CHAPTER 6

EXTRACORPOREAL MEMBRANE OXYGENATION SUPPORT IN THORACIC SURGERY

Esra YAMANSAVCI ŞİRZAİ [1]
Bedrettin YILDIZELİ [2]

Extracorporeal membrane oxygenation (ECMO) is a life support technique. For the first time in history, the atrial septal defect was closed successfully in an 18-year-old female patient, John Gibbon, by means of this technique in 1953. In 1971, Dr. J.D. Hill successfully used the extracorporeal circulation outside the operating room, in a 24-year-old male patient with acute respiratory distress syndrome (ARDS) development, for the first time. With the CESAR (Conventional ventilator support vs. Extracorporeal membrane oxygenation for Severe Adult Respiratory failure) study published in 2009, it was demonstrated that ECMO provided better results than the conventional treatment in adult respiratory failure [1]. In many centers, ECMO has been put into routine use with the technological developments over the last 10 years.

Extracorporeal life support (ECLS) describes various mechanical methods providing cardiopulmonary support to the failing heart and/or lung. ECMO does not save everyone but it has improved survival for many critically ill patients who are not responding to usual life support options. The aim of this section is to define the areas of use of ECMO, which is one of those life support systems, in thoracic surgery and to review some sensitive points of the mechanical system.

According to the latest Extracorporeal Life Support Organization (ELSO) guidelines for adult respiratory failure - August 2017, the ECMO indication is evaluated if the expected mortality risk is more than 50% despite the optimal treatment in hypoxic respiratory failure resulting from any primary or secondary cause. If there is a risk of mortality higher than %80, implementation of ECMO is recommended. ELSO guidelines currently use a combination of PaO2/FiO2 ratio and Murray score to determine the mortality risk. It is recommended to update the patient's evaluation every 6 hours. There are very few absolute contraindications for ECMO, as this is a life support therapy. The presence of an irreversible cause of respiratory failure, brain death, active hemorrhage, or life expectancy of less than 6 months are accepted contraindications for the ECMO therapy [2].

The use of ECLS techniques is increasing in the setting of general thoracic surgery, lung transplantation (LTx) and cardiorespiratory failure. Depending on the technique used, ECLS can provide a short to midterm extracorporeal mechanical support, help in carbon dioxide (CO2) clearance, aid in oxygen (O2) enrichment and provide cardiocirculatory support. The objective of the ECLS techniques is to supply the failing respiratory and/or cardiocirculatory systems to facilitate recovery (bridge to recovery), transplantation (bridge to transplantation) or change to another ECLS device or configuration (bridge to bridge).

[1] MD, Marmara University, Istanbul Pendik, Education And Research Hospital Clinic Of Thoracic Surgery
[2] Prof. Marmara University, School Of Medicine, Department Of Surgical Medical Sciences, Department Of Thoracic Surgery

piratory failure) study published during the influenza A H1N1 pandemic in 2009, patients were randomized to "consideration for ECMO" versus conventional ventilation, many of which were treated. The results were promising; 63% of the patients treated in the ECMO arm and 43% of the patients in the conventional ventilation arm lived without serious disability in their 6-month follow-up. These results have been improved on in some larger studies in patients suffering from ARDS as a result of influenza A H1N1 infection, with mortality rates as low as 14% [1]. With the recent COVID-19 pandemic, ARDS has been among the treatment methods sought [34].

ECLS and ECMO are increasingly used with more indications in the thoracic surgery with the developments in biomedical engineering. Their effectiveness has been confirmed by the leading transplantation centers in the field of transplantation, so they are used frequently. Their use in thoracic surgeries is reported more often in the literature in terms of feasibility and effectiveness. According to the Extracorporeal Life Support Organization guidelines, the ECLS is highly recommended to be available in tertiary medical / surgical neonatal / pediatric / adult intensive care units. However, there are no clinical scores, reliable biophysical or biological markers about the timing of patient selection, the technique to be used or its duration. The experience of multidisciplinary ARDS/Transplant centers continues to be the best reassurance in critical patients. In addition to all these difficulties, the institutional support of the health systems, equipment and multidisciplinary cooperation of trained specialists are required. ECMO training has become a topic definitely to be included in the education program of thoracic surgery for our country.

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