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Topic: 2 - Adult - Cardiac failure

Abstract: 6

Application of ECMO support during transcatheter valvular procedures

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Objective: ECMO has gained use as a rescue therapy in refractory cardiovascular and respiratory compromise. Increasingly, it is considered for cardiopulmonary support during percutaneous coronary and structural heart interventions.

Methods: We report 3 cases wherein ECMO successfully facilitated transcatheter valvular procedures in patients who were not surgical candidates due to the severity of their illness.

Results: A 51-year-old male presented with myocardial infarction and cardiogenic shock. Echocardiogram showed severe mitral regurgitation from posterolateral papillary muscle rupture. He developed refractory hypoxia from pulmonary edema. He underwent emergent MitraClip under VV-ECMO. He was decannulated 4 days post-procedure and discharged home on day 7 of hospitalization.

A 47-year-old female presented with acute coronary syndrome, and despite revascularization, arrested from ventricular fibrillation. She was emergently placed on VA-ECMO. Echocardiogram showed severe functional mitral regurgitation. After optimization of hemodynamics and volume status on ECMO, she underwent MitraClip procedure 5 days later and was decannulated the same day. She was discharged a week later.

A 34-year-old male presented to an outside hospital with cardiac arrest from myocardial infarction requiring VA-ECMO and Impella support. Following decannulation, he was found to have acute severe aortic regurgitation related to a flail aortic valve cusp, which was likely injured during Impella placement. VV-ECMO was subsequently instituted for refractory hypoxemia. At our center, he underwent transcatheter aortic valve replacement (TAVR) with VV-ECMO support. His pulmonary status rapidly improved and efforts were directed at weaning ECMO. Unfortunately, the patient suffered a large intracranial hemorrhage and expired 6 days after his TAVR.

Conclusions: The emerging patient population with compromised cardiopulmonary function undergoing percutaneous therapies has seen the use of ECMO as a rescue intervention or for perioperative prophylaxis. Our cases illustrate instances that utilize ECMO for stabilization during high-risk percutaneous valvular procedures which might otherwise not be tolerated. Applications of ECMO in these situations deserve further examination.

Abstract: 9

The role of extracorporeal membrane oxygenation in major aortic surgery with particular reference to aortic dissection

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Objective: Very little is known about the role of extracorporeal membrane oxygenation for the management of patients undergoing major aortic surgery with particular reference to aortic dissection. We sought to review the available literature to determine if there was any evidence

Methods: A systematic literature search was undertaken through PubMed and EMBASE according to specific key words combined as follows: ECMO and aortic surgery; ECMO and aortic dissection; ECLS and aortic surgery; ECLS and aortic dissection

Results: The search retrieved 29 publications relevant to the subject: 1 brief communication; 1 surgical technique report; 1 invited commentary; 1 retrospective case review; 1 observational study; 4 retrospective reviews; 13 case reports and 7 conference abstracts. A total of 194 patients were included in these publications of whom 77 survived. The articles had been published between 1994

recorded. Data were used to develop a multivariate logistic regression model predicting in-hospital mortality.

Results: There were 29 patients with a diagnosis of acute myocarditis support by extracorporeal membrane oxygenation from 2013 through 2019. 22 patients weaned from extracorporeal membrane oxygenation and 21 patients survival to hospital discharge. The average age of the population was 36.8 ±11.8 years, the median weight was 71.4±17.7kg, and females (n = 10) accounted for 34.5% of the patients. Hospital survival rate was 76%. 2 patients need Impella because of left ventricle distanding when support by extracorporeal membrane oxygenation, one patient of extracorporeal membrane oxygenation +Impella dead after weaning from extracorporeal membrane oxygenation and survival to discharge was 50%. Extracorporeal membrane oxygenation was deployed during extracorporeal cardiopulmonary resuscitation in 4 patients. In a multivariate model time before extracorporeal membrane oxygenation support, pre-extracorporeal membrane oxygenation arrest were associated with increased odds of in-hospital mortality.

Conclusions: Extracorporeal membrane oxygenation is effective in adults with acute myocarditis. Extracorporeal membrane oxygenation deployment early and prior to cardiac arrest may be associated with better outcomes.

Topic: 3 - Adult - Lab session - fundamental research

Abstract: 11

Testing extra corporeal life support devices to military environmental standards

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Objective: The objective of this work was to determine if a standard extracorporeal life support device that provides both kidney and lung support is able to withstand environmental extremes seen in military environments

Methods: The US Army Medical Materiel Development Activity (USAMMDA) provided the US Army Aeromedical Research Laboratory (USAARL) with extracorporeal life support devices that are able to provide lung and kidney support simultaneously for environmental testing in accordance with the methods and procedures outlined in MIL-STD-810H. The device was exposed to high and low temperature environments for operation and storage testing, vibration testing, drop testing, humidity testing, altitude testing, settling dust testing, blowing sand testing, and blowing dust testing.

Results: To be determined

Conclusions: To be determined

Abstract: 19

An innovative ovine model of severe cardiopulmonary failure supported by veno-arterial extracorporeal membrane oxygenation

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Objective: Cardiogenic shock (CS), complicated by pulmonary failure, often requires veno-arterial extracorporeal membrane oxygenation (VA-ECMO) to sustain end-organ perfusion. Currently used ovine models, such as coronary ligation are unstable, often resulting in ventricular fibrillation and cardiac arrest. Therefore, we aimed to develop a clinically-relevant but also controllable model of severe cardiopulmonary failure supported by VA-ECMO.

