



Perspective

Continuous Renal Replacement Therapy Prescription and Monitoring: What Intensivists Should Not Miss



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Received: January 01, 2025 | Revised: June 14, 2025 | Accepted: July 06, 2025 | Published online: March 30, 2026

Continuous renal replacement therapy (CRRT) is administered to approximately 10–15% of intensive care unit (ICU) patients.¹ In 2026, this modality of extracorporeal kidney support must be perfectly stable and effective. To reach this goal, a couple of aspects related to the prescription of CRRT and its monitoring must be fully mastered by intensivists.

The dose of CRRT refers to the intensity of the session. It is crucial to distinguish between the prescribed dose and the delivered dose, the difference between the two is named “downtimes”. The Kidney Disease: Improving Global Outcomes (KDIGO) Guidelines recommend a delivered dose of 20–25 mL/kg/h of effluent flow rate and, to reach this goal, the intensivist should prescribe 30–35 mL/kg/h of effluent flow rate.² Downtimes occur when the therapy (the effluent flow, not the blood flow) is stopped, such as during nursing time; during the time needed to change effluent/dialysate/substitution fluid bags; and during the time needed for a Computed tomography scan or a surgery, a replacement of a failing circuit and/or dialysis catheter. As a reminder, the prescribed dose of CRRT corresponds to the effluent flow rate (dialysate flow rate in case of Continuous Veno Venous Hemodialysis [CVVHD], ultrafiltration flow rate in case of Continuous Veno Venous Hemofiltration [CVVH] and the combination of both in case of Continuous Veno Venous Hemodiafiltration [CVVHDF]).

Like the ICU ventilator, the CRRT machine requires close monitoring, particularly the extracorporeal circuit pressures. Four circuit pressures are measured by pressure sensors along the extracorporeal circuit: the circuit entrance pressure, the exit pressure, the prefilter pressure, and the effluent pressure (Fig. 1). The entrance pressure is negative because its sensor is located before the blood flow pump. Two other pressures, also continuously monitored, are calculated by the software of the RRT machine.

The transmembrane pressure (TMP) that estimates the pressure gradient between the inside and outside of the RRT membrane. The TMP value is obtained using the following formula: $TMP =$

$(\text{Prefilter pressure} + \text{Exit pressure})/2 - \text{Effluent pressure}.$

The drop pressure (P) that estimates the difference between the entrance and the exit of the RRT membrane, giving information about the circulation inside the capillary fibers of the RRT membrane and is calculated using the following formula: $\text{Drop pressure} = \text{Prefilter pressure} - \text{Exit pressure}.$

Importantly, an isolated slow increase of the TMP means clogging is occurring within the RRT membrane (accumulation of blood components such as proteins in the pores of the RRT membrane, reducing the pore diameter), whereas an increase of the P or an increase of the prefilter pressure with a rapid increase of the TMP means clotting (coagulation within the capillary fibers). Clogging means the permeability of the RRT membrane is impaired whereas clotting means the circulation within the RRT membrane is impaired.³ In both situations, the CRRT session efficacy is reduced, and the switch for a new extracorporeal CRRT circuit should be rapidly considered.

NetUF remains one of the most challenging CRRT parameters to prescribe. First, in 2026, the precise definition of this parameter is unclear. For some intensivists, it refers to the rate of fluid that is removed with the CRRT machine, whereas, for others, it represents the net balance between fluid intake and output, considering both the machine and the patient. That said, intensivists should closely monitor the prescription of this parameter because an inappropriate netUF can rapidly cause harm. If the netUF prescription is too low, it will rapidly favor fluid overload, and if it is too high, it will lead to hemodynamic instability and organ ischemia. This is why it is crucial that netUF prescription is constantly reassessed day and night. Hemodynamic and hematocrit continuous monitoring are very useful to optimize netUF. Interestingly, Bitker *et al.*⁴ recently demonstrated that netUF can be maintained even in hemodynamically unstable patients if an advanced hemodynamic monitoring is performed (transpulmonary thermodilution cardiac indices assessed every 4 h, lactate measurement performed at least every 8 h, central venous pressure monitoring, and preload dependence assessed regularly). The benefit of this strategy is a significant reduction of cumulative fluid overload.⁴ Finally, hemodynamic monitoring devices should not be removed prematurely after an acute shock phase, as it is precisely during this period that significant netUF is prescribed.

