

Advance Cardiology Programs

3D aPPROaCH lab



The new three-dimensional lab for the planning and printing of congenital heart disease (3D aPPROaCH Lab) uses advanced technology to support pre-surgical planning and family education for patients with complex heart conditions. This is accomplished through the use of both 3D virtual viewing and 3D printing.

Cook Children's is one of the only pediatric healthcare facilities in the United States to combine these technologies.

This cutting-edge technology allows cardiologists and cardiothoracic surgeons the ability to fully understand a patient's complex heart defect and plan their procedures and surgeries to the finest of details. It also allows for doctors to practice and perform procedures prior to the patient entering the operating room.

An in-house lab

The 3D virtual viewing software and 3D printer are housed in a dedicated lab on the campus of Cook Children's Medical Center. This makes it easier for physicians to access, collaborate and formulate detailed plans before going into the operating room to work on a complex case. Often times, a physician may only have hours to prepare for surgery so accessing this technology on campus ensures timely planning and access to printing.

It also facilitates collaboration of physicians across subspecialties to provide the most comprehensive care available.

How does it work?

Specialized software called True 3D uses existing medical image datasets to create virtual reality environments of patient-specific anatomy. Using the system, physicians are able to view and dissect these complex structures just as they would real, physical objects. The technology aims to make reading medical images more intuitive, help physicians reach diagnosis, and assist in surgical planning.

For complex cardiac cases, we then use a 3D printer to generate a life-size model of the heart to explore options for repair. The actual surgery can be simulated numerous times, making sure the treatment plan yields the desired results.

What are the benefits?

The benefits of this kind of technology are still evolving but include:

- Comprehensive three-dimensional understanding of a patient's anatomy.
- More informed or detailed surgical or interventional plan.
- Virtual surgery or catheterization procedures.
- Less time in the operating room, leading to fewer complications.
- Possible reduction in follow up surgeries or catheterizations.
- Improved survival rates in complex cases.
- Family consultation and education.
- Medical education for staff and students.

When might this be used?

The application of 3D planning has a wide spectrum of uses. Examples might include:

- Planning palliative repairs in rare forms of complex congenital heart disease.
- Pre-operative evaluation of unique manifestations of common forms of congenital heart disease.
- Creation of pre-operative templates for surgical baffles and septal defects.
- Virtual deployment of transcatheter valve (Melody, Edwards) in high risk patients
- Virtual deployment of percutaneous atrial septal defect devices in patients with multiple defects.
- Mapping and unifocalization of patients with tetralogy of Fallot and multiple AP collaterals.

How does 3D printing work?

3D printing (also known as rapid prototyping or additive manufacturing) is a process of making three dimensional solid objects from a digital file. The patient-specific models of the heart are constructed primarily from MRI and CT scans. The scan data is then reviewed by the cardiologist and used to create a digital virtual model with specialized software (Mimics InPrint, Materialise). This virtual model is uploaded to the 3D printer, and the printer deposits microscopic layers of the designated material (plastic, rubber or resin) until the model is complete.

How is the image generated?

Cardiac magnetic resonance imaging (cMRI) is performed to evaluate the structure and function of the heart and blood vessels. cMRI is noninvasive and takes pictures of the heart and surrounding structures using a large magnet, radio waves and a computer. The powerful 3-Tesla cMRI technology at Cook Children's enables us to create images of the heart with details so sharp, we are able see very small lesions, tumors and abnormalities in the structure of the heart. Computers then use the images to provide 3-dimensional images that can be printed out or projected as a movie.



The cMRI program and 3D aPPROaCH Lab at Cook Children's is led by Steve Muyskens, M.D., who specializes in the field of pediatric cMRI.

If you would like to schedule an appointment, refer a patient or speak to our staff, please call our offices at 682-885-2140.

Need help referring a patient?

Please call the International Patient Services department at +1-682-885-4685, send faxes to +1-682-885-2557, or email international@cookchildrens.org