

Extra corporeal membrane oxygenation support: ethical dilemmas

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Abstract: The vast expansion of patients treated with of extra corporeal membrane oxygenation (ECMO) emerge novel ethical questions about the use of this new technology. In regard the indications, duration of support and timing of withdrawal of support, these questions sometimes create disagreement among surrogates, between health care team and surrogates, and even disagreement among health care team, these disagreements occurs because of the extreme emergency of support initiation, the ambiguity of the outcome as well as lack of clarity on the intended treatment direction, whether it is ineffective, bridge to recovery or bridge to lifetime mechanical support or transplant. In this article we discuss these questions through patients' scenarios.

Keywords: Extra corporeal membrane oxygenation (ECMO); ethics; extracorporeal support; mechanical circulatory support (MCS); multidisciplinary

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Introduction

Extra corporeal membrane oxygenation (ECMO) has remarkably progressed over the recent years; it became invaluable tool in the care patients with severe cardiac and pulmonary dysfunction refractory to conventional management (1-3). ECMO can provide partial or total support by controlling gas exchange and perfusion, stabilizing the patient physiologically, decreases the risk of ongoing iatrogenic injury, and allows ample time for evaluation, diagnosis, treatment, and recovery from the primary injury or disease (4). The indications are extended to more prolonged use in intensive care unit, such as bridge to mechanical circulatory support (MCS), bridge to transplant, for both cardiac and lung transplant and support for lung resections in unstable patients (2,3,5-8). With ECMO support, the definition of human viability has changed and the complete arrest of the heart or the lung no longer means death. ECMO support creates an artificial circulation to transport oxygen and blood to the whole body, maintain biological function, and the biological process of dying is interrupted. On daily bases, the ECMO

team should try to answer questions about patient's condition: is it life, death or in-between? Is ECMO a bridge to recovery, a guarantee of a status quo, or just prohibiting dying (9)?

According to the Extracorporeal Life Support Organization (ESLO) registry, MCS was used in over 7,900 cases in 2015 (10). This immense increase of patients treated with ECMO and the vast expansion to its indications rise novel ethical questions about the use of this new technology, the uncertainty of the outcome as well as lack of clarity on the intended treatment direction, whether bridge to recovery or bridge to lifetime mechanical support as ventricular assist devices or total artificial heart or it is bridge to transplant. These questions include what patients should be treated with ECMO? What is the duration of support? When the ECMO support should be stopped (11)? Is the goal quantity of life or quality of life? Is the continuation of ECMO reconcilable with the dignity of the patient? According to Courtwright *et al.* (12) in their review of ethics comity consultations on ECMO patients, found that the most common ethical issue involved disagreement about the ongoing use of ECMO,

which included multiple axes: disagreement among health care providers, disagreement among surrogates, and disagreements between health care providers and surrogates over stopping or continuing ECMO. Other questions could be asked: appropriate resource allocation given the expense and personnel required; whether decisions of ECMO support could be made without patient family explicit input due the emergent condition and the limited time available before initiation the support; whether the patients or surrogates should sign documents stating that the circuit will be withdrawn if the ECMO-specific goals are not met; whether it is appropriate to continue ECMO in brain dead potential organ donors; and whether hospitals without ECMO capability have an obligation to transfer patients to regional ECMO centers (12-14). These questions and situations are hard to be categorized in guidelines. In this article we discuss these questions through patients' scenarios.

Ethical dilemma of emergency insertion case 1

A 46-year-old male found unresponsive by his 14 years old daughter. She called 911 and started cardiopulmonary resuscitation (CPR) for 10 minutes before the arrival of emergency medical services (EMS), the patient was intubated, CPR was continued, multiple cardioversions were needed to be converted from ventricular fibrillation to sinus rhythm. Upon arrival to the hospital he underwent an emergent cardiac catheterization, a stent was placed in the mid circumflex coronary artery, and he was placed on therapeutic hypothermia protocol. Some hours later the patient developed a ventricular fibrillation; while the critical care team was inserting a central line. CPR was started and the ECMO team was called for ECMO support. Upon arrival, the ICU team was performing CPR, no information about the brain condition, a big concern about the quality of CPR by 14 years old daughter, no studies were performed to assess his brain function while he is on hypothermia protocol. The indication of ECMO support was questionable but who can hold this life-saving technology on such patient without ethical pain. All these concerns were quickly explained to the patient's wife while the team was preparing to perform ECMO insertion, the patient's wife was overwhelmed, she needs to make rapid decision, on something she doesn't know, and was not explained correctly, however she consented for the ECMO, acknowledging that this was the only opportunity 'to save his life at this time' and she concluded that any

