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Pulmonary Artery Intervention Following Transcatheter Pulmonary Valve (TPV) Implantation Can be Performed Safely Without Compromising the Previously Implanted TPV Function and Integrity

Sharib Gaffar, MD; Sanjay Sinha, MD; Michael R. Recto, MD

Keywords: percutaneous transcatheter pulmonary valve, pulmonary artery stenting, transvalvular interventions, tetralogy of Fallot, pulmonary atresia, pulmonary branch stenosis, RV to PA conduit stenosis

Abstract

Background: Transcatheter pulmonary valve implantation is a well-accepted method of addressing severe pulmonary valve insufficiency or stenosis following complete repair of tetralogy of Fallot (TOF) and similar lesions that require placement of a transannular right ventricular outflow tract patch or placement of right ventricle to pulmonary artery conduit. Many patients have benefitted from transcatheter pulmonary valve placement (TPV), but little information is known regarding TPV leaflet integrity following intervention to relieve distal conduit or main and branch pulmonary artery stenosis. **Case:** We describe six patients with either TOF or truncus arteriosus who had initially undergone complete surgical repair, followed by TPV implantation who then underwent either main or branch pulmonary artery angioplasty and stent implantation through previously implanted TPV. **Results:** Post intervention angiography showed competent TPV leaflet with normal leaflet function without evidence of pulmonary valve insufficiency. Post catheterization transthoracic echocardiography confirmed these findings. **Conclusion:** Multiple interventions across previously implanted TPV is a safe and effective procedure that can be successfully completed without damage to the transcatheter pulmonary valve leaflets.

Introduction

Transcatheter pulmonary valve (TPV) implantation has become accepted practice for patients of all ages following FDA approval of the Melody Valve (Medtronic Minneapolis, MN) in 2010 for Humanitarian Use device. The Sapien XT (Edwards Lifesciences, Irvine CA) TPV was FDA approved in March 2016 for use in dysfunctional RVOT conduits, and in March 2017 the FDA expanded approval of the Melody TPV for use in patients whose prior surgical valves have failed. More recently in August 2020, the FDA also approved the Edwards Sapien 3 Transcatheter Heart Valve that had previously been

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approved for treatment of severe aortic valve stenosis to include treatment of severe pulmonary valve regurgitation and stenosis. The availability of the aforementioned TPVs has increased the number of patients that can be managed via the transcatheter approach avoiding open heart surgery to replace leaking or stenotic native pulmonary valves and conduits.^{1,2} To date, there is limited information available regarding TPV leaflet integrity following transcatheter intervention through the previously implanted TPV. Little is known about the effect of interventions that require repeated or multiple crossings of the TPV on valve leaflet integrity. This case series describes six patients who safely underwent transcatheter interventions through previously implanted Melody and Sapien TPV while preserving the integrity and function of the pulmonary valve leaflets.

Case Series

Six patients (three females and three males) with mean age of 15 years (range 10-20 years), mean weight 54 kg (range 39-66), and mean body surface area 1.52m² (range 1.45-1.75) underwent TPV implantation. Of the five patients with tetralogy of Fallot (TOF), three had severe pulmonary valve stenosis, one had pulmonary atresia with major aortopulmonary collateral vessels and one had absent pulmonary valve. The remaining patient had truncus arteriosus Type 1. All six patients had previously undergone complete repair with development of severe pulmonary valve insufficiency and right ventricular enlargement necessitating TPV implantation. Five of the patients underwent percutaneous transcatheter pulmonary implantation with a Melody valve (Medtronic, Minneapolis, MN, US) and one patient had a Sapien (Edwards Lifesciences,

Irvine, CA, US) valve implanted. Following TPV implantation, six patients had evidence of either distal right ventricle to main pulmonary artery conduit or branch pulmonary artery stenosis. Two patients, one requiring distal conduit stenting (**Figure 1 A-D**) and another requiring left pulmonary artery stent re-dilation (**Figure 2 A-B**), each underwent a second procedure 10.2 and 7.4 months after TPV implantation (early in our experience). The other four patients underwent branch pulmonary artery intervention during the same catheterization procedure after first undergoing TPV implantation.

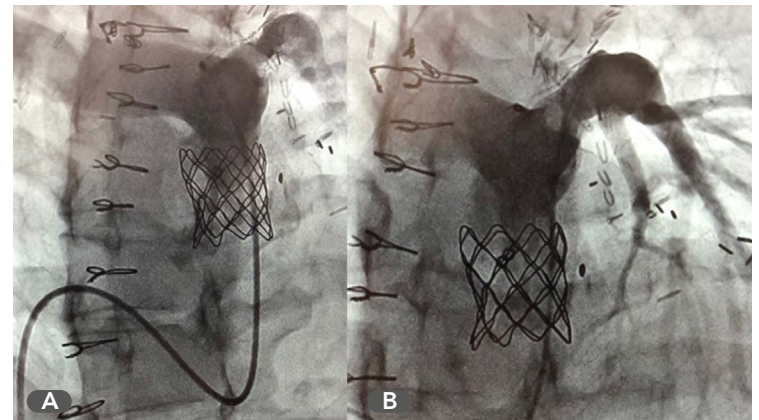


FIGURE 2 (A) Proximal left pulmonary artery in-stent stenosis. (B) Improvement of the in-stent stenosis following balloon redilation.

Cases

Areas of stenosis were documented in the distal main pulmonary artery or branch pulmonary arteries utilizing an Arrow Berman balloon-tipped angiographic catheter (Teleflex, Wayne, PA, US) that was advanced through the previously implanted TPV with the balloon inflated so as to minimize trauma to the previously implanted TPV leaflets. The Berman catheter was then replaced with an Arrow Balloon Wedge catheter (end hole catheter) that was advanced with the balloon inflated past the TPV into the distal branch pulmonary artery. An Amplatz Super Stiff wire (Boston Scientific) wire was then advanced through the wedge catheter into a distal right or left pulmonary artery branch. For the patients that required stent implantation of the distal main pulmonary artery or branch pulmonary arteries, a long transeptal sheath was initially positioned across the TPV to protect the TPV leaflets from the multiple wire and balloon exchanges that were required to deliver the stents (**Figure 3**). For the patient that required re-dilation of a previously implanted stent (**Figure 4**), the angioplasty balloon was delivered directly over the Super Stiff wire without utilizing a transeptal sheath and positioned across the stent. After the stent was re-dilated, the angioplasty balloon was deflated and removed over the Super Stiff wire. Post angioplasty angiography performed with a Berman angiographic catheter demonstrated competence of the TPV with normal leaflet function without evidence of pulmonary valve insufficiency, perivalvar leak or valve migration.

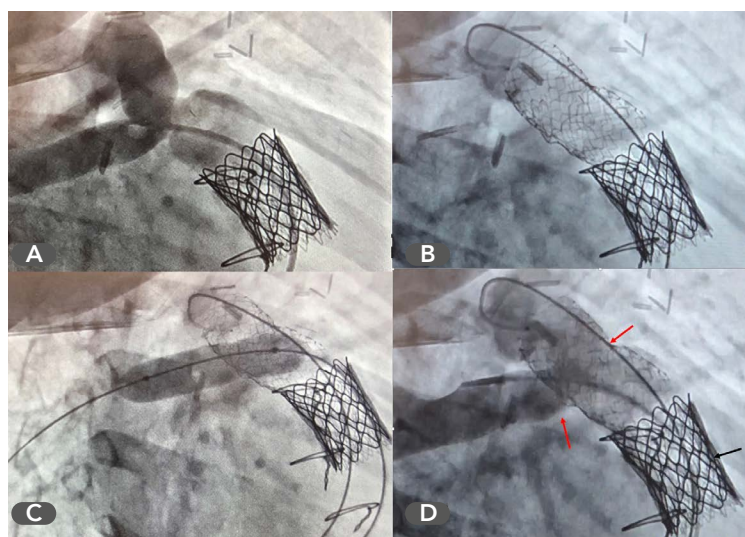


FIGURE 1 (A) Angiography showing the distal conduit stenosis. (B) The stenosis responded well to stenting, with improvement in caliber. (C) The stenosed proximal right pulmonary artery was balloon angioplastied after advancing the balloon through a conduit stent strut. (D) Improvement in proximal right pulmonary artery caliber seen with post balloon angiography.



FIGURE 3 The tip of the long transseptal sheath (white arrow) is positioned above the level of the pulmonary valve leaflets.

FIGURE 4 The balloon utilized to perform left pulmonary artery stent redilation was directly advanced over a super stiff wire (white arrow).

Results

Please see **Table 1** for full results. Four of the six patients underwent stent implantation into distal right ventricle to main pulmonary artery conduit stenosis (one patient) and right or left branch pulmonary arteries (three patients) with Palmaz Genesis (Cardinal Health, Dublin, OH) or Max LD (Medtronic) stents. All six patients underwent branch pulmonary artery angioplasty with Atlas Gold (Bard Medical, New Providence, NJ, US), Vida (Bard), Powerflex (Cardinal), or Opta Pro (Cardinal) balloons. All patients underwent a minimum of two interventions (median 2.5, range 2-4) through the TPV. All six patients underwent successful distal right ventricle to main pulmonary artery conduit or branch pulmonary artery balloon angioplasty and/or stenting without complications. Post-intervention angiography showed competence of the previously implanted TPV with normal leaflet function and no evidence of pulmonary insufficiency, perivalvular leak, or valve migration. All patients then underwent post-

catheterization transthoracic echocardiography demonstrating intact TPV leaflet integrity without pulmonic insufficiency. Post-catheterization course was uneventful for all patients.

