Le Bonheur Children’s Heart Institute is ranked as a top pediatric cardiology and heart surgery program by U.S. News and World Report and continues to improve the quality of life for hundreds of children with heart defects.

Highlights of the institute include:

- A state-of-the-art heart catheterization lab, including the only hybrid catheterization lab in the region.
- The region’s only pediatric electrophysiologists.
- Three-dimensional reconstruction capabilities and expertise in cardiac MRI.
- Joint research with St. Jude Children’s Research Hospital.
- Expertise in some of the most complex heart defects, including Ebstein’s Anomaly.

**Heart Institute minimizes blood loss, reduces transfusions in surgeries**

More than 20 percent of Le Bonheur’s open heart surgeries are now bloodless, meaning no blood or blood products are given during surgery. The Heart Institute has been taking aggressive steps to minimize blood loss during surgery and reduce perioperative blood transfusions over the last 18 months.

“Blood transfusions increase a patient’s risk of developing complications; it’s like getting a mini transplant,” said Chief Perfusionist Jerry Allen, CCP. “Blood transfusions are a known cause of whole body inflammation and have been linked to increased morbidity and mortality after cardiac surgery.”

For children weighing more than 34 pounds, more than 60 percent will have bloodless surgery, even if they have undergone previous operations during their lifetime, says Allen.

Allen’s team has focused on decreasing the cardiopulmonary bypass (CPB) circuit surface area, using shorter tube lengths and decreasing tubing diameters. This allows for less contact between the

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**HEART INSTITUTE OUTCOMES: 2013**

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Meet the Team

The Heart Institute at Le Bonheur Children’s Hospital uses the combined expertise of an advanced pediatric cardiology team to provide specialized care for children with congenital heart disease. Pediatric cardiologists, pediatric cardiology surgery, cardiac intensivists, pediatric intensivists and anesthesiologists make up the Heart Institute. Advanced practice nurses, perfusionists, cardia nurses, respiratory therapists and lab and imaging technicians are specially trained in pediatric cardiology care.

Leaders of the Heart Institute include:

- **Vijay Joshi, medical director of Non-Invasive Cardiology, interim chief of Division of Pediatric Cardiology, UTHSC Department of Pediatrics**
  - Vijay Joshi, MD, attended medical school at the University of Vermont and completed a fellowship in pediatric cardiology at Children’s Hospital of Philadelphia. Board certified by the American Board of Pediatrics with a cardiology subspecialty. His areas of focus include interventional pediatric cardiology, including therapeutic catheterizations for critically ill neonates, critically ill preoperative patients and complex cases of adults with congenital heart disease and transcatheter closure of intracardiac shunts.

- **Mayte Figueroa, medical director of Cardiovascular Intensive Care Unit**
  - Mayte Figueroa, MD, is a graduate of Mount Sinai School of Medicine. She completed fellowships in pediatric cardiology at both Mount Sinai Hospital and the Medical University of South Carolina. Figueroa is board certified in pediatrics and has a cardiology subspecialty. She is also an associate professor at UTHSC. Her patient care emphasis is on general cardiology with focus on fetal cardiology, advanced echocardiography, cardiac MRI and exercise testing.

- **Glenn Wetzel, medical director of Pediatric Electrophysiology, director of Fellowship Program**
  - Glenn Wetzel, MD, PhD, completed fellowship training in pediatric cardiology at University of California at Los Angeles. He is board certified by the American Board of Pediatrics and has a cardiology subspecialty. Wetzel is also a professor at UTHSC. His special interests include pediatric electrophysiology (arrhythmias), radiofrequency ablation and cryoablation, cardiomyopathy, pediatric pacemakers and internal defibrillator devices (ICDs).

- **B. Rush Waller, medical director of Cardiovascular Catherization Lab; interim co-director of Heart Institute**
  - B. Rush Waller, MD, PhD, completed fellowship in pediatric cardiology and pediatric interventional cardiology at the Medical University of South Carolina. Waller is an associate professor at UTHSC and is board certified by the American Board of Pediatrics with a cardiology subspecialty. His areas of focus include interventional pediatric cardiology, including therapeutic catheterizations for critically ill neonates, critically ill preoperative patients and complex cases of adults with congenital heart disease and transcatheter closure of intracardiac shunts.

- **Chris Knott-Craig, medical director of Cardiovascular Surgery and co-director of Heart Institute**
  - Christopher Knott-Craig, MD, graduated from the University of Cape Town in South Africa and completed training in cardiac surgery at the Groote Schuur Hospital in South Africa. He is board certified by the South African Medical & Dental Council in cardiothoracic surgery. Knott-Craig is also a professor for The University of Tennessee Health Science Center (UTHSC) School of Medicine. His areas of special focus include neonatal/infant cardiac surgery, Ebstein’s anomaly, Ross Procedure, minimally invasive valve surgery, cardiopulmonary bypass, ambulatory thoracic surgery, hyperhidrosis and pediatric congenital heart disease.

Study: Small diameter stents can be “unzipped”

Interventional cardiologists at Le Bonheur Children’s are testing options to “unzip” small diameter stents and give infants more options for implantation. Their study of eight popular stents found that small diameter stents can be unzipped and that stainless steel stents, of the closed cell design, were best suited to unzip. These stents unzipped predictably at twice their nominal diameter with minimal shortening.

