



New pediatric hybrid cath environment

Designed from the ground up to improve care and convenience

Who/where

Established in 1883, Cincinnati Children's Hospital Medical Center in Cincinnati, Ohio, is a leading medical research and teaching hospital with 475 licensed beds.

Challenge

Develop a new pediatric hybrid cardiac cath environment to support a wide variety of complex pediatric cardiac catheterization, electrophysiology, and surgical/hybrid procedures.

Solution

Cincinnati Children's Hospital selected the Philips Allura Xper FD 10/10 bi-plane imaging system to meet the requirements for this demanding and specialized hybrid lab.

The Heart Center at Cincinnati Children's Hospital Medical Center in Cincinnati, Ohio features two state-of-the-art, fully digital, multi-functional cardiac catheterization labs. Each lab includes an Allura Xper FD10/10 biplane angiography system. Located within the inpatient cardiology ward, the catheterization suite is designed to handle the full range of diagnostic and therapeutic cases. Since the catheterization suite is the setting for a unique new "hybrid" approach to comprehensive care for children with congenital heart disease, it was also designed to accommodate simultaneous catheterization and surgical procedures when necessary. This includes the use of cardiopulmonary bypass (CPB). The current caseload is approximately 650 procedures annually.

In existence for more than 125 years, Cincinnati Children's and its staff have played a key role in many significant breakthroughs, such as developing an oral vaccine for polio, the first heart and lung machine, and a technique for preserving whole blood. Ranked third nationally in general pediatrics and eighth in cardiology and cardiac surgery by *U.S. News & World Report*, Cincinnati Children's has the only pediatric cardiac intensive care unit in the region.

When Russel Hirsch, M.D., Director, Cardiac Catheterization Laboratory at Cincinnati Children's, discusses his vision for creating a hybrid pediatric cardiac catheterization laboratory, one thing comes through loud and clear—a genuine passion

for his patients and their families. His commitment to developing an environment that offers a high level of patient care and clinical efficiency is obvious. "We strive every day to make the procedures as safe as we can for our patients," says Dr. Hirsch.

Dr. Hirsch and his team have spent several challenging years translating his vision into a reality. With two rooms opened in early 2007, the team at Cincinnati Children's is successfully advancing an innovative new configuration that combines a state-of-the-art, catheterization laboratory and a world-class open surgical suite. As Dr. Hirsch explains, "The lab is both an operating room and a catheterization laboratory.

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More hope for patients and their families

When Dr. Hirsch considers the impact the new hybrid environment will have on delivering better care to his patients, he believes things are definitely changing for the better. “We’ve reached the realization that surgeons can’t do everything in the operating room, and interventionalists can’t do everything in the cath lab. I think the ability to offer the patient treatment of their congenital heart disease in a setting where we can provide simultaneous quality imaging and superb surgery is just incredible. This is going to bring about huge, enormous benefits for the patients and their families. I think the future looks very good.”



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It has the full functionality of a standard cardio-thoracic surgery operating room, with the ability to use cardio-pulmonary bypass if we need to, with the obvious space prerequisites and everything else that is required. At the same time, we have excellent angiographic visualization so we can, on a day-to-day basis, perform cardiac catheterizations like we ordinarily would.” As a result, the interventional cardiologists and cardiothoracic surgeons at Cincinnati Children’s are redefining how they can address the full range of procedures associated with congenital heart disease.



At the center of this new hybrid environment, Dr. Hirsch needed biplane cath labs that have been designed specifically for hybrid congenital labs—with an emphasis on reducing dose levels to patients and staff. Having a reliable system with outstanding imaging quality was of the utmost importance. There were also some very specific mobility

and geometry specifications that needed to be met, so Dr. Hirsch and the decision makers at Cincinnati Children’s decided that having an innovative team working together, even to the point of developing some unique modifications to the equipment and the way it was installed.

Dr. Hirsch also points out that a planning team needs to pay special attention to the needs for space and clinical efficiency in the hybrid environment. “Some of the custom modifications (in the room design) may not be appreciated by the casual observer. For example, the gantry, which supports the bank of six monitors, is offset. We can move the tower of monitors all the way back from the table, and as close to the wall as we possibly can—we can then accommodate a number of people around the table if we need to.” He also points out that the monitor suspension has the ability to move up and down. “That is also particularly useful in this facility,” he says. “It’s that kind of flexible design where (the team has) come up with a good solution.”

**A hybrid lab from the ground up—
for neonates to young adults**

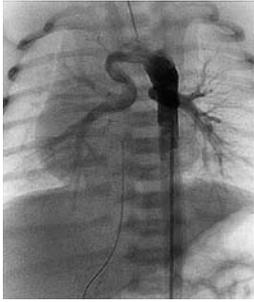
Ease of use for a wide variety of pediatric cases is key to taking care of children. Dr. Hirsch explains, “We need to use this for every type of patient, both cath and EP. User interface (needs to be) very intuitive.”

With safety always at the forefront of his thinking, minimizing the amount of patient and staff exposure to radiation is key.

After reading the literature, a priority was for “the radiation dose to the patient (to be) less for the same angiography,” says Dr. Hirsch. Dr. Hirsch has noted that his use of high-dose acquisitions has decreased since switching to a system that allows prospective or retrospective storage of fluoro runs. This saves considerable dose to patients and staff, as it eliminates the team having to make an acquisition to document something that has been correctly visualized using fluoroscopy. Collimation on last image is very useful, as this feature provides no radiation preparation of the next run. Another very useful feature is a dose display that gives meaningful feedback on the amount of time remaining to image a zone in the patient’s chest before reaching the 2 Gy limit.

