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

North American Edition
Vol. 21 - Issue 6

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How I Do It: Tips, Tricks and Techniques – Radial Artery Access

A PICS Society Education Series

Weiyi Tan, MD, MPH & Jamil Aboulhosn, MD

An Introduction to PICS "Tips and Tricks"

Need a quick and handy review of a novel technique or rare intervention? Want to know how leaders in pediatric and congenital cardiac interventions would approach the case?

The new PICS "Tips & Tricks" section provides congenital interventional cardiologists with nuanced techniques from experienced leaders in the field. These high yield articles highlight their approaches to these challenges, with particular attention paid to practical aspects of procedural techniques, challenges, and potential pitfalls.

Each topic is authored by a key opinion leader with specific procedural expertise and written in an accessible and succinct format with illustrative case examples and suggested references to make this an impactful educational platform.

In this issue of CCT, we present Dr. Tan's and Dr. Aboulhosn's approach to radial access. This duo has significant experience with complex radial access techniques that we are confident readers will appreciate, given the increase in teen and adult congenital case volumes.

We hope you enjoy this issue. We are confident PICS Society members of all experience levels will find this series to be educational and insightful. For the full list of available articles, which will be updated monthly, please visit https://www.picsymposium.com/tips_and_tricks.html.

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Radial Artery Access

Introduction

Radial artery access can be an attractive form of alternative arterial access for cardiac catheterization, as it leads to reduced time for bed rest and a lower incidence of access site complications, such as bleeding, pseudoaneurysm, and arteriovenous fistula. In adults with acute coronary syndrome, radial access has been shown to improve mortality in patients undergoing cardiac catheterization with ST-elevation myocardial infarction, mainly driven by reduced bleeding.[1] In patients with congenital heart disease, radial artery access can also be attractive as many patients have femoral arterial occlusions or stenoses from prior procedures.

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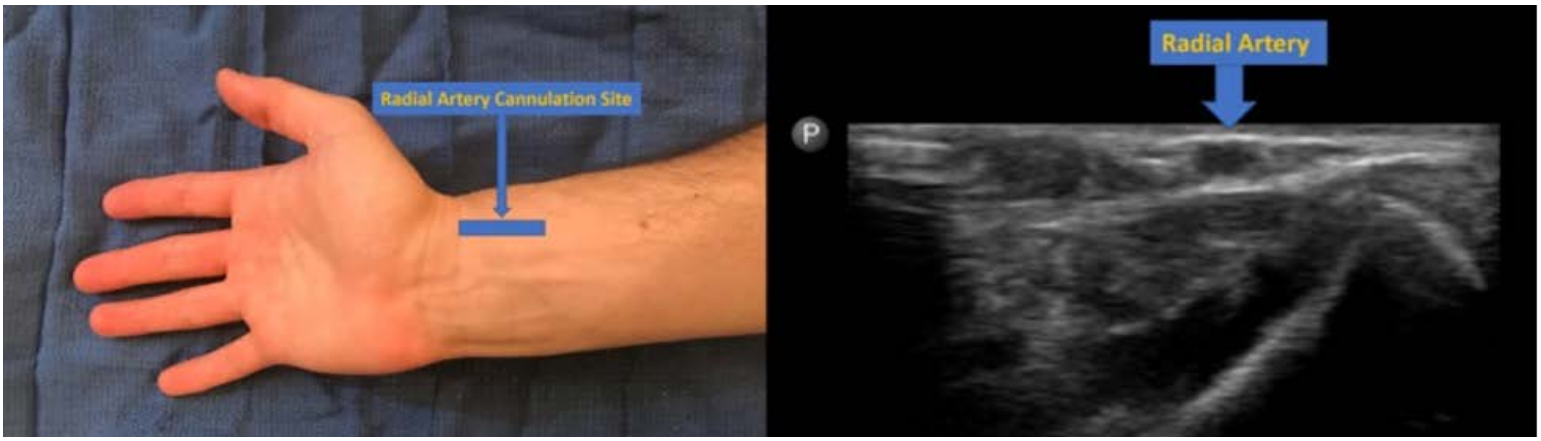

FIGURE 1 Radial Artery Cannulation Site and Ultrasound Image
Radial artery cannulation site and image of radial artery on ultrasound at this level. Contributed by Joshua Solano, MD (Wallace MW, Solano JJ. Radial Artery Cannulation. [Updated 2021 Jul 21]. In: StatPearls [Internet])

Anticipated Challenges of the Procedure

Challenges include confirming that the radial artery is an appropriate size, anatomical variation in radial artery anatomy that can preclude radial artery access, and radial artery vasospasm.

Tip 1 – Planning and Preparation

1. Patient Positioning and Setup: Try to use dedicated radial boards to position the hand/arm. Most adult cardiac catheterization labs carry arm boards for this purpose. Adjust the table so you can perform fluoroscopy of the wrist/arm during access.
2. Imaging: Review old imaging and notes. Did the patient have a prior classic BTT shunt that precludes radial artery access on that side? Does the patient have a CT angiogram that includes the subclavian arteries that shows significant tortuosity? Has radial access been attempted in the past with success?
3. Choice of Radial Artery: Traditionally, the right radial artery is chosen as a convenience to the operator, but consider left radial artery access in patients with history of bypass grafts, tortuous vascular anatomy, or right radial artery occlusions. Make sure the radial artery is an adequate size for cannulation (at least 2 mm in diameter).
4. Relative Contraindications: Vaso-occlusive disease (Raynaud disease, scleroderma), upper extremity vascular disease (subclavian artery stenosis, AV fistula for dialysis).

FIGURE 2 Terumo Slender Glidesheath for Radial Artery Access
This is a 6Fr Slender Glidesheath (Terumo Interventional Systems, Somerset, NJ). It has a 2.44 mm outer diameter compared to a regular 6Fr sheath with an outer diameter of 2.63 mm. It has a thin wall that allows for a better sheath to radial artery diameter ratio, which reduces spasm and radial artery occlusion, but it does make the sheath easier to kink.

