CONGENITAL CARDIOLOGY TODAY

Timely News & Information for Congenital/Structural Cardiologists & Cardiothoracic Surgeons Worldwide

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Auscultation Is Still a Valid Tool in the Evaluation of Cardiac Defects in Children

By P. Syamasundar Rao, MD

Introduction

With the increasing use of cardiac catheterization with cineangiography and echocardiography with Doppler studies in the evaluation and management of Congenital Heart Defects (CHDs), auscultation has taken a back seat. The author wishes to provide examples from his observations in 1980s, to bring back the importance of auscultation in the diagnosis of CHD.

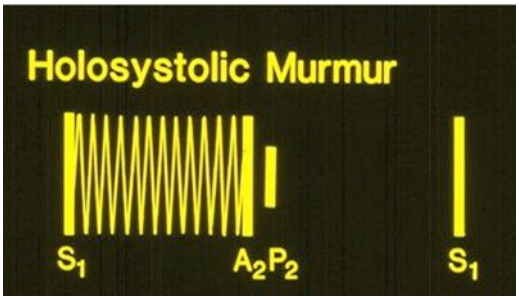


Figure 1. Artist's rendition of a holosystolic murmur caused by a Ventricular Septal Defect. The murmur begins with and obscures the first heart sound (S1) and lasts through the entire systole. A2, aortic component of the second heart sound; P2, pulmonary component of the second heart sound.

Holosystolic murmur (Figure 1) is characteristic of a Ventricular Septal Defect (VSD).[1-3] The murmur is usually heard best at the left lower sternal border, largely related to the direction of the blood flow from the left ventricle (LV) to the right ventricle (RV) across the VSD. However, in some children with small VSDs, the murmur may be heard at the left upper stenal border, along with a thrill at the left upper sternal border. A thrill may be felt even in the suprasternal notch. To explain these observations, the author theorized that closure of the VSD may have occurred in such a manner as to direct the jet of blood flow into the RV outflow tract and pulmonary artery (PA). The purpose of this communication is to present the data on three patients in support of this hypothesis and to comment on the importance of auscultation in the evaluation of CHD.

Case 1

A 15-year-old child was referred to the author for evaluation of dyspnea on exertion and a cardiac murmur in 1983. During cardiac evaluation, the cardiac sounds, including the pulmonary component of the second heart sound, were normal and a holosystolic murmur was heard best at the left upper sternal border, along with a thrill at that location. Hemoglobin was 9 gm% with reduced red blood cell indices suggestive of iron deficiency anemia. An electrocardiogram (ECG) showed mild-left LV hypertrophy. The echocardiogram showed mild left atrial and

LV dilatation with normal left ventricular systolic function. Cardiac catheterization revealed normal right and left heart pressures with minimal step-up in O_2 saturation in the RV outflow tract (Superior vena cava - 71%; Right atrium (RA) - 71%; RV body - 71%; RV outflow tract - 73%; PA - 73%). Selective LV cineangiography via a catheter introduced into the LV via a patent foramen ovale revealed an aneurysmal formation of the ventricular septum with a small VSD; the jet of the contrast was directed into the RV outflow tract (Figure 2). No surgical intervention was recommended, but oral iron therapy was initiated.

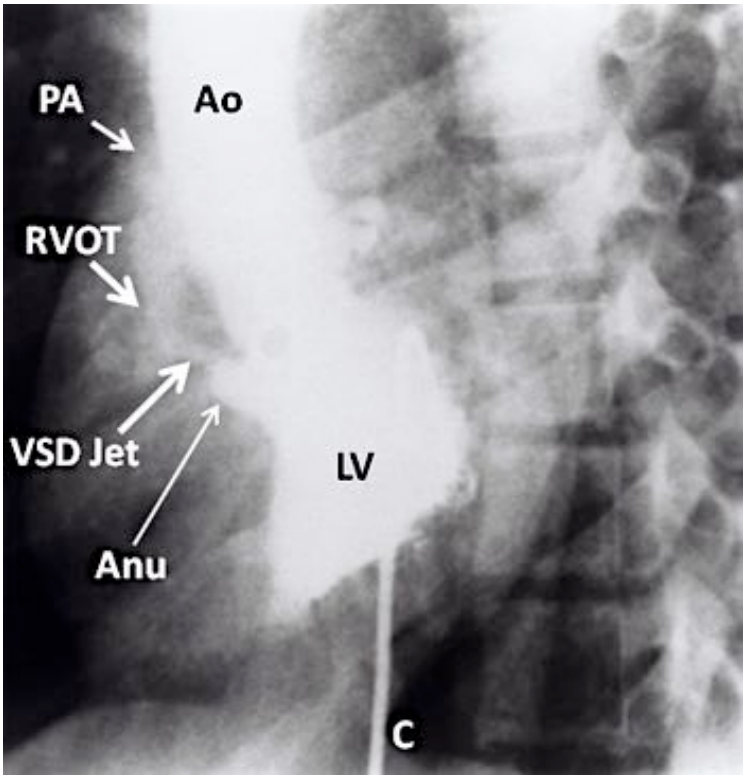


Figure 2. Selected frame from a left ventricular (LV) cineangiogram in a left anterior-oblique projection demonstrating aneurysm (Anu) of the membranous ventricular septum and Ventricular Septal Defect (VSD) jet with opacification of the right ventricular outflow tract (RVOT). The catheter (C) was positioned in the LV via a patent foramen ovale and left atrium (not marked). Ao, aorta; PA, pulmonary artery.

Case 2

An 8-year-old child was referred for evaluation in 1985 with of a cardiac murmur, fainting episodes and easy fatigability. During cardiac examination, the cardiac sounds were normal. A thrill was felt at the left upper sternal border. A holosystolic murmur was also heard best at the left upper sternal border. The ECG was normal. The clinical impression was a small VSD with additional possibility of infundibular pulmonary stenosis. On cardiac catheterization, a step-up in the RV outflow tract was noted (RA - 74%; RV body - 73%; RV outflow tract - 79%; PA - 78%). Both right and left heart pressures were within normal range without any gradient across the RV outflow tract. Selective LV cineangiography via a catheter introduced into the LV via a patent foramen ovale was performed which revealed a small VSD with the VSD jet opacifying RV outflow tract (Figure 3). No surgical intervention was recommended and parents were assured of excellent prognosis for their child.