Dr. Hirsch continues that for his lab these day-to-day features are, “very important, incredibly useful innovations, because really it’s all about dose. It’s all about reducing radiation.”

Another major concern is limiting contrast usage. Dr. Hirsch emphasizes the link between image quality and contrast. “If you get a better image, you can use less contrast,” he says. While acknowledging that the amount of contrast used is a multifaceted issue, Dr. Hirsch says, “The image quality is key. If you have poor image quality, it doesn’t matter how much contrast you give, you are going to get a poor image.”



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Enhanced access to the patient for wide variety of cases

Dr. Hirsch describes equipment mobility and flexibility as being a fundamental requirement in the hybrid environment. Insuring maximum access to the patient is critical, both for the cath staff, as well as for the specialized surgical staff that might have to be brought in. And that access has to be achievable in a minimum amount of time. The detector and gantry should be easily moved out of the traditional imaging position. Staff should have the option of either applying direct pressure and pushing the equipment or automatically repositioning it using the tableside control module.

Dr. Hirsch says, “The mobility of a system needs to be very good. The lateral camera and detector should park far out of the way. The AP camera should swing in either direction, up to 180 degrees, on a pivot point that puts the entire structure well away from the table. That way we can move other equipment around in there. It allows the surgeons to have excellent access to the patient”.

“We do have room at the table for the surgeons plus the biplane cameras; however, in hybrid procedures we often only need one good view—so we have a unique geometry that helps us get any view we need with a single camera, freeing up a lot of space around the table.”

He observes that having a table that cannot only tilt but also roll the patient is highly useful for the surgeons. Surgeons often ask to roll the patient during hybrid procedures, to improve visibility or to remove bubbles. “Having an angiography table that can tilt and also roll the patient is fantastic.



Automatically isocentering speeds the interventional portion of the procedures, so it further reduces radiation.”

Dr. Hirsch reviews the long list of hybrid of cases that he has performed in the lab, including Hypoplastic Left Heart Syndrome (HLHS) Stage 1 palliation, and notes that the facility has well accommodated the many different hybrid procedures that the Cincinnati Children’s team has been asked to perform.

The motivation for a hybrid environment

There’s no doubt in Dr. Hirsch’s mind about the rationale for pursuing this new approach to pediatric cardiac care. He points to a number of different scenarios where the traditional distinctions between the cath lab and open surgical suite may impact patient care and staff efficiency. “All too frequently,” he explains, “we were called down to the operating room to do procedures that are catheter related on patients who were on bypass, or who had their chests open.

We would attempt to balloon dilate, or place stents or devices, but with very poor angiographic assistance. On the other hand, not infrequently, we would call the surgeons to the cath lab to help us get vascular access, or to do other surgical procedures during cardiac catheterizations in an environment that really wasn’t an operating room.”

There is an acute awareness of the added strain placed on families when a procedure has to be rescheduled because something didn’t go as planned. According to Dr. Hirsch, “There are situations where we think we are going to be able to complete a procedure percutaneously with catheters, but we aren’t able to.” As an example, Dr. Hirsch describes a patient with a very large atrial septal defect (ASD). “Most of the time, we are able to close these with devices, but if we were unsuccessful, those patients would need to be awakened, rescheduled and brought back at a different time. Then they would again undergo general anesthesia for surgery to complete the ASD closure.”



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Now, in the case of an ASD closure procedure that fails, Dr. Hirsch explains, “We have the facility to simply keep the patient in the room under general anesthesia and create the operating room directly around him by bringing in the perfusion staff, OR staff, and surgeons.” He is confident that his team can offer family convenience and piece of mind that they will have the surgery taken care of in one setting.

Many of the patients Dr. Hirsch cares for have substantial multi-organ disease and frequently undergo various procedures at one setting. So for example, a patient who is having a cardiac catheterization may also need to be transferred down to the operating room to have a bronchoscopy while under general anesthesia. “Now what we can do is offer that family the option to get the cardiac catheterization and all other necessary procedures completed without having to transport the patient to different areas in the hospital,” says Dr. Hirsch.

Dr. Hirsch believes the new environment offers his patients a better setting for a range of care. “We’re not compromising our patients’ well being by doing an operation in an environment that isn’t set up for surgery.”

Hoping for the best, preparing for the worst

Not surprisingly, Dr. Hirsch’s focus never strays far from the patient. He explains, “The bottom line is there are times when we have a critically ill patient on the table. I don’t want to be too dramatic, but with the right room design and protocols more children can be saved, and that’s why we do what we do. These are incredibly complex procedures, and we need to be very organized.”

In assessing how things went in the first of many hybrid procedures he has performed, Dr. Hirsch says, “I was extremely proud of our people. The systems worked very, very well. The equipment performed beyond expectation. Everybody had exactly what he or she needed. The patient was cared for with a favorable outcome. We expect the best and prepare for the worst.”

Reliability and commitment in the hybrid cath lab

“Frankly, this equipment gets hammered every single day. We do between 550 and 650 cases a year. They are long cases, and the demands on the equipment are great.” When he says long cases, he means sometimes four+ hours long or even longer. “We’re working on very small babies, and often in high acuity situations. We have to have confidence in all of the machinery, and the support behind it.”

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