

CONGENITAL CARDIOLOGY TODAY

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

October 2013; Volume 11; Issue 10
International Edition

IN THIS ISSUE

Giant Right Coronary Aneurysm with Thrombus and Anomalous Left Coronary Arising from the Pulmonary Artery (ALCAPA) Visualized with 3D MDCT Reconstruction

by Tabitha Moe, MD and Stephen Pophal, MD
~Page 1

The CHIP Network is Ready to Serve The Congenital Heart Professionals' Community by Gary Webb, MD; Robert Campbell, MD
~Page 7

Image of the Month #7 - October 2013 - Presented by The Archiving Working Group

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

Fallot's Tetralogy: Anatomical Observations and Controversies
Contributors: Robert Anderson, MD; Vera D. Aiello, MD; Diane E. Spicer, BS; Jeffrey P. Jacobs, MD; Jorge M. Giroud, MD
~Page 10

DEPARTMENTS

January Meeting Focus
~Page 4

Medical News, Products and Information
~Page 14

CONGENITAL CARDIOLOGY TODAY
Editorial and Subscription Offices
16 Cove Rd, Ste. 200
Westerly, RI 02891 USA
www.CongenitalCardiologyToday.com

© 2013 by Congenital Cardiology Today ISSN:
1544-7787 (print); 1544-0499 (online).
Published monthly. All rights reserved.

Giant Right Coronary Aneurysm with Thrombus and Anomalous Left Coronary Arising from the Pulmonary Artery (ALCAPA) Visualized with 3D MDCT Reconstruction

By Tabitha Moe, MD and Stephen Pophal, MD

Case Report

A 66-year-old Native American male presented with chest pain. He had a known history of insulin-dependent diabetes mellitus, alcoholism, and thrombocytopenia. He initially underwent CT evaluation for suspicion of pulmonary embolus. A subsequent Cardiac CT (Image 1) showed an RCA aneurysm of 5.5 x 5.6 cm with eccentric mural thrombus and a dilated posterior descending artery of 9 mm. Three-dimensional reconstruction of the MDCT showed posterior origin of the ALCAPA (Image 2). A 2D Echo showed: no intracardiac shunting, ALCAPA with coronary flow retrograde into the MPA, multiple large saccular aneurysms of the RCA noted with low flow velocities within the sac and the left ventricular ejection fraction was preserved. Transesophageal echocardiogram confirmed echo findings and demonstrated mild dilatation at the sinuses of Valsalva of 4cm. Cardiac MRI (Image 3) revealed findings consistent with an anomalous left coronary artery arising from the main pulmonary artery (MPA), massive aneurysmal dilatation of the right coronary artery (RCA) with mural thrombus seen, moderate aortic regurgitation, and a normal Qp/Qs ratio of 1:1. Myocardial perfusion imaging revealed no

segmental wall motion abnormalities, and no perfusion defects (Image 4). The patient was referred for right and left heart catheterization to determine the degree of shunting, and was evaluated for possible revascularization. Cardiac catheterization did not reveal a significant shunt Qp:Qs 1.367, with a giant RCA aneurysm redemonstrated (Image 5). The RCA thrombus was not well visualized with this imaging modality. Despite the MDCT and MRI documentation of RCA mural thrombus, and dramatically increased risk of embolization phenomenon, it was determined not to anticoagulate or revascularize this patient as he was found to have multiple esophageal lesions suspicious for malignancy.

Discussion

Anomalous origin of the Left Coronary Artery from the Pulmonary Artery (ALCAPA) is a rare congenital coronary abnormality associated with early infant mortality and adult sudden death. ALCAPA results embryologically from failure of connection of the bud from the left aortic sinus of Valsalva with the epicardial arterial plexus; instead, a bud from the pulmonary trunk connects with the epicardial plexus. The incidence of ALCAPA is estimated at 1/300,000 live births accounting for 0.3% of

Need to Recruit a Pediatric Cardiologist?

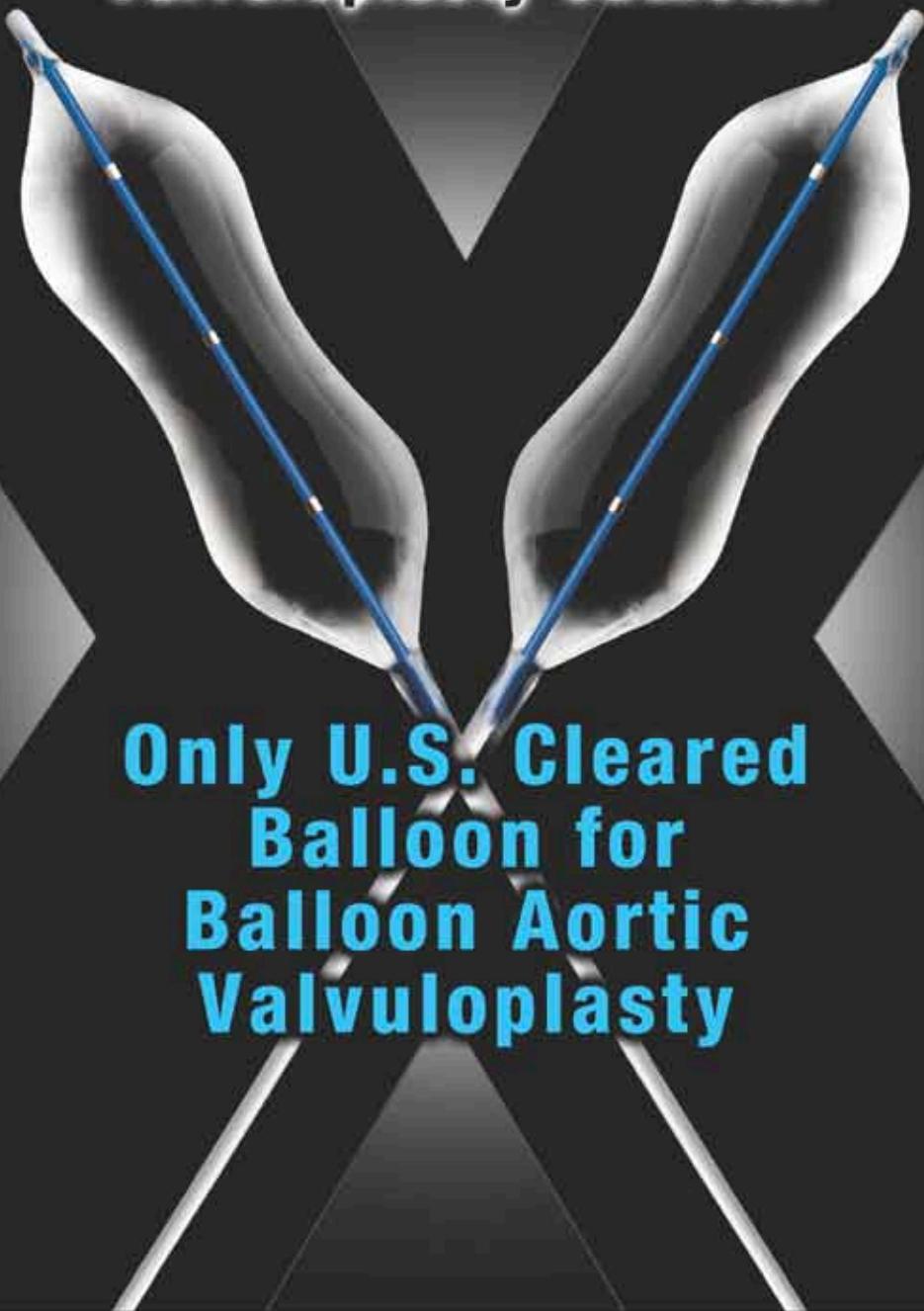
- Advertise in Congenital Cardiology Today, the only monthly newsletter dedicated to pediatric and congenital cardiologists.
- Reach over 6,000 Pediatric and Adult Cardiologist focused on CHD worldwide. CCT is the only monthly newsletter dedicated to Pediatric and Adult Cardiologists focused on CHD.
- Editions include North America and International.
- All recruitment advertising includes full color and is listed in that issue's email blast!
- We can create your recruitment ad at no extra charge!

Contact:

Tony Carlson, Founder
Tel: +1.301.279.2005 or TCarlsonmd@gmail.com

NuCLEUS-X™

Balloon Aortic & Pulmonic
Valvuloplasty Catheter



**Only U.S. Cleared
Balloon for
Balloon Aortic
Valvuloplasty**

B|BRAUN
www.bisusa.org Interventional
Systems

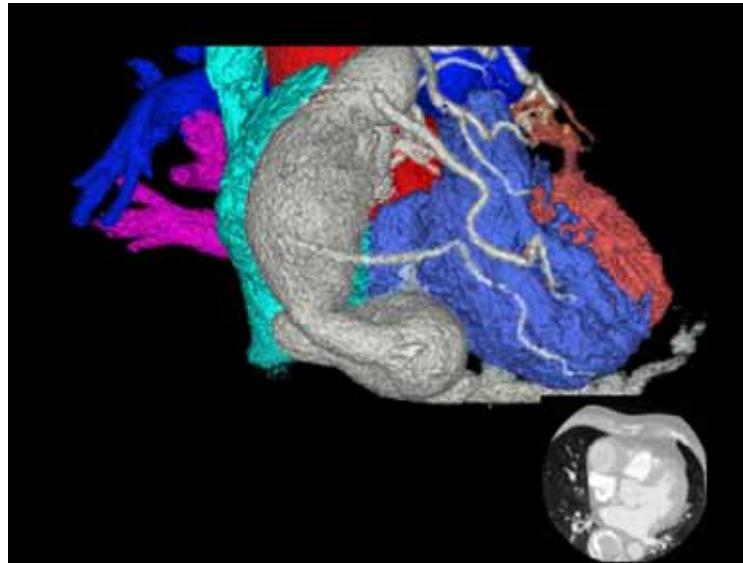


Image 1. 3D MDCT Reconstruction demonstrating Giant Aneurismal RCA and RCA to LAD collaterals.

