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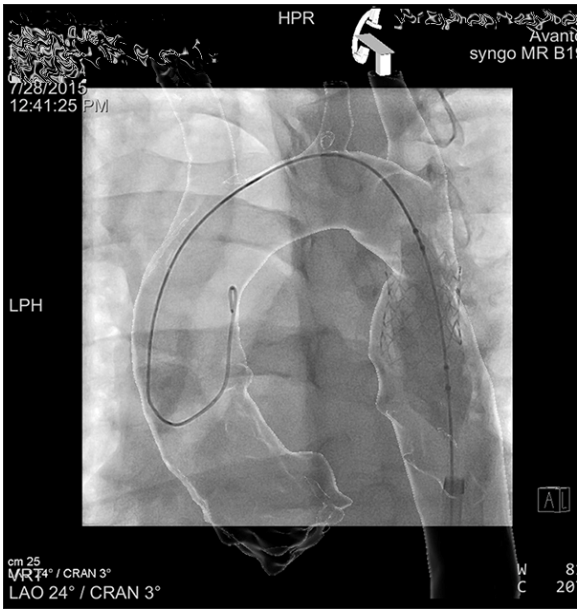
Next generation 3D-guidance for cardiac catheterization in congenital heart disease (CHD)

Glöckler M. (1), Ehret N. (1), Cesnjevar R. (2), Dittrich S. (1)
University Hospital Erlangen, Germany, Pediatric cardiology (1); Pediatric heart surgery (2)



Introduction: 3D-guidance in the cath lab for CHD is significant. The currently used 3D-models in VRT-format are not standardized and the commercially available registration needs an intraprocedural acquired 3D-dataset (Rotational angiography) with significant radiation.

Objectives: To evaluate feasibility and impact of tessellated 3D-models (triangulated surface-reconstruction) with new 2D-3D registration for now biplane 3D-guidance in catheterization of CHD.

Methods: Tessellated and segmented 3D-models (mesh in STL-format) are created from pre-interventional acquired MRI or CT by dedicated medical software (Mimics innovation suite). Accuracy of the tessellated models is evaluated in comparison to VRT-models. 2D-3D-Registration (between 3D-model and biplane fluoroscopy) was performed using a prototypic Siemens software solution (Monaco Workstation). Feasibility, accuracy of registration, visibility of the 3D-mesh and utility for intervention were evaluated in more than 50 cases.

Results: Measurements in STL-Meshes are significantly more accurate than in VRT-models. Overlaid on fluoroscopy visualization of STL-meshes are superior to VRT-Models. Nearly radiation-free 2D-3D-registration is practicable, using the trachea as fiducial marker.

Conclusions: 3D-meshes are the base for accurate, standardized and reproducible 3D-models; they can be used for 3D-roadmapping in the cath lab by 2D-3D-Registration. This technique has the potential to replace the rotational angiography in the pediatric cath lab.