potential complications are worth the risk. A peripheral VA ECMO "using femoral vein and artery" was initiated at 23 minutes of the start of second CPR. After the reversal of hypothermia, the patient didn't show any neurologic progress and the EEG and CT scan showed a severe irreversible brain injury. The ECMO support was stopped with family agreement 6 days after the ECMO support initiation.

Ethical dilemma and the duration of support case 2

A 19-year-old male was admitted with acute decompensated heart failure with ejection fraction (EF) of 10–15% due to viral myocarditis. During admission he experienced a cardiac arrest before he underwent an emergent insertion of central venoarterial (VA) ECMO (right atrium and ascending aorta) as a bridge to left ventricular assist device (LVAD) and ultimately to transplant if the heart doesn't recover. In the following days a brain CT scan and EEG demonstrated a severe, irreversible anoxic encephalopathy. On the other hand a new ECHO demonstrated a little improvement in cardiac function with EF in 30% range. At this point it was evident that the major problem is the brain injury and the outcome ECMO support is hopeless. The ECMO multidisciplinary team including (the ECMO team, ICU team, neurology, social workers and palliative care team) suggested to separate the patient of ECMO, and withdrawal of care but the family was questioning "how we can give up so quickly while his heart getting better? so his brain could still get better!", this discussion primarily led to family misinterpretation that counseling for ECMO separation could be related to the patient health coverage status as the patient is a non-documented US resident without any social or financial health support. Multiple family meetings were performed and the family wanted everything to be done awaiting for miracle to happen. The ECMO support was continued while the discussion continued, a repeated neurological test and evaluations didn't show any neurological progress however a new ECHO demonstrated an adequate recovery to the heart with EF up to 45%, and the patient was separated from ECMO on POD 14. The family finally agreed to withdraw of care one week after ECMO separation.

Ethical dilemma and ending of support case 3

A 76-year-old patient who underwent emergent coronary

artery bypass grafts (CABGS) for critical left main coronary stenosis, with left ventricle EF of 15–20%, the patient has an intra-aortic balloon pump (IABP) inserted in the left groin. He underwent a complicated revascularization CABGs surgery, complicated by vascular injury and severe bleeding led to coagulopathy, he needed multiple blood product transfusions, the patient failed to be separated from the bypass machine, a decision was made to keep the patient on post cardiectomy ECMO (central ECMO) to give his heart enough time to recover from the ischemic event and the stress of surgery.

Three days later an ECHO demonstrated better cardiac function with EF of 25–30%. Unfortunately, he developed a left leg ischemia at the same side of IABP. The IABP was removed and placed in the contra lateral femoral artery, along with thrombectomy removal and four compartments fasciotomy. The ECMO support was continued but the ischemia on the left leg progressed and the patient needed an above knee amputation, the kidney also acutely suffered from injury due to the prolonged bypass and the compartment syndrome. On post-operative day number 6 the patient underwent full evaluation including brain CT scan and full neurologic evaluation which didn't show any sustain brain injury. A new ECHO showed progress recovery with EF 30–35%, but unfortunately the condition of his leg and the kidney's function continued to deteriorate. A series of meetings with the patient's family regarding separation of ECMO and withdrawal of care or continuation of support along with leg amputation, the family stated that the patient was an active person and having amputation is not an acceptable quality of life for him or "the way he would like to live". The family agreed to withdraw of care, and the patient was separated of ECMO on post-operative day number 8.

