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CASE REPORT INTENSIVE CARE

The role of CRRT in the management of sepsis-associated acute kidney injury: case report

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ABSTRACT

Sepsis is an uncontrolled immunological host reaction to infection that causes organ dysfunction. Mortality related to sepsis-associated acute kidney injury (SA-AKI) is 30%−60%. A 62−year-old woman presented to emergency room (ER) of Fatmawati Hospital with decreased consciousness for one day. Complaints of productive cough, fever, and shortness of breath were noted. We found hypotension with cold extremities, fever, tachycardia, and labored breathing. Her SOFA score was 12, blood glucose level was very high, urine production was less than 0.5 ml/kg/h in 6 h, high creatinine level (1.69 mg/dL), fluid balance +643 ml/6 h, and chest X-ray showing bilateral infiltrates. The patient was intubated to reduce work of breathing and stabilize hemodynamics. Management of the sepsis bundle was initiated by administration of vasopressors despite adequate fluid intake and two broad-spectrum antibiotics (meropenem and levofloxacin). On the second day, continuous renal replacement therapy (CRRT) was performed due to oliguria and worsened AKI caused by septic shock. After 48 h of CRRT, the patient clinically improved. The patient was extubated successfully on the fifth day of treatment.

Abbreviations: AKI - acute kidney injury; CRRT - Continuous Renal Replacement Therapy; ER - Emergency room;

Key words: Acute kidney injury; CRRT; Sepsis; SOFA score;

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1. INTRODUCTION

Sepsis is an uncontrolled host immune response to infection, causing organ dysfunction and has been associated with high mortality.[1] Septic shock is characterized by persistent refractory hypotension, high lactic acidemia, and organ failure.[2] Sepsis is the leading cause of acute kidney injury (AKI) in intensive care unit (ICU), with mortality ranging from 30%-60%.[3,4] The management of sepsis-associated acute kidney injury (SA-AKI) consists of fluid, vasopressor, antibiotics, diuretics, and extracorporeal renal support i.e. Continuous Renal Replacement Therapy (CRRT).[5] Early CRRT can reduce mortality, enhance renal function, minimize the inflammatory state in SA-AKI patients, and prevent additional harm to the renal tubules.[6] We present this case report of a patient which suffered from severe sepsis with AKI, and could not be managed with sepsis bundle, so she had to undergo CRRT, which proved effective in controlling her disease. CRRT is a nice therapeutic alternative for sepsis-associated acute kidney injury.

2. CASE REPORT

A 62-year-old woman presented with decreased consciousness for one day and was admitted to Fatmawati Hospital. She suffered from a productive cough, fever and shortness of breath. The patient also

