Circulatory support system as a bridge to decision in patients with refractory acute cardiogenic shock: Is there a space for extracorporeal membrane oxygenation?

To the Editor:

We read with interest the timely report by John and colleagues¹ about the elective use of the Levitronix CentriMag as a bridge to decision in cardiogenic shock. We commend them for their encouraging results in 12 patients assisted with biventricular support.

Although the concept of cardiac assistance as bridge to decision is well addressed by the authors, we believe that extracorporeal membrane oxygenation (ECMO) could play a more valuable role in this context. This is especially so when the expected assistance time is relatively short (eg, an average support length of 9.4 days, as reported in John and colleagues' experience¹).

In our institution, we routinely use both ECMO and the Levitronix device. The latter is mainly used for patients with postcardiotomy syndrome or primary graft failure; we advise the use of ECMO in nonsurgical situations, such as cardiogenic shock after acute myocardial infarction or failed percutaneous coronary interventions.

In this selected group of patients, ECMO offers some advantages. These include avoidance of sternotomy and central cannulation, which may cause catastrophic bleeding after aggressive thrombolysis and antiplatelet treatment, and ease of emergency implantation, even in the intensive care unit or catheter laboratory, with consequent rapid institution of assistance.

Furthermore, newly designed oxygenators and ECMO circuits (Quadrox Jostra, Permanent Life Support PLS; MAQUET GmbH & Co KG, Rastatt, Germany) require a lower priming volume and present a bioinert surface treatment, guaranteeing assistance for an extended 14 days with a reduced risk of device-related complications and a less strict anticoagulation regimen. Moreover, ECMO can be easily switched to cardiopulmonary bypass at the time of transplantation or long-term device implantation.

In our institution, since the beginning of 2006, the PLS ECMO system has been extensively used to treat either lung (6 patients) or cardiac (8 patients) failure (venovenous and venoarterial cannulation,

respectively). No device failures have been recorded, even for assistance extending longer than 60 days.

In our experience, ECMO units are managed by intensive care unit nurses, and dedicated personnel are usually not required. Activated thromboplastin time is kept between 40 and 50 seconds, with a level of antithrombin III activity greater than 80%. In cases of bleeding, we have withheld heparin for more than 30 hours without any thrombotic events.

Leg ischemia, related to common femoral artery cannulation, is the complication we have seen most frequently. In most cases, however, this condition can be resolved by cannulating the superficial femoral artery as well with a small perfusion cannula.

In conclusion, although the many advantages offered by the Levitronix pump are remarkable, patient-tailored assistance can be achieved for selected candidates with new versions of ECMO systems, such as the PLS. Thanks to modern technology, these systems couple ease of implantation and management with device reliability and long-term durability.

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Reference

1. John R, Liao K, Lietz K, Kamdar F, Colvin-Adams M, Boyle A, et al. Experience with the Levitronix CentriMag circulatory support system as a bridge to decision in patients with refractory acute cardiogenic shock and multisystem organ failure. *J Thorac Cardiovasc Surg.* 2007;134:351-8.
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Reply to the Editor:

I appreciate the comments of Santise and colleagues regarding the role of extracorporeal membrane oxygenation (ECMO) in the care of patients with refractory cardiogenic shock. Clearly, ECMO has been, and will probably always remain, a useful treatment in the ever-changing armamentarium options for this critically ill group. It is still the primary option for pediatric patients, but the frequency of its use for adults has

been significantly reduced thanks to improved short-term ventricular support devices (eg, CentriMag, Abiomed). Such devices provide more reliable support, with markedly improved durability with respect to the Bio-Medicus systems, the first generation of short-term ventricular assist devices.

ECMO certainly offers the advantage of avoiding a median sternotomy, as well as the opportunity for rapid institution of support in the catheterization laboratory and the intensive care unit, as Santise and colleagues report. The use of ECMO is limited, however, by its main drawbacks: limited durability and significant neurologic and peripheral vascular complications. The incidence of such complications may be affected by technologic advances in the design of ECMO circuits and oxygenators or by altered peripheral cannulation techniques. Several published studies, some involving pediatric patients, have looked at the use of ECMO for a wide range of indications (eg, graft failure after lung transplantation, right ventricular failure after heart transplantation, postcardiotomy assistance, resuscitation after cardiac arrest, and bridge to bridge support for cardiogenic shock). All these series reported a mean ECMO duration of about 4 days or less.¹⁻⁵ In one large, experienced single-center series, the complications during ECMO were as follows: infectious, 49%; renal failure requiring dialysis, 40%; neurologic, 33%; and limb complications, 25%.² Of course, not all such complications are related to ECMO itself. Instead, they often are a result of the critical condition of a patient with multiorgan dysfunction. Further, all such complications (with the relative exception of limb complications) can also potentially occur with short-term ventricular assist devices.

In conclusion, I agree with Santise and colleagues that there is definitely a place for ECMO in the treatment of patients with acute cardiogenic shock. In the near future, we do not know what the interplay will be between surgical and percutaneous devices, including ECMO. Until then, it remains imperative that we continue to be innovative, open-minded, and aggressive, continually striving to improve outcomes for this critically ill group of patients.

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