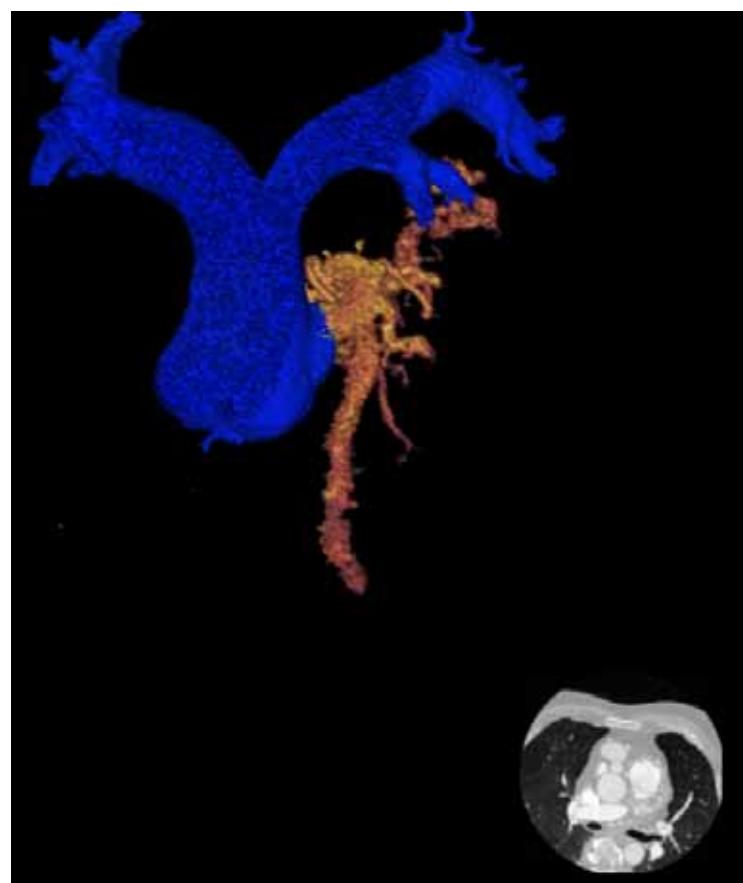


Image 2. 3D MDCT Reconstruction demonstrating Left coronary origin from the posterior aspect of the Main Pulmonary Artery.



Image 3. Cardiac MRI with giant aneurismal RCA.

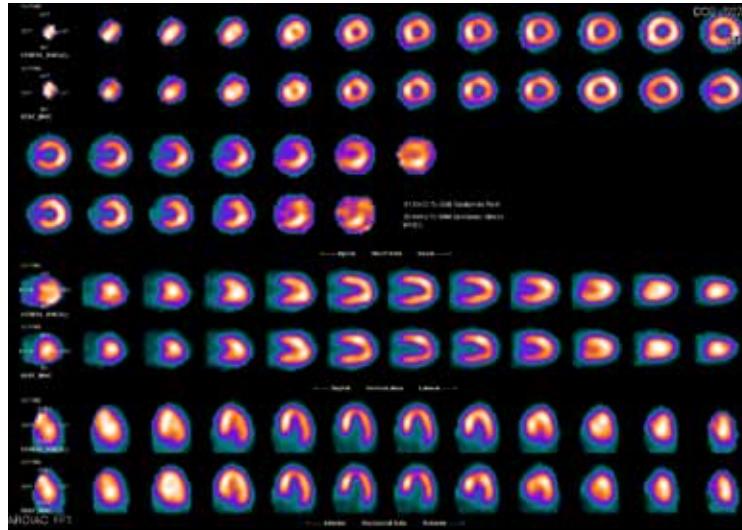


Image 4. Lexiscan Myocardial Perfusion Imaging Scan, with normal perfusion.

Congenital Cardiac Disease.¹ The first adult case of ALCAPA described a dilated and aneurismal RCA and thin-walled vessels in the normal left coronary distribution becoming the classical autopsy description of adult ALCAPA.² Infant presentation coincides with ductal closure at 2 months of life.³ Hemodynamic transition from fetal to adult circulation requires closure of the ductus, or persistent patent ductus. In the setting of ductal closure, RCA dilatation and right to left collaterals must form to perfuse the



Volunteer / Get Involved
www.chimsupport.com

HOW WE OPERATE

The team involved at C.H.I.M.S. is largely a volunteering group of physicians, nurses and technicians who are involved in caring for children with congenital heart disease.

The concept is straightforward. We are asking all interested catheter laboratories to register and donate surplus inventory which we will ship to help support CHD mission trips to developing countries.

JANUARY MEETING FOCUS

4th Vietnam Congress of Congenital and Structural Heart Disease - "Fistulae from A to Z"

Jan. 8 - 10, 2013; Ho Chi Min City, Vietnam

www.congenitalheartdisease.net.vn/en/Default.aspx

Overview: In addition to the aspects of *Fistulae from A to Z*, the 4th Congress will update attendees on new techniques and devices in congenital and structural intervention.

Congress Organization: HCMC Pediatric Cardiology & Congenital Heart Disease Society
341 Su Van Hanh, Ward 10, District 10, Ho Chi Minh City, Vietnam

Phone: (+84) 913.723.437 (Dr. Do Tin)
Email: donguyentin@congenitalheartdisease.net.vn
Website: www.congenitalheartdisease.net.vn

Organizing Committee: Hoang Trong Kim, Pham Nguyen Vinh, Vu Minh Phuc, Nguyen Lan Hieu, Do Nguyen Tin

Board of Directors: Bharat Dalvi India; Do Nguyen Tin, Viet Nam; Hoang Trong Kim, Vietnam; Le Trong Phi, Germany; Lee Beeson, Canada; Mohammed Omar Galal, Saudi Arabia; Neil Wilson, United Kingdom; Nguyen Lan Hieu, Vietnam; Nina Wunderlich, Germany; Pham Nguyen Vinh, Vietnam; Shakeel A. Qureshi, United Kingdom; Vu Minh Phuc, Vietnam

International Faculty: Anthony C. Chang, USA; Avraham Lorber, Israel; Carlos Zabal, Mexico; Casey Culbertson, USA; Farhouch Berdjis, USA; Geetha Kandavello, Malaysia; Haifa Abdul Latiff, Malaysia; Hans Reiner Figulla, Germany; Hara Hidehiko, Japan; Hasri Samion, Malaysia; Horst Sievert, Germany; Indriwanto Sakidjan, Harapan Kita; Jae-Young Choi, South Korea; Jieh - Neng Wang, Taiwan; Jing - Ming Wu, Taiwan; Joaquim Miro, Canada; Joseph De Giovannil, UK; Jose Jonas D. Del Rosario, Philippines; Jou-Kou Wang, Taiwan; Prof. Kai-Sheng, Taiwan; Kevin Walsh, Ireland; Krishna Kuma, India; Kritvikrom Durongpisitkul, Thailand; Martin B E Schneider, Germany; Mazeni Alwi, Malaysia; Nageshwar Rao, India; Mohammed Omar Galal, KSA; Pornthep Lertsapcharoen, Thailand; Rainer Kozlik Feldmann, Germany; Rasha I. Ammar, Egypt; Putra Sukman, Indonesia; Supaporn Roymanee, Thailand; Teiji Akagi, Japan; Tiow Hoe Goh, Australia; Toshio Nakanishi, Japan; Worakan Promphan, Thailand; Xiang Qing Kong, China; Yat-Yin Lam, Hong Kong; Yat-Yin Lam, Hong Kong; Zahid Amin, USA

Selected Meeting Topics:

- Coronary Fistulae
- Pulmonary AV Fistulae
- Porto - Systemic Fistulae
- Valsalva Sinus Fistulae
- Paravalvular Leak
- Renal A-V Fistulae
- And many more...

left coronary myocardial distribution, most commonly through the left anterior descending at the apex. This subsequently results in RCA dilatation and aneurysm formation, and reversal of flow through the left coronary ostia back through into the MPA.⁴ Natural history of the disease leads to an additional phase of coronary steal where myocardial perfusion of left coronary artery territory from the RCA has progressive shunting, at which point adult patients begin to present with symptoms.⁵ Adult presentation is most commonly associated with angina, dyspnea, palpitations, or fatigue. The