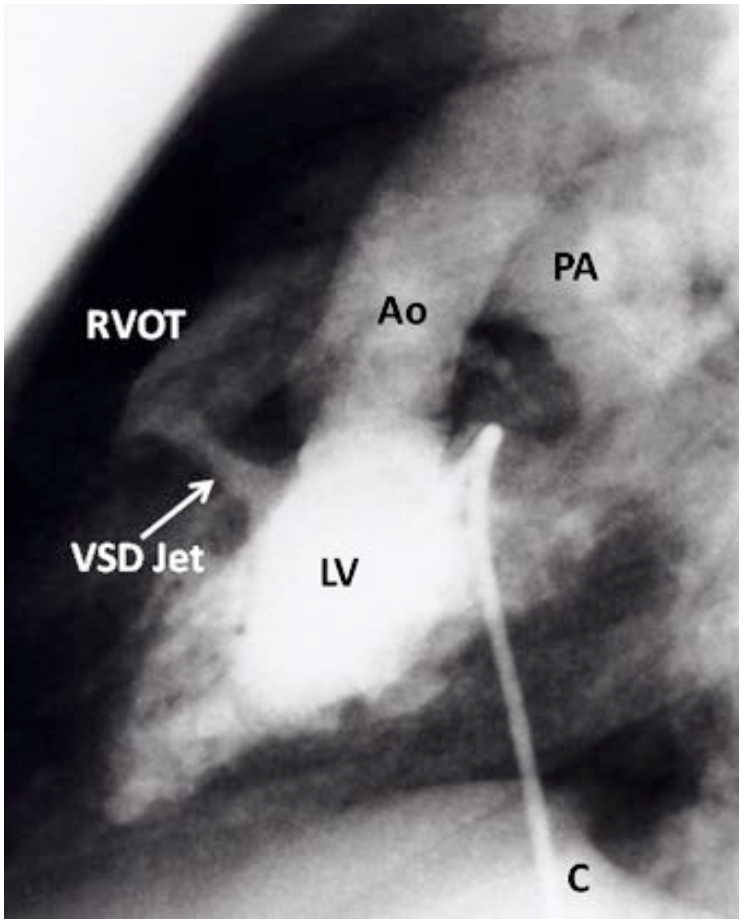
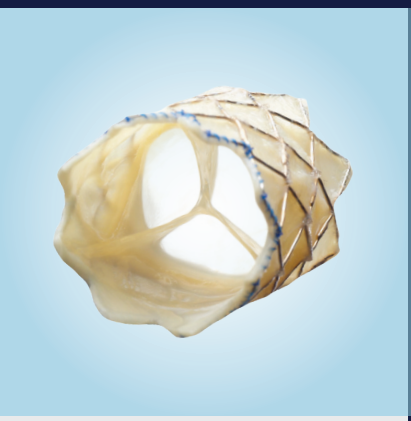


Figure 3. Selected frame from a left ventricular (LV) cineangiogram in a straight lateral projection demonstrating Ventricular Septal Defect (VSD) jet with opacification of the right ventricular outflow tract (RVOT). The catheter (C) was positioned in the LV via a patent foramen ovale and left atrium (not marked). Ao, aorta; PA, pulmonary artery.

Case 3

A 4-year old child was referred for evaluation in 1988, with a cardiac murmur. Cardiac evaluation was normal with the exception of a holosystolic murmur along with a thrill at the left upper sternal border. ECG was normal, as was a chest roentgenogram. Echo-Doppler study was performed which revealed a small VSD with the direction of the color Doppler jet of the VSD straight into the RV outflow tact and PA. Unfortunately, the images were not saved by

RIGHT DATA.



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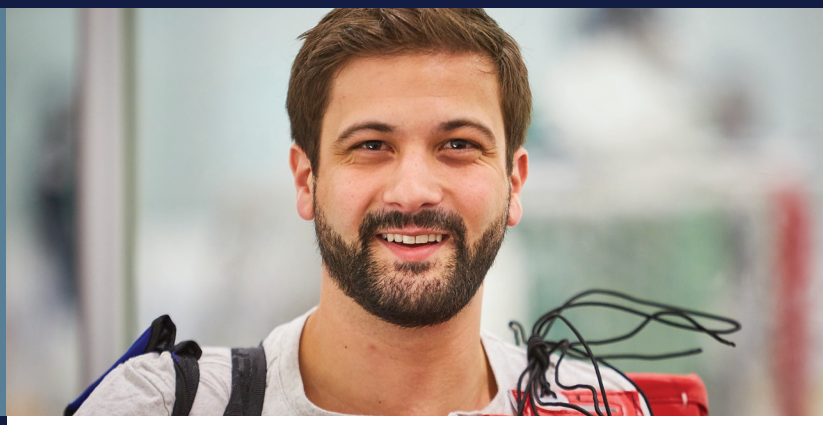

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Melody™ Transcatheter Pulmonary Valve, Ensemble™ II Transcatheter Valve Delivery System

Important Labeling Information for the United States

Indications: The Melody TPV is indicated for use in the management of pediatric and adult patients who have a clinical indication for intervention on a dysfunctional right ventricular outflow tract (RVOT) conduit or surgical bioprosthetic pulmonary valve that has ≥ moderate regurgitation, and/or a mean RVOT gradient ≥35 mm Hg.

Contraindications: None known.

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- 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. Standard medical and surgical care should be strongly considered in these circumstances.
- 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 the following: 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, blistering, or peeling of skin, pain, swelling, or bruising at the catheterization site.

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

*The term "stent fracture" refers to the fracturing of the Melody TPV. However, in subjects with multiple stents in the RVOT it is difficult to definitively attribute stent fractures to the Melody frame versus another stent.

For additional information, please refer to the Instructions for Use provided with the product or available on http://manuals.medtronic.com.

CAUTION: Federal law (USA) restricts this device to sale by or on the order of a physician.

Important Labeling Information for Geographies Outside of the United States

Indications: The Melody™ TPV is indicated for use in patients with the following clinical conditions:

- Patients with regurgitant prosthetic right ventricular outflow tract (RVOT) conduits or bioprostheses with a clinical indication for invasive or surgical intervention, OR
- Patients with stenotic prosthetic RVOT conduits or bioprostheses where the risk of worsening regurgitation is a relative contraindication to balloon dilatation or stenting

Contraindications:

- Venous anatomy unable to accommodate a 22 Fr size introducer sheath
- Implantation of the TPV in the left heart
- RVOT unfavorable for good stent anchorage
- Severe RVOT obstruction, which cannot be dilated by balloon
- Obstruction of the central veins
- Clinical or biological signs of infection
- Active endocarditis
- Known allergy to aspirin or heparin
- Pregnancy

Potential Complications/Adverse Events: Potential procedural complications that may result from implantation of the Melody device include the following: 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, pain, swelling or bruising at the catheterization site.

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For additional information, please refer to the Instructions for Use provided with the product or available on http://manuals.medtronic.com.