Tip 2 – Tools Needed

1. Micropuncture Needle and Wire: There are two kinds of access kits, for an anterior wall stick or for the two-wall method.
2. Sheaths: The smaller the better. Terumo Slender Glidesheaths **(Figure 2)** are great for this purpose. A 5Fr Slender has an outer diameter of 2.14 mm, while a 6Fr Slender has an outer diameter of 2.44 mm.
3. Medicines: To prevent vasospasm of the artery. Many different cocktails exist, but I like to give a combination of heparin, nitroglycerin, and verapamil.
4. Catheters: Standard coronary catheters (Judkins left and right) are acceptable, but catheters specifically made for radial access include the Tiger and Jacky catheters. These allow for selective engagement of both coronary arteries with one catheter.
5. Imaging Devices: Ultrasound machine for access. While radial artery access can be successful without ultrasound guidance, studies have demonstrated that ultrasound guidance improves the success and efficiency of radial artery canulation.[2]
6. Closure: Radial artery compression device. Use of a compression band, such as the TR Band (Terumo), allows for patent hemostasis and reduces the rate of radial artery occlusion after catheterization.

Tip 3 – How I Do It

1. Palpate the Radial Artery. Use ultrasound to identify the artery and its course if unable to confidently palpate the artery. Although assessment of the RA pulse is important, performing an Allen or Barbeau test to confirm the patency of dual arterial circulation to the hand and intact palmar arch system is only of historical interest. Recent studies of patients with normal and abnormal preprocedural Allen test who subsequently underwent radial access did not demonstrate differences in thumb capillary lactate, grip strength, or incidence of ischemia between the two groups.[1]
2. Prep and Drape. Use a dedicated arm board. Sterilize a wide area and drape the area from the styloid process of the radius to about 4-5 cm proximally on the forearm. Adjust the table so the arm can be imaged if necessary.
3. Numb the area of entry with subcutaneous lidocaine. Be careful not to hit the vessel wall as this can cause spasm.
4. Puncture the skin 1-2 cm proximal to the radial styloid.[3] Entering the radial artery over the bone can be painful for the patient **(Figure 1)**.

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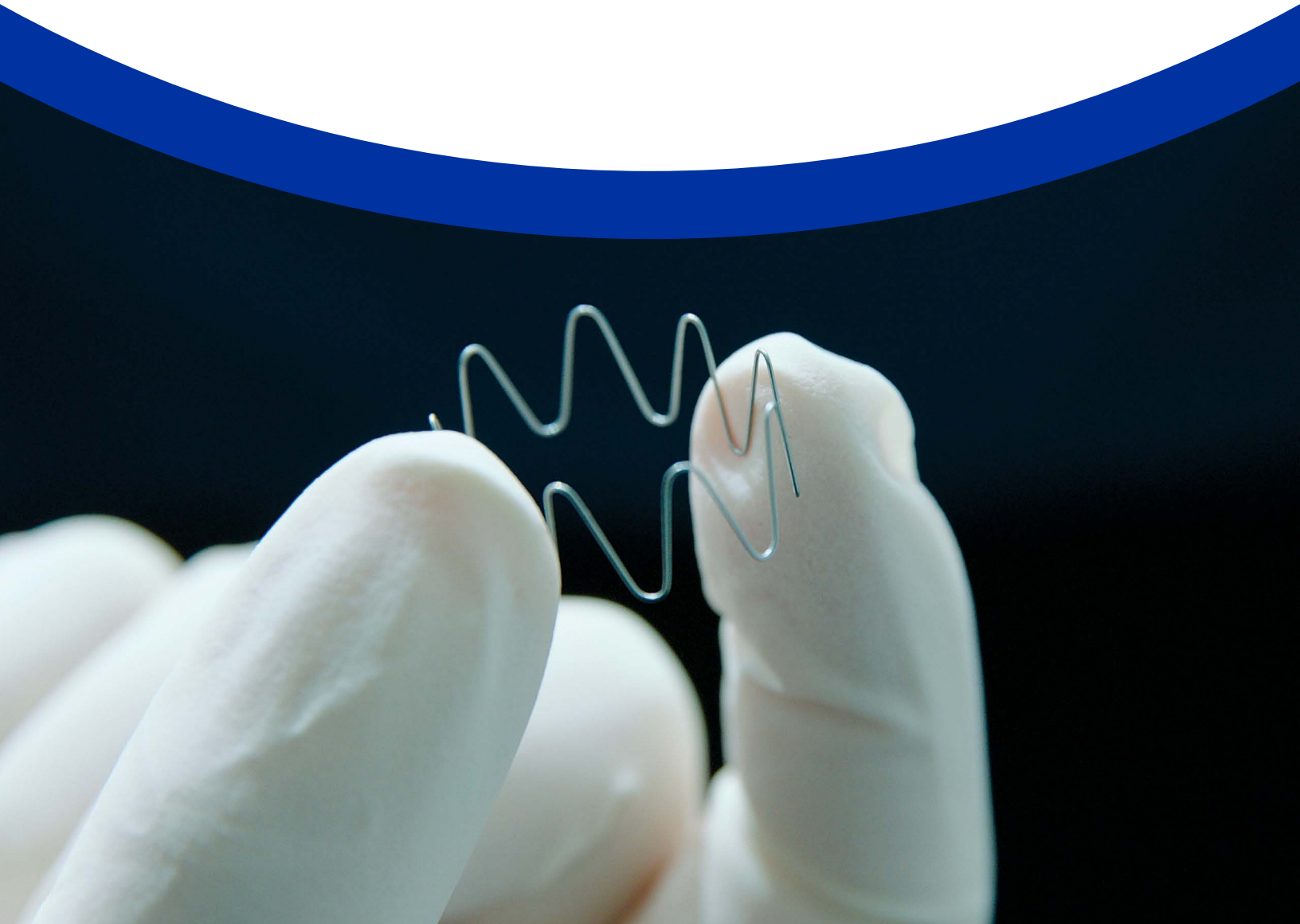

Indications
The Harmony™ transcatheter pulmonary valve (TPV) system is indicated for use in the management of pediatric and adult patients with severe pulmonary regurgitation (i.e., severe pulmonary regurgitation as determined by echocardiography and/or pulmonary regurgitant fraction ≥ 30% as determined by cardiac magnetic resonance imaging) who have a native or surgically-repaired right ventricular outflow tract and are clinically indicated for surgical pulmonary valve replacement.

