

# CONGENITAL CARDIOLOGY TODAY

Timely News and Information for BC/BE Congenital/Structural Cardiologists and Surgeons

April 2014; Volume 12; Issue 4  
North American Edition

## IN THIS ISSUE

### Real-Time-Three-Dimensional Echocardiographic Assessment of Atrial Septal Defects

By Donald J. Hagler, MD  
~Page 1

### Image of the Month #9: April, 2014 - The Archiving Working Group

Contributors: Jeffrey P. Jacobs, MD;  
Jorge M. Giroud, MD; Robert Anderson,  
MD; Vera D. Aiello, MD; Diane E.  
Spicer, BS; Charles W. Shepard, MD  
~Page 8

### Case Series: Unusual Causes of Dynamic ST-T Segment Changes

By Tabitha G. Moe, MD; Edward K.  
Rhee, MD; Joseph Graziano, MD  
~Page 12

### Upcoming Medical Meetings

(See [www.cct.bz](http://www.cct.bz) for additional meetings)

#### 5<sup>th</sup> Phoenix Fetal Cardiology Symposium

Apr. 23-27, 2014; Phoenix, AZ USA  
[kpoole@phoenixchildrens.com](mailto:kpoole@phoenixchildrens.com)

#### The 61<sup>st</sup> Annual Conference of the Israel Heart Society in association with the Israel Society of Cardiothoracic Surgery

Apr. 30-May 1, 2014; Tel-Aviv, Israel  
[israelheart.com](http://israelheart.com)

#### World Congress of Cardiology Scientific Sessions 2014

May 4-7, 2014; Melbourne, Australia  
[www.worldcardiocongress.org](http://www.worldcardiocongress.org)

#### SCAI 2014 Scientific Sessions

May 28, 2014; Las Vegas, NV USA  
[www.scai.org](http://www.scai.org)

#### Basic & Advanced Fetal Cardiology Symposium Workshop

Jun 5-6, 2014; Chicago, IL USA  
<http://fetalcardiacsymposium.com/>

#### Cardiac Imaging for Structural Heart Disease Special One Day Symposium at PICS-AICS

Jun. 7, 2014; Chicago, IL USA  
[www.picsymposium.com](http://www.picsymposium.com)

#### PICS-AICS

Jun. 7-10, 2014; Chicago, IL USA  
[www.picsymposium.com](http://www.picsymposium.com)

### CONGENITAL CARDIOLOGY TODAY

Editorial and Subscription Offices  
16 Cove Rd, Ste. 200

Westerly, RI 02891 USA

[www.CongenitalCardiologyToday.com](http://www.CongenitalCardiologyToday.com)

*Congenital Cardiology Today is the  
official publication of the CHIP Network  
([www.chipnetwork.org](http://www.chipnetwork.org))*

© 2014 by Congenital Cardiology Today ISSN:  
1544-7787 (print); 1544-0499 (online).  
Published monthly. All rights reserved.

Recruitment Ads - pages: 3, 4, 7, 11, 13, 15

## Real-Time-Three-Dimensional Echocardiographic Assessment of Atrial Septal Defects

By Donald J. Hagler, MD

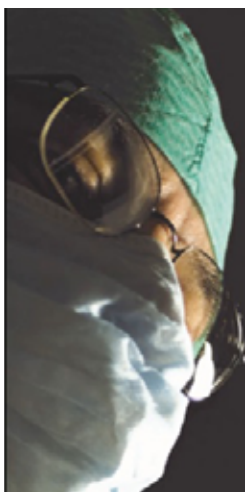
Previous reports have demonstrated the utility of real-time three-dimensional echocardiographic (RT3DE) imaging in the assessment of atrial septal defects (ASDs) prior to both surgical and device closure interventions.<sup>1-4</sup> To date, the reports have illustrated that secundum ASDs may have normal shape and location (Figure 1), or unusual oblong or irregular shapes, and may be multiple (Figures 2 and 3). RT3DE also has been particularly useful for illustrating the surrounding rims of the secundum ASD, and the abnormal location and absent rims of sinus venosus type defects. The purpose of this report is to extend these initial observations to include RT3DE Transesophageal (TEE) imaging of atrio-ventricular (AV) septal defects, and to review some preliminary experiences with RT3DE intracardiac (ICE) imaging of ASD prior to device closure.

Recent reports of RT3DE ICE imaging discussed the use of Acu Nav V 3-dimensional ultrasound catheter and SC2000 imaging platform (Siemens Healthcare, Mountain View, CA) during interventional electrophysiologic procedures.<sup>5</sup> The AcuNav V catheter is a 90 cm 10-French phase array probe similar to the 2D AcuNav catheter capable of articulating 160 degrees in four directions. It provides real-time (4D) imaging with a volume size of 22 degrees by 90 degrees with a variable, multi-MHz frequency capability. The report illustrates

the advantage of volume imaging in providing visualization of the entire pulmonary vein ostium.

Intraoperative TEE has been the standard of practice for assessment of patients with more complex forms of congenital heart disease. The addition of RT3DE in the TEE assessment provides views which allow the surgeon to view the cardiac structures in a format similar to the anatomic views obtained during cardiopulmonary bypass. Figures 4A and B illustrate diastolic and systolic 3D images of an adult patient with a partial form of AV septal defect and a common atrium. The diastolic view focuses on the crest of the ventricular septum (VS) with no evidence of intervening atrial septum. The systolic frame demonstrates effective closure of both AV valve with the line of closure of the cleft anterior mitral leaflet evident with real-time imaging. The post-operative image (Figure 4C) illustrates effective repair of the cleft in the anterior mitral leaflet observed in a short axis format. The valve was completely competent after surgical repair of the mitral valve cleft.

Concordant with the observations of improved recognition of the structural relations of atrial septal defect observed with 3D TEE imaging of secundum defects during surgical or interventional device closure procedure, we have utilized RT3DE ICE imaging in our assessment of patients during procedures for interventional device closure. Figures 5A, B and C illustrate typical features of a recurrent



## RECRUITMENT ADVERTISING IN CONGENITAL CARDIOLOGY TODAY

- Pediatric Cardiologists
- Congenital/Structural Cardiologists
- Interventionalists
- Echocardiographers
- Imaging Specialists
- Electrophysiologists
- Congenital/Structural Failure Specialists
- Cardiac Intensivists

For more information and pricing: [recruit@CCT.bz](mailto:recruit@CCT.bz)

# NIT-OCCLUD<sup>®</sup>

## COIL SYSTEM FOR PDA CLOSURE



## A SAFER, EASIER WAY TO CLOSE

The Nit-Occlud<sup>®</sup> coil system for PDA closure is designed to match individual morphologies and sizes

The delivery system facilitates optimal device positioning

The Nit-Occlud<sup>®</sup> PDA coil is repositionable and retrievable prior to release

Tight and compact windings ensure efficient occlusion

The Nit-Occlud<sup>®</sup> PDA coil was determined to be MRI conditional

Radiopaque

For more information or to place an order, contact your B. Braun Interventional Systems Inc. representative or call 1-877-VENA-CAV (836-2228)

**pfm**medical

Manufacturer:  
pfm medical, ag  
Wankelstraße 60  
50996 Köln, Germany  
T +49 (0)2236 9641-10  
F +49 (0)2236 9641-20



**B. BRAUN**

Interventional  
Systems

Distributed by:  
B. Braun Interventional Systems Inc.  
824 Twelfth Avenue  
Bethlehem, PA 18018 USA  
Tel: 1-877-VENA CAV (836-2228) (USA)  
Fax: 1-610-849-1334  
[www.bisusa.org](http://www.bisusa.org)

Indication: The Nit-Occlud<sup>®</sup> PDA coil is a permanently implanted prosthesis indicated for percutaneous, transcatheter closure of small to moderate size patent ductus arteriosus with a minimum angiographic diameter less than 4mm. Nit-Occlud Brief Statement: Do not implant the Nit-Occlud PDA into patients who have endocarditis, endarteritis, active infection, pulmonary hypertension (calculated PVR greater than 5 Wood Units), thrombus in a blood vessel through which access to the PDA must be obtained, thrombus in the vicinity of the implantation site at the time of the implantation or patients with a body weight < 11 lbs (5 kg). An angiogram must be performed prior to implantation for measuring length and diameter of the PDA. Only the pfm medical implantation delivery catheter should be used to implant the device. Administration of 50 units of heparin per kg body weight should be injected after femoral sheaths are placed. Antibiotics should be given before (1 dose) and after implantation (2 doses) in order to prevent infection during the implant procedure. Do not implant the Nit-Occlud PDA in an MR environment. Do not pull the Nit-Occlud coil through heart valves or ventricular chambers. Contrast media should not be injected through the implantation catheter. The catheter must not be connected to high pressure injectors. Patients may have an allergic response to this device due to small amounts of nickel that has been shown to be released from the device in very small amounts. If the patient experiences allergic symptoms, such as difficulty in breathing or swelling of the face or throat, he/she should be instructed to seek medical assistance immediately. Antibiotic prophylaxis should be performed to prevent infective endocarditis during first 6 months after coil implantation. Potential Adverse Events: Air embolism, Allergic reaction to drug/contrast, Apnea, Arrhythmia requiring medical treatment or pacing, Arteriovenous fistula, Bacterial endocarditis, Blood loss requiring transfusion, Chest pain, Damage to the tricuspid or pulmonary valves, Death, Embolization of the occluder, requiring percutaneous or surgical intervention, Endarteritis, False aneurysm of the femoral artery, Fever/Headache/migraine, Heart failure, Hemolysis after implantation of the occluder, Hypertension, Hypotension or shock, Infection, Myocardial infarction, Occluder fracture or damage, Perforation of the heart or blood vessels, Stenosis of the left pulmonary artery or descending thoracic aorta, Stroke/TIA, Thromboembolism (cerebral or pulmonary), Valvular Regurgitation, Vessel damage at the site of groin puncture (loss of pulse, hematoma etc.)



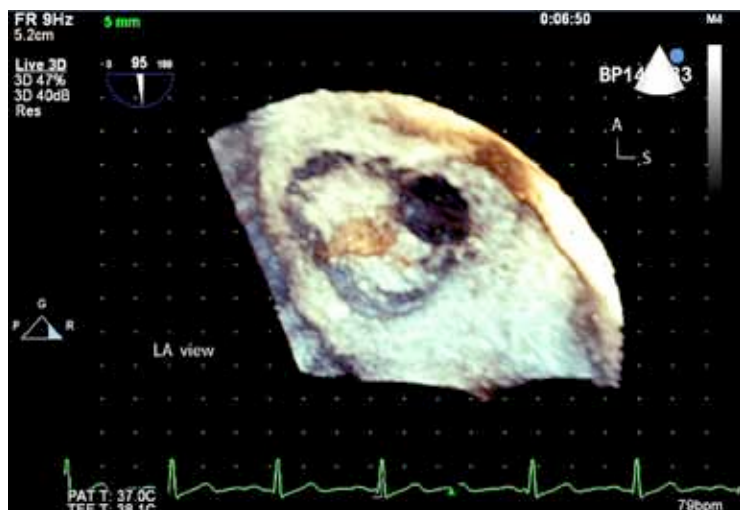


Figure 1. 3D Transesophageal (TEE) still frame volume image of a moderate sized ostium secundum atrial septal defect view from the left atrial aspect. The defect is round, symmetrical and located just below the limbus of the fossa ovalis. The remaining portion of the septum primum is intact.

