

# Should we be using extracorporeal cardiopulmonary resuscitation?

Early, effective cardiopulmonary resuscitation is crucial to achieving return of spontaneous circulation following cardiac arrest. European and UK resuscitation guidelines suggest considering veno-arterial extracorporeal membrane oxygenation during refractory cardiac arrest, known as extracorporeal cardiopulmonary resuscitation, for reversible causes to help achieve return of spontaneous circulation. This improves flow leading to greater end-organ perfusion and a longer time to treat the underlying condition in the hope of improving outcome. Given the cost, need for expertise and limited availability of resources, should extracorporeal cardiopulmonary resuscitation be used in clinical practice?

## Extracorporeal cardiopulmonary resuscitation should be used

Extracorporeal cardiopulmonary resuscitation has been used globally for 12 years, and survival to hospital discharge has been quoted as 29% (Richardson et al, 2017). With additional clinical interventions, survival to discharge could be as high as 54% (Stub et al, 2015). Other desirable outcomes (e.g. good neurological function and overall survival) are significantly improved with the use of extracorporeal membrane oxygenation (Kim et al, 2016). Outcomes in patients with primary non-cardiac disease, e.g. drug overdose, are usually better than those relating to ischaemic or other cardiac disease which may influence decision making.

Even unsuccessful attempts can have benefits – initiation of extracorporeal membrane oxygenation before discovery of

brain death post-cardiac arrest may increase the number of potential organ donors. This may help offset the financial cost of an extracorporeal membrane oxygenation service, but the ethical implications of such decisions must not be taken lightly.

## Extracorporeal cardiopulmonary resuscitation should not be used

The time taken to begin extracorporeal membrane oxygenation following start of cardiopulmonary resuscitation is inversely correlated with survival to hospital discharge. Cardiopulmonary resuscitation should take place for a minimum of 10 minutes before cardiac arrest is deemed refractory warranting extracorporeal membrane oxygenation (Kim et al, 2016), with lower survival rates and worse recovery the longer cardiopulmonary resuscitation continues. Contraindications for extracorporeal membrane oxygenation include >5 minutes from arrest to cardiopulmonary resuscitation or >100 minutes from cardiopulmonary resuscitation to extracorporeal membrane oxygenation, although this may change given the high mortality rate following such guidelines (Rousse et al, 2016).

Immediate mobilization of an experienced extracorporeal membrane oxygenation team is a substantial challenge, particularly for out of hospital cardiac arrest. With limited resources, distance from the team to the patient is a factor in patient selection. Despite increasing age, comorbidities and body weight of recipients as well as improved extracorporeal membrane oxygenation care provision, risk-adjusted survival has not changed over a 12-year period (Richardson et al, 2017), questioning whether patient selection has improved.

Extracorporeal cardiopulmonary resuscitation is not without complications – both mechanical (haemorrhage, infection and limb ischaemia) and ethical. An example is this becoming a ‘bridge to nowhere’, whereby patients initiated on extracorporeal membrane oxygenation are then found to have untreatable causes for their cardiac arrest (Riggs et al, 2015). The psychological and

emotional burden for patients and families should not be underestimated, highlighting the importance of patient selection.

## The remaining problems

Interpreting extracorporeal cardiopulmonary resuscitation data is challenging because there is no common definition of ‘refractory’ cardiac arrest, and exclusion criteria vary between centres. The literature mainly comprises small retrospective observational studies. Research should address propensity-score matching and risk adjustment to allow comparison between centres and thus extrapolation.

## Conclusions

Extracorporeal cardiopulmonary resuscitation is beneficial to some patients who suffer refractory cardiac arrest, particularly as inpatients. Patient selection is key to its success (hospital discharge). The decision should not be taken lightly, as it has substantial ethical implications. **BJHM**

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