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References
1. AMPLATZER Septal Occluder Pivotal Trial - Closure rate at 6 months is defined as a shunt less than or equal to 2 mm without the need for surgical repair.
2. AMPLATZER Multi-Fenestrated Septal Occluder - “Cribriform” Clinical Trial - Closure rate is defined as less than or equal to 2 mm residual shunt in those patients in whom successful deployment of the device was achieved.
3. AMPLATZER Duct Occluder Pivotal Trial Results.
4. AMPLATZER Muscular VSD Occluder Pivotal Trial - Closure success at 6 months is defined as patients who had a shunt of less than or equal to 2 mm at this time interval. This closure rate is based on the number of patients who were seen at follow-up, whether or not they had a shunt evaluated, and had a shunt of less than or equal to 2 mm at 6 months. Patients who were not seen but had a shunt greater than 2 mm at last follow-up interval (i.e., 1-month follow-up) are included in the denominator.

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With Live Case Demonstrations

JANUARY 19–22, 2013
Loews Miami Beach Hotel, Miami, FL

The symposium is presented by
the PICS Foundation in collaboration with
the Rush Center For Congenital & Structural Heart Disease
and sponsored for CME credit by Rush University Medical Center.

RUSH UNIVERSITY MEDICAL CENTER
Sponsored for CME credit by Rush University Medical Center
January 19, 2013

Welcome to Miami Beach!

On behalf of our residents and hospitality and tourism industry partners, it is a pleasure to welcome the delegates of the Pediatric and Adult Interventional Cardiac Symposium 2013 – PICS–AICS 2013 to the Loews Miami Beach Hotel, January 19-22, 2013.

We are delighted to host this global gathering and commend PICS–AICS for its work with live cases this year, which will be transmitted via satellites from Argentina, Brazil, Saudi Arabia, Orlando, Miami, West Palm Beach, Mississippi, Los Angeles and Denver.

Visitors from around the world enjoy the sophistication of our cosmopolitan community which seamlessly blends with the beauty and splendor of our tropical surroundings. The richly woven fabric of our culturally diverse city makes Miami an exciting global destination for your meeting!

We hope your stay in Miami is professionally rewarding and personally enjoyable and that we will have many opportunities to welcome you back.

Sincerely,

Matti Herrera Bower
Mayor
Dear Colleague,

Welcome to the Pediatric and Adult Interventional Cardiac Symposium 2013 – PICS–AICS 2013 held at the Loews Miami Beach Hotel, Miami, Florida, from January 19-22, 2013. This year we are fully committed to ensuring the meeting maintains its clinical focus with addition of taped cases to sessions on both congenital and structural heart disease, as well as live case demonstrations from around the globe.

PICS–AICS remains the standard-bearer for live case demonstrations, beamed from multiple international venues with experienced operators that will demonstrate the latest in medical device technology using approved and investigational devices/valves/stents etc. The live cases this year will be transmitted live via satellites from Argentina, Brazil, Saudi Arabia, Orlando, Miami, Mississippi, West Palm Beach, Los Angeles and Denver.

This year the meeting will begin on Saturday, January 19 with a “Tips and Tricks” session with practical demonstrations on how to prepare and load stents, how to perform surgical cutdowns and a special session on equipment modification to support successful transcatheter pulmonary valve implantation. This will be followed by an interactive taped case session with three cases for discussion. This year we have ensured that the oral abstract sessions are not competing with one another so that the true scientific endeavors of our colleagues are given the platform they deserve.

On Sunday, January 20, following staggered live case demonstrations in the morning, there will be a session on Catheterization in the Developing World followed by a session on interventional issues in the treatment of Hypoplastic Left Heart Syndrome. There is also a breakout session on Left Atrial Appendage Occlusion. There will be further breakout sessions for nurses and technologists and younger interventionalists who are establishing their practice as well as Aortic and Mitral Valve Therapies and a special breakout for those our Spanish speaking attendees. Finally, “My Nightmare Case in the Cath Lab” will take place on Tuesday 22nd, and again the audience will choose the most deserved case. This will be followed by a final session on Interventions on the Pulmonary Valve and Pulmonary Arteries again with a taped case to demonstrate some of the technical challenges with these procedures.

Poster Abstracts will be displayed throughout the meeting. Again this year we are supporting younger interventionalists with the Young Leadership Program at PICS with the winner receiving faculty status and involvement in the meeting. We also wish to recognize those committed to research with The PICS Scientific Scholarship Award with the winner receiving a $5,000 grant towards their research endeavor.

We have made significant endeavors to ensure the meeting remains fresh and provides the optimum learning experience for the attendees. Miami’s South Beach is world renowned and sure to provide a sensational backdrop for the meeting. We look forward to your participation and learning from you.

Course Directors
Ziyad M. Hijazi, MD    John P. Cheatham, MD    Carlos Pedra, MD    Thomas K. Jones, MD
RUSH UNIVERSITY MEDICAL CENTER
WELCOMES PICS-AICS ATTENDEES TO MIAMI

For more than 170 years, Rush University Medical Center has dedicated itself to serving the people of Chicago and beyond, and the opening of a new, 14-story, state-of-the-art hospital building this year is just one example of this effort.

The new hospital enhances Rush’s comprehensive cardiac care for children and adults, which includes the following:

- **Interventional Platform** – three consecutive floors in Rush’s new hospital are devoted to an interventional platform where diagnostic testing, surgical and interventional services (including interventional cardiology) and recovery are closely located, resulting in enhanced collaboration between specialists while making services more convenient for patients and families.

- **The Rush Preclinical Catheterization Laboratory** – a good laboratory practice (GLP)-certified facility that offers the latest technology designed to meet the needs of the translational research, physician training, medical device, pharmaceutical and surgical specialty communities.

- **The Rush Center for Congenital and Structural Heart Disease** – led by Ziyad M. Hijazi, MD, MPH, this center brings together world-renowned experts to handle even the most complex cases using state-of-the-art imaging, and advanced medical and surgical interventional approaches.

For more information about cardiac services at Rush, please call (312) 942-6800 or visit www.rush.edu/heart.
Upon completion of your participation in this educational activity you intend to incorporate the following into your practice of medicine:

- Utilize new interventional technologies and current strategies developed for the management of children and adults with congenital and structural heart disease.
- Incorporate into your practice the techniques for the proper placement of percutaneous valves, stents and devices for occlusion of septal defects.
- Utilize current management strategies for the treatment of adults with PFO who have experienced stroke or migraine.
- Initiate advances in diagnosis, evaluation and therapies for children and adults with congenital heart disease.
- Utilize current management strategies and their expected outcomes for infants born with obstructive right and left heart lesions.

- Identify the important factors which affect the long-term outcomes and quality of life in children and adults with congenital heart disease.
- Incorporate alternative management strategies to transcatheter management for patients with various congenital defects.
- Utilize new clinical research advances in the care of children and adults with congenital heart disease.
- Incorporate demonstrated practical techniques related to interventional cardiac therapies in patients with congenital heart disease.
- Utilize practical demonstrations and full interactive teaching to assist incorporating into practice the most up-to-date approaches for structural heart disease including left atrial appendage closure and transcatheter mitral and aortic valve therapies.
ACCREDITATION and CERTIFICATES

CME Accreditation
Sponsored for CME credit by Rush University Medical Center. Rush University Medical Center is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.
Rush University Medical Center designates this live activity for a maximum of 35 AMA PRA Category 1 Credit(s)™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.
A complete list of faculty conflict of interest statements can be found in your registration packet. They are also available for viewing at the Registration Desk.

CME Evaluation/Certificates
PICS–AICS 2013 CME evaluations will be done online this year. For your convenience, the CME/Attendance evaluation will be available on: https://www.surveymonkey.com/s/MMMQRCK
Upon successful completion of the evaluation you will receive a certificate/statement of credit for maximum of 35 hours. A certificate will be provided via email.
If you have any questions regarding Continuing Medical Education (CME) credits for PICS–AICS, please contact the Rush Office for Continuing Medical Education at 312-942-7119.
The online evaluation site will be available starting on 1/19/2013 through 3/1/2013.
Please allow 2-4 weeks to receive your certificate via email.

CEU Nursing Certificates
CEU certificates are available at the CEU desk upon completion of the evaluation form and the attendance sheet both of which are included in your nursing packet. CEU certificates will be issued to all RNs who qualify.
PLEASE PICK UP YOUR CEU CERTIFICATE BEFORE YOU LEAVE THE CONFERENCE.
All attendees will receive a certificate of attendance which may be presented to their institution, association, or health organization for consideration of credit. The certificates are included in your attendee folder within your conference bag.
A multidisciplinary journal and community resource devoted to structural heart disease treatment, including congenital heart disease.

Overview: JSHD represents a major departure in the format, content, and audience of the traditional medial journal. How? Here are ten founding principles of the journal...

1. Its primary goal is to build a community of individuals with an interest in SHD.
2. It is designed from the beginning as a new media journal rather than a print journal “dumped” into a web format.
3. It is designed for optimal delivery and interaction on a tablet.
4. It is dominated by images with supplementary text rather than the reverse.
5. It is structured to be interactive rather than a passive experience.
6. Its audience (participants) will be international and multiculturalism is implicit.
7. It will have a parallel and sometimes intersecting edition focused on patients and a lay audience with an even greater emphasis on interactivity with other patients as well as clinicians.
8. It will have educational material that can be downloaded and used by anyone.
9. The editorial group will include both established experts but also tap into the unique skills and backgrounds of people just starting their careers with a SHD focus.
10. The editorial group will spend more time on interactions regarding publications versus traditional reviewing of manuscripts.

The New Technical Format for the Journal
- Tablet optimized but will run well on laptops and desktops (EPUB 3 standard)
- Interactive table of contents
- High quality video and audio,
- Support for 3D models and graphics with interactive images (predominantly zooming and scrolling, interactive labels and image libraries)
- Novel applications will be encouraged for development, presentation, and dissemination in JSHD
- Digital libraries with open access will be built to support media content
  - Educational videos for use at the bedside
  - Libraries of videos portraying patient experiences
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WINNER OF THE PICS YOUNG LEADERSHIP AWARD 2013

This award was developed to recognize excellence in early career interventionalists. We are proud to announce this year’s winner:

Bryan H. Goldstein, MD

Dr. Goldstein is an assistant professor in the Heart Institute and Department of Pediatrics at Cincinnati Children’s Hospital Medical Center and University of Cincinnati College of Medicine in Cincinnati, Ohio. He graduated with honors from Boston University School of Medicine in 2004 and subsequently completed pediatric residency training at Children's Hospital Boston from 2004-2007. Dr. Goldstein completed his pediatric cardiology and interventional cardiology fellowships from 2007-2011 at C.S. Mott Children's Hospital, University of Michigan Health System in Ann Arbor, Michigan.

Active academically, Dr. Goldstein has published a number of manuscripts investigating the long-term functional outcomes of Fontan survivors, including assessments of exercise performance, quality of life and vascular function. He further published on outcomes following transcatheter intervention for post-operative re-implantation site pulmonary artery stenosis, the novel use of a pressure wire during fetal balloon aortic valvuloplasty, the use of hydrogel expandable coils in congenital cardiovascular disease and the use of covered balloon-expandable stents for treatment of acute traumatic aortic injuries. Dr. Goldstein’s current research focus includes the physiologic assessment of ventricular and vascular function in univentricular heart disease and the use of minimally invasive transcatheter therapies, including hybrid approaches, for treatment of CHD.

Dr. Goldstein is active nationally, as a member of the ACC Quality Metric Working Group, the SCAI Pediatric Quality Improvement Toolbox workgroup, and as a founding member of the Pediatric Interventional Catheterization Early-career Society (PICES). Locally, he serves on a number of important institutional committees including the Single Ventricle Program, the Generating Radiation Equipment committee, the Cardiology Fellowship Review committee and the hospital-wide IRB.

FINALISTS FOR THE PICS SCIENTIFIC SCHOLARSHIP AWARD

This award was designed to recognize original scientific work in the field of interventional cardiology. This year’s finalists are:

Mehul Patel, MD
Texas Children’s Hospital
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Houston TX

Surendranath Reddy, MD
University of Texas
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Both finalists work will be presented in abstract format at the Abstract Final Presentations on Tuesday April, 17th at 1:10 pm. The winner will be announced at the PICS-AICS Dinner with presentation of a $5,000 grant to further their research endeavors.

PICS Scientific Scholarship Award 2014

Applicants can apply through the standard abstract submission process and request they be considered for this. Applicants will also need to submit a paragraph outlining how the $5000 USD will be used to further their research.
What’s new with Philips? Come see for yourself.

Come see us at the Pediatric and Adult Interventional Cardiac Symposium, January 19 – 22. You’ll have an opportunity to chat with a Philips Healthcare representative and learn more about what we’re doing to help you treat your pediatric patients. Visit us at booth number 28.
SCIENTIFIC PROGRAM
7:00 AM-6:00 PM  
**REGISTRATION OPEN**  
Registration Desk, Level 2

7:00-8:30 AM  
**Continental Breakfast**  
Americana Foyer, Level 2

7:00 AM-6:00 PM  
**POSTER ABSTRACTS**  
Americana Foyer, Level 2

---

**GENERAL SESSION**

**AMERICANA BALLROOM 1&2, LEVEL 2**

Moderators: Frank Ing, Damien Kenny, Evan Zahn, and Michel Ilbawi

8:15-8:30 AM  
**WELCOME**  
Ziyad M. Hijazi

8:30-10:30 AM  
**“TIPS AND TRICKS”**

8:30-9:05 AM  
Preparing and Loading Stents: Frank Ing

9:05-9:35 AM  
Surgical Cutdowns: Michel Ilbawi

9:35-10:15 AM  
Transcatheter Pulmonary Valve Implantation – “Down to the Wire”: Evan Zahn

10:15-10:30 AM  
Discussion

10:30-11:00 AM  
Coffee Break  
Americana Foyer, Level 2

11:00 AM-1:00 PM  
**TAPE CASES**  
Moderator: Shakeel Qureshi

11:00-11:25 AM  
1. Frank Ing

11:25-11:50 AM  
2. Evan Zahn

11:50 AM-12:15 PM  
3. Lee Benson

12:15-12:40 PM  
4. Eric Horlick

12:40-1:00 PM  
Discussion

1:00 PM-2:00 PM  
Lunch Available  
Pick up box lunch in Americana Foyer, Level 2

1:10 PM-1:50 PM  
**LUNCH BREAKOUT SESSION #1**  
Poinciana 1&2, Level 2

**STENTS IN MY PRACTICE – WHEN AND WHY**

Moderators: Marc Gewillig and John Cheatham

1:10-1:20 PM  
Closed Cell Stents: Tom Forbes

1:20-1:30 PM  
Open Cell Stents: Jackie Kreutzer

1:30-1:40 PM  
Hybrid Stents: Jo DeGiovanni

1:40-1:50 PM  
Covered Stents: Marc Gewillig
# PICS-AICS

## Pediatric and Adult Interventional Cardiac Symposium

### SATURDAY, JANUARY 19

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Description</th>
<th>Location</th>
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<tr>
<td>1:10 PM-1:50 PM</td>
<td><strong>LUNCH BREAKOUT SESSION #2</strong></td>
<td>Poinciana 3&amp;4, Level 2</td>
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<tr>
<td></td>
<td><strong>OPTIMIZING DEVICE/VALVE DESIGN</strong></td>
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<td></td>
<td>Moderators: Zahid Amin and Larry Latson</td>
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<tr>
<td>1:10-1:20 PM</td>
<td>Occulotech–PLD’s and ACCELL Coating: Hakan Apkinar</td>
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<td>1:20-1:30 PM</td>
<td>Optimization of the GORE® Septal Occluder: Jake Goble</td>
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<td>1:30-1:40 PM</td>
<td>Lifetech: Nguyen Lan Hieu</td>
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<td></td>
<td><strong>Discussion</strong></td>
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<tr>
<td>1:10 PM-1:50 PM</td>
<td><strong>LUNCH BREAKOUT SESSION #3</strong></td>
<td>Cowrie 1&amp;2, Level 3</td>
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<tr>
<td></td>
<td><strong>SPECIALIST IMAGING</strong></td>
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<tr>
<td></td>
<td>Moderators: Craig Fleishman and Girish Shirali</td>
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<tr>
<td>1:10-1:20 PM</td>
<td>Imaging Guides for Radiofrequency Perforation for Aortic Atresia: Mario Carminati</td>
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<tr>
<td>1:20-1:30 PM</td>
<td>CT to Evaluate Atrial Erosion Following ASD Closure: Anthony Hlavacek</td>
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</tbody>
</table>
| 1:30-1:50 PM  | **Debate:** Echo Assessment of the Right Ventricle is an Acceptable Alternative to MRI in the Setting of tPVR  
Pro: Craig Fleishman  
Con: Mark Fogel |              |

2:00 PM-3:30 PM | **ORAL ABSTRACT PRESENTATIONS**                                                     | Americana 1&2, Level 2 |
|               | Moderators: Tom Forbes, John Rhodes, and Julie Vincent                              |              |

3:30-4:00 PM | **Coffee Break**                                                                    | Americana Foyer, Level 2 |

4:00-6:00 PM | **ORAL ABSTRACT PRESENTATIONS**                                                     | Americana 1&2, Level 2 |
|               | Moderators: Mike Tynan, Richard Ringel, and Jonathan Rome                           |              |

5:00-6:00 PM | **BREAKOUT SESSION: MEET THE EXPERTS**                                              | Poinciana 1&2, Level 2 |
|               | Moderators: Charles Mullins, John Bass, and Mario Carminati                         |              |

6:00-8:00 PM | **WELCOME RECEPTION**                                                                | Americana 3&4, Level 2 |
|               | **Exhibit Hall Open**                                                                |              |
6:30 AM-5:30 PM  
**REGISTRATION OPEN**  
Registration Desk, Level 2

6:45-8:00 AM  
**Continental Breakfast**  
Exhibit Hall Americana Ballroom 3&4, Level 2

7:00 AM-6:00 PM  
**POSTER ABSTRACTS**  
Americana Foyer, Level 2

**GENERAL SESSION**  
**AMERICANA BALLROOM 1&2, LEVEL 2**

**MORNING SESSION**  
Moderators: Ziyad M. Hijazi, John P. Cheatham, and Thomas K. Jones

8:00-8:15 AM  
**LIVE CASE 2012 UPDATE**  
Noa Holoshitz

8:15-10:30 AM  
**LIVE CASES** (Argentina, Sao Paolo, Saudi Arabia)  
Panelists: David Balzer, Manolis Pursanov, Mansour Al-Jufan, Howaida El-Said, and Donald Hagler

10:30-11:00 AM  
**Coffee Break / Visit Exhibits**  
Americana 3&4, Level 2

11:00 AM-1:15 PM  
**LIVE CASES** (Argentina, Sao Paolo, Saudi Arabia)  
Panelists: Levent Saltik, Jae Young Choi, Jacek Bialkowski, Francisco Chamie, and Worakan Promphan

1:15-2:00 PM  
**Lunch Break / Visit Exhibits**  
Americana 3&4, Level 2

**AFTERNOON SESSION**  
Moderators: Ralf Holzer and Giacomo Pongiglione

2:00-3:30 PM  
**CATHETERIZATION IN THE DEVELOPING WORLD**  
Moderators: Dan Levi, Masood Sadiq, and Maity El Sayed

2:00-2:12 PM  
Operability in Defects with Elevated PVR–Is There a Limit?: **Carlos Zabal**

2:12-2:24 PM  
History of Balloon Mitral Valvuloplasty in Children and Adults: **Savitri Shrivastava**

2:24-2:36 PM  
Novel Use of Available Resources for Catheterization in the Developing World: **Bharat Dalvi**

2:36-2:48 PM  
Transcatheter VSD Closure in China: **Shiliang Jiang**

2:48-3:00 PM  
PDA Closure in South America: **Raul Rossi**

3:00-3:12 PM  
Update on Initiatives: **Damien Kenny**

**Discussion**
2:00-3:45 PM  
**BREAKOUT #1**  
Poinciana 3&4, Level 2  

**LEFT ATRIAL APPENDAGE OCCLUSION – STATE OF THE ART**  
Moderators: Ted Feldman, James Hermiller, and Pat McCarthy

- 2:00-2:12 PM  
  Anatomical Specimens and Relevance to Closure: Mark Reisman

- 2:12-2:24 PM  
  Transseptal Puncture – Evolving Technology: Zoltan Turi

- 2:24-2:36 PM  
  WATCHMAN – Where Do We Stand?: Saibal Kar

- 2:36-2:48 PM  
  ACP – Updated Results: Kevin Walsh

- 2:48-3:00 PM  
  Epicardial Devices: Mark Reisman

- 3:00-3:12 PM  
  Devices in Development: Saibal Kar

- 3:12-3:32 PM  
  **Debate:** Chronic Atrial Fibrillation and ASD – Transcatheter Therapy is Preferable to Surgery  
  Pro: Horst Sievert  
  Con: Michel Ilbawi

- Discussion

3:30-4:00 PM  
**Coffee Break / Visit Exhibits**  
Americana 3&4, Level 2

4:00-5:45 PM  
**CATHETERIZATION IN HYPOPLASTIC LEFT HEART SYNDROME**  
Moderators: Mark Galantowicz, John Cheatham, and Dietmar Schranz

- 4:00-4:12 PM  
  Anatomical Correlations Relevant to Intervention: Paul Weinberg

- 4:12-4:24 PM  
  Stenting the Atrial Septum – Options for Stent Delivery and Modification: Marc Gewillig

- 4:24-4:36 PM  
  Progressive Retrograde Coarctation Following the Hybrid – Treatment Options: Ralf Holzer

- 4:36-4:48 PM  
  Collaterals Post Stage 2 – Do They Need to be Closed?: Herbert Stern

- 4:48-5:00 PM  
  Pulmonary Artery Interventions Following Stage 1: Jo DeGiovanni

