National Institute for Health and Care Excellence

IP2082 VA ECMO for extracorporeal cardiopulmonary resuscitation (ECPR) in adults with refractory cardiac arrest

IPAC date: 14/08/2025

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1.	Consultee 1 British Cardiovascular Society	1.1	The British Cardiovascular Society would wish to highlight the uncertainty around the recommendation for potential use in people with refractory cardiac arrest and a shockable rhythm. ECMO may have some benefit in selected patients but with low confidence in the evidence and more research is needed to identify the patient group most likely to benefit.	Thank you for your comment. Extra wording has been added to the recommendations, stating that for refractory cardiac arrests with a shockable heart rhythm or reversible causes, VA ECMO for ECPR can be used as an option, whereas for refractory cardiac arrest with a non-shockable heart rhythm or irreversible causes, more research is needed before VA ECMO for ECPR can be used in the NHS.
2.	Consultee 3 Company Medtronic	1.1 For refractory cardiac arrest with a	Medtronic Limited agrees with the recommendation of ‘can be used as an option’ for refractory cardiac arrest with a shockable heart rhythm.	Thank you for your comment.

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		shockable heart rhythm	We do not foresee any aspects of these recommendations inducing unlawful discrimination in the provision of healthcare services. All relevant evidence appears to have been identified and included in the evidence review and the summaries of clinical effectiveness appear to be a reasonable interpretation of the evidence base.	
3.	Consultee 3 Company Medtronic	1.2 For refractory cardiac arrest without a shockable heart rhythm	Medtronic Limited disagrees that the following draft recommendations represent a reasonable interpretation of the evidence or a sound and suitable basis for guidance to the NHS: 'More research is needed on VA ECMO for ECPR to manage in-hospital and out-of-hospital refractory cardiac arrest in adults without a shockable heart rhythm, before it can be used in the NHS.' 'This procedure should only be done as part of formal research and an NHS research ethics committee needs to have approved its use.'	Thank you for your comment. Extra wording has been added to the recommendations, highlighting that for refractory cardiac arrest with a non-shockable heart rhythm or irreversible causes, more research is needed before VA ECMO for ECPR can be used in the NHS. Huang (2015) is a case report so did not meet criteria for inclusion in the overview. Lálová (2018) is a case report so did not meet criteria for inclusion in the overview. Ijuin (2025) has been added to the overview (table 5)

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			We are aware that ECMO centres in NHS hospitals across the United Kingdom (UK) currently provide VA ECMO in a small number of carefully selected patients within this indication where survival to discharge with favourable neurological outcomes has been achieved. The draft recommendations are therefore inconsistent with clinical practice in the UK and risk restricting access to a procedure that has demonstrated life-saving potential in appropriately selected patients. These patients typically have an initial cardiac rhythm of pulseless electrical activity (PEA) and an underlying cause of cardiac arrest of pulmonary embolism. Evidence supporting the safety and efficacy of VA ECMO in this patient population started as small case series [1-3] but has recently been corroborated by a retrospective multicentre registry analysis involving 36 participating institutions in Japan.[4] The retrospective multicentre registry analysis[4] (n=473) reported an overall proportion of patients with favourable neurological outcomes and survival at hospital discharge of 8.2% and 16.9%, respectively. In a sub-group analysis of patients with an underlying cause of cardiac arrest of pulmonary embolism, the proportion of	Tanimoto (2020) is included in the overview (table 5). Inoue (2022) is included in the main evidence tables in the overview. Suverein (2023) is included in the overview (table 5).

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			favourable neurological outcomes and survival at discharge were far higher: 19.3% and 42.1%, respectively.[4] These findings are further supported by results from a single centre retrospective analysis (n=186) comparing outcomes for patients with an initial shockable or non-shockable cardiac rhythm.[5] In this study, no statistically significant difference in favourable neurological outcome at discharge was observed after controlling for potential confounders (Odds Ratio [OR]: 1.58; 95% Confidence Interval [CI]: 0.66–3.81, p = 0.31); the authors noted that, within the group of patients with initial non-shockable cardiac rhythms, most patients with favourable outcomes had pulmonary embolism as the underlying cause of cardiac arrest. Furthermore, an analysis of the Extracorporeal Life Support Organization (ELSO) registry using data between 2009 and 2022 for adult patients receiving ECPR (n=8,050) found that 1,930 (24%) had PEA, suggesting that VA ECMO is provided to these patients in other countries.[6] Overall, the findings for this patient population are comparable to those reported for patients with shockable heart rhythms (~20% favourable neurological outcomes and	