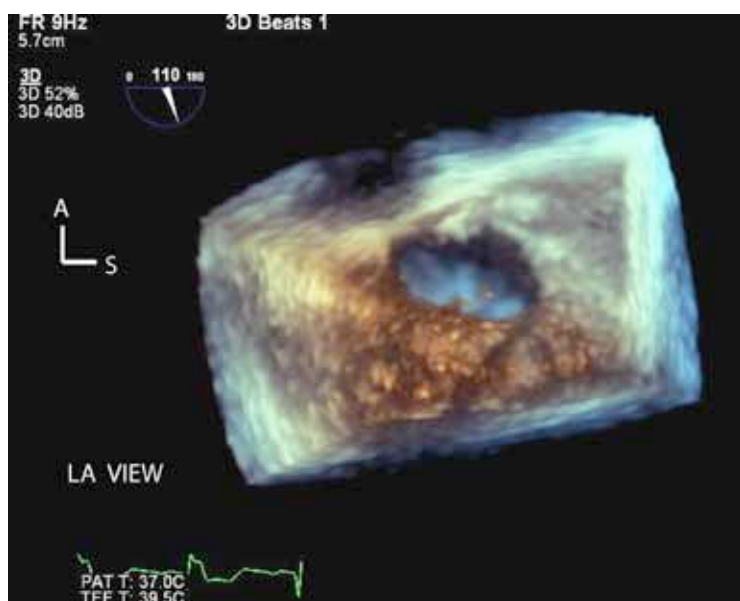


Figure 2. 3D TEE still frame volume image of a large, fairly oblong and irregularly shaped secundum ASD located more inferiorly in the atrial septum. No other defects are evident.

secundum atrial septal defect after attempted surgical repair. Figure 5A demonstrates a comparative image of 2D and 3D images obtained simultaneously with the AcuNav V catheter. Multiple defects were evident in close proximity with flail segments of disrupted tissue used in the surgical repair. Figure 5B illustrates the utility of RT3DE ICE images to allow rotation of the 3D image to visualize the left atrial (LA) aspect of the recurrent defect and its relationship to the mitral valve (MV) observed inferiorly. Figure 5C illustrates the closed defect



## PEDIATRIC CARDIOLOGIST

The Cardiology Division of the Department of Pediatrics at LSU Health Sciences Center in New Orleans is seeking a full-time academic pediatric cardiologist with specialized training and expertise in cardiac critical care, to become the Medical Director of the Cardiac Intensive Care Unit located at Children's Hospital. Appointment will be at the academic rank of Assistant Professor, Associate Professor, or Professor (non-tenure, clinical track) and will be determined by the candidate's credentials and experience. The successful candidate will direct the medical management of cardiac patients requiring intensive care and of patients having undergone surgery for congenital and/or acquired heart disease. The intensive care team will work in conjunction with other pediatric cardiologists, cardiothoracic surgeons and other subspecialists, in the management of patients. Currently, approximately 250 heart catheterizations (75% interventional) and 350 cardiothoracic surgeries are performed each year at Children's Hospital New Orleans. The service includes seven full time pediatric cardiologists and three cardiothoracic surgeons providing inter-disciplinary care for infants, children and young adults. Children's Hospital has a state-of-the art 20 bed CICU. Children's Hospital is a 247 bed tertiary-care teaching complex located in the heart of New Orleans, which serves the entire State of Louisiana and the central Gulf Coast region. There is an ACGME-accredited pediatric cardiology fellowship training program; and a newly-approved UNOS Heart Transplant Program.

There are excellent opportunities for clinical, translational and basic research, particularly with the LSUHSC Cardiovascular Center of Excellence.

The successful candidate is expected to have strong clinical skills, have an interest in research, and participate in teaching of residents and fellows. Qualified applicants must be BE/BC in Pediatric Cardiology and be licensable in the State of Louisiana. The School of Medicine does not participate in the sponsoring faculty candidates for the Department of Health and Hospitals' Conrad 30 Program.

**Interested applicants should submit a cover letter and CV electronically to:**

[SOM-Jobs@lsuhsc.edu](mailto:SOM-Jobs@lsuhsc.edu)

**Reference Pediatric Cardiology Intensivist position.**

*LSUHSC-NO is an AA/EOE.*



**PICS-AICS**  
Pediatric and Adult Interventional Cardiac Symposium

**CHICAGO**  
MARRIOTT CHICAGO DOWNTOWN  
JUNE 7-10, 2014





## OPPORTUNITY IN PEDIATRIC CARDIOLOGY MCALLEN, TEXAS

Driscoll Children's Hospital is advancing a comprehensive Heart Center to meet the healthcare needs of congenital heart patients in South Texas. The Center is recruiting a physician to support outpatient clinic activities in McAllen, TX and the Rio Grande Valley. Sub-specialty board eligible or certification is required. Spanish speaking is preferred.

Pediatric Cardiology has been an integral part of Driscoll Children's Hospital since 1962. The Hospital and the Heart Center are committed to bringing state-of-the-art technology and quality service to 31 counties in South Texas. In 2013, the Heart Center saw 9,500 outpatient and satellite visits; 6,121 echocardiograms, including 500 fetal echos, and 192 heart catheterizations (82% interventional). The Heart Center employees 8 physicians including 1 Electrophysiologist, 2 Interventional cardiologists, 1 MRI Imaging cardiologist, and 1 fetal cardiologist. Three pediatric cardio-thoracic surgeons deliver all aspects of surgical service including hybrid procedures.

The McAllen Clinic is a major clinic affiliated with Driscoll Children's Hospital. The cardiologist in McAllen will share a 1:4 call rotation involving consultation without post cardiovascular surgical care. Physicians will see challenging, complex patients in a beautiful, well-staffed clinic with 2 sonographers and in-house laboratory and radiology. The qualified physician will enjoy a young, fast growing patient base and a new University of Texas affiliated medical school.

McAllen and the Rio Grande Valley offer a vibrant, multicultural population. With the mild weather, it is a haven for year-round outdoor activities including golf, cycling, tennis and water sports and is 45 minutes from beautiful beaches. South Texas offers world class hunting, fishing, sailing and wind surfing. The cost of living in south Texas is low, and there is no state income tax.

### Contact Information

**Annette Shook, Executive Director,  
Physician Relations and Recruitment**  
Office: (361) 694 6807; cp: 361 877 7259  
email: [annette.shook@dchstx.org](mailto:annette.shook@dchstx.org)

*no contacts from recruitment firms accepted*

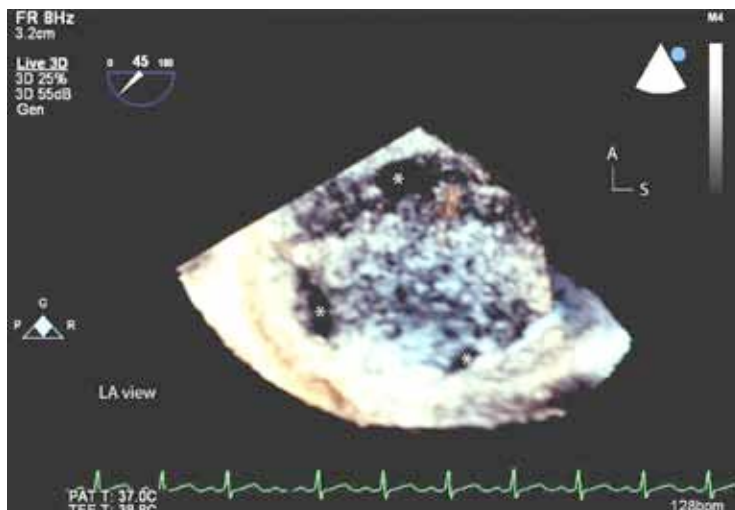


Figure 3. 3D TEE still frame volume image viewed from the left atrium demonstrating multiple (3) ostium secundum defects (asterisks) located in separate and isolated segments of the atrial septum. The largest defect is more anterior and below the limbus of the fossa ovalis.

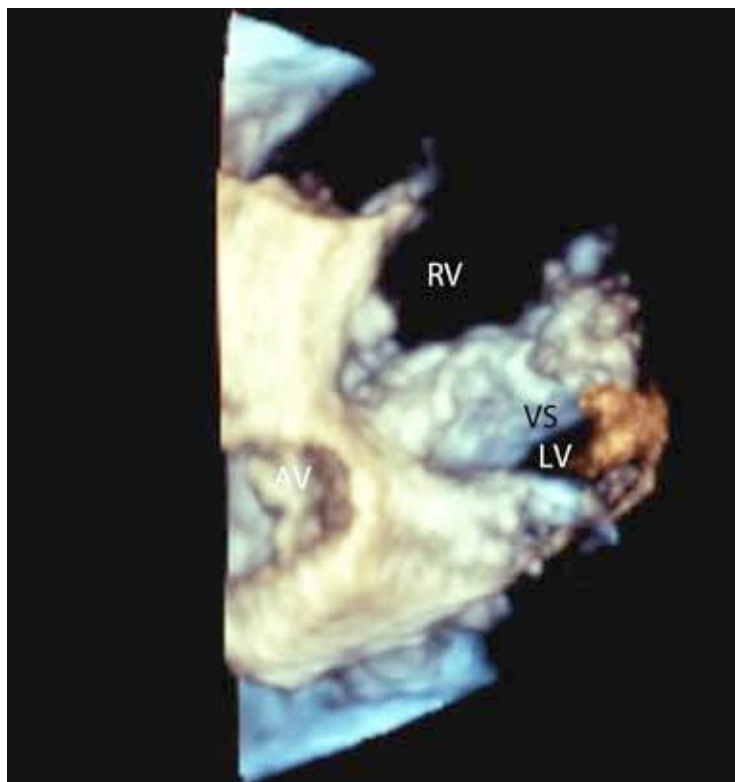


Figure 4A. 3D intraoperative TEE still frame volume image demonstrating a large ostium primum atrial septal defect (common atrium). A diastolic frame looking down on the crest of the ventricular septum (VS) through both atrioventricular valve (AV) orifices.

