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3D printed heart models in pediatric cardiology

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Objectives: To print 3D models of children hearts affected with complex congenital heart defects. To assess the accuracy of 3D printing by comparison of printed heart models with in vivo findings described by surgeons. To investigate the ideal form of printing in different types of congenital heart defects and to analyse the potential benefits of printed heart models use in surgical planning in pediatric cardiology.

Methods: Between December 2014 and March 2017, we printed 20 heart models for patients with congenital hearts defects. Initial data of heart anatomy came from CT images. A Bland-Altman analysis was used to evaluate the accuracy of 3D printing by comparing of cardiovascular proportions between models and in vivo surgical findings. The contribution of 3D printed heart models use for surgical planning improvement was analysed in all 20 patients.

Results: We successfully printed heart models in all 20 patients. The Bland-Altman analysis confirmed high accuracy of 3D heart printing. We printed the “cast types” of models, representing the “real” lumens of cardiovascular lumens, in 16 patients. The “meat-like types” of models, representing the “real” walls of cardiac chambers, were printed in specific

demand to image the real size of defects in ventricular septum, in 4 patients. All heart models provided us valuable preoperative information of congenital heart defects 3D anatomy.

Conclusions: 3D printers can be effectively used for exact printing of heart models of children suffering from complex congenital heart defects. Different types of models can be printed depending on indication. The use of printed heart models have a potential to improve preoperative planning in these patients.

Speaker Biography

Peter Olejnik MD, PhD is clinical deputy chief of Pediatric Cardiology Clinic of Comenius University Medical School in Bratislava. He trained in pediatrics at the Slovak Medical University of Bratislava and pediatric cardiology at the Comenius University of Bratislava, where he also obtained academic title “PhD”. He has been practicing since 2004, all 13 years in Bratislava, Slovakia, at the Department of Pediatric Cardiology of National Institute of Cardiovascular Diseases of Slovak Republic. His practise specializes in the care of children with congenital heart defects and interests include modern imaging methods in pediatric cardiology, i.e. computed tomography imaging and magnetic resonance imaging. He is focused on 3D printed heart models for children suffering with complex congenital heart defects.

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