

3D printing of heart with congenital heart disease-A case study

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Introduction and purpose:

To print 3D model of the heart with congenital heart disease. The 3D printed a physical model should provide more information for clinical management of patient

Conclusion :

Accurate Heart Model was successfully created using CT scan data and it helped to maximize the defect understanding and hence to improve the quality of solution.

Methods:

The management of congenital heart disease includes invasive as well as non-invasive or catheter based intervention with accurate timing. 3D printed physical model provides information for cardiologist and cardiac surgeons to manage patient from their perspective.

5 years old boy undergone Cardiac CT scan revealing situs ambiguus, ASD, VSD (Fig.1).

The DICOM data set was processed to reconstruct a 3D digital model by skillful segmentation using MIMICS software.

The model was exported as STL, format useful for 3D printing (Fig.2).SLS 3D printing Process was adopted with PA 12 Nylon material for fabricating the model.

With Clinician's inputs, the model is precut and built so as to maximize the visualization of the defects (Fig.3). A virtual planning with a CAD generated surgical patch is also exported as STL and printed and is tested for its suitability on physical model , sectional Model showing defect morphology (Fig.4)

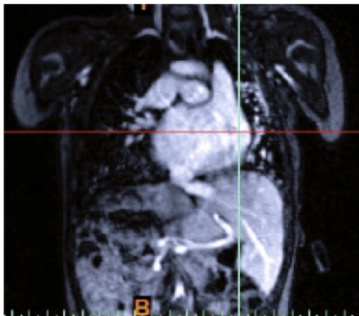


Figure 1.CT scan revealing situs ambiguus, ASD, VSD;



Figure 2.Reconstructed Heart model;

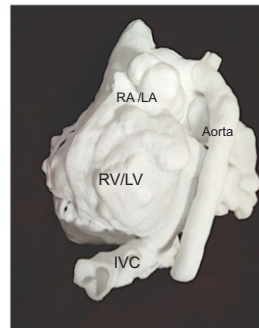


Figure 3. SLS 3D printed heart in Nylon

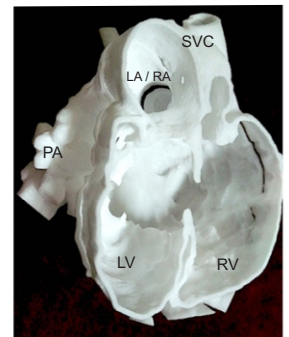


Figure.4 3D printed heart section showing the defect Morphology.

Results:

- The patient specific congenital heart defect condition is fabricated.
- CT data of patient was used as input.
- Advanced CAD / CAM tools are used to make an accurate physical model
- A patch prototype to repair the defect was made successfully.
- The procedure helped the surgical planning and surgery itself.