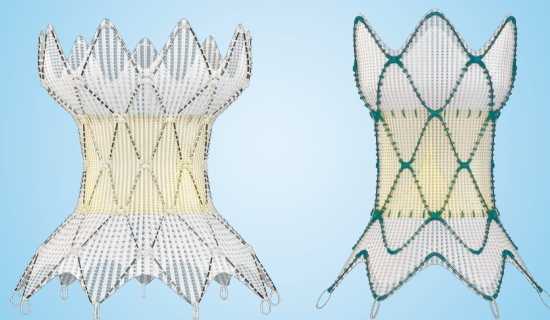
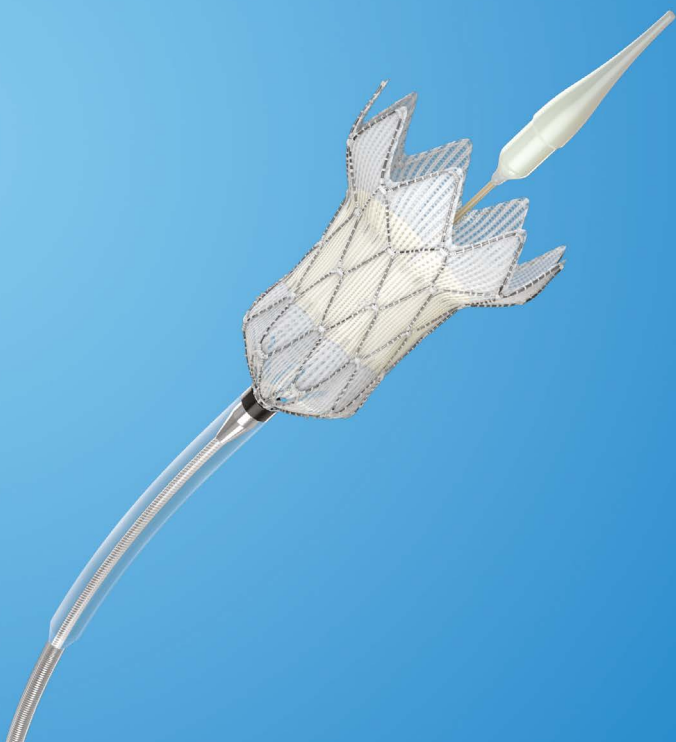
Discussion

Transcatheter pulmonary valve implantation is now widely accepted as standard therapy for patients who have developed severe pulmonary valve insufficiency with subsequent development of right ventricular enlargement following repair of tetralogy of Fallot with transannular right ventricular outflow tract patch or following placement of right ventricle to main pulmonary artery conduits that have failed.^{1,2} TPV is also now routinely utilized in patients whose prior surgical valves have failed (valve in valve procedure).³ What is not well known or described is the effect of repeated interventions on TPV leaflet integrity following transcatheter intervention through previously implanted TPV. This case series describes six patients who underwent pulmonary artery stent implantation and balloon angioplasty through previously implanted Melody and Sapien S3 TPV (**Table 1**). Early in our experience, two of the patients, one requiring distal conduit stenting and another requiring left pulmonary artery stent redilation, underwent a second procedure 10.2 and 7.4 months after their initial TPV implantation, respectively. The four other patients underwent balloon angioplasty and stent implantation immediately following TPV implantation. Five of the six patients underwent balloon angioplasty before undergoing stent implantation. One patient only required balloon angioplasty/stent re-dilation of a previously implanted left pulmonary artery stent. In all six patients there was no disruption of TPV leaflet integrity and in the four patients who had undergone balloon angioplasty and branch pulmonary artery stent implantation immediately following TPV, there was no dislodgement or movement of the TPV or development of increased TPV insufficiency on review of main pulmonary artery angiography following TPV implantation. In order to minimize trauma to the TPV leaflets, a long transseptal sheath was first positioned across the TPV. The angioplasty balloon and stents were then delivered through the transseptal sheath into the distal main pulmonary artery and branch pulmonary artery stenosis without injuring the TPV leaflets. In one case balloon angioplasty/stent re-dilation was performed over a Super Stiff wire without utilizing a long transseptal sheath without damage to the TPV leaflets. In retrospect, the operators feel that the balloon utilized for the stent re-dilation procedure should have been

TABLE 1 Demographics and Interventions

Patient	Sex	Age (years)	Weight (kg)	BSA	Diagnosis	Implanted PV	Balloon Angioplasty	PA Stenting	Total Interventions
1	F	10	51	1.45	ToF severe PS	Melody	3	1	4
2	F	20	55	1.54	ToF severe PS	Melody	2	0	2
3	F	16	65	1.75	ToF severe PS	Edwards	1	1	2
4	M	12	39	1.16	ToF PA MAPCAs	Melody	2	1	3
5	M	12	66	1.69	ToF absent PV	Melody	3	1	4
6	M	18	48	1.53	Truncus Arteriosus I	Melody	2	0	2
Average		14.667	54	1.52			2.167	0.667	2.833
Median		14	53	1.535			2	1	2.5

BSA = Body Surface Area; MAPCAs = Major Aortopulmonary Collateral Arteries; PA = Pulmonary Artery; PS = Pulmonic Stenosis; PV = Pulmonary Valve; ToF, Tetralogy of Fallot.



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Contraindications

The following are contraindications for the use of this device: active bacterial endocarditis or other active infections, known intolerance to Nitinol (titanium or nickel), or an anticoagulation/antiplatelet regimen.

Warnings

General: Implantation of the Harmony TPV system should be performed only by physicians who have received Harmony TPV system training. The transcatheter pulmonary valve (TPV) is to be used only in conjunction with the Harmony delivery catheter system (DCS). This procedure should only be performed where emergency pulmonary valve surgery can be performed promptly. Do not use any of the Harmony TPV system components if any of the following has occurred: it has been dropped, damaged, or mishandled in any way, or if the use-by date has elapsed.

Transcatheter pulmonary valve (TPV): This device was designed for single use only. Do not reuse, reprocess, or resterilize the TPV. Reuse, reprocessing, or resterilization may compromise the structural integrity of the device and/or create a risk of contamination of the device, which could result in patient injury, illness, or death. Do not resterilize the TPV by any method. Exposure of the device and container to irradiation, steam, ethylene oxide, or other chemical sterilants renders the device unfit for use. The device is packaged with a temperature sensor. Do not freeze the device. Do not expose the device to extreme temperatures. Do not use the device if the arrow on the sensor points to the symbol that indicates that the temperature limit has been exceeded. Do not use the device if any of the following have occurred: the tamper-evident seal is broken, the serial number tag does not match the container label, the arrow on the sensor points to the symbol that indicates that the temperature limit has been exceeded, or the device is not completely covered by the storage solution. Do not contact any of the Harmony TPV system components with cotton or cotton swabs. Do not expose any of the Harmony TPV system components to organic solvents, such as alcohol. Do not introduce air into the catheter. Do not expose the device to solutions other than the storage and rinse solutions. Do not add or apply antibiotics to the device, the storage solution, or the rinse solution. Do not allow the device to dry. Maintain tissue moisture with irrigation or immersion. Do not attempt to repair a damaged device. Do not handle the valve leaflet tissue or use forceps to manipulate the valve leaflet tissue. Do not attempt to recapture the device once deployment has begun. Do not attempt to retrieve the TPV if any one of the outflow TPV struts is protruding from the capsule. If any one of the outflow TPV struts has deployed from the capsule, the TPV must be released from the catheter before the catheter can be withdrawn. Do not attempt post-implant balloon dilatation (PID) of the TPV during the procedure, which may cause damage to or failure of the TPV leading to injury to the patient resulting in reintervention.

Delivery catheter system (DCS): This device was designed for single use only. Do not reuse, reprocess, or resterilize the DCS. Reuse, reprocessing, or resterilization may compromise the structural integrity of the device and/or create a risk of contamination of the device, which could result in patient injury, illness, or death. Do not reuse or resterilize the DCS. If resistance is met, do not advance the guidewire, DCS, or any other component without first determining the cause and taking remedial action. Do not remove the guidewire from the DCS at any time during the procedure.

Precautions

General: Clinical long-term durability has not been established for the Harmony TPV. Evaluate the TPV performance as needed during patient follow-up. The safety and effectiveness of Harmony TPV implantation in patients with pre-existing prosthetic heart valve or prosthetic ring in any position has not been demonstrated. The Harmony TPV system has not been studied in female patients of child-bearing potential with positive pregnancy.

