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EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO): ENGINEERING, INDICATIONS, CANNULATION STRATEGIES AND MANAGEMENT

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The basic operating principle behind ECMO is that a portion of the patient's blood is removed from the intravascular space, passed through a circuit which provides oxygen and removes carbon dioxide, and then returned back to the bloodstream. The main components of an ECMO circuit are the drainage and return cannulas, the centrifugal pump, the blender, the oxygenator, and the controller. The pump is constituted by a rotating configuration of blades (called an impeller) coupled magnetically to a motor. The blades spin to create a vortex which creates a pressure differential to drive blood through the circuit. The rotation is set at a constant rate, so the rate that blood travels through the pump is continuous and not pulsatile. Venous-Venous ECMO should only be considered in patients with preserved cardiac function, who have hypoxemic respiratory failure or refractory hypercapnia causing acidosis despite optimal management with a mechanical ventilator. Indications to venous-arterial ECMO are a low cardiac output state despite volume resuscitation, inotrope and vasopressor support, and aortic counterpulsation. Other indications are malignant cardiac arrhythmias refractory to antiarrhythmic therapy, severe pulmonary hypertension with hypoxemia despite pulmonary vasodilator therapy, septic shock (in selected cases) refractory to volume resuscitation, inotropes and vasopressor support. Some centers perform ECMO during Cardiopulmonary Resuscitation (called ECMO-CPR) for patients with undifferentiated cardiac arrest. There are two configurations of ECMO: peripheral and central. In peripheral ECMO the distal end of the drainage cannula is in the proximal IVC or right atrium, and the arterial cannula is in the femoral or axillary artery. In central ECMO the distal end of the drainage cannula is in the proximal IVC or right atrium while the return cannula is in the ascending aorta..

BIOGRAPHY

Marco Picichè graduated with a degree in medicine from the University of Florence in 1995 and completed his cardiac surgery residency at Tor Vergata University of Rome in 2000, both summa cum laude. He held regular teaching appointments at the university of Montpellier school of medicine, obtained certification by the French Board in cardiac surgery (Paris, 2007), earned his research master in surgical science (Paris, 2007), and received a university diploma in vascular surgery (Paris, 2007). In Canada he authored a research project on the occlusion of the internal mammary arteries as an alternative method of myocardial blood supply (2008, Laval University). In May 2009 he had the honor of opening the 44th Congress of the European Society for Surgical Research with a lecture on "The history of surgical research." In September 2011 he received a doctor of philosophy (Ph.D.) in therapeutic innovations from Paris-Sud University. He is the Editor in Chief of the book : « Dawn and evolution of cardiac procedures : research avenues in cardiac surgery and interventional cardiology » (Springer-Verlag publishing house, September 2012). He patented a new surgical instrument. Currently he is a cardiac surgeon in Italy.

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