The Melody Transcatheter Pulmonary Valve and Ensemble II Transcatheter Delivery System has received CE Mark approval and is available for distribution in Europe.

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Based on the above information the impression is that of either a pulmonic stenosis because of the location of the murmur or ventricular septal defect. Because of the very prominent murmur at the left upper sternal border along with a thrill in the left upper sternal border, pulmonic stenosis is most likely to be the reason, but the other findings such as a split second sound and lack of right ventricular hypertrophy would indicate this is not pulmonic stenosis. Therefore, I recommended an echocardiogram to be performed to delineate this further and it, indeed, revealed a small ventricular septal defect with direction of the jet of the ventricular defect straight into the right ventricular outflow tract and into the pulmonary artery. This appears to be the reason for the atypical location of the murmur.

In summary, Amanda has a small ventricular septal defect producing a loud murmur. I do not believe that further cardiac studies or cardiac medications are indicated at this time. She is a candidate for bacterial endocarditis prophylaxis. There is no need to restrict her activities. She may receive the usual well child care including immunizations as you see fit. I would recommend that Amanda return to see us in approximately one year for reevaluation.

Thank you for referring Amanda to us and feel free to contact me should you have any questions with regard to diagnosis or plan of management.

Sincerely yours,

P. Syamasundar Rao, M.D.
Professor of Pediatrics
Director, Division of Pediatric Cardiology

Figure 4. Selected portion of the letter to the referring physician (see text for details).

the author, a copy of the letter to the referring physician (Figure 4) written at that time confirms the above description.

Discussion

Most patients with large, medium and small VSDs exhibit holosystolic murmurs (Figure 1), usually heard at the left lower sternal border.[1-3] Extremely small VSDs may have shorter and softer systolic murmurs, and may even have decrescendo character.[3-5] Spontaneous closure of the VSD may occur by aneurysmal formation (Figure 2) of the membranous ventricular septum[6-9], or by progressive encroachment of the septal musculature (Figure 3) onto the defect. If the high velocity blood flow is directed into the RV outflow tract (Figures 2 and 3) or PA, then, the murmur of VSD may be heard at the left upper sternal border instead of the usual left lower sternal border. Similarly supracristal VSDs (Figure 5) may also exhibit murmurs at the left upper sternal border. In patients with infundibular or valvar pulmonary stenosis, the murmur is heard at the left upper stenal border, but the murmur is ejection (Figure 6) in quality instead of holosystolic nature (Figure 1). Consequently, a holosystolic murmur

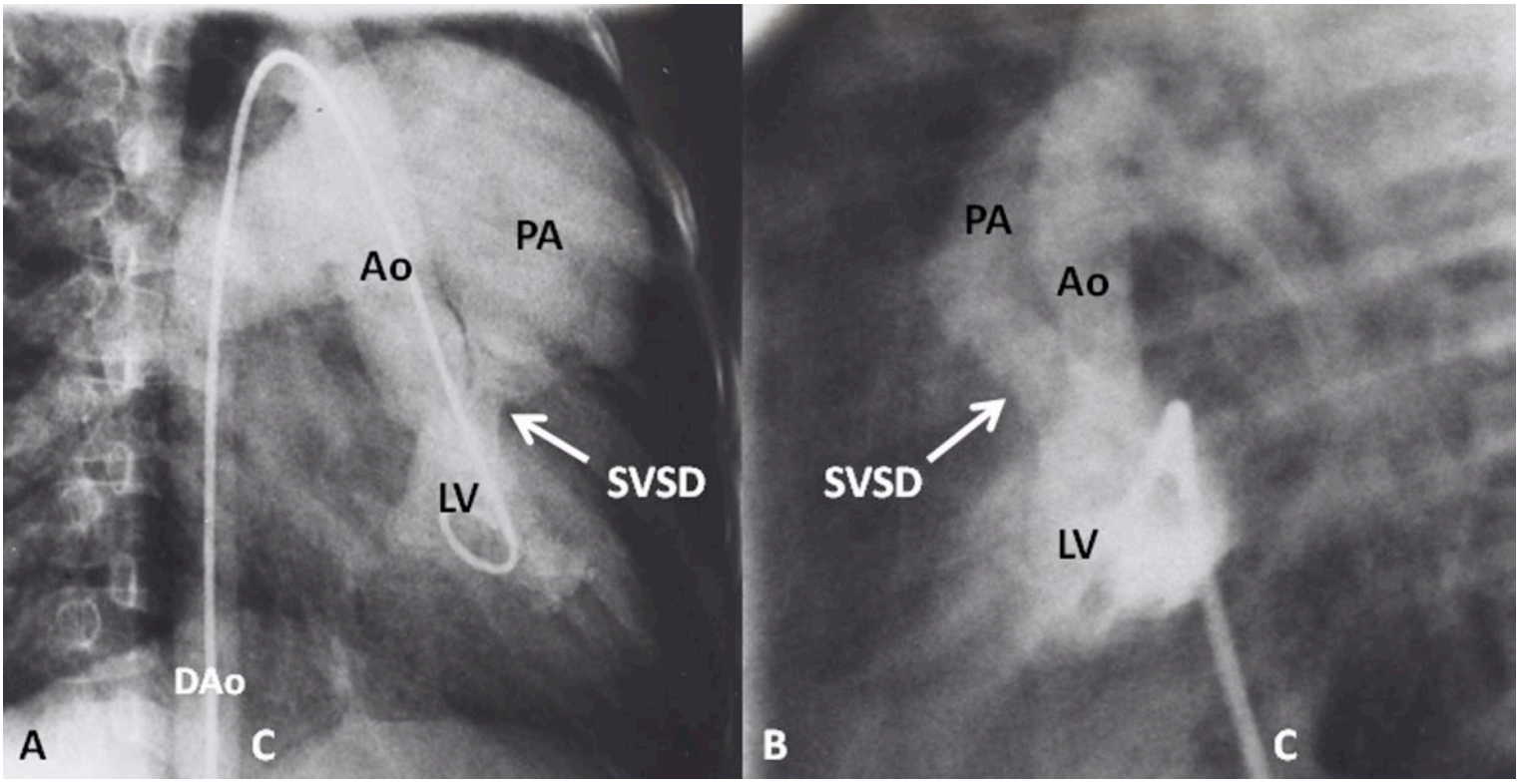

Figure 5. Selected frames from left ventricular (LV) cineangiograms in right anterior-oblique (A) and left anterior-oblique (B) projections in two different patients demonstrating Supracristal Dentricular Septal Defects (SVSD) with almost direct opacification of the pulmonary artery (PA). In A, the catheter (C) was positioned in the LV retrogradely from the femoral artery (not shown), descending aorta (DAo) and ascending aorta (Ao). In B, the catheter was positioned in the LV via a patent foramen ovale and left atrium (not marked).