Before use: Exposure to glutaraldehyde may cause irritation of the skin, eyes, nose, and throat. Avoid prolonged or repeated exposure to the chemical vapor. Use only with adequate ventilation. If skin contact occurs, immediately flush the affected area with water (for a minimum of 15 minutes) and seek medical attention immediately. The TPV and the glutaraldehyde storage solution are sterile. The outside of the TPV container is nonsterile and must not be placed in the sterile field. The TPV and DCS should be used only in a sterile catheterization laboratory (cath lab) environment. Ensure that sterile technique is used at all times. Strictly follow the TPV rinsing procedure. For TPV 25: Ensure that all green sutures have been removed from the attachment suture loops on the TPV before loading onto the DCS. Prevent contamination of the TPV, its storage solution, and the DCS with glove

powder. Verify the orientation of the TPV before loading it onto the DCS. The inflow end of the TPV with attachment suture loops must be loaded first. Do not place excessive pressure on the TPV during loading. Inspect the sealed DCS packaging before opening. If the seal is broken or the packaging has been damaged, sterility cannot be assured. Proper functioning of the DCS depends on its integrity. Use caution when handling the DCS. Damage may result from kinking, stretching, or forceful wiping of the DCS. This DCS is not recommended to be used for pressure measurement or delivery of fluids. Carefully flush the DCS and maintain tight DCS connections to avoid the introduction of air bubbles.

During use: The TPV segment is rigid and may make navigation through vessels difficult. Do not advance any portion of the DCS under resistance. Identify the cause of resistance using fluoroscopy and take appropriate action to remedy the problem before continuing to advance the DCS. Careful management of the guidewire is recommended to avoid dislodgement of the TPV during DCS removal. Once deployment is initiated, retrieval of the TPV from the patient is not recommended. Retrieval of a partially deployed valve may cause mechanical failure of the delivery catheter system or may cause injury to the patient. Refer to the section below for a list of potential adverse events associated with Harmony TPV implantation. During deployment, the DCS can be advanced or withdrawn prior to the outflow struts protruding from the capsule. Once the TPV struts contact the anatomy during deployment, it is not recommended to reposition the device. Advancing the catheter forward once the TPV struts make contact with the anatomy may lead to an undesired deployment or may cause damage to or failure of the TPV and injury to the patient. Refer to the section below for a list of potential adverse events associated with the Harmony TPV implantation. Physicians should use judgment when considering repositioning of the TPV (for example, using a snare or forceps) once deployment is complete. Repositioning the bioprosthesis is not recommended, except in cases where imminent serious harm or death is possible (for example, occlusion of the main, left, or right pulmonary artery). Repositioning of a deployed valve may cause damage to or failure of the TPV and injury to the patient. Refer to the section below for a list of potential adverse events associated with the Harmony TPV implantation. Ensure the capsule is closed before DCS removal. If increased resistance is encountered when removing the DCS through the introducer sheath, do not force passage. Increased resistance may indicate a problem and forced passage may result in damage to the device and harm to the patient. If the cause of resistance cannot be determined or corrected, remove the DCS and introducer sheath as a single unit over the guidewire, and inspect the DCS and confirm that it is complete. If there is a risk of coronary artery compression, assess the risk and take the necessary precautions. Endocarditis is a potential adverse event associated with all bioprosthetic valves. Patients should make their healthcare providers aware that they have a bioprosthetic valve before any procedure. Post-procedure, administer appropriate antibiotic prophylaxis as needed for patients at risk for prosthetic valve infection and endocarditis. Prophylactic antibiotic therapy is recommended for patients receiving a TPV before undergoing dental procedures. Post-procedure, administer anticoagulation and/or antiplatelet therapy per physician/clinical judgment and/or institutional protocol. Excessive contrast media may cause renal failure. Preprocedure, measure the patient's creatinine level. During the procedure, monitor contrast media usage. Conduct the procedure under fluoroscopy. Fluoroscopic procedures are associated with the risk of radiation damage to the skin, which may be painful, disfiguring, and long term.

Potential Adverse Events

Potential risks associated with the implantation of the Harmony TPV may include, but are not limited to, the following: ■ death ■ valve dysfunction ■ tissue deterioration ■ hematoma ■ heart failure ■ cerebrovascular incident ■ perforation ■ rupture of the right ventricular outflow tract (RVOT) ■ compression of the aortic root ■ compression of the coronary arteries ■ sepsis ■ pseudoaneurysm ■ erosion ■ stent fracture ■ arrhythmias ■ device embolization or migration ■ pulmonary embolism ■ occlusion of a pulmonary artery ■ laceration or rupture of blood vessels ■ device misorientation or misplacement ■ valve deterioration ■ regurgitation through an incompetent valve ■ physical or chemical implant deterioration ■ paravalvular leak ■ valve dysfunction leading to hemodynamic compromise ■ residual or increasing transvalvular gradients ■ progressive stenosis and obstruction of the implant ■ hemorrhage ■ endocarditis ■ thromboembolism ■ thrombosis ■ thrombus ■ intrinsic and extrinsic calcification ■ bleeding ■ bleeding diathesis due to anticoagulant use ■ fever ■ pain at the catheterization site ■ allergic reaction to contrast agents ■ infection ■ progressive pulmonary hypertension ■ progressive neointimal thickening and peeling ■ leaflet thickening ■ hemolysis. General surgical risks applicable to transcatheter pulmonary valve implantation: ■ abnormal lab values (including electrolyte imbalance and elevated creatinine) ■ allergic reaction to antiplatelet agents, contrast medium, or anesthesia ■ exposure to radiation through fluoroscopy and angiography ■ permanent disability.

Please reference the Harmony TPV system instructions for use for more information regarding indications, warnings, precautions, and potential adverse events.

Caution: Federal law (USA) restricts these devices to the sale by or on the order of a physician.

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delivered through a long transseptal sheath to minimize trauma from the uneven folding of the angioplasty balloon following stent re-dilation that could have damaged the TPV leaflets. All six patients underwent post procedure main pulmonary artery angiography demonstrating competence of the TPV. Transthoracic echocardiography performed the following day prior to discharge demonstrated absence to at most trace TPV insufficiency.

Conclusion

Transcatheter interventions consisting of balloon angioplasty and stent implantation can be performed safely and without injury to the pulmonary valve leaflets following TPV implantation. The operators recommend initially crossing the previously implanted TPV with balloon tipped catheters and once the TPV has been crossed so that a long transseptal sheath could be utilized to facilitate wire and catheter exchange through the TPV whenever possible. Once the transseptal sheath and wire are positioned across the TPV, wire and catheter exchanges can be performed through the TPV without risking damage to the leaflets of the TPV. In one case the operators did not utilize a transseptal sheath and an angioplasty balloon was directly advanced and subsequently withdrawn over the Super Stiff wire after performance of branch pulmonary artery stent re-dilation. While there was no damage to the valve leaflets, the uneven folding of the angioplasty balloon that can occur after the balloon is inflated could have damaged the TPV leaflets as there would have been direct contact between the rough uneven folds of the balloon and the valve leaflets. While this patient's TPV maintained leaflet integrity, the operators do not recommend performance of angioplasty procedures without first positioning a long transseptal sheath across the TPV.

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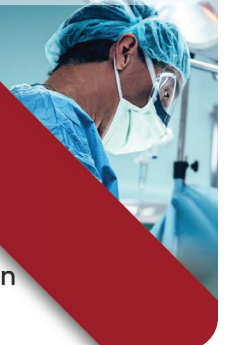
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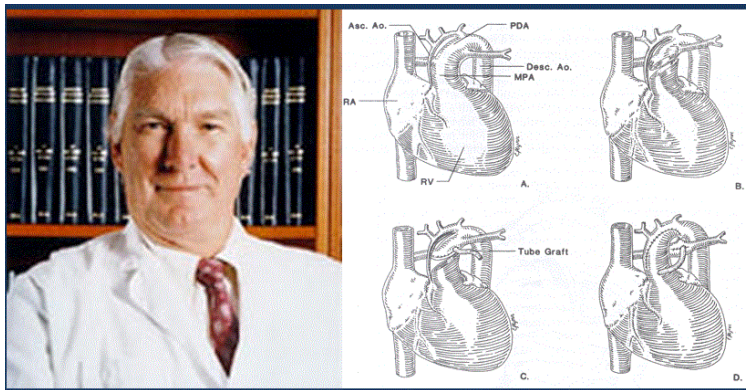


In Memoriam: William I. Norwood Jr (1941-2020)

Edward J. Malec, MD, PhD & Marshall L. Jacobs, MD

With great sorrow, we acknowledge the passing of a dear friend and an esteemed mentor and colleague, William I. Norwood Jr.

On Sunday, December 13, 2020, Dr. William Imon Norwood, Jr, "Bill," loving husband, father of three children, grandfather to nine and great-grandfather to five, passed away at the age of 79. In reality, the "extended family" that mourn Bill's passing, and whose lives were touched in immeasurable ways by his life, numbers in the thousands, or likely tens of thousands. So many families in all parts of the world have been beneficiaries of Bill's contributions to the present-day understanding of congenital heart disease and its management. Many thousands of patients, in numerous countries, were direct recipients of Bill's outstanding care, having benefited directly from his incomparable surgical skill and his genius in harnessing the fundamentals of cardiovascular physiology to design surgical therapies and optimize outcomes. Many, many more were beneficiaries of Bill's gifts, through the work of countless other surgeons, cardiologists, anesthesiologists, nurses, and additional caregivers whose careers were directly impacted by his teachings, his mentorship, and the advanced understanding of Congenital Heart Disease that he promoted.



