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| Question |
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| **Population:** | Adult (≥ 18 years) patients with cardiac arrest in any setting (out-of-hospital or in-hospital) |
| **Intervention:** | Extracorporeal cardiopulmonary resuscitation (ECPR) including extracorporeal membrane oxygenation or cardiopulmonary bypass during cardiac arrest |
| **Comparison:** | Manual or mechanical cardiopulmonary resuscitation (CPR) |
| **outcomes:** | Any clinical outcome |
| **Setting:** | Any setting |

# Assessment

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| ProblemIs the problem a priority? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes● Yes○ Varies○ Don't know | Survival for refractory cardiac arrest is low.  |  |
| Desirable EffectsHow substantial are the desirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial○ Small○ Moderate● Large○ Varies○ Don't know | Based on the evidence (primarily RCTs), there is a potential for large benefit in highly selected patients.  | The Task Force discussed the potential that ECPR could provide societal benefit by allowing initial survivors who subsequently meet criteria for brain death or withdrawal of life-sustaining treatment to be considered potential organ donors. |
| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Large○ Moderate○ Small○ Trivial● Varies○ Don't know |  | The risk of harm with the provision of ECPR likely depends on the scenario in which the intervention is applied. The risk of harm would be minimal or negligible if ECPR is provided in a patient who has already received prolonged advanced life support management and where no other treatment options are available. Conversely, if ECPR is provided early in the course of the cardiac arrest, then the risk of harm would include the possibility that ROSC and survival could have occurred without requiring ECPR since ECPR is known to have complications including but not limited to hemorrhage and death. Moreover, transportation to facilitate ECPR might reduce CPR quality. From a resource-allocation standpoint, the risks in applying ECPR to a non-selected population may be the provision of life support to patients who will inevitably not survive (e.g., elderly patient with comorbidities).The Task Force discussed the potential that ECPR could disadvantage individuals if ECPR increases probability of survival without good neurological recovery. |
| Certainty of evidenceWhat is the overall certainty of the evidence of effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low● Low○ Moderate○ High○ No included studies | Low for out-of-hospital cardiac arrest. Very low for in-hospital cardiac arrest.  |  |
| ValuesIs there important uncertainty about or variability in how much people value the main outcomes? |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability○ Possibly important uncertainty or variability● Probably no important uncertainty or variability○ No important uncertainty or variability |  | The importance of neurologically intact survival is generally agreed upon with recognition that survival without neurological recovery is an undesirable outcome for most patients. |
| Balance of effectsDoes the balance between desirable and undesirable effects favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison● Probably favors the intervention○ Favors the intervention○ Varies○ Don't know | See systematic review and CoSTR.  | Results of trials differ, and the task force discussed that this is likely due to both differences in trial design (including selection criteria and timing of randomization) and differences in delivery of the intervention.  |
| Resources requiredHow large are the resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ● Large costs○ Moderate costs○ Negligible costs and savings○ Moderate savings○ Large savings○ Varies○ Don't know |  | The provision of ECPR followed by the management of patients with ongoing veno-arterial ECMO is resource intensive. This intervention is currently unavailable for most OHCA settings and only available in select emergency departments and in-hospital settings. |
| Certainty of evidence of required resourcesWhat is the certainty of the evidence of resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low○ Low○ Moderate○ High● No included studies |  |  |
| Cost effectivenessDoes the cost-effectiveness of the intervention favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison○ Probably favors the intervention○ Favors the intervention○ Varies● No included studies | There has been no comprehensive cost-effectiveness analysis based on effectiveness data from RCTs. |  |
| EquityWhat would be the impact on health equity? |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced● Probably reduced○ Probably no impact○ Probably increased○ Increased○ Varies○ Don't know |  | No relevant studies have been identified; however logic would dictate that resource poor areas may not have local centers capable of providing this intervention. |
| AcceptabilityIs the intervention acceptable to key stakeholders? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes○ Yes○ Varies● Don't know |  | This is not formally known, but the acceptability of this intervention to key stakeholders would likely depend on their available resources. |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes○ Yes● Varies○ Don't know |  | Some are already poised to provide ECPR, but most centers and hospitals would require substantial additional resources and training to be capable of performing it. |

# Summary of judgements

|  | **Judgement** |
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| **Problem** | No | Probably no | Probably yes | **Yes** |  | Varies | Don't know |
| **Desirable Effects** | Trivial | Small | Moderate | **Large** |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | Small | Trivial |  | **Varies** | Don't know |
| **Certainty of evidence** | Very low | **Low** | Moderate | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | **Probably no important uncertainty or variability** | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | Don't know |
| **Resources required** | **Large costs** | Moderate costs | Negligible costs and savings | Moderate savings | Large savings | Varies | Don't know |
| **Certainty of evidence of required resources** | Very low | Low | Moderate | High |  |  | **No included studies** |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | Probably favors the intervention | Favors the intervention | Varies | **No included studies** |
| **Equity** | Reduced | **Probably reduced** | Probably no impact | Probably increased | Increased | Varies | Don't know |
| **Acceptability** | No | Probably no | Probably yes | Yes |  | Varies | **Don't know** |
| **Feasibility** | No | Probably no | Probably yes | Yes |  | **Varies** | Don't know |

# Conclusions

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| Recommendation |
| We suggest extracorporeal cardiopulmonary resuscitation (ECPR) may be considered as a rescue therapy for selected adults with out-of-hospital cardiac arrest when conventional cardiopulmonary resuscitation is failing to restore spontaneous circulation, in settings where this can be implemented (weak recommendation, low certainty of evidence).We suggest extracorporeal cardiopulmonary resuscitation (ECPR) may be considered as a rescue therapy for selected adults with in-hospital cardiac arrest when conventional cardiopulmonary resuscitation is failing to restore spontaneous circulation, in settings where this can be implemented (weak recommendation, very low certainty of evidence). |
| Justification |
| In making these recommendations, the task force acknowledges that results of the few available trials are inconsistent. However, in balance the evidence suggests that for some patients with refractory arrest, ECPR may be beneficial. More work is needed to determine the optimal patient selection, timing, and method for providing ECPR.  |

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| Subgroup considerations |
| There is no direct evidence for in-hospital cardiac arrest. The trials that have suggested benefit from ECPR have focused on those with an initial shockable rhythm.  |
| Implementation considerations |
| ECPR is resource-intensive and the ability to implement it will vary significantly across different healthcare systems.  |

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| Monitoring and evaluation |
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| Research priorities |
| * There are few, and no large, randomized trials of ECPR vs standard care
* The optimal patient population who may benefit from ECPR
* The optimal time to initiate ECPR in cases of refractory cardiac arrest
* Whether ECPR for out-of-hospital cardiac arrest should be initiated in the pre-hospital or in-hospital setting
* The optimal techniques for providing safe and timely ECPR
* The optimal post-cardiac arrest care strategy for patients resuscitated using ECPR
* Whether there are population-specific differences in performing ECPR for in-hospital cardiac arrest and out-of-hospital cardiac arrest
* Whether there are differences in quality of life between survivors of ECPR and standard CPR
* The cost-effectiveness of ECPR
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