Patient selection criteria are needed for extracorporeal cardiopulmonary resuscitation following cardiac surgery

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In their study, Dr Alsoufi et al. [1] reported on their institutional experience with a current-era extracorporeal cardiopulmonary resuscitation (ECPR) protocol in salvaging children who had experienced refractory circulatory arrest (CA) following surgical repair of a congenital heart disease (CHD).

Despite the protocol being advanced and well-structured, only 41% of patients who required early postoperative ECPR survived to hospital discharge. Higher immediate post-ECMO lactate and renal failure requiring haemodialysis were associated with death. The authors believe that timely application of ECPR to minimize organ injury and prompt correction of residual lesions might improve the likelihood of achieving more favourable outcomes. Unfortunately, no follow-up data are available to justify their ECPR protocol, particularly with regard to the long-term survival and neurological status of the patients.

More than a decade ago, a Boston group [2, 3] reported a nearly identical ECPR protocol, with 40% discharge survival and the same risk factors for failure. In the meantime, many others have shown very similar outcomes [4]. It is obvious that despite technological improvements and the large experience worldwide with ECPR, no significant survival improvement has been achieved. This point deserves a few comments.

(i) The applicability of advanced ECPR protocol [1], using the pre-assembled extracorporeal membrane oxygenation (ECMO) circuit and standardized ECMO management has become the indispensable tool in rescuing children with refractory CA in the majority of institutions. The current ECMO set-up is simple and in the majority of patients provides effective, but short-term support.

(ii) Apart from a few contraindications, such as extreme prematurity and severe dysfunction of the central nervous system, ECPR is used without any selection; therefore, the use of this technology has increased dramatically, having a profound effect on institutional and human resources. The establishment of living wills may be difficult and is uncommon in this scenario. In some institutions, an aggressive philosophy towards ECPR application has led to the paradoxical situation that after surgical repair of CHD, patients are more often dying after failure to wean from ECMO than by ‘natural death’.

(iii) On the other hand, the limitations of support with regard to the functional recovery of circulation are very well-established. Failure of the return of ventricular function within 72 h of the institution of support, inability to clear lactate and renal failure are ominous signs leading to the death of patients. Bad outcomes are seen in patients with technically imperfect repairs, thus calling for prompt and more accurate peri- and postoperative assessment of repair in order to correct residuals beforehand. Patients with an adequate two-ventricle repair have significantly higher hospital survival, whereas those with bidirectional Glenn and Fontan physiology, or those who need a second ECMO run, have a dismal prognosis [1–5].

(iv) Despite technological improvements, such as centrifugal pumps, coated tubing systems, and advanced coagulation management, bleeding is the most serious complication having a negative impact on gastrointestinal, pulmonary and central nervous systems.

(v) Unfortunately, many of the ‘successfully rescued’ patients have severe neurological impairments, which pose enormous economic and psychosocial burdens on patients, their families and also society. More recent reports on early better outcome categories [6, 7] stating no or mild neurological injury in 75% of the survivors remain to be proved by longer follow-up periods. Nevertheless, estimated survival free of neurological impairments is no >25–30%.

Clearly, patient selection criteria for ECPR are needed to improve the results and to use this technology more effectively. Research efforts should therefore focus on comprehensive analysis of pre-, peri- and postoperative factors that may lead to circulatory collapse, thus using ECMO preventatively. At the same time, increased attention should be paid to neuroprotection and diagnosis of neurological damage. The selective use of ECPR should be discussed during the indication of every patient for surgery of CHD, taking into account the natural history of specific CHD and associated lesions. The parents should be involved in the decision-making beforehand. More importantly, the parents should be informed on all potential complications, including neurological impairment. There is a great need for comprehensive data on the long-term survival and functional outcomes, including the neurological development of rescued patients; otherwise the non-selective use of ECPR, which was elaborated on in this article, is questionable.
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REFERENCES


