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CASE REPORT INTENSIVE CARE

Management of acute renal failure with CVVHDF in a patient with sepsis after post exploratory laparotomy: a case report

Yohanes Gunanta Bangun[1], Hanna Hidayat[2]

Author affiliation:

1. TZU CHI Hospital Pantai Indah Kapuk, Jakarta, Indonesia, 14470; E-mail: yohanesgunanta@gmail.com; ORCID: {0000-0002-9932-8422}
2. TZU CHI Hospital Pantai Indah Kapuk, Jakarta, Indonesia, 14470; E-mail: han.hidayat@gmail.com

Correspondence: Yohanes Gunanta Bangun, E-mail: yohanesgunanta@gmail.com; Telephone: (+62) 81362706262

Abstract

Acute renal failure (ARF) is a condition that may occurs in susceptible postoperative patients. The incidence of ARF reaches 30−60% and it is more after major surgery (e.g., laparotomy, heart surgery). It is often caused by hypovolemia, hypoperfusion, and systemic inflammation. Laparotomy is a major and complex operation that can lead to complications including ARF, acute pulmonary edema, sepsis, and increased morbidity and mortality.

A 76-year-old female patient underwent exploratory laparotomy for acute abdominal indications with suspected obstructive ileus with sepsis. Postoperatively, the patient was treated in the ICU using a ventilator. On the third day the patient's renal function and urine volume decreased. Creatinine level 5.19 mg/dL, urea 217 mg/dL and urine was 0.2 ml/kg/h. The patient was given diuretics but she did not show clinical and laboratory improvement. We decided to perform hemodialysis with continuous veno-venous hemodiafiltration (CVVHDF) mode because the patient was in septic condition and hemodynamic instability. CVVHDF was performed for three days, periodic laboratory examinations were performed to assess the patient's renal function. After three days CVVHDF, the clinical and laboratory indices improved and the patient could be extubated. Hemodialysis with CVVHDF mode has benefits in ARF, especially if the patient has unstable hemodynamics.

Key words: Acute Renal Failure; CVVHDF; Hemodialysis, Laparotomy, Sepsis

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1. Introduction

Acute renal failure (ARF) is defined as an acute decrease of the kidney function within hours, which encompasses both injury (structural damage) and impairment (loss of function). Many patients with ARF have mixed etiology like sepsis, nephrotoxicity, hypovolemia, and systemic inflammation.[1] Sepsis and acute hypovolemia due to any cause are the most common causes of the ARF. Sepsis-associated ARF is a common complication in hospitalized and critically ill patients in intensive care unit (ICU), which increases the risk of comorbidities and mortality.[2] Management of ARF comprises administration of fluids, diuretics, and hemodialysis. Hemodialysis can be done if the administration of fluids or diuretics does not improve the patient's condition. Hemodialysis with continuous veno-venous hemodiafiltration (CVVHDF) is good for ARF patients who are hemodynamically unstable. CVVHDF uses the principles of hemofiltration and hemodialysis. This mode allows the removal and replacement of solutes and fluids in the blood. This case discusses the use of hemodialysis with CVVHDF mode in post-laparotomy patients with sepsis and ARF with unstable hemodynamics in the ICU.

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2. Case Report

A 76-year-old woman came to the emergency department with complaints of pain throughout her abdomen, fever, nausea, and vomiting for one day before admission to the hospital. The patient had no history of previous illness.

Initial examination of vital signs found blood pressure 88/57 mmHg, heart rate 124 bpm, respiratory rate 24

