Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Purpose: Post-operative acute kidney injury (AKI) occurs in up to 65% of lung transplant recipients and is associated with chronic kidney disease and mortality. Plasma neutrophil gelatinase-associated lipocalin (pNGAL) is a biomarker of early structural kidney damage that has improved prediction of AKI compared with clinical variables alone in non-transplant patient populations. We sought to determine the association of pNGAL with AKI after lung transplantation and whether it could improve AKI prediction.

Methods: We included 189 lung transplant recipients enrolled in the prospective 5-center Lung Transplant Outcomes Group Acute Kidney Injury (LTOG-AKI) cohort study from 7/2017 - 6/2019. We tested pNGAL levels pre-transplant and at 6 and 24 hours post-reperfusion. We defined AKI using Kidney Disease Improving Global Outcomes creatinine criteria during the first 7 post-op days. We tested associations of pNGAL and clinical variables with AKI using the Wilcoxon rank-sum test. We constructed logistic regression models to predict AKI using pNGAL alone, clinical variables alone, and pNGAL plus clinical variables.

Results: AKI developed in 95 (50%) patients (45 (24%) stage 1, 21 (11%) stage 2, 29 (15%) stage 3), occurring a median of 2 (IQR 1-3) days post-op. pNGAL levels at 6h (p=0.001) and 24h (p<0.001) were significantly associated with AKI. Over 90% of 6h pNGAL levels were >150 ng/ml, the cut-off typically used to denote high risk of AKI in non-transplant populations. A model including clinical variables of recipient age and gender, transplant diagnosis and type, and lung allocation score had an area under the receiver operating characteristics (auROC) curve higher than pNGAL alone (Figure 1). Adding pNGAL to the clinical model did not improve the auROC curve. Model results were similar when defining AKI as stage 2-3 only.

Conclusion: Early post-lung transplant pNGAL levels were associated with AKI but did not add to clinical variables in predicting AKI.

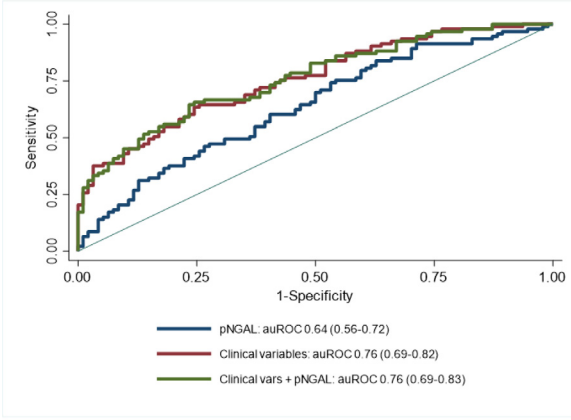

Figure 1. Receiver operating characteristics curves based on logistic regression models of acute kidney injury predicted by 6-hour plasma NGAL, clinical variables, and clinical variables plus pNGAL

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Ambulation in Veno-Arterial-Venous (VAV) Cannulation for ECMO Support in COVID-19 Related ARDS with Right Ventricular Failure

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Purpose: Physical functioning in patients undergoing extracorporeal membrane oxygenation (ECMO) related to strict bedrest requirements is debilitating. Physical therapy (PT) in these patients can be beneficial. However, the data in COVID-19 associated with acute respiratory distress syndrome (ARDS) is not well characterized. We present our experience with ambulation in patients receiving veno-arterial-venous (VAV) ECMO support.

Methods: Clinical charts of COVID-19 associated ARDS patients with VAV-ECMO support who received PT sessions between January 2021 and October 2021 were retrospectively reviewed and analyzed. Mobility functions were assessed. Episodes of oxygen saturation and hypotension were noted as primary outcomes.

Results: Eight patients were placed on VAV-ECMO for decompensated heart failure with right axillary artery cannulation via vascular graft and right internal jugular vein double lumen (Avalon) cannula. Mean age was 46.9 ± 10.3 years, and BMI was 30.6 ± 4.4 kg/m^2 with five males. Mean duration of ECMO support was 53.6 ± 13.4 days. Average PT sessions per patient were 22.8 ± 12.2, with average days to PT initiation from ECMO insertion being 19.0 ± 8.1 days. The total average time per daily PT session was 27.2 ± 9.3 minutes. The ability to perform mobility functions with minimal, moderate, total, stand-by, contact-guard assistance for all patients is listed in the table. During PT sessions, a total of 14 episodes of oxygen desaturation and six episodes of hypotension in four patients were noted. There were no events of any cannula displacement. Of all, three are still in the hospital supported by ECMO, three transferred to the lung transplant center, one died in hospital, and one discharged home.