- 5:00-5:20 PM  
  **Debate:** The Sano Procedure Leads to More Favorable Pulmonary Artery Growth Compared to the Hybrid Procedure  
  Pro: Shunji Sano  
  Con: Lee Benson

- Discussion

2:00-5:30 PM  
**BREAKOUT SESSION #2**  
Cowrie 1&2, Level 3

**NURSING AND ASSOCIATED PROFESSIONALS**  
Moderators: Sharon Cheatham and Kathleen Nolan

- 2:00-2:20 PM  
  Informatics in the Cath Lab: Sharon Bradley-Skelton

- 2:20-2:40 PM  
  The Value of Patient/family Education in Interventional Cath: Emily Kish

- 2:40-3:00 PM  
  Risk Stratification: Elaine McCarthy

- 3:00-3:20 PM  
  Percutaneous Valve Replacement – Not Just for Conduits: John P. Cheatham

- 3:20-3:40 PM  
  Quality of Life after TPVI: Ruby Whalen

- 3:40-4:00 PM  
  Emergencies in the Cath Lab: Karen Iacono

- 4:00-4:20 PM  
  Covered Stents: Update on Current and Future Trials: Richard Ringel

- 4:20-4:40 PM  
  No Boundaries – Mission Trips & CHD: Gina Langlois

- 4:40-5:30 PM  
  “Analyze This” – Interactive Session: Kathleen Nolan

5:45-6:00 PM  
PICS–AICS ACHIEVEMENT AWARD
MONDAY, JANUARY 21

6:30 AM-5:30 PM
REGISTRATION OPEN
Registration Desk, Level 2

6:45-8:00 AM
Continental Breakfast
Exhibit Hall Americana Ballroom 3&4, Level 2

7:00 AM-6:00 PM
POSTER ABSTRACTS
Americana Foyer, Level 2

GENERAL SESSION
AMERICANA BALLROOM 1&2, LEVEL 2

MORNING SESSION
Moderators: Elchanan Bruckheimer, Shakeel Qureshi, and Giacomo Pongiglione

8:00-10:15 AM
LIVE CASES (Orlando, Miami, Mississippi)
Panelists: Teiji Akagi, Mazeni Alwi, Wei Gao, Dan Gruenstein, and John Rhodes

10:15-10:45 AM
Coffee Break / Visit Exhibits
Americana 3&4, Level 2

10:45 AM-1:00 PM
LIVE CASES (Orlando, Miami, Mississippi)
Panelists: Donald Hagler, Alex Javois, Masood Sadiq, Robert Vincent, and Bryan Goldstein

1:00-2:00 PM
Lunch Break / Visit Exhibits
Americana 3&4, Level 2

1:10-2:00 PM
ORAL ABSTRACT FINALS
Americana Ballroom 1&2
Moderators: Julie Vincent, Jonathan Rome, and Mike Tynan

AFTERNOON SESSION
Moderators: Mario Carminati and Clifford Kavinsky

2:00-3:45 PM
NEW TECHNOLOGIES
Moderators: John Bass, David Balzer, and Alex Javois

2:00-2:12 PM
Biodegradable Stents: Dietmar Schranz

2:12-2:24 PM
Stem Cell Therapy for Percutaneous Valves: Massimo Caputo

2:24-2:36 PM
Low Profile Delivery Design for Transcatheter Valve Systems: Steve Bailey

2:36-2:48 PM
Transcatheter Ventricular Assist Devices: Cliff Kavinsky

2:48-3:00 PM
The Future of Radiation Protection: Michael de Moor

3:00-3:20 PM
Debate: Europe is a Better Place to Be For Transcatheter Intervention in Congenital Heart Disease
   Pro: Shakeel Qureshi
   Con: Larry Latson

3:20-3:45 PM
Discussion
**2:00-5:30 PM**

**BREAKOUT SESSION #3 PICES (Young Interventionalist Group)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:00-2:10 PM</td>
<td><strong>WELCOME:</strong> Dan Gruenstein</td>
</tr>
<tr>
<td>2:10-2:35 PM</td>
<td><strong>GUEST LECTURE 1:</strong> CCISC – Collaboration and Communication: Tom Forbes</td>
</tr>
<tr>
<td>2:35-4:00 PM</td>
<td><strong>CASE PRESENTATIONS</strong> (3 presentations - 25 minutes each, including discussion)</td>
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<td>Moderators: Dan Gruenstein and Brent Gordon.</td>
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</tbody>
</table>

**3:00-4:30 PM**

**Coffee Break / Visit Exhibits**

Americana 3&4, Level 2

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>4:30-4:50 PM</td>
<td><strong>GUEST LECTURE 2:</strong> Getting An Idea Off The Ground – Biodegradable Stents: Dan Levi</td>
</tr>
<tr>
<td>4:50-5:30 PM</td>
<td><strong>BUSINESS MEETING</strong></td>
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<td></td>
<td>Updates from Executive Board - Secretary, Chairs of Research/Clinical Elections</td>
</tr>
</tbody>
</table>

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**2:00-4:00 PM**

**BREAKOUT SESSION #4**

**MITRAL VALVE INTERVENTIONS**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>2:00-2:10 PM</td>
<td>Anatomical Specimens and Relevance to Closure: Mark Reisman</td>
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<tr>
<td>2:10-2:35 PM</td>
<td>Taped Case – MitraClip and MVP Software: Scott Lim</td>
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<tr>
<td>2:47-2:59 PM</td>
<td>Transcatheter Mitral Valve Replacement: Matthew Gillespie</td>
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<tr>
<td>2:59-3:11 PM</td>
<td>Device Development for Mitral PVL – Case Presentation: Omar Goktekin</td>
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<tr>
<td>3:11-3:23 PM</td>
<td>Percutaneous Mitral Annuloplasty – TITAN Trial Results: David Reuter</td>
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<tr>
<td>3:23-3:43 PM</td>
<td><strong>Debate:</strong> Transapical Approach is the Best Option for Mitral PVL</td>
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<tr>
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<td>Pro: Ziyad Hijazi</td>
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<td>Con: Robert Sommer</td>
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<td><strong>Discussion</strong></td>
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**3:45-4:15 PM**

**Coffee Break / Visit Exhibits**

Americana 3&4, Level 2

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**4:15-6:00 PM**

**TAVR**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>4:15-4:40 PM</td>
<td>Taped Case – Edwards 29mm Valve: Reda Ibrahim</td>
</tr>
<tr>
<td>4:40-5:05 PM</td>
<td>Taped Case – Core Valve: Olaf Franzen</td>
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<tr>
<td>5:05-5:17 PM</td>
<td>Commercialization of the SAPIEN Valve – Life Without PARTNER: Roberto Cubeddu</td>
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<tr>
<td>5:17-5:29 PM</td>
<td>Stroke Following TAVR – Minimizing Risk: Reda Ibrahim</td>
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<tr>
<td>5:29-5:49 PM</td>
<td><strong>Debate:</strong> TAVR is Cost Effective in the Non-Surgical Elderly Population</td>
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<td>Pro: Eric Horlick</td>
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<td>Con: Pat McCarthy</td>
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<td><strong>Discussion</strong></td>
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</table>
### BREAKOUT #5 SESION DE HABLA ESPAÑOLA

**TRATAMIENTO DEL PCA EN DIFERENTES SITUACIONES CON DISPOSITIVOS**

**Moderadores:** Horacio Faella and Carlos Pedra

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
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<tbody>
<tr>
<td>4:15-4:30 PM</td>
<td>Tratamiento en Bebés Prematuros: Joaquim Miro</td>
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<tr>
<td>4:30-4:45 PM</td>
<td>Cuando existe Hipertensión Pulmonar: Carlos Zabal</td>
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<tr>
<td>4:45-5:00 PM</td>
<td>En el Paciente Adulto: Felipe Heusser</td>
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<tr>
<td>5:00-5:15 PM</td>
<td>Y… ¿qué hay de las Anatomías Bizarras?: Alejandro Peirone</td>
</tr>
<tr>
<td>5:15-5:30 PM</td>
<td>Cuando un Dispositivo Emboliza, Consejos y Trucos: Miguel Granja</td>
</tr>
<tr>
<td>5:30-5:50 PM</td>
<td><strong>Debate:</strong> Cuando existe hipoflujio pulmonar, una fistula quirurgica es mejor que un stent ductal… Pro: Jacqueline Kreutzer Con: Raúl Arrieta</td>
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<tr>
<td>5:50-6:00 PM</td>
<td><strong>Discusión</strong></td>
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**Dinner Event - Monday, January 21**

- **6:45 PM-7:15 PM**
  Motor coaches will be departing from the Palm Court Entrance of the Hotel.

- **7:30 PM-10:30 PM**
  **PICS-AICS Dinner Event at Bongos Cuban Cafe**, owned by international superstars Gloria and Emilio Estefan. Enjoy authentic Cuban cuisine and dancing in a tropical setting of old Havana over looking the Port of Miami, Biscayne Bay, and the Miami skyline.
<table>
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<th>Time</th>
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<tbody>
<tr>
<td>6:30 AM-5:00 PM</td>
<td><strong>REGISTRATION OPEN</strong>&lt;br&gt;Registration Desk, Level 2</td>
</tr>
<tr>
<td>6:45-8:00 AM</td>
<td><strong>Continental Breakfast</strong>&lt;br&gt;Exhibit Hall Americana Ballroom 3&amp;4, Level 2</td>
</tr>
</tbody>
</table>
| 8:00-9:40 AM  | **GENERAL SESSION**<br>**AMERICANA BALLROOM 1&2, LEVEL 2**
|              | **MORNING SESSION**<br>Moderators: Neil Wilson, William Hellenbrand, Carlos Pedra |
| 8:00-9:40 AM  | **LIVE CASES** (West Palm Beach, Denver, Cedars Sinai)<br>Panelists: Jou-Kou Wang, Bryan Goldstein, Terry King, Seong-Ho Kim, Darren Berman |
| 9:40-11:30 AM | **ASD’S, PFO’S AND MORE!**
| 9:50-10:00 AM | Imaging Modalities to Evaluate Atrial Erosion Following ASD Closure: Girish Shirali |
| 10:00-10:10 AM| RESPECT – Where Does it Leave Us with PFO Closure?: Werner Budts |
| 10:10-10:20 AM| Update on the ADO II AS in Ductal Closure in the Premature Infant: Joaquim Miro |
| 10:20-10:30 AM| Recognition and Management of Porto-systemic Shunts in Congenital Heart Disease: Henri Justino |
| 10:30-10:40 AM| Covered Stents in CHD – Are BMS Outside of the US Becoming Obsolete?: Elchanan Bruckheimer |
| 10:40-10:50 AM| RVOT Conduit Rupture During iPVR – Pre-procedural Risk Identifiers: Thomas Jones |
| 11:00-11:10 AM| Guest Lecture: Tissue Engineering in the Management of HLHS: Shunji Sano |
| 11:10-11:20 AM| Discussion |
| 11:30-11:50 AM| Coffee Break / Visit Exhibits<br>Americana 3&4, Level 2 |
| 11:50 AM-1:00 PM | **LIVE CASES** (Denver, Cedars Sinai)<br>Panelists: Yun Ching Fu, Anthony Hlavacek, Chris Petit, Dan Levi, and David Nykanen |
| 1:00-2:00 PM  | Lunch Break / Visit Exhibits<br>Americana 3&4, Level 2 |
| 2:00 PM       | Exhibit Hall Closes |
AFTERNOON SESSION
Moderators: Tom Jones, John Cheatham, and Ziyad M. Hijazi

2:00-3:30 PM
MY NIGHTMARE CASE IN THE CATH LAB
Moderators: Neil Wilson and Shakeel Qureshi

3:30-4:00 PM
Coffee Available
Americana Foyer, Level 2

3:30-5:00 PM
THE PULMONARY VALVE AND PULMONARY ARTERIES
Moderators: Mark Fogel and Giacomo Pongiglione

3:30-3:55 PM
How to Work in the Branch Pulmonary Arteries (Taped Case): Ziyad Hijazi

3:55-4:07 PM
Transapical Injectable Pulmonary Valve Implantation: Massimo Caputo

4:07-4:19 PM
Cutting Balloon vs High Pressure Balloon Angioplasty: Lisa Bergersen

4:19-4:31 PM
High Pressure Ballooning to Crack Small Diameter Stents in the PAs: Phillip Moore

Debate: Surgical Arterioplasty is Destined to Require Further Intervention
Pro: Zahid Amin
Con: Emile Bacha

Discussion

5:00 PM
CLOSING REMARKS: Ziyad Hijazi

EXHIBIT PASSPORT DRAWING
SAVE THE DATE
JUNE 8-11, 2014
Marriott Chicago
D O W N T O W N
CHICAGO
WWW.PICSYMPOSIUM.COM

PICS-AICS
Pediatric and Adult Interventional Cardiac Symposium

RUSH UNIVERSITY MEDICAL CENTER
Sponsored for CME credit by Rush University Medical Center
LIVE CASE DEMONSTRATIONS
LIVE CASE SITES AND OPERATORS

SUNDAY, JANUARY 20

Hospital Privado de Córdoba, Córdoba, Argentina
Alejandro Peirone, MD

Prince Salman Heart Center – King Fahad Medical City, Riyadh, Saudi Arabia
Tarek Momenah, MD

Dante Pazzanese Instituto de Cardiologia, Sao Paulo, Brazil
Carlos Pedra, MD

MONDAY, JANUARY 21

Arnold Palmer Hospital for Children, Orlando, FL
David Nykanen, MD and Matthew Schwartz, MD

Miami Children’s Hospital, Miami, FL
Darren Berman, MD and Roberto Cubeddu, MD

University of Mississippi Medical Center, Jackson, MS
Makram Ebeid, MD and Thomas Jones, MD

TUESDAY, JANUARY 22

JFK Medical Center – West Palm Beach, FL
Roberto Cubeddu, MD, Marcos Nores, MD, Mark Rothenberg, MD, and Ziyad M. Hijazi, MD

Cedars-Sinai Medical Center, Los Angeles, CA
Evan Zahn, MD, Saibal Kar, MD, and Raj Makkar, MD

University of Colorado, Aurora Children’s Hospital, Denver, CO
Thomas Fagan, MD and John Carroll, MD
Case #1  SUNDAY, JANUARY 20

Live Case Operators:
Operator: Dr. Alejandro Peirone
Assistant: Dr. Juan Díaz

History:
• 18 year old woman. Asymptomatic. Found to have a murmur recently.

Physical Findings:
• Her weight is 63 kg. Mild II/IV systolic ejection murmur at the upper left sternal border, fixed splitting of the 2nd heart sound.

Pertinent Tests:
EKG:
• SR, incomplete RBBB.

Chest X-ray:
• Mild cardiac enlargement, increased pulmonary vascular markings.

Echo (TEE):
• Moderate size ostium secundum type ASD measuring 13-14 mm, RA and RV enlargement.

Intended Intervention:
• Percutaneous ASD closure using the pfm Nit-Occlud ASD-R device.
Case #2 SUNDAY, JANUARY 20

Live Case Operators:
Operator: Dr. Alejandro Peirone
Assistant: Dr. Juan Díaz

History:
• 8 year old girl. History of recurrent upper respiratory tract infections. Referred recently for evaluation of a heart murmur. Mild exercise intolerance.

Physical Findings:
• Her weight is 28 kg. Grade II/IV systolic ejection murmur best heard at the left medium sternal border radiating superiorly as well as a widely split and fixed S2.

Pertinent Tests:
EKG:
• SR, RBBB with an rsR’ pattern in V1.

Chest X-ray:
• Mild cardiac enlargement, increased pulmonary vascular markings, prominent MPA segment.

Echo (TEE):
• Moderate size ostium secundum type ASD measuring 10-12 mm, RA and RV enlargement.

Intended Intervention:
• Percutaneous ASD closure using the pfm Nit-Occlud ASD-R device.
Live Case Operators:
Operator: Dr. Alejandro Peirone
Assistant: Dr. Juan Díaz

History:
- 7 year old girl. History of recurrent upper respiratory tract infections. Referred recently for evaluation of a heart murmur.

Physical Findings:
- Her weight is 22 kg. Grade III/IV continuous murmur best heard at the upper left sternal border (infraclavicular area). Bounding peripheral pulses. Clear lungs. No hepatomegaly.

Pertinent Tests:
EKG:
- SR, LVH.

Chest X-ray:
- Mild cardiac enlargement (with LAE), increased pulmonary vascular markings.

Echo (TEE):
- Moderate-large size PDA with a minimal lumen diameter (PA end) 3-4 mm, LA and LV enlargement.

Intended Intervention:
- Percutaneous PDA closure using the pfm Nit-Occlud PDA-R device.
Case #1  SUNDAY, JANUARY 20

Live Case Operators:
Dr Tarek Momenah

History:
• 7 year old boy asymptomatic

Physical Findings:
• Well looking boy
• Weight : 23 kg
• Height : 123 cm
• H/R 102/min
• R/R 20 /min
• BP 99/67 mmHg

• Femoral pulses well palpable and good volume
• CVS: Normal heart sounds and soft continuous murmur.
• Chest: Clear

Pertinent Tests:
EKG:
• Normal sinus rhythm

Echo:
• Mod PDA dilated LA and LV

Intended Intervention:
• Transcatheter PDA closure
Case #2  SUNDAY, JANUARY 20

Live Case Operators:
Dr Tarek Momenah

History:
• 45 year old man with history of ROSS procedure done in past at the age of 30 years utilizing a homograft.
• Subsequent F/U shows homograft stenosis and regurgitation with symptoms on exertion
• December 2011, he underwent transcatheter Melody valve implantation.
• Recent follow up showed increased gradient across the Melody valve.
• Fluoroscopy showed stent fracture of melody valve.

Physical Findings:
• Normal pulses and perfusions. Normal heart sounds and no murmur. Chest is clear and no organomegaly.

Pertinent Tests:
EKG:
• Normal sinus rhythm

Chest X-ray:
• Normal

Echo:
• Gradient of 55mmHg across RVOT with mild PI

CT Scan:
• Will be shown in meeting

Intended Intervention:
• Re stent and implantation of second pulmonary valve
Live Case Operators:
Dr Tarek Momenah

History:
• 40 year old woman with history of transient ischemic attacks and brief loss of consciousness twice over the last year. Otherwise, she is healthy.

Physical Findings:
• Normal pulses and perfusions. Normal heart sounds and no murmur. Chest is clear and no organomegaly.

Pertinent Tests:
EKG:
• Normal sinus rhythm

Chest X-ray:
• Normal

Echo:
• TEE positive bubble contrast

Intended Intervention:
• PFO Closure
Case #4  SUNDAY, JANUARY 20

Live Case Operators:
Dr Tarek Momenah

History:
• 10 year old girl S/P ASD, VSD surgical closure. She had surgical Carpentier Edward valve size 19 implantation.

Physical Findings:
• Normal pulses and perfusions. Normal heart sounds and no murmur. Chest is clear and no organomegaly.

Pertinent Tests:
EKG:
• Normal sinus rhythm

Chest X-ray:
• Normal

Echo:
• Moderate pulmonary stenosis, severe pulmonary insufficiency

Intended Intervention:
• Pulmonary valve implantation
**Live Case Operators:**
Dr Tarek Momenah

**History:**
- 11 year old girl diagnosed to have small perimembranous VSD and RPA stenosis.

**Physical Findings:**
- Normal pulses and perfusions. Normal heart sounds and loud systolic murmur. Chest is clear and no organomegaly.

**Pertinent Tests:**

**EKG:**
- Normal sinus rhythm with normal axis

**Chest X-ray:**
- Normal

**Echo:**
- Small restrictive VSD and mild RPA stenosis

**CT angio:**
- Lung Perfusion scan: Rt 30 Lt 60

**Intended Intervention:**
- RPA stenting
Case #6  SUNDAY, JANUARY 20

Live Case Operators:  
Dr Tarek Momenah

History:  
- 10 year old girl with obesity and obstructive sleep apnoea, S/P adrenalectomy, persistent hypernatremia.

Physical Findings:  
- Normal pulses and perfusions. Normal heart sounds and systolic murmur. Chest is clear and no organomegaly.

Pertinent Tests:  
EKG:  
- Normal sinus rhythm, no arrhythmia or block

Chest X-ray:  
- Normal

Echo:  
- Dilated RA and RV dilatation. Trivial TR, Moderate ASD secundum picture still ASD and 4 chamber

Intended Intervention:  
- ASD device closure
Case #7  SUNDAY, JANUARY 20

Live Case Operators:
Dr Tarek Momenah

History:
• 6 month old boy, asymptomatic. Feeding well and gaining weight.

Physical Findings:
• Weight 7 kg. Normal pulses and perfusions. Normal heart sounds and loud systolic murmur at LUSB. Chest is clear and no organomegaly.

Pertinent Tests:
EKG:
• Normal sinus rhythm, left axis and LVH

Chest X-ray:
• Normal

Echo:
• Thickened tricuspid aortic valve leaflet with severe aortic stenosis peak gradient of 63mmHg and mean of 31mmHg, mild LVH and mildly dilated ascending aorta.

Intended Intervention:
• Percutaneous aortic balloon valvuloplasty
Case #8  SUNDAY, JANUARY 20

Live Case Operators:
Dr Tarek Momenah

History:
• 25 year old man with H/O systemic hypertension.
  On antihypertensive medications.

Physical Findings:
• HR 84/min
• BP 160/84 mmHg
• Normal heart sounds and no murmur. Chest is clear
  and no organomegaly.
• Diagnostic cath done shows complete interruption of
  the aorta, after left subclavian.

Pertinent Tests:
CT/MRI:
• Will discuss during the meeting.

EKG:
• LVH

Intended Intervention:
• Transcatheter perforation of atretic aorta
  and tenting of interrupted aortic arch.
Case #9  SUNDAY, JANUARY 20

Live Case Operators:
Dr Tarek Momenah

History:
- 3 year old girl asymptomatic, incidental murmur.