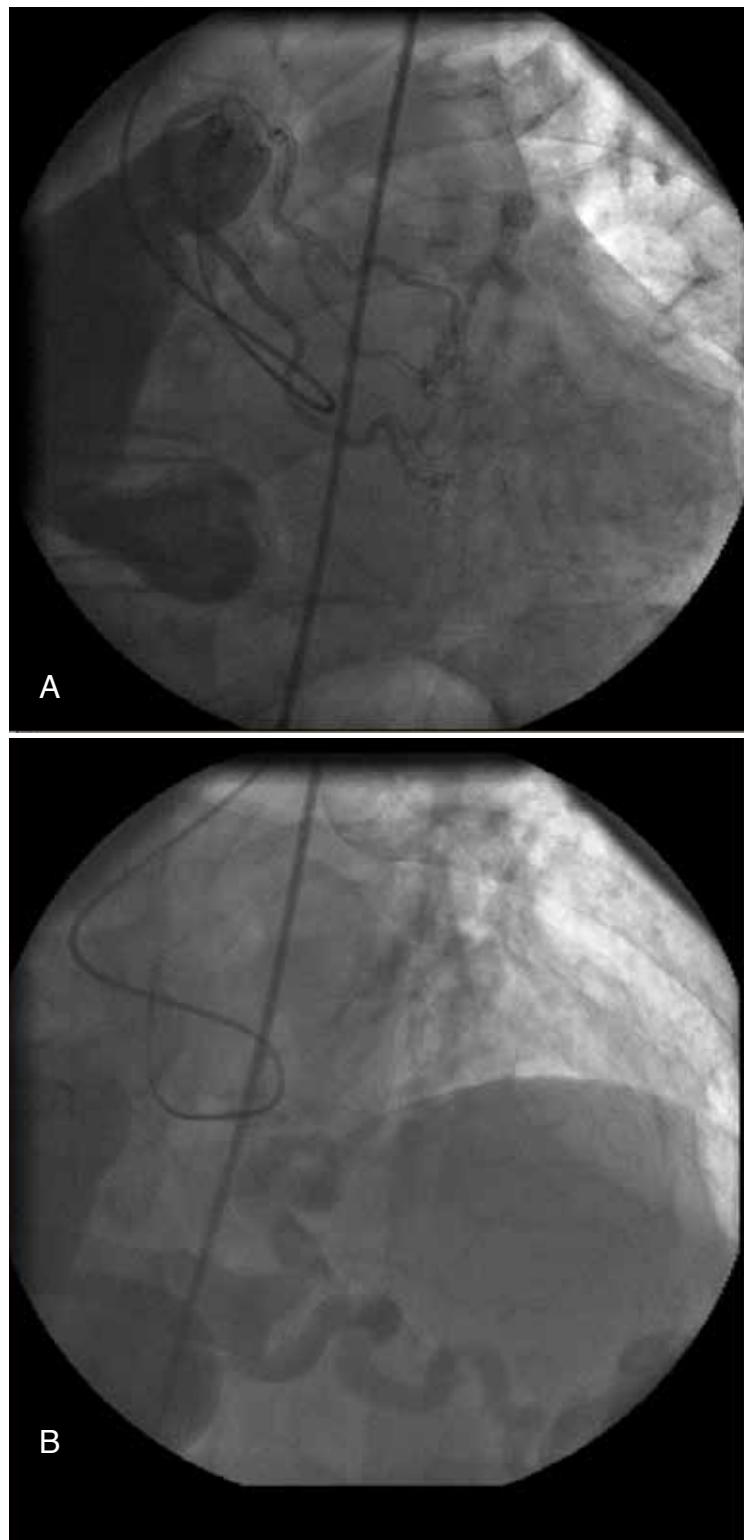


Image 5. A&B. Panel A Coronary Angiography with a Multipurpose Catheter in the RCA demonstrating the giant RCA aneurysm, but not well illuminating the known RCA mural thrombus. Panel B demonstrating the RCA aneurysm with very delayed filling of the LAD via collaterals, and faint retrograde blush into the MPA.

average age for adult presentation is 33.⁶ A review of autopsy studies suggests that sudden death occurs in unrecognized adult ALCAPA patients on average at 35 years of age.^{7,8} Availability and utilization of noninvasive cardiac imaging has increased the number of asymptomatic adult ALCAPA cases over the age of 50 years. In contrast



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 ($\geq 16\text{mm}$ in diameter when originally implanted) that is either regurgitant (\geq moderate) or stenotic (mean RVOT gradient $\geq 35\text{ mm Hg}$)

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.

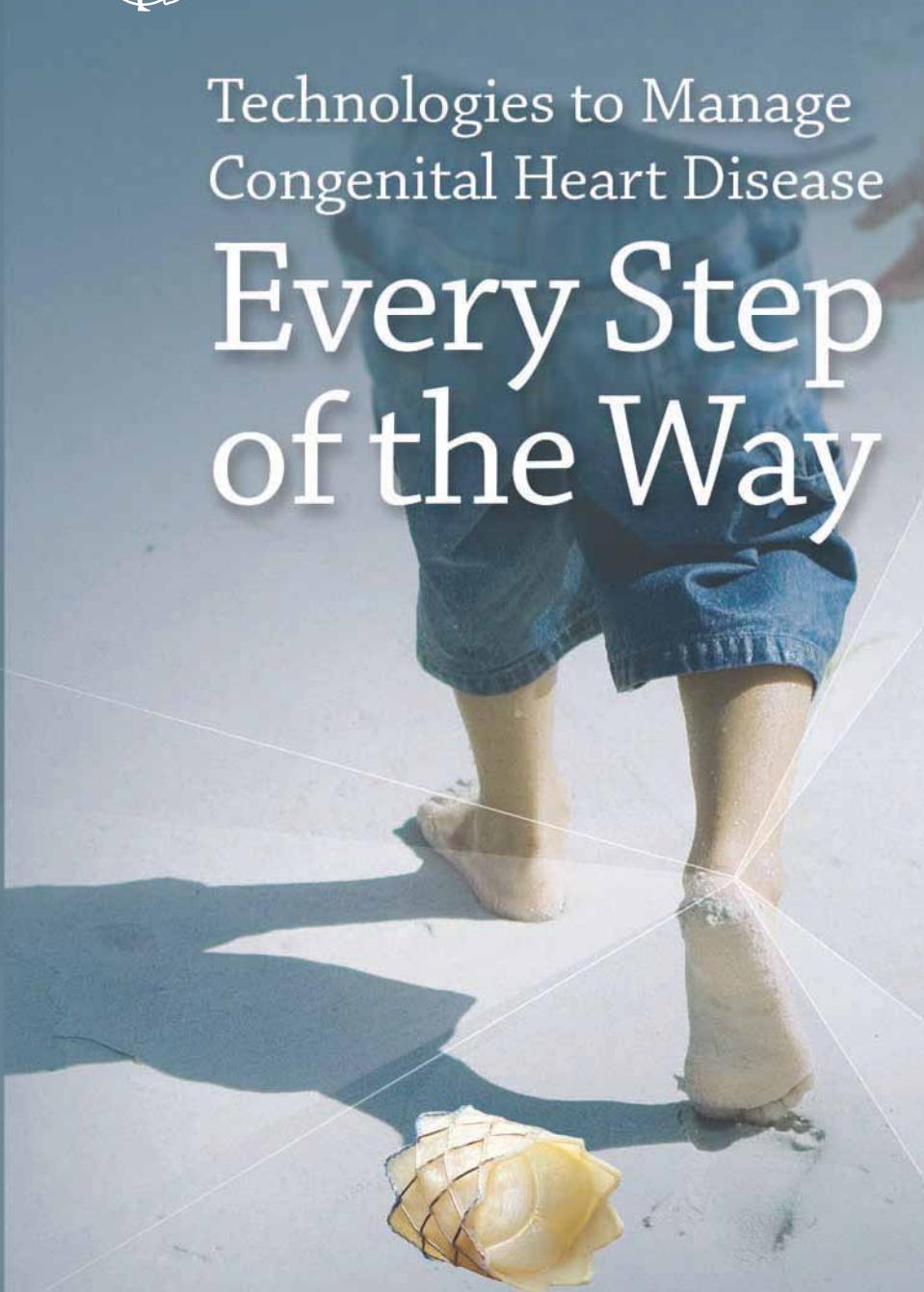
Potential procedural complications that may result from implantation of the Melody device include: rupture of the RVOT conduit, compression of a coronary artery, perforation of a major blood vessel, embolization or migration of the device, perforation of a heart chamber, arrhythmias, allergic reaction 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.

Humanitarian Device. Authorized by Federal law (USA) for use in patients with a regurgitant or stenotic Right Ventricular Outflow Tract (RVOT) conduit ($\geq 16\text{mm}$ 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.

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

- Title page should contain a brief title and full names of all authors, their professional degrees, and their institutional affiliations. The principal author should be identified as the first author. Contact information for the principal author including phone number, fax number, email address, and mailing address should be included.
 - Optionally, a picture of the author(s) may be submitted.
 - No abstract should be submitted.
 - The main text of the article should be written in informal style using correct English. The final manuscript may be between 400-4,000 words, and contain pictures, graphs, charts and tables.
- Accepted manuscripts will be published within 1-3 months of receipt.
- Abbreviations which are commonplace in pediatric cardiology or in the lay literature may be used.
- Comprehensive references are not required. We recommend that you provide only the most important and relevant references using the standard format.
 - Figures should be submitted separately as individual separate electronic files. Numbered figure captions should be included in the main Word file after the references. Captions should be brief.
 - Only articles that have not been published previously will be considered for publication.
 - Published articles become the property of the Congenital Cardiology Today and may not be published, copied or reproduced elsewhere without permission from Congenital Cardiology Today

"Cardiac CT and MRI allow for longitudinal follow-up and risk stratification, and will guide future guidelines for clinical management of this rare form of congenital heart disease."

to the younger cohort, older patients appear to be better compensated. The risk of sudden death declines progressively in new diagnoses after age 50, despite less frequent surgical correction.⁶ Current practices in noninvasive cardiac imaging allow for additional diagnostic capabilities. CT and MRI features include direct visualization of the left coronary artery from the MPA, dilated and tortuous RCA, and visualization of dilated right to left collateral vessels. Multi-detector CT uniquely allows for evaluation and quantification of thrombus burden in the aneurismal RCA. MRI also allows for flow evaluation from the LCA to the MPA.⁹ Cardiac CT and MRI allow for longitudinal follow-up and risk stratification, and will guide future guidelines for clinical management of this rare form of congenital heart disease.