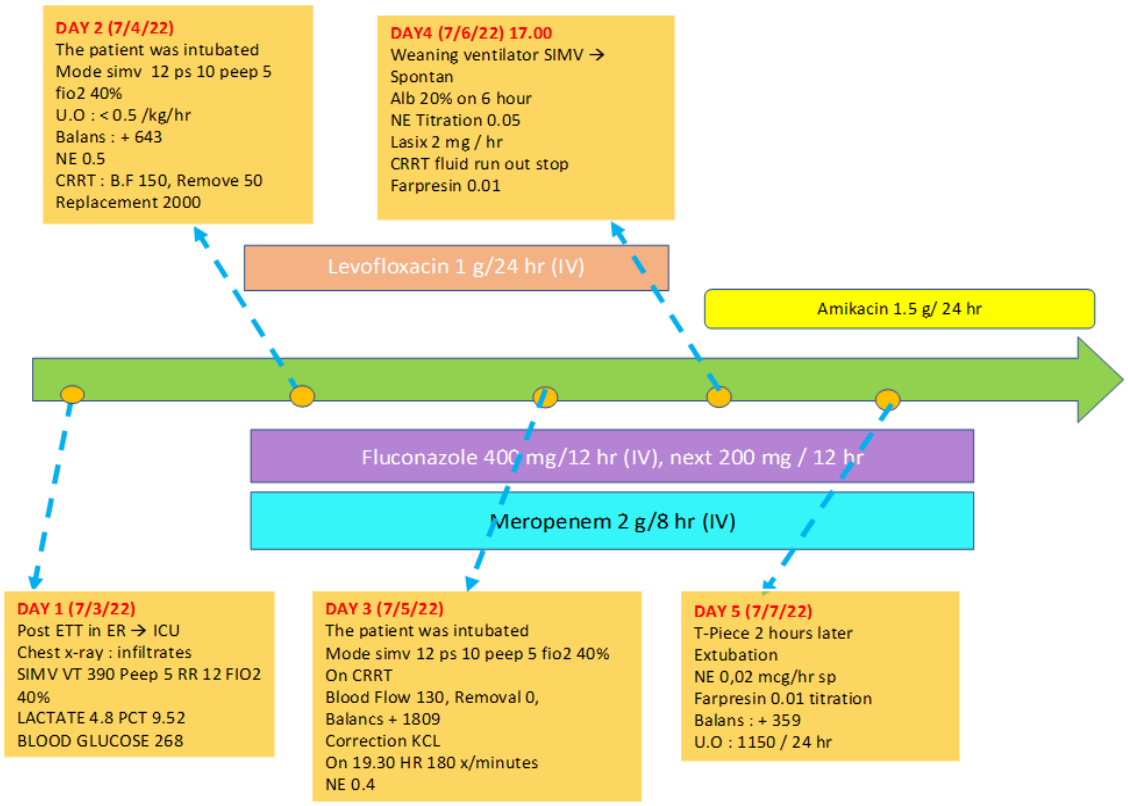

Figure 1: Timeline table from Day 1 to Day 5

had a history of hypertension and diabetes mellitus and she routinely consumed tab. amlodipine 1x10 mg and tab. metformin 3x500 mg, but had no prior history of renal dysfunction.

On examination, her blood pressure was 80/40 mmHg, heart rate 140 beats/min, respiratory rate 40/min, SpO_2 98%, and temperature 40°C. Her extremities were cold. Based on the Kidney Disease Improving Global Outcomes (KDIGO) criteria, the patient was in AKI stage 1. The patient was diagnosed with pneumonia based on Clinical Pulmonary Infection Score (CPIS).[7] The total Sequential Organ Failure Assessment (SOFA) score was 12, meaning that there was organ dysfunction identified by an acute change associated with infection. Patient's timeline table during admission is presented in Figure 1.

Laboratory findings showed a very high blood glucose level, increased serum creatinine level (1.69 mg/dL) with urine production < 0.5 ml/kg/h, and fluid balance +643 ml/6 h. Laboratory results showed decreased leukocyte count, lactate, PCT, neutrophil to lymphocyte ratio (NLR), and Na value after CRRT was carried out. Chest x-ray (Figure 2) showed bilateral infiltrates.

The patient was intubated to reduce work of breathing and to stabilize hemodynamics. Sepsis bundle

Figure 2: Chest x-ray showing bilateral diffuse infiltrates

management was initiated by administering vasopressor, adequate fluid resuscitation, broad spectrum antibiotics (meropenem and levofloxacin), and anti-fungal drugs. Sputum and blood were sent for culture/sensitivity, and the lactate level was monitored.

On the second day, CRRT was performed due to oliguria and worsened AKI caused by septic shock. After 48 h of CRRT, the patient clinically improved with stable hemodynamics (Figure 3). The decreasing levels of serum creatinine are shown in Figure 4. The total duration of therapy was 5 days.

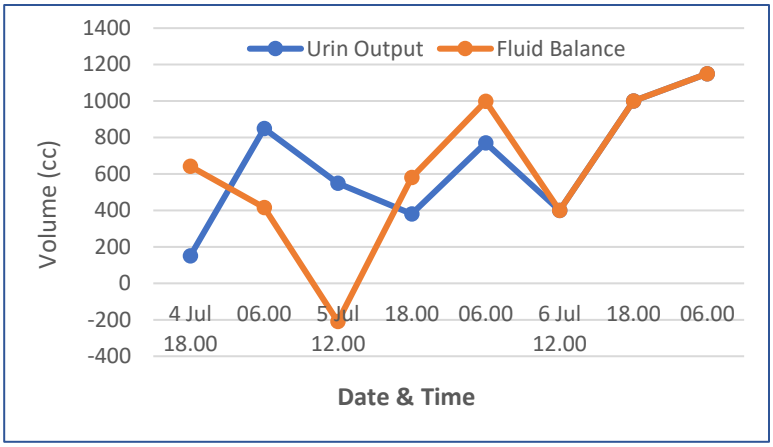

Figure 3: Urine output and fluid balance with time after CRRT

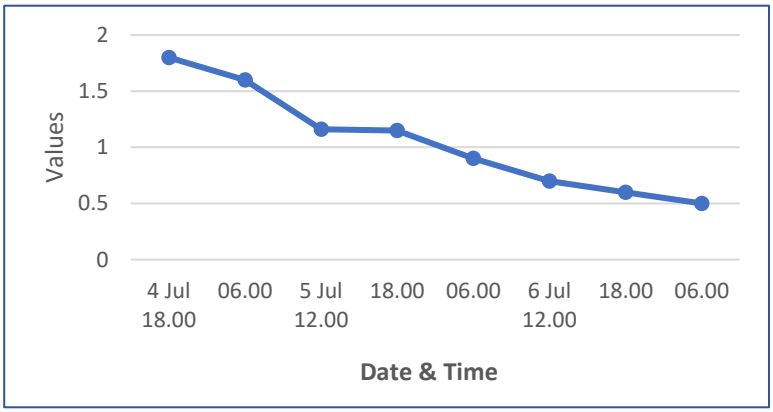

Figure 4: Creatinine (mg/dL) level over time

3. DISCUSSION

Antibiotic treatment is essential to prevent AKI and reduce mortality. However, antibiotics like vancomycin, piperacillin-tazobactam, aminoglycosides, amphotericin B, or other nephrotoxin substances need to be used with caution.[7] Since the patient received CRRT, the antibiotic doses administered were regular and no dose modifications were necessary.[8] Adequate antibiotic management in patients with septic shock is paramount. This is one of the keys to successful management of sepsis. Unfortunately, many situations do not allow adequate antibiotic dosing, such as decreased renal function in SA-AKI. Underdosage of antibiotic therapy can lead to inadequate management of sepsis, eventually worsening the patient's condition and can even induce antibiotic resistance.