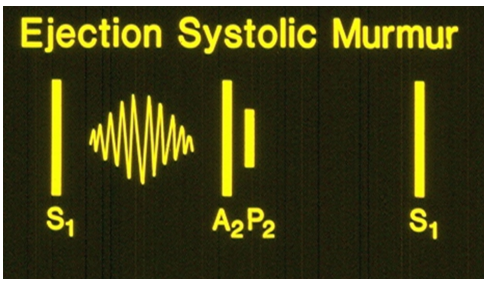

Figure 6. Artist's rendition of an ejection systolic murmur caused by pulmonary stenosis (valvar or infundibular). The murmur begins shortly after the first heart sound (S_1) and ends before the aortic component of the second heart sound (A_2). The gap between S_1 and the murmur represents isovolumic contraction period during which there is no forward flow. P_2, pulmonary component of the second heart sound.

heard at the left upper sternal border is most likely to be due to a VSD.

Careful evaluation of auscultatory findings with regard to nature (holosystolic vs. ejection systolic) and location (left lower vs. left upper stenal border), enables the examiner to likely come to the correct conclusion, which may be confirmed by echocardiographic studies, and if necessary, by angiographic studies. In the author's assessment, it is possible to distinguish these clinically, and auscultation is still a valid tool in the evaluation of cardiac defects in children.

References

1. Kulangara RJ, Strong WB, Miller MD. Differential diagnosis of heart murmurs in children. Postgrad Med 1982;72:219-228.
2. Rao PS. Evaluation of cardiac murmurs in children. Indian J Pediat 1991;58:471-489.
3. Evans JR, Rowe RD, Keith JD. Spontaneous closure of ventricular septal defects. Circulation 1960;22:1044-1154.
4. Nadas AS, Scott LP, Hauck AJ, Rudolph AM. Spontaneous functional closing of ventricular septal defects. N Engl J Med 1961;16;264:309-316.
5. Alpert BS, Mellits ED, Rowe RD. Spontaneous closure of small ventricular septal defects. Probability rates in the first five years of life. Am J Dis Child. 1973;125:194-196.
6. Varghese PJ, Rowe RD. Spontaneous closure of ventricular septal defects by aneurysmal formation of the membranous septum. J Pediatr 1969;75:700-703.
7. Misra KP, Hildner FJ, Cohen LS, et al. Aneurysm of the membranous ventricular septum. A mechanism for spontaneous closure of ventricular septal defect. N Engl J Med 1970;283:58-61.
8. Pickering D, Keith JD. Systolic clicks with ventricular septal defects. A sign of aneurysm of ventricular septum? Br Heart J 1971;33:538-539.9.Freedom RM, White RD, Pieroni DR, et al. The natural history of the so-called aneurysm of the membranous ventricular septum in childhood. Circulation 1974;49:375-384.

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"In the author's assessment, it is possible to distinguish these clinically, and auscultation is still a valid tool in the evaluation of cardiac defects in children."

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The Western Society of Pediatric Cardiology Held Its 29th Annual Conference in San Diego, May 31st through June 2nd, 2018

By John W. Moore, MD

The Western Society of Pediatric Cardiology (www.wsopc.org) held its *29th Annual Conference* in San Diego, May 31st through June 2nd 2018. The Conference was sponsored by Rady Children's Hospital San Diego and UC San Diego Medical School. Rady Children's Hospital Heart Institute hosted the event.

Laurie Armsby from Oregon Health Sciences University, one of the Society's Past Presidents, congratulated the Rady team "on an outstanding conference." She commented: "The location, food, accommodations and social events were all superb. But I was particularly impressed with the quality of the faculty and their presentations. You provided an outstanding review of controversial and/or emerging aspects of our field."

More than two hundred registrants made this one of the most well attended

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Main conference room - Dr. Nigro smiling in the last row.

Dr. Moore and Best Abstract winners, Drs. Nageotte, Priromprintr, Vlakunth and Algae-Yogay.

WSOPC Conferences in the Society's history. The program included: an informal pre-Conference Panel Discussion for Fellows, Oral Abstracts, eight Focused Sessions covering important current areas of practice and research, Debates and a Keynote Address. Loew's Resort, a beautiful San Diego Bayfront hotel located steps from the Pacific Ocean, was the venue. Social events included: an Evening Reception with live entertainment, the Conference Dinner, a 5K Fun Run and a surfing event.

Thirty-three Abstracts were displayed as Posters throughout the Conference, and

Keynote speech, "Social Media and Medicine: the Doctor in the Digital Era" by Dr. Farris Timimi.

Drs. El Said and Hanley after the debate.

the 4 "Best Abstracts" were recognized and presented orally. Blind graders from the Rady/UCSD faculty selected these abstracts. Lead authors and presenters were: Claudia Algaze-Yogay (Stanford), Sumeet Viakunth (Stanford), Stephen Nageotte (CHLA), and Bryant Priromprintr (Stanford).

Two-hour sessions provided the bulk of the program content: Chris Davis (San Diego) moderated Session 1, which was focused on "Office Dilemmas." In this session topics included: What to Do with Borderline QT Intervals, Anomalous Coronary Arteries, and LV Non-Compaction with Normal Function. Jim Perry (San Diego) and Seshadri Baiagi (Portland) led Session 2, covering the arrhythmias (particularly atrial fibrillation and ventricular tachycardia), which have emerged in the adult congenital population. Percutaneous Valve technologies (including TAVR in pediatric and congenital patients) and valve indications were covered in Session 3, moderated by Kanishka Ratnayaka (San Diego) and Stephen Pophal (Phoenix). Surgeons, Raghav Murthy (Cardiac) and Matthew Brigger (ENT), both on San Diego's Airway Team, led Session 4, discussing tracheal and airway management issues in patients with Congenital Heart Disease (CHD). The audience was updated on cardiomyopathy, transplant and device therapies in Session 5, led by Rakesh Singh (San Diego) and Yuk Law (Seattle). Session 6 dealt with management of Fontan patients, and included discussions of Fontan liver failure and recommended surveillance programs. Exercise, new pharmacotherapy, and unique catheter interventions were also subjects of discussion. This session was moderated by Gabrielle Vaughn and Howaida El Said (both from San Diego). Neurodevelopment Patient Outcome programs and research were subjects of Session 7 orchestrated by Brian Fagan (San Diego) and Nancy Pike (CHLA). The final session was entitled "Genetics for the Pediatric Cardiologist," and was led by Paul Grossfeld and Jim Perry (both from San Diego). This session included important discussions of CPVT, Syndromes and Genome Sequencing.