References

1. Keith JD. The anomalous origin of the left coronary artery from the pulmonary artery. Br Heart J. 1959;21:149-161.
2. Abbott ME. Congenital heart disease. In: Osler W, ed. Modern Medicine; Its Theory and Practice. Philadelphia, PA: Lea and Febiger; 1908:420-421.
3. Kaunitz PE. Origin of the left coronary artery from the pulmonary artery: review of literature and report of two cases. Am Heart J. 1947;33:182-206.
4. Edwards JE. Anomalous coronary arteries with special reference to arterio-venous like communications. Circulation. 1958;17:1001-1006.
5. Baue AS, Baum S, Blakemore WS, et al. A later stage of anomalous coronary circulation with origin of the left coronary artery from the pulmonary artery: coronary artery steal. Circulation. 1967;36:878-885.
6. Yau JM, Singh R, Halpern EJ, Fischman D. Anomalous Origin of the Left Coronary

Artery from the Pulmonary Artery in Adults: A comprehensive Review of 151 Adult Cases and a New Diagnosis in a 53-year-old Woman. Clin Cardiol. 2011;34:204-210

7. Jurishica AJ. Anomalous left coronary artery; adult type. Am Heart J. 1957;54:429-436.
8. Alexi-Meskishvili V, Berger F, Weng Y, et al. Anomalous origin of the left coronary artery from the pulmonary artery in adults. J Card Surg. 1995;10:309-315.
9. Khanna A, Torigian DA, Ferrari VA, et al. Anomalous origin of the left coronary artery from the pulmonary artery in adulthood on CT and MRI. Am J Roentgenol. 2005;185:326-329.

CCT

Corresponding Author



Tabitha Moe, MD
Cardiology Fellow
Banner - Good Samaritan
Carl T. Hayden VA
Phoenix, AZ USA
tabitha.moe@gmail.com



Stephen Popoff, MD
Division Chief Pediatric Cardiology
Phoenix Children's Hospital
Phoenix, AZ USA
Phone 602-933-2311
spopoff@phoenixchildrens.com



SYMPOSIUM ON
CONGENITAL CORONARY ANOMALIES
=2013=
HOUSTON, TEXAS

DECEMBER 5-6, 2013



www.texaschildrens.org/AOCA2013

The CHIP Network is Ready to Serve The Congenital Heart Professionals' Community

By Gary Webb, MD; Robert Campbell, MD

The community of congenital heart professionals is large and is growing. The community has many needs and offers many opportunities. One long-standing problem has to do with how best to communicate within our large family. The July 2010 issue of *Congenital Cardiology Today* (<http://tinyurl.com/l7b827o>) carried an article addressing the need for a possible North American Pediatric Cardiology Organization. The profession of congenital heart disease care (pediatric and adult) has no single identified pediatric cardiac organization, and likewise no singular source of information to contact healthcare and administrative professionals. To this point, many individuals and organizations maintain more proprietary e-mail lists of colleagues, members of various organizations, registrants of courses, and so on. Many of the addresses are out-of-date, and hard to keep current. All of them are incomplete.

Against this backdrop, a number of individuals and groups have been discussing the establishment of the Congenital Heart Professionals Communications Network, also known as "The CHIP Network."

The purpose of The Network is to create a single global list of CHD-interested people in order to: provide a mechanism through which events/activities, research opportunities, and employment opportunities may be shared; provide a mechanism for partner organizations to communicate with all or selected members of the community; bring the pediatric and adult congenital heart communities into closer contact; provide a forum for increased education and awareness of providers about developments in the included professions; and provide a forum for surveys about critical issues in the profession.

The management committee includes representatives of the partner organizations, and presently includes: Drs. Robert Shaddy, Jeff Jacobs, Curt Daniels, Robert Campbell, Gary Webb, and Ms. Maryanne Kessel, Executive Director of the Herma Heart Center in Milwaukee. The management committee will decide how best to manage these communications and how best to build and maintain the list. Funding to establish and maintain the website is being provided by Cincinnati Children's Hospital Heart Institute.

"The purpose of The Network is to create a single global list of CHD-interested people in order to: better provide a forum for increased education and awareness of providers about developments in the included professions; provide a forum for surveys about critical issues in the profession...."

To date, partner organizations committing to contribute to this list include the annual CHOP course, the Adult Congenital Heart Association, the annual North American ACHD course, Pediatric Interventional Cardiac Symposium (PICS), the World Congress of Pediatric Cardiology and Cardiac Surgery, the International Society for Adult Congenital Heart Disease, and *Congenital Cardiology Today*. The management committee invites the participation of other organizations who will wish to communicate with all or some of the congenital heart professionals on this list. Please contact Dr. Gary Webb (gary.webb@cchmc.org) to ask that your organization's or institution's name be added to the list of partner organizations.

The list will be inclusive of anyone and everyone who considers themselves a congenital heart provider or administrator, including cardiologists, cardiac surgeons, cardiac care associates, trainees, administrators, social workers, psychologists and mental health professionals, researchers/scientists, transition medicine specialists, and others (have we left anybody out?).

The CHIP Network's address is: www.chipnetwork.org. Go ahead. Try it out! It's open for business!

Registration will take less than a minute. All participants will always have the option of unsubscribing. Participants' information will not be released to anyone else. Participants

will receive appropriate messages that they request with the assistance of the management committee. No one will contact participants directly using the information they provide on the website.

This is a global list. This will permit communications in languages other than English, and language preferences can be recorded in your profile.

We would encourage you to circulate this information to any of your colleagues, inviting them to participate in the CHIP Network. We want to be able to reach as many members of the congenital heart professionals' community as possible. We are obviously very excited to launch this initiative! With your support, it should greatly improve communications within the growing congenital heart community throughout the world.

CCT

Corresponding Author



Gary D. Webb, MD
Cincinnati Adolescent and Adult Congenital Heart Disease Program
The Heart Institute at Cincinnati Children's Hospital Medical Center
3333 Burnet Ave. – ML 2013
Cincinnati, OH 45229 USA
Phone: 513-803-1777; Fax: 513-803-1778
Gary.Webb@cchmc.org



Robert M. Campbell, MD
Emory University School of Medicine
Child Healthcare of Atlanta / Egleston
Sibley Heart Center
2835 Brandywine Rd., Ste. 300
Atlanta, GA 30329 USA

Image of the Month #7 - October 2013 - Presented by The Archiving Working Group

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

This is a special column that is published bimonthly in *Congenital Cardiology Today* with contributors and images from the Archiving Working Group (AWG) of the International Society for Nomenclature of Paediatric and Congenital Heart Disease.

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.

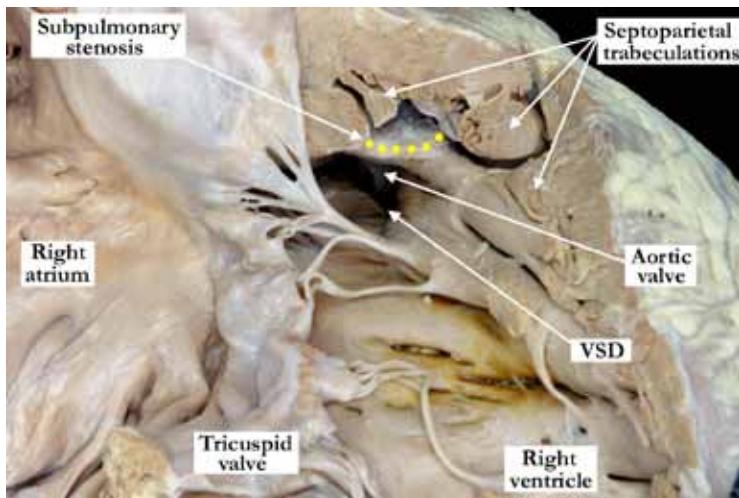
The authors would like to acknowledge the Children's Heart Foundation (www.childrensheartfoundation.org) for financial support of the AWG Web Portal.

IPCCC:
01.01.01

AEPC Derived Term:
Tetralogy of Fallot (01.01.01)

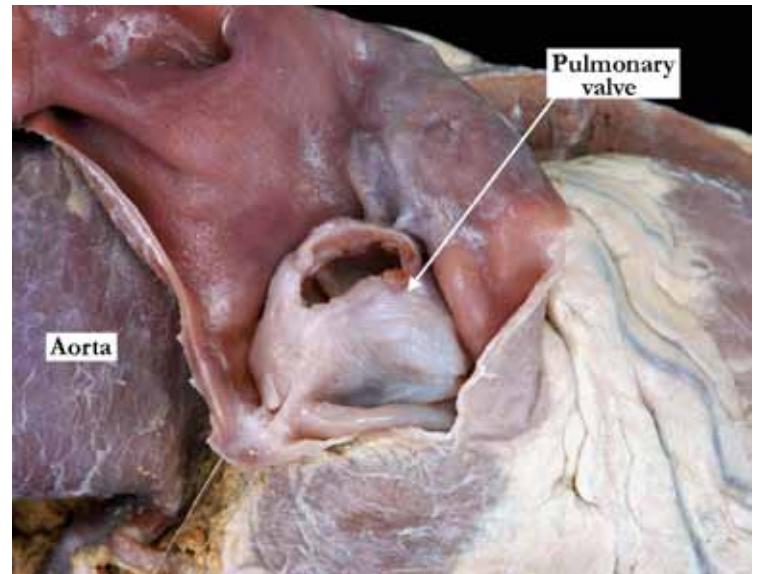
EACTS-STS Derived Term:
Tetralogy of Fallot (01.01.01)

ICD10 Derived Term:
Tetralogy of Fallot (Q21.3)

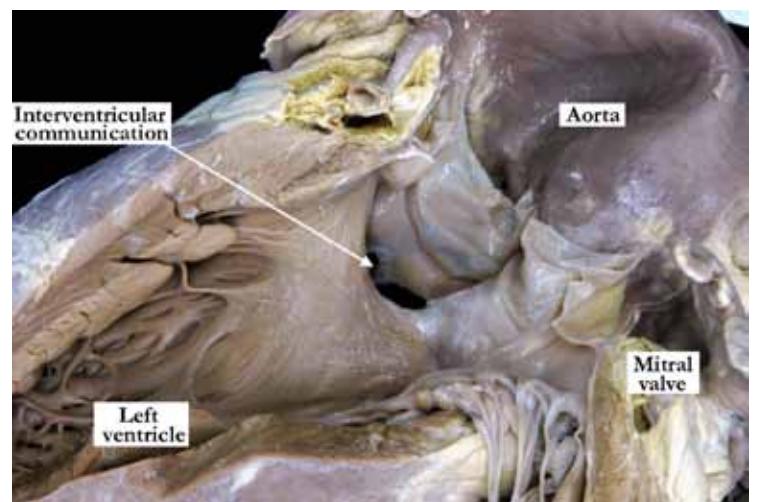


Description: This close-up, anatomical view of this morphologically right ventricle demonstrates the classic features of tetralogy of Fallot. The thickened tricuspid valve guards the inlet to the right ventricle which is hypertrophic. There is a perimembranous Ventricular Septal Defect (VSD) and because the aorta overrides the interventricular septum, the aortic valve can be seen at the roof of the ventricular septal defect. Anterior deviation of the outlet septum (yellow dots) causes the infundibular or subpulmonary stenosis. Hypertrophy of the septoparietal trabeculations contributes to the subpulmonary stenosis.

