

APPENDIX I: ECMO CURRICULAR REQUIREMENTS: DIDACTIC LEARNING OBJECTIVES

Title	Learning Objective	Learning Objective	Learning Objective
ECMO Overview	Describe the different modes of ECMO support.	Discuss global trends in ECMO utilization.	
History of ECMO	List the key milestones in the development of ECMO.	Describe the evolution of the Extracorporeal Life Support Organization.	
Circuit Overview	Define the main components of an ECMO circuit.	List circuit monitoring tools.	
Cannulas and Tubing	Describe the differences in ECMO cannula design.	List the considerations for selecting the appropriate ECMO cannula.	
Pump	Describe the requirements of a blood pump used in ECMO.	Explain the physics and working principles of a centrifugal pump.	
Membrane Lung and Blender	Describe the structure and function of the membrane lung	Describe the function of the blender	
Pressure Monitoring	List the different pressure zones in an ECMO circuit	Discuss the utility of monitoring drainage pressure	Discuss the utility of monitoring pre- and post-membrane lung pressures
Other Circuit Components	Describe the utility of the flowmeter	Describe the function of the heater	Describe the utility of circuit clamps
Cannulation	List the differences between percutaneous and open cannulation	Outline the process of percutaneous cannulation	Discuss the role of ultrasound in cannulation
VV ECMO Configurations	List the different configurational options for VV ECMO	Review the benefits and limitations of specific configurations	
VA ECMO Configurations	List the different configurational options for VA ECMO.	Review benefits and limitations of specific configurations.	
Cannulation Complications	Identify complications of ECMO cannulation	Describe steps to prevent, recognize, and treat complications	
Oxygen Delivery & Uptake	Describe the normal physiology of oxygen delivery and uptake.		
Gas Transfer in the Membrane Lung	Describe the key determinants of oxygen uptake in the membrane lung.	Describe the key determinants of carbon dioxide removal in the membrane lung.	
Hemodynamic Monitoring on VV ECMO	List the hemodynamic changes that accompany VV ECMO	Describe the changes in hemodynamic monitoring on VV ECMO	
Hemodynamic Monitoring on VA ECMO	Discuss the hemodynamic changes that accompany VA ECMO	Describe the changes in hemodynamic monitoring on VA ECMO	
Drainage Insufficiency	Define and diagnose drainage insufficiency.	Troubleshoot drainage insufficiency.	
Return Obstruction	Define return obstruction and identify its causes.	Diagnose and manage return obstruction.	

Respiratory Failure	Provide an overview of respiratory failure	List standard management strategies for respiratory failure	Discuss the rationale of VV ECMO in respiratory failure
Patient Selection for VV ECMO	List the indications and contraindications for VV ECMO support.		
Initiation of VV ECMO	Describe the steps in initiating a patient onto VV ECMO.		
VV ECMO Maintenance	Describe titration of blood flow and gas flow to achieve adequate support on VV ECMO	Describe the concept of native lung rest	
Recirculation	Define and identify recirculation.	Troubleshoot recirculation.	
Weaning VV ECMO	Describe the process of weaning VV ECMO support.	List exit strategies for the VV ECMO patient.	
Cardiac Failure	Provide an overview of cardiac failure	List standard management strategies for cardiac failure	Discuss the rationale of VA ECMO in cardiac failure
Patient Selection for VA ECMO	List the indications and contraindications for VA ECMO support.		
Initiation of VA ECMO	Describe the steps for initiating a patient		
VA Maintenance	Describe vasopressor use and blood flow titration for cardiovascular support.	Describe the concept of native heart rest.	Describe ventilator management and blood and gas flow titration for pulmonary support.
Left Ventricular Distention -- PRIORITY	Describe the mechanism of LV distention	List strategies to unload the left ventricle	
Differential Oxygenation	Define and identify differential oxygenation.	Troubleshoot differential oxygenation.	
Weaning VA ECMO -- PRIORITY	Describe the process of weaning VA ECMO support	List exit strategies for the VA ECMO patient	
Sedation	Identify the role of sedation during ECMO support.	Discuss the paradigm shift towards awake ECMO.	
Physiotherapy	Describe the rationale for physiotherapy during ECMO.	Identify appropriate candidates for physiotherapy on ECMO.	
Anticoagulation	List anticoagulation strategies on ECMO.	Discuss anticoagulation monitoring on ECMO.	
Procedures	Discuss considerations for procedures on the ECMO patient.		
Renal Replacement Therapy	Identify the benefits and limitations of administering RRT via a dialysis catheter.	Identify the benefits and limitations of administering RRT via the ECMO circuit.	
Hospital Transport	Identify considerations and logistics for intrahospital transport.	Identify considerations and logistics for interhospital transport.	

Complications Overview	List medical and mechanical complications of ECMO.		
Neurological Complications	List the etiology and risk factors for neurological complications.	Discuss the management of ischemic and hemorrhagic strokes.	
Bleeding	List the etiology of bleeding	Discuss the management of bleeding	
Thrombosis	List the etiology of thrombosis	Discuss the management of thrombosis	
Hemolysis	Understand the etiology and risk factors of hemolysis on ECMO	Discuss how to prevent and manage hemolysis	
Limb Ischemia	List the risk factors for developing limb ischemia on VA ECMO	Describe how to monitor limb perfusion	Discuss the prevention and management of limb ischemia
Cardiac Arrest During ECMO	Discuss the management of cardiac arrest on VV ECMO	Discuss the management of cardiac arrest on VA ECMO	
Pump Failure	Define pump failure.	Describe how to identify and manage pump failure.	
Membrane Lung Dysfunction	Define membrane lung dysfunction.	Describe how to diagnose and manage membrane lung dysfunction.	
Air Embolism	Define air embolism and its determinants.	Define strategies to prevent air embolism.	Describe how to detect and manage air embolism.
Circuit Disruption	Identify determinants of circuit disruption	Recognize early signs of circuit disruption	Manage circuit disruption
Accidental Decannulation	Manage an accidental decannulation		
Coming Off ECMO Emergently	List the indications for coming off ECMO emergently	List the steps required to come off and back on ECMO emergently	
Historical Studies	List the historical ECMO studies and identify their limitations.		
Recent Evidence for VV ECMO	Interpret the results and limitations of the main cohort studies on VV ECMO.	Interpret the results and limitations of the CESAR and the EOLIA trials.	
Recent Evidence for VA ECMO	Interpret the results and limitations of the main cohort studies on VA ECMO.	Describe the results of trials comparing ventricular assist devices to VA ECMO	

APPENDIX II: ELSO ESSENTIAL SIMULATIONS

- 1) Air Embolism
- 2) Pump Failure
- 3) Gas Failure
- 4) Membrane Lung Failure
- 5) Drainage Insufficiency