LIVE CASES

**JUNE 26 – 28, 2014**  
**FRANKFURT, GERMANY**

**CSI 2014 – CONGENITAL,  
STRUCTURAL & VALVULAR  
INTERVENTIONS**  
[www.csi-congress.org](http://www.csi-congress.org)







**Medtronic**

Technologies to Manage  
Congenital Heart Disease

# Every Step of the Way

**Melody® Transcatheter Pulmonary Valve  
Ensemble® Transcatheter Valve Delivery System**

**Indications:** The Melody TPV is indicated for use in a dysfunctional Right Ventricular outflow Tract (RVOT) conduit ( $\geq 16$  mm in diameter when originally implanted) that is either regurgitant ( $\geq$  moderate) or stenotic (mean RVOT gradient  $\geq 35$  mm Hg)

**Contraindications:** None known.

**Warnings/Precautions/Side Effects:**

- DO NOT implant in the aortic or mitral position.
- DO NOT use if patient's anatomy precludes introduction of the valve, if the venous anatomy cannot accommodate a 22-Fr size introducer, or if there is significant obstruction of the central veins.
- DO NOT use if there are clinical or biological signs of infection including active endocarditis.
- Assessment of the coronary artery anatomy for the risk of coronary artery compression should be performed in all patients prior to deployment of the TPV.
- To minimize the risk of conduit rupture, do not use a balloon with a diameter greater than 110% of the nominal diameter (original implant size) of the conduit for pre-dilation of the intended site of deployment, or for deployment of the TPV.
- The potential for stent fracture should be considered in all patients who undergo TPV placement. Radiographic assessment of the stent with chest radiography or fluoroscopy should be included in the routine postoperative evaluation of patients who receive a TPV.
- If a stent fracture is detected, continued monitoring of the stent should be performed in conjunction with clinically appropriate hemodynamic assessment. In patients with stent fracture and significant associated RVOT obstruction or regurgitation, reintervention should be considered in accordance with usual clinical practice.

Potential procedural complications that may result from implantation of the Melody device include: rupture of the RVOT conduit, compression of a coronary artery, perforation of a major blood vessel, embolization or migration of the device, perforation of a heart chamber, arrhythmias, allergic reaction to contrast media, cerebrovascular events (TIA, CVA), infection/sepsis, fever, hematoma, radiation-induced erythema, and pain at the catheterization site.

Potential device-related adverse events that may occur following device implantation include: stent fracture resulting in recurrent obstruction, endocarditis, embolization or migration of the device, valvular dysfunction (stenosis or regurgitation), paravalvular leak, valvular thrombosis, pulmonary thromboembolism, and hemolysis.

For additional information, please refer to the Instructions for Use provided with the product or call Medtronic at 1-800-328-2518 and/or consult Medtronic's website at [www.medtronic.com](http://www.medtronic.com).

**Humanitarian Device.** Authorized by Federal law (USA) for use in patients with a regurgitant or stenotic Right Ventricular Outflow Tract (RVOT) conduit ( $\geq 16$  mm in diameter when originally implanted). The effectiveness of this system for this use has not been demonstrated.

Melody and Ensemble are trademarks of Medtronic, Inc.  
UC201303735 EN © Medtronic, Inc. 2013;  
All rights reserved.

The Melody® TPV offers children and adults a revolutionary option for managing valve conduit failure without open heart surgery.

Just one more way Medtronic is committed to providing innovative therapies for the lifetime management of patients with congenital heart disease.

## Innovating for life.

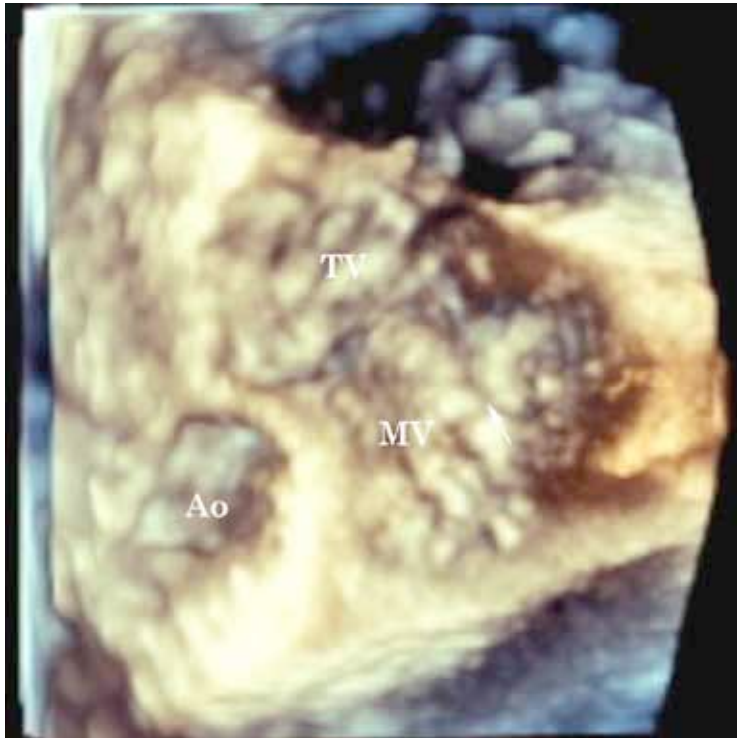


Figure 4B. A systolic frame from the same projection demonstrating closure of both AV valves. The arrow points to the coaptation point of the cleft in the anterior mitral leaflet.

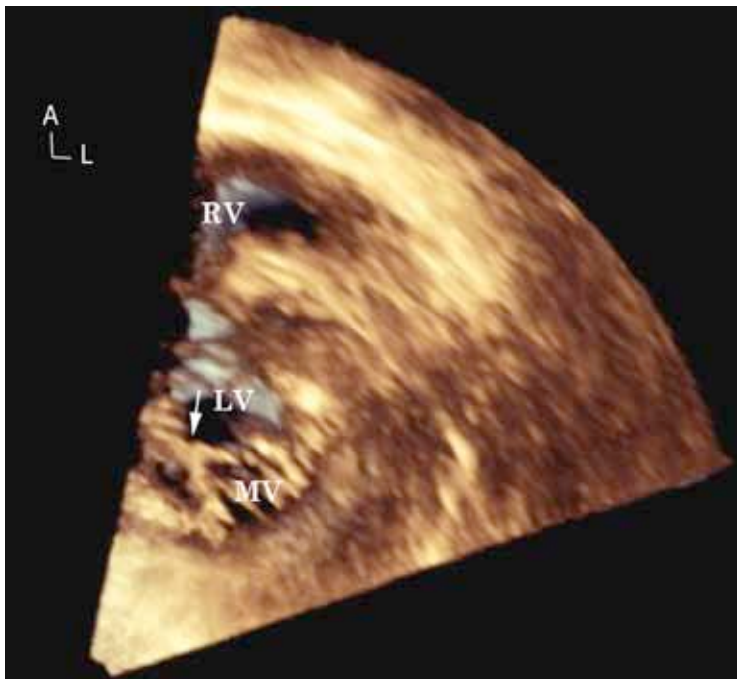


Figure 4C. A 3D still frame image illustrating a cross sectional view of the mitral valve orifice after surgical repair. The arrow points to the area of repair of the cleft in the anterior mitral leaflet.

with an Amplatzer atrial septal occluder (St. Jude Medical, St. Paul, MN) with no evidence of residual defect and no interference with the mitral valve.

Although the RT3DE ICE images are limited with the 20 degree format currently available, they provide additional imaging capability and view of cardiac structures not possible with

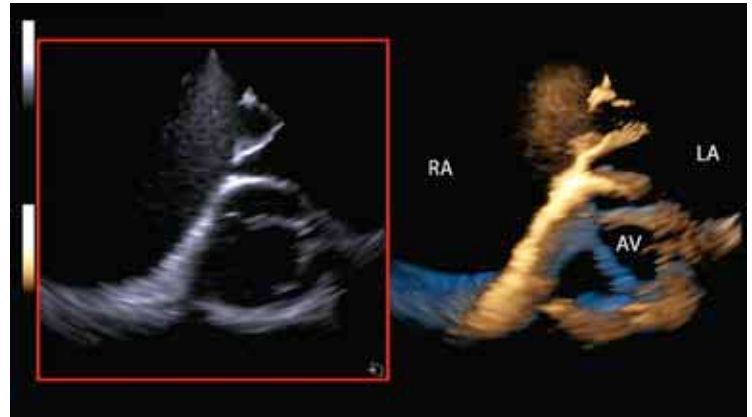


Figure 5A. 2D and 3D comparative images of a recurrent secundum atrial septal defect obtained with 3D ICE imaging.

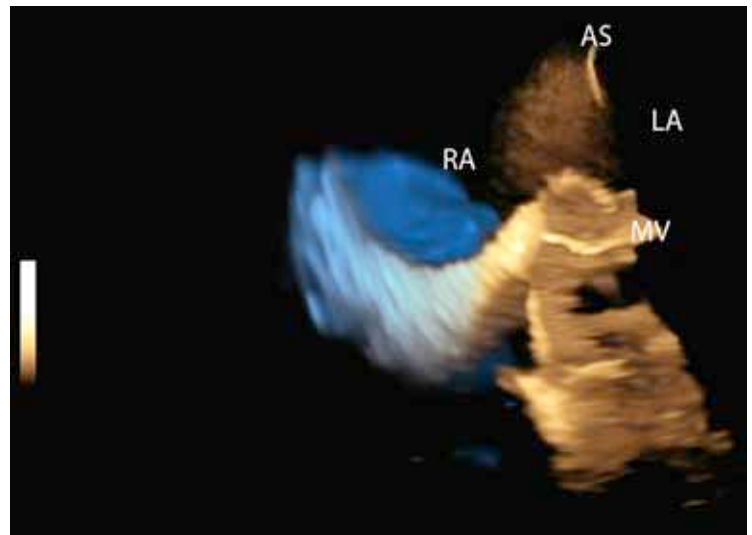


Figure 5B. Rotated 3D ICE image illustrating the left atrial aspect of the recurrent atrial septal defect and its relationship to the mitral valve just inferior to the defect.

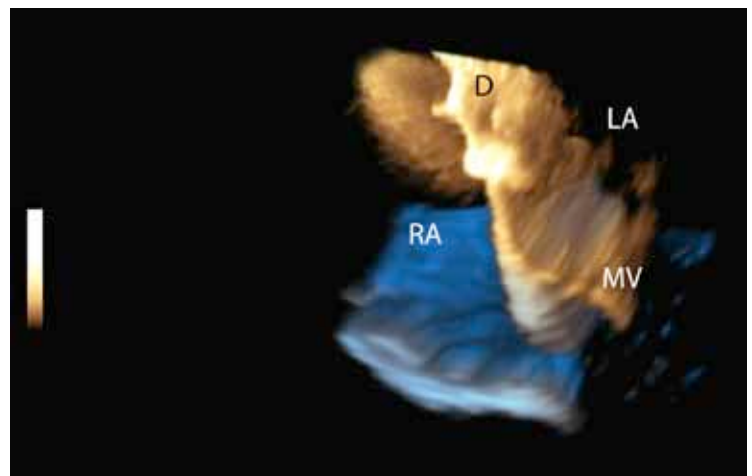


Figure 5C. Similarly rotated 3D ICE image demonstrating the left atrial aspect of an Amplatzer atrial septal occluder closing the recurrent defect. The device does not interfere with the mitral valve function.

standard 2D ICE images. This topic will be discussed in more detail and with additional demonstration in video format at the 22<sup>nd</sup> Annual International Echo Symposium in Parma, Italy, June 16<sup>th</sup>-18<sup>th</sup>, 2014.



