

Acute Kidney Injury and ECMO: Two Sides of the Same Coin

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Extracorporeal membrane oxygenation (ECMO) is being used as a life-saving therapy for severe cardiac or respiratory failure. As these patients are the sickest in intensive care unit (ICU), the mortality has always been very high, ranging from 21 to 37% in Venovenous ECMO (VV-ECMO) to 40–60% in Venoaerterial ECMO (VA-ECMO).¹ Acute kidney injury (AKI) has 26–85% incidence during ECMO and has resulted in increased morbidity and mortality.² Venoaerterial ECMO has a higher incidence of AKI probably due to more hemodynamic alterations with some evidence of renal hypoperfusion due to cardiorenal syndrome, raised intra-abdominal pressure or even venous congestion due to heart failure.

The AKI risk factors are either patient-related like cardiogenic shock, use of nephrotoxic drugs, hypovolemia, preexisting comorbidities like uncontrolled diabetes, hypertension or ECMO related like pump speed, use of high vasopressors or blood transfusion during ECMO and type of ECMO.^{3,4} Chen et al.⁵ conducted a retrospective study and concluded that cardiac dysfunction before ECMO, comorbidities and high serum lactate were independent risk factors.

In the current issue of the *Indian Journal of Critical Care Medicine*, Surjit et al.⁶ conducted a retrospective study enrolling 64 patients who underwent ECMO for at least 24 hours. The authors found that 38 patients (59.38%) developed AKI, and out of which 31 patients (81.58%) required renal replacement therapy (RRT). They found that the mortality of patients who underwent RRT was 87.1%. They established that advanced age, reduced cardiac function, high vasopressor usage and use of nephrotoxic drugs were responsible for AKI. This is a single-center retrospective study and the long-term renal outcome could not be commented on.

The incidence of AKI development within 24 hours of initiation of ECMO has been shown to be as high as 57% by Schmidt et al.⁷ It appears that most of the patients who require ECMO are already at risk of developing AKI and ECMO becomes a precursor of manifestation. Venoaerterial ECMO has shown higher incidence as renal perfusion is compromised due to poor left ventricular function pre-ECMO. Pre-Extracorporeal membrane oxygenation (Pre-ECMO) sequential organ failure assessment (SOFA) score has also been studied in various studies and it has been found to be an independent predictor of AKI post-ECMO. In a retrospective cohort study conducted by Lumlertgul et al.⁸ involving patients with VV-ECMO, 76.7% of patients developed AKI out of which 59.3% required RRT. They found that 1-year mortality in patients who required RRT was 32%. Most of the studies looking at AKI in ECMO patients have been conducted in the last decade and hence the incidence appears to be higher. With increasing knowledge and predictability of AKI, the incidence should reduce in the coming

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years as the management of many of the risk factors has become more advanced.

Any organ failure that would develop along with ECMO would worsen the outcome of the patient and will increase the mortality. When the patient is on two extracorporeal therapies simultaneously, the incidence of complications increases multifold. There will be more hemolysis, more hemodynamic and fluid shifts and more chances of hypothermia and the need for blood transfusion. So the big question that arises is whether can we prevent or reduce AKI for patients who are initiated on ECMO. Adequacy of intravascular volume, reduction or avoidance of nephrotoxic drugs, avoiding swings in hemodynamics and minimizing blood transfusion should be attempted. Early detection of AKI may help in planning treatment protocols. Acute kidney injury biomarkers have been used in practice recently but none of them have proved to be very sensitive and specific for ECMO patients. AKIN48 hour scoring system is used to monitor urine output and serum creatinine at 48 hours after initiation of ECMO and has shown to have prognostic value in these patients.⁹ The type of RRT has not been found to show any difference in renal recovery except the fact that continuous renal replacement therapy (CRRT) may be associated with a higher incidence of hypothermia and hemolysis due to longer duration of therapy and more hemodynamic instability.

Both ECMO and RRT are life-saving measures done for different organ support and cannot be avoided if needed. ECMO is an independent risk factor for AKI and early detection and prevention strategies should be incorporated into the ECMO protocol so that AKI incidence can be reduced. Particular attention should be paid to VA ECMO patients as they have an element of cardiorenal syndrome pre-ECMO. Till the time, we don't have a very specific and sensitive AKI biomarker, we should rely on clinical knowledge to diagnose AKI.

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