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			~30% survival at discharge) for which VA ECMO is generally indicated worldwide.[7, 8] Medtronic requests that, for this specific patient population, a recommendation of 'can be used as an option/can be used during the evidence generation period' is adopted; such a recommendation would provide acknowledgement of the more favourable outcomes in this patient population, facilitate access to treatment for these patients, and allow further data collection via the ELSO registry to support ongoing research. References 1. Mehta C, Brady W. Pulseless electrical activity in cardiac arrest: electrocardiographic presentations and management considerations based on the electrocardiogram. The American journal of emergency medicine. 2012 Jan 1;30(1):236-9. 2. Huang HW, Chiu CC, Yen HH, Chen YL, Siao FY. Prolonged pulseless electrical activity: successful resuscitation using extracorporeal membrane oxygenation. The American journal of emergency medicine. 2015 Mar;33(3):474-e5.	

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			3. Lálová I, Filipovská L, Skalická H, Šmíd O, Linhart A, Kollárová H, Bělohlávek J. Refractory ventricle arrhythmias alternating with pulseless electrical activity in a young woman rescued by extracorporeal cardiopulmonary resuscitation. Case Reports in Medicine. 2018;2018(1):5686790. 4. Ijuin S, Inoue A, Hifumi T, Taira T, Suga M, Nishimura T, Sakamoto T, Kuroda Y, Ishihara S, SAVE-J II study group. Analysis of factors associated with favorable neurological outcomes in patients with initial PEA who underwent ECPR-A secondary analysis of the SAVE-J II study. Journal of Critical Care. 2025 Feb 1;85:154917. 5. Tanimoto A, Sugiyama K, Tanabe M, Kitagawa K, Kawakami A, Hamabe Y. Out-of-hospital cardiac arrest patients with an initial non-shockable rhythm could be candidates for extracorporeal cardiopulmonary resuscitation: a retrospective study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2020 Dec;28:1-7. 6. Tonna JE, Boonstra PS, MacLaren G, Paden M, Brodie D, Anders M, Hoskote A, Ramanathan K, Hyslop R, Fanning JJ, Rycus P. Extracorporeal life support organization registry	

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			international report 2022: 100,000 survivors. ASAIO Journal. 2024 Feb 1;70(2):131-43. 7. Inoue A, Hifumi T, Sakamoto T, Okamoto H, Kunikata J, Yokoi H, Sawano H, Egawa Y, Kato S, Sugiyama K, Bunya N. Extracorporeal cardiopulmonary resuscitation in adult patients with out-of-hospital cardiac arrest: a retrospective large cohort multicenter study in Japan. Critical Care. 2022 May 9;26(1):129. 8. Suverein MM, Delnoij TS, Lorusso R, Brandon Bravo Bruinsma GJ, Otterspoor L, Elzo Kraemer CV, Vlaar AP, Van Der Heijden JJ, Scholten E, Den Uil C, Jansen T. Early extracorporeal CPR for refractory out-of-hospital cardiac arrest. New England Journal of Medicine. 2023 Jan 26;388(4):299-309.	
4.	Consultee 8 Resuscitation Council UK	1	RCUK is supportive of the ECPR guidance and feels the guidance is reasonable in its recommendations. The guidance recommends that non-shockable rhythms ECPR should only be part of research studies. - This would exclude patients who have a reversible treatable cause with a non-shockable rhythm where ECPR might be helpful, e.g. severe hypothermia, PE.	Thank you for your comment. Extra wording has been added to the recommendations, highlighting that for refractory cardiac arrest with a non-shockable heart rhythm or irreversible causes, more research is needed before VA ECMO for ECPR can be used in the NHS.