## References

1. Marx GR, Fulton DR, Pandian NG, Vogel M, Cao QL, Ludomirsky A, et al. Delineation of site, relative size and dynamic geometry of atrial septal defect by real-time three-dimensional echocardiography. *J Am Coll Cardiol* 1995;25: 482-490.
2. Franke A, Kuhl HP, Rulands D, Jansen C, Erena C, Grabitz RG et al. Quantitative analysis of the morphology of secundum -type atrial septal defects and their dynamic change using transesophageal three-dimensional echocardiography. *Circulation* 1997; 96:II323-27.
3. Van den Bosch, Harkel DJT, McGhie JS, Roos-Hesselink JW, Simoons ML, Rogers AJJC, Meijboom FJ. Characterization of Atrial Septal Defect Assessed by Real-time 3-Dimensional Echocardiography. *J Am Soc Echocardiogr* 2006;19:815-821.
4. Mahmood F, Shakil O, Gerstle JR, Matyal R. Percutaneous Closure of an Atrial Septal Defect and 3-Dimensional Echocardiography. *J Cardiothorac Vasc Anesth* 2013;27:400-401.
5. Brysiewicz N, Mitiku T, Haleem K, Bhatt P, Al-Shaaroui M, Clancy JR, Marieb MA, Sugeng L, Akar JG. 3D Real-Time Intracardiac Echocardiographic Visualization of Atrial Structures Relevant to Atrial Fibrillation Ablation. *J Am Coll Cardiol Img* 2014;7:97-100.

## CCT



Donald J. Hagler, MD  
Professor of Pediatrics and Medicine  
Divisions of Pediatric Cardiology and  
Cardiovascular Diseases  
Mayo Clinic College of Medicine  
Rochester, MN USA  
Tel: 507 266-0676  
Fax: 507 255-8122  
hagler.donald@mayo.edu



## Pediatric Noninvasive Cardiac Imaging and Cardiac MRI Opportunity

The Heart Center at Nationwide Children's Hospital (NCH), pediatric teaching facility for The Ohio State University in Columbus Ohio, is recruiting an attending faculty with expertise in Pediatric Noninvasive Cardiac Imaging with a focus on advance cardiac imaging including cardiac MRI/CT as well as echocardiography and Research to join its faculty at the level of an Assistant Professor.

The NCH Advanced Cardiac Imaging Laboratory is a collaboration between The Heart Center and the Department of Radiology. We have a busy and growing cardiac MRI/CT program which performs over 400 studies per year including cardiac functional CT. The team includes 1 dedicated pediatric cardiologist, 4 dedicated pediatric radiologists, 4 dedicated cardiac MRI technologists, 3 dedicated cardiac CT technologists as well as an advanced post processing laboratory using the most cutting edge software and hardware. There are numerous opportunities in research and participation in development of both the cardiac MRI and cardiac CT program.

The NCH Echocardiography Laboratory is IAC accredited and includes all state-of-the-art facilities and equipment. The NCH Echocardiography Laboratory team includes 8 attending physicians and 10 sonographers, and performs more than 12,000 studies annually, including well over 1,000 fetal studies, as well as transesophageal, intracardiac, intravascular, and 3D echocardiograms. There are numerous opportunities in research, and participating in developing the Research Echocardiography Laboratory at NCH. Additional opportunities include engaging in translational research, and developing quality assurance initiatives.

The program includes a 4th year Advanced Noninvasive Cardiac Imaging fellowship, in addition to pediatric and combined pediatric-adult cardiology fellowship programs. We are directly linked to our Center for Cardiovascular and Pulmonary Research, which has an NIH T-32 training grant. The Heart Center has extensive and active programs in adult congenital heart disease, hybrid strategy, cardiac intensive care, translational and outcomes research, interventional catheterization, cardiovascular surgery and outreach clinics. Current annual clinical metrics for the Heart Center include: 450 cardiothoracic surgeries, 600 catheterizations, and 10,000+ cardiology outpatient visits.

**Interested candidates are encouraged to submit their curriculum vitae to:**

Kan N. Hor, MD,  
Director of Cardiac MRI, Cardiology Section  
and Associate Professor of Pediatrics  
Nationwide Children's Hospital  
ED635, 700 Children's Drive  
Columbus, OH 43205, or  
[Kan.Hor@nationwidechildrens.org](mailto:Kan.Hor@nationwidechildrens.org)



THE OHIO STATE UNIVERSITY  
COLLEGE OF MEDICINE



## Join Us for Two Weeks to Save Children with Congenital Heart Defects!

We are looking for medical volunteers who can join us in our missions to underdeveloped countries to perform pediatric cardiac surgery and care while also training the local medical staff.

For more information and our 2014 mission schedule, please visit [Babyheart.org](http://Babyheart.org)



# Image of the Month #9: April, 2014 - The Archiving Working Group

Contributors: Jeffrey P. Jacobs, MD; Jorge M. Giroud, MD; Robert Anderson, MD; Vera D. Aiello, MD; Diane E. Spicer, BS; Charles W. Shepard, MD

The Archiving Working Group (AWG) Web Portal link for this series of images: [http://www.accd-awg.umn.edu/Coronary\\_Disease/ALCAPA\\_09\\_41\\_03/ALCAPA\\_09\\_41\\_03\\_MPA.html](http://www.accd-awg.umn.edu/Coronary_Disease/ALCAPA_09_41_03/ALCAPA_09_41_03_MPA.html)

IPCCC: 09.41.03

## AEPC Derived Term:

Anomalous origin of left coronary artery from pulmonary artery (ALCAPA) (09.41.03)

## EACTS-STIS Derived Term:

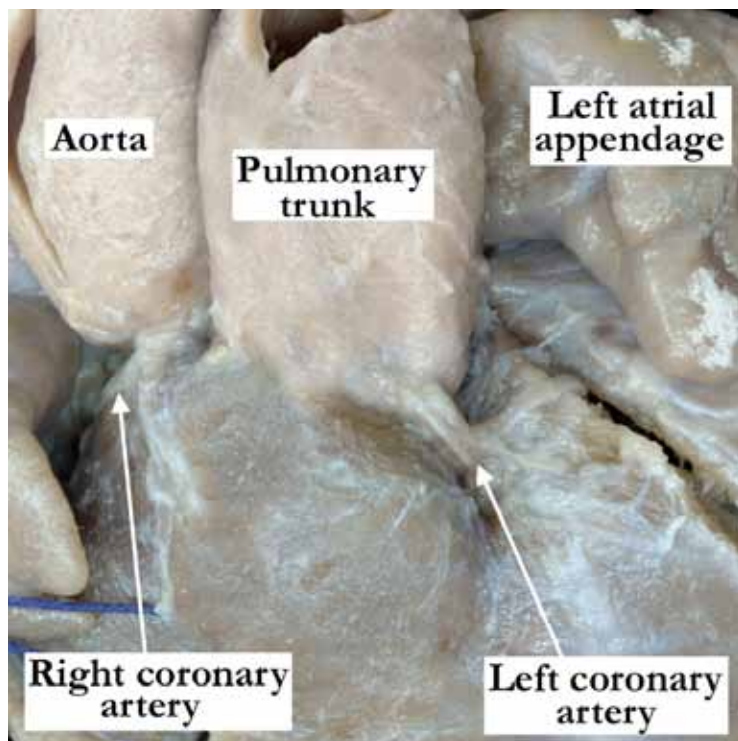
Coronary anomaly, APOC (Anomalous pulmonary origin of coronary), ALCAPA (Anomalous left main coronary artery from PA) (09.41.03)

## ICD10 Derived Term:

Malformation of coronary vessels (Q24.5)

## Commentary

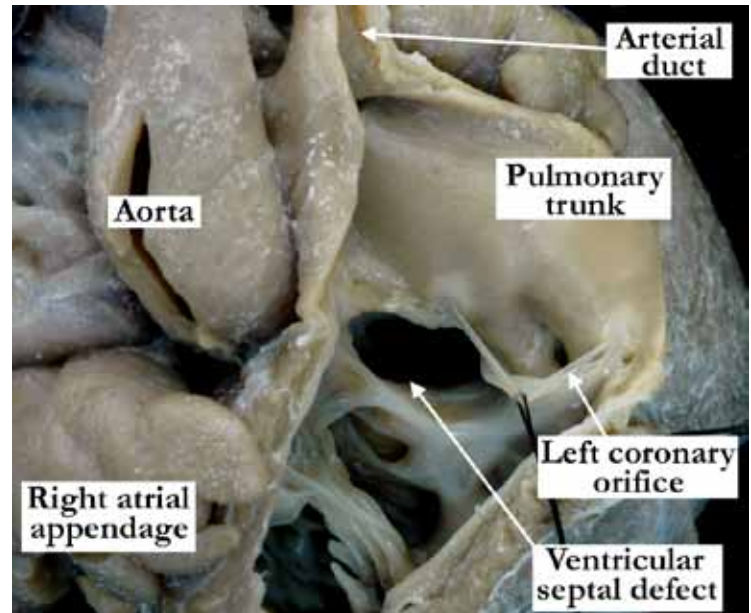
Anomalous pulmonary origin of the left coronary artery is a rare congenital defect involving the coronary circulation. It is estimated to occur in 1 of 300,000 live births. If untreated, it results in



*Orientation:* Anterior superior view

*Description:* This view of a heart with normally related great arteries demonstrates the normal origin of the right coronary artery from the aorta. The left coronary artery arises from the pulmonary right-handed adjacent truncal valvar sinus.