Physical Findings:
- Normal pulses and perfusions. Wide splitting of second heart sounds and ES murmur. Chest is clear and no organomegaly.

Pertinent Tests:
EKG:
- First degree heart block and incomplete RBBB

Echo:
- Fenestrated ASD Picture

Intended Intervention:
- Closure of fenestrated ASD.
Case #10  SUNDAY, JANUARY 20

Live Case Operators:
Dr Tarek Momenah

History:
• 14 year old girl diagnosed recently to have coarctation of aorta. She has H/O systemic hypertension.

Physical Findings:
• Weight : 49 kg
• Height : 150cm
• Weak femoral pulses and perfusions. Normal heart sounds and ESM in interscapular region. Chest is clear and no organomegaly.

Pertinent Tests:
EKG:
• Sinus rhythm, LVH

Echo:
• Coarctation of aorta with gradient of 53 mmHg

Intended Intervention:
• Referred from other hospital for stenting of aortic coarctation.
Case #1  SUNDAY, JANUARY 20

Live Case Operators:
Carlos A.C. Pedra, Rodrigo N. Costa, Marcelo Ribeiro, Wanda Nascimento, and Luis Otávio Santanna

History:
- 28 year old man, Weight: 60 kgs, Height: 1.63 m
- Arterial Hypertension discovered during an orthopedic surgery
- Asymptomatic
- On Enalapril, Diuretics

Physical Findings:
- BP: 150/90
- Diminished pulses inferior limbs
- Mild systolic ejection murmur mid sternal border irradiated to the furcula
- Mild systolic murmur heard in the left inter scapular area at the back

Pertinent Tests:
EKG:
- Sinus rhythm, LVH

Echo:
- Normal LV systolic fxn, Bicuspid aortic valve, CoA with difficult assessment of the local gradient (inadequate suprasternal windows), abnormal Doppler pattern in the DAo with diastolic tail.

CT/MR:
- Not performed

Catheterization (11/12):
- Subatretic CoA with 50 mmHg gradient (pictures)

Intended Intervention:
- CoA stenting using the Large Advanta V12 covered stent under general anesthesia in the new hybrid room with 3D RTA (3 Dimensional Rotational Angiography) capability.
Case #2  SUNDAY, JANUARY 20

Live Case Operators:
Carlos A.C. Pedra, Simone Fontes Pedra,
Rodrigo N. Costa, Marcelo Ribeiro,
Wanda Nascimento, and Luis Otávio Santanna

History:
- 73 year old woman, Weight: 64 kgs, Height: 1.58 m
- Fatigue and dyspnea on exertion for many years
- Hypertension
- On B blockers, ASA, Diuretics, Amlodipine

Physical Findings:
- BP: 150/90
- Mild systolic ejection murmur mid sternal border
- Fixed splitting of the 2nd heart sound with mildly increased pulmonary component

Pertinent Tests:
EKG:
- Sinus rhythm, RVH

Echo (TTE and TEE):
- Normal LV systolic fxn, LV hypertrophy, Abnormal LV diastolic fxn (relaxation), Increased RA and RV, RV systolic pressure estimated at 45-55 mmHg, ASD 19X15 mm shunting L-R

CT/MR:
- Not performed

Catheterization (11/12):
- Normal coronary arteries; PAP: 50/20 (30);
  RA: 10; Ao: 140/90; LV: 140/18; Qp/Qs: 2.3

Intended Intervention:
- ASD closure using a fenestrated Figulla device under general anesthesia and 3D TEE guidance.
Case #1  MONDAY, JANUARY 21

Live Case Operators:
David Nykanen MD and Matthew Schwartz MD

History:
• 9 month old TGA/VSD, juxtaposed RA appendage
• ASO, VSD closure (Complex RVOT reconstruction with homograft as PA bifurcation rightward)
• Post op SVC obstruction asymptomatic
• ASA 20.5 mg daily

Physical Findings:
• Wt: 7 kg, Thriving, 1-2/6 SEM. No DM
• No hepatomegaly or ascites

Pertinent Tests:
LPS : Rt 74%, Lt 2
EKG:
• Sinus, normal axis, borderline LVH
Echo:
• No residual shunt, No RV/LV OTO, Diffuse LPA hypoplasia with flow acceleration, RSVC thrombus, good biventricular function.

Intended Intervention:
• LPA angioplasty / Stent

Case #2  MONDAY, JANUARY 21

Live Case Operators:
David Nykanen MD and Matthew Schwartz MD

History:
• Multiple muscular VSD’s (Large Apical VSD)
• Double orifice mitral valve (No MS/MR)
• PA Band October 18, 2010
• Asymptomatic

Physical Findings:
• Wt: 10 kg, SpO2 99% in Room Air
• 3/6 harsh SEM. No DM
• No hepatomegaly or ascites

Pertinent Tests:
EKG:
• Sinus, RBBB, RVH
Echo:
• Large posterior apical VSD
• Additional small mid to low muscular ventricular septal defects.
• Double orifice mitral valve without stenosis or regurgitation, atypical mitral chordal attachments from the mitral valve extending across the left ventricular outflow tract without LVOTO ventricular outflow tract obstruction, moderate right ventricular hypertrophy, including prominent moderator band without evidence of obstruction. ? LV non compaction.

Intended Intervention:
• Transcatheter closure of VSD
• Surgical removal of PA band
Case #1  MONDAY, JANUARY 21

Live Case Operators:
Darren Berman, MD and Roberto Cubeddu, MD

History:
- A.S. is a 17 year old male born with TOF.
- 2 month old (2/1996; Haas) – Complete repair with transannular patch
- Developmentally delayed, b/l deafness with cochlear implants
- Foster parents, felt to be asymptomatic

Physical Findings:
- HR 90/min, RR 18/min, BP 117/76, O2 Sat 100%, 48.6kg
- HEENT/Neck: Microcephalic, no JVD
- CV: well healed midline sternotomy, dynamic precordium, reg rate, clear S1, single S2, 3/6 to-fro murmur over LUSB
- Ext: warm, 2+pulses in UE and LE, no LE edema

Pertinent Tests:
EKG:
- Normal sinus rhythm, RBBB, QRS duration 145ms

Echo:
- Mild TR – RVp ~34mmHg + RAp
- Mild PS (PSG 27mmHg, mean Doppler gradient 17mmHg)
- Severe PR, with flow reversal in BPA’s
- Moderate-severe RV dilation
- RV function fair to normal (subjective)
- Normal LV function (EF 60%)

MRI:
- Contraindicated due to cochlear implants

Cath (10/2012):
- C.I. 3.5 L/min/m2
- Mild PS
- Severe PR
- Moderate RV dilation

Intended Intervention:
- Trans-catheter pulmonary valve implantation.
Case #2  MONDAY, JANUARY 21

Live Case Operators:
Darren Berman, MD and Roberto Cubeddu, MD

History:
• L.W. 65 year old woman with 6 month history of exertional dyspnea and palpitations referred for CV evaluation.
  • Trans-thoracic echo 10/2012: hemodynamically significant secundum ASD associated with RA/RV enlargement and moderate pulmonary HTN

Co-morbidities:
• Hypothyroidism
• Essential HTN

Physical Findings:
• BP 135/85 mmHg, NSR rate 68/min, RR 18/min, O2 Sat 97%, 209 Lbs
• Obese, African american female, NAD
• HEENT/Neck: no JVD
• CV: RRR, S1, accentuated S2, 2/6 soft parasternal flow murmur
• Ext: warm, 2+pulses, no LE edema, no clubbing
• Neuro: unremarkable

Pertinent Tests:
EKG:
• Normal sinus rhythm, normal QRS and axis, rate 74 bpm

Echo:
• Preserved LV size and function: EF 55%
• Mod-severe dilated RA/ RV chambers
• Mild-mod TR
• Moderate pulmonary HTN
• (RVSP 55mmHg)
• Secundum ASD (Left to right shunting color Doppler)

Pre-op 3D TEE
• Complex multifenestrated secundum ASD with adequate rim margins; largest defect measuring approximately 18-20 mm

Intended Intervention:
• Trans-catheter closure of multifenestrated ASD
Case #1  MONDAY, JANUARY 21

Live Case Operators:
Makram R. Ebeid, MD and Tom Jones, MD

History:
• 18 year old, Truncus arteriosus s/p surgery as an infant in a different state using 12 mm conduit. In 1999 underwent replacement of the RV to PA conduit using pulmonary homograft. Operative note could not be located.

Physical Findings:
• General: Delayed, suggestive of Di George syndrome
• wt. 61 kg, Ht 160 cm BP 113/71
• Chest CTA,
• Active precordium with RV lift
• 3/6 Harsh ejection systolic murmur heard along the entire precordium
• 2/6 early diastolic murmur at the left sternal border
• Liver palpable at the right coastal margin
• He and his grandmother do not want surgery

Pertinent Tests:
EKG:
• NSR, RBBB

Echo:
• Mild truncal valve regurge and mild truncal valve stenosis
• Severe PI; Severe PS (peak Gradient 97 mmhg, mean gradient 61 mmhg)

CT/MR:
• RV volume 74 ml/M2 with moderate RVH, dilated RA severe homograft stenosis and moderate PI.

Intended Intervention:
• Placement of covered stent followed by Melody valve.
University of Mississippi Medical Center, Jackson, Mississippi

**Case #2  MONDAY, JANUARY 21**

**Live Case Operators:**
Makram R. Ebeid, MD and Tom Jones, MD

**History:**
- 6 year old with Tricuspid atresia Type 1A. At age 1 day underwent BAS followed by a B/T shunt. At age 6 months underwent a Glenn procedure with extended post op course requiring multiple indwelling lines. Pre Fontan cath showed mild LPA stenosis which was balloon dilated. At age 3 years he underwent fenestrated Fontan procedure with 16 mm Gortex conduit including a 4 mm fenestration. Previous cardiac catheterizations suspected occluded femoral veins.

**Physical Findings:**
- General: playful NAD
- Wt: 20.3 Kg, ht 105 cm, BP 96/64, sats 90-92 %
- Chest: CTA
- Cardiac: S1 7 S2 Single no murmurs
- Soft abdomen

**Pertinent Tests:**
- Previous cardiac catheterizations suspected mild LPA stenosis and occluded femoral veins.

**EKG:**
- SR LAD

**Echo:**
- Normal LV function
- Laminar flow in the Fontan
- Unable to see LPA well
- Small fenestration

**Intended Intervention:**
- Transhepatic cardiac catheterization
- Assessment of the LPA and the fenestration
- Possibly transhepatic LPA stenting and Fenestration closure
Case #3  MONDAY, JANUARY 21

Live Case Operators:
Makram R. Ebeid, MD and Tom Jones, MD

History:
• 9 year old. TGV, s/p Arterial switch.

Physical Findings:
• Wt: 70.6 kg, Ht: 152 cm, BP: 117/63
• Chest CTA, 3/6 medium pitch long ejection systolic murmur heard along the left chest.

Pertinent Tests:
EKG:
• NSR

Echo:
• Mild – moderate supra PS and LPA stenosis gradient 79 mmhg.

CT/MR:
• Moderate long segment LPA stenosis

DOPPLER of Femoral Vessels:
• Occluded femoral vessels

Intended Intervention:
• Transhepatic stenting of LPA
Case #1  TUESDAY, JANUARY 22

Live Case Operators:
Robert Cubeddu, MD, Marcos Nores, MD, Ziyad Hijazi, MD, Mark Rothenberg, MD, Larry Lovitz, MD, Arvind Kapila, MD, and Lance Lester, MD

History:
• 88 year old male with critical aortic stenosis + CHF
  NYHA III
• High risk / high frailty index
• Moderate pulmonary HTN

Co-morbidities:
• History of prostate CA
• Essential HTN
• COPD
• CHF
• Hyperlipidemia

Physical Findings:
• BP 128/66 mmHg, NSR rate 68/min, RR 18/min, O2 Sat 97%
• Frail elderly male
• HEENT/Neck: no JVD
• CV: RRR, 3/6 high pitch SEM with soft S2.
• Ext: warm, 1+ pitting edema
• High frailty index

Pertinent Tests:
EKG:
• Normal sinus rhythm, RBBB, rate 74 bpm

Echo:
• Preserved LV size and function: EF 55%
• Critical AS: AVA 0.8cm2; mean gradient 41mmHg, Vmax 4.1m/s
• Moderate MR
• Moderate pulmonary HTN

Labs:
• Normal serum creatinine and Hb
**Case #1**  TUESDAY, JANUARY 22

**Intended Intervention:**
- Trans-femoral TAVR (Edward Sapien Valve)

<table>
<thead>
<tr>
<th>Anulus Diameter Measurement</th>
<th>THV Valve Size Proposed</th>
<th>Femoral Access Side Proposed for TF Only or TA</th>
<th>Smallest Vessel Diameter Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.8 mm</td>
<td>26</td>
<td>TF</td>
<td>9.3 mm</td>
</tr>
</tbody>
</table>
Cedars-Sinai Medical Center, Los Angeles, California

Case #1 TUESDAY, JANUARY 22

Live Case Operators:
Saibal Kar, MD, Evan Zahn, MD, Mamoo Nakamura, MD, Takashi Matsumoto, MD, Wen-loong Yeow, MD, and Asma Hussaini, PA

History:
• 65 year old man presented with symptomatic atrial fibrillation failed chemical cardioversion requiring DC cardioversion. Not candidate for anti-coagulation as hematemesis due to a bleeding gastric ulcer on endoscopy.

Past History:
• MitraClip procedure for mitral valve prolapse (2006 & 2010)
• Paroxysmal atrial fibrillation (since 2009)

Pertinent Tests:
TTE:
• MR grade = 1+
• LVED d/s = 56/39 mm
• EF = 58%
• Six-year follow-up TTE of MitraClip procedure showed trivial MR with normal LV systolic function.

Intended Intervention:
• Percutaneous left atrial appendage suture ligation with the LARIAT Device.
Case #2  TUESDAY, JANUARY 22

Live Case Operators:
Saibal Kar, MD, Evan Zahn, MD, Mamoo Nakamura, MD, Takashi Matsumoto, MD, Wen-loong Yeow, MD, and Asma Hussaini, PA

History:
• 72 year old male with chronic atrial fibrillation on Pradaxa requiring ventriculoperitoneal shunting for hydrocephalus with some improvement of ataxia following high volume spinal tap.

Past History:
• Hypertension
• Sleep apnea – CPAP
• Hypercholesterolemia
• Benign prostatic hyperplasia

Intended Intervention:
• Percutaneous left atrial appendage suture ligation with the LARIAT Device.
PICS-AICS 2013

PEDIATRIC AND ADULT INTERVENTIONAL CARDIAC SYMPOSIUM

Cedars-Sinai Medical Center, Los Angeles, California

Case #3  TUESDAY, JANUARY 22

Live Case Operators:
Saibal Kar, MD, Evan Zahn, MD, Mamoo Nakamura, MD, Takashi Matsumoto, MD, Wen-joong Yeow, MD, and Asma Hussaini, PA

History:
• 50 year old male with cardiac murmur since childhood increasing fatigue but remains active at work as a mechanic.

Past History:
• Smoker

Pertinent Tests:
• LVEF 66%
• Severely dilated RV 5.4cm
• TR trivial
• PA pressure 24mmHg

Intended Intervention:
• Secundum ASD closure
Case #1  TUESDAY, JANUARY 22

Live Case Operators:
Thomas E. Fagan, MD, Brian Fonseca, MD, Uyen Truong, MD, and Osamah Aldoss, MD

History:
- 7 year old female with a history of syncope and pre-syncope. 4 months ago an echocardiogram revealed an anomalous connection between the LUPV and left innominate vein.

Physical Findings:
- Wt: 29.9 kg; RA Saturation: 97%; Normal precordium, Normal S1 and widely split S2 but varies with respiration. No murmurs.

Pertinent Tests:
EKG:
- Sinus rhythm with RAD and RBBB.

Echo:
- The left upper pulmonary vein drains anomalously to a vertical vein, which drains into the innominate vein. Otherwise normal segmental cardiac anatomy. Normal biventricular size and systolic function.

MR:
- Impression: Normal pulmonary venous connections with partial anomalous drainage from the LUPV (white arrowhead) to a vertical vein (white arrow) to the innominate vein (yellow arrow). (Qp:QS 1.6 :1). Mildly dilated right ventricle with normal systolic function (EF 53%). Normal left ventricular size (LVEDV 69.53ml/m2) with normal systolic function (EF 55%).

Intended Intervention:
- HeartNavigator (MR image registration and road-mapping) guided occlusion of anomalous vertical vein.
Case #2  TUESDAY, JANUARY 22

Live Case Operators:
Thomas E. Fagan, MD, John Carroll, MD,
Robert Quaiff, MD, Ernesto Salsedo, MD,
Bruce “Biff” Landeck, MD, and Osamah Aldoss, M.D.

History:
- 9 year old female with a history of PA/VSD, discontinuous PA’s, and right aortic arch. The RPA is diminutive and multiple attempts at unifocalization have failed. In 3/03 she underwent RV transannular patch and left BT shunt, 3/27/03 she had direct aorta to LPA shunt. In 11/03 RV to LPA conduit and takedown of BT shunt. On 2/2/05 RV to LPA conduit revision with pulmonary homograft and fenestrated VSD closure (5mm). 12/06 she had LPA stent placement. Cardiac cath 10/15/12 revealed systemic RV pressure with bidirectional flow at fenestration and baseline Qp:Qs 0.75; conduit and LPA (fractured LPA stent) stenosis; post conduit and LPA stent – RV pressure decreased to 66% systemic and Qp:Qs increased to 1.5.

Physical Findings:
- Wt: 23 kg; RA Sat: increased from 85% to 95%; Grade III/VI medium pitched holosystolic murmur LLSB; Grade III/VI medium pitched systolic murmur LUSB radiating throughout precordium; Grade II/VI medium pitched decrescendo diastolic murmur LLSB.

Pertinent Tests:
EKG:
- Sinus rhythm with RBBB.

Echo:
- Estimated RV pressure 60 mmHg; Gradient across RV-PA conduit of 55 mmHg; Left-to-right shunt at fenestrated VSD with gradient of 50 mmHg.

Intended Intervention:
- EchoNavigator (registered 3D TEE images) guided fenestrated VSD closure to help relieve volume load and pulmonary vascular damage.
ORAL AND POSTER ABSTRACT SCHEDULES
ORAL ABSTRACT SCHEDULE

SATURDAY, JANUARY 19
2:00 AM-3:30 PM

AMERICANA 1 & 2, LEVEL 2
Moderators: Tom Forbes, John Rhodes, and Julie Vincent

2:00-2:09 PM
Prospective Randomized Trial of Transthoracic vs Transesophageal Echocardiogram for Definitive Assessment and Guidance of Transcatheter Closure of ASD in Children using the Amplatzer® Septal Occluder.
Sergio Bartakian  O-1

2:10-2:19 PM
More Acute Angle of Approach Identifies Patients Who Benefit From Hybrid Transapical Placement of Transcatheter Pulmonary Valve.
Michael D. Seckeler  O-2

2:20-2:29 PM
Improved Outcomes in HLHS with Restrictive Atrial Septum, a Single Institution Experience.
Alejandro Torres  O-3

2:30-2:39 PM
NuMED Covered Cheatham-Platinum Stent (CCPS) for the Treatment of Right Ventricle to Pulmonary Artery (RV-PA) Conduit Disruption During Transcatheter Pulmonary Valve Replacement (TPVR).
Ram Bishnoi  O-4

2:40-2:49 PM
Risk Factors of Significant Adverse Events in Adults Undergoing Cardiac Catheterization in Pediatric Catheterization Laboratories — Congenital Cardiovascular Interventional Study Consortium (CCISC).
Daisuke Kobayashi  O-5

2:50-2:59 PM
Success of Balloon Angioplasty for Recurrent Coarctation in Neonatal Univentricular and Biventricular Norwood-Type Arch Reconstructions.
Wendy Whiteside  O-6

3:00-3:09 PM
Transcatheter Interventions in Post Fontan Patients – A 24 Years Single Centre Experience.
Vikram Kudumula  O-7

3:10-3:19 PM
The Flow Detection System, a Novel Technique to Detect Cardiac Right to Left Shunts.
Mark Reisman  O-8

3:20-3:29 PM
Eighteen Year Experience with Bronchial Casts and Protein Losing Enteropathy.
Bharat Ramchandani  O-9

(O-# represents listing order in syllabus)
ORAL ABSTRACT SCHEDULE

SATURDAY, JANUARY 19
4:00 AM-6:00 PM

AMERICANA 1 & 2, LEVEL 2
Moderators: Michael Tynan, Richard Ringel, and Jonathan Rome

4:00-4:09 PM
Use of Ultra-High Pressure Balloon Angioplasty for Resistant Vascular Stenosis in Congenital Heart Disease.
Ryan Callahan O-10

4:10-4:19 PM
Congenital Multicenter Trial of Pulmonic Valve Regurgitation Studying the SAPIEN Transcatheter Heart Valve (COMPASSION): One-year follow-up.
Damien Kenny O-11

4:20-4:29 PM
Transcatheter Device Closure of Atrial Septal Defects in Patients Weighing < 10 Kg is Safe and Effective.
Joanne Chisolm O-12

4:30-4:39 PM
Radiofrequency Perforation in Pulmonary Atresia and Intact Ventricular Septum: A Single Center Experience.
Benjamin Auld O-13

4:40-4:49 PM
Intentional Stent Fractures in Structural Heart Disease: When Breaking the Chains is the Only Way!
Mehul Patel O-14

4:50-4:59 PM
A Novel Biodegradable Stent for Use in Congenital Heart Disease: Mid Term Results in a Rabbit Model.
Surendranath R. Veeram Reddy O-15

5:00-5:09 PM
Diagnostic Utility of 3-Dimensional Rotational Angiography in Pediatric Cardiac Catheterization.
Osamah Aldoss O-16

5:10-5:19 PM
Medium-to-Long Term Outcomes of Percutaneous Transcatheter Closure of Congenital Ventricular Septal Defects.
Kiran Mallula O-17

5:20-5:29 PM
Occlutech Duct Occluder – Initial Human Experience.
Mazeni Alwi O-18

5:30-5:39 PM
Feasibility of Dilation of Homograft RV to PA Conduits Beyond Their Native Diameter: Implications for Conduit Stenting and Placement of Percutaneous Pulmonary Valves.
Aimee Liou O-19

5:40-5:49 PM
Transcatheter Embolization of Aortopulmonary Collaterals using the Trufill n-Butyl Cyanoacrylate (n-BCA) Liquid Embolic System.
Joseph Casadonte O-20

5:50-5:59 PM
Practical Evaluation of a New Left Atrial Appendage Occluder (Lifetech LAmbre Device in a Canine Model).
Yat-Yin Lam O-21

(O-# represents listing order in syllabus)
P-1 Percutaneous Balloon-Expandable Covered Stent Implantation for Treatment of Traumatic Aortic Injury in Children and Adolescents. **Bryan Goldstein**

P-2 Altered Right Ventricular Diastolic Function in Children with Unrepaired Ventricular Septal Defect. **Gretel Monreal**

P-3 Transcatheter Closure of PDAs at the Seriously Ill Premature Babies. **Osman Baspinar**

P-4 Report a Case of Percutaneous Occlusion of Antegrade Pulmonary Blood Flow in Post Operative Bidirectional Cavo Pulmonary and Pulmonary Artery Banding. **Denoel M. Oliveira**

P-5 Intermediate And Longterm Follow-Up after Patent Ductus Arteriosus Closure With Amplatzer Device. **Tharak Yarrabolu**

P-7 Partial Anomalous Pulmonary Venous Return into the IVC in a 28-Year-Old Woman: A Variant of Scimitar Syndrome Amenable to Interventional Treatment. **Heike Schneider**

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ABSTRACTS

Oral and Poster Presentations

Pediatric & Adult Interventional Cardiac Symposium (PICS/AICS 2013)

January 19-22, 2013
Miami, FL
O-1
PROSPECTIVE RANDOMIZED TRIAL OF TRANSTHORACIC VS. TRANSESOPHAGEAL ECHOCARDIOGRAM FOR DEFINITIVE ASSESSMENT AND GUIDANCE OF TRANSCATHETER CLOSURE OF ASD IN CHILDREN USING THE AMPLATZER® SEPTAL OCCLUDER

Sergio Bartakian, Howaida El-Said, John Moore, University of California, San Diego; San Diego, CA, USA

Objective: To determine whether TTE can provide safety and efficacy equivalent to TEE for assessment and guidance of transcatheter ASD occlusion using the Amplatzer septal occluder (ASO) in pediatric patients.