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5.	Consultee 8 Resuscitation Council UK	1	The key should be reversible cause and the potential for survival based on time to establish VA-ECMO and comorbidity/frailty/underlying cause.	Thank you for your comment. Please see response too comment 4.
6.	Consultee 5 Clinical	1	No comments but I agree with the recommendations	Thank you for your comment.
7.	Consultee 6 Clinical	1	No comments but I agree with the recommendations	Thank you for your comment.
8.	Consultee 8 Resuscitation Council UK	What this means in practice	NICE recommends that patients are enrolled in the EuroELSO registry, but does not mention the National Cardiac Arrest Audit for in-hospital cardiac arrest, and the Out-of-hospital cardiac arrest outcome audit for out-of-hospital patients - patients receiving ECPR would fulfil the inclusion criteria for these UK national audits, which are both supported and funded by RCUK.	Thank you for your comment. NICE contacted both registries and has only received a response from the National Cardiac Arrest Audit (NCAA). So, NCAA is recommended in the guidance.
9.	Consultee 2 Clinical	General	I am a cardiologist specialising in adult congenital heart disease and have been providing specialist ACHD care at a UK Level 1 congenital heart centre for the last 16 years. Audit of our own data (historically the largest ECMO centre by volume in the country) has shown that post cardotomy VA ECMO in patients with adult congenital heart disease improves survival significantly above that in older cohorts	Thank you for your comment. This appears to refer to post-cardiotomy ECMO, which is a separate piece of guidance (IP2083 VA-ECMO for postcardiotomy cardiogenic shock in adults). Please see consultation comments and

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			undergoing surgery for acquired cardiac conditions who also receive this treatment. For this reason, analysis of outcomes associated with post cardotomy VA ECMO should be determined separately for these two cohorts. In addition, as the number of ACHD patients undergoing surgery in the UK is small in comparison to those having surgery for acquired conditions, adjustments should be made to the length of time that data is acquired for the ACHD group in order to draw valid statistical conclusions. Account should also be made of the potential life years saved in this much younger cohort and the fact that many patients require repeated cardiac surgery through their lifetimes, making it essential that the myocardium is preserved as much as possible for each surgical episode including the immediate recovery period on the ICU. The use of VA ECMO as a bridge to recovery from the assault of elective surgery can be vital in this group of patient with complex cardiac anatomy facing a potential long lifetime of procedures. Finally, patients with congenital heart disease very often undergo surgery for right sided cardiac lesions i.e. tricuspid and pulmonary valve operations. In this context, we have found that VA ECMO can be even more vital in supporting the	responses for IP2083 (response to comment 9).

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			heart to recovery after surgery, especially in the context of pre-operative right ventricular impairment, an additional risk factor to early surgical mortality in this group. Those undergoing tricuspid valve repair for Ebstein anomaly are often at particularly high risk and may have the most to gain from post cardotomy VA ECMO support. Any analysis of the efficacy of post cardotomy VA ECMO should therefore also involve subgroup analysis of patients undergoing surgery for right sided lesions. Again numbers will be relatively small and as with the ACHD group as a whole, sufficient time should be given to build up a large enough cohort to allow valid conclusions to be drawn.	
10	Consultee 4 Professional expert	2.3 What research is needed	cost-effectiveness	Thank you for your comment. Cost-effectiveness is not within the scope of the IP guidance.
11	Consultee 7 Royal Papworth Hospital	Not specified	1. Patient and Disease Selection: o Criteria for patient selection: We would advocate use of STOP criteria as a patient selection approach with ongoing research focused on development of better patient selection scoring systems o Types of diseases/conditions we believe could be suitable for treatment: Patient age, down time and initial rhythm are key selection criteria, although more research is	Thank you for your comment. The guidance states, 'patient selection should be done by a multidisciplinary team…'