*Contributor:* Diane E. Spicer, BS



*Orientation:* Anterior superior view of the right ventricle, outflow tract and pulmonary trunk

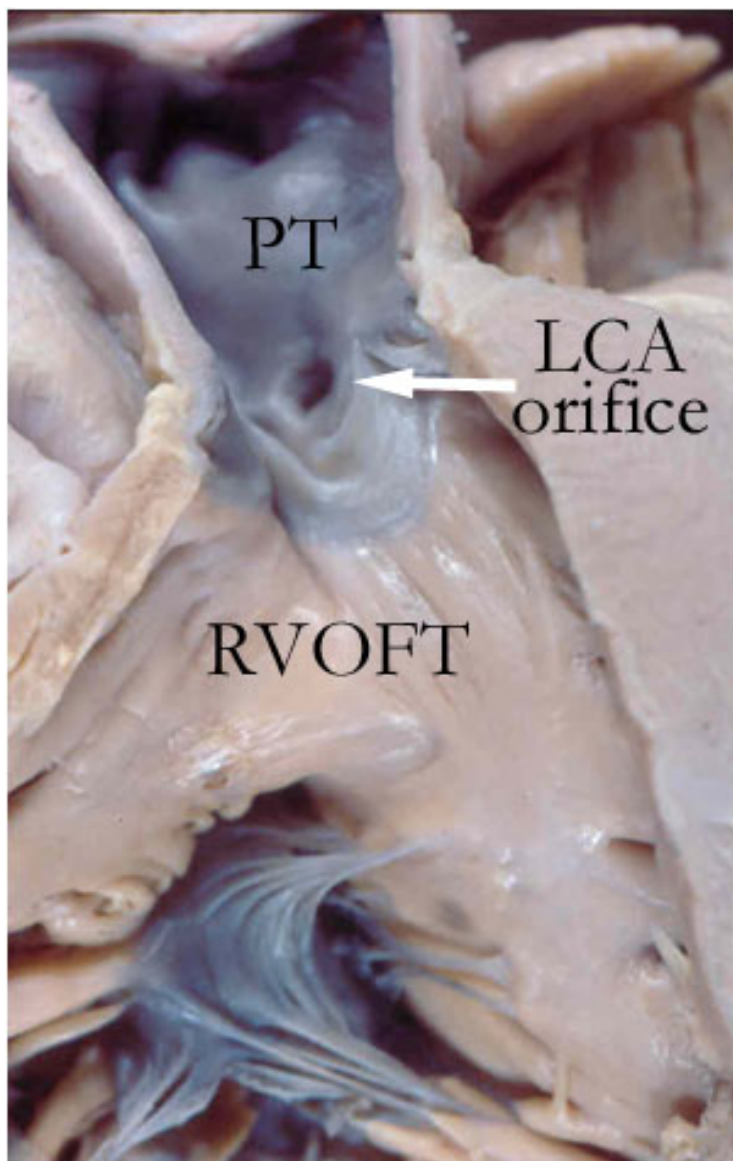
*Description:* This view of the opened right ventricle demonstrates that the left coronary artery arises from the right-handed adjacent sinus of the pulmonary trunk. Well-illustrated in this image is the presence of a doubly committed and juxta-arterial ventricular septal defect. Although not shown in this image, other findings included signs of left ventricular ischemia, severe aortic stenosis secondary to postero-caudal deviation of the outlet septum, interrupted aortic arch distal to the brachiocephalic trunk, and isolated origin of the left carotid artery from the right pulmonary artery, hypoplastic right ventricle and tricuspid valve dysplasia. Please note the patent arterial duct.

*Contributor:* Diane E. Spicer, BS

ischemia, left ventricular dysfunction or infarction accompanied by mitral regurgitation, arrhythmias, and death in infancy in up to 90% of affected patients. The lesion commonly presents in early infancy, and manifests with increasing difficulties in breathing and feeding, accompanied by physical findings of mitral regurgitation and myocardial ischemia. Although there are case reports that date as early as the 19<sup>th</sup> century, it is Bland, White and Garland, from Massachusetts General Hospital, who are credited as being

***“Anomalous pulmonary origin of the left coronary artery is a rare congenital defect involving the coronary circulation. It is estimated to occur in 1 of 300,000 live births. If untreated, it results in ischemia, left ventricular dysfunction or infarction accompanied by mitral regurgitation, arrhythmias, and death in infancy in up to 90% of affected patients.”***





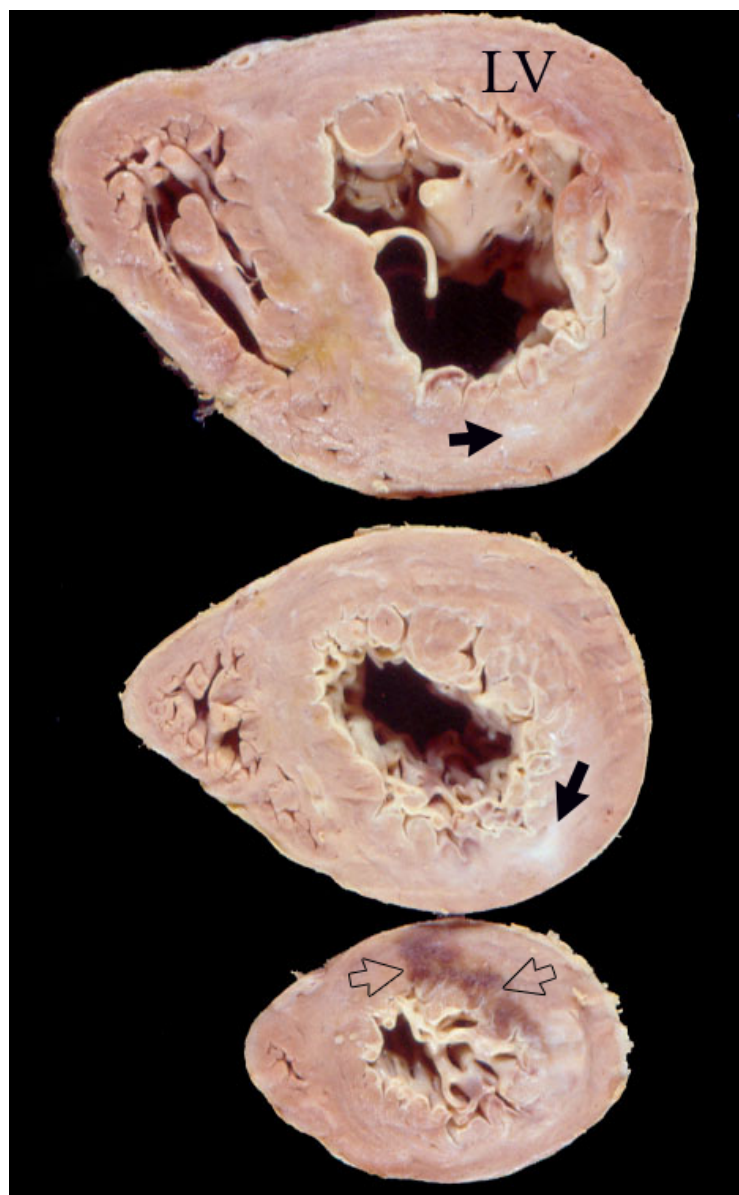
**Orientation:** Anterior-superior view through opened right ventricular outflow tract and pulmonary trunk

**Description:** In a different specimen, the right ventricular outflow tract (RVOFT) has been exposed to show the Anomalous Origin of the Left Coronary Artery (arrow) from the right-handed adjacent sinus of the pulmonary trunk (PT).

**Contributor:** Vera D. Aiello, MD

**Institution & Source:** Heart Institute (InCor), University of São Paulo Medical School, São Paulo, Brazil

the first to describe a constellation of clinical observations, validated by the autopsy findings in their patient. The anatomical observation of an abnormal origin of the left coronary artery from the pulmonary circulation provides understanding of the pathophysiology of the disorder. As the pulmonary vascular resistance falls in early infancy, there are incremental changes in



**Orientation:** Short-axis sections of the ventricular mass

**Description:** In this heart from a child with Anomalous Origin of the Left Coronary Artery from the pulmonary trunk there are signs of chronic and acute ischemic heart disease. The left ventricle (LV) is hypertrophic and the myocardium shows areas of fibrosis (healed infarction, black arrows) besides an apical area of recent necrosis (open arrows).

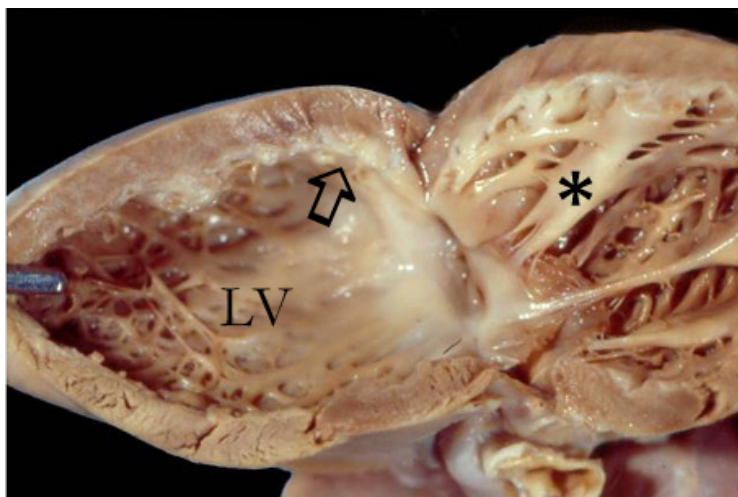
**Contributor:** Vera D. Aiello, MD

**Institution & Source:** Heart Institute (InCor), University of São Paulo Medical School, São Paulo, Brazil

symptoms due to the fall in myocardial perfusion. This 'run-off', or 'steal', of blood away from the ventricle, and into the lesser resistance of the pulmonary circulation, decreases myocardial perfusion. It is thought that, if there is insufficient collateralization from the right coronary circulation, myocardial ischemia with mitral



**Archiving Working Group**  
**International Society for Nomenclature of**  
**Paediatric and Congenital Heart Disease**  
[ipccc-awg.net](http://ipccc-awg.net)



**Orientation:** Left ventricle opened in clamshell fashion.

**Description:** In this heart, from a patient with Anomalous Origin of the Left Coronary Artery, there are signs of long-standing left ventricular (LV) ischemia from the pulmonary circulation. There is severe ventricular dilatation and the subendocardial myocardium shows fibrosis (arrow). The supero-posterior (3) papillary muscle of the mitral valve (asterisk) is pale and fibrotic.

**Contributor:** Vera D. Aiello, MD

**Institution & Source:** Heart Institute (InCor), University of São Paulo Medical School, São Paulo, Brazil

valvar dysfunction increases as time passes, and the pulmonary resistance changes. This can ultimately lead to myocardial infarction, with arrhythmias occurring during periods of increased metabolic demand, such as feeding, crying or an intercurrent illness. Although typically the most common origin of the abnormal left coronary artery is from the pulmonary truncal sinuses, the abnormal origin can also be from the pulmonary trunk, or from the right or left pulmonary arteries. In some instances, the left coronary artery can have a normal origin, but then fail to divide, so that either the circumflex or superior interventricular (anterior descending) artery may arise anomalously from the pulmonary circulation. In the most common form, the abnormal coronary artery arises from a pulmonary valvar sinus, as shown in the initial three images, rather than the pulmonary trunk. The traditional acronym for this entity is ALCAPA or Anomalous Origin of Left Coronary Artery from Pulmonary Artery (or pulmonary trunk). In most cases, however, this is not an accurate representation of the abnormality. Because of these facts, the acronym favored by the surgeons, namely "APOC," or Anomalous Pulmonary Origin of the Coronary Artery, is the more accurate term. This, however, does not distinguish between anomalous origin of the right, as opposed to the left, coronary arteries. APOLC, or Anomalous Pulmonary



**Orientation:** Oblique Coronal CT Angiogram

**Description:** In another patient with Anomalous Pulmonary Origin of the Left Coronary Artery, the coronary artery arises from the pulmonary trunk, approximately 3 mm above the sinutubular junction, and not from a pulmonary valvar sinus. It runs between the trunk and the aorta to reach the interventricular groove. This is an unusual presentation, as the abnormal coronary artery arises from the pulmonary trunk rather than the more common pulmonary valvar sinus origin.