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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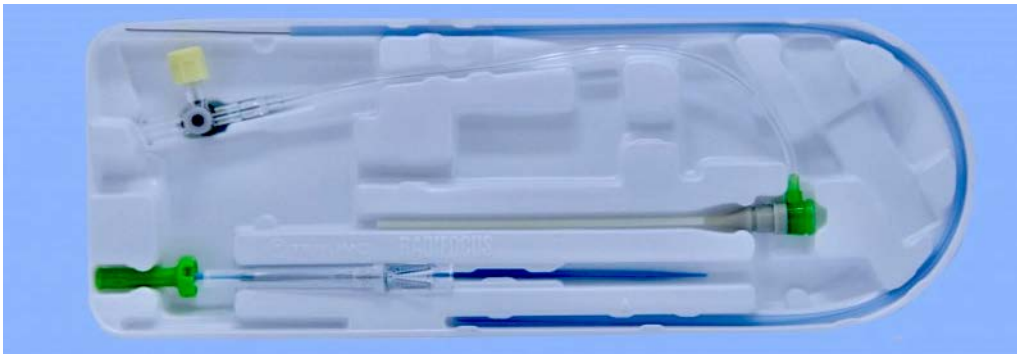

FIGURE 3 Radial Artery Access Kit
Radial artery access kit, with micropuncture needle, wire, and sheath/dilator.

5. If using the anterior-wall stick method, use a 4Fr micropuncture needle that is 2-3 cm in length (usually comes in the kit) at a 45-degree angle to the skin and advance the needle firmly and slowly until the front wall of the artery is punctured. I use ultrasound to guide my access. Tenting of the anterior vessel wall is usually visualized, and then the operator may feel a "pop" and see the anterior wall "bounce" as gentle pressure is applied with the needle to enter the vessel lumen. Confirm that the needle is in the middle of the lumen, visualize pulsatile blood flow from the needle, and then advance the wire. One may have to lower the angle of the needle by a few degrees to facilitate wire entry into the vessel.[4] If using the two-wall method, use a 20-gauge Angiocath needle system to puncture the anterior wall. Once a flash of arterial blood is seen in the barrel of the Angiocath, then advance the entire system until the back-wall is punctured and the bleed-back stops. Remove the needle and slowly withdraw the plastic catheter until brisk, pulsatile blood flow is obtained, confirming that the catheter is in the arterial lumen. The guidewire can then be advanced through the Angiocath.
6. Use a 0.018-0.021-inch micropuncture wire **(Figure 3)** with a floppy tip to access the radial artery. Do not advance the wire if there is resistance, as this could signify the wire is in a small branch or is subintimal. Fluoroscopy of the wire tracking up the artery and past the elbow may be necessary in patients with tortuous radial arteries or radial artery loops.
7. Remove the needle and then advance a sheath over the wire. A skin nick should not be necessary as radial artery sheaths are gently tapered and designed to have minimal transition between the sheath and dilator.
8. Remove the dilator, aspirate the sheath, and flush the sheath with an anti-spasmodic "cocktail."[1,4] I like to use a combination of heparin (2000-5000 units depending on body weight, 50 units/kg), nitroglycerin (100-200 ug), and verapamil (2.5 mg). Dilute the mixture with 10-20mL of blood, as the mixture is acidic and can cause a burning sensation during infusion if injected too quickly. Flush the sheath with heparinized saline.
9. Secure the sheath with a transparent adhesive dressing.
10. At the end of the case, aspirate and flush the sheath one more time and then remove the sheath after placing a hemostasis device. I use an external compression device to maintain patent hemostasis, such as a TR band (Terumo Interventional Systems, Somerset, NJ), **(Figure 4)**. Confirm patent hemostasis by using a pulse oximetry device placed on the ipsilateral thumb or index finger and document a normal waveform.
11. Excellent video example of radial artery access by Dr. Emmanouil Brilakis.[5] (https://www.youtube.com/watch?v=zQCx7wQSe-Q)

Tip 4 – What Complications to Expect and How to Deal with Them

- Radial artery spasm: Make sure the patient is comfortable. Use topical lidocaine. Use of moderate sedation or general anesthesia leads to a reduction of radial artery spasm as well. Use of spasmolytic agents (nitroglycerin, verapamil) at the beginning of the case and between catheter exchanges is helpful. Anticoagulation with heparin also prevents radial artery occlusion.

FIGURE 4 Radial Artery Compression Device
The TR Band (Terumo Interventional Systems, Somerset, NJ) is a radial artery compression device designed to assist in selective hemostasis of the radial artery after a cardiac catheterization by providing enough pressure to maintain patent hemostasis, which prevents the risk of radial artery occlusion.

- Hypotension: In patients with severe aortic stenosis, left ventricular dysfunction, or cardiogenic shock, be careful in administering spasmolytic agents, as they may reduce preload significantly.

- Radial, Brachial, Aorto-subclavian Artery Tortuosity: There may be significant tortuosity that makes entering the aorta difficult. Use of a 0.035-inch 1.5 mm-radius J-tip wire or 0.035-inch hydrophilic wire may help. In short patients with a short aortic root, having the patient take a deep breath "lengthens" the aorta and may make advancing the wire and catheter into the ascending aorta easier. A stiff exchange-length wire can be used to also straighten tortuous arteries when performing catheter exchanges. Use balloon-assisted tracking (a slightly inflated coronary balloon) or catheter-assisted (smaller French multipurpose or pigtail catheter) tracking if there is resistance with advancing guide catheters through the artery over the wire.[1] Do not be afraid to convert to femoral access. Significant tortuosity may make catheter manipulation difficult, and extended catheter manipulation may lead to arterial vasospasm.

- Radial artery occlusion: It can occur in 3-5% of radial artery catheterizations. Use an external compression device to maintain patent hemostasis. Ipsilateral ulnar artery compression after the procedure can also reduce rates of radial artery occlusion. Fifty percent of radial artery occlusions recanalize in one to three months.[1]

- Radial artery avulsion: Do not remove the sheath when there is severe

spasm. Use of more spasmolytics and deepening of anesthesia may be helpful.