Additional presentations included an entertaining, highly informative, and compelling Keynote Address entitled, "Social Media and Medicine: the Doctor in the Digital Era" provided by Farris Timimi (Director of Social Media, Mayo Clinic). Two informative debates followed. Frank Hanley (Stanford) advocated early repair of cyanotic infants with Tetralogy of Fallot

Attendees talking between sessions.

(TOF), and Howaida El Said (San Diego) argued for two-stage repair with initial palliation by PDA stenting. In a second debate, transcatheter valve technologies designed for patients with trans-annular patch-type repair of TOF (Harmoni from Medtronic and Alterra from Edwards) were highlighted in a lively back and forth by

"Join us next year for the 30th Annual WSOPC Conference in Las Vegas!"

Dan Levi (UCLA) and Ruchira Garg (Cedars-Sinai).

In addition to the formal program, the conference offered lots of opportunities for reunions, networking, meeting fellows and colleagues, and just plain relaxing with friends. We adjourned on a beautiful Saturday afternoon, with plenty of time to enjoy the long weekend in San Diego.

Join us next year for the *30th Annual WSOPC Conference* in Las Vegas!

Special thanks to Chris Abe (Rady Children's Hospital VP of Operations and Director of the Rady Children's Hospital Heart Institute), her Assistant, Nicole Elise, and numerous Heart Institute staff for their major contributions in planning and organizing the Conference; and also thanks to Lisa Quinn and her coworkers for helping the Conference gain CME accreditation from UC San Diego.

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3DI3 - International Symposium on 3D Imaging for Interventional Catheterization in CHD

By Aimee K. Armstrong, MD; Gregor *Krings, MD*

3D Rotational Angiography (3DRA) represents the most innovative and sophisticated technique available in heart catheterization imaging for adult and pediatric patients. With its astonishing image quality, it offers significant benefit during diagnostic and interventional catheterizations. It provides a thorough anatomic evaluation with 2D CT-like images and 3D reconstruction of complex structures and interactions, including of the airway and esophagus, with views from an almost infinite number of angles. This allows for a quick and easy understanding of anatomy on which to base optimal therapeutic decisions and gantry angles. It also provides image-guided therapy with overlay of the 3D reconstruction on live fluoroscopy and can decrease radiation exposure by limiting the number of required 2D angiograms. The combined diagnostic and therapeutic advantages are all available in a one-stop shop environment in the catheterization laboratory. The *3DI3* conference will give you and your team the necessary knowledge and hands-on post-processing skills to apply this in your laboratory quickly and simply. Furthermore, the *3DI3* faculty will show additional state-of-the-art 3D imaging capabilities, including 3D TEE, ICE, CT, and MRI, as they are used to compliment and assist interventional catheterization for Congenital Heart Disease (CHD).

While 3DRA is rooted in techniques developed in the 1960s with the patient being fixed in a motor-driven cradle rotated in a fixed x-ray tube, it took 30 years until a complex algorithm was developed to convert those rotational angiograms into DICOM stacks for reconstruction. By 2010, multiple vendors were offering 3DRA capable angiographic systems but clinical use was rare for cardiac catheterization. Despite the available hardware and software, a significant lack of user experience prevailed in the early part of this decade. Dr. Gregor Krings in Utrecht, The Netherlands was an early adopter of 3DRA technology, and he started working on x-ray system settings, injection timing, location, and amount, and ventilation and pacing protocols to optimize image quality and lower radiation dose.

In order to share his experience and learn from others around the world with experience in 3DRA, Dr. Krings created the *International 3DRA Conference* in Utrecht in 2013. This platform for learning and collaboration turned into an annual meeting that was integral in spreading 3DRA technique and its many advantages for interventional therapies around the globe. The hallmarks of these conferences were hands-on rooms for learning 3DRA post-processing from 3 different vendors, live cases, and a "cookbook" lecture on basic 3DRA techniques. After 3 years of success, it was time to expand both the content and the audience by moving the conference to the U.S. Dr. Krings teamed up with Dr. Aimee Armstrong at Nationwide Children's Hospital to create *3DI3*, an international conference to share knowledge and skills on all 3D imaging, as it pertains to interventional catheterization for CHD.

The first *3DI3* conference was held in October 2016 in Columbus, OH, and featured 3DRA how-to basics, advanced 3DRA techniques, hands-on post-processing stations, live cases from Nationwide Children's Hospital and San Donato in Milan, Italy, and a taped case from Children's Hospital of Colorado in Denver. Multi-modality image fusion, computational fluid dynamics, 4D MRI and 3DRA, and 3D ICE were also covered in this entertaining 2-1/2 day meeting with esteemed faculty, including: Drs. Mario Carminati, John P. Cheatham, Lee Benson, Shakeel Qureshi, Francisco Garay, Thomas Fagan, Seong-Ho Kim, Sven Dittrich, Darren Berman, Orlando Simonetti, Michael Markl, Shyam Sathanandam, Pei-Ni Jone, Martin Bocks, Sharon Cheatham, Michael Seckeler, Brian Boe, Mark Galantowicz, Patrick McConnell, Kan Hor, and John Kovalchin.

Since then, *3DI3* has had the privilege of joining the *IPC Workshop* in Milan in September 2017 with plans for March 2019. Drs. Krings and

Armstrong are also extremely honored to bring *3DI3* to the first day of *PICS* this year on September 5th, which will include the hallmark live case, hands-on rooms for individualized instruction and practice, how-to guides, and advanced 3D imaging techniques. Please join us to learn how to use 3DRA during your cases, and how to administer the proper contrast dose safely while decreasing radiation exposure. Learn how your staff can help you to obtain high quality images quickly. Get introduced to fusion of CTA and MRA data with the x-ray system and see the benefit of combining pre-interventional information with peri-interventional data. Learn how to understand vessel-vessel and vessel-airway interactions to enhance procedural success and safety in pulmonary artery stenting, aortic arch interventions, and TPVR. *3DI3* will teach you to bring 3D into your cath lab to improve your safety, efficiency, and therapeutic decision making.

In 2019, *3DI3* will be combining with the prestigious *15th Society for Pediatric Radiology Symposium on Advanced Pediatric Cardiovascular Imaging* and *the 17th SPR Hands-On Course on Pediatric Cardiovascular MR*. All three conferences will be held at Nationwide Children's Hospital in Columbus, OH with the following 2019 schedule:

- SPR Hands-on Course: Oct. 15-17.
- SPR Advanced Symposium: Oct. 18-20
- 3DI3: Oct .19-21.

