

3D-Printed Hearts Could Lower Surgeries

"3D imaging is a main theme of EuroEcho-Imaging this year and 3D printing of the heart is particularly exciting," said president of the European Association of Cardiovascular Imaging, Prof. Patrizio Lancellotti. "It allows us to make a perfect model of a patient's anatomy [1] and decide the optimal device and procedure in advance."

It is possible to create replicas of people's hearts using computed tomography (CT) or magnetic resonance imaging (MRI [2]) scans. The scans are then printed using flexible materials.

Dr. Peter Verschueren, who spoke on the topic at EuroEcho-Imaging 2014, said:

"Until recently, doctors would look at an image and then try to visualize the heart in 3D. Now they can use a 3D copy of an individual patient's heart to plan the procedure in detail before they go into the operating theater."

As well as congenital heart diseases [3], such as double outlet right ventricle or Tetralogy of Fallot, Dr. Verschueren says the 3D-printed hearts could be used to plan interventions for "complex bicuspid aortic valve cases that doctors want to treat with transcatheter aortic valve implantation (TAVI) and new transcatheter interventions for repairing or replacing the mitral and tricuspid valves."

Also at EuroEcho-Imaging 2014, biomedical research engineer Helen O'Grady presented a 3D-printed model of tricuspid regurgitation, which was used as a training aid. To create the model, CT scans of tricuspid regurgitation patients were used to build a 3D software model, which formed the blueprint for the 3D-printed heart.

O'Grady also molded a more flexible model to replicate the anatomical properties of the heart in the body as well as the motion of the valve.

"There is a variation in normal anatomies and more so in diseased anatomies such as tricuspid regurgitation," O'Grady told the attendees. She continued:

"Being able to practice on the model allows for better surgical planning and doctors can optimize the interventional procedure pre-operatively. Cardiologists, surgeons and physicians say there's nothing like having a tangible model in your hands as it gives such invaluable insight into the patient anatomy involved."

Another benefit of 3D models, she added, is that they can be used to discuss the intervention not only with the medical team, but with patients and parents of children with congenital heart defects.

"It helps everyone affected to better understand what the procedure will involve," she said.

3D printing to plan face transplants

In other 3D printing news, a study presented this month at the annual meeting of the Radiological Society of North America also made the case for CT-based 3D printing as a tool for [planning face transplantation surgery](#) [4].

To do this, surgeons made 3D-printed models of the patients' heads, which allowed them to physically hold and study a life-size model of the skull they would be operating on.

"If there are absent or missing bony structures needed for reconstruction, we can make modifications based on the 3D-printed model prior to the actual transplantation, instead of taking the time to do alterations during ischemia time," said Dr. Frank J. Rybicki, radiologist and director of Brigham and Women's Hospital in Boston, MA. "The 3D model is important for making the transplant cosmetically appealing."

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