In 2010, the inaugural issue of the World Journal for Pediatric and Congenital Heart Surgery included an article by Dr. Norwood, titled "Our Roots, Our Future."¹ This text version of an address that Dr. Norwood had delivered at the 2009 meeting of the Congenital Heart Surgeons' Society recounted the contributions of some of his mentors and predecessors in the field of congenital heart surgery. Dr. Norwood emphasized the importance of innovation and discussed some of the inherent challenges that go along with it. Reflecting on the contributions of Robert Gross, C. Walton Lillehei, Clarence Dennis, Richard Varco, Aldo Castaneda, and others, Dr. Norwood concluded that "... the following are some of the characteristics of an innovator: confidence, conviction, creativity, courage." As he has done numerous times in numerous settings, he mentioned an aphorism attributed to the late Theodore Levitt, former professor at the Harvard Business School and editor of Harvard Business Review. Levitt, he said, put it simply: "Creativity is thinking up new things. Innovation is doing

new things." In 2015, when the first Lifetime Achievement Award of the Congenital Heart Surgeons' Society was bestowed upon Dr. Norwood, it was accompanied by an expression of profound respect, but also one of gratitude for his having the "Curiosity, Determination and Genius that it takes to Think Up New Things ... for the Empathy, Faith and Courage that it takes to Do New Things ... and the Generosity to use those gifts to improve so many, many lives."

All who devote their careers to improving the lives of individuals with congenital heart disease have been influenced by Dr. Norwood's enormous contributions. His influence extends to individuals in diverse roles. Among them are practitioners who are engaged in virtually every aspect of the multidisciplinary management of congenital heart disease. Perhaps those who worked side-by-side with him in Boston, Philadelphia, Genolier, Wilmington, Krakow, Oslo, Rome, and Shanghai feel most tangibly a sense of indebtedness to Bill Norwood as teacher and mentor. It is the case, however, that surgeons (and their non-surgical colleagues) throughout North, Central and South America, Europe, Asia, Africa, and Oceania have benefited from Dr. Norwood's mentorship and are more versatile and more effective as a result of his teaching.

It is important though, to be mindful of the fact that the lives most directly impacted by the contributions of an innovator such as Bill Norwood are the patients—those individuals who might not otherwise have the opportunity to get up each morning and face the challenges of another day. In this journal, in 2016, a pediatric cardiac intensive care unit nurse who was born with hypoplastic left heart syndrome (HLHS) and had undergone her initial surgery by Dr. Norwood in 1987 shared a very personal perspective.² She said, "People have always asked me, both while I was growing up and since I have become an adult, 'Was my life with congenital heart disease normal?' Well, what's normal? Was I sick a lot? Yes. Was I teased a lot for being small, for not having a lot of strength, for not being able to run? Yes. Were these things hard for me? Yes. However, I tried not to focus on what I could not do but would instead focus on what I could do. I could not play soccer, OK; I did not want to play soccer. I wanted to take Taekwondo! So, I did and soon earned my black belt! I wanted to be a cheerleader, so I tried out. I ended up being a flier who was at the top of the pyramids and did stunts. I did whatever I wanted, and I rarely asked for permission. I was intent on leading my life to the fullest without unmerited restrictions."

Now, several years after undergoing neo-aortic valve replacement, she continues to work in the Heart Institute Clinic. Of this work, she said, "Working in the clinic has allowed me to work closely with other heart patients and their families. I have loved getting to know these families on a personal level and seeing them on a consistent basis."



Outpatient Pediatric Cardiologist Opportunity – Northeast Ohio

Ohio-based Akron Children's Hospital seeks a ***Pediatric Clinical Cardiologist*** to join its expanding Heart Center. Akron Children's Hospital is the largest pediatric healthcare system in Northeast Ohio and is ranked among the best children's hospitals by *US News and World Report*.

This integrated healthcare delivery system includes:

- Two free-standing pediatric hospitals
- More than 800 providers, who manage over 1.1 million patient visits annually
- A network of more than 60 primary and specialty care locations
- Robust research and innovation endeavors

The successful candidate will provide Cardiology care at the Beeghly campus, expanding the services of the dedicated Heart Center team, which includes 16 pediatric cardiologists, 5 nurse practitioners and 2 cardiothoracic surgeons who provide a complete spectrum of coordinated, compassionate, cardiac care to over 10,000 patients annually. Services include: advanced diagnostics, complex surgical procedures, an adult congenital heart disease program, a fetal imaging program and a cardiac MRI program. Enjoy practicing in a comfortable community setting.

This position offers opportunities for:

- Partnership with an established team of Cardiologists affording exceptional work-life balance
- Active involvement in medical student and resident education; academic appointment at Northeast Ohio Medical University is available and commensurate with experience
- An attractive compensation plan that includes bonus compensation

Requirements include board eligibility/certification in Pediatric Cardiology and the ability to obtain an active medical license in the state of Ohio.

The Mahoning Valley is an exciting and vibrant place to live...outstanding parks, museums, theaters, art galleries, sport events, golf courses, country clubs, live concert and event venues, biking and hiking trails, lakes and much more provide residents with a dynamic choice of recreational opportunities. This area is successfully transitioning to a technology and knowledge-based economy by leveraging its industrial and academic strengths. In just the last two years, 107 businesses have invested \$682 million here, creating over 4500 new jobs!

Interested candidates may contact Jane Hensley, Physician Recruiter at 330-543-3015 or jhensley@akronchildrens.org. To learn more, visit our website at www.akronchildrens.org.



FIGURE 1 Photograph taken during a picnic at the home of Dr. Norwood in Gladwyne, Pennsylvania, in the early 1990s.



FIGURE 2 Dr. Norwood and Dr. Malec at a gathering of families in Zakopane, Poland. The red T-shirts bear the inscription: "S/P Norwood, hope and miracle."

Every patient's story is unique, but some common themes do emerge. In 2015, a young woman who was at that time a premedical student at college was asked what Bill Norwood's contributions mean to her. She had never met Dr. Norwood, though she was born in 1994 with HLHS and underwent what many call "the three stage Norwood Procedure." So, when asked what Dr. Norwood's contributions mean to her, she responded, "For my parents, it was the chance to have a family . . . But for me, it is every opportunity I have ever received. It's about being able to have dreams of things I'd like to do 5, 10 or 15 years from now." Where those dreams have taken her is to medical school, where she will soon graduate and pursue training in pediatric cardiology.

These anecdotes are but a few of the many stories that each of us could recount, by way of illustrating the countless lives that have

been positively influenced by Bill Norwood and his immeasurable contributions to the understanding of congenital heart disease and the care of patients and families whose lives are affected by it. The accompanying photograph (**Figure 1**) was taken during a picnic at Dr. Norwood's home in Gladwyne, Pennsylvania, in the early 1990s. Each year, patients and their families were invited to get together in his back yard and enjoy one another's company. Without echocardiograms, one cannot be absolutely certain. But it is very likely that the older guy with white hair in the second row is the only person in the picture with two well-developed ventricles. As for the others, most are now beginning the fourth decade of their lives. In **Figure 2**, Dr. Norwood is seen with a gathering of families in Zakopane, Poland, in 2017. The yellow inscription on the back of the children's red T-shirts says: "S/P Norwood, hope and miracle." Surely, these "snapshots" suggest the tangible legacy of Dr. William I. Norwood Jr., MD, PhD.

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THE UNIVERSITY
of **NORTH CAROLINA**
at **CHAPEL HILL**

Clinical Instructor, Division of Cardiothoracic Surgery

The Division of Cardiothoracic Surgery of the University of North Carolina at Chapel Hill is seeking candidates for a **full-time faculty position**. The appointment will be at the **Clinical Instructor level** on the Fixed-Term track. The **UNC Children's Heart Center** is a comprehensive program which performs the **full spectrum of procedures** including neonatal cardiac surgery and surgery for low birth weight babies, complex valve repair, pediatric ventricular assist devices and cardiopulmonary transplantation, and adult congenital heart surgery.

Candidates should possess experience in caring for complex congenital heart patients. Qualified candidates should also have completed an ACGME-accredited cardiothoracic residency program or an international equivalent. Primary responsibilities will include providing exemplary care in all facets of the service including preoperative assessment of children adults and with congenital heart disease, assisting with all surgical cases, and postoperative care. Participation in educational activities with medical students and residents will be expected along with contributions to the research mission of the Department. Job duration 1-2 years with possibility of promotion and/or retention.

Educational Requirements

Medical degree from an accredited medical school. Completion of an ACGME-accredited cardiothoracic residency program or international equivalent.

Qualifications and Experience

- Meets applicable credentialing and privileging standards for his/her specialty.
- Unrestricted license to practice medicine in the State of North Carolina (or the ability to obtain one prior to appointment), or completion of all steps of the United States Medical License Exam (USMLE) prior to starting the position.
- Eligible for faculty appointment in the Department of Surgery.

