Using the Hybrid Approach in the Correction of Congenital and Structural Heart Disease

By Ziyad M. Hijazi, MD, MPH

As one of the top five medical centers in the US, Rush University Medical Center in Chicago opened the Rush Center for Congenital and Structural Heart Disease to address the needs of patients born with heart abnormalities and adults suffering from structural heart defects. Rush brings together a distinguished team of cardiac specialists, including interventional cardiologists, electrophysiologists, transplant cardiologists, echocardiologists and cardiovascular surgeons, along with state-of-the-art X-ray vascular technology to handle the most complex cases and provide the best care possible.

As a pioneer in the non-surgical correction of congenital heart defects, I was recruited by Rush University to help shape the vision and methodology of Rush Center for Congenital and Structural Heart Disease and to practice the innovative “hybrid” approach to treating patients with heart defects, including infants and adults with congenital and structural heart conditions, ranging from asymptomatic to life-threatening. At the time the Rush Center opened, it was one of only three places in the country employing this type of innovative hybrid approach to treating heart disease. It is still one of the most experienced centers in hybrid cardiovascular intervention today.

In this article, I address using the hybrid approach for the correction of congenital and structural heart disease, common hybrid procedures including Hypoplastic Left Heart Syndrome (HLHS), and factors to consider when building a hybrid operating room (OR) suite.

Defining The Hybrid Approach

The hybrid approach brings interventional cardiologists, like myself, along with cardiovascular surgeons and other clinical experts together in the operating room (OR) to offer a complete, collaborative medical solution. Unlike most medical centers where patients are moved to various departments based on what procedures are being performed, the hybrid approach allows patients to be treated in a single OR suite that includes state-of-the-art vascular imaging technology. A well-designed hybrid OR suite allows for vascular imaging, implanting small devices such as stents, devices and open-heart surgery to be performed in the same setting using a single vascular X-ray system, making a hybrid OR extremely efficient for patients and physicians, alike.

Beyond the potential patient benefits of non-surgical intervention, performing multiple procedures, both hybrid and traditional, using a single hybrid OR suite is extremely cost-effective for the hospital. By performing multiple types of procedures in a single OR suite, the hospital’s space and imaging technology are better utilized. Additionally, in the event that a patient undergoing non-surgical intervention requires emergency surgery, the hybrid OR room is already sterile and

Dr. Hijazi is using the Toshiba Infinix CF-i/BP to perform a percutaneous procedure.

Dr. Hijazi and his team are using the Toshiba Infinix CF-i/BP in the hybrid approach while transmitting live via satellite to an educational meeting.
equipped with the proper tools and technology needed for the clinical staff.

**Common Hybrid Procedures**

When performing hybrid procedures, unparalleled access to the patient for the interventional cardiologist, cardiovascular surgeon and other clinical staff is critical for success. Many of the hybrid cases performed at Rush Center for Congenital and Structural Heart Disease include muscular ventricular septal defects and Hypoplastic Left Heart Syndrome (HLHS).

For infants born with HLHS, we can use hybrid intervention to temporarily correct the condition without the patient being put on cardiopulmonary bypass. Going through a median sternotomy, the cardiovascular surgeon bands the left and right branch pulmonary arteries. This is followed by the interventional cardiologist completing a stent implantation in the ductus arteriosus. In a case where the atrial septal communication is restrictive, a stent is placed across the patent foramen ovale, either percutaneously or via a per atrial route.

This hybrid approach for HLHS is far less strenuous for the infant than bypass surgery, which would require the infant’s heart to be supported by a machine. After hybrid intervention on HLHS is completed, the infant can grow larger and stronger for several months before the more comprehensive stage II (Norwood and Glenn) procedure is needed.

**Factors to Consider When Creating a Hybrid OR Suite**

In order to make the hybrid approach successful, a state-of-the-art interventional vascular X-ray system must serve as the foundation of any hybrid OR suite. The vascular X-ray system must be dependable, produce high-quality images and most importantly, must provide access for the entire clinical team to work together around the patient without compromising quality, efficiency or safety. To maximize the hybrid OR suite, we use it to perform both hybrid interventional and traditional X-ray vascular procedures.

At Rush Center for Congenital and Structural Heart Disease, we use the Toshiba Infinix™ CF-i/BP and have been very pleased with its capabilities. The system provides crisp images and amazing views, especially when we perform hybrid intervention. The design of the Infinix CF-i/BP makes it ideal for performing hybrid procedures on pediatric and adult patients. The five-axis system allows movement of the C-arm and lateral detectors away from the head of the table, which creates 180 degrees of open access at the head of the table, providing better access for anesthesia, echo and procedures performed from the neck and upper chest area. Its design also enhances collaboration between clinicians and critical equipment used to aid diagnosis and treatment. Since some of these procedures are performed on infants, we use the high-definition flat panel detector to see contrast, dynamic resolution and visualization of small details, such as infant blood vessels.

Along with other leaders in hybrid intervention, I have used the Infinix CF-i/BP to perform live pediatric cases at educational conferences, including Pediatric Interventional Cardiac Symposium (PICS) and the Hybrid Approach to Congenital Heart Disease (ISHAC) symposium for hundreds of clinicians via live satellite transmission. Rush Center’s hybrid OR suite is equipped with state-of-the-art broadcasting equipment to continue our commitment to advancing education of pediatric patient treatment. These conferences bring together international faculty to provide demonstrations, live operations and the latest breakthroughs in interventional cardiology for congenital heart disease.

Centers including Nationwide Children’s Hospital in Columbus, Ohio, led by my colleague John P. Cheatham, MD, and Rush Center for Congenital and Structural Heart Disease have experience in hybrid intervention for HLHS and are dedicated to continuing to refine this innovative approach to improve patient outcomes. Centers looking to establish their own hybrid approach using a hybrid OR suite may consider collaborating with well-established centers with proven track records, such as the teams at Nationwide Children’s or Rush Center, to learn first-hand about the hybrid approach and the patient care that follow.

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