Contributor: Diane E. Spicer, BS



Description: This close-up view of the pulmonary valve shows a thickened, stenotic, dome-shaped pulmonary valve.
Contributor: Diane E. Spicer, BS



Description: The left ventricular aspect of the heart shown above demonstrates the interventricular communication and the aorta overriding the interventricular septum. The aortic valve is in fibrous continuity with the mitral and tricuspid valves.
Contributor: Diane E. Spicer, BS

Please read this article with the column that immediately follows,
“Fallot’s Tetralogy: Anatomical Observations and Controversies”
by Robert Anderson, MD; Vera D. Aiello, MD; Diane E. Spicer, BS;
Jeffrey P. Jacobs, MD; Jorge M. Giroud, MD

CCT

AWG Web Portal link for this series of images: http://www.accd-awg.umn.edu/TOF/TOF_01_01_01/TOF_01_01.html



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



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



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



And the members of the Archiving Working Group
http://ipccc-awg.net/about_us.html



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



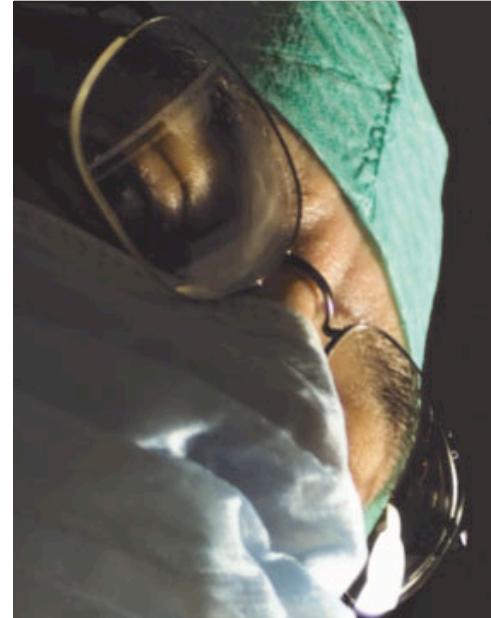
Corresponding Contributor
Jorge M. Giroud, MD
Co-Chairman, Archiving Working Group
Congenital Heart Institute of Florida
601 5th Street South, Suite 711
St. Petersburg, FL, 33701 USA
Phone: 727-767-4200
jorgemgiroud@gmail.com

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



Congenital Cardiology Today

Can Help You Recruit:

- Pediatric Cardiologists
- pediatric Interventional Cardiologist
- Adult Cardiologist focused on CHD
- Congenital/Structural Heart Surgeons
- Echocardiographers, EPs
- Pediatric Transplant Cardiologist

Reach over 6,000 BC/BE Cardiologists focused on CHD worldwide:

- Recruitment ads include color!
- Issues's email blast will include your recruitment ad!
- We can create the advertisement for you at no extra charge!

Contact:

Tony Carlson
+1.301.279.2005 or
tcarlsonmd@gmail.com

Cardiology
2014

Save the Date!

17th Annual Update on Pediatric and Congenital Cardiovascular Disease
Feb. 19-23, 2014; Disney's Yacht & Beach Club Resorts, Lake Buena Vista, FL

www.chop.edu/cardiology2014

The Children's Hospital
of Philadelphia®

CARDIAC CENTER

Fallot's Tetralogy: Anatomical Observations and Controversies

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

Introduction

In this issue of *Congenital Cardiology Today*, the authors publish the 7th column in the *Image of the Month of the Archiving Working Group* series (see page 8). In this column, we concentrate on the history and anatomy of Fallot's Tetralogy, and highlight and discuss some of its phenotypic features, including the problems associated with describing and classifying holes between the ventricles. This subject was first addressed in our 6th *Image of the Month of the Archiving Working Group* column, where we featured images from a specimen with multiple ventricular septal defects in association with double outlet right ventricle, the major interventricular communication being in subpulmonary position. This variant of double outlet, producing the hemodynamics of transposition, is also known as the Taussig-Bing malformation.¹ We hope that this complementary article to our 7th column helps to expand and educate our readers in the distinctions that surround the classification of holes between the ventricles, as well as the pertinent anatomic features of Fallot's Tetralogy.

Historical Background

Some of the earliest descriptions of what we now call 'Tetralogy of Fallot' were from, among others, Nicolas Steno (Niels Stensen) (1671), Eduard Sandifort (1777), and William Hunter (1784).² Even though written over two centuries ago, Hunter's account of a hypercyanotic spell remains recognizable today: "...When the fit was coming upon him, he was commonly sensible of it: he grew oppressed at his heart, became weak or faint, grew dark in his colour, and at last almost black, fell down, and seemed insensible. He commonly soon came out of the fit, with sobbing and yawning, and a sense of fatigue."³ In 1858, Thomas Peacock published his book, "On Malformations of the Human Heart," which was based on a series of lectures given during 1854 to students at St. Thomas' Hospital, London. In this compendium, he described many clinical and pathologic observations of 'malformation of the heart' including several cases of 'Constriction of the Pulmonary Orifice,' 'Deficiency of the Septum Ventriculorum' and 'Aorta Arising Chiefly from the Right Ventricle.'⁴ It was left to Étienne-Louis Arthur Fallot, nonetheless, to describe these anatomical findings in greater detail, and nominate the four lesions that were typically present as a 'tetralogie', this being the French word derived from the Greek tetralogia, a series of 4 plays by the same author.⁵ In 1888, Fallot, a professor of Hygiene and Legal Medicine in Marseille, had written a series of articles titled "Contribution à l'anatomie pathologique de la maladie bleue," which were based on his clinical and pathologic findings in hearts encountered during the course of his practise as a clinician and forensic pathologist. The 'tetralogie,' as described by Fallot, included narrowing of the pulmonary artery, an interventricular communication, hypertrophy of the right ventricle, and deviation of the aorta to the right.⁶ Fallot did not name the combination of lesions after himself. The eponym was used sporadically by such authors as Pierre Marie, who used it in a series of lectures delivered at the University of Paris very late in the 19th century. It was also used in the book, published in 1905, "Estudio Semiológico de las Anomalías Congénitas del Corazón," written by Manuel A. Santas, from Argentina.² Although some have argued that Paul Dudley White, a founder of the American Heart Association, is the one that should deserve the credit for the use of "Tetralogy of Fallot," most agree that it is Maude Abbott who should take the credit. It is she who immortalized the use of the term 'Tetralogy of Fallot' as a

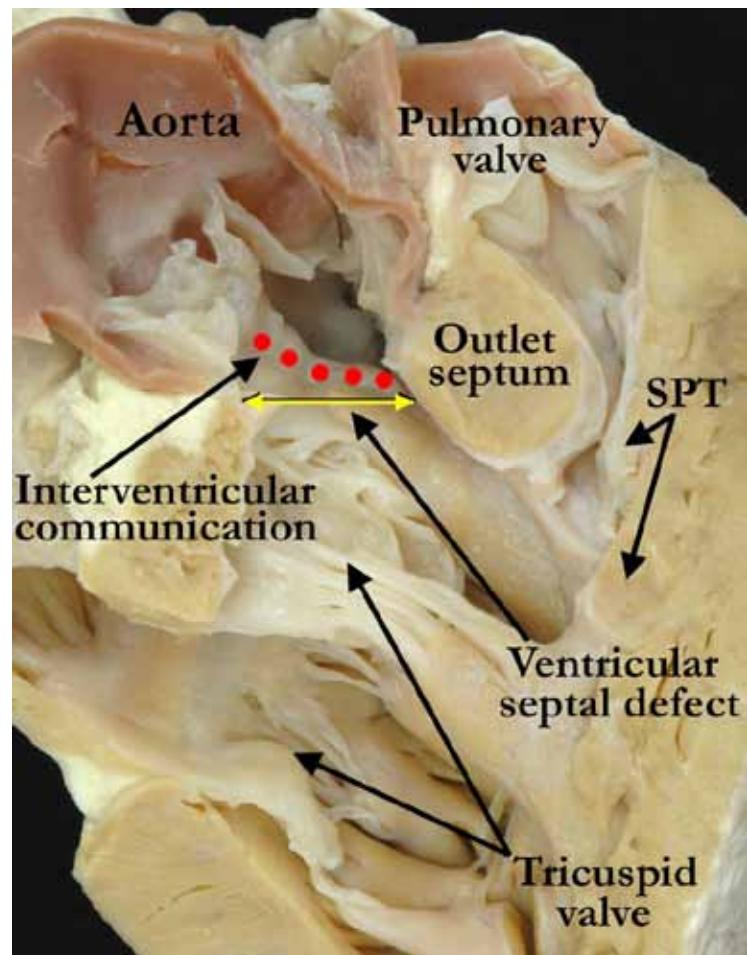


Figure 1a: This close up, anatomical view of this morphologically right ventricle demonstrates the classic features of tetralogy of Fallot. The thickened tricuspid valve (TV) guards the inlet to the right ventricle (RV) which is hypertrophic. There is a perimembranous ventricular septal defect (VSD) and because the aorta overrides the interventricular septum, the aortic valve (AoV) can be seen at the roof of the ventricular septal defect. Anterior deviation of the outlet septum causes the infundibular pulmonary stenosis. Hypertrophy of the septoparietal trabeculations (SPT) contributes to the subpulmonary stenosis. Note the difference between the plane of the interventricular communication (red dots) and that of the deficient ventricular septation (yellow double headed arrow).