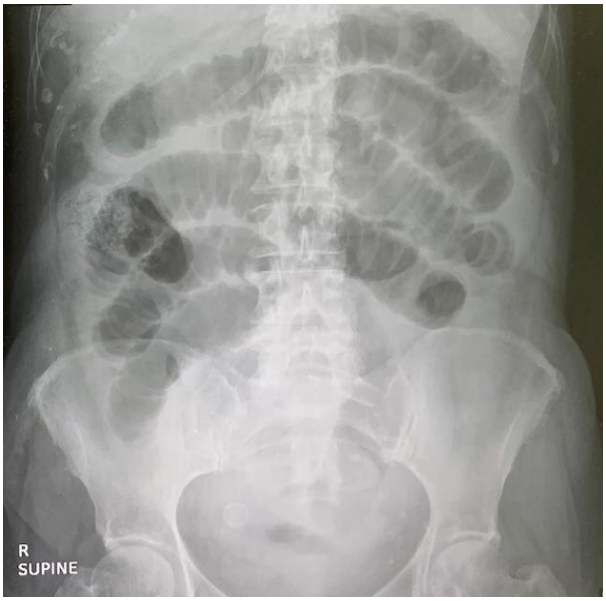

Figure 1: X-ray abdomen, showing distended gut loops

times per min, temperature of 38.8 °C and pulse oxygen saturation 98% with oxygen 8 L/min using a simple mask. Physical examination found the patient with obesity status (BMI 32 kg/m^2) and tenderness all over the abdomen. Laboratory result found creatinine 1.05 mg/dl, urea 38 mg/dL, elevated of leukocyte 18.000/µL, C-reactive protein (CRP) 54.4 mg/dL, lactate 3.4 mmol/L, and procalcitonin 10 ng/mL. Abdominal x-ray examination suspected that there was a small bowel obstruction (Figure 1).

Fluid resuscitation and antibiotics were given. We decided to perform laparotomy exploration. The patient was admitted to ICU for perioperative care. Patient's course of event during admission is presented in Table 1.

The patient was diagnosed with ARF and sepsis after post laparotomy exploration with colon resection based on clinical and laboratory findings. The patient's condition was also aggravated by obesity, pulmonary edema and hemodynamic instability.

The patient was intubated and ventilated using mechanical ventilator with assist control / pressure controlled (AC/PC) mode P_{ins} 12 cmH_2O PEEP 5 cmH_2O RR 18 FiO_2 60% and pressure support (PS) 10 cmH_2O. Morphine and midazolam were administered to keep patient sedated. Norepinephrine infusion was started with a dose of 0.05–0.2 µg/kg/min to maintain adequate blood pressure (MAP > 65 mmHg). Meropenem 1 g and metronidazole 500 mg were administered three times daily. On the third day of treatment, urine output started to decrease from 0.5 ml/kg/h to 0.2 ml/kg/h, creatinine level increased from 1.02 mg/dL to 5.19 mg/dL, and there were signs of pulmonary edema on physical examination of the lungs. We gave furosemide with an initial dose of 5 mg/h to 60 mg/h for 6 h but there was no improvement in urine production. Due to unstable hemodynamics of the patient, we decided to carry out hemodialysis with CVVHDF mode while monitoring urine production and laboratory values.

After CVVHDF had been executed for three days, the patient showed an increase in diuresis with urine output 0.5 ml/kg/h and a decrease in creatinine levels to 1.1 mg/dL (Figure 2). The patient was treated in ICU for 10 days; when her condition was stable and her vital sign within normal limits, she was shifted to the general ward for follow-up.

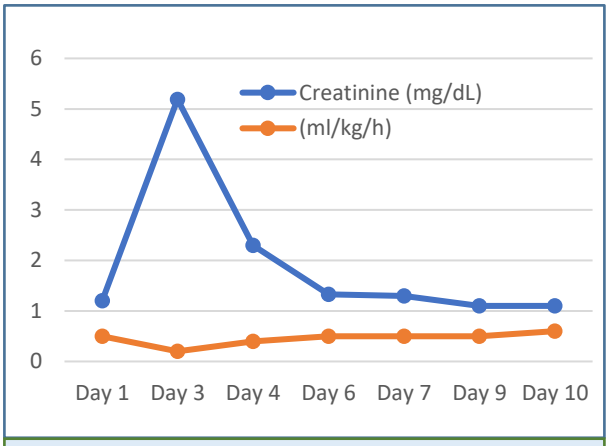

Figure 2: Graphic depiction of patient's serum creatinine and urine output from her admission

3. Discussion

Acute renal failure (ARF) is a frequent and serious complication of sepsis in ICU patients, especially the elderly. Almost 50% or more cases of ARF in ICUs are associated with very high mortality.[3,4] Sepsis and ARF are independently associated with increased morbidity, length of hospital stay, cost of care and mortality. Early detection is critical to a successful intervention. Regardless of the cause and associated comorbidities, all ARF cases are diagnosed based on an increase in serum creatinine or decreased urine output.[5,6]

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Table 1. Patient's vital data over ten days