- Radial artery hematoma: This is a rare complication, but if it occurs, adjust or reposition the external compression band to a more proximal location. It may be necessary to place a second band more proximal to the first one. If the hematoma is very large, use an inflated blood pressure cuff to provide hemostasis.

Summary

The radial artery is an attractive location for alternative arterial access. When performed in the appropriate patient, radial artery access can lead to improved patient comfort due to reduced bed rest time as well as improved patient safety outcomes due to fewer bleeding complications. In patients with congenital heart disease, radial artery access may also be the only form of arterial access in those with a history of previous cardiac surgery or cardiac catheterizations leading to femoral artery occlusion.

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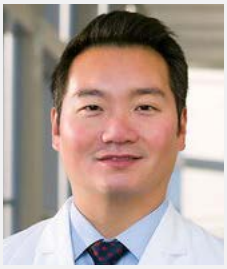

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Pediatric Cardiologist Faculty Position

UC Davis Children's Hospital, School of Medicine, Department of Pediatrics Cardiology

The Department of Pediatrics at the University of California, Davis School of Medicine is recruiting a full-time Pediatric Cardiologist. We are recruiting at the Assistant, Associate, or Full Professor ranks in the Clinical Pediatrics or Health Sciences Clinical Series in the Division of Pediatric Cardiology.

The candidate's primary clinical duties include: 1) general outpatient pediatric cardiology in our local clinics as well as our outreach clinics, 2) in-patient consult service, 3) supervise and interpret pediatric electrocardiograms and transthoracic, transesophageal, and fetal echocardiograms. Required skillsets include ability to perform and interpret transesophageal and fetal echocardiograms. It is expected that the candidate will share in the on-call and weekend/holiday coverage schedule.

In addition to the clinical responsibilities, the ideal candidate will be expected to participate in teaching of medical students, residents and fellows, research activities of the Department of Pediatrics, and serve on departmental committees. A background and/or interest in research or quality improvement is preferred.

Candidates must have the following experience/qualifications:

- M.D. or D.O.
- Successful completion of an approved pediatric residency training program
- Successful completion of an approved Pediatric Cardiology fellowship training program at this hire
- Board certification/eligibility in Pediatric Cardiology
- Eligibility for a California Medical License
- Ability to foster collegiality and work collaboratively in a diverse environment
- An additional year of advanced pediatric echocardiography training is preferred

The Pediatric Heart Center at UC Davis Children's Hospital is inland Northern California's only full-service facility for children and young adults with congenital and acquired heart disease offering the most advanced testing and treatments for a range of congenital or acquired cardiovascular conditions. Our integrated multidisciplinary team of 2 CHD surgeons, 9 Pediatric Cardiologists and 6 Nurse Practitioners/PAs along with other pediatric subspecialists and researchers offer Northern California's most sophisticated and specialized expertise in cardiac imaging, diagnostic, interventional, hybrid procedures and cardiac surgery. Other specialized cardiac services of the Program include echocardiography (including fetal, transesophageal, IVUS, and intracardiac), exercise stress testing, electrophysiology testing, radiofrequency and cryoablation and pacemaker services. The CHD program also has an advanced interventional/hybrid fellowship. Other advanced subspecialty cardiac clinics offered include cardiomyopathy and heart failure, pulmonary hypertension, adult congenital heart disease, and interstage for single ventricle infants. To provide more flexibility, accessibility, and timely care for pediatric cardiology patients, the Pediatric Heart Center treats patients in both Sacramento and throughout Northern California at various outreach sites.

Completed applications include CV, Cover Letter, Statement of Teaching, Statement of Contributions to Diversity, Equity, and Inclusion and contact information for 3-5 references. Candidates should submit their application online at: https://recruit.ucdavis.edu/apply/JPF05614.

The salary range for this position is $235,628 - $396,166. This position includes membership in the **Health Sciences Compensation Plan**.

With more than 120 physicians in 33 pediatric subspecialties, the Children's Hospital is a 121- bed hospital housed within the 619-bed University of California, Davis Medical Center. It is the only designated Children's Hospital in the Sacramento region, and is known for offering comprehensive, compassionate, family-centered care. UC Davis Children's Hospital is distinguished for its outstanding congenital heart program and its internationally recognized telemedicine programs. UC Davis Children's Hospital has a 49-bed level 4 Neonatal Intensive Care Unit and a new 24-bed Pediatric Intensive Care Unit/Pediatric Cardiac Intensive Care Unit. UC Davis Medical Center is a Baby-Friendly designated birth center.

The UC Davis Children's Hospital is based on the UC Davis Health campus in Sacramento, California and serves a population of over 1 million children in the Northern California, Central Valley and Western Nevada regions. Sacramento is an easily accessible, family-oriented city in close proximity to the San Francisco Bay area, Lake Tahoe and the Sierra Nevada Mountains, the California coast, and Napa Valley.

UC Davis commits to inclusion excellence by advancing equity, diversity and inclusion in all that we do. We are an Affirmative Action/Equal Opportunity employer, and particularly encourage applications from members of historically underrepresented racial/ethnic groups, women, individuals with disabilities, veterans, LGBTQ community members, and others who demonstrate the ability to help us achieve our vision of a diverse and inclusive community. For the complete University of California nondiscrimination and affirmative action policy see: **http://policy.ucop.edu/doc/4000376/NondiscrimAffirmAct**. If you need accommodation due to a disability, please contact the recruiting department.

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Highlights from PDA Stenting in Cyanotic Newborns: Comprehensive Management Strategies from Fetus to Toddler – First Annual PDA Stenting Symposium

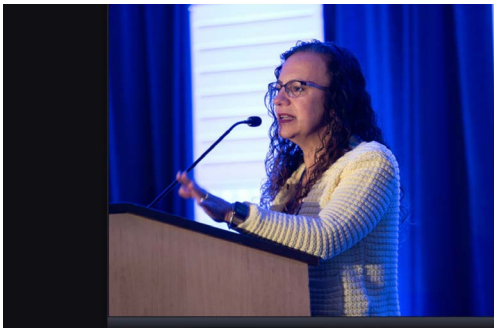
Howaida El Said, MD, PhD & Brent Gordon, MD

The inaugural "PDA Stenting in Cyanotic Newborns: Comprehensive Management Strategies from Fetus to Toddler" Conference took place April 20th – 22nd, 2023, at the Loews Coronado Bay Resort in San Diego, California. The meeting was a tremendous success and hosted over 375 registrants from around the world who gathered in person and on zoom to participate in a discussion of this unique and critically important topic. Esteemed faculty from across the country were represented from neonatology, cardiology, intensive care, cardiothoracic surgery, hematology, neurology, bioengineering, and developmental pediatrics. Participants were challenged to discover how to not only enable these critically ill infants to survive, but to help them thrive after PDA stenting, as well.