In patients with hemodynamic instability, CRRT is more well-tolerated and has a better effect on kidney recovery by regulating fluid, electrolyte, acid-base, and clearance of inflammatory mediators.[9] A previous study of CRRT in SA-AKI reported a good effect on inflammatory mediators and coagulation function. It showed that the patients undergoing CRRT had shorter ICU stay, shorter organ support treatment times, and faster urine volume recovery times.[10] CRRT is effective in reducing inflammation in sepsis. It regulates the concentrations of circulating pro and anti-inflammatory mediators, such as IL-1β, IL-10, and IL-6.[3] CRRT can help restore coagulation function with less harmful cardiovascular side effects. To mitigate the effects of substantial fluid resuscitation during the earliest stages of septic shock, CRRT controls fluid balance to prevent development of intestinal wall edema. After receiving CRRT, the patient clinically improved, and kidney function slowly recovered. The total recovery time for renal function was 7 days.

4. CONCLUSION

In patients with sepsis associated acute kidney injury, the main problems are decreased urine output and the ability to filter solutes. CRRT has a significant role in the recovery and stabilization of renal function, characterized by increased urine output, regulation of fluid balance, and decreased SOFA scores. Hence, CRRT is an alternative for an effective management of sepsis associated acute kidney injury, despite a need to adjust the antibiotics dose.

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6. Conflicts of Interests

The authors have no conflict of interest to disclose.

7. Author Contributions

All authors contributed equally in the conduct of the patient and preparation of this case report.

8. References

1. 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 Nov 1;49(11):e1063-e1143. [PubMed] DOI: 10.1097/CCM.0000000000005337
2. Wang Z, Zhang L, Xu F, Han D, Lyu J. The association between continuous renal replacement therapy as treatment for sepsis-associated acute kidney injury and trend of lactate trajectory as risk factor of 28-day mortality in intensive care units. BMC Emerg Med. 2022;22(1):32. [PubMed] DOI: 10.1186/s12873-022-00589-6
3. Zhang J, Tian J, Sun H, Digvijay K, Neri M, Bhargava V, et al. How does continuous renal replacement therapy affect septic acute kidney injury? Blood Purif. 2018;46(4):326−331. [PubMed] DOI: 10.1159/000492026
4. Chen WY, Cai LH, Zhang ZH, Tao LL, Wen YC, Li ZB, et al. The timing of continuous renal replacement therapy initiation in sepsis-associated acute kidney injury in the intensive care unit: The CRTSAKI Study (Continuous RRT Timing in Sepsis-associated AKI in ICU): Study protocol for a multicentre, randomised cont. BMJ Open. 2021 Feb 19;11(2):e040718. [PubMed] DOI: 10.1136/bmjopen-2020-040718
5. Setyawati T, Aditya R, Trihartini Maskoen T. Sepsis Associated Acute Kidney Injury. Infections and Sepsis Development [Internet]. 2021 Oct 27. DOI: 10.5772/intechopen.97609
6. An N, Chen R, Bai Y, Xu M. Efficacy and prognosis of continuous renal replacement therapy at different times in the treatment of patients with sepsis-induced acute kidney injury. Am J Transl Res. 2021;13(6):7124−7131. [PubMed]
7. Manrique-Caballero CL, Del Rio-Pertuz G, Gomez H. Sepsis-Associated Acute Kidney Injury. Crit Care Clin. 2021;37(2):279−301. [PubMed] DOI: 10.1016/j.ccc.2020.11.010
8. Prabowo DS, Aditianingsih DD. Early CRRT and antibiotic management in shock patient due to urosepsis with immunocompromised post renal transplantation. Int J Med Res Rev. 2018;6(4):204−209. DOI: 10.17511/ijmrr.2018.i04.01
9. Li Y, Li H, Zhang D. Timing of continuous renal replacement therapy in patients with septic AKI: A systematic review and meta-analysis. Med (United States). 2019;98(33):e16800. [PubMed] DOI: 10.1097/MD.0000000000016800
10. Wu S, Xu T, Wu C, Lei X, Tian X. Continuous renal replacement therapy in sepsis-associated acute kidney injury: Effects on inflammatory mediators and coagulation function. Asian J Surg. 2021;44(10):1254−1259. [PubMed] DOI: 10.1016/j.asjsur.2021.02.004