Conclusion: VAV ECMO support via right axillary and RIJ dual lumen cannulation provides a safe strategy for prolonging support and effective rehabilitation in severe COVID-19 related ARDS patients complicated with RV failure.

Table- Type of assistance required to perform various mobility functions in all patients

	Rolling	Supine to sit	Sit to stand	Bed to chair	Gait
Patient 1	MO	MO	MO	MO	MO
Patient 2	SB	SB	SB	CG	SB
Patient 3	MO	MO	T	T	NA
Patient 4	T	T	NA	T	NA
Patient 5	MO	MO	M	M	M
Patient 6	CG	CG	MO	M	M
Patient 7	MO	MO	MO	T	NA
Patient 8	CG	SB	CG	CG	CG

Abbreviations: M *minimal*, MO *moderate*, T *total*, CG *contact-guard*, SB *stand-by*, NA *not achieved*

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Outcomes by Severity of Obesity During Extracorporeal Membrane Oxygenation Support for COVID-19

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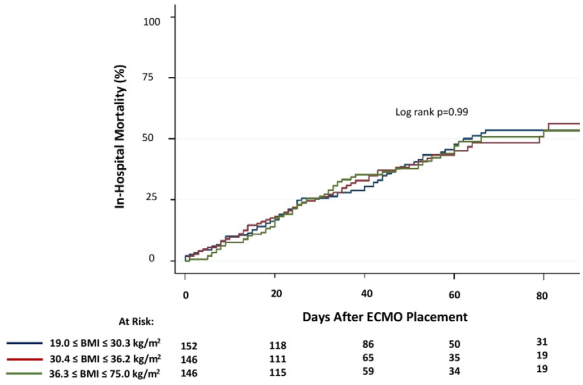
Purpose: Obesity adversely impacts outcomes during COVID-19 but its relation to mortality in those receiving extracorporeal membrane oxygenation (ECMO) is uncertain.

Methods: A retrospective multicenter study was conducted. Adult patients (≥18 years old) with severe COVID-19 infection placed on ECMO between March 1, 2020 to April 30, 2021, across the United States were included. A web-based database application, REDCap, was utilized to capture clinical characteristics and outcomes. Patients were grouped into tertiles of body mass index (BMI). The primary outcome was in-hospital mortality after ECMO placement assessed by a time-to-event analysis.

Results: Overall 444 patients (age 49, IQR: 38-57 years, 29% female, BMI: 33, IQR: 29-39 kg/m2) from 17 centers comprised the study cohort. Patients that expired during hospitalization had a similar BMI in comparison to those that were discharged (33, IQR: 29-38 vs. 34, IQR: 30-40 kg/m2, p=0.13). BMI across groups was 27, IQR: 25-29 (lowest tertile),

33, IQR: 32-34 (middle tertile), 41, IQR: 38-45 kg/m2 (highest tertile). At 90 days, in-hospital mortality between BMI tertiles was 53%, 59%, and 53%, p=0.99 (figure). After adjustment for clinical covariates including age, sex, presence of preexisting co-morbidities, cardiopulmonary arrest prior to ECMO, serum creatinine and arterial partial pressure of oxygen (PaO2) to inspired oxygen concentration (FiO2) ratio, there was no difference in hospital mortality in the middle (aHR:1.13, CI: 0.79-1.63, p=0.5) and highest (aHR: 1.38, CI: 0.95-2.01, p=0.09) tertiles in comparison to the lowest BMI tertile.

Conclusion: Severity of obesity is not associated with death during hospitalization in patients placed on ECMO for COVID-19



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Intermediate (One-Year) Outcomes of Cardiogenic Shock Patients Supported by ECMO Due to Decompensated Heart Failure and Acute Myocardial Infarction

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Purpose: Cardiogenic shock patients who are supported by ECMO have high mortality and morbidity. We evaluated the 1-year outcomes in ECMO supported patients with decompensated heart failure (DHF) or acute myocardial infarction (AMI), including death, heart transplantation (HT), left ventricular assist device (LVAD) implantation as well as dependency on hemodialysis or ventilation.

Methods: Patients supported by ECMO due to DHF or AMI registered in the Spectrum Health ECMO registry were included in this study. Clinical, echocardiographic, laboratory and hemodynamic characteristics were obtained in all patients. Survival analysis using Kaplan-Meier curves for the combined outcome of death, heart transplantation (HT) and LVAD implantation were developed. These outcomes were compared between DHF and AMI patients. The frequency of renal replacement therapy or ventilator dependency on 1-year survivors was calculated.