The meeting kicked off with a welcome from course director Howaida El Said, MD, PhD, before reviewing fetal imaging, prenatal counseling, and how a fetal coordinator functions as the "quarterback" of the cyanotic newborn team. Dr. Amir Ashrafi from Children's Hospital Orange County discussed optimal pre-procedural feeding strategies and the dangers of mechanical ventilation before Dr. Terri Inder (also from CHOC) gave an outstanding lecture on the complex interplay of prenatal brain development and anesthesia. She encouraged us to talk to our patients every time we examine them and how the human voice and music is critical for the developing brain. Dr. Ganga Krishnamurthy from Columbia New York Presbyterian highlighted the contribution of prematurity and weight to mortality in congenital heart disease patients. She encouraged an individualized approach for each patient and suggested that prematurity is likely more important than weight. The first evening came to a close as the attendees were treated to an amazing sunset during the welcome reception.

The second day of the conference was jam-packed and focused on the peri-procedural aspects of PDA stenting. The session started with demonstrations of echocardiography and CT angiography and their role in planning PDA stenting. Dr. Timothy Slesnick from Children's Hospital of Atlanta revealed how all CT scans at CHOA are performed without sedation or heart rate control and how this information helps to predict PDA stent length. Dr. Kanwal Farooqi (also from Columbia) showed a virtual reality PDA stent implant and the session closed with a spirited debate between Justin Ryan PhD and Frank Ing, MD on whether a pre-procedural CT should be required for all patients undergoing PDA stenting. Dr. Ing did a virtual "break-in" to Justin's house to show 3D images on his walls while Justin demonstrated a live 3D segmentation and PDA stent planning case.

The interventional cardiologists then took to the stage and discussed the ins and outs of the stenting procedure. Dr. John Moore started the session by reviewing the history of PDA stenting and how his early work on lambs was eventually translated to the first attempt at PDA stenting in a patient by Dr.



Gibbs. We were honored by an in person visit from Dr. Alwi Mazeni from Malasia who shared his personal experiences in stenting symptomatic cyanotic newborns and how his pioneering work really opened the eyes of the rest of world to this important intervention. Attendees were then treated to talks on: stenting in dual versus single source pulmonary blood flow, how to manage ductal tortuosity, equipment and team considerations, if jailing pulmonary arteries was a good idea (it turns out it is), and what cardiac anesthesiologists really think of PDA stenting, especially when the baby is flipped! Additional talks included umbilical arterial and transvenous approaches for PDA stenting, and Dr. Dietmar Schranz joined us in person to highlight how PDA stenting in Germany has evolved over the past two decades. The crowd got to enjoy a stunning ocean view as they enjoyed lunch and were entertained by a few taped cases of challenging PDA stents. The afternoon kicked off with a talk on how a bioengineer thinks about a PDA stent and Dr. Lynn Peng from Stanford showed us animal work on the prototype of a custom-made PDA stent from Starlight Cardiovascular. We then learned the top 10 ways to avoid complications from Dr. Ing, and Dr. David Balzer imparted some of his hard-earned wisdom from doing this procedure for many years. Finally, we received an update on the COMPASS trial from one of the trial PIs, Jeffrey Zampi, MD, and how the information gathered from this trial will be so important for our community in many ways. The session ended with a debate on whether or not prostaglandin should be discontinued before bringing the patient to the catheterization laboratory for a planned PDA stent.

After packing all of that information into a single day we were running behind, but the intensivists got us back on track as they always do! The last session of the day focused on how to take care of these fragile patients after a successful PDA stent. Artificial intelligence is now routinely used to predict trends in patients and alert practitioners to intervene before things get too far off track. Pulse ox and renal NIRS are utilized to predict oxygen delivery to the tissues and used to manipulate systemic and pulmonary resistance in the post-procedural period. Nutrition, specifically the importance of breastmilk, and the role and route of feeding, including timing after the procedure, was highlighted. Dr. John Kim from Colorado Children's Hospital discussed the use of bivalirudin to transition patients to dual anti-coagulation after ductal stenting. Finally, we heard about the PC4 outcomes for PDA stenting versus BTT shunts. After another amazing sunset, the attendees were treated to parent corner, where a family whose child had previously undergone a PDA stent, was interviewed and shared their experiences and provided suggestions for care providers. Their beautiful daughter humbled and reminded everyone why we work so hard to take care of these patients.

The last day kicked off with an in-depth discussion of the home monitoring program, including how to use MyChart to track patient progress and neurodevelopmental outcomes after PDA stenting. Early intervention remains a key factor and many of the families face a significant amount of stress in the interstage period. While not statistically significant, babies with PDA stents tended to have better gross motor skills and less need for G-tubes as compared to those who received BTT shunts. Stent imaging and reintervention was touched on as well as a review of current literature on outcomes for PDA stenting versus BTT shunts. Dr. Andrew Glatz from St. Louis Children's Hospital and Dr. John Nigro from Rady Children's Hospital debated early primary repair of Tetralogy of Fallot versus PDA stenting, with Dr. Nigro pointing out that many of the patients who travel great distances or face significant challenges in access to care may do better with a primary repair.