Finally, regional citrate anticoagulation should be fully understood and mastered by intensivists. It must be the preferred anticoagulation strategy for CRRT, as it is associated with prolonged hemofilter lifespan and a reduced bleeding risk. The two main

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How to cite this article: Rimmelé T, Bidar F, Chardon N, Zuo Z, Peng Z. Continuous Renal Replacement Therapy Prescription and Monitoring: What Intensivists Should Not Miss. *J Transl Crit Care Med* 2026;8(1):e00018. doi: 10.14218/JTCCM.2025.00018.

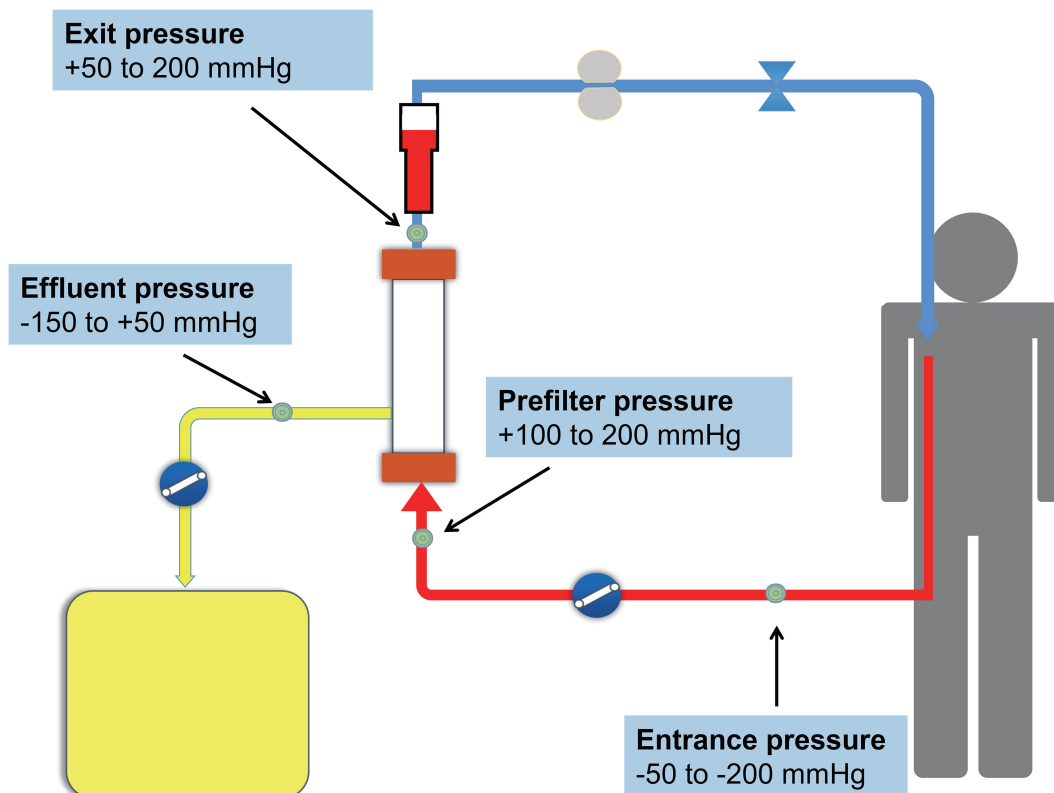


Fig. 1. The four measured circuit pressures on a CRRT circuit. Circuit pressures are measured by sensors located at the entrance of the circuit (entrance pressure), just before the hemofilter (prefilter pressure), after the hemofilter at the end of the circuit (exit pressure), and on the effluent line of the circuit (effluent pressure). CRRT, continuous renal replacement therapy.

complications, citrate overload and calcium-citrate complexes accumulation must be detected early and efficiently managed.⁵

To conclude, CRRT prescription and monitoring deserve the same attention as the one given to ventilators and hemodynamic monitoring devices by intensivists. They need to be aware that the prescribed CRRT dose often differs from the delivered CRRT dose, that circuit pressures are easy to monitor on new generation CRRT machines, that netUF requires continuous reassessment when CRRT is ongoing, and that regional citrate anticoagulation must be the first choice for CRRT anticoagulation.

Acknowledgments

None.

Funding

This work received no external funding.

Conflict of interest

TR and ZP are the Associate Editors-in-chief of *Journal of Translational Critical Care Medicine*. The article was subject to the journal's standard procedures, with peer review handled independently of the editors and the affiliated research groups.

Author contributions

Conceptualization (TR), writing—original draft (TR), writing—review and editing (TR, FB, NC, ZZ, ZP), supervision (TR). All authors have read and approved the final version.

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