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Commentary and concepts

Ethics in the use of extracorporeal cardiopulmonary resuscitation in adults☆

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ABSTRACT

Extracorporeal cardiopulmonary resuscitation (ECPR) promises to be an important advance in the treatment of cardiac arrest. However, ECPR involves ethical challenges that should be addressed as it diffuses into practice. Benefits and risks are uncertain, so the evidence base needs to be further developed, at least through outcomes registries and potentially with randomized trials. To inform decision making, patients' preferences regarding ECPR should be obtained, both from the general population and from inpatients at risk for cardiac arrest. Fair and transparent appropriate use criteria should be developed and could be informed by economic analyses.

Despite remarkable advances in cardiopulmonary resuscitation (CPR) and post-resuscitative care, overall survival from cardiac arrest remains poor.[1,2] Using veno-arterial extracorporeal membrane oxygenation (ECMO) for cardiac arrest refractory to conventional CPR (known as ECPR) promises to enhance outcomes. By supporting systemic circulation, ECPR can provide time for recovery from underlying insults causing arrest (e.g., electrolyte abnormalities or hypothermia) or interventions to correct those causes (e.g., cardiac revascularization). When there is particularly devastating heart damage, ECPR can be a bridge to treatment with cardiac transplantation or a left ventricular assist device.

Despite these potential benefits, ECPR is not standard of care throughout most of the world. However, ECMO use in general is increasing rapidly,[3] and given the promising results being reported for ECPR,[4–8] it is probable that use of ECPR will increase. In fact, recent international CPR guidelines recommend consideration of ECPR in certain situations.[9,10] Clinicians and hospitals may believe that there is little downside to adopting ECPR, reasoning that patients who have failed conventional CPR have very little to lose. However, ECPR involves ethical challenges that should be addressed as the technology diffuses into practice. These challenges include its uncertain risk–benefit profile, the inability to obtain express informed consent in most cases, high costs, and ensuring fair access. While these challenges are arguably present to varying degrees with other resuscitation techniques and technologies, they deserve close attention in regard to ECPR. In this article, we describe these challenges and offer recommendations on how to begin addressing them.

1. Ethical challenges

1.1. Benefits and risks

Current information on the clinical benefits and harms of ECPR comes from observational studies; data from randomized controlled trials are not available. If there were no potential clinical downsides to providing ECPR, moderate quality evidence suggesting benefit might be sufficient to justify providing it to patients who otherwise face a grave prognosis. However, ECPR is associated with potential harms. For example, in one study ECPR was associated with higher survival with good neurologic outcome at six months compared to conventional CPR, but was also associated with higher rates of coma or vegetative state.[5] Thus, ECPR may increase the chances that patients experience outcomes that could be considered by some to be "worse than death."[11] ECPR can also lead to the so-called "bridge to nowhere"—a situation where the patient is awake on ECMO but not a candidate for transplant and not likely to recover, essentially trapped in the intensive care unit because

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of their dependence on ongoing life support.[12] Additionally, averting death temporarily with ECPR may foreclose the possibility of a "good death."[13] Families rarely need to be consulted when declaring death following unsuccessful conventional CPR; however, they will necessarily be more involved when death involves "turning off" ECMO. While some may view even a short period of additional survival as valuable (e.g., to provide an opportunity to "say goodbye"), families of patients who die in intensive care units often suffer anxiety, depression, and post-traumatic stress.[14]

1.2. Acceptability and difficulty in obtaining explicit consent

As with many other potentially life-saving therapies delivered to patients in emergent settings, it is often not possible to obtain informed consent prior to initiating ECPR, although proxy consent sometimes may be obtained. Accordingly, treatment typically proceeds by presuming consent, the notion that patients would have agreed to the treatment if they had been given the opportunity.[15] While it is generally accepted that consent can be presumed for conventional CPR,[16] it is uncertain whether this presumption should extend to ECPR because potential patients who would hypothetically consent to CPR may find the risks of ECPR unacceptable. Nevertheless, a lower rate of acceptability would not necessarily preclude being able to ethically provide ECPR without explicit consent, because the alternative of not providing ECPR to anyone would prevent those who would have consented from potentially benefitting.

While presuming consent for resuscitation is reasonable, especially for patients who suffer cardiac arrest outside of the hospital or in the emergency department prior to any discussion of their preferences, the justification for presuming consent is less compelling for hospitalized patients who suffer cardiac arrest. Ethics guidelines have long recommended that resuscitation preferences be discussed with patients who are at heightened risk of cardiac or respiratory failure.[16] Therefore, discussing the possible use of ECPR with patients ahead of time (i.e., as part of a routine "code" discussion following hospital admission) would significantly mitigate the ethical concern raised by lack of explicit consent if ECPR is needed.