CAREER OPPORTUNITY

Children's Hospital LOS ANGELES
DIVISION OF CARDIOLOGY

USC University of Southern California

Director of Echocardiography / Associate or Full Professor of Clinical Pediatrics

The Keck School of Medicine (KSOM) of the University of Southern California (USC) and Children's Hospital Los Angeles (CHLA) in the Department of Pediatrics in the Division of Cardiology, are actively seeking a full-time faculty member at the level of Associate or Full Professor of Clinical Pediatrics. This position will fulfil the role of Director of Echocardiography at Children's Hospital Los Angeles, and Keck School of Medicine. Applicants must have an M.D. or equivalent degree and have demonstrated scholarly, clinical, and teaching capabilities. Candidates must be board certified or board eligible in Pediatric Cardiology by the American Board of Pediatrics and be eligible for medical licensure in the State of California. Candidates will have already completed an ACGME accredited 3-year fellowship in Pediatric Cardiology, with additional relevant training and leadership experience in Pediatric Echocardiography.

Candidates should be academically committed to the field of pediatric echocardiography, and non-invasive imaging in general. Demonstrated leadership excellence in this field is an essential requirement, with attributed prior development of the facilities staffing and other resources of a highly functioning echocardiography service at a tertiary care pediatric and congenital heart disease deemed to be pre-eminent. Relevant additional areas of experience include 3D/4D echocardiography, exercise echocardiography, and quantitative methods of cardiac evaluation (including deformation/strain analysis and evaluation of diastolic function). Candidates should also demonstrate a rigorous academic focus—ideally with a history of research/investiga¬tional pursuits and publications in peer-reviewed journals—and a clear intention and well-defined plan for continued research, publication, and teaching throughout their careers.

Since the successful candidate will assume attending physician responsibilities for echocardiographic service delivery on inpatients and outpatients, as well as developing the research capabilities of the echocardiography laboratory at CHLA/KSOM, clinical expertise in the performance and interpretation of pediatric transthoracic, transesophageal, and/or fetal echocardiography is essential.

This position will also include general clinical cardiology duties including rotation in the regular inpatient service, as well as outpatient cardiology responsibilities. The preferred candidate should therefore have a broad exposure to, and familiarity with the assessment of newborns, infants, and children in an inpatient setting, and also be familiar with general pediatric cardiology outpatient concerns, including post-operative follow up following surgical repair of congenital heart disease. Provision of didactic teaching to fellows, residents, medical students, and nurses is expected. Night and weekend on-call responsibilities will be shared on a rotating basis with other faculty members in the division.

When extending an offer of employment, the University of Southern California considers factors such as (but not limited to) the scope and responsibilities of the position, the candidate's work experience, education/training, key skills, internal peer equity, federal, state, and local laws, contractual stipulations, grant funding, as well as external market and organizational considerations.

Children's Hospital Los Angeles is ranked among the top hospitals in the nation for pediatric cardiac care on the U.S. News & World Report Best Children's Hospitals List. We are a recognized leader in state-of-the-art evaluation, diagnosis, and treatment for all forms of heart disease. As a core component of the hospital's Heart Institute, our division offers expertise in all major areas of cardiology, with nationally recognized subspecialists in all major areas. Children are referred to us for care from across the western United States and Pacific Rim countries.

Academic appointment through USC Keck School of Medicine is available at a level appropriate to training and experience. USC is an equal opportunity, affirmative action employer. CHLA and USC greatly values diversity and is committed to building a vibrant and culturally diverse community of faculty that best reflects the patients and families that we serve. Individuals from underrepresented groups in medicine are especially encouraged to apply.

https://facultypositions.usc.edu/FAS/application/position?postingId=REQ20131352

If interested, please apply using the link above. For further inquiries, please contact:

Dr. Paul Kantor, pakantor@chla.usc.edu or
Nailea Corado, ncorado@chla.usc.edu

The final session of the meeting shifted gears and focused our attention on pulmonary atresia/intact ventricular septum and the unique challenges facing this population. Dr. Tara Karamlou from Cleveland Clinic reviewed how outcomes in these patients often hinges on the size of the tricuspid valve and how performing a right ventricular septal myectomy did not necessarily improve outcomes. The role of coronary artery interrogation and newer methods of non-invasive imaging such as echo VTI, CT angiography, and 4D flow to detect right ventricular dependent coronary circulation were also reviewed. Dr. Henri Justino from Rady Children's challenged the audience to consider transcatheter atrial restriction as an additional strategy to encourage the right ventricle to "grow" after right ventricular decompression. Finally, Dr. Eric Feins from Boston Children's shared their experience with this patient population and showed a recent surgery highlighting takedown of right ventricular muscle bundles, perforated patch closure of the ASD, and creation of a perforated patch in the right pulmonary artery to avoid hypertensive Glenn physiology. The session closed with a review from Laith Alshawabkeh, MD, who discussed what the future holds for these patients when they reach adulthood and how, even if we do get the right ventricle to grow, it may perform abnormally, especially during exercise. After the meeting concluded, interested attendees were treated to a tour of the Dickinson Image-Guided Interventional Center at Rady Children's Hospital, which features two Siemens ARTIS icono biplane catheterization labs with an embedded interventional CMR suite.

All in all, attendees gave the conference high marks and were especially pleased with the ability to focus on one topic in detail. The beautiful weather certainly helped and made us realize how lucky we are to have such wonderful colleagues from across the world. The meeting was recorded and will be made available in the upcoming weeks, so please stay tuned. Thanks again to everyone for their tireless efforts, and we look forward to seeing everyone in San Diego for our next conference!

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2023 Pediatric Cardiology Research Fellowship Award $35,000

The American Academy of Pediatrics (AAP) and The Children's Heart Foundation (CHF) share a purpose...to promote understanding of the basic mechanism of cardiovascular disease in children. Thirty-five thousand dollars can provide a Training Fellow with invaluable experience in the basic science realm and encouragement to become a physician scientist. The submission site is now open for the 2023 Research Award with a deadline of July 1. You'll find guidelines, application, and timeline posted on the SOCCS Website.

