

trial about ECPR for pulmonary embolisms revealed early ECPR implementation might be beneficial.³ Therefore, we should not ignore a potential candidate for ECMO, such as a patient with a pulmonary embolism and avoid delaying the implementation of ECPR for one such candidate. Goto et al⁴ developed a relatively new algorithm to initiate VA-ECMO by an emergent physician at the same time as the decision to enact a PMCD, which might be reasonable for many MCAs.

We admit that evidence was scarce, but combining the results from previous ECMO studies and studies about MCA has led us to recommend earlier consideration of ECMO therapy. As mentioned by Zelop et al,¹ incorporating multidisciplinary teams, including an emergent physician, obstetrician/maternal-fetal medicine specialist, anesthesiologist, and cardiologist to diagnose an appropriate candidate for ECMO, is mandatory for MCA to perform time-efficient treatment. ■

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The authors report no conflict of interest.

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REPLY



We thank Mizuno et al for their interest in our review and acknowledge their astute commentary. As detailed in our review,¹ we have explored extracorporeal membrane

oxygenation (ECMO) and cardiopulmonary bypass as additional interventions that may provide external hemodynamic and/or respiratory support when the etiology of maternal cardiac arrest is potentially reversible. Clinical entities that may be amenable include local anesthetic toxicities unresponsive to lipid rescue, drug overdose, respiratory failure, acute respiratory distress syndrome, cardiomyopathy, and pulmonary/amniotic fluid embolism.

While the American Heart Association incorporated extracorporeal membrane oxygenation resuscitation as an alternative intervention in the 2015 guidelines,² data are limited, especially in the setting of pregnancy. Barriers to implementation of this intervention revolve around pathophysiology and feasibility.

The prothrombotic maternal coagulation system is highly complex, especially when amniotic or pulmonary embolism is superimposed. With either of these clinical entities, the interactions between heart strain and perfusion pressures, anticoagulation, disseminated intravascular coagulation, hypothermic cooling, ECMO, and the presence of a surgical wound lead to an intricate interplay of risks that may culminate in exsanguination, irreversible cardiac failure, permanent brain damage, multiorgan injury, and maternal and perinatal death.³

ECMO resources require time to deploy, and therefore, it is reasonable to incorporate cardiology and cardiothoracic surgery into the multidisciplinary team managing maternal cardiac arrest. Consideration of implementation of this modality should not compromise the initial maneuvers of resuscitation including perimortem delivery. Simulation exercises will facilitate the education of clinical providers to prioritize time-sensitive interventions and enhance teamwork.

While no modality should be dismissed as a possible maternal life-saving intervention, ECMO and cardiopulmonary bypass do present extraordinary circumstances and clinical challenges. The need for national and international registries is truly urgent. ■

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Dr Zelop receives royalties from uptodate on the topic of maternal cardiac arrest. The other authors report no conflict of interest.

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A clinician's concerns about motor function outcomes of fetal surgery for myelomeningocele



TO THE EDITORS: In 2011, Adzick et al¹ reported the outcomes of the Management of Myelomeningocele Study (MOMS) of fetal surgery vs postnatal surgery for myelomeningocele. Enrollment was closed early because the benefit of fetal surgery was demonstrated in all outcome domains. Farmer et al² recently (2018) reported in the Journal motor function outcomes at 30 months of age for the complete study population and confirmed that fetal surgery resulted in better motor function segmental level compared with the anatomic level of lesion and better ambulation status than did postnatal surgery.

I am a neurodevelopmental pediatrician who took care of patients with spina bifida for 35 years. I have the following concerns about the motor function outcomes reported by MOMS^{1,2}:

1. The age at which motor function outcomes was determined, 30 months, is too young to assess both muscle function segmental level³ and ambulation status in myelomeningocele accurately.⁴ This casts doubt on the validity of main motor function outcomes of MOMS.
2. In Farmer et al², male sex appears to be an unrecognized confounder favoring better motor function outcomes in fetal surgery.^{1,2}
3. Motor function impairment from spinal cord tethering may be more frequent after fetal surgery than postnatal surgery. Adzick et al¹ found a trend toward a greater prevalence of tethered cord surgery in the fetal surgery cohort than in postnatal surgery cohort at 12 months old (8% vs 1%; $P = .06$),¹ but prevalences of tethered cord surgery in the 2 cohorts at 30 months of age were not reported by Farmer et al.²
4. The primary motor outcome of MOMS, called walking independently, favored fetal surgery by 40% to 24%, but walking independently is too easily misconstrued by both parents who are deciding about fetal surgery and by obstetricians who are counseling them. It is defined in the

Methods section as “taking 10 steps without devices,” a low bar for ambulation for 30 month old children, most of whom can run and jump. Furthermore, motor function differences were less marked on the widely accepted secondary outcome measure, the Bayley Scales of Infant Development (15% in the normal range for fetal surgery vs 7%).

Parents and obstetricians need to understand that it is likely that most patients who have had fetal surgery will have life-long impairments of muscle function and mobility and consider this when weighing risks and benefits. ■

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