Background: Most centers currently employ TEE for definitive ASD assessment and guidance of transcatheter ASD occlusion with the ASO.

Methods: A prospective randomized trial of ASD closure using the ASO from March 2008 to April 2012. Key inclusion criteria were: isolated secundum ASD, age 2-18 years, and adequate TEE windows. Forty patients were enrolled and randomized to either TEE or TTE. In the TEE group, we used conventional ‘stop flow’ balloon sizing. In the TTE group, we used the average ASD diameter from three standard views times 1.2 to determine device size. Baseline and follow-up (1-2 days, 1 month, and 6-12 months) ECGs, TTEs, and examinations were obtained for all patients.

Results: Patient general and hemodynamic characteristics were similar in both groups. Procedural success was 100% in both groups. The average TEE stop flow diameter was similar to the scaled TTE diameter (15.35 ± 4.62 vs. 16.57 ± 5.47 mm; P = 0.46). Device size (16.0 ± 4.94 vs. 16.37 ± 5.05 mm; P = 0.82) and ratio of device to defect size (1.0 ± 0.06 vs. 0.99 ± 0.03; P = 0.52) were also similar. Total fluoroscopy (13.6 ± 6.17 vs. 8.9 ± 8.45 min; P = 0.007), procedure (70.6 ± 22.98 vs. 51.1 ± 17.61 min; P = 0.005), and room (126.8 ± 28.41 vs. 95.7 ± 20.53 min; P = 0.0004) times were all significantly shorter in the TTE group. Neither group had significant procedural complications or in follow-up. Rates of shunt resolution were also similar.

Conclusions: Our findings suggest that the use of TTE is as efficacious and safe as TEE for assessment and guidance of ASD occlusion using the ASO. Reduced fluoroscopy time appears to be a safety advantage of TTE. TTE may also reduce costs because of lower requirements for laboratory time and ancillary staff.

O-2
MORE ACUTE ANGLE OF APPROACH IDENTIFIES PATIENTS WHO BENEFIT FROM HYBRID TRANSCAPILLARY PLACEMENT OF TRANSCATHETER PULMONARY VALVE

Michael D. Seckeler,1 D. Scott Lim,2 1Cincinnati Children’s Hospital Medical Center, Cincinnati, OH, USA, 2University of Virginia Health Systems, Charlottesville, VA, USA

Background: While transcatheter pulmonary valve implantation has allowed many patients with previous surgical palliation of congenital heart lesions to undergo minimally invasive procedures for valve replacement, some may have anatomical issues which make valve implantaion difficult or impossible from a transvenous approach. Hybrid techniques allow a cardiac surgeon to provide novel access routes so the interventional cardiologist can safely implant a pulmonary valve in patients with challenging anatomy.

Methods: In the previous 12 months, 25 patients have undergone implantation of a Melody® percutaneous pulmonary valve (Medtronic, Minneapolis, MN) at the University of Virginia, and three of these have been via a hybrid, transcapillary approach. Angles of approach (inferior vena cava-to-tricuspid valve and tricuspid valve-to-ventricular apex) were measured from coronal imaging of the right ventricular inflow, body and outflow tract from preprocedural cardiac MRI, or CT scans and compared between patients undergoing transvenous and hybrid Melody® valve placement using Mann–Whitney U test. ROC curve was used to test the sensitivity and specificity of angle of approach for identifying patients undergoing hybrid Melody® placement.

Results: Hybrid patients had a lower weight (38 vs. 77 kg, P = 0.04) and longer median postprocedure length of stay (3 vs. 1 day, P < 0.001). There were similar procedural complication rates (33 vs. 11%, P = NS) and right ventricular outflow tract gradients by Doppler echocardiography on final follow-up (25 vs. 31 mm Hg, P = NS). Preprocedure coronal images were available for all hybrid patients and six transvenous patients. There was a trend toward a smaller total angle of approach in the hybrid patients (102.5° vs. 121.7°, P = 0.07). ROC analysis using a total angle of approach <106° gave an AUC of 0.889 (P = 0.07), a sensitivity of 100%, and specificity of 67%.

Conclusions: Our findings suggest that a smaller total angle of approach on preprocedural CT or MRI scans may predict the need for a hybrid pulmonary transvenous approach for Melody® valve placement. Identifying appropriate patients for hybrid placement will improve the chances of a successful procedure.

O-3
IMPROVED OUTCOMES IN HLHS WITH RESTRICTIVE ATRIAL SEPTUM, A SINGLE INSTITUTION EXPERIENCE

Alejandro Torres, Tasneem Hoque, Marc Richmond, Emile Bacha, Julie Vincent, Children’s Hospital of New York Presbyterian, New York, NY, USA

Background: Survival of HLHS patient has improved over time. However, mortality in those with a restrictive atrial septum (HLH-RS) remains high. We report outcomes and impact of neonatal intervention on HLH-RS at our institution.

Methods: All newborns with HLHS from January 2003 to December 2010 were included. Patients who underwent catheterization for LA decompression <72 hr of life were classified as HLH-RS. Patients without a restrictive atrial septum (HLH-NRS) formed the control group.

Results: Of 141 patients diagnosed with HLHS, 20 (14%) presented with a restrictive atrial septum. Catheterization was performed <24 hr in 10 patients (50%), between 24 and 48 hr in eight (40%), and 48–72 hr in two patients. Initial mean septal gradient (MSG) by Doppler was 17.5 ± 5 mm Hg. In 12/20 patients (66%), MSG was the sole indication for intervention. Access to LA was achieved in 19/20 patients via native PFO in 7 patients and by creation of atrial communication in 12 patients. RF was used in eight patients, RF followed by transseptal needle in three, and transseptal needle alone in one patient. Static balloon septoplasty was used in 10 patients, septal stenting in 8, and traditional septostomy in 1 patient. Procedure was successful in 17/20 (84%) with a drop in mean LA pressure from 21 ± 6 mm Hg to 11 ± 3 mm Hg (P < 0.001) and in MSG to 5.2 ± 4 mm Hg (P < 0.001). Residual MSG was similar regardless of intervention type. No patient required re-intervention before Norwood. The procedure was unsuccessful in three patients (inability to cross atrial septum in one, stent dislodgement in one, and no change in LA pressure post-septoplasty in one patient). Serious complications occurred in only 2 patients (stent dislodgement and pericardial effusion). No procedural deaths occurred. Median follow-up was 36 months (0.4–104). Initial hospitalization survival was 16/20 (80%) for the HLH-RS group and 114/121 (94%) for the HLH-NRS (P = 0.028). Twenty of 141 patients (14%) were lost to follow-up and 9 (6%) underwent heart transplant. Overall survival was 10/16 (62%) for HLHS-RS patients and 77/95 (81%) for HLH-NRS (P = 0.1). Survival after initial discharge was 30/35 (86%) for HLH-RS and 77/85 (90%) for HLH-NRS patients (P = 0.67). No predictors for HLHS-RS outcome were identified.
Conclusion: Neonatal mortality in HLH-RS has improved but remains higher than HLH-NRS. However, survival is similar after discharge from initial hospitalization. Balloon septoplasty and septal stenting are equally effective in LA decompression for HLH-RS patients.

O-4
NUMED COVERED CHEATHAM-PLATINUM STENT FOR THE TREATMENT OF RIGHT VENTRICLE TO PULMONARY ARTERY CONDUIT DISRUPTION DURING TRANSCATHETER PULMONARY VALVE REPLACEMENT

Ram Bishnoi, Allen Everett, Richard Ringel, Johns Hopkins University, Baltimore, MD, USA

Introduction: On January 25, 2010, the Melody transcatheter pulmonary valve (TPV) was approved for replacement of the pulmonary valve for patients with CHD, who have dysfunctional right ventricle to pulmonary artery conduits. RV-PA homograft conduits are frequently calcified and rigid. Dilation of these conduits prior to transcatheter pulmonary valve replacement (TPVR), poses a significant risk of conduit tearing or rupture. The covered Cheatham-platinum stent (CCPS) has been used in the Prevention or Treatment of Aortic Wall Injury trial in coarctation of the aorta (COAST II) with excellent results. There were 650 Melody valve implant procedures and 23 CCPS were implanted under emergent percutaneous (EU) or compassionate use (CU) conditions into RV-PA conduits during Melody valve implant procedures for an estimated occurrence of 3.5%.

Aims: The aim of this study is to retrospectively assess the effectiveness and safety of the CCPS for treating RV-PA conduit disruption and preventing the development or worsening of rupture into the mediastinum during additional enlargement of the conduit.

Methods: Data regarding 50 CCPS implants during TPVR procedures (48 Melody and 2 Edwards Sapien valves) were retrospectively reviewed from multiple institutions around the country. Catheterization records and 6 months follow-up visit data were collected. Outcomes of the valve implant associated with CCPS use were compared to the reported effectiveness and safety of the valve implants reported in the original pivotal trial.

Results: From September 2009 (September 17, 2012) to July 2012 (July 17, 2012), 50 patients received CCPS during TPV implant procedure (16 for CU and 34 for EU). Patient age ranged from 5.5 to 56 years (mean 21.4 ± 3.7 years). Forty-one patients had pulmonary or aortic homografts, four had Hancock conduit, two had Contegra conduit, one had Medtronic mosaic valve, and the remaining two patients had no conduit (native RVOT). Conduit size ranged from 14 to 27 mm (21.1 ± 3.7 mm). Thirty-five patients had mixed disease and the remaining 15 had isolated conduit stenosis. The mean preintervention minimum angiographic conduit diameter ranged from 4 to 16.81 mm (10.4 ± 3.3). Nine patients had pre-existing tears, 30 patients developed tears after performing conduit dilation and three developed tears after TPV implantation and for the remaining seven patients the CCPS was used prophylactically. Average largest balloon size used for dilation prior to tear recognition ranged from 12 to 22 mm (18.4 ± 2.4). The average ratio of the largest balloon prior to conduit tear to minimum conduit diameter ranged from 1.15 to 3.5 (1.9 ± 0.57). The average ratio of the largest balloon to initial conduit diameter increased from 0.6 to 1.3 (0.91 ± 0.17). Conduit tears were repaired or prevented by covered stents in 49 out of 50 patients. A total of 69 covered stents were used (single CPSS for 33 patients, two each for 15 patients and three each for the remaining two). CCPS were implanted through the newly implanted Melody valve in two patients and effectively sealed the rupture, but they required another Melody valve implantation for valve incompetence. The mean preimplant peak-to-peak RVOT gradient ranged from 19 to 110 mm Hg (45.5 ± 17.5) compared to 0–30 mm Hg (10.6 ± 6.3) postimplant. No CCPS related complications were reported. On echo at 6 months, peak Doppler RVOT gradient ranged from 11 to 40 mm Hg (22.7 ± 8.4) and mean gradient 4–20 mm Hg (12.86 ± 5.0). Average Doppler mean gradient was 22.4 ± 8.1 mm Hg at 6 months follow-up in original pivotal trial compared to 12.86 ± 5.0 mm Hg in this study. Valve competence was maintained during the follow-up, with 94% of patients having no/trivial PR, which is comparable to the original pivotal trial (93%).

Conclusions: In this retrospective multicenter review, the CCPS was successful on all attempts in preventing or treating RV-PA conduit disruption occurring during TPV implant procedures without complication and without negatively impacting the function of the transcatheter valve. The postimplantation RVOT gradient and the follow-up Doppler peak and mean gradients were comparable to the results in the original pivotal Melody valve trial. Prospective study of this use of the CCPS will help to confirm its benefits and hopefully inform us as to when prophylactic covered stent implantation should be considered.

O-5
RISK FACTORS OF SIGNIFICANT ADVERSE EVENTS IN ADULTS UNDERGOING CARDIAC CATHETERIZATION IN PEDIATRIC CATHETERIZATION LABORATORIES—CONGENITAL CARDIOVASCULAR INTERVENTIONAL STUDY CONSORTIUM

Daisuke Kobayashi,1 David Nykanen,2 Wei Du,1 Thomas Forbes,1 Children’s Hospital of Michigan, Detroit, MI, USA, 2Arnold Palmer Medical Center, Orlando, FL, USA

Background: Patients with congenital heart disease increasingly survive into adulthood and cardiac catheterization plays an important role in their management. The current practice of cardiac catheterizations on adults with congenital heart disease in pediatric catheterization laborator-ies (PCL) has not been well described.

Objective: We sought to describe demographic and procedural data, significant adverse events (SAE), and assess the predictors of SAE in adults undergoing cardiac catheterization in PCL, utilizing a multi-institutional database.

Method: Data were prospectively collected using a multcenter registry congenital cardiovascular interventional study consortium (CCISC). The demographic, procedural, hemodynamic data, and SAE were collected. Predictors of SAE were assessed by univariate and multivariate analysis.

Results: Among 11,489 registered patients from 17 centers between 2008 and June 2012, 2,341 adults (20.4%) were identified with a mean age of 37.3 years (sd = 16.0). The incidence of SAE was 3.6% in adults, compared to 6.8% and 2.4% in children aged <1 year and 1–18 years (P < 0.001), respectively. In univariate analysis, age, weight, inotropic support, procedure type, physiologic score, airway status, systemic illness, ASA status, and general anesthesia were correlated with SAE. Final multivariable model includes age ≥ 50 years (odds ratio [OR] = 1.826, P = 0.012), ventilator use (OR = 4.059, P = 0.015), systemic illness (OR = 2.120, P < 0.001), and general anesthesia (OR = 1.776, P = 0.012). Patients with SAE were more likely to have incomplete planned procedure, longer procedure time, fluoroscopy time, and extended length of stay.

Conclusion: Adults undergoing cardiac catheterization in PCL had the higher incidence of SAE than children but lower incidence than infants. Older age, ventilator use, systemic illness, and general anesthesia were highly correlated with significant adverse events in adults undergoing in PCL.

O-6
SUCCESS OF BALLOON ANGIOPLASTY FOR RECURRENT COARCTATION IN NEONATAL UNIVENTRICULAR AND BIVENTRICULAR NORWOOD-TYPE ARCH RECONSTRUCTIONS

Wendy Whiteside, Jennifer Hirsch-Romano, Sunkyung Yu, Aimee Armstrong, University of Michigan, C.S. Mott Children’s Hospital, Ann Arbor, MI, USA

Objectives: The aim of this study was to determine the success of balloon angioplasty (BA) in relief of recurrent coarctation in both single
ventricle (SV) and two ventricle (2V) patients following Norwood-type arch reconstructions.

Background: A Norwood-type arch reconstruction (NTAR), patch augmentation of the aorta using cardiopulmonary bypass, has been utilized at our center for 2V patients with a diffusely hypoplastic aortic arch and for all SV patients undergoing a Norwood procedure (NP). While the incidence of recurrent coarctation and the use of BA in 2V patients following the NP have been well cited, its application in the 2V population following NTAR is not known.

Methods: Neonates who underwent a NP or a NTAR at the University of Michigan Congenital Heart Center between January 2000 and December 2010 were retrospectively reviewed, and patients with recurrent coarctation requiring intervention were identified.

Results: A NP was performed in 366 patients and a NTAR was performed in 88 patients. Thirty-five SV patients (9.6%) and 17 2V patients (19.3%) required intervention for recurrent coarctation, and all but two of these patients had BA as the primary intervention. Median time from initial surgery to first intervention was 0.5 (IQR 0.1–1.2) years. BA was successful in 22 SV patients (71%) and 10 2V patients (71%) with reduction in peak systolic ejection gradient by 83% in SV and 77% in 2V patients. Of the procedural characteristics evaluated, higher initial peak-to-peak gradient (P = 0.04), location of coarctation proximal to the left subclavian artery (P = 0.02), and smaller diameter of the descending aorta at the diaphragm (P = 0.03) were associated with balloon failure. Freedom from subsequent re-coarctation in all patients following balloon angioplasty was 85% at 1 month, 74% at 1 year, and 71% at 5 years.

Conclusions: While the incidence of recurrent coarctation in 2V patients following NTAR is greater, the use of BA in 2V patients following NTAR has similar success to that in SV patients following the NP and should continue to be considered in this patient population.

Conclusion: Transcatheter interventions after Fontan surgery are an integral part in the postoperative management of early and late Fontan complications.

O-8

THE FLOW DETECTION SYSTEM, A NOVEL TECHNIQUE TO DETECT CARDIAC RIGHT TO LEFT SHUNTS

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Background: The Flow Detection System (FDS) (Cardiox Corporation, Seattle, WA) is designed to detect right-to-left cardiac shunts (RLS) (e.g., patent foramen ovale (PFO)). FDS enables a rapid minimally invasive technique with an integrated and automated measured Valsalva process and requires neither operator interpretation nor patient sedation. FDS procedure includes a practice Valsalva step, during which the patient is provided coaching by the device through visual feedback. During the actual procedure, the sufficiency and duration of the Valsalva pressure generated, as well as the sufficiency of the release, are measured to assure that only those procedures with an effective Valsalva maneuver are valid. FDS also employs a fluorocing indicator dye, indocyanine green (ICG) (Pulsion Medical Systems AG, Munich, Germany), given via intravenous injection, and time-synched by the system, which is measured by non-invasive spectroscopic sensors on each ear. The ICG dye arrival time and magnitude is measured by the FDS device, which determines whether the dye arrives in a single bolus, or in the case of an abnormal circulatory pathway, (e.g., RLS), in two stages, in which case the relative amount of dye that arrived through the abnormal pathway is compared to the relative amount of dye that traveled through the normal pathway, to produce the novel Shunt Conductance Index (SCI). The SCI reflects the percentage of volume in the right side of the heart that transits the shunt during the Valsalva maneuver. FDS evaluation typically takes 15–20 min to complete and can be performed in the clinic or office setting by a single clinician that need not be a physician. Total time commitment for the patient is about 30 min. TEE is typically performed in the hospital setting, requires multiple clinicians (including an MD), sedation or anesthesia and takes about 1 hr to complete.

Methods: This was a multicenter, non-randomized clinical trial for comparison of three diagnostic tests for the detection of RLS. Power M-mode transcranial Doppler (TCD) and FDS tests were conducted sequentially during the same appointment on subjects who previously underwent or were scheduled to undergo TEE with bubble study evaluation. Subjects were selected from a pool of candidates who either had closure of a known PFO and were receiving follow-up care or had PFO evaluation and returned to the clinic to participate in a confirmatory clinical trial. TEE results fell into two categories: negative results, defined as no bubbles detected crossing into the left atrium (LA), and positive results, with at least one bubble detected in the LA. TCD results were categorized as negative if the Spencer grade was 0, I, or II, or positive if the Spencer Grade was III–V. Considering TEE as the gold standard for statistical comparison, the sensitivity, specificity, positive and negative predictive values, and accuracy of FDS were assessed; FDS was also compared with TCD to determine the positive and negative percent agreement, positive and negative predictive values, and accuracy.

Results: Data were analyzed using two groups, FDS vs. TEE (n = 43) and FDS vs. TCD (n = 44).

