May 2017

Innovations in Cardiology & Heart Surgery

Rady Children's Hospital San Diego

Rady Children's - A comprehensive system focused solely on children.

PEOPLE

Dr. John J. Nigro joins Rady Children's to lead cardiac surgery program and Heart Institute

John J. Nigro, M.D., a cardiothoracic and heart transplant surgeon, has joined Rady Children's Hospital-San Diego as chief of cardiac surgery, director of cardiac transplantation and the mechanical assist program and director of the Heart Institute. Previously, he worked at Phoenix Children's Hospital Heart Center, where he held similar roles. Dr. Nigro has considerable experience and an interest in complex neonatal heart surgery and pediatric heart transplantation.

Under his leadership, Rady Children's Heart Institute will continue to focus on providing the highest quality comprehensive care to congenital heart patients. Care will be delivered to provide the best possible patient experience in a family-centered environment and to optimize long-term outcomes after heart surgery. The vision is to provide this care with an integrated multidisciplinary team and to help create a regional network to care for all patients with congenital heart disease.

Dr. Nigro received his medical degree from the University of Illinois School of Medicine at Chicago. He completed his internship and surgery residency at LAC + USC Medical Center, a cardiothoracic surgery residency at LAC + USC Medical Center and a pediatric cardiothoracic surgery and transplantation fellowship at Children's Hospital Los Angeles.

A frequently invited lecturer, Dr. Nigro is widely published. His professional society memberships include the Society of Thoracic Surgeons, Western Thoracic Surgical Association and International Society for Heart and Lung Transplantation.

PROGRAMS

Acute Cardiac Unit provides comprehensive, seamless care

Rady Children's Hospital's Acute Cardiac Unit, directed by Justin Yeh, M.D., provides a full range of cardiac services to patients of all ages (newborn to adult) with both congenital and acquired heart disease.

Services include perioperative management of patients undergoing heart surgery, treatment of heart failure/arrhythmias/pulmonary hypertension, heart transplant care and the management of other pediatric conditions in the setting of complex cardiac disease. When needed in patients with extreme lung or cardiac failure, mechanical support in the form of extracorporeal membrane oxygenation (ECMO) and ventricular assist devices (VADs) can be provided.

The unit consists of a cardiovascular intensive care unit (CVICU) and cardiac step-down unit (CSU), with all 30-beds capable of functioning as a CVICU- or CSU-level bed. This assures an appropriate level of care based on the patient's needs. Staffed by cardiac critical care physicians and nurses, 24 hours a day, the CVICU cares for cardiology and cardiovascular surgery patients when they are most critically ill. As patients recover, they progress to the CSU and on to discharge.

Care is provided using a multidisciplinary approach by a team including cardiac intensivists, neonatologists, cardiologists, cardiac surgeons, nurses and respiratory therapists. Patients also receive dietary services, social services and child life services.

To ensure continuity of care, the team that cares for patients throughout their procedures continues to care for them in the Acute Cardiac Unit afterwards. Since a consistent team cares for all cardiac patients admitted to the unit, patients who return to Rady Children's Hospital for subsequent procedures will recognize their doctors and nurses.

RESEARCH

Intentional fracture of previously placed stents: impact of pre-stenting in a piglet model

An abstract co-authored by Howaida El-Said, M.D., Ph.D., and John Moore, M.D., M.P.H., among others, received the best abstract award at the Pediatric Interventional Cardiology

Rady Children's Hospital San Diego

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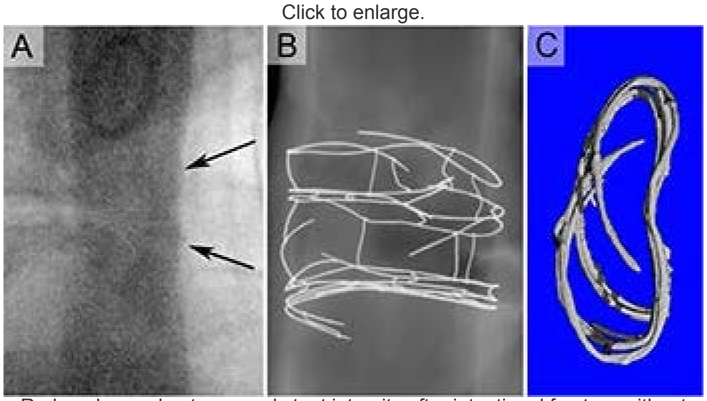
Questions & Comments

Symposium held in January. The research showed multiple advantages of pre-stenting using a piglet model that simulated the aorta of a growing child.

Spontaneous stent fracture in humans has been reported to cause stent collapse, hemodynamic compromise and embolization of stent fragments, many of which were treated with pre-stenting. Intentional stent fracture in vivo has also shown medial dissection/vessel injury.

Click to enlarge.