Overlapping 3DI3/SPR sessions will focus on the collaboration of non-invasive cardiologists and radiologists, interventional cardiologists, and surgeons leveraging all of our strengths and techniques to improve care for our patients. For more information, visit: www.3DI3.org.

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Live 3-D Surgery from Herma Heart Institute Heart Summit Advances Worldwide Learning

By Jeanne James, MD

I couldn't be more pleased with the response we received for our first *Heart Summit,* held at the Herma Heart Institute last fall. We were able to bring together cardiologists from around the world to share what we have learned here at Children's Hospital of Wisconsin, and to hear how others have advanced the treatment of Congenital Heart Disease (CHD).

I believe that many who attended considered the real-time surgery, led by Viktor Hraska, MD, PhD, the most fascinating presentation of the *Summit*. We were able to recreate the old model of a traditional surgical theatre in our auditorium with a live-streamed 3D presentation projected onto an 18-foot-wide screen. The audience was able to watch as Dr. Hraska and his team performed a double switch operation on a 9-month-old infant with CC-TGA. In the last 20 years, Dr. Hraska has performed more than 70 such surgeries.

The physicians in attendance were able to see and hear everything taking place in the operating room in real-time, and even had the ability to speak with Dr. Hraska. Some asked questions about particular steps of the procedure, and why certain choices were made; others commented on Dr. Hraska's techniques and skills and some

Viktor Hraska, MD, PhD

Cameras in the operating room broadcast surgery in 3-D at Children's Hospital of Wisconsin.

Dr. Viktor Hraska and the surgical team from Children's Hospital of Wisconsin perform open-heart surgery.

View from the control room during the live 3-D broadcast of a child's heart surgery.

View from the auditorium during the live 3-D broadcast of a child's heart surgery.

even offered suggestions for ways to conduct the repair.

While the 3-D was visually stunning, Dr. Hraska also believes it's a superior teaching tool.

"You can more clearly see the structures of the heart, their relationship and how they're connected and organized," Dr. Hraska said. "That helps you understand the complexity of the procedure."

In addition to the live surgery, doctors from some of the world's leading health care institutions—Boston Children's Hospital, Evelina London Children's Healthcare, the Mayo Clinic, Advocate Children's Hospital and Children's Hospital of Philadelphia—presented on a variety of CC-TGA topics. Subjects included the history of the malformation, an examination of the different treatment options, fetal assessment and post-operative complications, among others.

Children's Hospital of Wisconsin is committed to innovation, collaboration and education to ensure the very best outcomes for patients. Being a truly world-class hospital means not just utilizing the latest techniques, but also pioneering them and teaching them to others. It means turning those groundbreaking methods into the standard of care. That's the philosophy of Children's Hospital of Wisconsin—and is the philosophy behind the *Heart Summit.*

"While the 3-D was visually stunning, Dr. Hraska also believes it's a superior teaching tool."

The 2017 inaugural *Heart Summit* was so successful that the Herma Heart Institute has developed the conference into an annual event. This year's topic is Management of Complex Left Ventricular Outflow Tract Disease, and will be held in Milwaukee on Oct. 11th, 2018. Details can be found online at chw.org/theheartsummit. We hope to see you there!

CCT

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Medical News, Products & Information

Compiled and Reviewed by Kate Baldwin, Special Projects Editor

Digisonics Showcased New Functionality at ASE 2018 for Data-Driven Decisions

Digisonics exhibited its latest functionality for data-driven decisions at the American Society of Echocardiography *29th Annual Scientific Sessions* in Nashville, TN.

Single click access to patient data in EMRs, PACS and VNAs combined with immediate graphics and plots of a patient measurements over time, all at a Digisonics workstation, provides cardiologists the data they need to make critical decisions in a limited amount of time. Required fields to ensure Billing and Accreditation requirements are met along with an automated Indications Validation Tool, allow clinicians to focus on patient care and not on data entry.

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Digisonics Cardiovascular Information System (CVIS) Solutions are standards-based and vendor-neutral, combining image review, structured reporting, an integrated clinical database and powerful PACS image archive into one complete solution for all modalities. Combined with seamless integration to incumbent 3rd party systems, Digisonics automates the cardiovascular workflow for improved efficiency and greater reporting accuracy leading to better patient outcomes.

Digisonics provides top-rated clinical image management and structured reporting systems for cardiovascular (CVIS), radiology, and obstetrics & gynecology. Digisonics structured reporting solutions combine high performance image review workstations, a powerful PACS image archive, an integrated clinical database, comprehensive analysis capabilities and highly configurable reporting for multiple modalities. Key applications are complemented with interfaces to information systems and 3rd party vendors, providing facilities with a seamless, efficient clinical workflow. To learn more, please visit www.digisonics.com.

New Algorithm More Accurately Predicts Life Expectancy After Heart Failure: *UCLA Research Could Help Health Care Providers Make Better Use of Life-Saving Resources*

Newswise — A new algorithm developed by UCLA researchers more accurately predicts which people will survive heart failure, and for how long, whether or not they receive a heart transplant. The algorithm would allow doctors to make more personalized assessments of people who are awaiting heart transplants, which in turn could enable health care providers to make better use of limited life-saving resources and potentially reduce health care costs.

As Precision Medicine gains ground in health care, this study could be a key step toward tailoring organ transplant procedures to individual patients. The study, which was published in *PLOS* One, was led by Mihaela van der Schaar, Chancellor's Professor of Electrical and Computer Engineering at the UCLA Samueli School of Engineering.

The algorithm, which the researchers call "Trees of Predictors, "uses machine learning — meaning that computers effectively "learn" from additional new data over time. It takes into account 53 data points — including age, gender, body mass index, blood type and blood chemistry — to address the complex differences among people waiting for heart transplants and the compatibility between potential heart transplant recipients and donors.

Trees of Predictors uses these 53 data points to predict how long people with heart failure will live, based on whether they receive a transplant or not. Of those data points, 33 relate to information about the recipients or potential recipients, 14 pertain to the donors and six apply to the compatibility between donor and recipient.

The researchers tested the Trees of Predictors on 30 years of data on people who were registered with the United Network for Organ Sharing, the nonprofit organization that matches donors and transplant recipients in the U.S. They found that their algorithm provided significantly better predictions for how long someone would live than the current methods that health care providers use.

It also outperformed predictions from machine learning methods that have been developed by other research groups.

"Our work suggests that more lives could be saved with the application of this new machine-learning–based algorithm," said van der Schaar, who also is a Turing Fellow at the Alan Turing Institute in London, and the Man Professor at University of Oxford. "It would be especially useful for determining which patients need heart transplants most urgently and which patients are good candidates for bridge therapies such as implanted mechanical-assist devices."