Discussion

The patients placed on ECMO support or who needs an ECMO support are acutely ill and unable to participate in decision-making, this compromises the right for an individual patient to determine his own care. The optimism of reversal of a catastrophic acute medical condition often leans the patient's family toward more aggressive therapies hoping for recovery. In extreme situations in which the patient is in cardiogenic shock or while performing CPR, the families and clinical teams must act rapidly and make quick complex decisions to intervene and perform a procedure in which the outcome

is unclear, and only the patient's progression in the next few days will determine whether the indication for ECMO was adequate or the primary condition is untreatable. Although in recent years, some helpful and score systems have been presented to assess the probability of survival with extracorporeal life support, using multivariate analysis of comorbidity, the history of lung or cardiac failure, and additional organ dysfunction, unfortunately there is no definitive measure of heart or lung failure to identify 80% mortality risk (4).

Emergent cases (first scenario) do not allow for clear, long and thoughtful conversations between the clinical team and the patient's family, this incomplete dialogue could compromise the process of informed consent and undermine respect for the patient's values. Surrogate decision makers may be pressured into making time-sensitive choices, having little time to review consent documentation and fully absorb and understand the clinical risks and benefits of such emergent therapies (15). Furthermore, hurried clinicians may oversimplify these complex interventions, or presenting it as "the only option for the patient to live or he will die" without offering enough details about potential complications, the goals of support or when the treatment is futile. Although a prospectively executed well prepared conversation is not always feasible during such emergencies, clinicians must try to provide the key components of appropriate informed consent, including essential information regarding the device's risks, benefits, the limitation of this technology, and possible unfavorable outcomes, ensuring that the family understand the information provided.

During the ECMO support the ECMO team should try to improve trust and gain the family confidence, this might help in resolving and managing conflicts between the families and care team. It is important to maximize patient's comfort, avoid prolongation of patient's suffering, and provide ongoing supportive care to the patient and their family. The family should be informed with a defined time and goals of support, along with transparent updates about the patient condition whether the expectations of recovery for the patient are met or he is deteriorating, and long term outcome, and patient wellbeing after ECMO separation, this should be done in timely fashion. This trust and alliance with the family is often achieved with multiple multi-disciplinary family meetings involving primary physicians, social workers, spiritual advisors, psychologists, palliative care specialists and the immediate care providers and hospital ethics committees.

Whenever, an ongoing ECMO support is futile or no longer meets its intended goals (first and second scenario), or the outcome is not optimal or the quality of life is not acceptable according to the patient or family wishes (third scenario). A discussion of limiting treatment to either no escalation of withdrawal of life support should be considered (16). It is important not to force the family into making decisions that are against their beliefs and to provide them with adequate psychological support through and after the process, it is also important to understand their emotional needs, and understand the problem from their prospective (16,17). It might be helpful to explain that withdrawal of care is not abandoning the patient, but the best treatment option at this time; we can offer according to his wishes. The ECMO team personnel involved in making these decisions, and the ICU team personnel as well, would benefit as well from team meetings with debriefings and psychological support.

The process of ECMO separation should be thoughtfully coordinated and facilitated by a multidisciplinary team around patient comfort and family support (16). This support should include along with the ECMO team, the ICU team, a comfort care plan, psychiatric, spiritual and social support to the family. The timing of ECMO separation should be chosen by the family members, this will give some time for bereavement, assuring them that their emotions are valid and reasonable, and allow time for extended family to gather or other signature family events to be completed prior to separation of ECMO.

Summary

ECMO is typically initiated in a time sensitive manner, this presents several ethical dilemmas; leaving little time for a prolonged conversation with the patient's family about the ECMO support goals, the duration of support. Early clarification about the expectations, the exit strategy plans, and the acceptable functional outcomes following ECMO separation is required. The health care team must respect and sustain autonomy while being prepared to recognize futility of support. A multidisciplinary team-based approach is required, involving the ethics team in routine care of ECMO patient should be considered. While the patient is on ECMO support, the family should be informed with a clear transparent updates, whether the expectations of ECMO support for the patient are met or not. If an ongoing ECMO support is futile or no longer meets its intended goals, the process of ECMO separation

should be thoughtfully coordinated by a multidisciplinary team.

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Footnote

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