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Commentary: A picture is worth a thousand words, but only tells one story

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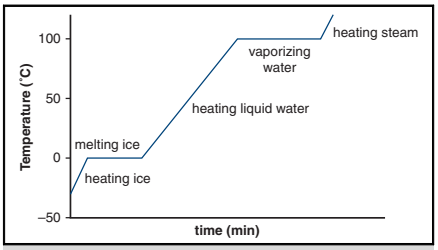
If done slowly, the initial heating curve for water is linear. It is a predictable relationship. And, without prior knowledge, it wouldn't be unreasonable to think that it goes on, one-for-one, well beyond 100°C. But we know this isn't true. Like many things in science and life, the past does not always predict the future.

In this issue of *JTCVS Open*, Hameed and colleagues[1] provide in-depth analysis of their novel hybrid stage II repair for select patients with hypoplastic left heart syndrome using computational fluid dynamic (CFD) modeling. Based on representative patient imaging, they were able to create virtual models of the repair and interrogate the hemodynamic implications of *H*, or the distance between the anterior main pulmonary artery and the anterior baffle. The team concluded that the repair is hemodynamically sound based on an estimated pressure loss over the baffle of less than 10 mm Hg, a Reynolds coefficient of less than 2000, and a clinically insignificant vortex shedding distance. As a standalone report, we would agree with their assessment, although having read their clinical case series, we have some reservations.[2] Over a 6-year period, 4 patients underwent a hybrid stage II repair. One died due to a pulmonary embolism, and the other 3 ultimately required an estimated 19 cardiac catheterizations, 13 balloon angioplasties, and 13 stents.



The heating curve for water is not a linear relationship with regards to time.

CENTRAL MESSAGE

The past does not always predict the future. And while attractive, CFD models should be cautiously interpreted in the face of contradictory clinical outcomes.

While their model is accurate and the math is sound, "Computational Fluid Dynamic Investigation of the Novel Hybrid Comprehensive Stage II Operation" highlights how inductive reasoning can lead us astray. CFD can quickly turn into a foreign language for those of us without strong engineering backgrounds. It is intimidating. Our default, to downplay our lack of understanding, is to accept everything at face value. However, as surgeons we can see the disconnect in these related, although independent, conclusions, highlighting one of the most important points about CFD—it is an *n* of 1 at time zero. Generally speaking, although Hameed and colleagues[1] adjusted *H* and explored the sensitivity of their model to surgical and patient variability, the model continues to represent one time point. It isn't wrong, but like a happy turkey on the farm, Thanksgiving Day still comes, and eventually the model falls apart. CFD has a role in cardiac surgery, and with time we're confident it will find its place.[3-5] In the meantime, when making decisions, we should be cautious about the relative weight we give theoretical models when faced with contradictory clinical outcomes. The past does not always predict the future, particularly when it's built on assumptions.

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