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			needed in identification of patients with massive PEs where this could be a beneficial intervention.	
12	Consultee 7 Royal Papworth Hospital	Not specified	2. Decision Making: o Decision-making process: We would advocate for a multidisciplinary team approach involving a shock team call consisting of Cardiology consultant, Intensivist/ECMO consultant and referring clinician (Pre-hospital Physician in out of hospital context) o eCPR is a time critical intervention so any decision needs to be made as rapidly as possible, hence the need for well evidenced criteria selection processes	Thank you for your comment. The guidance states, 'patient selection should be done by a multidisciplinary team…' Section 3.12 states 'Clinical experts advised that a shorter time between cardiac arrest and starting VA ECMO was associated with better outcomes.'
13	Consultee 7 Royal Papworth Hospital	Not specified	3. Training and Expertise: o There is a learning curve for initiation and management of VA-ECMO patients and therefore we would advocate for the care of these patients in expert high volume centre. o Given the time critical nature of initiation of eCPR and a need for equity of care in the NHS there is a strong argument for the development of local eCPR teams in acute hospitals, however outcomes will be linked to experience, so caution and a risk benefit analysis should be considered o Other countries, notably the Netherlands and the US have seen success in establishing OOHCA eCPR programs and this is an area we believe deserve further research in the	Thank you for your comment. Extra wording has been added to the guidance ('who should be involved in the procedure'), stating 'patient selection should be done by a multidisciplinary team. The procedure should only be done in centres specialising in using VA ECMO for ECPR for refractory cardiac arrest and by healthcare professionals with specific training in this procedure.'

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			UK looking at the practicalities of delivering equitable care across the UK. This should be a health economics research priority.	
14	Consultee 7 Royal Papworth Hospital	Not specified	4. Research: o Evolving evidence supports early decision making rapid, earlier onset of eCPR improves neurological outcomes, and considered patient selection. o Ongoing UK research should focus on good data collection, adoption of a UK network approach and registry and application of adaptive and novel trials methodologies as well as health economic analysis of how to deliver eCPR in and out of hospital and the health economics impact such a program would have on organ donation.	Thank you for your comment. Section 3.12 states 'Clinical experts advised that a shorter time between cardiac arrest and starting VA ECMO was associated with better outcomes.' The guidance describes 'what research is needed' and highlights the need for 'auditing of outcomes'.
15	Consultee 8 Resuscitation Council UK	General	The number of eligible ECPR patients is small – Only about 20 centres at most out of 200+ acute hospitals in the UK can potentially provide ECPR, and the NICE technologies guidance does not come with funding, so this will not help things much.	Thank you for your comment. Commissioning is outside the remit of the IP guidance.
16	Consultee 8 Resuscitation Council UK	General	NICE should include the potential for people becoming organ donors when they die as an outcome from the review - this gives quite a large gain for ECPR programs.	Thank you for your comment. Section 3.15 has been added to the guidance in response to the comment.

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17	Consultee 3 Company Medtronic	General	While not within the remit of the Interventional Procedures Guidance programme, we would also like to highlight the potential benefits of VA ECMO for organ donation. There is a growing evidence base suggesting that organs from donors after ECMO can be successfully utilised, expanding the organ pool with high graft and recipient survival; a systematic review by Rajsic et al. identified 20 studies comprising 147 donors and 360 organ donations.[1] The most frequently donated organs were kidneys (68%, n=244/360) and livers (24%, n=85/360). In total, 98% (n=292/299) of recipients survived with preserved graft function (92%, n=319/347) until follow-up within a variable period of up to 3-years. References 1. Rajsic S, Treml B, Innerhofer N, Eckhardt C, Spurnic AR, Breitkopf R. Organ Donation from Patients Receiving Extracorporeal Membrane Oxygenation: A Systematic Review. Journal of cardiothoracic and vascular anesthesia. 2024 Mar 20.	Thank you for your comment. Please see response to comment 16.
18	Consultee 8 Resuscitation Council UK	Overview	On P47 the 2019 ILCOR Treatment Recommendations are mentioned but these should be update to the 2024 version: • ILCOR Treatment Recommendations (2024)	Thank you for your comment. This has been updated in the overview.

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			○ We suggest that ECPR may be considered as a rescue therapy for selected adults with out-of-hospital cardiac arrest when conventional CPR is failing to restore spontaneous circulation in settings where this can be implemented (weak recommendation, low-certainty evidence). ○ We suggest ECPR may be considered as a rescue therapy for selected adults with in-hospital cardiac arrest when conventional CPR is failing to restore spontaneous circulation in settings where this can be implemented (weak recommendation, very low–certainty evidence).	

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