Since 2003, this financial award has sparked the research work of and publications by Dr. Michael Gaies, Dr. Robert Webster, Dr. Thomas Dispenza, Dr. Katja Gist, Dr. Angela Lorts, Dr. Stephanie Nakano, Dr. Cammon Arrington, Dr. Aaron Olson, Dr. Michael-Alice Moga and Dr. Catherine Allan. The complete list of winners and the titles to their work can be found on the Section on Cardiology & Cardiac Surgery website. More recent winners have this to say about the honor and opportunity afforded to them by this award:

ANDREW L. CHENG, MD, FAAP, FACC

Attending Physician, Division of Pediatric Cardiology, Children's Hospital Los Angeles
Assistant Professor of Clinical Pediatrics
Keck School of Medicine,
University of Southern California

"The AAP SOCCS Research Fellowship Award was instrumental for launching my career as a physician-scientist. It allowed me to successfully complete the aims of my fellowship research project during my 3rd and 4th years of training. I was then able to use the data from this project as a foundation for grants from the NIH and American Heart Association. Just as important, the award provided me with the unique opportunity to present my research to the entire SOCCS community at the AAP NCE meeting. This was a wonderful formative experience which provided me with sage advice from and connections with prominent pediatric cardiologists and cardiac surgeons from across the country."

The Children's Heart Foundation™

JOSHUA KURTZ, MD, FAAP, FACC

Assistant Professor, Director of Pediatric Cardiology Education Division of Pediatric Cardiology,
University of Louisville
Congenital Interventional Cardiologist
Norton Children's Hospital

"The AAP SOCCS research fellowship award is a great opportunity for pediatric cardiology fellows. As a fellow it allowed me to understand the full extent of what goes into applying for an extramural grant. It helped me solidify my research and career development plans, which are important parts of larger grant awards. It allows for a chance to obtain enough funding to collect data from small projects that can then be used to apply for larger career development awards, such as an NIH K award. This is such a career benefit and comes from an organization dedicated to pediatrics and congenital heart disease. Other society awards are geared towards adult cardiology and give preference to that population. This award is specifically for our population of congenital heart disease and children with heart disease."

If you're interested or know of a training fellow who would benefit from this financial opportunity, please visit the application page, **https://www.aap.org/en/community/aap-sections/cardiology-and-cardiac-surgery/soccs-awards/** for more details. If you have any questions, please contact Vivian Thorne at **vthorne@aap.org**.

CAREER OPPORTUNITY

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Congenital Heart Surgeon

Primary Purpose of Organizational Unit
The UNC School of Medicine has a rich tradition of excellence and care. Our mission is to improve the health and wellbeing of North Carolinians, and others whom we serve. We accomplish this by providing leadership and excellence in the interrelated areas of patient care, education, and research. We strive to promote faculty, staff, and learner development in a diverse, respectful environment where our colleagues demonstrate professionalism, enhance learning, and create personal and professional sustainability. We optimize our partnership with the UNC Health System through close collaboration and commitment to service.

OUR VISION
Our vision is to be the nation's leading public school of medicine. We are ranked 2nd in primary care education among all US schools of medicine and 5th among public peers in NIH research funding. Our Allied Health Department is home to five top-ranked divisions, and we are home to 18 top-ranked clinical and basic science departments in NIH research funding.

OUR MISSION
Our mission is to improve the health and well-being of North Carolinians and others whom we serve. We accomplish this by providing leadership and excellence in the interrelated areas of patient care, education, and research.

> ***Patient Care:*** We will promote health and provide superb clinical care while maintaining our strong tradition of reaching underserved populations and reducing health disparities across North Carolina and beyond.
>
> ***Education:*** We will prepare tomorrow's health care professionals and biomedical researchers by facilitating learning within innovative curricula and team-oriented interprofessional education. We will cultivate outstanding teaching and research faculty, and we will recruit outstanding students and trainees from highly diverse backgrounds to create a socially responsible, highly skilled workforce.
>
> ***Research:*** We will develop and support a rich array of outstanding health sciences research programs, centers, and resources. We will provide infrastructure and opportunities for collaboration among disciplines throughout and beyond our University to support outstanding research. We will foster programs in the areas of basic, translational, mechanistic, and population research.

Position Summary
The Department of Surgery at The University of North Carolina is seeking applications for a full-time academic congenital heart surgeon to join our Division of Cardiothoracic Surgery. The Division of Cardiothoracic Surgery is among 9 clinical Divisions in the Department of Surgery. The Division currently includes 7 faculty members that provide exceptional care to patients from across the state of North Carolina. Academic appointment will be commensurate with the candidate's experience.

The ideal candidate will be mid to late career with a proven track record and requisite experience in all aspects of congenital cardiac surgery. The chosen candidate will be expected to work closely with the current Section Chief of Congenital Cardiac Surgery. The breadth of responsibilities will include neonatal cardiac surgery, pediatric heart failure, transplantation, ECMO, and adult congenital surgery. Preference will be given to individuals who bring unique skills, interests or qualifications to the current faculty in a complementary fashion. Individuals with a strong interest in research are encouraged to apply. Faculty members within the Division of Cardiothoracic Surgery must possess a desire to commit to all three mission of the department and school of medicine, including the clinical, education, and research missions. Regarding the education mission, faculty members are expected to regularly participate in the education of medical students, residents, and fellows. Regarding research, a commitment to any one of a broad array of research interests is desirable, including but not limited to clinical, outcomes, health services, basic science, translational, ethics, education, or global surgery research. Regarding the clinical mission, faculty members must be committed to delivering high quality clinical care that is of value to the patients of UNC. Selected candidate must be team-oriented and have the ability to interact well with colleagues inside and out of the Division.

Minimum Education and Experience Requirements
Prospective candidates must be Board Certified/Board Eligible or Equivalent in Thoracic Surgery and in Congenital Cardiac Surgery.

Preferred Qualifications, Competencies, and Experience
Completion of an ACGME approved Cardiothoracic Surgery Residency and Congenital Cardiac Surgery fellowship is preferred. Chosen candidate should either have a current North Carolina Medical License or be eligible for application.

Please apply online at https://unc.peopleadmin.com/postings/234256

PCA 500 – The World's Most Efficient and Versatile 12-lead ECG

Los Angeles, California /PRNewswire/ – QT Medical announced FDA clearance of PCA 500, a resting 12-lead electrocardiogram (ECG or EKG), for use in pediatric patients. First cleared in 2018 for professional and personal use by adults 18 years and older, PCA 500's new FDA clearance expands its indication for use to all pediatric populations, including: newborns, infants, children and adolescents.