Contributor: Diane E. Spicer, BS

convenient way to refer to the collective features of "pulmonary stenosis and septal defect with dextroposition of the aorta and hypertrophy of the right ventricle." At all events, it is now entirely appropriate that we now perpetuate the tetralogy in his name.^{2, 7, 8} All four of these lesions are typically present in the hearts now recognised as representing the tetralogy.

Anatomical Observations & Discussion

Tetralogy of Fallot, in its classical form, includes the collective features of an interventricular communication, biventricular connection of the aortic valve, subpulmonary obstruction, and right ventricular hypertrophy. One feature stands out, nonetheless, as being phenotypic; namely, the

AWG Web Portal link for this series of images: http://www.accd-awg.umn.edu/TOF/TOF_01_01_01/TOF_01_01.html

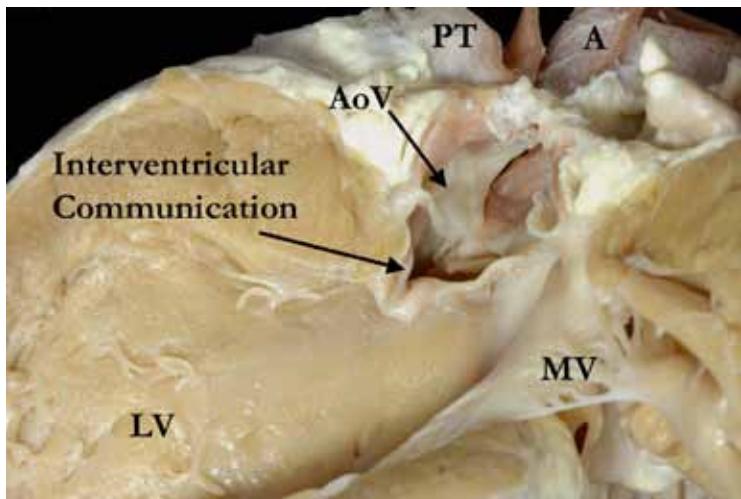


Figure 1b: The left ventricular (LV) aspect of the heart shown in Figure 1a, demonstrates the plane of the interventricular communication, and the aorta (A) overriding the interventricular septum. The aortic valve (AoV) is in fibrous continuity with the mitral valve (MV).

Contributor: Diane E. Spicer, BS

squeeze created at the mouth of the subpulmonary infundibulum between the malaligned muscular outlet septum and the septoparietal trabeculations. This feature is well seen in the views of hearts as photographed from the morphologically right ventricle (Figures 1a, 2a). The muscular outlet septum, also known as the conal septum, or infundibular septum, inserts to the septal surface of the right ventricle antero-cephalad relative to the limbs of the septomarginal trabeculation, or septal band. Because of this abnormal insertion of the outlet septum, the hole between the ventricles opens to the right ventricle between the limbs of the septomarginal trabeculation.

In both of the illustrated hearts, there is fibrous continuity between the leaflets of the aortic and mitral valves, the fibrous tissue forming the roof of the exit from the left ventricle into the cone of space subtended beneath the leaflets of the aortic valve and extending to the crest of the apical muscular ventricular septum. The images taken from the right ventricle then demonstrate a fundamental difference between the two hearts in terms of the relationships between the leaflets of the aortic and tricuspid valves. In the first heart illustrated (Figure 1a), not only are the leaflets of the aortic valve in fibrous continuity with those of the mitral valve, they are also in continuity with those of the tricuspid valve. Thus, when viewed from the right ventricle, the postero-inferior margin of the space subtended from the leaflets of the aortic valve is formed by the area of aortic-to-tricuspid valvar continuity. Included within this fibrous area is the atrioventricular component of the membranous septum. Oftentimes a triangular remnant of the interventricular membranous septum hangs down between the hinges of the tricuspid and mitral valves, and is known as the membranous flap. It overlies the point of penetration of the atrioventricular conduction axis, which is at potential risk during surgery in the postero-inferior margin of the defect. The situation is markedly different in the heart shown in Figure 2. In this specimen, the postero-caudal limb of the septomarginal trabeculation fuses with the inner heart curvature, or ventriculo-infundibular fold, the muscular bar thus formed interposing between the hinges of the tricuspid and aortic valves. The muscle bar protects the axis of

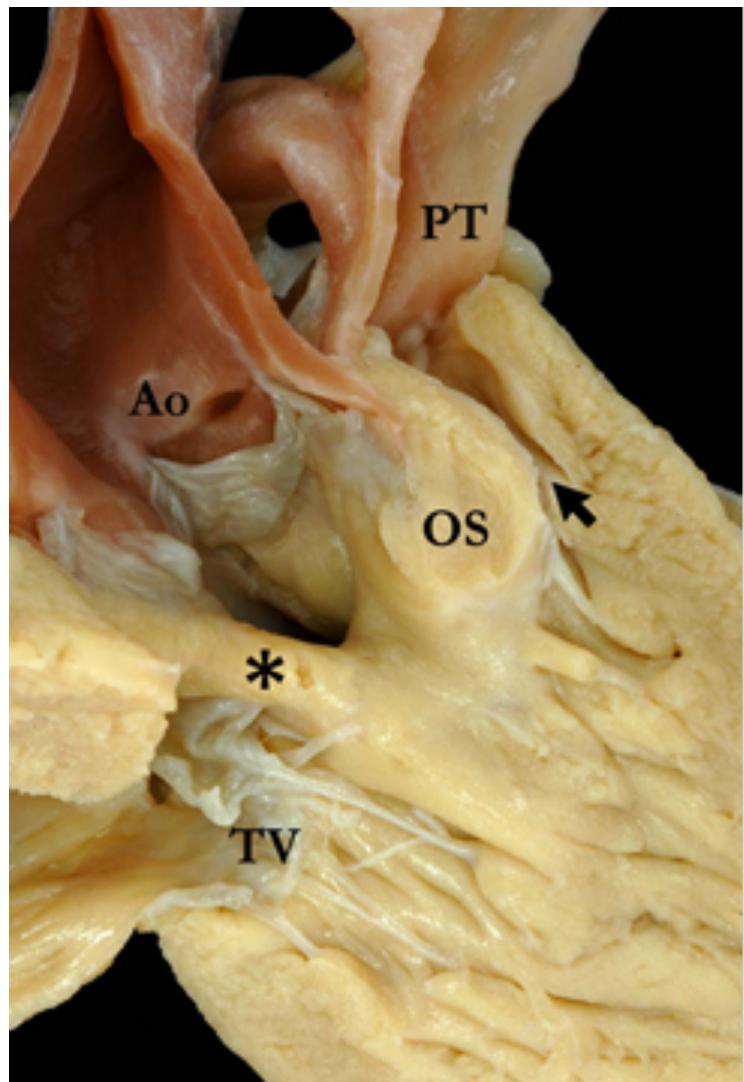


Figure 2a: In a different heart, the morphologically right ventricle is sectioned to show the typical features of Tetralogy of Fallot, with anterior deviation of the outlet septum (OS), squeezing the sub-pulmonary infundibulum (arrow). In this specimen, however, the postero-inferior border of the ventricular septal defect (*), which is the postero-caudal border of the plane of deficient ventricular septation, is completely muscular, separating the aortic and tricuspid (TV) valves. A0- ascending aorta; PT-pulmonary trunk. The plane of the interventricular communication has a fibrous caudal border, as shown in Figure 2b (Described by Vera D. Aiello, MD).

Contributor: Diane E. Spicer, BS

atrioventricular conduction, which penetrates through the intact fibrous membranous septum at a distance from the edge of the septal defect.

The best means of distinguishing between these defects, and cataloguing the findings, emphasises the need also to distinguish between the plane of space that represents the interventricular communication as opposed to the rightward margin of the cone of space



Archiving Working Group
**International Society for Nomenclature of
 Paediatric and Congenital Heart Disease**
ipccc-awg.net

