Evidence justifying indications of ECMO in intensive care?

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Frontiers in Intensive care

ECMO in ARDS & RESPIRATORY FAILURE

CAESER trial[1] -

The first clinical trial that evaluated role of ECMO in adults with ARDS came in 2009 "CESAR" trial. It was a multicentre RCT which evaluated ECMO against standard ventilation for ARDS in UK. It involved 99 tertiary ICUs and 11 referral ICU. If the patient satisfied the inclusion criteria they were referred to Glenfield Hospital, Leicester. The referred patients were given a trial of 12 hours with conventional ventilation (Though they used steroids in this group in addition). If the patients did not improve and still qualified for the inclusion (i.e Murray score≥ 3, pH <7.2), they were put on ECMO. There were 90 patients each in the ECMO (Managed in Glenfield Hospital, Leicester) and conventional management group i.e PCV, low pressure, low volume ventilation (ARDS net only in 84% in ECMO group vs 64% in conventional group of patients) or HFOV (managed in respective hospitals). Out of 90, 22 patients did not receive ECMO (17 managed conventionally and 5 either died before or during transport). ECMO was not used in transport of these patients.

The study results were impressive. Fifty-seven patients out of 90 on ECMO survived after 6 moths with no disability compared to 41 out of 87 patients in conventional group (NNT=5). This study had multiple flaws which included the application of ECMO confined to a single center, 24% of the patients designated to receive ECMO eventually did not receive it, lack of any stringent study protocol (93% vs 70% patients were managed with ARDSnet protocol in ECMO and non-ECMO group respectively).

Even if with so many faults this study opened a gateway for the future research.

Australian & NZ pandemic of H1N1 (2009)[2]

An observational study reported no definite evidence of use of ECMO in H1N1 pandemic though reported a relatively low mortality (21%) with ECMO compared to other published study on ECMO. The recruitment in to the ECMO arm was based on severity of the disease and understandably, the mortality was higher than the conventional management group as they had less severely ill patients. This study did not give any significant account of the use of ECMO and its benefit though suggested that it can be used as a rescue therapy.

UK Pandemic (2009)[3]

This was a cohort study including ECMO-referred patients with H1N1 related ARDS in United Kingdom who were refereed to one of the 4 ECMO enabled centers. Then the investigators pooled data from 1756 patients to identify 59 matched pairs of ECMO-referred and ECMO-non-referred patients using individual matching, 75 pairs were identified using propensity score matching and another 75 pairs were identified using GenMatch matching. There was a significant improvement of mortality demonstrated in all forms of matching in favor of ECMO treatment. The authors concluded that ECMO-referral was associated with lower hospital mortality as compared to non-ECMO-referred patients.

ECMO AS BRIDGE TO LUNG TRANSPLANT IN ACUTE RESPIRATORY FAILURE IN ILD[4]

Single center retrospective study showed that out of 40 referred patients for acute respiratory failure 22 were treated with ECMO. Out of 22, 13 were evaluated for lung transplant and 8 found suitable for it. 6 of them underwent lung transplant and five of them survived hospital discharge. Two died while waiting for it. Out of 15, 14 died who did not undergo lung transplant (93.3%). The authors concluded that in group of patients with acute respiratory failure who are candidate for lung transplant, ECMO can be lifesaving as a bridge for transplant but is unhelpful in patients who are not suitable for transplant.

MASSIVE PULMONARY EMBOLISM & ECMO[5,6]

A recent review found no robust evidence while searching for indication of ECMO for massive pulmonary embolism. They included 78 cases from 11 case reports and 8 case series over a period of two decades demonstrated an overall survival of 70.1%. The treatment modalities used are either ECMO alone or combination of ECMO and thrombolysis, embolectomy (catheter or surgical). Forty-three patients (55.1%) were managed with ECMO along with the process of E-CPR (ECMO started as a continuation of CPR) with an overall survival of 51.2% (22 patients). Sixteen patients who were treated with ECMO alone had a 100% survival alone without any additional therapy.[5]

The European Society of Cardiology documented the role of ECMO in acute PE for hemodynamic support and an adjuvant therapy to surgical embolectomy.[6]

Few cases of pregnancy complicated with massive PE have been treated with ECMO. Bataillard etal reported two cases of massive PE in pregnancy managed with ECMO and heparin therapy.[7] A similar case of PE in peripartum period managed with ECMO post cesarean section was described by Yao-Kai Ho et al. [8]

CPR & ECMO (ECPR)

A recent review identified 21 studies (20 studies and one guideline) including 833 patients with OHCA with an overall survival rate of 22% with 13% reported to have good neurological recovery (CPC 1-2 or GOS 4-5). A total of 88 potential deceased donors were identified from 8 studies out of which 17 patients became actual donors.[1]
The Extracorporeal Life Support Organization Registry (ESLO) published their data from 1988 to 2016. They reported outcome data of 2885 patients undergoing ECPR with an overall survival of 1137 patients (39%) and survival to hospital discharge of 848 patients (29%).[2]
A prospective observational trial in 2008 compared CPR with ECMO to conventional CPR. They enrolled in hospital cardiac arrest patients of cardiac origin who received CPR for more than 10 minutes. 113 patients received conventional CPR vs 59 received CPR with ECMO. There was a significantly higher survival rate at 30 days (34.8% Vs 17.4%) and one year (19.6% Vs 13%) survival in the ECMO group even when propensity matching was done.[3]
A similar observational but retrospective study in 120 cases of in hospital cardiac arrest demonstrated a significantly improved survival to discharge with minimal neurological impairment in patients who received ECMO as a part of CPR (odds ratio, 0.17; 95% confidence interval, 0.04– 0.68; *p* .012).[4]

CHEER trial[5]

A single center prospective pilot observational study evaluated a protocolized management approach combining hypothermia, ECMO and early reperfusion in patients with refractory cardiac arrest (CPR of more than 30 mins without ROSC). The study included 26 patients with cardiac arrest (11 OHCA+15 IHCA, with 73% had VF as initial rhythm). The protocol included mechanical chest compression including AutopulseTM, rapid iv administration of 30ml/kg of ice-cold saline (Target temp 33c) and then slow rewarming 0.24c/hr), percutaneous VA-ECMO cannulation by two ICU consultants and early coronary reperfusion with PCI. This study used a CPC grade (Cerebral Performance Category Scale). Survival with good neurological recovery (CPC 1-2) and survival to hospital discharge were achieved in 14 out of 26 patients (54%). ROSC was achieved in 25/26 patients. Two patients died of major bleeding and two patients had cerebral hemorrhage. Sixteen patients (69%) required blood transfusion. Nine patients required surgical repair of femoral artery and one patient had ischemic limb requiring fasciotomy. The median time from collapse to institution of ECMO was 40 minutes in the 14 patients (3/9 OHCA and 9/15 of IHCA who received ECMO). Two patients out of 14 did not require ECMO due to ROSC achieved early without ECMO.

Temporary ECMO support in post cardiac Sx

A five-year prospective observational study looking in to patients who were put on ECMO post operatively after cardiac surgery involving CABG, CABG±AVR, CABG±MVR and some other cardiac Sx). 219 patients were followed up for 5 years who required ECMO in post-operative period (1.2% of all patients undergoing cardiac Sx). Though 60% of the patients weaned successfully from ECMO but only 24% survived to hospital discharge. Main cause of death was heart failure. After 5 years, 37 out of 52 patients who were discharged from hospital were alive with reasonable functional capacity.[1]

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ECMO in ARDS, Respiratory failure & bridge to Lung transplant, Massive PE

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