The algorithm is able to analyze many possible risk scenarios for potential transplant candidates to help doctors more thoroughly assess people who could be candidates for heart transplants, and it is flexible enough to incorporate more data as treatments evolve.

"Following this method, we are able to identify a significant number of patients who are good transplant candidates but were not identified as such by traditional approaches," said Dr. Martin Cadeiras, a cardiologist at the David Geffen School of Medicine at UCLA. "This methodology better resembles the human thinking process by allowing multiple alternative solutions for the same problem but taking into consideration the variability of each individual."

For example, when compared against prediction models that most doctors currently use to project which transplant recipients would live for at least three years after a transplant, a commonly used benchmark, the

UCLA algorithm outperformed the models by 14% — correctly predicting that 2,442 more heart transplant recipients of the 17,441 who received transplants and lived at least that long after the surgery.

In addition to van der Schaar and Cadeiras, the study's other primary authors are Jinsung Yoon, a UCLA engineering doctoral student, and William Zame, a UCLA Distinguished Professor of Economics and Mathematics. Contributing authors are Dr. Amitava Banerjee of the Farr Institute of Health Informatics Research at University College London, and Ahmed Alaa, a UCLA engineering doctoral student.

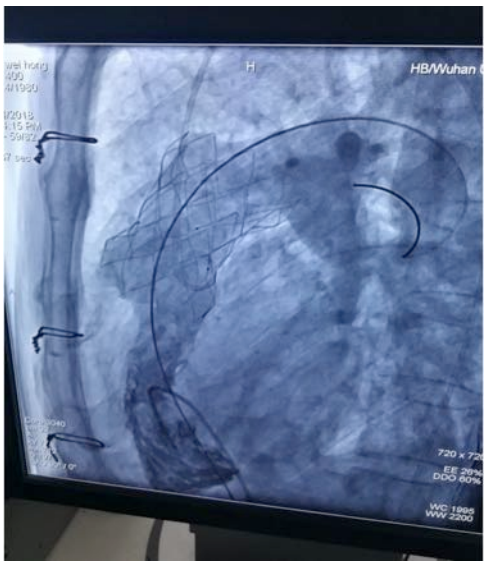
Van der Schaar said that the Trees of Predictors algorithm could be used for insights from medical databases and many other types of complex databases. Already, Yoon, Zame and van der Schaar have shown it can work to recognize handwriting, and to predict credit card fraud and the popularity of specific news items.

The study was supported by the National Science Foundation and the Office of Naval Research.

Med-Zenith™ PT-Valve™ Successfully Implanted in Patients After Surgical Correction of Tetralogy of Fallot

In March 2018, Dr. John Cheatham (Nationwide Children's Hospital, Columbus USA), in collaboration with Dr. Dong Nianguo's interventional cardiology team (Union Hospital, Wuhan, China), performed the first implantation of the Med-Zenith PT-Valve (a transcatheter, self-expandable, stented pulmonary valve) in a 29 yo male patient. Dr. Dong's team performed a second PT-Valve implantation in a 38-year-old male patient on June 24, 2018. The Med-Zenith PT-Valve offers a minimally invasive, non-surgical solution for patients with pulmonary artery valve disease.

After patients have surgical correction for a condition known as Tetralogy of Fallot (TOF), moderate and/or severe pulmonary valve regurgitation often leads to right ventricular overload in patients. This "RV overload" seriously affects patient health with various



After PT-Valve implantation.

complications, including arrhythmias. Minimally invasive pulmonary valve (PT-Valve) implantation can avoid the difficulty, trauma, and risk of traditional re-thoracotomy and improve the long-term patient quality of life.

Med-Zenith™ Medical Scientific Ltd. offers minimally invasive product solutions for the treatment of numerous Congenital and Structural Heart diseases, as well as for patients suffering from Atrial Fibrillation. These conditions affect millions of patients globally.

The Med-Zenith PT-Valve is currently for clinical trial use only, and is not available commercially.

For more information, www.med-zenith.com

Dr. Jonathan R. Lindner Elected President of the American Society of Echocardiography

June 27, 2018 – Jonathan R. Lindner, MD, FACC, FASE, has taken the helm as President of the 17,000 member American Society of Echocardiography (ASE) for a one-year term following the *Society's 29th Annual Scientific Sessions,* which were held this week in Nashville, TN.

Dr. Lindner addressed the members of the Society at their annual business meeting and shared his excitement for leading the Society and helping the field of cardiovascular ultrasound grow and celebrate the science of imaging. He said "I am honored and look forward to serving as ASE's 30th president. ASE is committed to improving healthcare not only in North America, but worldwide through science, innovation, technology, and education. I plan on leveraging my background as a translational scientist to make sure our society continues to shape the evolution of cardiovascular ultrasound."

Dr. Lindner is Professor of Medicine at Oregon Health & Science University where he is the Director of Cardiovascular Imaging and holds the M. Lowell Edwards Professorship of Cardiology. He has expertise in the fields of cardiovascular imaging and microvascular physiology; and is currently the principal investigator on several R01 grants from the National Institutes of Health (NIH) and a grant from the NASA National Space and Biomedical Research Institute. His research laboratory has pioneered the use of contrast ultrasound for non-invasive molecular imaging of disease and the evaluation of microvascular function/dysfunction. Specific areas of research include: application of molecular imaging techniques for early detection of atherosclerosis and evaluation of new therapies for atherosclerosis; molecular imaging of angiogenesis and stem cell therapy; molecular imaging for early diagnosis of myocardial ischemic injury and inflammation; microvascular dysfunction and endothelial abnormalities in atherosclerosis, insulin resistance, and sickle cell disease; development of new methods for detecting and treating peripheral arterial disease, and novel approaches for therapeutic ultrasound.

Dr. Lindner received the 1997 ASE Young Investigator Award (YIA) and has since gone on to mentor six YIA winners since 1999. He has held leadership roles on a number of ASE committees including service as vice chair of the Research Committee for eight years, co-chair of the Finance Committee, and program chair of the Echo Hawaii course and the Society's first international course, Echo ASE ASEAN. He has also had the leadership responsibilities associated with the ladder that culminates in the Scientific Sessions chair position (abstract Co-Chair, Abstract Chair, Scientific Sessions co-chair), and he chaired the *2014 Scientific Sessions* in Portland, OR. In addition, he has been a member of the Industry Relations, CME, and Education committees and was an abstract grader 2009-2015. He has served on the Foundation Annual Appeal Committee and has been on the Journal of the American Society of Echocardiography (JASE) Editorial Board, as an Associate Editor, since 2009. He was also a member of the Board of Directors from 2006 to 2009.