Conclusions: FDS provides excellent sensitivity and specificity relative to TEE and TCD in the detection of abnormal circulatory pathways such as PFO, is significantly less invasive for the patient than TEE, and assures satisfactory Valsalva performance without the need for specially trained personnel.
EIGHTEEN YEAR EXPERIENCE WITH BRONCHIAL CASTS AND PROTEIN LOSING ENTEROPATHY

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Objective: To review the incidence and our clinical experience with bronchial casts (BC) and protein losing enteropathy (PLE) in congenital heart disease (CHD).

Methods: Retrospective case notes review and data analysis of patients with CHD who developed BC or PLE between 1994 and 2012.

Patients: Between 1994 and 2012, 14 patients with univentricular circulation developed Fontan failure either in the form BC (N = 6) or PLE (N = 8). Additionally, one patient had undergone a 1.5 type repair (N = 1) and developed PLE thereafter. The median time to development of BC and PLE was 3.7 years and 1.5 years, respectively, post their last cardiac surgery. All patients underwent cardiac catheterization. Eleven patients underwent Fontan fenestration stenting (five for BC and six for PLE). Seven patients required de novo fenestration creation using the Brockenborough needle. Five patients with PLE were on optimal medical management pre-catheter intervention.

Results: In patients with BC, the Fontan pressure was reduced by a mean of 2.4 mm Hg and there was complete resolution of symptoms in all patients at a mean interval of 3.5 months post-fenestration stenting. One patient with severe BC arrested during the diagnostic catheterization secondary to acute airway occlusion. In the PLE group, there was symptom resolution in three patients with normalization of biochemical markers and symptom improvement in one patient post-fenestration stenting at median interval of 10 (9–15) months. In the other two patients who had fenestration stenting there was no improvement leading to death in one and cardiac transplantation in the other. One patient with PLE had satisfactory hemodynamics and responded to medical therapy alone. In two other patients with PLE surgical intervention was required to address hemodynamic abnormalities leading to complete resolution of PLE.

Conclusion: BC and PLE are life threatening complications in CHD especially in the Fontan circulation. Aggressive therapy with transcatheter fenestration creation and stenting and appropriate medical management may induce remission in a significant proportion of patients.

USE OF ULTRA-HIGH PRESSURE BALLOON ANGIOPLASTY FOR RESISTANT VASCULAR STENOSIS IN CONGENITAL HEART DISEASE

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Background: Vascular stenosis, either congenital or acquired, is seen within a wide spectrum of congenital heart morphologies causing significant morbidity/mortality. Transcatheter approaches include balloon angioplasty (BA) using low pressure (LP, ≤8 atm), high pressure (HP; ≥8–18 atm), ultra-high pressure (UHP; >18 atm), and cutting balloon (CB) angioplasty as well as stent implantation (SI). CB angioplasty and SI do increase success rate, but many lesions cannot be stented and CB angioplasty is limited by size to <8 mm. Data are limited regarding the safety and efficacy of UHP BA. Thus, this study evaluates the safety and efficacy of UHP BA at Children’s Hospital of Pittsburgh.

Methods: Retrospective review of all consecutive patients (N = 72) who underwent BA using balloons expandable to UHP, between January 3, 2006, and January 3, 2010, was performed. Success of each individual BA was defined as resolution of waist. Procedural success of each lesion was defined as an increase in vessel diameter ≥50%. Comparison of means was performed using unpaired t-tests.

Results: Four hundred-twenty-seven angioplasties were performed on 164 stenotic lesions, including branch pulmonary arteries, surgical grafts, systemic veins, pulmonary veins, and coarctation of aorta. Waist resolution was 66% (29/44) for LP, 81% (21/26) for CB, 71% (149/210) for HP, and 67% (99/147) for UHP. For all non-UHP BA (≤18 atm) waist resolution was 71% (199/280) which is not a statistically significant difference compared to UHP (P = 0.8). Of the 164 lesions, 85 included UHP (alone, or after other balloons) and achieved procedural success in 67% (57/85). Success when no UHP was used was 52% (41/79), P = 0.051. Fourteen percent of the lesions (23/164) were resistant with residual waist regardless of balloon type. Vessel recoil, defined as resolution of waist without ≥50% diameter increase occurred in 35% (57/164) of lesions. Vascular trauma occurred in 7/147 (4.8%) angioplasties using UHP (six confined tears, one aneurysm) and 10/280 (3.6%) using non-UHP (10 confined tears), P = 0.6. There were no unconfined tears, four reperfusion injuries, and no deaths.

Conclusion: Despite available novel technologies of BA, there continues to be failure related to highly resistant lesions as well as vessel recoil. UHP BA is safe and should be considered routinely in the treatment of vascular stenosis resistant to lower pressure BA.

CONGENITAL MULTICENTER TRIAL OF PULMONIC VALVE REGURGITATION STUDYING THE SAPIEN TRANSCATHETER HEART VALVE (COMPASSION): ONE-YEAR FOLLOW-UP

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Background: Early safety and efficacy of the Edwards SAPIEN transcatheter heart valve (THV) in the pulmonary position has been established through a multicenter clinical trial. This study provides one-year follow-up results in an extended number of patients undergoing SAPIEN THV implantation for moderate-to-severe pulmonary regurgitation with or without stenosis.

Methods: Eligible patients were screened if body weight was greater than 35 kg and in situ conduit diameter ≥16 mm and ≤24 mm. Standardized implantation and follow-up protocols were used.

Results: From April 2008 until June 2012, 43 patients (15 females) completed 12-month follow-up from a total of 50 total implants in 57 enrolled patients. Mean weight was 72.45 ± 22.9 kg. Indication for THV implantation was mixed (72%), stenosis (19%) and regurgitation (9%). Ten patients underwent implantation of 26 mm valve. Intraprocedural mean right ventricular systolic pressure decreased from 53.3 ± 17.5 mm Hg to 39.61 ± 13.2 mm Hg (P < 0.01). At one-year follow-up of 24.1 ± 11.7 months patients with class I NYHA symptoms increased from 18.6% pre-procedure to 77.6%. At one-year, mean estimated RV pressure decreased from 62.42 ± 20.1 mm Hg to 47.84 ± 14.0 mm Hg (P < 0.01). Pulmonary regurgitation was mild or less in 100% of patients. Freedom from re-intervention was 95.3%. One patient who did not receive the SAPIEN died secondary to bacterial endocarditis involving the surgical valve.

Conclusion: Transcatheter pulmonary valve replacement using the Edwards SAPIEN THV demonstrates excellent valve function and durability at one-year follow-up.

TRANSCATHETER DEVICE CLOSURE OF ATRIAL SEPTAL DEFECTS IN PATIENTS WEIGHING ≤10 KG IS SAFE AND EFFECTIVE

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Background: Few data exist regarding transcatheter closure (TC) of atrial septal defects (ASD) in infants and small children. We report TC of ASD in patients weighing ≤10 kg.
**O-13**

**RADIOFREQUENCY PERFORATION IN PULMONARY ATRESIA AND INTACT VENTRICULAR SEPTUM: A SINGLE CENTER EXPERIENCE**

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**Background:** Percutaneous radiofrequency perforation (RFP) of the pulmonary valve is frequently used as a primary therapy in children born with pulmonary atresia and intact ventricular septum (PAIVS). Recent reports suggest that there is significant procedure related early mortality (6–21%) raising concern about this approach to management. We sought to determine the safety and efficacy of RFP for PAIVS in a single center.

**Methods:** The study retrospectively reviewed all cases of PAIVS that were treated primarily with RFP by a single operator from 1999 through 2012. We collected baseline echocardiographic and angiographic data, technical aspects of the procedure, adverse events, acute, and long-term outcomes.

**Results:** RFP was performed in 16 patients. The acute complication rate requiring intervention was 6% (1/16). Two patients were noted to have a ductal hematoma which were managed conservatively. There was no acute mortality and all children were alive at most recent follow-up (median 5.4 years, IQR 3.66–8.68 years). Seventy-five percent (12/16) of children have a biventricular circulation, 6% (3/16) a 1½ ventricle repair, and 19% (3/16) requiring Fontan track palliation. All but one stent fracture attempts were performed by a single operator. The mean age at the time of first stent implantation was 8.2 ± 10.6 years. The primary sites for stent implantation included pulmonary veins (n = 2), SVC/innominate veins (2), branch pulmonary arteries (3), coarctation (1), IVC/iliac veins (2), and RV-PA conduit (1). Types of stents were Genesis XD (n = 2), Mega LD (1), Palmaz 4 series (2), Palmaz 8 series (3), and “coronary” type (5; 2 drug-eluting). Initial stent diameters were 4–13 mm. Two patients had two overlapping stents and one had three overlapping stents at the stented segment to be fractured. Using noncompliant balloons such as Dorado (n = 5), Atlas (5), Conquest (2), and Bluemax (1), longitudinal fracture was achieved in five and side cell fractures to enlarge stenotic jailed branches.

**Conclusions:** Intentional stent fractures can be induced safely using high-pressure balloons both longitudinally to expand undersized stents or through side cells to expand stenotic jailed branches.
Background: Use of 3-Dimensional Rotational Angiography (3DRA) in pediatric cardiac catheterization is rapidly increasing in frequency; however, data related to its diagnostic potential are limited. We evaluated the diagnostic utility of using the three modalities of 3DRA [rotational angiography (RA), multi-planer reformation (MPR), and 3-dimensional reconstruction (3DR)] in pediatric cardiac catheterization.

Methods: Retrospective review of 3DRA images was conducted with grading of the three modalities as inferior (gr 1), similar (gr 2), or superior (gr 3) to the diagnostic quality of fixed plane angiography.

Results: One hundred fifteen 3DRA studies were performed on 87 patients between August 2010 and March 2012. The 3DRA studies were classified by anatomy of interest: pulmonary arteries (PA), aorta (AO), cavo-pulmonary anastomosis (CPA), and others (pulmonary veins, coronaries, balloon occlusion PA shunts). Most common reason for gr 1 was limited opacification and surgical clips artifact.

Conclusions: In pediatric cardiac catheterization, 3DRA imaging was of diagnostic quality and frequently provided additional clinically relevant data when compared to fixed plane angiography.

O-17
MEDIUM-TO-LONG-TERM OUTCOMES OF PERCUTANEOUS TRANSCATHETER CLOSURE OF CONGENITAL VENTRICULAR SEPTAL DEFECTS
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Objective: Procedural success with transcatheter ventricular septal defect (VSD) closure is well reported. However, longer-term outcome data are limited. The aim of this study was to describe longer-term outcomes of transcatheter closure of congenital VSDs over 10 years.

Methods: Retrospective chart review of all patients undergoing transcatheter VSD closure was performed after IRB approval.

Results: A total of 72 procedures (muscular defects \( n = 40 \), perimembranous defects \( n = 19 \), and residual postoperative defects \( n = 13 \)) were performed in 62 patients (25 males). Median age at closure was 5.5 (range 0.07–78) years. Median size of the defect irrespective of location was 5.8 mm (range 3.5–12 mm). Devices deployed included Amplatzer muscular VSD occluders \( n = 81 \), Amplatzer membranous VSD occluders \( n = 7 \), Amplatzer duct occluders \( n = 9 \), flipper coils \( n = 8 \), and Amplatzer cribriform device \( n = 1 \). Median procedure time was 119 min (range 44–351 min). There were 12 (16.6%) procedural complications with one patient requiring surgical extraction secondary to embolization. One other patient had device embolization that was retrieved successfully. Median follow-up period was 1.6 years (0.5–8.8 years). All patients had a minimum follow-up of 6 months. There was no mortality. There was complete closure of defects in 58/62 patients (93.5%) at last follow-up. These shunts were not clinically significant. None of the patients developed sustained complete heart block or significant arrhythmia. None of the cohort developed endocarditis.

Conclusions: Percutaneous closure of congenital VSDs is safe and effective and is associated with minimal complications. Longer-term follow-up suggests excellent clinical outcomes with no late complications seen.
O-18
OCCLUTECH DUCT OCCLUDER—INITIAL HUMAN EXPERIENCE
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Objective: To evaluate the feasibility, safety, and efficacy of the new Occlutech duct occluder for closure of patent ductus arteriosus (PDA). Background: The device is a self-shaping device made of Nitinol wires, consisting of a retention disc and shank joined by a tether theoretically to assure a better obturation of the duct. Polyethylene terephthalate (PET) patches are integrated ductally in the shank to assure a better obturation of the duct defect. Two subsequent design changes were made, the final being the removal of the tether to ensure correct position of the shank in the PDA. Methods: A prospective non-randomized pilot study conducted from November 2011 to September 2012. Patients weighing less than 6 kg or those with associated cardiac anomalies that required cardiac surgery were excluded. Large PDA was defined as narrowest PDA diameter size ≥3.5 mm associated with symptomatic heart failure. All PDA were closed following the standard method technique. All devices were delivered via 5/6 Fr sheath. All patients were followed up by transthoracic echocardiography for 24 hr, 1 month (earlier if indicated), 3 month, 6 month, and 12 month after implantation. Results: Twenty-six patients with type A PDA (16 females, 10 males), with a median age of 23 months (6 months–36 years) and median weight 9.2 kg (6–56 kg) were included. The median PDA narrowest diameter was 2.7 mm (1.8–4.6 mm). Of included patients six patients had large PDA as defined, Mean fluoroscopy time was 9.2 min. All patients with large PDA had significant residual shunt immediately postimplantation. Two patients (PDA size 4.4 mm and 3 mm) needed removal of the earlier device design due to malposition following release and AGA occluder was implanted. With current design, five patients with large PDA showed significant residual shunt through the device despite correct position, which became insignificant within 1 to 2 weeks. Complications: There was no device embolization, hemolysis, obstruction to left pulmonary artery or descending aorta in all cases. One patient developed insignificant tricuspid regurgitation during retrieval of a released device. Conclusion: Occlutech ductal occluder is safe, feasible, and effective. However patients with large PDA tended to have delayed complete closure.

O-19
FEASIBILITY OF DILATION OF HOMOGRAFT RIGHT VENTRICLE TO PULMONARY ARTERY CONDUITS BEYOND THEIR NATIVE DIAMETER: IMPLICATIONS FOR CONDUIT STENTING AND PLACEMENT OF PERCUTANEOUS PULMONARY VALVES
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Background: Percutaneous balloon angioplasty (BA) ± stenting is an accepted therapy for relieving obstruction in right ventricle (RV) to pulmonary artery (PA) conduits. Historically, balloon size for BA ± stenting of homograft conduits was limited to the native diameter of the conduit due to risk of conduit rupture. Aim: To report our experience with BA ± stenting of homograft RV-PA conduits beyond their native diameter to (1) treat RV hypertension, (2) prolong conduit lifespan, and (3) to prepare for percutaneous pulmonary valve placement. Methods: Retrospective single center review of patients (pts) with RV-PA homograft conduits who underwent catheterization for conduit stenting or re-dilation of a stented conduit from 2001 to 2012.

Results: Forty-seven pts underwent 64 caths: In 17/47 pts (36%), a balloon smaller than the native diameter of the conduit was used. In 5 pts (11%), the maximum balloon size chosen to dilate the conduit or implant the stent was the same as the native diameter of the conduit. In 25 pts (53%), the maximum balloon size chosen for conduit stent implantation or re-dilation exceeded the native diameter of the conduit (maximal balloon:native conduit ratio of 105–160%). After conduit recoil, final stent:native conduit diameter ratio was 79–153%. There were no cases of conduit rupture or leak. In 10 cases (16%), a percutaneous pulmonary valve (Melody) was implanted after conduit dilation, with two having a conduit whose native diameter was <16 mm. Conclusions: RV-PA homograft conduits, particularly if non-calciﬁed or minimally calcified, can safely be dilated to sizes signiﬁcantly greater than their native diameter. This has important implications: (1) Stents implanted in minimally calcified conduits should be selected such that the stent itself is not a limitation to expandability of the conduit (when appropriate, stents reaching >18 mm diameter should be used); (2) Small conduits (<16 mm rated diameter) may still be amenable to stenting and/or Melody valve placement, prolonging the conduit lifespan to a greater extent than was previously thought possible.

O-20
TRANS Catheter Embolization of Aortopulmonary Collaterals Using the Trufill N-Butyl Cyanoacrylate Liquid Embolic System
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Background: Aortopulmonary collaterals (APC) are commonly found in patients with cyanotic heart disease. The APC compete with the normal pulmonary blood ﬂow, in patients, who have undergone Glenn or Fontan surgery. APCs are also seen in patients with cystic ﬁbrosis (CF), where they are known to cause hemoptysis. Transcatheter occlusion of APC has previously been described using coils, vascular plugs, and poly vinyl alcohol (PVA) particles. We present a series of patients in which the APCs were embolized using Trufill n-butyl cyanoacrylate (n-BCA) liquid. Methods: From 2009 to 2012, a total of 17 catheterization procedures were performed (in 16 patients), in which APC were embolized using n-BCA. The mean age is 8.5 years (4 months–21 years) with a mean weight of 29 kg (7–72 kg). Three patients had CF and had presented with hemoptysis. The rest of the patients had cyanotic congenital heart disease and had undergone Bidirectional Glenn or Fontan procedures. One of the congenital heart disease patients had two cath procedures (2.5 years apart) for hemoptysis. Results: The procedure of n-BCA embolization of APC was technically successful in all patients. Three patients with cystic ﬁbrosis who presented with hemoptysis had symptomatic improvement and have not needed repeat catheterization. One patient with cyanotic congenital heart disease, who presented with hemoptysis, had acute improvement. However 2.5 years later, she had recurrent hemoptysis and required more APCs to be embolized. The only complication attributable to n-BCA use also occurred in this patient. Following occlusion of APC arising from the left lateral thoracic artery, she developed erythema of the overlying skin followed few days later by the formation of a small ulcer (presumably due to ischemia of soft tissue/skin). The ulcer resolved without any speciﬁc treatment. There were no other major n-BCA related complications such as cerebral vascular accident, pulmonary embolism, or instances of catheters getting “glued” to vessel wall. Conclusion: n-BCA is a liquid embolic agent that is FDA approved for embolization of cerebral arteriovenous malformations. PVA particles, that were previously used for cerebral AVMs have a high recanalization rate and have therefore been replaced by Trufill n-BCA or Onyx liquid embolic system for embolization of cerebral AVMs. APC have been embolized previously using coils, vascular plugs, and PVA particles—all of which are associated with a varying incidence of recanalization. We felt that n-BCA would provide a more permanent form of APC occlusion with decreased incidence of recanalization. However, caution should be exercised especially while embolizing arteries/APCs that might have
branches extending to the subcutaneous tissue. Since n-BCA might be less forgiving as compared to other methods of vessel occlusion.

O-21

PRECLINICAL EVALUATION OF A NEW LEFT ATRIAL APPENDAGE OCCLUDER (LIFETECHLAMBRETMDEVICE) IN A CANINE MODEL

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Background: Transcatheter left atrial appendage (LAA) occlusion was proven non-inferior to warfarin in preventing stroke in patients with non-valvular atrial fibrillation (NVAF).

Aim: The study evaluated the safety and feasibility of a novel LAA occluder (LAmbrTM, Lifetech Scientific Corp., Shenzhen, China) for stroke prevention in a canine model.

Device Description: LAmbr is a nitinol-based, self-expanding device comprising a hook-embedded umbrella and a cover which secure the device to the LAA wall and seal the LAA opening, respectively (Figure 1). The umbrella is specially designed to allow full recapture and repositioning and a 8–10 Fr sheath is required for delivery of a 16–36 mm device. The umbrella and the cover are both sewn with PET membrane for optimal sealing of LAA after placement.

Methods: Twenty-four canines (23 ± 3 kg) received LAmbr implants via fluoroscopic-guided transseptal puncture from June 2011 to August 2012 under general anesthesia. All dogs received 1-week antibiotics and 4-week aspirin (80 mg daily) after implants and were sacrificed in groups at day 1–3 ($n$ = 5), 1- ($n$ = 8), 3- ($n$ = 5), and 6-months ($n$ = 6) for gross and microscopic examinations. Transthoracic echocardiography was performed immediately after implant, at day 3 and before sacrifice.

Results: The device was successfully implanted in all canines and found to be fully retrievable and repositionable. The mean implant size was 24 ± 3 mm and an average 36 ± 7% of device oversizing with reference to the measured landing zone diameter was required. One dog died on day 3 after device embolization as a result of improper device selection (only 21% oversizing). Postimplant angiography and TTE showed well-positioned device without pericardial effusion or impingement on surrounding structures. Complications detected during follow-ups included small device-related thrombus ($n$ = 1) and clinically insignificant pericardial effusion at 1-month ($n$ = 1). Complete healing on the atrial facing surface with continued obliteration of LAA opening were confirmed by gross and microscopic examinations in dogs that been followed up ≥ 3months ($n$ = 11). No infarct was detected in major organs.

Conclusions: Our preliminary data suggested LAA closure with LAmbr device is safe, feasible with high implant success rate in canines. Human trials are needed.

P-1

LATE RESOLUTION OF ATRIOVENTRICULAR BLOCK AFTER TRANSCATHETER ASD CLOSURE WITH THE GORE® HELEX® SEPTAL OCCLUDER

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Introduction: Atrial septal defects (ASD) account for approximately 10% of all congenital heart defects. Transcatheter device closure has become a widely acceptable alternative to surgical closure. Atrioventricular (AV) node conduction disturbances including complete heart block are among the rare complications associated with this procedure. We describe the first known case of prolonged heart block associated with implantation of the GORE® HELEX® septal occluder.