Please apply online at <https://unc.peopleadmin.com/postings/193648>

The University of North Carolina at Chapel Hill is an equal opportunity and affirmative action employer. All qualified applicants will receive consideration for employment without regard to age, color, disability, gender, gender expression, gender identity, genetic information, national origin, race, religion, sex, sexual orientation, or status as a protected veteran.



The PICS 25th Anniversary Symposium and Inaugural Fellows/Early Career Course: An Interview with the Program Directors

The PICS Society's Communications Staff recently interviewed Directors of the PICS Society's 25th Anniversary Symposium (September 1-4, 2021, in Las Vegas) and the inaugural PICS Fellows/Early Career Course (August 30-31, 2021 in the same location). Interview highlights:

The 25th Anniversary PICS Symposium

PICS staff: Dr. Hijazi, we have heard you refer to the 2021 PICS Symposium as both the 25th anniversary and the first anniversary meeting! How is this possible?

Ziyad M. Hijazi, MD, MPH, FPICS (PICS Society President & Symposium Founder/Director): This is the 25th anniversary of the PICS Symposium AND the first anniversary for the new PICS Society. In 1997 our field didn't have its own focused educational meeting. We needed to change that! I explored the idea with my mentors Dr. Bill Hellenbrand and the late Dr. Charlie Kleinman, and with the great help of my first boss Dr. David R. Fulton. With their encouragement, in 1997 we held our first meeting and grew quickly from there. We constantly update the meeting while always focusing on excellence in education towards the best possible patient care.



PICS staff: Congratulations on the 25th Silver Anniversary! So, why is this also the first anniversary?

Dr. Hijazi: September marks the first anniversary of The Pediatric and Congenital Interventional Cardiovascular Society--The PICS Society--the professional home for our global community. Last year we looked at how best to represent the interests of interventional congenital cardiologists and our amazing teams. Until now, no organization has focused exclusively on our needs. With encouragement of colleagues worldwide, we formally launched The PICS Society late last year and are growing very fast!

PICS staff: Dr. Kenny, you have noted The PICS Symposium is the Society's flagship event, and that the Society as a membership organization is spearheading many additional areas.

Damien Kenny, MD, FPICS (PICS Society Vice President & PICS Symposium Director): The Symposium is a vital part of the PICS Society. It's exciting that the culture of excellence and community Dr. Hijazi alluded to continues to drive the Symposium and the Society overall. The PICS Society is now the dedicated home for passionate physicians who do amazing work for the equally amazing patients we treat, with many opportunities for our members to get involved--guidelines, advocacy, education, early career and more. Our culture is dedicated to learning from one another, constantly improving and advocating as a unified voice for our patients and colleagues.



PICS staff: Is it true that members of the PICS Society receive special recognition and benefits?

Dr. Hijazi: Yes! Members receive a significant registration discount for the PICS Symposium if they stay in the Aria Las Vegas hotel-- we have negotiated an EXTREMELY low room rate for this world class hotel. Those who apply for membership by August 1 will be Founding Members of the Society. For those who qualify for the FPICS designation (Fellow of the PICS Society), FPICS wall certificates will be presented at a Symposium ceremony recognizing the highest level of achievement in our profession. This will be a historic moment.

PICS staff: Let's talk about safety. The world is starting to open up after an incredibly challenging year.

Dr. Hijazi: We take safety extremely seriously. COVID-19 has been devastating and we are a global organization. We are working closely with the hotel to ensure a safe, enjoyable gathering. Regarding social distancing, masking, sanitizing and the like, we are

monitoring all policies, rules and guidelines-- and will insist on adherence to them. Our staff and contractors are all experienced in these matters. As medical professionals, we believe in the importance of vaccination and urge attendees to do so.

Last year's Symposium was fully virtual to great success under difficult circumstances. This year we recognize some colleagues still will be unable to travel. There will be a hybrid component this year, with selected sessions streamed or archived for future viewing.

There is nothing better than an in-person meeting where you will interact with your colleagues. Networking is so important--we have all missed this so much during the past year. We are social beings, and we have all been starved for social contact for so long. We would like our attendees to come and have a wonderful experience in a great venue.

PICS staff: Tell us about opportunities to interact with industry partners at the Symposium.

Dr. Hijazi: This is crucial. CEO's or their representatives will be there to learn our needs. Take time to introduce yourself, interact, learn and avail yourself of opportunities for hands-on demonstrations. The relationship between industry and medical professionals is extremely important; we have the ideas about what we need to better treat patients. Industry has the engineers, the scientists and the resources to meet those needs.

Dr. Kenny: In the exhibit hall, industry will display the latest products and the tried-and-true. Everything will be on display, with those who developed these products available for discussion. Industry demonstrations in the exhibit hall and expert presentations during industry lunchtime sessions will focus on



PICS Society

Pediatric and Congenital Interventional Cardiovascular Society



Announcing the First Annual
PICS Fellows & Early Career Course

August 30 & 31, 2021

ARIA CONVENTION CENTER, LAS VEGAS



Director, Pediatric Cardiac Catheterization Cohen Children's Medical Center – NYC Suburbs

The Department of Pediatrics at the Steven and Alexandra Cohen Children's Medical Center of New York is seeking a BC/BE Fellowship trained Pediatric Cardiologist with additional training or experience in Pediatric Cardiac Catheterization to join our award-winning team of physicians in our New Hyde Park/Queens location. Our division is currently performing about 160 catheterizations per year that include the breath of cardiac interventions and has one of the largest experiences with the Piccolo device in the region, as well as transcatheter valve replacements, device closures etc. The ideal candidate will have at least 5-8 years of clinical experience and have a vision to help assist in the further growth of our rapidly growing division. Our current Cath Lab director is committed to ongoing clinical care and excellence, and to working with the incoming director to support their leadership. Consideration of a more junior person is possible with the potential for transitioning to the director role in the future. Active interest and a track record of research and investigation is highly desirable.

The Pediatric Heart Center at Cohen Children's Medical Center is an integrated program, with specialists in cardiac surgery, cardiology, and critical care. Programs of excellence include interventional catheterization, advanced CT and MR imaging, COVID/MIS-C follow up, Advanced Fetal Center, genetic aortopathies, electrophysiology and device implantation, comprehensive echocardiography, as well as the inception of our heart failure program.

The Steven and Alexandra Cohen Children's Medical Center is rated by US News as the best children's hospital in New York State and one of the five best in the mid-Atlantic region. It is the largest pediatric teaching hospital in the New York metropolitan region, with more than 13,000 admissions per year. It is the tertiary pediatric medical center of Northwell Health, formally the North Shore-Long Island Jewish Health System, and is the only Level-1 Pediatric Trauma Center and ECMO Center on Long Island.

Cohen Children's is the only children's hospital on Long Island that offers comprehensive pediatric/congenital cardiology and cardiac surgery care from pregnancy through infancy, childhood, adolescence and adulthood for congenital heart disease. The Cohen Children's Heart Center provides more than 14,000 inpatient and outpatient visits annually. With one of the highest volume programs in New York State, the Division of Pediatric Cardiology has a long reputation of providing exceptional cardiovascular care throughout the region.

We offer a competitive salary and benefits package. In addition, an academic appointment with The Donald and Barbara Zucker School of Medicine at Hofstra/Northwell is commensurate with credentials and experience. Physicians will be employed as members of Northwell Physician Partners, the seventh largest medical group in the country.

For further details and opportunities, please contact:

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advances in imaging and new interventional devices.

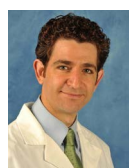
PICS staff: What will be the focus of this year's Symposium?

Dr. Kenny: The lynchpin will be live case demonstrations from around the world. Seeing how teams perform procedures provides invaluable educational benefit. We will have taped moderated cases with instructor/attendee interaction. We will have didactic lectures, vigorous debates and demonstrations. Finally, we will be providing a full 30 hours of CME, very important for board certification or recertification and, of course, for one's own professional development.

Dr. Hijazi: Whether you are new to the field or an experienced operator, there is always something new to learn. I can assure you 100% you will return home better informed to treat your patients--and that's our goal!

The Inaugural PICS Fellows and Early Career Course

Goal of this new course. Darren Berman, MD, FPICS, Course Co-Director: For those



in advanced training or early years of practice, there is a keen desire to constantly learn and improve. Our goal is to fill this niche: to provide a relatively small, focused program for those early in their careers. For fellows, the course will complement their home institution program relatively early in their interventional training. For early career interventionalists, this course will complement what they have learned. For both groups, they will be able to build networks that will benefit them throughout their careers.

It sounds exciting! Tell us more. Vivian Dimas, MD, FPICS, Course Co-Director:



What's exciting is that we will have a very full two days focused on this small group of attendees, who will then hopefully continue to expand on many of the topics covered by participating in the full Symposium. The faculty, attendees, live cases and taped moderated cases are all global, with core faculty eager to interact with attendees. There will be lively back-and-forth including case-based learning. "What have we done well? Where can we improve? What have we learned from our mistakes?" That's how we will teach this course.

How do fellows & early career physicians apply for this course? Dr. Dimas: Space is limited, so apply early! We have made the application process simple: Go to www.picsymposium.com and click on "registration" then "fellows course."