Dr. Lindner is also active in a number of other organizations, including the American College of Cardiology, American Heart Association, National Board of Echocardiography, European Society of Cardiology, NIH, Sarnoff Cardiovascular Research Foundation, and the Agency for Healthcare Research & Quality. He is currently serving on the editorial board of Circulation: Cardiovascular Imaging.

He received his MD from the University of Texas Southwestern Medical School, Dallas, TX, where he also completed his residency. He then completed a cardiology fellowship at the University of Virginia, Charlottesville, VA. He is board certified in cardiovascular disease and echocardiography.

Dr. Lindner served as ASE's Vice President and President-Elect prior to ascending to President. Joining him as new members of the 2018-2019 Executive Committee are Vice President, Judy Hung, MD, FASE, from Massachusetts General Hospital, Boston, MA; Council Representative, Wyman Lai, MD, MPH, FASE, CHOC Children's Hospital, Orange, CA; and Treasurer, Carol Mitchell, PhD, RDMS, RDCS, RVT, RT(R), ACS, FASE, University of Wisconsin Hospital, Madison, WI.

Continuing ASE officers include: President-Elect, Madhav Swaminathan, MD, FASE, from Duke University Medical Center, Durham, NC; Secretary, Elizabeth McIlwain, MHS, RCS, FASE, of West Jefferson Medical Center/LCMC Health, New Orleans, LA; and Immediate Past President, Vera H. Rigolin, MD, FASE, of Northwestern Medicine, Chicago, IL.

In addition to the new officers, the ASE membership has elected the following new board of directors members to two-year terms: Jayashri Aragam, MD, FASE, West Roxbury VA Hospital, West Roxbury, MA; G. Burkhard Mackensen, MD, FASE, University of Washington Medical Center, Seattle, WA; Michael Main, MD, FASE, Saint Luke's Mid America Heart Institute, Kansas City, MO; and Elaine Shea, ACS, RCS, RCCS, FASE, Alta Bates Summit Medical Center, Oakland, CA, Sonography Council Steering Committee Chair.

As the largest global organization for cardiovascular ultrasound imaging, the American Society of Echocardiography (ASE) is the leader and advocate, setting practice standards and guidelines. Comprised of over 17,000 physicians, sonographers, nurses, and scientists, ASE is a strong voice providing guidance, expertise, and education to its members. The Society has a commitment to improving the practice of ultrasound and imaging of the heart and cardiovascular system for better patient outcomes.

For more information about ASE, visit ASEcho.org; or for more information about the ASE Scientific Sessions visit ASEScientificSessions.org.

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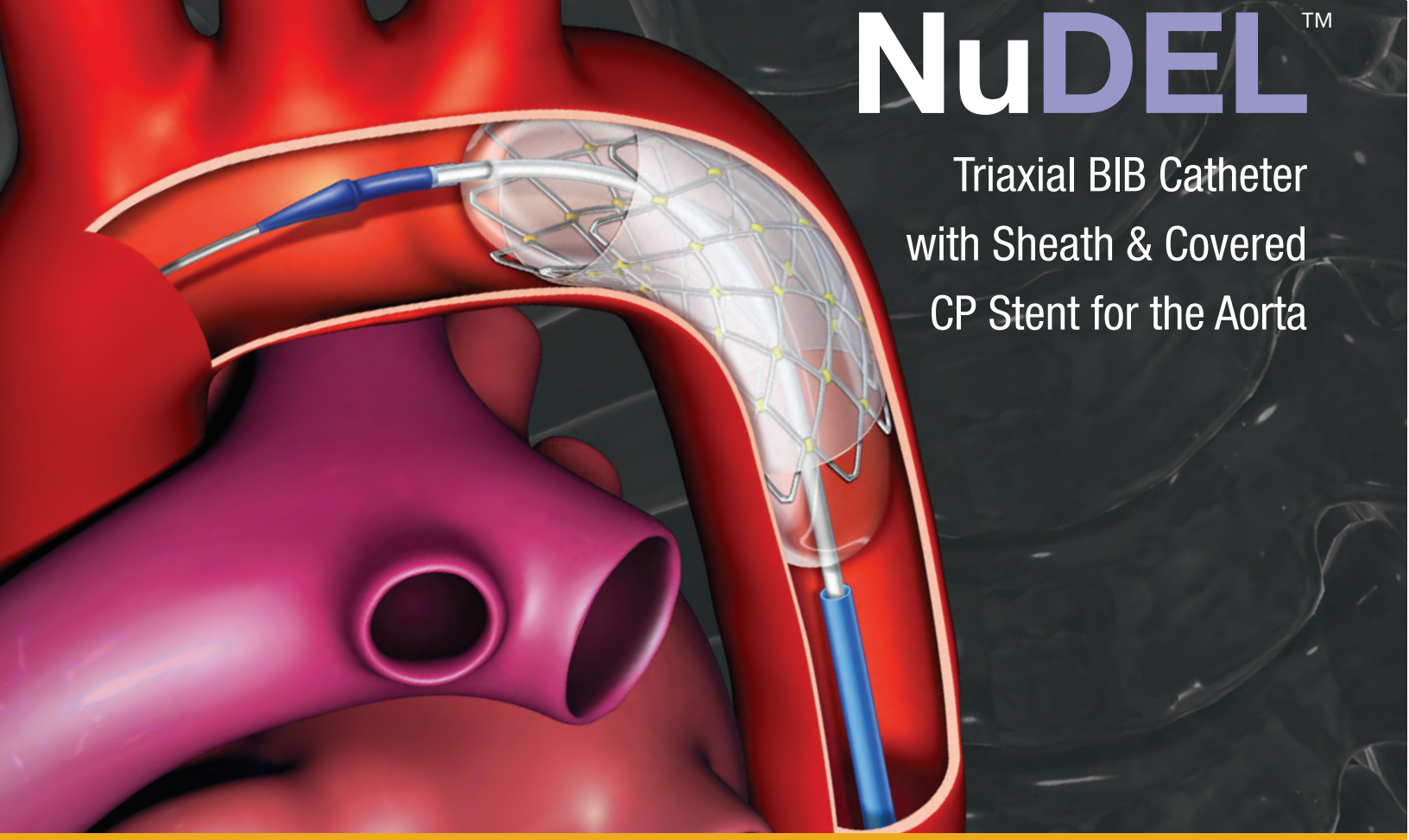
[1] "International Multicentre Clinical Device Investigation on Safety and Effectiveness of the Nit-Occlud® Lê VSD Spiral Coil System for VSD Occlusion" (clinicatrials.gov identifier NCT00390702).

[2] "The Nit-Occlud® Lê VSD Registry", publication in preparation.



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