Case Description: An asymptomatic 6-year-old boy with Trisomy 21 and a moderate sized (10 mm) centrally located ASD was referred for device closure. His baseline EKG showed sinus rhythm and a typical rsR’ pattern in lead V1. Immediately upon deployment of the right atrial loops of a 25 mm device, he developed complete AV block lasting several minutes. He had a stable escape rhythm and after several minutes reverted to high-grade second-degree AV block. The decision was made to release the device and monitor for return of sinus rhythm. He was observed in the hospital and received high-dose steroid therapy. He remained in high-grade AV block but with intermittent periods of sinus capture. He was discharged home 5 days postprocedure on a steroid taper. At the 6-week follow-up, a 24-hr Holter showed sinus rhythm with sinus arrhythmia and no AV block or dropped beats. At the 6-month follow-up, the patient continued to have had an AV sequential rhythm with questionable wandering atrial pacemaker, but no AV block.

Discussion: We report the first known case of prolonged heart block following placement of the HELEX® septal occluder. We review the literature of previously reported heart block following ASD device closure including possible risk factors. We suggest a framework for making treatment recommendations based on proposed physiologic mechanisms and on the onset and severity of device related AV block.

P-2

TRANSCATHETER DEVICE CLOSURE OF RUPTURED SINUS OF VALDSALVA: IMMEDIATE RESULTS AND SHORT-TERM FOLLOW-UP

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Introduction: This is a retrospective study comprising of 13 patients with isolated rupture of the sinus of Valsalva (RSOV) who underwent transcatheter device closure.

Results: The mean age of presentation was 39 ± 10.0 years. New York Heart Association (NYHA) class at the time of presentation was II (six patients) and III (six patients), class IV (one patient). The RSOVs were all closed using a patent ductus arteriosus device. The mean procedural time was 30 ± 5.4 min, while the fluoroscopic time was 20 ± 7 min. The average hospital stay was 2 ± 1.1 days. Successful immediate closure was achieved in all except one. There was one hospital mortality. The patients were followed up for a mean of 3 years (ranging from 1 month to 5 years). All had complete closure of the shunt in follow-up. During the learning curve, we modified the technique making subtle changes such as use of buddy wire, kissing technique for right ventricu-
lar outflow tract opening, and use of braded sheaths in all cases. At the time of the last follow-up all the patients were in NYHA class I.

Conclusion: We conclude that in the short-term, transcatheter closure of isolated RSOV is a viable alternative to surgical repair though long-term data are required particularly in a procedure which has been traditionally subjected to surgical therapy. Very large RSOV in patients presenting with congestive cardiac failure or shock as in one of our patients may not be subjected for this technique.

P-3

UNCONVENTIONAL USES OF SEPTAL OCCLUDER DEVICES

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Device closure is now accepted modality of treatment for cardiac septal defects. We are reporting the efficacy of closure of nonseptal defects with devices conventionally used for septal cardiac defects.

Study design: Retrospective study.

Material and Methods: Forty-seven patients, age group 2–67 years. They were divided into two groups; group 1: with no available customized device, group 2: for which customized devices are available but alternate devices have been used. These included 38 in group 1: ruptured sinus of Valsalva (duct occluder; n = 11), coronary arteriovenous (CAV) fistula (duct occluder; n = 5), closure of mitral paravalvular leak (n = 4; duct occlude devices = 3, VSD device = 1) and aortic paravalvular leak (n = 2 duct occluder, n = 2, vascular plug = 2), closure of AP window (duct occluder, n = 3), Fontan fenestration closure (asd septal occluder, patent foramen ovale device, vascular plug n = 3, 1 each), pulmonary AV fistula (duct occluder; n = 2), systemic AV fistula(vascular plug; n = 1), closure of ascending aorta perforation (septal occluder, n = 1), occlusion of subclavian artery (vascular plug; n = 1), splenic artery (duct occluder; n = 1), Blalock Taussig shunt (duct occluder, n = 1). In group 2: there were 9 patients, VSD closure by ADO II device (n = 6), PDA closure by muscular VSD device (n = 2), and ASD device (n = 1).

Results: Residual shunt was detected in two patients each of coronary AV fistula and mitral paravalvular leak. No shunt detected in ruptured sinus of Valsalva, fenestrated Fontan, and ascending aorta perforation.

Complications: Local site hematoma was observed in four patients. Hematuria was observed in four patients. It subsided with conservative management. There was one mortality observed in table during the attempted closure of a very large RSOV with gross congestive heart failure. On follow-up ranging from 2 months to 6 years, all the patients are asymptomatic. There was no late complication related to device in any patient.

Conclusion: It is feasible in selected lesions, which traditionally have been subjected to surgical interventions, to treat successfully, non-surgically with the use of non-prototype occluder devices without significant complications.

P-4

PERCUTANEOUS BALLOON-EXPANDABLE COVERED STENT IMPLANTATION FOR TREATMENT OF TRAUMATIC AORTIC INJURY IN CHILDREN AND ADOLESCENTS

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Objectives: To describe the use of balloon-expandable covered endovascular stents for percutaneous treatment of traumatic aortic injury (TAI) in children and adolescents.

Background: Surgical treatment of pediatric acute TAI following blunt chest trauma is standard of care. The use of endovascular stent grafts for treatment of TAI in adults is common, but has important limitations in children.

Methods: Participants of the multicenter Coarctation Of The Aorta Stent Trial (COAST) had access to an investigational large-diameter, balloon-expandable, covered stent (covered Cheatham-platinum stent, NuMED, Hopkinton NY) on an emergency-use basis. Between 2008 and 2011, six covered stents were implanted in four patients at three COAST centers for treatment of TAI. Records were reviewed and relevant data extracted.

Results: Median patient age was 13.5 years (range 11–14) and weight was 58 kg (40–130). All patients sustained severe extra-cardiac injuries that were felt to preclude safe open surgical repair of TAI. Median aortic isthmus and stent implantation balloon diameters were 16.4 mm (13.2–19) and 19 mm (16–20), respectively. Stent implantation was technically successful in all attempts. Complete exclusion of the aortic wall injury was achieved in all cases. There were no access site complications. At a median follow-up of 24 months, there was one early death (related to underlying head trauma), and one patient with recurrent aortic aneurysm who required additional stent implantation.

Conclusions: Balloon-expandable covered stent implantation for treatment of pediatric TAI following blunt trauma is generally safe and effective. Availability of this equipment may alter the standard approach to treatment of pediatric TAI.

P-5

ALTERED RIGHT VENTRICULAR DIASTOLIC FUNCTION IN CHILDREN WITH UNREPAIRED VENTRICULAR SEPTAL DEFECT

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Background: Ventricular septal defect (VSD) in asymptomatic children is often unrepaired. Emphasis is predominantly placed on repair outcomes; however there is a paucity of literature assessing patients with unrepaired VSD. We previously demonstrated the presence of RV diastolic dysfunction despite the absence of overt hemodynamic abnormalities in a porcine model of VSD. In the present study, we test the hypothesis that children with unrepaired VSD have underlying abnormal RV diastolic function despite normal systolic function.

Methods and Results: We retrospectively queried our institutional echocardiography database for children 3 months to 18 years old with unrepaired isolated restrictive VSD. Measurements included LV and RV systolic and diastolic function, and Doppler tissue imaging. Data from 106 control and 121 VSD patients (52% muscular, 48% perimembranous) were studied. VSD jet velocity and gradient measured 4.0 ± 0.07 m/sec and 68.6 ± 2.3 mm Hg. LV systolic function in VSD patients was identical to controls; however, children with unrepaired VSD demonstrated alterations in cardiac structure (increased LA diameter, LV dimensions, and LV wall thickness) and RV diastolic function (reduced tricuspid E/A ratio and prolonged RV relaxation time). A subgroup of VSD patients (6.6%) with definitive criteria for RV diastolic dysfunction had reduced LV fractional shortening and LV medial S’ compared to the rest of the VSD patients (34.7% ± 1.0 vs. 39.1% ± 0.5 and 0.07 m/sec ± 0.005 vs. 0.08 m/sec ± 0.001, respectively).

Conclusions: Most children with unrepaired VSD have normal LV and RV systolic function; nevertheless, a subgroup has echocardiographic evidence of RV diastolic dysfunction, potentially as a response to persistent shunting. Children with unrepaired VSD may represent a population at risk for RV diastolic dysfunction with some requiring eventual intervention. The long-term implications of these findings are uncertain, emphasizing the need for further studies to understand the natural history of RV function in patients with unrepaired VSD.
**P-6**

**TRANSCATHETER CLOSURE OF PDAS IN THE SERIOUSLY ILL PREMATURE BABIES**

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**Aim:** The aim of this study was to evaluate our institutional experience of transcatheter closure of PDA in the seriously ill premature babies. Currently, available technology is not designed for these age groups. Transcatheter occlusion of PDA at the preterm babies challenges the interventionist.

**Methods:** Eight seriously ill premature children underwent PDA closure with different devices. The approach was venous in all patients. The Amplatzer duct occluder (ADO) type II, Cook detachable coil, and ADO type II additional sizes were used. Arterial access and catheter manipulation within the cardiac chambers were avoided whenever feasible. The patients had many co-morbid problems; respiratory distress syndrome in all, necrotizan enterocolitis in six patients; intravascular coagulation in three; and pulmonary hemorrhage in one patient. All patients were receiving mechanical ventilation before intervention.

**Results:** Gestational age ranged from 27 to 31 weeks. The mean birth weight was 1,067 ± 232 (range 900–1,550) g, and the mean weight at the time of procedure was 1,862 ± 534 (range 1,190–2,820) g. The mean age was 41 (range 17–90) days. The median PDA diameter was 2.3 (range 1–3.5) mm. Four-French venous sheaths were used. All implantations were technically successful. Echocardiography confirmed no residual shunts on the following day. During manipulation, cardiac perforation occurred in one patient and the patient died. Another patient died six days later after procedure because of co-morbid problems. PDAs were completely occluded without significant obstruction of the pulmonary arteries or aorta. Additional sizes were used six times; the others were used one time.

**Conclusions:** In these special age groups, delicate catheter and guide-wire manipulation is needed. Especially, the lower profile and symmetry of ADO additional sizes give the opportunity to close premature PDAs. Transcatheter technique is possible in the seriously ill preterm infants. And it is a safe alternative to surgical ligation especially in the severe ill patients.

**P-7**

**REPORT OF A CASE OF PERCUTANEOUS OCCLUSION OF ANTEGRADE PULMONARY BLOOD FLOW IN POSTOPERATIVE BIDIRECTIONAL CAVO-PULMONARY AND PULMONARY ARTERY BANDING**

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**Substrate:** Bidirectional Glenn used as surgical staged palliation for complex congenital heart disease has often defended the thesis that additional sources of pulmonary flow, especially the pulsed antegrade may be valuable in the long-term evolution, although difficult, their quantification, in many cases, the extra flow becomes excessive, and need to be occluded.

**Methods:** The patient is male syndromic (Down), 2 years 5 months, 8.3 kg, total atrioventricular septal defect unbalanced with hypoplastic right ventricle and septal reconstruction, is being treated by surgery at 9 months; patia of valves AV, pulmonary banding surgery, and bidirectional Glenn evolving with congestion and superior vena cava syndrome and important collateral circulation to inferior vena cava hospitalization by pleural effusion, irritability, and saturation around 84%, underwent cardiac catheterization under general anesthesia, by femoral vein reached pulmonary artery. Temporary occlusion with Berman catheter for 30 min for review, after this period occlusion with Amplatzer muscular VSD number “6”.

**Result:** After procedure, the saturation was stable at around 78%, extubated in the catheterization laboratory without the need for drugs and discharged without medication with significant clinical improvement, disappearance of syndrome febrile of flow-VCS > VCI, reduction in irritability and improves the quality of life.

**Conclusion:** Percutaneous occlusion of antegrade flow in pulmonary circulations, in patients with bidirectional Glenn or Fontan Type, may be necessary in the evolution of some patients. Literature reports with occlusion by other prostheses. The procedure is feasible, safe, and efficient and can add significant improvement in quality of life and long-term evolution.

**P-8**

**INTERMEDIATE AND LONG-TERM FOLLOW-UP AFTER PATENT DUCTUS ARTERIOSUS CLOSURE WITH AMPLATZER DEVICE**

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**Background:** The purposes of this study is to document the results of Amplatzer duct occluder (ADO) closures of patent ductus arteriosus (PDA) in a large number of patients with particular emphasis on long-term follow-up in an attempt to provide evidence for feasibility, safety, and effectiveness of this method of PDA closure. Immediate and short-term results of ADO occlusion of PDA have been documented in a limited number of children.

**Methods:** During a seven-year period ending in December 2009, 103 patients with PDA were taken to cath lab with intent to occlude the PDA. In three patients, no attempt was made to occlude the PDA either because of severe pulmonary hypertension (N = 2) or very large size (N = 1). Transcatheter ADO closure of PDA was attempted in 100 patients, aged 0.36–35.6 years (median, 1.8); in 99 (99%) the ADO was successfully deployed and in 1 the device was unstable and was uneventfully withdrawn. The follow-up data review protocol is approved by IRB.

**Results:** The PDA measured 1–6.73 mm (median 2.67) at the narrowest diameter; they were occluded with devices measuring from 6/4 to 12/10 mm, delivered via 5 Fr to 7 Fr sheaths. The Qp/Qs decreased from 1.95 ± 0.95 to 1. Effectiveness of the occlusion, defined as no or trivial residual shunt, on the morning following implantation was achieved in 97.9% (97 of 99) of patients. All types of PDAs (Krichenko) irrespective of shape, size, and length could be occluded with ADO. Follow-up data, 1–60 months after implantation, were available in all patients; none had residual shunt. No evidence for left pulmonary artery or descending aortic obstruction was seen on echo-Doppler studies. None of the patients required re-intervention.

**Conclusions:** This large, single-institution experience with long-term follow-up confirms the feasibility, safety, and effectiveness of Amplatzer device closure of the PDA. All types of PDAs irrespective of shape, length, and diameter can be effectively occluded.

**P-9**

**PERCUTANEOUS PATENT FORAMEN OVALE CLOSURE FOR PARADOXICAL STROKE IN 8-KG TWINS WITH HURLERS SYNDROME**

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Patient foramen ovale (PFO) is a known risk factor for paradoxical embolus, especially in the presence of other risk factors such as hypercoagulable states or central lines. A PFO is a common incidental finding in infants and children. However, paradoxical emboli are not common
in infants, and so PFO closure is rarely indicated in this age group. We present two cases of PFO closures in identical 8 kg twin boys with Hurler’s syndrome who had central lines for planned bone marrow transplants, with embolic stroke in one. We discuss the treatment options as well as the special challenges based on the patients’ age, size, and diagnoses. We discuss the technical aspects and safety of percutaneous PFO or atrial septal defect (ASD) closure in this patient population, as these are the smallest patients described in the literature who have undergone PFO or ASD closure with the Helex Septal Occluder.

P-10
PARTIAL ANOMALOUS PULMONARY VENOUS RETURN INTO THE IVC IN A 28-YEAR-OLD WOMAN: A VARIANT OF SCIMITAR SYNDROME AMENABLE TO INTERVENTIONAL TREATMENT
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Scimitar syndrome is a rare congenital heart defect with partial anomalous pulmonary venous return (PAPVR) of right pulmonary vein(s) to the inferior vena cava. The syndrome is commonly associated with hypoplasia of the right lung and right pulmonary artery, pulmonary sequestration, and dextroposition of the heart. Treatment of the PAPVR usually requires a surgical approach. We present a 28-year-old woman suffering from dyspnea, who was diagnosed with PAPVR at the age of 17 years after a typical curvilinear pattern—the so called Scimitar sign—was detected on chest X-ray. Anatomical characteristics were further evaluated using echocardiography and MRI studies. The Scimitar vein was slightly stenotic proximal to its drainage into the inferior vena cava. Furthermore, all three right-sided pulmonary veins were connected via the Scimitar vein and drained not only into the inferior vena cava but also into the left atrium. Cardiac catheterization confirmed the diagnosis and showed a significant left-to-right shunt and mild pulmonary hypertension. Balloon test occlusion of the inferior portion of the Scimitar vein documented unobstructed drainage of all right pulmonary veins into the left atrium, thus, interventional closure was a treatment option. The patient underwent occlusion of the inferior portion of the Scimitar vein with an Amplatzer Vascular Plug II without obstructing the right lower pulmonary vein or a hepatic vein. At 4 months follow-up, the patient was asymptomatic and clinically well and the device was in good position without residual flow.

P-11
DILATATION OF COARCTATION OF THE AORTA WITH ANDRASTENT XL/XXL
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Background: Stenting in coarctation of the aorta (CoA) has emerged as an alternative to surgery with good intermediate result. Recently, new bare metal stent made of a cobalt-chromium alloy (Co-Cr) (namely Andrastents XL/XXL, Andramed GmbH) was introduced to clinical practice. The stents have a hybrid cell design and therefore has a strong radial force, high flexibility, and good radio-opacity and it should be advantageous in implantation in CoA.

Objective: To evaluate the use of Andrastents in the management of CoA at a single tertiary care center with immediate result and midterm follow-up.

Methods: Andrastents were implanted for a 30 months period in 30 patients: 26 with native CoA and 4 with recurrent after previous surgery (ReCoA). The stents were manually mounted on high pressure balloons and delivered through 10–14 Fr Mullins sheaths using a conventional femoral approach.

Results: Mean patient age was 28.3 ± 15.6 (ranged from 9 to 65) years. The systolic gradient across the native CoA decreased from a mean 48.3 ± 20.2 before to 11.9 ± 10.2 mm Hg after the procedure and in case of ReCoA from 37.8 ± 20.7 before to a mean 9.7 ± 12.4 mm Hg after the procedure. No aneurysm formation, stent migration, or rupture of the aorta were observed in any patient during the procedure. The mean fluoroscopy time was 6.1 ± 2.3 min. Procedural outcome remained favorable during mean follow-up 1.1 ± 0.8 without stent fracture. Planned redilatation of implanted stent was performed between 4 and 14 months in six patients. In one man with secondary LV failure, EF 15% (49 years old), the procedure was performed urgently during cardiogenic shock with good clinical result.

Conclusion: Implantation of Andrastents XL/XXL are very good therapeutic option for the treatment of native and recurrent CoA.

P-12
TRANSCATHETER CLOSURE OF PATENT FORAMEN OVALE WITH DIFFERENT NITINOL WIRE MESH OCCLUDERS
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Background: The use of Amplatzer devices (A) for percutaneous patent foramen ovale (PFO) closure is common clinical practice. Recently, new device very similar to A namely Cardio-O-Fix (COF) were introduced as new armamentarium. This occluder is cheaper than Amplatzer, but it is lack of published data comparing results of applications of both devices. The aim of the present study was to asses intermediate and mid-term clinical outcome of patients with PFO after paradoxical embolism event (EE) who underwent transcatheter PFO closure with Amplatzer PFO occluder (group A) or Cardio-O-Fix PFO occluder (group COF).

Methods: Overall, 63 consecutive patients underwent percutaneous closure of PFO—38 with A device and the results were compared to those in 25 patients treated with COF. Stroke or transient ischemic attack (TIA) was considered recurrent EE. Pre- and at least 6 month postintervention right to left shunting (RLS) were evaluated with intravenous contrast injection by transcranial Doppler examination of middle cerebral artery (TCT).

Results: The procedure was successfully completed in all patients in both groups. No procedure related complications were observed during hospitalization. Large residual RLS was noted at 6 months in 8/38 patients (21%) in group A and 6/25 (24%) in group COF. In group A, 3/38 patients (7.9%) had postprocedural new neurological events: 1 patient TIA (double) and 2 new strokes. From this, patients in one TCD and TEE were positive, but new atherosclerotic changes in vertebral arteries developed. No recurrence of EE was recorded in COF group.

Conclusion: Transcatheter closure of PFO with Amplatzer and Cardio-O-Fix occluders are clinically safe and effective. The latter device has similar, but new atherosclerotic changes in vertebral arteries developed. No recurrence of EE was recorded in COF group.

P-13
ACUTE DISSECTION AND PSEUDOANEURYSM WITH TRANSCATHETER PATENT ARTERIAL DUCT DEVICE OCCLUSION
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Background: Transcatheter device occlusion of PDA is a well-established and safe procedure with a high success rate. Previous reports describing pseudoaneurysms as complications with PDA devices have alluded to femoral artery pseudoaneurysms at the vascular access site. A literature review did not identify reports of acute dissection and pseudoaneurysm formation during transcatheter PDA occlusion.

Case report: A 3.1 kg 74-day-old infant with a moderate ASD, PDA, and pulmonary valve stenosis was planned for transcatheter balloon pulmonary valvotomy (BPV) and PDA device closure. PV annulus measured 8 mm.

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An aortogram with a 4 Fr vessel sizing pigtail with the end cut off showed a long and tubular PDA with a slight constriction at the pulmonary end. BPV was performed with a 9 mm × 3 cm Tyshak II balloon. A 4-4 ADO II AS device was deployed from the aortic side. The device was however mobile on stability testing and pushed through the duct into the MPA with easy retrieval of the fully deployed device back into the aorta. The delivery system and unreleased device were removed. Repeat angiography into the PDA with a cut pigtail catheter demonstrated dissection and pseudoaneurysm of the duct with two exit points into the MPA. Transhepatic echocardiography confirmed a tissue flap at the proximal pulmonary end of the duct and a pseudoaneurysm which prolapsed into the MPA. The infant was referred for surgical PDA ligation. Post ligation, there was no residual PDA with resolution of the pseudoaneurysm.

Conclusions: The dissection could have occurred during BPV, during retrieval of the occlusion device or with positioning the catheter. With the cut vessel sizing pigtail during the second aortogram. We feel the injury most likely occurred with the cut pigtail catheter. This highlights the risks associated with the sharp edges of a cut catheter.

**P-15**

**TRANSCATHETER CLOSURE OF PERIMEMBRANOUS VENTRICULAR SEPTAL DEFECT WITH THE AMPLATZER DUCT OCCLUDER**

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**Background:** Perimembranous ventricular septal defect (PmVSD) is the most common congenital heart disease. The standard closure method is open heart surgery. So far, there is no FDA approved device for closure. The defect usually has an ampulla-like aneurysm which resembles the patent ductus arteriosus. This study aimed to investigate the feasibility of the Amplatzer duct occluder to close the perimembranous VSD with aneurysm.