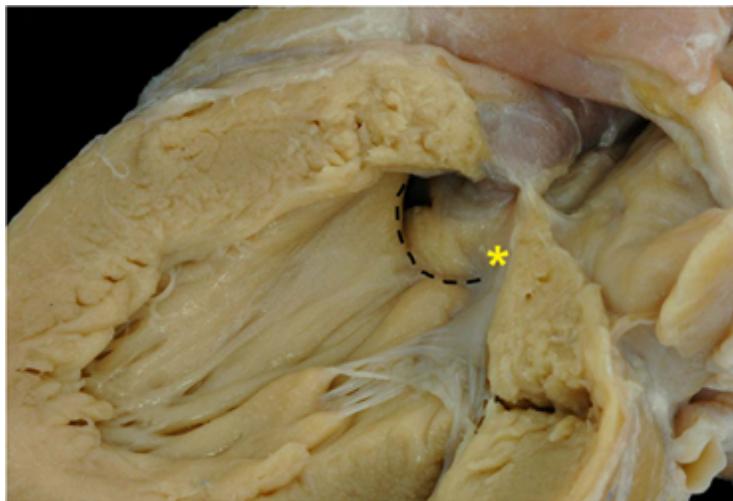
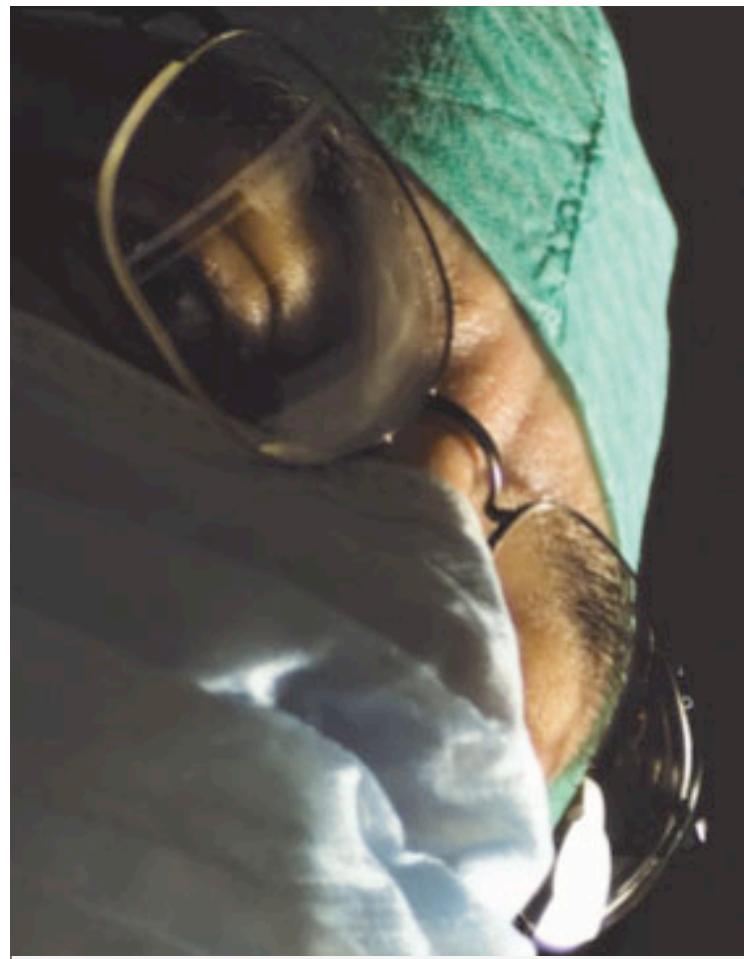


Figure 2b: The left ventricular aspect of the heart shown in Figure 2a is opened to expose the ventricular outflow tract. The aortic valve overrides the muscular trabecular septum. The dotted line bordering the defect continues up to the area of the aortic-to-mitral fibrous continuity (yellow asterisk). See also the commentary (Described by Vera D. Aiello, MD).

Contributor: Diane E. Spicer, BS

subtended beneath the leaflets of the aortic valve. In tetralogy, the interventricular communication is the cranial continuation of the long axis of the plane of the ventricular septum, this being the virtual plane that separates the cavities of the right and left ventricles. But it is the rightward margin of the cone of space, being limited at the base by the hinges of the leaflets of the aortic valve, that represents the plane of septal deficiency. Its cephalad margin is the malaligned muscular outlet septum (Figures 1a, 2a). This plane is also the locus along which the surgeon will place a patch so as to reconnect the aorta with the left ventricle. It is, therefore, this plane that can be considered to represent the ventricular septal defect. In the first heart illustrated (Figure 1a), both planes incorporate the membranous septum, and the defect is therefore perimembranous. In the second heart, in contrast (Figure 2a), the plane of septal deficiency is made up exclusively of muscular structures. Because of this, the defect, opening to the outlet of the right ventricle, can also be described as being muscular. Both defects, of course, are subaortic, and both are outlet defects. Both also represent malalignment between the apical and outlet septal components, and hence are surely both conoventricular. Only by recognising that one is perimembranous, whilst the other has exclusively muscular rims, are we able to distinguish between them. From a surgical perspective, it is imperative that we do distinguish between them, since the atrioventricular conduction axis is at direct risk postero-inferiorly in the defect that is perimembranous (Figure 1a), yet is protected to a certain degree in the muscular defect (Figure 2a).

The images show the need also to distinguish between the ventricular septal defect, when defined as representing the right ventricular margin of the subaortic cone, and the interventricular communication. This is because, as is shown by the left ventricular views of the two defects (Figures 1b, 2b), the cranial continuation in both hearts is made up of the area of fibrous tissue between the leaflets of the aortic and mitral valves, which incorporates the



Congenital Cardiology Today Can Help You Recruit:

- Pediatric Cardiologists
- pediatric Interventional Cardiologist
- Adult Cardiologist focused on CHD
- Congenital/Structural Heart Surgeons
- Echocardiographers, EPs
- Pediatric Transplant Cardiologist

Reach over 6,000 BC/BE Cardiologists focused on CHD worldwide:

- Recruitment ads include color!
- Issues's email blast will include your recruitment ad!
- We can create the advertisement for you at no extra charge!

Contact:

Tony Carlson

+1.301.279.2005 or tcarlsonmd@gmail.com



Global Heart Network Foundation (GHN)

a global non-profit organization with a mission to connect people and organizations focused on the delivery of cardiovascular care across the Globe to increase access to care.

Contact: annabel@globalheartnetwork.net

www.globalheartnetwork.net

membranous septum. If this plane were chosen to represent the ventricular septal defect, the defects in both hearts would need to be categorised as being perimembranous. We believe it is the plane of septal deficiency that should be defined as representing the ventricular septal defect. This, in turn, points to the advantage of describing the exit from the left ventricle in patients with double outlet right ventricle as the interventricular communication, rather than the ventricular septal defect.

The hearts also illustrate another of the potential problems in providing a precise description of the anatomic features of tetralogy. The aorta is often said to be dextroposed in the setting of tetralogy. There is no question but that the hinges of its leaflets override the crest of the apical muscular ventricular septum. It is a fact, nonetheless, that the cavity of the right coronary aortic sinus also overrides the crest of the muscular ventricular septum in the normal heart, which lacks any deficiency between the apical and outlet septal components. This then offers the temptation to describe "true" aortic dextroposition, or "true" aortic override. But in the normal heart, of course, the leaflets of the aortic valve are exclusively hinged within the left ventricle. The feature that distinguishes tetralogy from normality is the biventricular connection of the aortic valvar leaflets, which as Fallot emphasised is deviated still further rightwards when compared to the normal situation so as to override the crest of the apical muscular septum. The other feature that can appear paradoxical when assessing the morphology of tetralogy is that the muscular outlet septum itself is far more prominent in the setting of the septal malalignment. In the normal heart, the muscular outlet septum is inserted between the limbs of the septomarginal trabeculation. Indeed, without recourse to dissection it is impossible to divine where the outlet septum stops, and the free-standing muscular subpulmonary infundibulum begins. The outlet septum, in fact, is remarkably small in the normal heart, with the greater part of the supraventricular crest being formed by the ventriculo-infundibular fold and the free-standing subpulmonary infundibular sleeve. It is these components of the supraventricular crest that have come apart in the setting of tetralogy, permitting the aortic valve to achieve its right ventricular connections, producing the ventricular septal defect, and at the same time, by virtue of the insertion of the outlet septum, contributing to the subpulmonary squeeze that is the essence of the malformation. Recognition of this characteristic anatomy, however, poses the question as to whether it is justifiable to diagnose tetralogy of Fallot when the malaligned outlet septum is fibrous as opposed to being muscular. We will address this issue in one of our future contributions.

Conclusion

The constellation of features, associated with Fallot's Tetralogy, has a long history that is itself not free of controversy. Irrespective of these potential disagreements, and recognising the declining use of eponyms, and also irrespective of the outcome of discussions surrounding the correct or appropriate use of the term interventricular communication versus ventricular septal defect, we remain confident that the anatomical features: subpulmonary obstruction, an interventricular communication, biventricular connection of the aortic valve, and right ventricular hypertrophy will forever be associated with the name of Étienne-Louis Arthur Fallot.

References

1. Giroud JM, Anderson RH, Aiello VD, Spicer DE, Jacobs JP. Image of the Month #6 - June 2013 - Presented by The Archiving Working Group. *Congenital Cardiology Today*. 2013; 11(7):12-13.
2. Evans WN. "Tetralogy of Fallot" and Étienne-Louis Arthur Fallot. *Pediatr Cardiol* (2008) 29:637-640.
3. Neill CA, Clark EB. Tetralogy of Fallot, the First 300 Years. *Texas Heart Institute Journal*. 1994; 21(4):272-279.
4. Peacock TB (1858). On malformations of the human heart with original cases. John Churchill, London.
5. <http://www.merriam-webster.com/dictionary/tetralogy>. Accessed 24 June 2013.
6. E. L. A. Fallot. Contribution à l'anatomie pathologique de la maladie bleue (cyanose cardiaque). *Marseille médical*, 1888, 25: 77-93, 138-158, 207-223, 341-354, 370-386, 403-420.
7. Abbott ME. *Atlas of congenital cardiac disease*. McGill-Queens Univ Press, Montreal, 2006.
8. Somerville W. Letters to the Editor. *Tetrad Versus Tetralogy: II*. *JACC*. 1983;2(2):401.

CCT



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



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



Corresponding Contributor

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

Medical News, Products & Information

Electronic Health Records Slow the Rise of Healthcare Costs

Newswise — ANN ARBOR — Use of electronic health records can reduce the costs of outpatient care by roughly 3%, compared to relying on traditional paper records.

That's according to a new study from the University of Michigan that examined more than four years of healthcare cost data in nine communities. The "outpatient care" category in the study included the costs of doctor's visits as well as services typically ordered during those visits in laboratory, pharmacy and radiology.

The study is groundbreaking in its breadth. It compares the healthcare costs of 179,000 patients in three Massachusetts communities that widely adopted electronic health records and six control communities that did not. The findings support the prevailing but sometimes criticized assumption that computerizing medical histories can lead to lower healthcare expenses.

"To me, this is good news," said Julia Adler-Milstein, an assistant professor in the U-M School of Information and School of Public Health who led the study. "We found 3% savings and while that might not sound huge, if it could be sustained or even increased, it would be a substantial amount."

"That said, when we talk about cost savings, it does not mean that the costs went down, but that the costs did not go up as quickly in the intervention communities. This suggests that adopting electronic records helped slow the rise in healthcare costs."