Parameter	Admission	Day 1–2	Day 3	Day 4–6	Day 7–8	Day 9	Day 10
Clinical condition	Abdominal pain, Fever, Nausea, Vomiting	Post laparotomy exploration	Worsening condition Lung edema Oliguria	Improved condition	Improved condition	Improved condition	Improved condition Move to ward
Vital signs							
• BP (mmHg)	88–100	90–110	70–80	80–100	90–110	90–120	90–120
• MAP (mmHg)	/57–71	/60–70	/55–60	/55–70	/60–70	/60–80	/70–80
• HR (bpm)	64–71	70–80	60–66	63–80	70–83	70–84	81–90
• RR (bpm)	124	92	120	88	84	80	80
• T(c)	24	On Venti	On Venti	On Venti	On Venti	Extub	20
• SpO_2 (%)	38.8	37.5	37.9	37.1	36.9	36.8	36.9
	98	98	94	97	97	98	98
Physical exam	Obesity (BMI 32 kg/m^2) Tenderness in abdomen	Improved condition	Rales in basal of the lung	Rales in basal of the lung decrease	Improved condition	Improved condition	Improved condition
Labs							
• Creatinine	1.05	1.02	5.19	2.3→1.3	1.30	1.1	1.1
• Urea	38	30	217	60→48	44	44	36
• Lactate	3.4	2.4	2.8	2.6	1.6	1.4	1.3
• Procalcitonin	10	6.9	4.28	2.97	3.57	3.02	1.97
Urine output ml/kg/min	0.5	0.5	0.2	0.4	0.5	0.5	0.6
Intervention							
• Norepinephrine	–	0.02–0.05	0.05–0.1	0.1–0.2	0.2→0.1	0.1→0.05	Weaning
• (µg/kg/min)							
• Fluid therapy	√	√	√	√	√	√	√
• Antibiotics	√	√	√	√	√	√	√
• (Meropenem. metronidazole)							
• Furosemide			√				
• CVVHDF				√			

The incidence of postoperative ARF in hospitals is quite high, and 30-day mortality also increases after major surgery. Kim et al. conducted a retrospective study of 4718 gastric surgery patients and reported that the in-hospital and 3-month mortality for patients with ARF was significantly higher than those for patients without ARF.[7]

According to Kidney Disease Improving Global Outcomes (KDIGO), treatment for ARF can be started by stabilizing hemodynamics, administering fluids, vasopressors, diuretics, avoiding nephrotoxic drugs, and carrying out renal replacement therapy (RRT).[8] The indications for initiation of RRT generally include volume overload, severe metabolic acidosis, electrolyte disturbances, and excessive uremic symptoms.[9]

In our patient, hemodynamic condition was unstable with volume overload and uremia. Fluid and diuretics were given but the patient did not show noticeable clinical improvement. We decided to start renal replacement therapy using CVVHDF mode with QB 80 UF 30 substitution of 1.5 L and heparin 600 IU/h for three days. After three days with CVVHDF the patient showed improvement clinically. Laboratory results also showed progress. The creatinine level decreased from

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5.19 mg/dL to 1.3 mg/dL and urine output increased from 0.2 ml/kg/h to 0.5 ml/kg/h.

CVVHDF has many advantages as an RRT in patients with multiorgan failure and unstable hemodynamics. Hypotensive patients can be dialyzed successfully with this mode. Rapid fluid and electrolyte shift responsible for cerebral alterations, disequilibrium syndromes and increased intracranial pressure associated with intermittent hemodialysis (HD) can be avoided with CVVHDF. Because it acts in accordance with the principles of convection and diffusion on a continual basis, it is good for the removal of medium-sized as well as small molecules. It can also remove inflammatory cytokines more effectively than HD in septic inflammatory response syndrome.[10]

4. Conclusion

In conclusion, hemodialysis using CVVHDF mode can be one of the treatments for acute renal failure, especially in unstable hemodynamic conditions with sepsis and multi-organ disorders. However, hemodynamic monitoring, anticoagulation therapy, and dialyzer infusions are required during the hemodialysis process.

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6. Ethical considerations

The institutional ethical committee approved the case report for publication.

7. Competing Interests

There is no conflict of interest in this study.

8. Author Contributions

YGB: Concept, Design, Literature search, Data acquisition, Manuscript preparation

HH: Literature search, Data acquisition, Manuscript preparation

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