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# Commentary: Virtual reality 3-dimensional imaging of atrioventricular valves: A tool for surgeons or a toy for engineers?

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**CENTRAL MESSAGE**

Congenital atrioventricular valve 3-dimensional virtual reality assessment may enhance surgeons' understanding and repair strategy, but its validity is not certain considering the early-stage development.

Virtual reality (VR) and 3-dimensional (3D) printed model technologies are more frequently used in the congenital heart disease field, mainly to plan complex surgical repairs[1,2] or to enhance medical training.[3] Usually, 3D printed models are derived by computed tomography or cardiac magnetic resonance reconstructions, which provide better spatial definition. Both imaging techniques are limited to reproducing atrioventricular valves. On the other hand, 3D echocardiography allows better valve visualization and is already part of the cardiologic evaluation, preoperative repair planning, and intraoperative result assessment.[4] Echocardiographic 3D valve reconstructions, when transferred into VR software,[4] may provide better imaging manipulation and allow surgeons to assess atrioventricular valves in a modality similar to the 3D printed models.

In their study is this issue of *JTCVS Techniques*, Pushparajah and colleagues[5] evaluate the impact of 3D VR imaging of congenitally anomalous atrioventricular valves on surgeons' perception of anatomy and how VR may improve surgical repair decision strategy. They retrieved 2-dimensional (2D) and 3D preoperative echocardiographs of the atrioventricular valves of 15 patients who underwent surgical repair, retrospectively reconstructed them in VR, and asked 5 surgeons (blinded to the patients' disease and clinical history) to assess 3 cases each. The evaluation process encompassed a step-by-step image review starting from the standard 2D echocardiogram, 3D echocardiogram, and VR dynamic reconstruction. After each step, the surgeon completed an evaluation questionnaire focused on anatomy perception, understanding of the disease, and the repair plan.

The use of VR showed encouraging results, with greater surgeon confidence in the valve anatomy and surgical approach in 67% of the cases presented. It must be noted that valve anatomy comprehension and type of repair were already good with the standard 2D and 3D echocardiography; surgeons would have made a significant modification to the repair technique after VR evaluation of the valve in only 7% of the cases. Thus, standard echocardiographic evaluation allows correct surgical planning that is not greatly modified by VR. The study design carries a significant limitation because the raters (surgeons) were repeatedly exposed to the same valves before the VR that occurred only as a third assessment. The authors may have overestimated the increased surgeons' confidence in understanding the disease using VR because the surgeons assessed the same valve 3 times. VR may become a useful clinical tool in the near future, but for now, it remains more a toy for engineers that requires further development to prove its efficacy and usefulness, especially when compared with 2D and 3D echocardiography, available technologies that allow real-time assessment.

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