“We hope this study will encourage physicians to implant small stents in growing infant blood vessels and help in the selection of the appropriate stent type,” said Shyam Sathanandam, MD, a lead author on the study.

Potential benefits of this work is that, with an unzipable stent, it may be possible to non-surgically thread a balloon catheter into the vessel and gradually dilate the stent until it unzips. Then the narrow vessel can be re-stented with a larger stent that can be re-dilated to the eventual adult vessel diameter, without removing the old stent.

In the study, small diameter stents of different design types were dilated using angioplasty balloons in vitro. Investigators performed small increment dilations in balloon size to prevent napkin ringing and then dilated the stents until they unzipped, radially fractured, or both. Investigators measured pressures used to dilate the stent and change in length, thickness and diameter. They also calculated the hoop stress, Tresca Yield Point force when stent fractured, ratio of change in length to stent and change in length, thickness and diameter. They also calculated the hoop stress, Tresca Yield Point force when stent fractured, ratio of change in length to stent and change in length, thickness and diameter. They also calculated the hoop stress, Tresca Yield Point force when stent fractured, ratio of change in length to stent thickness and change in length and diameter. They also calculated the hoop stress, Tresca Yield Point force when stent fractured, ratio of change in length to stent thickness and change in length.
Quality Efforts Improve Outcomes

Le Bonheur Children’s has improved outcomes for children who undergo cardiovascular surgery, thanks in large party to key quality initiatives. Those quality measures include:

• Implementation of cardiopulmonary bypass strategies to optimize renal function and neurological outcomes after surgery in infants 0-60 days old. Since January 2010, only 1 percent of these Le Bonheur patients have experienced acute renal failure and 1.5 percent have experienced neurological complications, compared to the incidence rate of 6-16 percent cited in published studies.

• Reduction of central line-associated bloodstream infections (CLABSI) in the Cardiovascular and Pediatric Intensive Care units. Together, the units maintained a rate of .44 infections per 1,000 line days in 2012 — against a national benchmark of 1.85. The CVICU hasn’t encountered a CLABSI in 19 months.

• Aggressive steps to minimize blood loss during surgery and reduce perioperative blood transfusions in the last 18 months. More than 20 percent of heart surgeries are now bloodless.

• Improving the post-operative care for patients in the CVICU with continued training — using simulations as well as didactic methods — of expert nurses and physicians trained in pediatric heart surgical care.

CVICU CLABSI rates fall

Hospital-wide central line-associated bloodstream infection (CLABSI) rates at Le Bonheur Children’s were reduced by 65 percent from 2011 to 2012. The improvements have helped protect children in the hospital’s Cardiovascular Intensive Care Unit (CVICU) and Pediatric Intensive Care Unit (PICU) from central line-associated bloodstream infections for more than one year. Other inpatient units saw additional reductions in infections.

Michelle Grandberry, clinical director of Le Bonheur’s CVICU, attributes the reduction in part to a more judicious use of central lines in the CVICU. Since 2010, the team has seen a 26 percent decrease in central line usage after incorporating discussions of line necessity into daily CVICU rounds.

“Team members are more aware of CVL, including timing of tubing, cap and dressing changes. They take the time to inspect and discuss the integrity of the central line during bedside handoff. We also have a hard stop for any dressing that is not pristine,” Grandberry said.

Electrophysiology lab reduces fluoroscopy use

Le Bonheur’s Heart Institute – the only center in the region offering pediatric electrophysiology expertise – has taken steps to reduce the use of fluoroscopy in its catheterization lab. Fluoroscopy, an imaging technique that uses X-rays to obtain real-time moving images of the heart’s internal structures, is often used in conjunction with 3-D mapping to help pinpoint the origin of complex arrhythmias. Fluoroscopy is most often used to help guide catheters and to confirm the correct location for invasive procedures such as radiofrequency ablation and cryoablation.

Three-dimensional mapping, a non-invasive technology, is an increasingly popular alternative to radiation usage. Variations of 3-D imaging have been available for use in the cath lab setting for approximately 10 years, and Le Bonheur’s electrophysiology team has been using the technology for eight years. As the 3-D technology improves and team members become increasingly comfortable using this modality for imaging, the lab is minimizing fluoroscopy time – aiming to complete procedures with relatively low or no radiation.

“While the amount of radiation exposure during these procedures has always been relatively low, our radiation usage now is ALARA – as low as reasonably achievable – and there has been a definitive reduction in fluoroscopy time,” said Glenn Wetzel, MD, PhD, a Le Bonheur pediatric cardiologist and medical director of Pediatric Electrophysiology. “In addition to minimizing each patient’s radiation exposure, we have avoided such alternatives as transesophageal echocardiogram and larger catheters placed in the leg, which are not appropriate for most children.”

Reducing radiation exposure is a key focus for all Le Bonheur subspecialties, particularly for children with chronic conditions who require multiple scans and procedures.
Pediatric Heart Update is a publication of the Heart Institute at Le Bonheur Children’s Hospital

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B. Rush Miller, MD, Interim Co-Director, Heart Institute
Vijay Joshi, MD, Interim Chief, Division of Cardiology, UTHSC

Publications


Shyam Sathanandam. 46th Annual Southeastern Pediatric Cardiology Society meeting, Sep 19-21, 2013, Biloxi, MS


Book Chapters

