

Letter to the Editor

We have all been on ECMO: The cues we can take from fetal circulation***Todos hemos estado en ECMO: las señales que podemos tomar de la circulación fetal***

The use of Extra Corporeal Membrane Oxygenation (ECMO) is constantly increasing as are the medical indications for which its use seems to have clinical efficacy.¹ The purpose of this paper is not to go into the technical and clinical aspects related to ECMO and its different uses, but to try to propose parallelism between this technology and the fetal circulation in utero, which can provide small cues for the future development of this treatment.

The fetus in utero possesses a portion of its bloodstock stored outside its body and, through the umbilical cord, circulates to the placenta where it receives oxygen, nutrients, immunoglobulins, hormones, and exchanges carbon dioxide and waste products with the placenta.²

The placenta acts as a pump and the interface between the fetal and maternal blood, the oxygenator is external to the machine and they are the mother's lungs so the fetal blood does not directly relate to fresh gases. The oxygen supply is one of the most important functions of the fetal circulation because the lungs of the unborn child are still immature, collapsed, full of liquid and not ventilated; it is, therefore, the oxygen exchanged by the maternal alveoli that oxygenate the fetus through the placenta. Most of this oxygenated blood is used for cerebral perfusion through Botallo's oval foramen and systemic perfusion through Botallo's duct,³ only a small part of the oxygenated blood reaches what, ironically, we can call "baby lung"⁴ through the bronchial arteries remaining unchanged in the concentrations of the gases dissolved in it. ECMO as therapy in patients with severe ARDS is faced with the same problem, a lung unable to perform its function. In VV-ECMO the blood drained from the venous side is returned to the right heart and passes through the lungs allowing to calculate precisely the shunt fractions and, more generally, the residual function of the lung parenchyma.

Through the placenta the fetus receives, as previously said, nutrients, immunoglobulins, and mother's hormones. Everything is provided by the same interface. One can imagine transferring this peculiarity to the ECMO machine. Try to think of a patient on ECMO (VV or VA) with applied, on the arterial cannula after the oxygenator, a ramp to which all the infusion pumps with inotropes, sedation, antibiotics and parenteral nutrition, are connected. So the patient may not need a central venous catheter, thus reducing the risk of catheter-related bloodstream infection (CRBSI). Besides, the placement of all infusions on the machine may allow easier

handling by nursing staff with less risk of contamination. A patient with this type of setup may only need an arterial catheter for blood pressure monitoring and a peripheral venous catheter for rapid fluid challenge or transfusions, considering that ECMO does not have a reservoir like traditional CPB.

A similar argument can be made with the elimination of metabolic products such as urea, creatinine, and uric acid that the placenta exchanges with maternal blood. Already several centers use Renal Replacement Therapy (RRT) in series on the machine and this has the undoubted advantage of not having to place a dialysis catheter with the risk of infection, malfunction, and bleeding, to name a few, which it carries with it. This configuration is subject to some problems regarding the circuit and pressures but it is widely practicable in several cases.⁵

Observing in a disenchanting way what is the origin of life, that is, the fetal period, it can be noted that, ancestrally, a condition of extracorporeal circulation had been provided for that would serve to vicariously perform the functions of certain organs at a time when they could not be functional. The characteristics that make fetal circulation so exceptional are also found, in part, in the concepts underlying ECMO. Everything passes through the blood and changes in the chemical composition that the placenta can operate on it, add oxygen, remove nitrogen, add glucose, remove carbon dioxide.

'Do not quench your inspiration and your imagination; do not become the slave of your mode'

Vincent Van Gogh

References

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