The communities that computerized their records — Brockton, Newburyport and North Adams — did so in approximately the middle of the study period of 2005-2009. All the communities, including the controls, had applied to be part of the Massachusetts eHealth Collaborative's pilot that gave funding and support for entire cities' worth of doctors' offices to convert their records. To maximize the benefit from computerized records, experts believe it's important that the shift occurs throughout entire communities, rather than piecemeal. This real-world experiment gave the researchers a chance to test that premise.

Adler-Milstein and her colleagues calculated healthcare costs per patient per month, which amounted to 4.8 million data points. They examined not only total cost, but broke the data down by hospital care and outpatient care. They further examined outpatient costs for prescriptions, laboratory and radiology.

They didn't find any savings when they looked at measures of total cost or inpatient cost. The savings showed up when they narrowed the scope to outpatient care.

"That makes sense because the people who adopted electronic records were the community physicians, not the hospitals," Adler-Milstein said. "It's reassuring that the electronic records were adopted on the ambulatory side and that's where we saw the savings." On average, the researchers estimated \$5.14 in savings per patient per month in the communities with electronic health records relative to those without the records. Most of the savings were in radiology, and Adler-Milstein says doctors may have ordered fewer imaging studies because they had better access to patients' medical histories.

Digitizing health records is expected to lead to higher-quality, lower-cost care, as well as fewer medical errors. This motivated the passage



SAVE THE DATE
JUNE 7-10, 2014
Marriott Chicago
DOWNTOWN

CHICAGO

WWW.PICSYMPORIUM.COM



LIVE CASE DEMONSTRATIONS • ABSTRACT SESSIONS •
"MY NIGHTMARE CASE IN THE CATH LAB" • WORKSHOPS
• SMALLER BREAKOUT SESSIONS • HOT DEBATES

RUSH UNIVERSITY
MEDICAL CENTER
Sponsored for CME credit by Rush University Medical Center

of the 2009 *Health Information Technology for Economic and Clinical Health Act*, which created a \$27-billion incentive program to encourage doctors and hospitals to adopt electronic records.

Vanderbilt App Helps Children Manage Their Health Care Routine

Newswise — Adults have calendar applications on all their digital devices to remind them of appointments and what's next on their agenda.

Now, children who function well with schedules and routines for tasks have a new Vanderbilt-created app for that.

The iPad app, called *MyRoutine*, allows parents and providers to create visual stories to let children know what to expect during their daily schedule, helping to reduce anxieties and provide structure.

A doctor's appointment or routines like bedtime can be turned into a series of tasks, using the iPad's camera to take photos or video of each step. The app, free for a limited time, is available in iTunes for the iPad.

MyRoutine was created for medical providers and families in collaboration with developmental medicine specialists at the Monroe Carell Jr. Children's Hospital at Vanderbilt.

The Center for Child Development plans to use the app in clinic for patient appointments.

The center primarily sees children ages 18 months to 14 years for concerns of developmental delay.

"The app has been designed keeping children with special needs in mind, but even typically developing children could benefit from this," said Niru Madduri, MD, Clinical Director for the Center for Child Development.

"A lot of these children respond to using the iPad. It's made an impact on how they learn skills. When children know they get something out of it, they are more likely to complete the tasks."

Currently, the center uses a hardcopy storyboard filled with photos and words that offer a short narrative for patients about a clinic visit. The patient checks in; sits in the

waiting room; a nurse calls the patient's name; height and weight are measured; and so on. Each photo depicts a step or task to be completed.

That hardcopy communication tool served as the impetus and inspiration for the iPad app. The child becomes an active participant with both tools and is able to move a photo with the storyboard or press an icon on the iPad to show a task has been completed.

Visual support tools, commonplace in education for years, are growing in popularity in other settings because of their effectiveness, said David Crnobori, MS, Ed, behavior consultant in Children's Hospital's Center for Child Development.

"Children, especially those with developing language skills, tend to be visual learners."

"Since implementing these visual tools in the clinic, we've seen a decrease in patient anxiety."

"This has allowed for more effective evaluations and has created a more pleasant experience for the patients and their families," Crnobori said.

The *MyRoutine* app comes with a photo gallery of children going through a routine checkup at the doctor's office.

Families or their doctor may use these photos to create a story and help the child's next office visit go smoothly. The child can tap the photos for a reward sound, and parents and providers can also record their own sounds.

Vanderbilt University Medical Center's Web development team has previously produced several other apps, including BabyTime for expectant mothers in labor and CoachSmart for athletes and coaches to track hazardous weather conditions.

Letters to the Editor

Congenital Cardiology Today welcomes and encourages Letters to the Editor. If you have comments or topics you would like to address, please send an email to: LTE@CCT.bz, and let us know if you would like your comment published or not.

CONGENITAL CARDIOLOGY TODAY

© 2013 by Congenital Cardiology Today (ISSN 1554-7787-print; ISSN 1554-0499-online). Published monthly. All rights reserved.

Publication Headquarters:

8100 Leeward Way, Nehalem, OR 97131 USA
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

www.CongenitalCardiologyToday.com

Publishing Management:

- Tony Carlson, Founder, President & Sr. Editor - TCarlsonmd@gmail.com
- Richard Koulbanis, Group Publisher & Editor-in-Chief - RichardK@CCT.bz
- John W. Moore, MD, MPH, Medical Editor - JMoore@RCHSD.org
- Virginia Dermatatis, Assistant Editor
- Caryl Cornell, Assistant Editor
- Loraine Watts, Assistant Editor
- Chris Carlson, Web Manager
- William Flanagan, Strategic Analyst
- 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*.



Volunteer / Get Involved
www.chimsupport.com

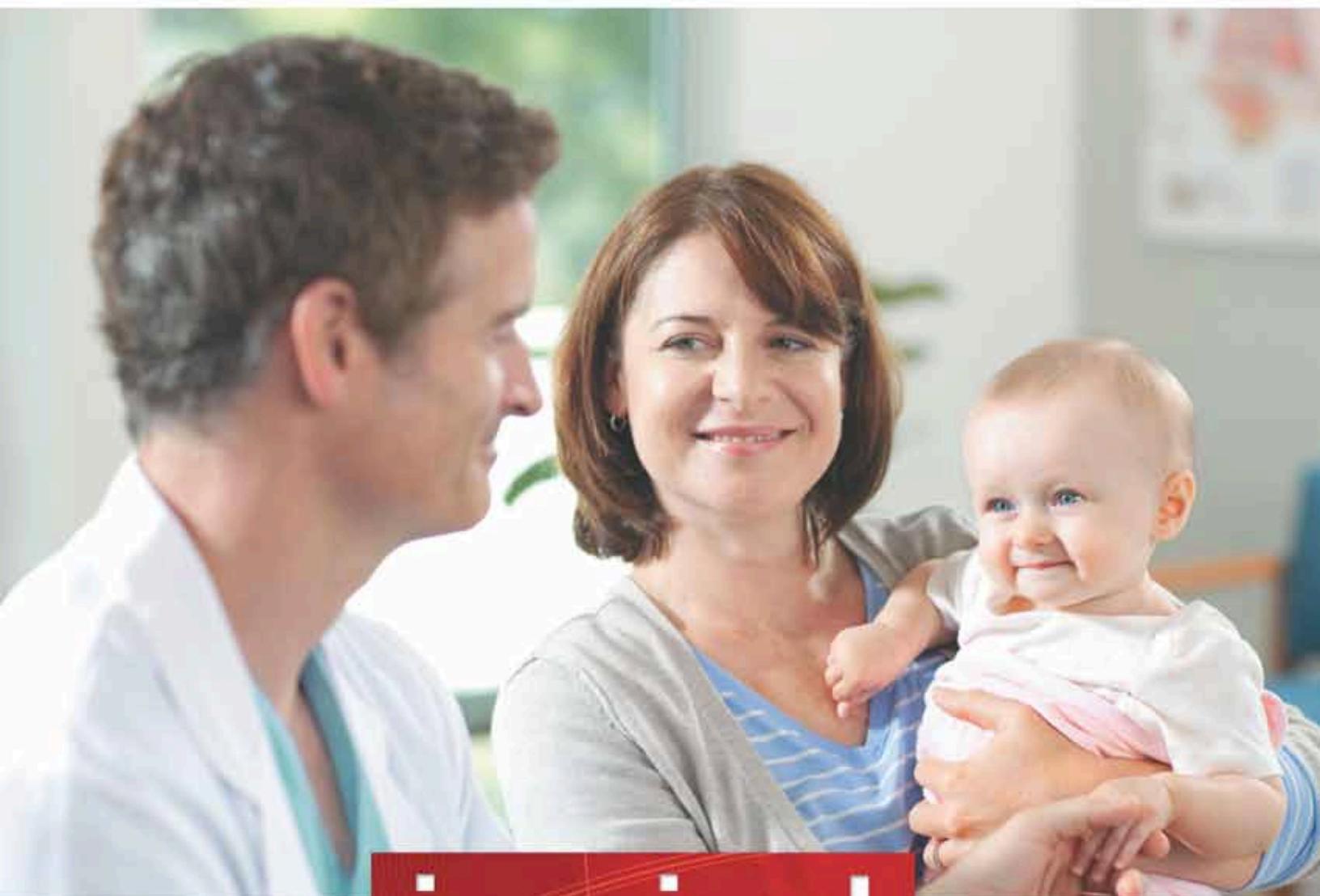
HOW WE OPERATE

The team involved at C.H.I.M.S. is largely a volunteering group of physicians nurses and technicians who are involved in caring for children with congenital heart disease.

The concept is straightforward. We are asking all interested catheter laboratories to register and donate surplus inventory which we will ship to help support CHD mission trips to developing countries.

TOSHIBA

Leading Innovation >>>



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



youtube.com/toshibamedical



@ToshibaMedical