Methods: Three Leicester Cross sheep (62±7 kg) were anaesthetized, intubated and mechanically ventilated. The right humeral artery was cannulated for hemodynamic and metabolic assessment. Peripheral V_jA_f-15/24-ECMO was started at flow rate of 1 L/min. After a left minithoracotomy and administration of anti-arrhythmic drugs, CS was induced through multiple 1 mL sub-epicardial injections of 96% ethanol into the left ventricle. CS was confirmed by systolic blood pressure (SBP) < 90 mmHg, lactate >4 mmol/L and bed-side echocardiography. Then, ventilatory support was reduced to achieve PaO2 < 60mmHg and ECMO support increased to maintain mean arterial pressure of 65 mmHg. Echocardiography and Troponin I (TnI) samples were performed at baseline, upon CS and pulmonary failure. After 5h, animal was euthanized and the cardiac tissue samples assessed by immunohistochemistry.

Results: Ethanol injections (54±18 mL) rapidly induced CS in all animals. TnI levels increased 2000-fold (from 0.04 to 80.5 ng/L). SBP decreased from 99±25 at baseline to 73±11 mmHg upon CS, respectively, and lactate from 1.5±1.0 to 5.5±0.4 mmol/L. Baseline PaO2 was 77.5±17.6 and decreased to 40.3±11.5 mmHg, when ventilation was reduced. Echocardiography revealed a dose-dependent effect on heart function and fractional

area change decreased from 34.7±13.5% upon baseline to 19.7±6.3% after CS.

Histological samples and macroscopic evaluation resemble acute myocardial infarction with both necrosis and inflammatory infiltrates present.

Conclusions: We successfully developed a titratable model of severe cardiopulmonary failure through intramyocardial ethanol injections. This model could be essential to further characterize left-sided heart failure and develop future treatments.

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Blood drainage performance characteristics of VV-ECMO drainage cannulas

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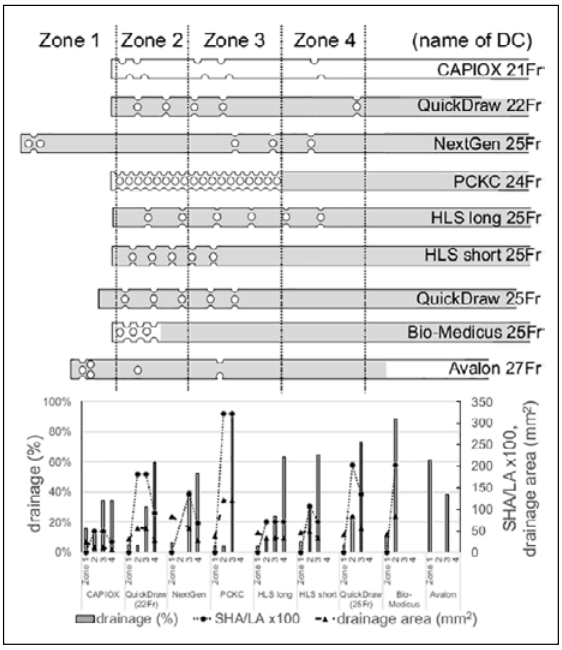
Objective: To evaluate the blood drainage volume from the end hole (EH) and side holes (SHs) of different types of VV ECMO drainage cannula (DC).

Methods: Nine DCs were tested. A water tank filled with 33% vol glycerin solution was divided into 4 compartments; the EH was positioned in Zone 1, and the SHs were equally spaced horizontally along the side of the tank unless the DC configuration necessitated otherwise. The suction volume of each compartment was measured at a constant flow rate of 3 L/min.

Results: The suction volumes of each DC are shown in the figure. For most DCs, the drainage areas (DAs) of distal side (Zones 1 and 2), and proximal side (Zones 3 and 4) were similar but the drainage volumes of proximal side were greater. The PCKC DC, which had a large SH area (SHA) and a high SHA-to-lumen cross-sectional area (SHA/LA), had an especially high drainage volume from proximal side. In contrast, the CAPIOX DC, which had a small SHA and a low SHA/LA, had a relatively high drainage volume from Zones 1 and 2. The CAPIOX and Avalon DCs had about 20% and 60% drainage from the EH, respectively, while most of the other DCs had less than 5%.

Conclusions: The drainage volume from the EH and the SHs depends on the SH positions, SHA, and the SHA/LA. Understanding the DC characteristics facilitates optimal placement of the holes, leading to maximum effectiveness.



Nine DCs and the suction volumes of each DC.

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Effects of hyperoxia on platelet aggregation, inflammation and oxidative stress during ex-vivo extracorporeal membrane oxygenation

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Objective: Despite increasing use of extracorporeal membrane oxygenation (ECMO) for support of refractory cardiac and pulmonary failure, it remains a complex, high-risk intervention. Current practice often exposes patients to higher doses of oxygen (hyperoxia) during ECMO in order to avoid episodes of hypoxia.