

Novel Visualizations Of Hemodynamic Analyses Using Interactive, Stereoscopic VR Capabilities

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Introduction: Stereoscopic, three-dimensional visualization provides informative guidance in various medical settings, such as pre-surgical planning and post-surgical evaluation for cardiovascular interventions¹. EchoPixel's True 3D is a virtual reality (VR) software platform that supports interactive, stereoscopic clinical image visualization, and facilitates the understanding of complicated anatomical structure. It is widely recognized that visualizing the hemodynamics could further improve the comprehension of patient's pathophysiological conditions. Therefore, this study incorporated patient-specific hemodynamic analysis and associated imaging into interactive VR visualizations for clinical review via EchoPixel True 3D.

Materials and Methods: Hemodynamic analyses are imported into Ansys EnSight. An in-house workflow developed at Boston Scientific Corporation is utilized to transform data into polygon files format in ASCII (.ply). The polygon files are next loaded into EchoPixel and incorporated into the DICOM scene of the patient's original clinical images, automatically matching the corresponding patient coordinate system. By adjusting the properties of the model, for example, flow streamlines representing CFD results were seen in the medical images. This study examined the developed workflow by using simulation results obtained from commercial Computational Fluid Dynamics (CFD) solver ANSYS Fluent, which has been widely used to assess hemodynamics of the cardiovascular system.

Results and Discussion: CFD flow data was successfully incorporated into the interactive VR mode in EchoPixel for stereoscopic visualization (Figure 1). The CFD data in EchoPixel shows distinct and density-controllable streamlines representing the flow direction with color schemes showing the magnitude of flow velocity. Users could easily interact with the visualized CFD data inside the original clinical images; both pre- and post- surgical views; and, as desired, with or without virtual device implants.

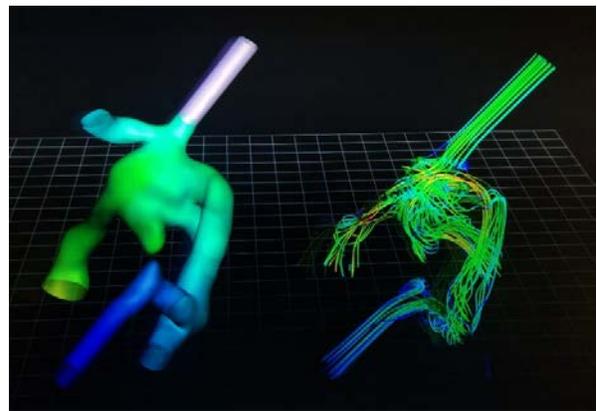


Figure 1 CFD simulation results of a patient with congenital single ventricle heart defects in VR mode via EchoPixel True 3D

Conclusions: Hemodynamic data has been successfully incorporated into stereoscopic VR mode with interactive features via EchoPixel True 3D. Such visualizations help clinical users obtain more insights regarding physiological conditions of the patient and could facilitate diagnosis of the disease, planning & optimizing the surgery, and comprehensive assessment of the post-surgery outcomes.

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References:

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