This work presents a patient-specific 3D modelling and 3D printing procedure for surgical planning in case of complex heart diseases. The main steps of the adopted workflow are described below: the starting data for the whole process are represented by medical imagery. Parts of interest (chambers, vessels, etc.) are segmented and transformed in 3D models whose accuracy is checked through comparisons with the original data. The models are then adequately prepared to be physically reproduced through a low-cost additive manufacturing process (3D printing) for surgical planning and educational purposes. The procedure has been applied to two different case studies.

For both the case studies, multi-detector computed tomography (MDCT) imagery are available. The two patients suffer from different heart diseases: an old woman with a vascular prosthesis in the descending part of the aorta and a young man with severe pulmonary regurgitation and right ventricular dilatation.

The available data are processed in 3D Slicer (https://www.slicer.org/), an open source software package for medical image computing and visualization.

The meshes are corrected for the topological errors and prepared for the 3D printing process. Their accuracy assessment is performed by extracting sections in the three orthogonal main plane that are compared with the original MDCT volumetric data.

For each class, separate surface mesh models are generated using marching cubes (MC) and smoothing algorithms.

The mesh models are printed in polylactic-acid (PLA) using a Sharebot NG printer (http://www.sharebot.it/?lang=end, help3D.it).

The final 3D patient specific physical models are used by the surgeons for surgery planning.

**ACKNOWLEDGMENT**

Part of the presented work was financed by the IRCS (“Implementazione della Ricerca Clinico-Sanitaria”) project co-financed by the Autonomous Province of Trento, Italy.