224009; PMCID: PMC8820145; DOI: 10.1159/000515533
10. Al Dalbhi S, Alorf R, Alotaibi M, Altheaby A, Alghamdi Y, Ghazal H, et al. Sustained low efficiency dialysis is non-inferior to continuous renal replacement therapy in critically ill patients with acute kidney injury: A comparative meta-analysis. Medicine (Baltimore). 2021 Dec 23;100(51):e28118.PMID: 34941056; PMCID: PMC8702221; DOI: 10.1097/MD.0000000000028118

