

Outcome of ECMO and CRRT, experience of Hospital University MED VI, Oujda, Morocco.

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Abstract

Background: Although acute kidney injury (AKI) is a frequent complication in patients receiving extracorporeal membrane oxygenation (ECMO), and the CRRT impact is widely studied. The incidence of simultaneous use of ECMO and CRRT remain unclear. **Objective:** We conducted this retrospective study to define the incidence of concomitant CRRT with ECMO therapy and to determine the overall impact of this strategy on patient outcomes such as mortality and renal recovery.

Methods: We retrospectively analyzed data of patients of all ages, genders and ethnicities, admitted in the intensive care unit of Mohammed VI University Hospital, Oujda, Morocco, on a cumulative period of 2 years (January 2019 – December 2020). Were enrolled in the study patients who benefited from ECMO, and presented an acute kidney injury afterwards, using 'Microsoft Excel' as a software to utilize the information collected from the computerized patient database. 30 patients were included in the final study.

Results: 30 patients with ECMO were enrolled. The mean age was 59.8 ± 12.7 years, with a male predominance (sex ratio (M/F) of 3.28). Over one third of the patients had comorbidities, Diabetes mellitus was the most common (30%), followed by hypertension (17%). 83.3% of our patients benefited from a veno-venous type of ECMO; and ARDS was the most frequent cause for using ECMO comparing to cardiac failure (90% vs 16.6%). 63.3% of our ECMO-using patients developed an AKI, with a mean creatinine peak of 28.74mg/L. 36.6% of our ECMO-using patients required the use of a continuous renal replacement therapy (CRRT). Unfortunately, all our ECMO-using patients complicated with AKI died, with a mortality rate of 100%.

Conclusion: Among patients receiving ECMO, the incidence rates of AKI and severe AKI requiring CRRT are high, regardless of their prior medical conditions and the technique used to connect ECMO and CRRT.

Main Text

Extracorporeal membrane oxygenation (ECMO) is a technique that has improved the prognosis of patients with refractory hypoxemia or cardiac failure, unfortunately this therapy can be complicated by Acute Kidney injury (AKI) which may need Continuous renal replacement therapy (CRRT).

Although the effects of CRRT have been widely studied, the impact of simultaneous CRRT and ECMO is less well described.

We aimed to define the incidence of concomitant CRRT with ECMO therapy and to determine the overall impact of this strategy on patient outcomes such as mortality and renal recovery.

We retrospectively analyzed data of patients of all ages, genders and ethnicities, All enrolled patients or their families have been informed that data from their ICU experience may be collected for research purposes, admitted in the intensive care unit of Mohammed VI University Hospital, Oujda, Morocco, on a

cumulative period of 2 years (from January 2019 to December 2020). Patients enrolled in the study must have benefited from ECMO during their stay, and presented an acute kidney injury afterwards. Were excluded: patients who developed AKI before benefitting from ECMO and/or missing data (ex. duplicated records, empty or incomplete files). We excluded: patients who developed AKI before benefitting from ECMO and/or missing data (ex. duplicated records, empty or incomplete files).

We used 'Microsoft Excel' as a software to utilize the information collected from the computerized patient database. This study has been approved by the clinicaltrials Ethics Committee under Number NCT05033509.

Our data comprised a total of 30 patients that were included in the final study ;The mean age was 59.8 ± 12.7 years, ranging from 19 to 87 years. Our patients were mainly males, with a sex ratio (M/F) of 3.28. Over one third of the patients had comorbidities, Diabetes mellitus was the most common (30%), followed by hypertension (17%). 83.3% of our patients benefitted from a veno-venous type of ECMO; and ARDS was the most frequent cause for using ECMO comparing to cardiac failure (90% vs 16.6%). All the 30 patients had their creatinine levels and their diuresis status monitored daily. 63.3% of our ECMO-using patients developed an AKI, defined by the KDIGO guidelines, and staged (1 to 3) following the KDIGO staging of AKI severity. The mean creatinine peak was 28.74mg/L (N.R: 5.7 – 11 for female patients, and 7.2 – 12.5 for male patients).

