AUGMENTED REALITY VISUALIZATION OF 3D ROTATIONAL ANGIOGRAPHY IN CONGENITAL CARDIAC CATHETERIZATION

Arash Salavitabar,[1], Wendy Whiteside,[2], Jeffrey Zampi,[2]

[1] Nationwide Children's Hospital; Pediatrics, [2] University of Michigan

Three-dimensional rotational angiography (3DRA) has become a mainstay of congenital cardiac catheterization. Augmented reality (AR) is an exciting and emerging technology that allows for interactive visualization of 3D holographic images in the user's environment. This case series reports on the utilization of a wireless headset to visualize 3DRA in AR during congenital cardiac catheterizations within a Canon Infinix-I fluoroscopic platform. Patients were prospectively enrolled and consented. AR visualization of 3DRA was performed in 5 cases: repaired Tetralogy of Fallot (TOF) with left pulmonary artery (PA) stenosis, truncus arteriosus with right ventricular-PA conduit stenosis/regurgitation, re-coarctation of the aorta following surgical repair, hypoplastic left heart syndrome following Hemi-Fontan operation, and repaired TOF with RPA stenosis. Following 3DRA acquisition, standard 3D reconstructions were performed using Vitrea software and transferred to the headset. Mean patient age was 8.1 ± 9.5 years and mean weight was 40.2 ± 45.0 kg. 3DRAs were performed using a mean total injection volume of 2.3 ± 1.2 cc/kg with a median contrast dilution to 50% (50-66%). Apnea was performed for 4 of 5 3DRAs and all five were performed with a 1-second X-ray delay and without rapid ventricular pacing. The headset was easily placed and removed by a separate staff member in all cases. Mean time from completion of initial 3D reconstruction to optimization and visualization in AR was 3.8 ± 0.8 minutes. The models were evaluated alongside standard computer visualization of the 3D model (see Figure). AR visualization was feasible in all cases and the primary operator was able to maintain sterility, perform manipulations, and share the view and manipulations of the model with a second operator (see Video). Subsequent interventions included LPA balloon angioplasty, transcatheter pulmonary valve implantation, aortic stent implantation, and RPA stent implantation, which were all successful. AR visualization of 3DRA is feasible, can be performed while maintaining sterility, and adds minimal procedural time. This technology has the potential to aid in planning of select transcatheter interventions. Future work should include the development of simulated interventions on 3DRAs in AR, hardware optimization to limit the need for extra equipment, and further improvement of image quality.