How will you serve two audiences--fellows and early career-- in one course? Dr. Berman: Think about it: an interventional fellow and a first-year attending are separated by one day! One day you're a fourth year. The next day you begin your first year in practice. The lines are blurry and your first day as an attending can be a little nerve wrecking-I know mine was!

Dr. Dimas: In those training and early years, there is much to learn, especially from faculty who have made mistakes themselves and want to share those lessons learned. Call it wisdom if you want to. These two groups of attendees are going to align very well.

Collaboration with industry. Dr. Dimas: We so appreciate their support and partnership, without which this course would be impossible to offer. We faculty are all volunteers, but this course does require resources. For this course and for our field as a whole, we are indebted to our industry partners and cannot thank them enough for their ongoing collaboration and partnership. This course will facilitate working relationships between attendees and industry, which will benefit our field's development well into the future.

Networking. Dr. Berman: The small size of this meeting creates the right environment for interactive discussion in the classroom and relationship building outside of the conference. This short time together can set the foundation for a lifetime of interactions. The nature of this focused course will allow a seamless way to start creating those relationships and bonds.

Why are you doing this? Dr. Berman: Great question! Each of us wants to contribute beyond the clinical work we do each day. It's important to find those things that really light the fire in each of us. For me, this opportunity to help create and build this course from scratch lays the foundation for teaching, learning, creating new friendships, and gives me the opportunity to start "paying it forward" by helping the next generation of great congenital interventional cardiologists. I'm grateful for the opportunity to help do this, and I know that Dr. Dimas and the entire faculty feels the same way.

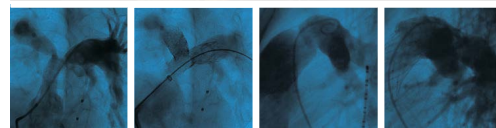
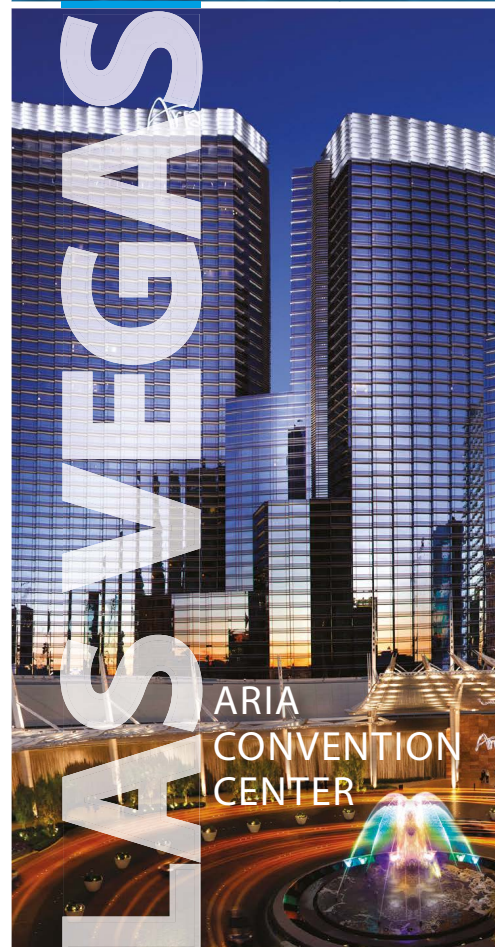


PICS Society

Pediatric and Congenital Interventional Cardiovascular Society



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Focusing on the latest interventional catheter strategies for congenital and structural heart disease in children and adults.

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Atrium Health

Pediatric Imaging Cardiologist

Sanger Heart & Vascular Institute / Levine Children's Hospital

The Congenital Heart Center at Levine Children's Hospital (LCH) and **Sanger Heart & Vascular Institute (SHVI)**, seeks to recruit a **Pediatric Imaging Cardiologist** to join their existing faculty.

- Candidates will have completed an ACGME accredited fellowship in pediatric cardiology and be BC/BE by the American Board of Pediatrics; expertise in echocardiography and congenital heart disease, which includes transthoracic, transesophageal, and fetal echocardiography; responsibilities will include both outpatient and inpatient cardiology. Minimum five (5) years of post-fellowship experience preferred, with potential to join as Medical Director of the Echocardiography Program.
- Team includes: 13 cardiologists, 5 cardiac intensivists, 4 pediatric cardiac anesthesiologists, 2 pediatric cardiac radiologists, 18 APPs (includes 2 surgical APPs), 3 Surgeons, 13 sonographers, 4 nurse navigators and 5 dedicated RNs.

The Congenital Heart Center, established in 2010, has been ranked as one of the top-50 pediatric heart centers in the country by U.S. News and World Report for the last nine years. Our comprehensive services include cardiac imaging, diagnostic and interventional catheterization, electrophysiology, dedicated cardiovascular intensive care staff, and regional referral programs in heart failure / transplantation, adult congenital heart disease, and fetal echocardiography. Program volume has been growing secondary to increased referral patterns and regional population growth. Our new outpatient suite will be opening in December 2020, designed to treat all from fetal cardiology to ACHD. Our state-of-the-art two lab cardiac catheterization and electrophysiology suite opened in February of 2017, with dedicated staffing and anesthesia teams. We have one of the most comprehensive Cardiac Neurodevelopment programs in the region, providing a multitude of specialty services to our congenital heart population in the same office suite. Participation in investigator initiated and multi-center industry sponsored studies is ongoing within the Heart Center, with the support of an active clinical research department.

Levine Children's Hospital (LCH) is a state-of-the-art facility open since 2007 in beautiful Charlotte, North Carolina. LCH has 11 floors and 234 inpatient beds, including an on-site PICU and CVICU covered 24/7 by in-house intensivists, Progressive Care Unit, Inpatient Observation Unit, Pediatric Rehab Unit and Pediatric Emergency Department. We are committed to being the region's leading provider of pediatric health care services.

LCH and SHVI are both premier referral facilities within Atrium Health and one of the nation's leading and most innovative healthcare systems. Atrium Health employs nearly 2,500 system-employed physicians, more than 60,000 employees, and more than 7,460 licensed beds across the Carolinas and Georgia.

Sanger Heart & Vascular Institute is one of the Southeast's largest cardiac and vascular programs providing the highest quality care available to patient with cardiovascular disease throughout North and South Carolina. Sanger employs more than 110 physicians in a network of more than 25 locations to provide the highest quality care available to patients with cardiovascular disease throughout North and South Carolina. Sanger has more than 50 years of experience providing world-class, comprehensive acute and chronic cardiovascular services including the region's only heart transplant center and pediatric heart surgery program.

To apply or for more information, please contact:

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Physician & APP Recruiter

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Researchers Identify New Way to Improve the Diagnosis of Fetal Heart Defects

UC San Francisco researchers have found a way to double doctors' accuracy in detecting the vast majority of complex fetal heart defects in utero - when interventions could either correct them or greatly improve a child's chance of survival - by combining routine ultrasound imaging with machine-learning computer tools.

The team, led by UCSF cardiologist Rima Arnaout, MD, trained a group of machine-learning models to mimic the tasks that clinicians follow in diagnosing complex Congenital Heart Disease (CHD). Worldwide, humans detect as few as 30-50% of these conditions before birth. However, the combination of human-performed ultrasound and machine analysis allowed the researchers to detect 95% of CHD in their test dataset.

The findings appear in the May issue of Nature Medicine.

Fetal ultrasound screening is universally recommended during the second trimester of pregnancy in the United States and by the World Health Organization. Diagnosis of fetal heart defects, in particular, can improve newborn outcomes and enable further research on in utero therapies, the researchers said.

Typically, the imaging includes five cardiac views that could allow clinicians to diagnosis up to 90% of Congenital Heart Disease, but in practice, only about half of those are detected at non-expert centers.

"On the one hand, heart defects are the most common kind of birth defect, and it's very important to diagnose them before birth," Arnaout said. "On the other hand, they are still rare enough that detecting them is difficult even for trained clinicians, unless they are highly sub-specialized. And all too often, in clinics and hospitals worldwide, sensitivity and specificity can be quite low."

The UCSF team, which included fetal cardiologist and senior author Anita Moon-Grady, MD, trained the machine tools to mimic clinicians' work in three steps. First, they utilized neural networks to find five views of the heart that are important for diagnosis. Then, they again used neural networks to decide whether each of these views was normal or not. Then, a third algorithm combined the results of the first two steps to give a final result of whether the fetal heart was normal or abnormal.

"We hope this work will revolutionize screening for these birth defects," said Arnaout, a member of the UCSF Bakar Computational Health Sciences Institute, the UCSF Center for Intelligent Imaging, and a Chan Zuckerberg Biohub Intercampus Research Award Investigator. "Our goal is to help forge a path toward using machine learning to solve diagnostic challenges for the many diseases where ultrasound is used in screening and diagnosis."