36.6% of our ECMO-using patients required the use of a continuous renal replacement therapy (CRRT). Unfortunately, all our ECMO-using patients complicated with AKI died, with a mortality rate of 100%. (Tables 1, 2,3)

While using ECMO, AKI is a very common complication (incidence: 52 – 85%) and usually requiring Renal Replacement Therapy (45%) [1]. The most common reasons for initiating dialysis with ECMO are fluid overload (43%), prevention of fluid overload (16%), AKI (35%) and electrolyte disturbances (4%) [3]. The Mortality under ECMO and CRRT is significantly higher and goes up to 80% (RR: 4.99) [1-2] . There are three ways that CRRT can be initiated in a patient undergoing treatment with ECMO, The most common technique is using separate vascular access and circuit for CRRT and ECMO [2] ,but The safest and most accurate way to combine the two developed so far is to connect an external CRRT machine (commonly used in an ICU) to its own circuit, an ECMO circuit. This approach is becoming increasingly popular, especially with continuous venous Hemofiltration (CVVH) , continuous venous hemodiafiltration (CVVHDF), and continuous venous hemodialysis (CVVHD); it allows a precise control of blood flow in the CRRT cycle with proper control of transmembrane pressure (TMP) and precise fluid balance. [3-4]

The results were similar to those described in the literature. It was found that the majority of our patients undergoing ECMO therapy presented an AKI (19 out of 30; 63.3%); and the majority of ECMO-patients with an AKI required a CRRT (11 out of 19; 57.8%).This highlights the need for multisystem knowledge and an interdisciplinary approach in the care of ill patients requiring the use of ECMO therapies.

congruent with literature data where mortality rates varied between 60-100%; studies also showed a 3.7-fold increased risk of hospital mortality among ECMO patients with severe AKI requiring RRT. [1,5]. Future studies should focus on strategies for prediction, detection, and prevention of AKI among ECMO patients.

List Of Abbreviations

ECMO: Extracorporeal membrane oxygenation.

ELCS: Extracorporeal Life Support Program.

CRRT: continuous renal replacement therapy.

AKI: Acute kidney injury.

RRT: renal replacement therapy.

CVVH: continuous venous Hemofiltration.

CVVHD: continuous venous hemodialysis.

CVVHDF: continuous venous hemodiafiltration.

TMP : Transmembrane pressure .

KDIGO : Kidney Disease: Improving Global Outcomes.

ARDS : Acute respiratory distress syndrome.

ICU : Intensive care unit .

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Declarations

- Ethics approval and consent to participate : Not applicable
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Title, Email and contributions of each author to the paper:

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Tables

table 1 : Clinical characteristics of ECMO patients

	n=30
	all ECMO Patient
Age ,n (average) (years)	59,86 [19-87]
Male sex, n (%)	76,66
BMI, n (kg/m2)	30,22
ATCD	
Hypertension, n (%)	17,01
Cardiopathie, n (%)	6,66
Diabetes, n (%)	30
other, n (%)	23,33
Any, n (%)	73,36
type of ECMO	
V-V, n (%)	83,33
V-A, n (%)	16,66
indication of ECMO	
ARDS, n (%)	90
Cardiac Failure, n (%)	16,66

Table 2: Clinical characteristics ECMO patient with AKI

	n=19
	ECMO and AKI
Age ,n (average) (years)	45,19 [47-87]
Male sex, n (%)	78,94
BMI, n (kg/m2)	28.93
ATCD	
Hypertension, n (%)	15,78
Cardiopathie, n (%)	10,52
Diabetes, n (%)	47,36
other, n (%)	21,05
Any, n (%)	52,63
type of ECMO	
V-V, n (%)	73,68
V-A, n (%)	26,31
indication of ECMO	
ARDS, n (%)	84,21
Cardiac Failure, n (%)	26,31
pic of Creat, n Median (mg/l)	28,74
KDIGO stage of AKI	
1, n (patients)	8
2, n (patients)	7
3, n (patients)	4

Table 3 : Clinical characteristics of ECMO patients under CRRT too.

	n=11
	ECMO and CRRT
Age ,n (average) (years)	58,88 [47-69]
Male sex, n (%)	72,72
BMI, n (kg/m2)	28,75
ATCD	
Hypertension, n (%)	18,18
Cardiopathie, n (%)	9,09
Diabetes, n (%)	36,36
other, n (%)	18,18
Any, n (%)	18,18
type of ECMO	
V-V, n (%)	72,72
V-A, n (%)	27,27
indication of ECMO	
ARDS, n (%)	90,9
Cardiac Failure, n (%)	27,27
pic of Creat, n Median (mg/l)	61,88