**Materials and methods:** Between January 2010 and August 2012, 20 patients (9 males) with perimembranous VSD underwent the attempt of VSD closure using the Amplatzer duct occluder. The median age was 18.6 (2.1–53.5) years and the median weight was 48.5 (12–86) kg. Five patients also had pulmonary hypertension. Seven patients had aortic valve prolapse. Five patients had trivial aortic regurgitation. Symptoms included exercise intolerance in 10 patients, palpitation in 7, chest pain in 6, and failure to thrive in 3. The median VSD size was 4.0 (1.9–7.8) mm and the median Qp/Qs was 1.47 (1.23–2.67).

**Results:** All devices were successfully implanted to close the VSDs. The median device size was 10/8 (5/4–12/10) mm. The median fluoroscopic time was 23.1 (12.8–49.7) min and the median procedure time was 81.5 (35–148) min. Complications included transient complete heart block in one patient and hemolysis in one. The complete closure rate was 90% (18/20) on the following and follow-up days. No change of aortic or tricuspid regurgitation was noted.

**Conclusions:** Transcatheter closure of PmVSD with aneurysm using the Amplatzer duct occluder is technically feasible and safe in patients weighing more than 12 kg.
a severe RPA proximal stenosis and in other two patients simultaneous aortic and pulmonary stenosis was performed to aortic stenosis. The procedure was considered successful in 35 cases (97%), a decrease in mPAP to 33 ± 6.3 mm Hg was seen after closure. In only one patient, an ADO was deployed originating significant aortic obstruction requiring surgical removal and PDA ligation. No other major or minor complications were encountered. Mean procedural time was 72 min (range 30–120) and mean fluoroscopy time was 11.2 ± 7.8 min.

Conclusions: Percutaneous PDA closure is effective in low-weight body infants and should be considered in this group of patients.

P-17

INITIAL MEXICAN EXPERIENCE WITH THE HELEX SEPTAL OCCLUDER IN CONGENITAL HEART DISEASE

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Background: Secundum atrial septal defect (ASD) is one of the most common congenital heart defects. Left untreated ASD produces right heart volume overload with well-established complications such as worsening functional capacity, heart failure, atrial dysrhythmias, and pulmonary hypertension. Patent foramen ovale (PFO) has been implicated in the pathogenesis of cryptogenic stroke (CS), transient ischemic attacks (TIA) and migraine. The Helex septal occluder (HSO) (W.L. Gore and Associates, Flagstaff, AZ) is a low profile, double disc occluder device composed of an expanded polytetrafluoroethylene membrane bonded to a single nitinol wire frame. The HSO became available in Mexico in 2010 and is approved by national health authorities for closure of both defects.

Objective: To describe the initial experience in a single-center with the use of the HSO for percutaneous closure of congenital heart defects.

Methods: We performed a retrospective analysis in patients that underwent percutaneous closure with the HSO at our institution between 2010 and 2012.

Results: A total of 14 patients (female = 11) were included for review: 12 patients with secundum ASD, one patient with PFO with an aneurismatic interatrial septum and history of stroke, and one patient with univentricular Fontan repair that underwent elective transcatheter fenestration closure 2 years after surgery. Mean age was 11.4 ± 9.9 years, mean weight was 35 ± 18 kg. In ASD patients, mean diameter of the defect was 9.5 mm ± 2.8 mm measured by intracardiac echocardiography (ICE), mean pulmonary artery pressure (mPAP) was 15 ± 3 mm Hg with Qp/Qs 1.8 ± 0.6. Successful occlusion occurred in 13 cases (92%). Only one patient with ASD suffered device misplacement/embolization that required retrieval and an Amplatzer Septal Occluder (ASO) was used for closure. Occlusion was successful in the PFO and the Fontan fenestration. All patients were discharged on aspirin for the following six months. Mean follow-up was achieved in all patients at 6 months, all of them were asymptomatic in NYHA functional class I and transthoracic echocardiography revealed adequate device position in all patients with no residual shunt.

Conclusions: The Helex septal occluder is safe and effective for small to medium-size secundum ASD and its use can be considered in additional interatrial defects with positive results.

P-19

MORPHOLOGY OF THE PATENT DUCTUS ARTERIOSUS DOES NOT PRECLUDE SUCCESSFUL PATENT DUCTUS ARTERIOSUS STENT IMPLANTATION IN HIGH RISK PATIENTS UNDERGOING HYBRID STAGE I PALLIATION

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Background: Hybrid palliation for hypoplastic left heart syndrome (HLHS) is gaining acceptance as an alternative to the Norwood operation. Advantages include shorter recovery and comparable survival. Complications include development of restrictive atrial communication, arch obstruction, proximal and distal coarctation secondary to inadequate coverage of the patent ductus arteriosus (PDA) following ductal stenting.

Purpose: To describe the three main types of ductal morphology encountered in patients undergoing PDA stent implantation as part of hybrid stage I palliation.

Methods: The echocardiograms and angiograms of high risk patients (weight <2.5 kg, history of prematurity, restrictive atrial septum requiring atrial stent implantation, chromosomal abnormality) who underwent hybrid stage I palliation for HLHS between May 2005 and August 2012 were retrospectively reviewed. All angiograms pre- and post-stent implantation and angiograms performed prior to comprehensive stage II operation were reviewed. A protégé GPS self-expanding stent 1 mm larger than the diameter of the PDA was utilized in all cases except 1 patient with a long tortuous PDA with stenosis midway between the pulmonary and aortic ends who required a stent 2 mm larger than the region of stenosis.

Results: Twelve patients were identified. Mean age 6.7 days (range 3–15 days), mean weight 2.5 kg (range 1.7–3.6 kg). Three types of ductal
P-20

PERCUTANEOUS REPAIR OF RIGHT-TO-LEFT SHUNT AFTER PFO CLOSURE: CLINICAL AND PROCEDURAL IMPACT.

CASE REPORT

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Background: Patent foramen ovale (PFO) closure can be attained to a reasonably high degree of completeness. Moderate to large residual shunts (RS) after PFO closure poses a significant clinical dilemma firstly due to the fact that they can add a higher risk for recurrent neurological events regardless of antplatelet or anticoagulant therapy and secondly in terms of therapeutical choices, as the surgical approach may be needed. The possible causes of RS are inappropriate device selection (undersized device or partial device malposition) or the association with septum primum multifenestration. Moreover, if a neurological recurrence occurs in patients deemed closed, it is mandatory to consider the presence of atrial fibrillation, device thrombosis, athero-sclerotic progression of aortic plaques or a non-paradoxical source of embolic event. The management of RS after PFO closure has not been clearly established in clinical practice. In this report, we describe our experience with closing a RS by the implantation of a second occluder device.

Methods and Results: A 53-year-old lady, aura migraineur, with previous transient ischemic attack (TIA) was found to have a PFO with a permanent significant right-to-left shunt documented by contrast transthoracic/transesophageal echocardiography (cTTE/cTEE) and by contrast-enhanced transcranial Doppler (ceTCD). PFO anatomy was complex due to the association with a huge atrial septal aneurysm (ASA). Minor thromboembolic disorder (MTHFR gene mutation) was detected and a sister has been diagnosed with Lupus. On March 2012 she underwent uneventful percutaneous PFO closure with a Figulla Flex I PFO 27/30 mm device that partially covered the entire ASA. Clopidogrel 75 mg was recommended for the first two months and aspirin 100 mg for at least 6 months. Nonetheless, a moderate RS was detected by cTTE and ceTCD at 4 months follow-up with unclear clinical relevance. The presence of pulmonary arteriovenous malformations was ruled out. A percutaneous reintervention using a second device was accomplished using a Figulla Flex II PFO 16/18 mm device. The procedure was done with local anesthesia under fluoroscopic guidance and rotational intracardiac echocardiography (Ultra-ICE, Bosin Scientific Technologies) with simultaneous cTTE, Rotational IRE documented a small residual device placed infero-anteriorly on the partially uncovered septum primum. Complete residual shunt closure was achieved. The 1-month postprocedural ceTCD and cETCD revealed no interatrial RS. A 53-year-old lady, aura migraineur, with previous transient ischemic attack (TIA) was found to have a PFO with a permanent significant right-to-left shunt documented by contrast transthoracic/transesophageal echocardiography (cTTE/cTEE) and by contrast-enhanced transcranial Doppler (ceTCD). PFO anatomy was complex due to the association with a huge atrial septal aneurysm (ASA). Minor thromboembolic disorder (MTHFR gene mutation) was detected and a sister has been diagnosed with Lupus. On March 2012 she underwent uneventful percutaneous PFO closure with a Figulla Flex I PFO 27/30 mm device that partially covered the entire ASA. Clopidogrel 75 mg was recommended for the first two months and aspirin 100 mg for at least 6 months. Nonetheless, a moderate RS was detected by cTTE and ceTCD at 4 months follow-up with unclear clinical relevance. The presence of pulmonary arteriovenous malformations was ruled out. A percutaneous reintervention using a second device was accomplished using a Figulla Flex II PFO 16/18 mm device. The procedure was done with local anesthesia under fluoroscopic guidance and rotational intracardiac echocardiography (Ultra-ICE, Bosin Scientific Technologies) with simultaneous cTTE, Rotational IRE documented a small residual device placed infero-anteriorly on the partially uncovered septum primum. Complete residual shunt closure was achieved. The 1-month postprocedural ceTCD and cETCD revealed no interatrial RS.

Conclusions: The prevention of RS depends on precise anatomical definition of PFO and associated septal abnormalities (ASA, multiple defects). Percutaneous repair of RS after PFO closure using the Occlutech Figulla Flex PFO device is feasible, safe, and effective, ensuring definitive abolition of the shunt and avoiding surgical approach. Long-term cTCD and ceTCD follow-up should be pursued at regular intervals postoperatively in order to confirm the abolition of the shunt. Further randomized clinical trials are necessary to assess the predictive value of RS and the long-term efficacy of catheter closure when compared to pharmacological or surgical closure.

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MID-TERM RESULTS OF PERCUTANEOUS CLOSURE OF ATRIAL SEPTAL DEFECT AND PATENT FORAMEN OVALE USING THE OCCLUTECH FIGULLA FLEX I/II CLOSURE DEVICE. MULTICENTER ITALIAN EXPERIENCE

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Purpose: To assess the safety and efficacy of percutaneous closure of atrial septal defect (ASD) and patent foramen ovale (PFO) with or without atrial septal aneurysm (ASA) using the novel Occlutech Figulla Flex I/II ASD/PFO closure device.

Methods: Between April 2010 and September 2012, we performed transcatheter ASD and PFO closure in 224 consecutive symptomatic patients (pts). Twenty-six ASDs (female/male = 2.3/1; mean age 40 ± 18 years, range 14–65) and 198 PFOs (female/male = 2.9/1; mean age 48 ± 15 years, range 12–75) were included. Patients were preprocedurally submitted to cardiological/neurological examination including contrast transthoracic/transesophageal echocardiography (cTTE/cTEE), brain CT/NMR imaging and contrast-enhanced transcranial Doppler (cTCD). Indication for ASD closure was significant left-to-right shunt associated with RV overload and mild-to-moderate pulmonary artery hypertension. Eleven ASDs (47.8%) were more than 30 mm in diameter. Closure of PFO was clinically indicated for secondary prevention in pts with previous cryptogenic cerebrovascular events due to presumed paradoxical embolism. Preprocedurally thromboembolic events were: 103 ischemic strokes (56.8%) and 78 transient ischemic attack (43.2%). Atrial septal aneurysm was observed in 35 pts (17.1%); a prominent redundant Eustachian valve was present in 25 pts (12.2%). Thromboembolic disorders were present in 10 pts (5.5%). Forty pts were aura migraineurs (19.6%). Primary prevention of cerebrovascular accidents was done in three professional scuba divers with multiple episodes of decompression sickness with large RLS via PFO. All procedures were performed with local anesthesia under fluoroscopic guidance and rotational intracardiac echocardiography (Ultra-ICE) achieving accurate device placement. Clopidogrel was recommended for 2 month and aspirin for at least 6 months after ASD/PFO closure.

Results: Device implantation was successful in all pts, except one. The in-hospital complications were: self-limited supraventricular arrhythmia in 25 pts (12.2%); new onset transient atrial fibrillation in 1 pt (0.5%); minimal groin hematoma in 15 pts (7.3%); mild pericardial effusion which appeared not to be related to the procedure in 1 pt; massive coronary air embolism with prolonged inferior ST segment elevation and transient cardiac arrest successfully resuscitated without further sequelae in 1 pt. cTTE/cTEE and cTCD 6 months after PFO closure (n = 105) revealed four moderate residual shunts with unclear clinical relevance (4.2%). Nonetheless, in two cases a second device implantation has been successfully performed with abolition of the residual shunt. In the ASD group (n = 18), one mild-to-moderate residual shunt was observed after implantation of a 39 mm device four months before. No device malfunction, erosion, valvular regurgitation, or thrombus formation occurred so far.

Conclusions: Catheter ASD/PFO closure using Occlutech Figulla Flex I/II devices appear to be easy, safe, and effective, ensuring high closure rate and low complication rate. Mid-term follow-up results appear favorable with respect to recurrent thromboembolic events. Further studies with adequate follow-up are warranted to confirm long-term efficacy.
TRANSTHORACIC ECHOCARDIOGRAPHY-GUIDED PERCUTANEOUS ASD CLOSURE IN CHILDREN: IS LESS MORE?

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Background: TEE guidance during percutaneous ASD closure remains the gold standard, unsurpassed by none but the use of ICE. However TTE can offer a reasonable time—saving substitute especially in children where subcostal views are superior. It can also be used when more recent imaging is not feasible or unavailable. In this study, we aim to evaluate the safety and efficiency of transthoracic Echocardiography monitoring during device ASD closure in children.

Methods and Results: Between January 2011 and July 2012, 21 children with ASD secundum were percutaneously closed using Occlutech-Figulla-N occluder. The procedures were carried out under general anesthesia, biplane fluoroscopy, and transthoracic echocardiographic guidance. The mean age was 3.7 years (±2.3) years. Mean weight at closure was 8.4 (±3.9) kg. The indications for closure were: FTT, PHT, RA, and RV dilatation. Thorough TTE was performed in multiple views to observe ASD size, position, long axis and short axis diameters, and rims. Patients were divided into two groups based on their largest ASD diameters: 12 patients with ASD diameter 7–15 mm (group A); 9 with ASD diameter 16–22 mm (group B). Occlutech-Figulla-N septal occluders were successfully deployed in all patients. Mild residual shunt at the end of procedure was detected by TTE in two cases (in group B) and resolved at one month follow-up. No mortality or major complications occurred. Postoperative follow-up TTE was performed at day 1, weekly for the first month and monthly for the remaining 5 months. At the end point of the study, no significant complications or mortality were detected.

Conclusions: Transthoracic echocardiographic guidance during percutaneous ASD device closure is a safe and efficient substitute to TEE or ICE in children. Posterior rims are difficult to visualize and hence cautious selection of cases is mandatory.

CONTRAST INDUCED NEPHROPATHY IN HIGH-RISK PEDIATRIC PATIENTS UNDERGOING CARDIAC CATHETERIZATION

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Objective: The purposes of this study were to determine the incidence of contrast induced nephropathy (CIN) in high-risk pediatric patients from the CICU undergoing cardiac catheterization and to describe any factors that may predispose critical patients to CIN.

Design: Retrospective analysis of all patients under the age of 18 admit to the CICU who underwent cardiac catheterization using the contrast Omnopaque 300 over four years period using RIFLE criteria modified for pediatrics with univariate logistical models.

Results: Seventy-nine patients met the criteria for inclusion; 36 males and 43 females, mean age 643 ± 1.227 days and weight 9.8 ± 16.4 kg. Eighteen patients had pre-existing renal abnormalities or impaired function. Within the 24 hr prior to catheterization, a total of 42 patients were mechanically ventilated, none were dialyzed, 3 were undergoing mechanical cardiopulmonary support, and 44 were hemodynamically unstable. There were five deaths on the same admission. Fourteen patients had CIN accounting for an overall occurrence of 17.7%. By pRIFLE criteria, 10/79 (13%) developed risk, 3/79 (4%) developed injury, and 1/79 (1%) developed failure. Recorded contrast dose for the patients that developed CIN (8.2 ± 3.5 cc/kg, range 4.2–16.9) was not different from those that did not develop CIN (9.0 ± 6.0 cc/kg, range 0.3–25.2) P = 0.63.

Conclusions: The incidence of CIN in this high-risk population was less than expected relative to studies in adults despite a very high and likely underestimated contrast load. Factors that likely play a role in predicting risk for CIN include: pre-existing renal disease, intervention procedures, and concomitant use of peripheral vasodilators. Further prospective study utilizing sensitive markers of renal dysfunction is warranted.

THE OCCLUTECH FIGULLA DEVICES FOR ATRIAL SEPTAL DEFECT OCCLUSION. COMPARISON WITH THE AMPLATZER SEPTAL OCCLUDER

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Many devices are nowadays available for atrial septal defect (ASD) occlusion but the Amplatz septal occluder (ASO) is clearly the most widely used for many years. We report here one center experience in transcatheter closure of ASD using the Occlutech Figulla ASD occluder. A comparison is performed with the ASO during the same period of time. From September 2009, 126 patients underwent ASD occlusion. Percutaneous closure was realized under general anesthesia with TEE control. Patients received intravenous heparin (100 IU/kg) at the beginning of the procedure. Choosing of device size was performed after a balloon test occlusion and measurement of the stretched diameter. None of them had pulmonary artery hypertension. One hundred five patients had ASD occlusion with ASO: 64 females, 41 males, with a mean age of 32.5 ± 5 years, a mean device size of 20.4 ± 6.9 mm. The fluoroscopic time was 6.3 ± 9.3 min, irradiation dose 19.2 ± 33.2 Gycm². Implantation succeeded in all but two who had surgical repair later on. Another patient had device embolization in the aorta. The device was retrieved by catheterization and this patient underwent 2 months later transcatheter occlusion with another ASO. During the same period of time, 21 patients underwent ASD occlusion with the Occlutech Figulla

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device including five patients with the Flex II occluder: 12 females, 9 males, with a mean age of 41.7 ± 21 years, a mean device size of 20.7 ± 4.8 mm. The fluoroscopic time was 4.4 ± 2.7 min, irradiation dose 14.3 ± 18.1 Gy cm². Device implantation succeeded in all but one who had surgical repair later on. No other complication was noticed. During follow-up, 2 patients with ASO had tiny residual shunt and 1 in the Figulla group had a persistent shunt due to another small defect. Transcatheter closure of ASD with the Occlutech device is feasible and safe with no learning curve since the implantation technique is similar to the Amplatz device. In addition, use of larger introducing delivery sheath for the Figulla device compared to the ASO is not a problem in the adult population but may be a limiting factor in younger children. Finally, the results of the Occlutech Figulla devices compare favorably with those of Amplatz devices. However, additional long-term results including more patients are mandatory.

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PERCUTANEOUS CLOSURE OF PATENT DUCTUS ARTERIOSUS IN SMALL INFANTS WITH SIGNIFICANT LUNG DISEASE OFFERS FASTER RECOVERY OF RESPIRATORY FUNCTION WHEN COMPARED TO SURGICAL LIGATION


Background: Surgical ligation via thoracotomy has traditionally been used to close the patent ductus arteriosus (PDA) in small infants, but this has been associated with initial deterioration in respiratory function and need for escalated ventilatory support. More recently, percutaneous closure of PDA in this population became feasible. We sought to describe our experience with percutaneous PDA closure in small infants on significant respiratory support and compare to matched surgical patients. We hypothesized that both methods would be safe and effective, but percutaneous closure would be followed by a shorter period of worsened respiratory status.

Methods: We retrospectively reviewed all patients ≤4 kg with significant lung disease requiring positive pressure ventilation that underwent percutaneous closure of PDA between January 2000 and April 2012 and matched to contemporary surgical patients on gestational age (GA), birth weight (BW), procedure weight (WT), and mode of ventilation. Patients were deemed to have returned to baseline respiratory status when the product of BW, GA, and WT was 1.43 kg (0.52–2.97), 29.8 weeks (24–39), and 2.8 kg (2.2–3.9) for catheter patients and 1.55 kg (0.48–3.04), 29 weeks (23–37), and 2.75 kg (2.3–4.2) for surgical patients. In the percutaneous group, Qo/Qs ranged from 1 to >4 and PVRi 0.9 to 6.7 Wood Units. The Amplatz Ductal Occluder was used in two patients and the Amplatz Vascular Plug II in six with complete occlusion in all. Two patients developed mild aortic coarctation and 1 mild LPA stenosis. There were three femoral artery and one femoral vein thrombi (all resolved with medical therapy). Surgical complications included: significant respiratory and cardiac compromise, rib fractures, subcutaneous emphysema, and urinary retention. The median time to return to baseline respiratory status was significantly shorter in the percutaneous closure group (17 hr, range 0–113) compared to the surgical group (53 hr, range 13–219), P < 0.05. Conclusion: Percutaneous closure of PDA in small infants on respiratory support is equivalent in safety and efficacy and may offer shorter recovery time than surgical ligation.
Conclusion: Successful percutaneous recanalization of occluded central vessels to normalize cardiac physiology is possible with careful mapping and understanding of the surrounding tissue substrate. Continued follow-up and anti-coagulation will be vital to ensure continued patency of recanalized vessels.