Results: A total of 283 patients received ECMO, 228 due to DHF and 55 due to AMI. Of these, 22 patients received LVAD, and 1patient received HT. A total of 174 patients died (including 6 LVAD patients and 1 HT patient) within 1 year of ECMO. Patients with AMI had higher troponin (2.5 ng/dL (0.49 - 7.85) vs. 1.4 ng/dL (0.15 - 4.6), p=0.013), lower total bilirubin 0.65 mg/dL (0.4 - 1.12) vs. 0.8 mg/dL (0.5 - 1.6), p=0.025), higher ALT (117 IU (61- 225) vs. 48 IU (29 - 171), p = 0.003), lower creatinine (1.35 mg/dL ± 0.75 vs. 1.6 mg/dL ± 1.17, p=0.006), lower inotropic score (7 (1 - 18) vs. 9 (4 - 20), p=0.022). The combined endpoint survival free of HT or LVAD implantation at 1-month was 45.5% vs. 38.6% for AMI and DHF, respectively. There was a small but continued decrease in the survival of combined outcome at 1 year (36.4% vs. 32%, p=0.607, Figure 1). The 1-year survival probability free of the combined outcome for those patients who survived 30 days was 81.4% vs. 81.7% for AMI and DHF, respectively. Of the 92 patients who were alive at one year, 5 (5.4%) had end stage renal disease and were receiving hemodialysis and 3 (3.2%) were dependent on a ventilator.

Conclusion: The 1-year survival free of HT or LVAD in AMI or DHF patients requiring ECMO is low. This is predominantly driven by the outcome on the first 30 days after ECMO implantation. A small proportion of 1-year survivors have end stage renal disease or are dependent on mechanical ventilation.

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Multicenter Study on Sex-Based Differences in Patients Placed on Extracorporeal Life Support for Cardiogenic Shock

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Purpose: The use of extracorporeal life support (ECLS) for patients in cardiogenic shock has significantly increased over the past decade. However, there are insufficient data for the presence of gender-associated differences in outcomes. Our study assesses differences between male and female patients placed on venoarterial ECLS (VA-ECLS) for cardiogenic shock at numerous centers worldwide.

Methods: This is a multicenter retrospective study conducted on 9888 patients from the Extracorporeal Life Support Organization database. We looked at adult patients (≥18 years old) who were placed on VA-ECLS between January 1st, 2011 and December 31st, 2019 for cardiogenic shock. We only looked at patients' first ECLS runs, excluding subsequent ECLS runs for patients who received ECLS multiple times. The primary endpoint was in-hospital mortality. Patients who were transferred to outside hospitals after ECLS placement were excluded. Secondary endpoints include postoperative bleeding, infection, cardiac arrhythmia, cardiac arrest, limb ischemia, compartment syndrome, fasciotomy requirement, stroke, renal replacement therapy, and metabolic acidosis.

Results: There were 6747 male patients and 3141 female patients. In an unadjusted comparison, male patients were more likely to have prior myocardial infarction (29.5% vs 20.9%, p<0.001), coronary artery disease (23.1% vs 15.6%, p<0.001), diabetes (10.6% vs 9.2%, p=0.038), chronic kidney disease (7.7% vs 5.2%, p<0.001), and CHF (23.9% vs 21.4%, p=0.006). Female patients were more likely to be centrally cannulated (23% vs 18.5%, p<0.001). There was no difference in in-hospital mortality between male and female patients (57.2% vs 55.7%, p=0.169). Female patients were more likely to have limb ischemia as a complication (7.0% vs 4.6%, p<0.001), whereas male patients were more likely to require renal replacement therapy (43.5% vs 38.6%, p<0.001) and have arrhythmias (15.2 vs 13.1, p=0.008) after ECLS. There were no other differences in the secondary outcomes between male and female patients.

Conclusion: Compared with male patients, female patients were more likely to centrally cannulated and experience limb ischemia as a complication of ECLS, potentially due to their smaller vessel size. Varying cannulation approach based on biologic sex may be warranted to reduce ECLS complication rates in female patients.

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Combining VA-ECMO and Impella (EC-Pella) Before Reperfusion Mitigates Left Ventricular Injury Due to VA-ECMO in Acute Myocardial Infarction

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Purpose: Combining veno-arterial extracorporeal membrane oxygenation (ECMO) with an Impella CP (EC-Pella) is increasingly used in acute myocardial infarction (AMI). We recently reported that compared to reperfusion alone, ECMO increases, but Impella decreases infarct size in preclinical models. Whether EC-Pella limits cardiac damage remains unknown. We hypothesized that compared to ECMO alone, EC-Pella mitigates left ventricular (LV) injury when activated before reperfusion in AMI.

Methods: Ischemia-reperfusion injury (IRI) was induced in adult swine via percutaneous occlusion of the left anterior descending artery (LAD) for 120 minutes. We then activated either ECMO alone for 30 minutes or EC-Pella for 45 minutes with persistent LAD occlusion. All groups underwent 180 minutes of reperfusion (n=4-6/group). To study whether the sequence