1.3. Appropriate use criteria

In current practice, the decision to provide ECPR is made on a "case-by-case" basis, either by initial responders and those in the emergency department for patients with out-of-hospital cardiac arrest or by hospital care teams for patients with in-hospital cardiac arrest, which could lead to the potential for discrimination. However, it may be difficult to devise fair criteria for provision of ECPR. Prospective studies to date have used inclusion criteria aimed at targeting those who are most likely to benefit, some specifically citing avoidance of initiating futile aggressive care.[4] In some studies, for example, ECPR has not been offered to individuals who arrived at the hospital more than 45 min after their cardiac arrest,[5] or who are more than 70 years old.[17] However, survival has been reported in patients where ECPR was started after more than 150 min of conventional CPR,[17] so in practice a strict futility argument based solely on time since arrest is unlikely to be valid. Further, at least in the US, age is generally not used as a basis for not offering potentially beneficial therapies, so age cutoffs may be controversial in this setting.

In addition, not all emergency departments are currently capable of providing ECPR due to lack of equipment and relevant expertise. Arguably, ECPR will be more likely to be beneficial in settings where there is sufficient expertise and the ability to provide appropriate follow-up care.

1.4. Cost

Cost-effectiveness analyses have not been conducted on ECPR. However, there are substantial costs associated with making ECPR available due to the cost of equipment and training. There are also substantial downstream costs incurred in caring for survivors of cardiac arrest. When survivors are neurologically compromised, care can cost hundreds of thousands of dollars per patient.[18] Thus, the use of ECPR raises concern about the appropriate use of scarce health resources.

2. Towards addressing the ethical challenges

Given the ethical challenges in the provision of ECPR, there are important steps that policy makers, hospital administrators, professional groups, researchers, and clinicians can take to ensure that this potentially life-saving technology is provided responsibly.

As an emerging technology with unproven benefit and the potential for serious harm, stakeholders should commit to continuing to develop the evidence base for ECPR. In addition to focusing on short-term mortality, evidence is needed regarding long-term survival, short- and long-term disability, as well as the experiences of patients and their families. Much of this information could be collected in registries. The Extracorporeal Life Support Organization (ELSO) has more than 170 participating international institutions and maintains a registry of extracorporeal life support cases, including ECPR cases.[3] Currently, the ELSO registry focuses on short-term survival and complications, but it could be expanded or linked with other registries designed to collect additional important outcomes. For now, institutions that provide ECPR should at least commit to providing data to the ELSO registry. Further, efforts should be directed at formally studying ECPR in randomized trials under an exception from the requirement to obtain informed consent.[19]

Data on acceptability of providing ECPR by default should be gathered. Preferences can be elicited by conducting representative surveys targeted at a wide range of stakeholders. Additionally, institutions that provide ECPR to patients who suffer in-hospital cardiac arrest should update their policies regarding how code status is elicited and documented following admission to the hospital, so that preferences about ECPR are obtained directly from patients who may be treated with it.

Fair and transparent indications and contraindications for ECPR need to be developed. As with most medical therapies, the degree of benefit is unlikely to be uniform for all patients. If patients can be clearly identified who are unlikely to benefit (or likely to be harmed), then it would be unjustifiable to use ECPR on those patients. Furthermore, appropriate use criteria may help prevent disadvantaged patient groups from being discriminated against.

In addition to building the evidence base of clinical risks and benefits, economic analyses should also be conducted on ECPR. Cost-effectiveness analyses could be used to help inform policies on ECPR.

ECPR promises to be an important advance in the treatment of cardiac arrest. At present, it seems ethically appropriate to use ECPR when there is a tangible likelihood of clinical benefit, clinicians have adequate training and expertise, and institutions will provide subsequent care. Nevertheless, attention to the associated ethical issues is paramount as further evidence is gathered and policies regarding its appropriate use are formulated.

Conflict of interest statement

Dr. Riggs has no potential conflicts of interest to declare. Dr. Sugarman serves as the Ethics Officer for the NIH Resuscitation Outcomes Consortium. Dr. Becker serves on the Data Safety Monitoring

Committee and Protocol Review Committee of the NIH Resuscitation Outcomes Consortium.

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