

Three-Dimensional Image Fusion to Facilitate Guidance of Complex Cardiac Catheterizations in Congenital Heart Defects - Results from an International Multi-center Registry.

Goreczny S. (1), Schubert S. (2), Dryzek P. (1), Kim S. (3), Sandoval J.P. (4), Morgan G.J. (5), von der Wettern J.M. (2), Moszura T. (1)

Department of Cardiology, Polish Mother's Memorial Hospital, Research Institute, Lodz, Poland (1); Department of Congenital Heart Disease/Pediatric Cardiology, Deutsches Herzzentrum Berlin, Germany (2); Department of Pediatrics, Sejong General Hospital, South Korea (3); Department of Pediatric Cardiology / Congenital Heart Disease, Ignacio Chavez National Institute of Cardiology, Mexico City, Mexico (4); Department of Cardiology, Colorado Children's Hospital & Department of Adult Congenital Cardiology, University of Colorado Hospital, USA (5)

Introduction

Developments in fusion imaging software have facilitated the use of three-dimensional (3D) roadmaps based on preregistered Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) datasets for live guidance of trans-catheter interventions. VesselNavigator (Philips Healthcare) allows direct fusion of fluoroscopic two-dimensional (2D) images with CT or MRI derived 3D roadmaps: 2D-3D registration.

Methods

International multi-centre, prospective study to evaluate fusion of CT and MRI datasets for guidance of cardiac catheterizations in congenital heart disease. Consecutive patients with pre-existing cross sectional imaging deemed clinically suitable by the operator for VesselNavigator assisted cardiac catheterization were included in the study.

Results

From 10/2016 until 11/2017, VesselNavigator was applied in a total of 141 cardiac catheterizations: in 126 patients for interventional guidance (89%) and in 15 for procedural planning (11%). In one hundred patients (71%), the fusion imaging was derived from contrast CT scans and the remaining 41 patients (29%) underwent MRI. Ninety-six interventions were performed in 92 patients with 34 patients having diagnostic catheterization. Stenting of right ventricular outflow tract (n=24), aortic coarctation (n=22) or pulmonary artery (n=17) was the most common intervention followed by balloon dilation of aortic coarctation (n=11) or pulmonary artery (n=10), collateral closure (n=5) and other (n=7). Successful 2D-3D registration was achieved on 96% of occasions (n=121). In the remaining 5 patients 3D-3D registration was used. Internal markers were used for registration in 102 patients (80%) and angiography was used in 25 patients (20%). In 42 patients (33%) catheterization was performed solely with 3D guidance with the remaining 85 patients (67%) requiring additional angiography. Overall, VesselNavigator guidance was judged useful or very useful in 107 patients (85%) and essential in 17 patients (13%). In three patients (2%) VesselNavigator guidance was not deemed useful.

Conclusions

Fusion of 2D fluoroscopic images with CT or MRI datasets is safe and effective method of guidance of cardiac catheterizations in various congenital heart defects. In selected patients 3D guidance allows percutaneous treatment without initial contrast application.