**Contributor:** Charles W. Shepard, MD

**Institution:** University of Minnesota Amplatz Children's Hospital

Origin of the Left Coronary Artery, therefore, would be the better acronym. It is doubtful, nonetheless, whether ALCAPA will ever be discarded.

## References

1. J. of Cardiovasc. Trans. Res. (2013) 6:197–207.
2. Pediatr Radiol. 2007 Sep;37(9):890-5.
3. Anderson RH, Loukas M. The importance of attitudinally appropriate description of cardiac anatomy. Clin Anat. 2009 Jan; 22(1):47-51.

CCT

Please visit us at the AWG Web Portal at <http://ipccc-awg.net/> and help in the efforts of the Archiving Working Group and the International Society for Nomenclature of Paediatric and Congenital Heart Disease.

The authors would like to acknowledge the Children's Heart Foundation (<http://www.childrensheartfoundation.org/>) for financial support of the AWG Web Portal.



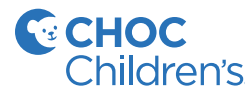
**Western  
Society  
Of  
Pediatric  
Cardiology**

## 25<sup>th</sup> Annual Conference of the Western Society of Pediatric Cardiologists

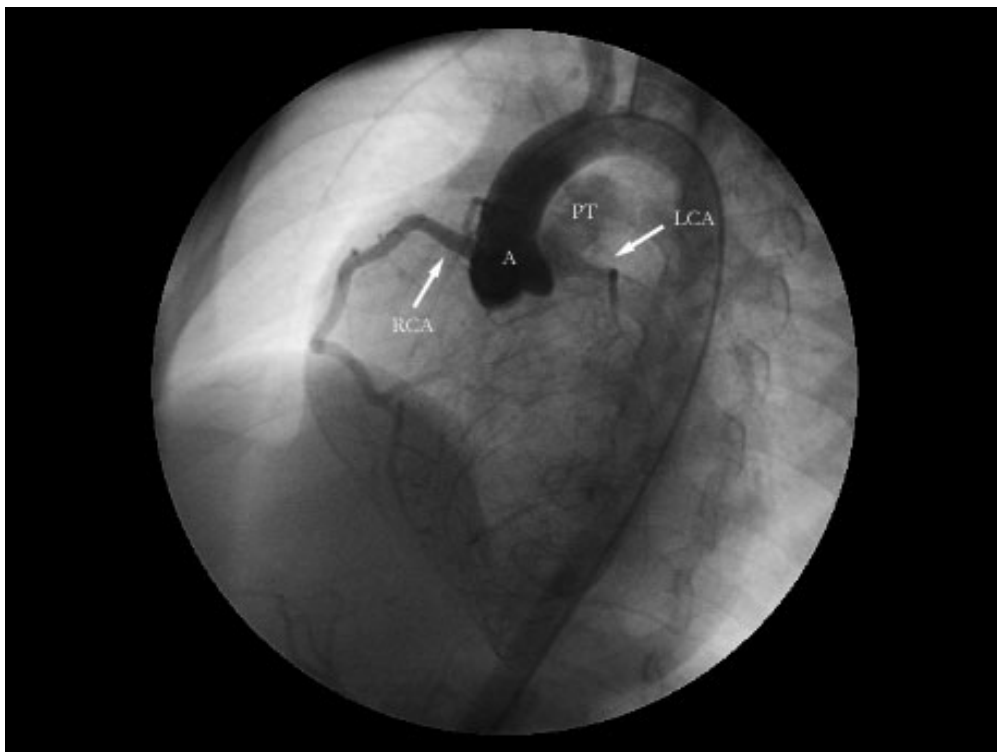
*Especially designed for care providers of patients with pediatric, adolescent, or adult congenital heart disease. Hosted by Children's Hospital of Orange County*

April 11-13, 2014; St. Regis Monarch Beach, Dana Point, CA

[www.choc.org/wsopc](http://www.choc.org/wsopc)







**Description:** In another patient with Anomalous Pulmonary Origin of the Left Coronary Artery, an aortogram shows that the right coronary artery (RCA) arises from the right coronary aortic sinus and it is larger than usual. The presumed left coronary aortic sinus, in fact, has no coronary artery arising from it. It can be seen that there is opacification of the left coronary artery (LCA) through myocardial collateral channels. The artery arises anomalously from a pulmonary truncal sinus, with the trunk (PT) filled in retrograde fashion.

**Contributor:** Jorge M. Giroud, MD

Vera D. Aiello, MD  
Co-Chairman, Archiving Working Group  
Heart Institute (InCor)  
São Paulo University School of Medicine,  
São Paulo, Brazil

Diane E. Spicer, BS  
Senior Archivist, Archiving Working Group  
University of Florida, Department of  
Pediatrics-Cardiology, Gainesville, Florida  
Congenital Heart Institute of Florida  
St. Petersburg & Tampa, FL USA

Jeffrey P. Jacobs, MD  
Archiving Working Group  
Congenital Heart Institute of Florida,  
St. Petersburg & Tampa, FL USA

Robert H. Anderson, MD  
Co-Chairman, Archiving Working Group  
Institute of Medical Genetics  
Newcastle University  
Newcastle upon Tyne, UK

#### Corresponding Contributor

Jorge M. Giroud, MD  
Co-Chairman, Archiving Working Group  
Congenital Heart Institute of Florida  
601 5<sup>th</sup> Street South, Suite 711  
St. Petersburg, FL, 33701 USA  
Phone: 727-767-4200

[jorgemgiroud@gmail.com](mailto:jorgemgiroud@gmail.com)

Charles W. Shepard, MD  
Archiving Working Group  
University of Minnesota  
Amplatz Children's Hospital  
Minneapolis, MN USA

And the members of the Archiving  
Working Group of the International Society  
for Nomenclature of Paediatric and  
Congenital Heart Disease  
[http://ipccc-awg.net/about\\_us.html](http://ipccc-awg.net/about_us.html)



### Pediatric Echo Cardiographer for Cardiology Academic Practice

The Division of Academic Pediatric Cardiology is seeking an experienced Pediatric echocardiographer(s) for newly established pediatric cardiac practice. Responsible for performing pediatric echocardiograms in the outpatient satellite clinics and at the main affiliated teaching hospital, the Women and Children's Hospital of Buffalo.

Training in echocardiography with at least 1 year of neonatal and pediatric experience required. Fetal echocardiography skills are a plus though not mandatory. Must be RDMS, RDCS, or RCS certified or eligible.

Salary commensurate with experience, excellent benefit package. Good oral communication skills. Must be organized and dependable. Ability to work independently.

#### Please send Resume and Cover Letter to:

Sandra A. Carlo, COO, at  
[sfabi@upa.chob.edu](mailto:sfabi@upa.chob.edu) or  
UBMD Pediatrics  
239 Bryant Street 2nd FL  
Buffalo NY 14222.

Job Code: CECTKN

AA/EOE

#### CONGENITAL CARDIOLOGY TODAY CALL FOR CASES AND OTHER ORIGINAL ARTICLES

Do you have interesting research results, observations, human interest stories, reports of meetings, etc. to share?  
Submit your manuscript to: [RichardK@CCT.bz](mailto:RichardK@CCT.bz)

# Case Series: Unusual Causes of Dynamic ST-T Segment Changes

By Tabitha G. Moe, MD; Edward K. Rhee, MD; Joseph Graziano, MD

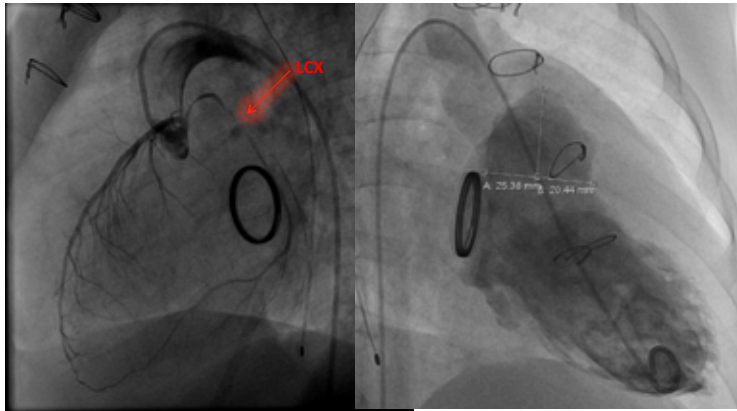


Image 1. Dynamic LCX compression with Diastole. Demonstration of large left atrioventricular disruption with aneurysm.

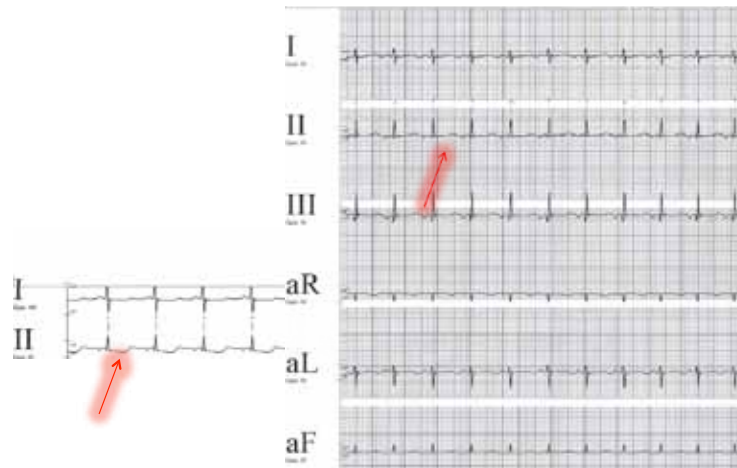


Image 2. Dynamic ST segment depression in lead II.

## Case 1

Case 1 is an 18-month-old female with a history of congenital mitral valve dysplasia with severe mitral regurgitation and mild mitral stenosis who is status post initial palliation at five months of age with a 16 mm St. Jude mitral valve replacement. She developed a thrombus along the valve along in addition to dysfunction of the valve prosthesis and underwent surgical inspection of the mitral valve and prosthetic valve thrombectomy. She developed a post-operative complication of a left middle cerebral artery embolic stroke with complete neurologic recovery. She then developed a left subdural hematoma and underwent craniotomy and hematoma evacuation without significant neurologic deficits. Repeat mitral valve replacement was indicated for redevelopment of mitral valve prosthesis dysfunction and thrombus formation with a 19 mm St. Jude MVR. A follow-up echo showed significant ventricular dysfunction and the patient was referred for cardiac catheterization. Cardiac catheterization showed dynamic diastolic compression of the left circumflex artery by a pseudoaneurysm thought to be an atrioventricular (AV) disruption at the site of her two previously placed prosthetic mitral valves (Image 1). The dynamic diastolic compression causes interesting EKG features consistent with ST-segment elevation and ischemia (Image 2). Echo analysis revealed progression of wall motion abnormalities, and slowly decremending left

ventricular ejection fraction in the setting of an ongoing coronary insult. Medical and operative management continued to be difficult in light of two failed mitral valve prostheses, and she was subsequently listed for heart transplant. She underwent a bicaval orthotopic heart transplant at age 20 months and was able to be discharged to home without further postoperative complications.