Reduced vessel patency and stent integrity after intentional fracture without pre-stenting. A: Angiogram demonstrating mild decrease in the diameter of the stented vessel segment compared to adjacent area two months after intentional fracture and re-dilation of a 6 mm Cook Formula 418 biliary stent with an ultra-high-pressure 16 mm Atlas balloon. Black arrows indicate the edges of the Cook stent. B: High-resolution radiograph of the same segment demonstrating fractured circumferential struts. C: Down the barrel view of a 3-D rendition CT image of the same stent demonstrating severely compromised luminal diameter in the antero-posterior dimension with struts protruding into the vessel lumen.

In their study, the researchers aimed to evaluate the effects of pre-stenting prior to intentional stent fracture by studying the short- and mid-term effects on the vessel size and integrity in a piglet model. Five months after 14 low-profile stents (Cook Formula 418 stents) were implanted in the aorta of four piglets, they were intentionally fractured using high-pressure balloons. In one group, an additional supporting stent was placed prior to fracture (pre-stent group) while the second group had the stents broken without the supporting stent (single-stent group). Vessels/stents were then studied at both short-term and mid-term intervals.

The researchers found that the pre-stent group not only demonstrated significantly larger vessel lumen area than the group with the single stent (109 (89-141) mm2 versus 57 (47-73) mm2, p=0.0190), but showed less mid-term luminal diameter loss (44 (26-59) percent versus 75 (62-85) percent, p=0.0065), a lack of strut protrusion and improved endotheliziation (100 (89-100) percent versus 73 (56-96) percent, p=0.0221). Additionally, while the vessel wall injury was similar at the time of stent fracture in both groups, the injury score improved significantly at mid-term in the pre-stent group compared to the single-stent group (p=0.0463). No damage to the external part of the blood vessels or the surrounding soft tissue was noted in either group.

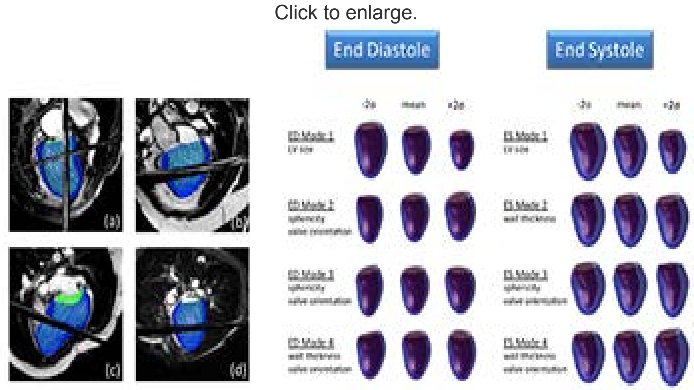
INNOVATIONS

Collaborative project to establish and study computational models of congenital heart disease

James Perry, M.D., and Sanjeet Hegde, M.D., Ph.D., of the Division of Cardiology are engaged in translational research with the Department of Bioengineering at UC San Diego that seeks to develop and investigate uses of computational models of complex congenital heart disease (CHD).

The study, called the Congenital Heart Disease (CHD) Atlas, is funded by an R01 National Institutes of Health grant that includes Drs. Perry and Hegde, along with bioengineering professors Andrew McCulloch and Jeffrey Omens. It is part of the Cardiac Atlas Project, a worldwide initiative to establish a structural and functional atlas of the heart.

Click to enlarge.



Atlas-based ventricular shape analysis for understanding congenital heart disease

The Congenital Heart Disease (CHD) Atlas represents MRI data sets, physiologic clinical data and computer models from adults and children with various congenital heart defects. The data has been acquired from several clinical centers, including Rady Children’s Hospital, UC San Diego Medical Center and Starship Children’s Hospital in Auckland, New Zealand. The purpose of the study is to create a database of cardiac images and computational models in CHD patients that will enable clinicians and scientists to examine detailed ventricular shape and function in individual patients and compare them statistically against a database of other similar CHD patient examinations.

The computational models in this database allow for improved quantitative analysis of ventricular remodeling and changes in function to provide optimal management of CHD. Studies include child and adult patients with single ventricle physiology states (e.g. hypoplastic left heart syndrome, tricuspid atresia), tetralogy of Fallot and aortic coarctation. Imaging and clinical data are typically obtained before and after palliative treatments such as the Fontan procedure or valve replacements. Already, the models are providing insight into CHD-specific alterations of shape and functional properties that may prove predictive of long-term outcomes and interventional success or failure.

Among other research collaborations with UC San Diego, Dr. Hegde and Kanishka Ratnayaka, M.D., with guidance from John Moore, M.D., M.P.H., and Dr. Perry, are working with mechanical engineers from UC San Diego to develop novel MRI compatible technology. Dr. Perry is currently an advisor for UC San Diego undergraduate students in mechanical and aerospace engineering for their senior projects, which include electrocardiography, flow dynamics in cardiac pacing and non-invasive epicardial activation sequence predictions for normal and abnormal cardiac rhythms. The cross-campus collaboration has resulted in innovative and cutting-edge research.