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Commentary: The tortoise and the hare: Does speed matter in pediatric VAD therapy?

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The arrival of the HeartWare HVAD (Medtronic, Minneapolis, Minn) had an immediate impact on the pediatric ventricular assist device (VAD) community. The HVAD became the dominant VAD used to support children weighing ≥ 20 to 25 kg.¹ Although the use of this device in children is associated with comparable survival to that seen in case-matched young adults, the hemocompatibility and neurologic event rates have room for improvement, especially in children < 20 kg.^{2,3} The potential reasons for the observed event rate are likely multifactorial, but the use of lower pump speeds has been identified as a possible contributor.

In their article in this issue of the *Journal*, Granegger and colleagues report their clinical observations of elevated lactate dehydrogenase (LDH) and d-dimer in 14 children supported with an HVAD.⁴ Drawing conclusions from their clinical cohort is challenging given the small patient numbers, heterogeneity in anticoagulation management, and nonhemolytic causes of elevated LDH. Nonetheless, the clinical observations of potential elevated hemolysis were used to guide in silico and in vitro analyses of the flow characteristics and hemolysis profile under a variety of potential operating conditions. The in silico analysis suggested that the lower RPM state was associated with adverse changes in device flow fields and shear stress. These lower RPM states were also associated with increased levels of blood trauma in vitro as assessed by the normalized index of hemolysis.

The clinical significance of the changes in flow dynamics and in vitro blood trauma reported by Granegger and colleagues remains unclear. The idealized flow

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CENTRAL MESSAGE

Modified operating conditions of continuous-flow ventricular assist devices in children may have clinical implications.

conditions that they describe have little resemblance to the implant conditions and modifications required to implant the device in small children and patients with congenital heart disease. Furthermore, such factors as clinical condition at the time of implantation, arterial pressure, and anticoagulation management are more easily modified than RPM for a given patient and have been shown clinically to be associated with improved outcomes.^{2,5} Thus, the impact of the study on individual patient management is likely small, given the relatively narrow RPM range used for any given patient. Nonetheless, the study has potential broader implications for the field of pediatric VAD. To date, only 1 implantable continuous-flow VAD (the HVAD) is available that is small enough to be placed in most children. The device was rapidly deployed in the field off-label, with little pre-clinical data regarding the operating characteristics of the devices under “pediatric conditions.” Ultimately, the clinical outcomes were reassuring; however, this study underscores a familiar refrain in pediatrics, “children are not small adults.” The authors do believe that industry is now engaged with pediatric caregivers to maximize the use and outcomes of these devices in adolescents and pre-teens because of our pediatric learning network, ACTION, and its quality improvement initiatives. The pediatric VAD field, once a tortoise, is now a hare, because of our abandonment of competition and commitment to collaboration.

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