## Case 2

The patient is a 13-year-old male with a history of repaired truncus arteriosus and an interrupted aortic arch status post-arch reconstruction. Cardiac catheterization one year previously noted moderate narrowing of the pulmonary homograft, moderate pulmonary insufficiency, and a peak gradient across his aortic arch of 50 mmHg. He was referred for pulmonary homograft replacement and arch repair. The operative course was unremarkable and he was transferred to the cardiovascular intensive care unit (CVICU) for recovery. Shortly after arrival in the CVICU, he was noted to have 3 mm ST-segment elevation in leads II, III, and aVF suggestive of inferior ischemia (Image 3). The patient's previous cardiac magnetic resonance imaging was reviewed extensively and there were no coronary anomalies noted. It was, therefore, determined that he should be taken to the cardiac catheterization lab to evaluate for patency of the RCA. Fluoroscopic evaluation of coronary anatomy revealed compromise of the RCA by the chest tube placed on intermittent suction for drainage post-operatively (Images 4 and 5). The chest tube was removed and the ST-segment changes resolved.

## Discussion

These two unique cases highlight the need for clinical acumen in electrocardiogram interpretation. Each of these cases presents a very

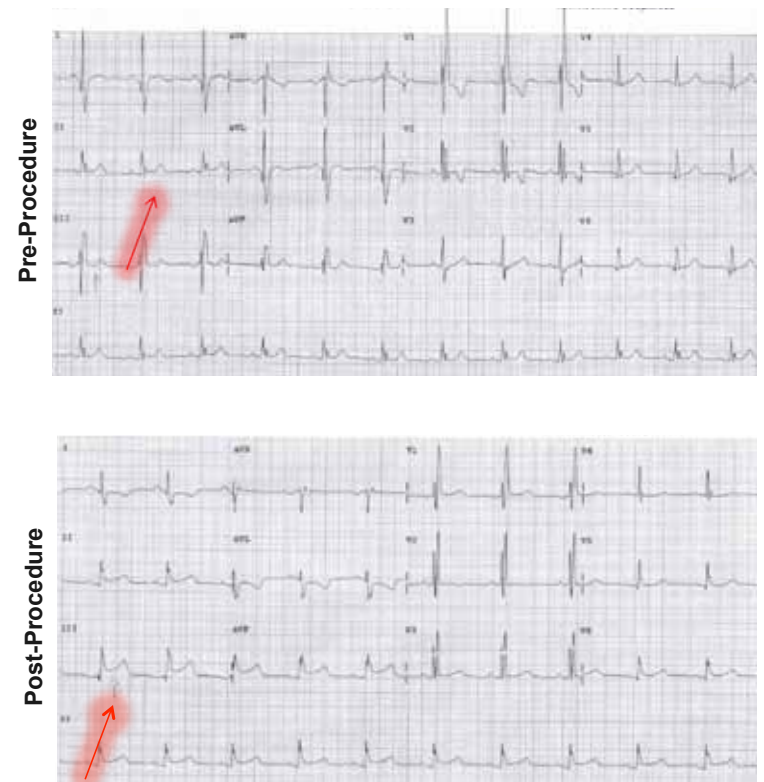


Image 3 - Dynamic LCX compression with Diastole. Demonstration of large left atrioventricular disruption with aneurysm.



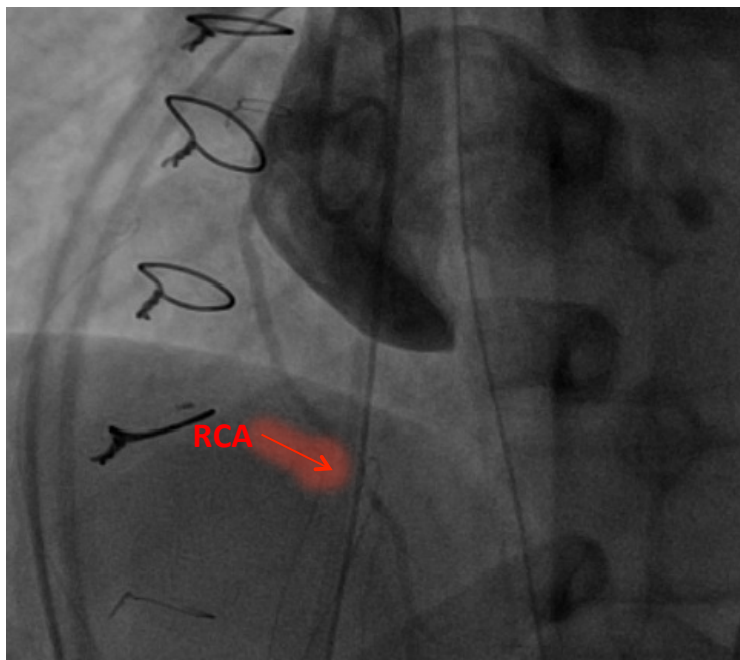


Image 4. Dynamic LCX compression with Diastole. Demonstration of large left atrioventricular disruption with aneurysm.

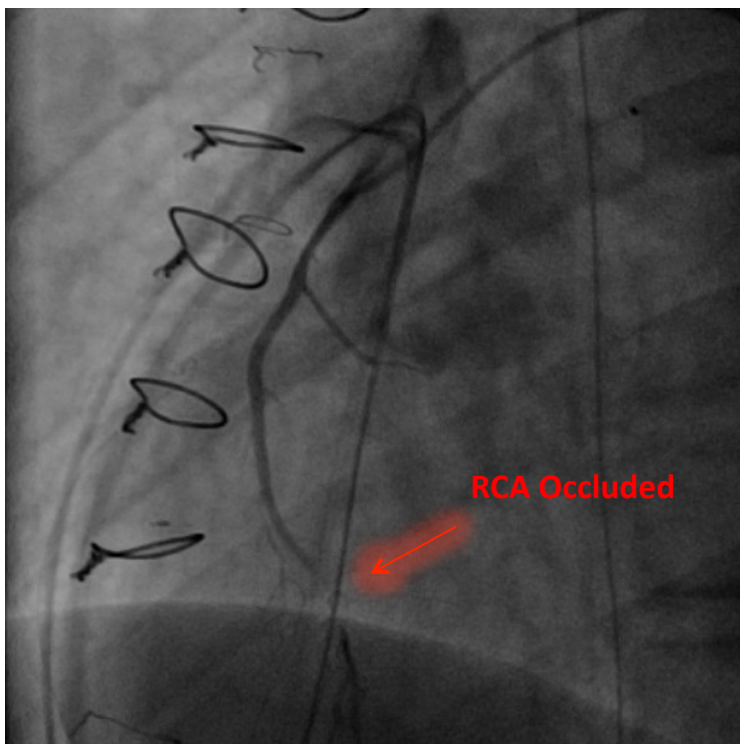


Image 5. Selective RCA angiography with mid RCA occlusion.



## PEDIATRIC CARDIOLOGIST

Louisiana State University Health Sciences Center, Department of Pediatrics and Division of Pediatric Cardiology and Children's Hospital in New Orleans are seeking a full-time academic pediatric cardiologist specializing in Heart Transplantation. Appointment and appointment track will be at the academic rank of Assistant Professor, Associate Professor, or Professor and will be determined by the candidate's credentials and experience. The successful candidate will serve as the Medical Director of the Heart Transplant Program at Children's Hospital, and will direct the programmatic medical management of children and young adults undergoing heart transplantation. The incumbent will work in conjunction with the Cardiothoracic Surgery team, along with other pediatric cardiologists and others involved in care of these complex patients.

The Heart Center at Children's Hospital has an active interventional cardiology and cardiothoracic program with seven full time pediatric cardiologists and three cardiothoracic surgeons providing inter-disciplinary care for infants, children and young adults. Children's Hospital serves the entire State of Louisiana and central Gulf Coast region, and is a 247 bed tertiary-care teaching complex located in the heart of New Orleans, with a state-of-the art 20 bed CICU. There is an ACGME-accredited pediatric cardiology fellowship training program.

There are excellent opportunities for clinical, translational, and basic research, particularly with the LSUHSC Cardiovascular Center of Excellence.

Qualified applicants must be BE/BC in Pediatric Cardiology and licensable to practice medicine in Louisiana. Salaries are competitive. The School of Medicine does not participate in sponsoring faculty candidates for the Department of Health and Hospitals' Conrad 30 Program.

**Interested applicants should submit a cover letter and CV electronically to:**

[SOM-Jobs@lsuhsc.edu](mailto:SOM-Jobs@lsuhsc.edu);

**Reference Pediatric Cardiology Heart Transplant position.**

*LSUHSC-NO is an AA/EOE.*



## BASIC AND ADVANCED FETAL CARDIOLOGY SYMPOSIUM & WORKSHOP 2014

1<sup>ST</sup> ANNUAL MEETING

SAVE THE DATE JUNE 5-6, 2014; CHICAGO IL USA

<http://fetalcardiacsymposium.com>

unusual set of circumstances leading to intermittent myocardial ischemia in a child. Atrioventricular (AV) disruption occurs rarely (1% to 2%), but is usually fatal with an operative mortality rate of 50%.<sup>1,2</sup> Our patient is unique in that her presentation of AV disruption was found during cardiac catheterization after an abnormal echo suggested it. In the case of multiple mitral valve surgeries, AV disruption, injury to the left circumflex artery and thromboembolic events are infrequent but documented complications.<sup>3</sup> Various predisposing and intraoperative factors have been suggested as to the cause of AV disruption.<sup>4</sup> Dark and Bain suggest the cause of the rupture at the AV groove occurs after damage to the myocardium that has lost the internal support structure of the subvalvular apparatus.<sup>5</sup> Although there are multiple case reports of left coronary artery injury or accidental occlusion perioperatively, there are no documented cases of dynamic left circumflex occlusion secondary to AV disruption.<sup>6-10</sup> There are rare case reports of patients developing acute ischemia following uneventful non-coronary cardiac surgery even after successful weaning of cardio-pulmonary bypass in adults. There are exactly two cases of coronary ischemia reported secondary to chest tube placement with intermittent suction.<sup>11</sup> A similar case reports RCA acute marginal branch compression by intrapericardial drain placement and not an extra-cardiac chest tube with intermittent suction.<sup>12</sup> There are no previously reported cases of RCA compression in children after conduit replacement. These two cases serve as excellent reminders to critically examine both the patient and objective data in patients with complex congenital heart disease, and multiple repairs.