Developing a Lead Extraction Program for Patients with Complex CHD

Wilson W. Lam, MD, FACC; Douglas Mah, MD; Jeffrey J. Kim, MD, FACC

Pacemaker and defibrillator lead extraction plays an important role in lead management strategy and complements novel technology, such as leadless pacing and subcutaneous implantable cardiac defibrillators. Indications and recommendations for lead extraction have been established.^{1,2} Pediatric and adult congenital heart disease (CHD) centers may have lower case volumes than adult lead extraction centers. However, CHD adds anatomic complexity in a younger population of smaller patient size, where limited transvenous access, prior operations, and baffles and conduits may alter lead position. The 2014 PACES/HRS Consensus Statement recommends that device-based procedures be performed in a regional ACHD center laboratory with appropriate personnel and equipment, by an electrophysiologist with expertise in CHD.³ Guidelines have identified necessary components of a CHD lead extraction program, and we propose modifiers that demonstrate CHD expertise (**Table 1**). In experienced centers, procedural success remains high (~95%), with reported complication rates in the range of approximately 3-4%,⁴⁻⁷ with no mortality – similar to adult series.^{8,9} Due to anatomic complexity and potential for adverse outcomes which may be life threatening, centers performing these procedures should have a designated team familiar with the CHD management to maximize procedural success and safety.

TABLE 1 Suggested CHD Lead Extraction Operator Training/Expertise

	Guideline Recommendation	Suggestion
Lead extraction specialist	Electrophysiologist or CT surgeon Initial: 30 lead extractions Annual: 20 extractions	Primary operator: training in pediatric or adult congenital heart disease or Co-operator: training in pediatric electrophysiology
Cardiothoracic (CT) surgeon	Continuing education in surgical management of lead complications Immediately available for emergent sternotomy or thoracotomy within 5-10 minutes	Additional congenital heart disease training
Cardiovascular anesthesiologist	Procedures performed under general anesthesia in most centers which facilitates intraoperative TEE, and eliminates urgent intubation	Additional congenital heart disease training
Tools	Simple manual traction Lead locking stylets Telescoping sheaths Femoral snares Mechanical cutters Laser sheaths	For leads that have been in place for a longer time ("dwell time"), the likelihood of requiring snares is higher
Intraoperative imaging	Strong recommendation for transesophageal echocardiogram (TEE) or intra-cardiac echocardiography (ICE) based on operator familiarity and comfort with image interpretation	ICE - less fluoroscopic interference; better right heart visualization; relies on the extractionist for interpretation. TEE - less costly upfront; image interpretation independently performed by an echocardiographer.
Access	Some centers routinely place femoral arterial and venous sheaths for rapid cannulation if bypass is necessary	Venous occlusion and interrupted inferior vena cava with azygos continuation may limit maneuverability
Vascular tear preparation	Some centers include interventional radiologists or vascular surgeons to assist with percutaneous management of vascular tears	Routine preparation of tamponade balloon. Coordination with interventional cardiology (if use of covered stent required).



Adult Congenital Cardiologist

Cohen Children's Medical Center – NYC Suburbs

The Department of Pediatrics at the Steven and Alexandra Cohen Children's Medical Center of New York is seeking a BC/BE Fellowship trained Pediatric Cardiologist with dual training and BC/BE in Adult Congenital Heart Disease to join our award-winning team of physicians in our New Hyde Park location.

The Adult Congenital Heart Program at Cohen Children's Medical Center is a fully integrated program, with specialists in adult medicine including hepatology, pulmonary, heart failure and intensive care. We also have an outstanding maternal-fetal medicine program and high risk obstetrical team to provide cutting edge care for our mothers with congenital heart disease.

Our Adult Congenital Heart Program team includes ABIM Board Certified adult and ABP Certified pediatric cardiologists, cardiothoracic surgeons, cardiovascular anesthesiologists, interventional catheterization physicians, advanced imaging physicians, exercise physiologists, electrophysiologist, nurse practitioners, nurses and staff, who are all specialized in treating adults with congenital heart defects. The program is led by our Medical Director, who is an ABIM certified and ACHD accredited provider, with over 25 years of experience as an electrophysiologist.

The Steven and Alexandra Cohen Children's Medical Center is the largest pediatric teaching hospital in the New York metropolitan region, with more than 13,000 admissions per year. It is the tertiary pediatric medical center of Northwell Health, formally the North Shore-Long Island Jewish Health System, and it is the only Level-1 Pediatric Trauma Center and ECMO Center on Long Island.

Cohen Children's is the only children's hospital on Long Island that offers comprehensive pediatric/congenital cardiology and cardiac surgery care from pregnancy through infancy, childhood, adolescence and adulthood for congenital heart disease. The Cohen Children's Heart Center provides more than 14,000 inpatient and outpatient visits annually. With one of the highest volume programs in New York State, the Division of Pediatric Cardiology has a long reputation of providing exceptional cardiovascular care throughout the region.

We offer a competitive salary and benefits package. In addition, an academic appointment with The Donald and Barbara Zucker School of Medicine at Hofstra/Northwell is commensurate with credentials and experience. Physicians will be employed as members of Northwell Physician Partners, the seventh largest medical group in the country.

For further details and opportunities, please contact:

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EOE M/F/D/V



Where and who is to perform lead extractions for anatomically complex cases need to be determined. Both the Heart Rhythm Society (HRS) and European Heart Rhythm Association (EHRA) suggest that competency is conferred with the performance of at least 30-40 lead extractions as the primary operator, requiring 20 lead extractions annually to maintain competency.^{10,11} Large adult referral centers perform an average of 9-16 cases (17-29 leads) per month^{12,13} compared to pediatric and adult centers that perform approximately 0.2-1 case (0.3-2.4 leads)/month, albeit with an anticipated volume increase due to an aging ACHD population. Though lead dwell time is similar (~6-7 years), CHD centers treat cases with more complex anatomy, including 23% who had undergone atrial switch operations for d-transposition of the great arteries.⁴⁻⁷ These differences in volume and anatomic complexity make it challenging to train extraction experts to care for Congenital Heart Disease patients.

Since the launch of our dedicated pediatric and congenital lead extraction program, we have identified strategies to assist with complex CHD (Table 2):

TABLE 2 Strategies to Assist with CHD Extraction and Lessons Learned

	Recommendation	Comments
Pre-procedural		
Strategy	Aggressive lead management to remove dysfunctional leads and infected hardware	Institutional commitment to achieve this (e.g., equipment, staffing, operating room schedule, and surgical backup availability)
Case review	Multidisciplinary discussion between electrophysiologist, surgeon, and anesthesiologist	Review of prior imaging and past chest operations can assist with setup, access, approach, and surgical rescue planning
Protocols and simulation	Preparation for possible complications	Given rarity of emergencies, established routines and simulated practice may reduce mortality
Intraoperative		
Anesthesia	General anesthesia for all cases	Reduces patient movement and discomfort in anticipation of prolonged procedures and optimizes hemodynamics
Access	Arterial access obtained in all cases Venous access obtained in all cases	Real time blood pressure monitoring in case of emergency Immediate availability for percutaneous cannulation and rapid infusion of volume or blood products if superior vena cava (SVC) flow is obstructed when the tamponade balloon is deployed
Tamponade balloon	Access with stiff guidewire across SVC and innominate veins and 12F peelaway sheath	Tamponade balloon equipment prepped and readily available for immediate use
Imaging	Real-time intracardiac or transesophageal echocardiogram	Immediate detection of pericardial effusion and intraoperative assessment of leads. ICE may be beneficial in evaluating prosthetic valve function (difficult to image prosthetic pulmonary valves with TEE in cases of endocarditis). ^{14,15} TEE requires a separate echocardiographer for interpretation.
Pacing	Backup transvenous and transcatheter pacing (in case of dislodgement) should be tested before extraction, if needed	Heart block without adequate escape rate may require additional venous access
Case differences		
High percentage of atrial switch operations	Majority of extractions in Mustard and Senning patients require concurrent baffle interventions	Coordination with congenital interventional cardiologist to optimize procedural yield
Lead dysfunction rather than infection	More aggressive attempts to salvage functional leads to limit collateral damage	Familiarity with techniques and potential complications may result in improved salvaging of functional leads
More snare techniques utilized	Longer lead dwell time and patient youth (<40 years of age) are associated with more challenging extractions ¹⁶	Familiarity with femoral snare techniques and steerable sheaths can assist with challenging cases. Minority of cases are successful with manual traction alone (readiness to escalate to advanced methods and powered sheaths).
Complications	Anatomic concerns, cumulative instrumentation (e.g., number of generator changes over a lifetime), infection risk, and anticoagulation	Outcome Transparency and measurement of key metrics; Regular Data review to promote quality initiatives and improve outcomes

Conclusion

Lead extraction can be performed successfully in CHD with comparable results as non-CHD patients. However, differences exist between most adult institutions and those that care for patients with CHD. Additional training and experience are necessary for anatomically complex

and challenging cases. Multi-disciplinary collaboration with focused attention on the nuances related to CHD is critical to ensure procedural success and safety.

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**Joe DiMaggio Children's Hospital**

Join a Leading Children's Hospital in South Florida

**Pediatric Cardiac Imaging Physician Career Opportunity**

Joe DiMaggio Children's Hospital, located in South Florida, is recruiting for a board certified pediatric cardiologist with specialty training and experience in advanced cardiovascular imaging for pediatric and congenital heart disease. Primary responsibilities will be for children and adults with congenital heart disease in need of cardiac imaging, including transthoracic and transesophageal echocardiography as well as cardiac magnetic resonance imaging. Additional responsibilities will include related outpatient clinic evaluations, sharing inpatient night and weekend call and occasional coverage of the inpatient service. Candidate will participate in research opportunities with supportive resources.

