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# The Role of Extracorporeal Membrane Oxygenator In Critically Ill Patients

Essay

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# List of Abbreviations

| Abb. | Full term |
|---|---|
| *ACT* | *Activated coagulation time* |
| *ARDS* | *Acute respiratory distress syndrome* |
| *BF* | *Blood flow* |
| *Bp* | *Barometric pressure* |
| *BP* | *Blood pump* |
| *$CaO_2$* | *Circuit arterial oxygen* |
| *CESAR* | *Conventional ventilatory support versus ECMO for Severe Adult Respiratory failure* |
| *Cin* | *Circuit inlet* |
| *CO* | *Cardiac output* |
| *COPD* | *Chronic obstructive pulmonary disease* |
| *Cout* | *Circuit outlet* |
| *CPB* | *Cardiopulmonary bypass* |
| *Cvmix* | *Circuit mixed venous* |
| *$CvO_2$* | *Circuit venous oxygen* |
| *$DO_2$* | *Systemic oxygen delivery* |
| *$ECCO_2R$* | *Extracorporeal carbon dioxide removal* |
| *ECLS* | *Extracorporeal life support* |
| *ECMO* | *Extracorporeal membrane oxygenator* |
| $F_DO_2$ | Fraction of delivered oxygen |
| *$FiO_2$* | *Fraction of inspired oxygen* |
| *GF* | *Gas flow* |
| *Hb* | *Hemoglobin* |
| *HIT* | *Heparin-induced thrombocytopenia* |
| *IABP* | *Intra aortic balloon pump* |

*ICH* ..... *Intracranial hemorrhage*
*LFPPV*..... *Low-frequency positive-pressure ventilation*

# List of Abbreviations cont...

| Abb. | Full term |
|---|---|

*LV* ..... *Left ventricle*
*ML*..... *Membrane lung*

*NL*..... *Natural lung*
$PaO_2$.....*Pressure of oxygen in the blood*
*PEEP* ..... *Positive end expiratory pressure*
$PinO_2$ ..... *Oxygen pressure entering membrane lung*
*PIP*..... *Peak inspiratory pressure*
$PO_2alv$ ..... *Alveolar partial pressure of oxygen*
$PO_2insp$ ..... *Partial pressure of oxygen of inspired gases*
$Pvo_2$..... *Partial pressure of oxygen in the venous blood*
*Q*..... *Perfusion*
*Qs/Qt*..... *Ratio of shunted blood to total cardiac output*
$SatO_2$ ..... *Oxygen saturation*
$SinO_2$ ..... *Oxygen saturation entering membrane lung*
$SvmixO_2$ ..... *Mixed venous oxygen saturation*
*TPN*..... *Total parenteral nutrition*
*VA* ..... *Venoarterial*
*VADs*..... *Ventricular assist devices*
$VCO_2$..... *Carbon dioxide removal*
$VCO_2NL$ ..... *Carbon dioxide removal natural lung*
*VILI* ..... *Ventilator induced lung injury*
*VO2*..... *Oxygen delivery*
$VO_2NL$..... *Oxygen delivery natural lung*
*VV* ..... *Venovenous*

## Abstract

Once it has been determined that ECMO will be initiated, the patient is anticoagulated with intravenous heparin. Cannulae are then inserted and the patient is connected to the ECMO circuit. The blood flow is increased until respiratory and hemodynamic parameters are satisfactory. Once the initial respiratory and hemodynamic goals have been achieved, blood flow is maintained, ventilator support is minimized, and vasoactive drugs are decreased to minimal levels. Frequent reassessment and adjustments are usually necessary.

The patient's readiness for weaning from ECMO should be evaluated frequently. Prior to discontinuing ECMO permanently, one or more trials should be performed during which the patient is off ECMO. Such trials give the clinician the opportunity to determine whether conventional supportive care is sufficient for the patient.

Bleeding is the most common complication (30 to 40 percent) of ECMO. Thromboembolism and cannula complications are rare.



**Keywords:** Pressure of oxygen in the blood - Oxygen pressure entering membrane lung - Peak inspiratory pressure - Natural lung- Left ventricle

# Introduction

Extracorporeal membrane oxygenator (ECMO) is a temporary support of heart and lung function by partial cardiopulmonary bypass (up to 75% of cardiac output). It is used for patients who have reversible cardiopulmonary failure from pulmonary, cardiac or other disease. Since the first successful application of the heart-lung machine in 1953, extracorporeal technology had continued to evolve ***(Gibbon, 1978).***

The ECMO consists of a cannula to drain deoxygenated blood from the patient, as well as a pump, an artificial lung to provide oxygenation, heat exchanger, and second cannula to return oxygenated blood back to the patient ***(Gaffney et al., 2010).***

ECMO has been successfully used in the last 30 years to treat newborns with hypoxic respiratory failure and there is strong evidence that ECMO improves long-term survival of these infants up to 90% ***(Javier et al., 2013).***

Using ECMO, it is possible to support patients for days to months while injured tissues recover. The goal of ECMO for pediatric or adult patients is to provide lung rest from the high levels of oxygen and higher airway pressures that are necessary to support oxygenation and ventilation ***(Peek et al., 2009).***

ECMO can be venovenous (VV) or venoarterial (VA). During VV ECMO, blood is extracted from the vena cava or right atrium and returned to the right atrium. VV ECMO provides respiratory support, but the patient is dependent upon his or her own hemodynamics. During VA ECMO, blood is extracted from the right atrium and returned to the arterial system, bypassing the heart and lungs. VA ECMO provides both respiratory and hemodynamic support ***(Wang et al., 2008).***

# Aim of the work

The aim of this work is to discuss the principles and the indications of using ECMO in critically ill patients together with its potential complications.