*The authors have no disclosures.*

## References

1. Karlson KJ, Ashraf MM, Berger RL. Rupture of left ventricle following mitral valve replacement. *Ann Thorac Surg* 1988;46: 590-7.
2. Bjork VO, Henze A, Rodriguez L. Left ventricular rupture as a complication of mitral valve replacement. *J Thorac Cardiovasc Surg* 1977;73:14-22.
3. Cammack PL, Edie RN, Edmunds LH Jr. Bar calcification of the mitral annulus: a risk factor in mitral valve operations. *J Thorac Cardiovasc Surg* 1987;94:399-404.
4. Katske G, Golding LR, Tubbs RR, Loop FD. Posterior midventricular rupture after mitral valve replacement. *Ann Thorac Surg* 1979;27:130-2.
5. Dark JH, Bain WH. Rupture of posterior wall of left ventricle after mitral valve replacement. *Thorax* 1984;39:905-11.
6. Morin D, Fischer AP, Sohl BE, Sadeghi H. Iatrogenic myocardial infarction. A possible complication of mitral valve

surgery related to anatomical variation of the circumflex coronary artery. *Thorac Cardiovasc Surg* 1982;30:176-9.

7. Kaklikkaya I, Yeginoglu G. Damage to coronary arteries during mitral valve surgery. *Heart Surg Forum* 2003;6:E138-42.
8. Cornu E, Lacroix PH, Christides C, Laskar M. Coronary artery damage during mitral valve replacement. *J Cardiovasc Surg (Torino)* 1995;36:261-4.
9. Virmani R, Chun PK, Parker J, McAllister HA Jr. Suture obliteration of the circumflex coronary artery in three patients undergoing mitral valve operation. Role of left dominant or codominant coronary artery. *J Thorac Cardiovasc Surg* 1982;84:773-8.
10. Danielson GK, Cooper E, Tweedale DN. Circumflex coronary artery injury during mitral valve replacement. *Ann Thorac Surg* 1967;4:53-9.
11. Chapin JW, Kahre J, Newland M. Acute Myocardial Ischemia caused by mediastinal chest tube suction. *Anesth Analg* 1980; 59:386-7.
12. Sulimovic S, Noyez L. Postoperative myocardial ischemia caused by compression of a coronary artery by a chest tube. *J Cardiovasc Surg* 2006; 47:371-2.

**CCT**

## Corresponding Author



*Tabitha G. Moe, MD  
Banner- Good Samaritan Medical Center  
1111 E. McDowell Road  
Phoenix, AZ 85006 USA  
602-839-2000  
Tabitha.Moe@gmail.com*



*Joseph N. Graziano, MD, FACC  
Director, Cardiac Catheterization Laboratory  
Phoenix Children's Heart Center  
1920 E Cambridge Ave #301  
Phoenix, AZ 85006 USA*



*Edward K. Rhee, MD, FACC, FAAP  
Director of Electrophysiology  
Phoenix Children's Hospital  
1919 East Thomas Rd.  
Phoenix, AZ 85013 USA*

## CONGENITAL CARDIOLOGY TODAY

© 2014 by Congenital Cardiology Today (ISSN 1554-7787-print; ISSN 1554-0499-online).  
Published monthly. All rights reserved.  
[www.CongenitalCardiologyToday.com](http://www.CongenitalCardiologyToday.com)

### Mailing Address:

PO Box 444, Manzanita, OR 97130 USA  
Tel: +1.301.279.2005; Fax: +1.240.465.0692

### Editorial and Subscription Offices:

16 Cove Rd, Ste. 200, Westerly, RI 02891 USA

### Publishing Management:

- Tony Carlson, Founder, President & Sr. Editor - [TCarlsonmd@gmail.com](mailto:TCarlsonmd@gmail.com)
- Richard Koulbanis, Group Publisher & Editor-in-Chief - [RichardK@CCT.bz](mailto:RichardK@CCT.bz)
- John W. Moore, MD, MPH, Group Medical Editor - [JMoore@RCHSD.org](mailto:JMoore@RCHSD.org)
- Virginia Dematatis, Assistant Editor
- Caryl Cornell, Assistant Editor
- Loraine Watts, Assistant Editor
- Chris Carlson, Web Manager
- Rob Hudgins, Designer/Special Projects

**Editorial Board:** Teiji Akagi, MD; Zohair Al Halees, MD; Mazeni Alwi, MD; Felix Berger, MD; Fadi Bitar, MD; Jacek Bialkowski, MD; Mario Carminati, MD; Anthony C. Chang, MD, MBA; John P. Cheatham, MD; Bharat Dalvi, MD, MBBS, DM; Horacio Faella, MD; Yun-Ching Fu, MD; Felipe Heusser, MD; Ziyad M. Hijazi, MD, MPH; Ralf Holzer, MD; Marshall Jacobs, MD; R. Krishna Kumar, MD, DM, MBBS; John Lamberti, MD; Gerald Ross Marx, MD; Tarek S. Momenah, MBBS, DCH; Toshio Nakanishi, MD, PhD; Carlos A. C. Pedra, MD; Daniel Penny, MD, PhD; James C. Perry, MD; P. Syamasundar Rao, MD; Shakeel A. Qureshi, MD; Andrew Redington, MD; Carlos E. Ruiz, MD, PhD; Girish S. Shirali, MD; Horst Sievert, MD; Hideshi Tomita, MD; Gil Wernovsky, MD; Zhuoming Xu, MD, PhD; William C. L. Yip, MD; Carlos Zabal, MD

*Statements or opinions expressed in Congenital Cardiology Today reflect the views of the authors and sponsors, and are not necessarily the views of Congenital Cardiology Today.*



# Find Your Path At Sidra

Join a dynamic team working to build a holistic and nurturing pediatric patient experience at Sidra Medical and Research Center in Doha, Qatar. Our Cardiovascular Center of Excellence is looking for:

## Pediatric Cardiologists

- General Pediatric Cardiologists: Board certified in Pediatric Cardiology with a minimum of 6 years' experience
- Pediatric Cardiologists: Board certified in Pediatric Cardiology with expertise in exercise physiology and minimum of 3 to 6 years' experience

## Sonographers

- BSc Clinical Physiology or Associate of Applied Sciences
- RDCS in fetal, pediatric and adult echocardiography
- 5+ years clinical experience in diagnostic imaging in an accredited academic facility

Registration with ARDMS

## Benefits

- Highly competitive salary (paid tax free in Qatar)
- Company-provided accommodation or housing allowance and company-provided transport or allowance
- Other financial rewards, including

## Staff Nurses

- Nurses: Certified nurses with 2+ years of experience working in a congenital pediatric cardiac catheterization laboratory

## Technologist - Cardiovascular

- BSc (Hons) Clinical Physiology or equivalent (RCVT)
- 3+ years as a Senior Cardiac Technologist or RCVT in a western tertiary care facility
- Minimum of 5 years' experience of congenital and structural cardiac catheterization laboratory work

performance bonuses and annual gratuity payment

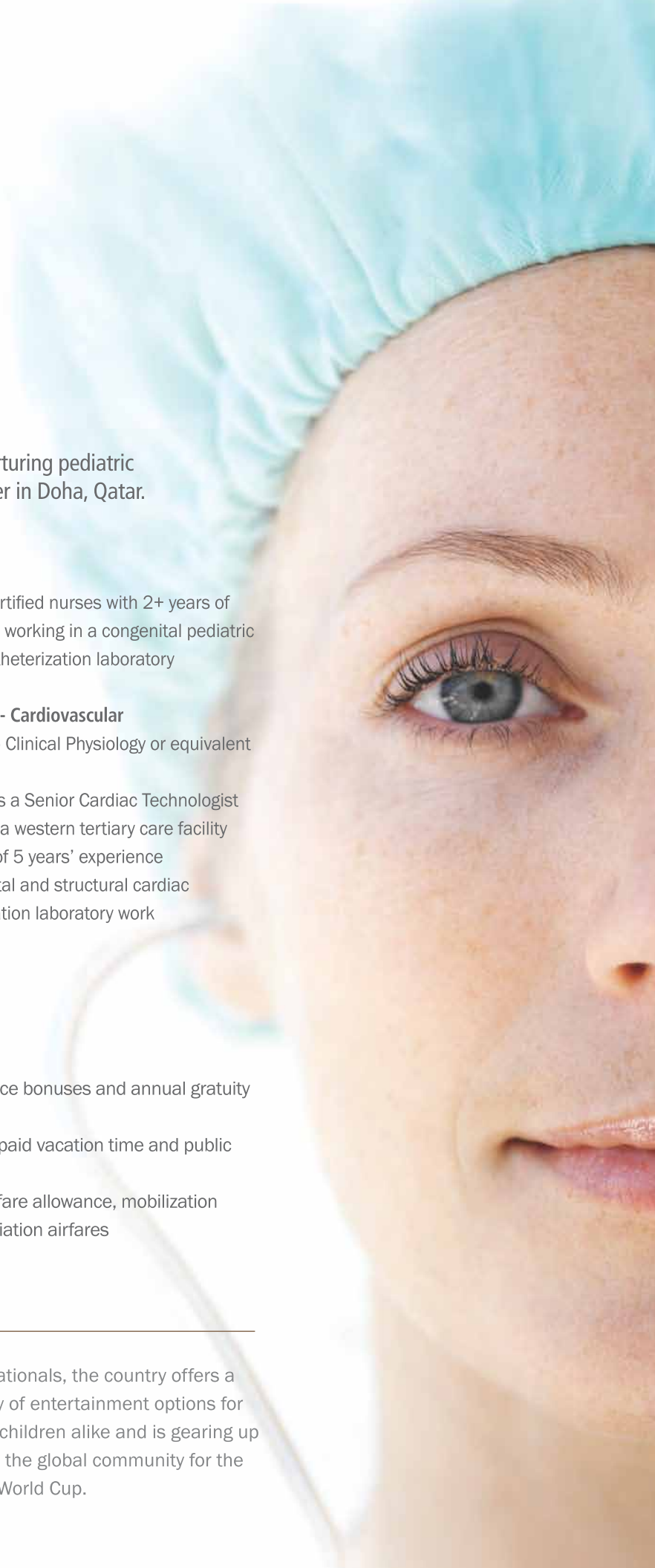
- Generous paid vacation time and public holidays
- Annual airfare allowance, mobilization and repatriation airfares

To find out more, visit [careers.sidra.org](https://careers.sidra.org)

## Living in Qatar

Nestled at the heart of the Arabian Gulf is the Peninsula of Qatar, a country where traditional meets modern, creating a unique authenticity. Home to some 2 million people, including approximately

300,000 nationals, the country offers a wide variety of entertainment options for adults and children alike and is gearing up to welcome the global community for the 2022 FIFA World Cup.





**TINY HEARTS**

**inspired**

## **HYBRID LABS WITH ACCESS FOR BIG TEAMS.**

Fixing a heart from birth through adulthood takes big teams working together. So we examined the needs of leading clinicians when designing our hybrid solutions. The result: our Infinix™-i with 5-axis positioners and low profile detectors, stays out of the way, but right where needed, providing the best possible access to patients. To lead, you must first listen. [medical.toshiba.com](http://medical.toshiba.com)



[youtube.com/toshibamedical](http://youtube.com/toshibamedical)



[@ToshibaMedical](https://twitter.com/ToshibaMedical)