Cardiac imaging volume has been steadily increasing specifically for CMR cases. Currently there are four available Siemens 1.5T scanners with state of the art clinical and research sequences, including 4D flow, turbo flash first pass perfusion with perfusion quantification post-processing capabilities, myomaps (T1, T2 and ECV analysis) and many others. The candidate must hold a cardiac MRI level II or III certification by the Society of Cardiovascular Magnetic Resonance.

The CMR Stress Perfusion Program at Joe DiMaggio Children's Hospital is the only one available in the region and has grown in the last couple of years. In our Heart Transplant Program, CMR has also become one of the non-invasive imaging modality of choice for patients with suspected allograft rejection and or coronary vasculopathy.

Our echo lab is equipped with state of the art GE E95 machines for transthoracic and transesophageal echocardiography and Voluson E10 for fetal echocardiography. Echo images are manipulated in raw data using ViewPoint (ECHOPAC) software for post-processing.

This is a full-time employed position with the multispecialty Memorial Physician Group. The position offers competitive benefits and a compensation package that is commensurate with training and experience. Professional malpractice and medical liability are covered under sovereign immunity.

About Joe DiMaggio Children's Hospital

Joe DiMaggio Children's Hospital (JDCH) is a 226-bed free-standing children's hospital located in Hollywood, Broward County, Florida. As one of six hospitals in one of the largest public health systems in the country, Memorial Healthcare System, JDCH delivers nearly 14,000 babies per year and has 132 Neonatal Intensive Care Unit beds in three of its hospitals. Memorial also has three pediatric emergency departments.

JDCH has robust high-risk and congenital programs including a US News and World Report ranked pediatric Cardiology and Heart Surgery Program, one of only two in the state who do heart transplants. JDCH's Orthopedic and Sports Medicine program is ranked by US News as number one in Florida and is one of the largest programs in the southeastern United States.

JDCH serves over 375,000 children per year and our services continue to grow with our new specialty center/ambulatory surgery center in Palm Beach County. JDCH combines leading-edge clinical excellence with a child- and family-friendly environment that emphasizes the Power of Play. JDCH offers a comprehensive range of healthcare services – delivered with kindness, dedication and compassion.

About South Florida

South Florida offers a dynamic urban/suburban lifestyle with an abundance of cultural and recreational amenities, miles of beautiful beaches, top-rated golf courses, zoos and wildlife refuges, a vibrant arts community, museums and world-class dining. South Florida's high quality of life – including year-round summer weather, exciting multiculturalism and no state income tax – attracts new residents from all over the country and around the world.

To submit your CV for consideration, please visit memorialphysician.com. Additional information about Joe DiMaggio Children's Hospital can be found at jdch.com.

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**Nicklaus
Children's
Hospital****Heart Institute**

Outstanding Opportunity for Director of Adult Congenital Heart Disease in Miami

Nicklaus Children's Hospital, a 309-bed freestanding children's hospital, and Nicklaus Children's Pediatric Specialists, the physician multispecialty group practice of Nicklaus Children's Health System, have an exceptional opportunity for an adult congenital heart disease specialist to direct the Adult Congenital Heart Disease (ACHD) Program.

The Nicklaus Children's Hospital Heart Institute is a world leader in cardiology and cardiovascular surgery for the care of patients with congenital heart disease. Nicklaus Children's Hospital is expanding its services to the growing number of adult congenital heart disease patients in partnership with top-ranked adult specialists in the region. Interested candidates for the ACHD directorship should have completed a residency in either pediatrics, internal medicine or a combined med/peds program, followed by a three-year fellowship in either pediatric or adult cardiology. Either completion of a two- year ACGME accredited ACHD fellowship or a career demonstrating clinical and academic leadership in the field of ACHD is required. The candidate should be board certified in ACHD.

Nicklaus Children's Hospital is an affiliate of the Florida International University Herbert Wertheim College of Medicine. Our state-of-the-art Advanced Care Pavilion houses a 34-bed cardiac in-patient unit with an adjustable acuity model that allows all rooms to accommodate critically ill patients with heart disease. The Heart Institute offers a full range of services, including the management of patients following congenital heart surgery, interventional catheterization and invasive electrophysiology. Our cardiac surgical program, led by Dr. Redmond Burke, is one of the most transparent in the world. It remains the only cardiovascular surgical program to offer real-time outcomes reporting <https://rto.nicklauschildrens.org>.

Competitive compensation and benefits package.

Qualified candidates please contact:**Lourdes Prieto, MD**

Interim Chief, Cardiology

Lourdes.Prieto@nicklaushealth.org**Joyce Berger**

Physician Recruiter

Joyce.Berger@nicklaushealth.org
786.624.3510**NicklausChildrens.org/NCPS**

DFW



AUGUST

27-30

ESC Congress 2021 – The Digital Experience

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<https://www.escardio.org/Congresses-&-Events/ESC-Congress>

30-31

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Kimberly_ray@chdinterventions.org

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01-04

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<https://picsymposium.com/>

23-24

EPIC Live – Emory Practical Intervention Course

Virtual

<https://www.epicsec.org/>

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01-03

Echo in Congenital Heart Disease: Adult and Pediatric Cases, Including Multimodality Imaging

Rochester, MN, USA

<https://cveducation.mayo.edu/store/echo-in-congenital-heart-disease-adult-and-pediatric-cases-including-multimodality-imaging>

07-09

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Pediatric Heart Failure / Transplant Cardiologist

Overview

Children's Minnesota is seeking a dynamic, fellowship-trained pediatric heart transplant cardiologist to lead the Heart Failure Heart transplant (HFHT) program. This physician would have the benefit of collaborating with a comprehensive multidisciplinary team that includes: surgeons, cardiologists, transplant coordinators, dietitians, pharmacists, therapists and social workers. The HFHT program also offers a growing Ventricular Assist Device program as well as a well-established ECMO program.

Our Transplant program partners closely with The Children's Heart Clinic (CHC). Annually, the CHC cardiologists see more than 16,000 patients and surgeons perform over 400 surgical interventions. The CHC's state-of-the-art facilities include a dedicated pediatric cardiovascular intensive care unit, one of 30 approved pediatric cardiac catheterization laboratories in North America for transcatheter pulmonary valve placement, a complete pediatric arrhythmia service including the latest technology for ablation and devices, a collaborative fetal program for diagnosing and managing congenital heart disease in-utero, a collaborative adult congenital cardiology program, an ICAEL-accredited echocardiography lab and a rapidly growing congenital cardiac MRI/CT program.

Program Description

Children's Minnesota's cardiovascular program provides comprehensive pediatric cardiovascular services and on average, we annually perform:

- 425+ cardiac surgeries
- 400+ cath procedures
- 12,000 + echos (1,200+ fetal)
- 370+ cardiac CT/MRIs

Children's Minnesota and Mayo Clinic Children's Center collaborate in the care of children with congenital heart disease and build on each organization's passion for children as well as the complementary strengths of both programs. The Mayo Clinic – Children's Minnesota Cardiovascular Collaborative is one of the largest and strongest pediatric cardiovascular collaborations in the country.

This exciting opportunity is open for a pediatric cardiologist with heart failure heart transplant experience to lead our recognized program. Candidates should have a strong commitment to patient care, teaching and clinical research.

Requirements of the position include:

- Board Certified in Pediatric Cardiology from the American Board of Pediatrics
- Advanced Heart Failure/Transplant fellowship training in a program certified by the American Board of Pediatrics.
- Physicians should have clinical competency and expertise in caring for patients who are candidates for or are recipients of advanced heart failure therapies including mechanical circulatory devices.
- Must have an M.D., D.O. or equivalent degree from another country with a current Minnesota Medical License or the ability to obtain one.
- Ability to be successfully credentialed by both Hospital and 3rd Party Payers

Children's Minnesota

Children's Minnesota is the seventh largest pediatric health system in the United States and the only health system in Minnesota to provide care exclusively to children, from before birth through young adulthood. An independent and not-for-profit system since 1924, Children's Minnesota serves kids throughout the Upper Midwest at two free-standing hospitals, 12 primary and specialty care clinics and six rehabilitation sites. Additionally, Children's Minnesota is Minnesota's only Level I pediatric trauma center inside a hospital dedicated solely to children. Children's Minnesota maintains its longstanding commitment to the community to improve children's health by providing high-quality, family-centered pediatric services and advancing those efforts through research and education

Minneapolis - St. Paul (Twin Cities)

The Twin Cities has an estimated population of 3.5 million making it the 13th most populous metropolitan area in the US. The Twin Cities are known for their extraordinary quality of life, thriving economy, outstanding educational system and vibrant cultural amenities. The large numbers of colleges and universities, as well as the strong economy account for the high per-capita attendance at theatrical, musical and comedy events making the Twin Cities the capitol for arts in the upper Midwest. There are numerous lakes in the region and cities in the area have expansive park systems for recreation. Major sports teams include the Minnesota Twins (MLB), Vikings (NFL), Timberwolves (NBA), Wild (NHL) and the University of Minnesota (Big 10).

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