

Predictors of mortality in 142 cases who received extracorporeal membrane oxygenation for cardiac or pulmonary indications

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INTRODUCTION

Extracorporeal membrane oxygenation (ECMO) has shown promising results as a bridge or definitive therapy for critically ill patients who are otherwise expected to die. Cases on ECMO support experience significant morbidity and a high mortality rate approaching 60-85 % which relates to the severity of the underlying pathology and a high incidence of multiorgan failure. The availability of new treatment modalities for refractory circulatory failure including ventricular assist device and cardiac transplantation together with the limitation of benefit provided from medical therapy illustrates the important role for ECMO whether as a bridge to ventricular assisted device, transplantation or recovery. Predictors of mortality for patients receiving ECMO support have been variable and inconsistent among prior studies. The purpose of this study was to determine predictors of mortality, outcome and long-term survival in patients placed on ECMO for cardiac indications.

METHODS

After IRB approval, a retrospective chart review was performed to identify cases of ECMO support for either cardiac or pulmonary indications from 2007 to 2013. The following factors were analyzed as potential predictors of ECMO outcome: age, body mass index, height, diabetes mellitus, hypertension, patient with known end stage renal disease on dialysis, preoperative atrial fibrillation, preoperative intra-aortic balloon pump placement, pulmonary hypertension, indication for ECMO (cardiac or pulmonary), preoperative lactic acid (LA), 24-hour LA, duration of ECMO therapy, type of ECMO, quantity of transfused packed red blood cells (pRBCs), plasma, platelets and cryoprecipitate, 24-hour lactate dehydrogenase and plasma free hemoglobin. Continuous data were expressed as mean \pm standard deviation and compared using two-tailed independent Students *t*-tests. Categorical variables were compared using two-tailed independent Mann-Whitney U tests. Univariate and multivariate logistic regression models were used to evaluate clinical variables on the binary dependent variable, survival (Survived/Expired). Data were analyzed using IBM SPSS 21.0 statistical software (IBM SPSS Version 21.0. Armonk, NY).

RESULTS

A total of 142 patients received ECMO support due to either cardiac (N=118) or pulmonary etiology (N=24). Patient demographics and co-morbidities did not significantly influence the outcome of ECMO (table 1). The quantity of RBCs and platelets transfused resulted in significant predictors of mortality when comparing patients who expired versus patients who survived; 33 versus 23 units respectively, $p = 0.039$ and 57 versus 30 units respectively, $p = 0.026$ (table 2). 24-hour lactic acid levels showed a trend towards significance with levels of 6.5 versus 4.4 in expired vs survived cases respectively, $p = 0.056$. However, these results were no longer significant when adjusted for baseline imbalances using a multivariate logistic regression analysis (table 3). There was no mortality difference according to type of ECMO; venovenous or venoarterial ($P = 0.798$). There was a significant correlation between amount of packed RBCs ($r = 0.495$) and platelets ($r = 0.497$) transfused and the mean ECMO duration ($P < 0.001$).

Table 1: Outcome of ECMO According to Patient Demographics and Comorbidities

	All (n = 142)	Survivors (n = 59)	Non-survivors (n = 83)	p-value
Age, years (mean)	50.5	50.1	50.7	0.837
Female, % (n)	24.6 (35)	23.7 (14)	25.3 (21)	.831
BMI (mean)	29.1	27.9	30.0	.174
Height (mean)	1.74	1.73	1.74	.506
Hypertension, % (n)	62.0 (88)	64.4 (38)	60.2 (50)	.616
Diabetes Mellitus, % (n)	35.9 (51)	40.7 (24)	32.5 (27)	.320
ESRD (Dialysis) , % (n)	8.45 (12)	3.4 (2)	12.0 (10)	.073
Preop A-fib	22.5 (32)	28.8 (17)	18.1 (15)	.118
Preop IABP	12.7 (18)	6.8 (4)	16.9 (14)	.082
Pulmonary Hypertension	27.5 (39)	28.8 (17)	26.5 (22)	.762

BMI; body mass index, ESRD; end stage renal disease, A-fib; atrial fibrillation, IABP; intra-aortic balloon pump

CONCLUSIONS

Although the amount of transfused pRBCs and platelets were associated with increased mortality, the data could not be reproduced when adjusted for imbalances at baseline. Therefore ECMO outcomes are related to severity of the main underlying pathology rather than comorbidities. ECMO support should therefore be implemented on case-by-case basis depending on pre-procedural chances of success.

Table 2: Outcome of ECMO According to Laboratory, Blood products, and ECMO Characteristics

	All (n=142)	Survivors (n=59)	Non-survivors (n=83)	p-value
Laboratory Values				
Preop Lactic Acid (Mean)	6.3	5.5	6.7	.267
24hr Lactic Acid (Mean)	5.8	4.4	6.5	.056
24hr LDH (Mean)	2212.9	2528.3	1897.5	.677
24hr PFH (Mean)	90.5	52.6	130.6	.116
Blood Products on ECMO				
RBCs (Mean units)	29.0	23.3	33.0	.039*
Platelets (Mean Units)	46.1	30.1	57.4	.026*
Plasma (Mean Units)	12.4	13.8	11.5	.393
Cryo (Mean Units)	24.3	23.1	25.2	.721
ECMO Characteristics				
Mean Duration of ECMO (days)	5.6	4.9	6.1	.230

Table 3: Logistic regression analysis to identify predictors associated with mortality: Odds ratio (OR), 95 % confidence interval (CI) and P-values.

	OR	95 % CI	P-value
RBCs	0.987	(0.968, 1.007)	.209
Platelet	0.997	(0.990, 1.005)	.457
24-h lactic acid	0.927	(0.846, 1.017)	.107

REFERENCES

Henriquez-Henriquez M et al. Blood component usage during extracorporeal membrane oxygenation: experience in 98 patients at a Latin-American tertiary hospital. Int J Artif Organs. 2014 Mar;37(3):233-40.