The development of PCA 500's pre-positioned electrodes and compact recorder was initially funded by NIH for an easy-to-use ECG specifically designed for pediatric use. PCA 500 offers digital, mobile and cloud-based ECG management solution and is widely used by airlines, telehealth practices, clinics, urgent care centers, skilled nursing facilities, hospitals, schools, and in clinical trials, with many CRO partners anticipating the pediatric clearance. QT Medical will introduce PCA 500 to the pediatric market at the 2022 American Academy of Pediatrics National Conference.

"The potential of PCA 500 in improving the heart health of children is extremely exciting. As a pediatric cardiologist, I know how difficult it is to get an ECG on a child. With PCA 500, we can make ECG technology easily accessible to all children. We believe this will make a difference in many lives, which is the exact reason why I founded QT Medical," said Dr. Ruey-Kang Chang, CEO of QT Medical, Inc.

Two new initiatives will be announced at the pediatric market launch of PCA 500. First, Youth Xpress ECG, in partnership with Who We Play For, a non-profit organization dedicated to preventing sudden cardiac arrest of young people, is a mail delivery home 12-lead ECG testing service with interpretation by expert pediatric cardiologists. Second, Baby Xpress ECG, an at-home ECG screening service for newborns and infants with increased risks for Long QT Syndrome (LQTS). With Baby Xpress ECG, when a baby's ECG shows prolonged QT interval, a saliva test will be used to check for genetic mutations known for causing LQTS. Long QT Syndrome, occurring one in every 2000 babies, is a known cause for sudden death (including SIDS).

About QT Medical

QT Medical is a medtech company with a focus on high quality 12-lead diagnostic ECG for use by healthcare professionals and patients. With its simplicity, ease of use, mobile technology and cloud management, PCA 500 brings hospital-grade ECG to millions of patients for better cardiac care at home. More information at: www.qtmedical.com

ACTION and the Parent Project Muscular Dystrophy Develop Patient Registry to Improve Outcomes for Patients with Muscular Dystrophy

ACTION MD Registry is the Largest Real-World Dataset Collecting Comprehensive Cardiac Data

Cincinnati, Ohio – A leading pediatric heart failure organization ACTION (the Advanced Cardiac Therapies Improving Outcomes Network in Cincinnati, OH), in conjunction with support of Parent Project Muscular Dystrophy (PPMD), has developed a patient registry to improve outcomes for the Muscular Dystrophy patient population. To date, this registry is the largest real-world dataset collecting comprehensive cardiac data.

"The care practices are rapidly evolving and there's an urgent need to understand how best to treat cardiac disease to improve the outcomes for Muscular Dystrophy patients," said Chet Villa, MD, ACTION, Cincinnati Children's.

ACTION's initial MD study focused on Duchenne Muscular Dystrophy (DMD), the most common of muscular dystrophies. DMD is caused by the lack of a functional dystrophin protein and leads to progressive skeletal, lung and cardiac muscle weakness. The long-term survival of those living with DMD is increasing, leading to a growing number of people living with heart dysfunction.

As a result, clinicians and families are having to make significant decisions regarding cardiac care. This includes when to start cardiac medications and when to consider advanced therapies such as cardiac devices or transplantation. The burgeoning field of gene therapy and implications for the heart remains an important question for ACTION teams to answer. Additionally, ACTION's current DMD studies have highlighted the need to broaden its understanding to include individuals with Becker Muscular Dystrophy (BMD), as well as female carriers of the dystrophin mutation.

"Not only will ACTION improve the care and treatment of patients with dystrophinopathies, but this information has the potential to impact all individuals with cardiomyopathy," said Linda Cripe, MD, ACTION, Nationwide Children's.

Until ACTION's MD initiative, patients, caregivers and providers have not had access to research and opportunities for evidence-based care. Research in a rare disease population poses unique challenges and requires multi-institutional data sharing. The enhanced ACTION MD Registry is the largest real-world dataset collecting comprehensive cardiac data.

Ricky, a Duchenne Muscular Dystrophy Patient, Orlando, Florida

As of April 10th, 2023, ACTION's MD registry includes:

- Institutions - 22 pediatric institutions have entered patient data.
- Patients - 275 patients have been enrolled in the MD Registry.

ACTION's infrastructure allows the database to facilitate a knowledge sharing, data driven and quality improvement approach to formalizing MD education, best practices and future clinical trial design to move the field forward and ultimately improve MD patient outcomes.

"We really stand at the precipice of a new era of cardiac care for patients with muscular dystrophies and heart failure," said Deip Nandi, MD, ACTION, Nationwide Children's." By organizing cardiologists across the country and world within the framework of ACTION, we're confident that we will be able to capture and harness the data we need to make real improvements in quantity and quality of life for our patients."

To learn more about ACTION and ACTION's Muscular Dystrophy registry and initiatives, please visit www.actionlearningnetwork.org; or contact ACTION directly at info@actionlearningnetwork.org.

About ACTION

ACTION (the Advanced Cardiac Therapies Improving Outcomes Network) is an organization that unites and connects a global healthcare community to improve outcomes for patients with heart failure, especially children. Since 2017, ACTION has continued to grow and engage an international community by uniting key stakeholders: patients, families, clinicians, researchers, payors and industry.

Based in Cincinnati, OH, ACTION uses a quality improvement and research-based approach. ACTION works in collaboration with network sites and network members, sharing data, finding better solutions and discovering new innovations. Currently, there are over 60 network sites and 1,185 network members. Learn more at www.actionlearningnetwork.org.

JULY

28-29

CICT 2023 – CICT Controversies in Interventional Cardiovascular Therapies
Pasadena, CA, USA
https://cictsymposium.com/

AUGUST

25-27

3rd Annual PICS Fellows & Early Career Course
Washington, DC, USA
kimberly_ray@chdinterventions.org

27-09/01

8th World Congress of Pediatric Cardiology and Cardiac Surgery
Washington, DC, USA
http://wcpccs2023.org/

SEPTEMBER

08-09

2023WPC – 2023 World Pediatric Conference
Singapore
https://pediatrics.episirus.org/

25-26

CME HeartCare and Cardiovascular Medicine Cardiac Surgery
Paris, France
https://heart.plenareno.com/

OCTOBER

06-08

CSI Asia-Pacific 2023
Bangkok, Thailand
https://www.csi-congress.org/asia-pacific

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