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FEASIBILITY OF TRANSCATHETER CLOSURE OF SINUS VENOSUS ASD AND LARGE SECUNDUM ASD WITH ABSENT SUPERIOR OR INTERIOR RIM
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Transcatheter closure of sinus venosus ASD or large ASD with absent superior or inferior rim has been challenging and is usually not recommended. Therefore, our goal was to assess the feasibility of transcatheter closure of such defects. To provide a stable rim for device anchorage, we have used a covered CP stent in the superior vena cava. Part of the stent will act as the superior rim of the defect. Therefore, we have used 45 mm length and cutting part of it and deployment of the stent in the SVC with part protruding into the right atrium. Three female patients underwent such trial, age ranged from 14 to 31 years with large sinus venosus ASD (One of them had sinus venosus ASD and two with large defects and absent superior rim). The patient with sinus venosus ASD had small tiny residual shunt after closure, while the other two patients had complete closure immediately after closure. At 6 weeks follow-up, the sinus venous patient had complete closure as documented by transesophageal echocardiography. Long-term follow-up data are still needed.

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OUTCOMES AND PREDICTORS OF REINTERVENTION IN PATIENTS WITH PULMONARY ATRESIA AND INTACT VENTRICULAR SEPTUM TREATED WITH RADIOFREQUENCY PULMONARY VALVOTOMY
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Background: Radiofrequency valvotomy (RFV) is an effective initial treatment in patients with pulmonary atresia and intact ventricular septum (PA-IVS) and mild-to-moderate right ventricle and tricuspid valve hypoplasia. Risk factors for the need for additional interventions in these patients are poorly defined.

Methods: All patients with PA-IVS who underwent RFV at the Children’s Hospital of Philadelphia between January 2000 and July 2011 were reviewed. Patients with Ebstein’s anomaly were excluded.

Results: Twenty-three patients met inclusion criteria. All underwent successful valvotomy with no procedural deaths and one major complication. Excluding two patients with limited follow-up, six (29%) patients underwent no subsequent interventions and nine (42%) patients required surgical right ventricular outflow tract augmentation. All patients with adequate follow-up have a biventricular circulation including 16 (84%) with oxygen saturations ≥95%. Patients that did not require any right ventricular outflow tract intervention after valvotomy had a significantly lower gradient across the pulmonary valve following valvotomy compared to patients who did require subsequent intervention (9.9 mm Hg ± 8.4 vs. 19.1 mm Hg ± 10.4, P = 0.05). Significantly more patients that required a neonatal intervention after valvotomy had a tricuspid valve z-score <−0.7 than patients that did not require additional intervention in the neonatal period (2 (15%) vs. 7 (70%), P = 0.008).

Conclusions: In our cohort of patients with PA-IVS, RFV was an effective and safe first step in establishing a biventricular circulation. Post-valvotomy pulmonary valve gradient may be a risk factor for subsequent outflow tract intervention and tricuspid z-score <−0.7 may put patients at risk for subsequent intervention in the neonatal period.

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TRANSCATHERET LEFT ATRIAL DECOMPRESSION IN HYPOPLASTIC LEFT HEART SYNDROME WITH INTACT ATRIAL SEPTUM: EVOLUTION OF A SINGLE-CENTER PERINATAL STRATEGY
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Background: Hypoplastic left heart syndrome with intact atrial septum (HLHS/IAS) has high neonatal mortality, with survival depending upon prompt relief of atrial septal obstruction. While some success has been reported with fetal intervention, our institution has undertaken a program of cardiac catheterization laboratory (CCL) delivery with immediate atrial septal stent placement. We report on the evolution of this process aimed at expediting left atrial (LA) decompression.

Methods: Single-center chart review of all cases of CCL delivery for prenatally diagnosed HLHS with intact or highly restrictive atrial septum from 2007 to 2012 at a large quaternary care children’s hospital.

Results: With extensive collaboration between interventional and perinatal cardiology, obstetric and cardiothoracic surgery teams, six patients with HLHS/IAS have undergone cesarean delivery in the CCL since 2007. The first two patients underwent percutaneous transhepatic atrial septal stent delivery. One of these was successful, with the second complicated by atrial perforation, tamponade, and death. The third patient had femoral venous access but procedural failure, and immediately transitioned to a successful open surgical atrial septectomy in the CCL. These percutaneous challenges prompted modification to the current protocol with CCL delivery, immediate sternotomy, and per-atrial transcatheter atrial septal stent placement. Procedural survival in the three per-atrial approaches was 100%, with no complications and two patients surviving to their next palliative surgery. In all successful procedures, stents were deployed in less than 1 hr after delivery, the fastest being 37 min.

Discussion: In this single-institution series of HLHS/IAS, we have noted systematic improvement in procedural success with evolution to the current strategy of CCL delivery and immediate per-atrial stent placement for initial palliation. In the three per-atrial stent cases, successful decompression of the LA enabled further medical management and two patients to complete hybrid stage I surgical palliation. While on-going improvements to this practice are necessary, a per-atrial approach appears to provide an efficient and efficacious means to LA decompression in these high-risk neonates.

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INTRACARDIAC ECHOCARDIOGRAPHY IS SAFE IN PEDIATRIC AND ADOLESCENT PATIENTS
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Purpose: Intracardiac echocardiography (ICE) use is common during interventional cardiac catheterization in adults. We describe our experience with ICE in pediatric and adolescent patients.

Methods: We reviewed all cases using ICE in patients ≤ 21 years old from January 2002 to February 2012. Demographics and variables reviewed included indication for ICE, type of interventional procedure, ICE-related morbidity, procedure morbidity, and procedural and fluoroscopy time. All studies were performed using the Acuson AcuNav™ ICE system.
Results: One hundred nineteen patients (65 females, mean age 13.1 ± 6.1 years, range 1–21 years) underwent ICE. In 100 patients (54%), ICE was used to facilitate closure of a patent foramen ovale (PFO) or atrial septal defect (ASD). Other interventional procedures for which ICE was used included occlusion of complex shunts (3), creation of an ASD or Fontan fenestration (3), and to assess Melody valve function after placement (6). ICE was used in diagnostic cases to identify or describe the presence of intracardiac or Fontan conduit thrombus (2), intracardiac shunt (3), prosthetic valve regurgitation (1), and abnormal pulmonary venous anatomy (1). An 8 Fr catheter was used in 53% of cases; a 10 Fr catheter was used in the remainder. Mean procedure time = 170 ± 65 min (fluoroscopy time 23 ± 13 min), Procedural/fluoroscopy times were longer in non-PFO/ASD cases (P < 0.002 for both). The use of ICE allowed for 51/119 (43%) patients to have procedures without general anesthesia. ICE imaging identified deficiency of critical defect rims in seven patients and complex/multiple ASDs in two patients, all of whom were referred for surgical closure. Only two patients (1.7%) experienced minor complications—groin hematomas that resolved without sequelae.

Conclusion: ICE is safe in pediatric patients. As in the adult population, ICE eliminates the need for a second operator in the lab. It may eliminate the need for general anesthesia, and complication rates are extremely low. ICE is a reasonable alternative to TEE to clarify complex anatomy and facilitate catheter-based interventions in children.

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BALLOON AORTIC VALVULOPLASTY FOR CRITICAL AORTIC STENOSIS IN NEONATES AND SMALL INFANTS
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Background: Balloon aortic valvuloplasty (BAV) is the preferred treatment for congenital aortic valve stenosis (AS) in neonates and infants. We describe immediate and intermediate outcomes of balloon aortic valvuloplasty in neonates and small infants at our center.

Methods: It is a retrospective analysis of patients who underwent BAV at our institution over the past 3 years. The following endpoints were evaluated: moderate-to-severe aortic insufficiency by echocardiography (AI), need for reintervention, and death.

Results: Between January 2009 and June 2012, balloon aortic valvuloplasty was performed in 20 infants with congenital valvar aortic stenosis. The age of the patients ranged from 2 days to 5 months, with 12 infants (57%) belonging to the neonatal age group (<1 month), body weight ranged from 3.8 ± 1.3 kg and the smallest neonate weighed 1.7 kg. The balloon-annulus ratio was 0.92 ± 0.1. Immediately after valvuloplasty, the mean systolic pressure gradient across the aortic valve decreased from 60 ± 14.4 to 22 ± 11 mm Hg (P < 0.001). Out of 20 infants, two infants died (mortality rate of 10%). Both patients had significantly thickened and dysplastic aortic valves with hypoplastic mitral valve (mean z score = −3.1). There were no late deaths and survivors were followed for a mean of 6 months. Of the remaining 18 patients, 3 (15.7%) had immediate moderate aortic regurgitation (AI) but none had severe AI. There was no significant relationship between occurrence of AR and balloon-annulus ratio. Repeat valvuloplasty was performed in four (14%) infants at a mean interval of 3 months. One patient had associated lesions with small left heart structures and one patient had an unicuspid dysplastic aortic valve. The remaining two patients had high post-BAV gradients of > 25 mm Hg.

Conclusion: BAV confers good immediate and interim benefits to most patients with congenital AS. Neonates with thick, dysplastic aortic valves, associated lesions of LV inflow and those with high post-BAV gradients experienced worse outcomes and needed

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WITHDRAWN

P-34
THE ROLE OF INTERVENTIONAL CARDIAC CATHETERIZATION IN FONTAN PATIENTS
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Background: Residual postoperative findings are common in Fontan patients. Many of them can be successfully managed in the catheterization laboratory.

Methods: We conducted a retrospective study of all catheterization interventions performed in our Fontan patients between 1994 and 2012. The angiographic and hemodynamic data as well as the data from the inpatient and outpatient clinic were analyzed.

Results: In our database, 233 Fontan patients were identified; a total of 138 interventions were performed in 100 of them (1–7 procedures per patient, in 11 procedures, more than 1 intervention was performed). In 27 patients (19.6%), the intervention was performed in the early postoperative period (before discharge). The main indications were hemodynamic instability and effusions. In 73 patients, the intervention was performed during the later follow-up period; the main indication was cyanosis or pulmonary branch stenosis. The most commonly performed intervention was fenestration closure (in 77 patients, in the long-term, 2 patients developed exsudative enteropathy). In eight patients, the fenestration was opened or enlarged (with an improvement of clinical status in four patients). In 36 procedures, collateral vessels, A-V fistulae or L-SVC were closed. In 20 procedures, a pulmonary branch stenosis was treated (LPA in 16 patients, RPA in 4 patients with 12 stents implanted). Complications occurred during nine procedures (three arrhythmia, two febrilities, one endocarditis, one stent embolization, two other). Radiofrequency ablation was necessary in two patients (in three interventions in total) and in one patient, aortic isthmus stenting was performed. The median age of patients at the time of catheterization was 6.3 years (range 2–30.4 years), the median time between the Fontan operation and the interventional procedure was 28 months (range 1 day–16.7 years). The median weight of patients at the time of procedure was 21 kg (range 9–75 kg). During the follow-up period, four patients died.

Conclusion: In cardiac centers which perform a fenestrated Fontan operation, the most frequent intervention is the fenestration closure, which is generally well tolerated, with a significant increase in oxygen saturations. By contrast, an emergent fenestration dilation or stenting can improve the acute hemodynamic situation in the early postoperative period. LPA stenting and collaterals closure are also often needed and can be safely performed.

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CHALLENGES OF INTERVENTIONS FOR ASSOCIATED LESIONS IN CASES OF APLICAL NON-COMPACTION
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Background: Isolated left ventricular non-compaction is reported extensively. But apical non-compaction (ANC) of both ventricles and septum is not reported much in literature. For the first time in the world, we are reporting the challenges of various interventions for different associated lesions in ANC.

Aim: To know the challenges and feasibility of transcatheter interventions for the associated lesions in cases of ANC to reduce the pump failure.

Material and Results: Out of 62 consecutive patients diagnosed as ANC by echocardiography, 28 (45.2%) underwent various transcatheter interventions, formed the material for this study. Age ranged 3 days to 35 years (mean 6.6 years). Eight cases had left ventricular (LV) dysfunction, 7 had right ventricular (RV) dysfunction, three had biventricular dysfunction, 46% had pulmonary artery hypertension (PAH), and two patients (3.2%) had thrombus in LV and RV. The device closure was done in 3 PDA, 14 PFO, 1 ASD, 1 aorto-right ventricular tunnel. Balloon
dilatation done for four aortic stenosis (AS), two pulmonary stenosis (PS), one coarctation of aorta, five patients underwent two procedures simultaneously (ABV and PBV, ABV and PTMC, ABV and PDA device closure, ASD and VSD device closure and PDA and VSD device closure). Three cases of VSD were postoperative residual shunts with severe PAH and in one case two devices were deployed. One 5 kg infant had large apical VSD and tubular PDA closed with ADO II. Hybrid surgery (14 mm septal occluder) was done for a large mid muscular VSD in 7 kg child. Device closure done for mid muscular VSD with dextercoria. In one case procedure was abandoned as 18 mm VSD device slipped.

**Discussions:** Procedures in ANC is risky in the presence LV/or RV dysfunction with or without thrombosis. Positioning the device in apical VSD in ANC cases is very challenging as the device gets caught in trabeculae in RV and if more tug is given the device slips through spongy myocardium. The results of interventions are very gratifying as the superadded pump failure due to pressure or volume overload caused by associated lesions improves significantly. One patient with severe AS and mitral stenosis had reverse May Thurner syndrome (obstruction of right common iliac vein by right common iliac artery), hence procedure was done through left femoral puncture.

**Conclusion:** Associated lesions in ANC worsen the pump failure. Transcatheter interventions though challenging are feasible safe effective and are life saving. Transcatheter interventions certainly reduce the morbidity and mortality in ANC patients who are at high risk for surgery or redo surgery.

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**BALLOON PULMONARY VALVULOPLASTY IN SEVERE PULMONARY VALVE STENOSIS PRESENTING LATE WITH RV DYSFUNCTION IN CHILDREN**

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**Background:** Patients with isolated pulmonary valve stenosis (PVS) tend to present late and may have associated RV dysfunction. Dysplastic pulmonary valve stenosis (DPVS) present a subset of this group where the optimal management becomes even more challenging. **Objectives:** To compare the result of BPV between severe DPVS and isolated PVS presenting late and determine various factors affecting the outcome.

**Material and Methods:** All patients presenting to single tertiary care hospital from June 2006 to May 2012 with severe PVS undergoing BPV were included in the study. Patients with critical PS were excluded. The patients were divided into dysplastic (group 1) and isolated doming (group 2) pulmonary valves based on echocardiographic appearance of the valves. Immediate percentage reduction in gradient across PV and complications in either group were analyzed along with frequency of RV dysfunction, balloon to annulus ratio, predilatation, and balloon stabilization.

**Results:** A total of 162 patients underwent BPV. The age ranged from 3 months to 14 years with median 2 years and mean ± SD 3.7 ± 4.0 years. There was a male predominance (M:F:2.1:1). BPV was found in 76 patients (46.9%). Thirty-four patients (21%) had RV dysfunction at the time of intervention. There was no significant difference between frequency of RV dysfunction between both groups (P = 0.4). Balloon stabilization was significantly more difficult in group 1 (P = 0.01). Mean balloon to annulus ratio was 1.3 ± 0.2 with no significant difference between the two groups (P = 0.4). Average preprocedure systolic gradient across PV fell from 93 ± 35 mm Hg to 29 ± 20 mm Hg with mean percentage reduction of 67.2 ± 19.8%. Percentage reduction in gradient was significantly lower in group 1 (62.9 ± 22.5% vs. 70.6 ± 16.6%, P = 0.02). Ninety patients (55.6%) had a successful and 67 (41.4%) partially successful BPV. DPV and poor balloon stabilization were significantly associated with partial relief or failed attempt (P = 0.038 and <0.001 respectively). RV dysfunction was significantly associated with various arrhythmias (3.7%, SVT 3, significant sinus bradycardia 3) during procedure (P = 0.001). There was no significant correlation between balloon to annulus ratio to gradient reduction in either group (P = 0.78).

**Conclusion:** Severe PVS presents late with 1/3rd having RV dysfunction. DPV and poor balloon stabilization are most important factor determining the outcome of BPV. RV dysfunction is significantly associated with arrhythmias during intervention.
This is the first report comparing the short-term outcomes between the hybrid and standard surgical approach.

**Methods:** Medical record review was performed for patients with PA/IVS who had either surgical or hybrid right ventricular decompression between January 2002 and December 2011 at our institution. Preoperative variables, procedural, and immediate postprocedural data, and short-term follow-up data were collected and compared between the cohorts.

**Results:** Seven patients with PA/IVS underwent a hybrid procedure; percutaneous pulmonary valvuloplasty with BT shunt placement in five and valvuloplasty alone in two. The procedure was technically successful in all attempts, and none required CPB. No patients required surgical re-intervention prior to hospital discharge, and none died prior to hospital discharge or on follow-up (median follow-up 28.4 months, IQR 23.1–37.2). Surgical RV decompression using CPB was performed in 17 patients, who had fewer preoperative risk factors for surgical morbidity/mortality than the hybrid group. The median CPB time for the surgical cohort was 80 min (IQR 69–108) compared to 0 min for the hybrid cohort. The patient outcomes were similar between the cohorts with similar rates of postoperative complications (58.8% vs. 57.1%) and no deaths prior to hospital discharge. One surgical patient underwent a second surgery for RV to pulmonary artery conduit placement.

**Conclusions:** The hybrid approach to PA/IVS is an attractive alternative to the standard surgical approach. The short-term patient outcomes are comparable, despite more risk factors in the hybrid group. Moreover, no patient in the hybrid cohort required surgical re-intervention prior to discharge, thus avoiding cardiopulmonary bypass in the neonatal period.

**P-39**

**SECUANDUM ASD CLOSURE USING THE AMPLATZER SEPTAL OCCLUDER IN PATIENTS UNDER 8 KG: RESULTS OF THE MULTICENTER MAGIC ATRIAL SEPTAL DEFECT STUDY**

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**Background:** The Amplatzer septal occluder (ASO) was approved by the FDA in 2001, but children less than 8 kg were excluded from the pivotal trial. Nevertheless, the ASO is being used in this patient population with very limited feasibility, safety, and efficacy data.

**Aims:** The objective of this study was to determine the safety and effectiveness of the ASO for ASD closure in infants weighing less than 8 kg.

**Methods:** The MAGIC ASD registry database used for this analysis began on November 20, 2004, ended on January 6, 2011, and enrolled patients from 13 hospital centers across the United States. One thousand thirty-one patients underwent attempted transcatheter closure of ASD.

**Results:** Forty-nine out of 1,031 patients weighed less than 8 kg. Catheterization records and follow-up visit data were collected. Indications for ASD closure were failure to thrive, significant right heart enlargement, hemodynamically significant shunts, and poor clinical status (respiratory support, congestive heart failure, chronic lung disease, pulmonary hypertension, and feeding problems).

**Results:** Patients ranged in age from 1 to 24 months (8.8 ± 4.8). Their weights ranged from 2.3 to 7.7 kg (5.6 ± 1.5 kg). Nine patients had trisomy 21 and 13 patients had very significant chronic lung disease with pulmonary hypertension and other prematurity related multisystem problems. Defect size ranged from 4.0 to 19 mm (8.4 ± 3.6). Stop-flow sizing was performed in 10 patients. Thirty-seven patients had single ASDs, nine had two defects, two patients had three, and one patient had a multiply fenestrated ASD. Five patients had aneurismal atrial septum. Additional interventional procedures included PDA coiling, LPA stenting, pulmonary balloon valvuloplasty and device closure of a left SVC. Pulmonary artery systolic pressure ranged from 15 to 90 mm Hg (36.5 ± 11.3). The pulmonary to systemic flow ratio ranged from 0.7 to 4.89 (1.95 ± 0.95). Pulmonary vascular resistance index ranged from 0.69 to 6.41 WU*M2 (2.1 ± 1.1). The pulmonary to systemic vascular resistance ratio ranged from 0.05 to 0.53 (0.2 ± 0.1). An ASO was successfully implanted in 48 of 49 infants (one patient had insufficient rims) and ranged from 4 to 20 mm (9.6 ± 3.7 mm) in size. At 24 hr postimplantation, 13 patients had a small residual shunt, 9 had a trivial shunt, and the remaining 26 had no residual shunt. One patient had a brief episode of atrial tachycardia. There were no other procedure related complications. One had pre-existing pericardial effusion that was drained before the device implantation. Follow-up data were available for 25 patients and ranged from 0.5 to 8 years. Clinical development and growth significantly improved in all children with failure to thrive, all ventilator or oxygen dependent children could be weaned after ASD closure. Diuretics and pulmonary vasodilator medications were also weaned successfully. There were four late deaths. One patient died 6 months postimplant from aspiration and autopsy showed evidence of acute and chronic aspiration pneumonitis. The ASO was found to be well positioned and endothelialized with no residual defect. Two other patients with ventilator dependent chronic lung disease died 6 and 21 months postimplant. One child died 12 months after the ASD closure likely due to a neurological event.

**Conclusions:** The ASO device can safely and successfully close ASDs in infants weighing <8 kg. In this small series, implantation has a high success rate and low complication rate. Short-term results especially in children with poor weight gain and lung disease are very encouraging, but continued follow-up of these patients is very important to determine long-term safety.

**P-40**

**AFTER FONTAN PROCEDURE, ARE THE HYPATOPATHY AND RELATED CARDIOVASCULAR FACTORS CAN BE ASSESSED BY TRANSIENT ELASTOGRAPHY?**

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**Objectives:** This study aimed to evaluate the congestive hepatopathy in the patients with Fontan circulation using transient elastography (TE) and other non-invasive methods, and to investigate whether the related risk factors are correlated with the liver stiffness (LS).

**Methods:** We evaluated 46 patients with more than 5 years after the Fontan procedure (Fontan group) and 26 patients who had hepatic congestion caused by right side heart failure (RHF group), with laboratory test, serum fibrosis marker, ultrason, and TE. We reviewed the records of cardiac catheterization taken within 1 year in 19 patients among the Fontan group.

**Results:** Nineteen patients of the Fontan group (41.3%) showed abnormally high LS in the abdominal ultrasound without significant abnormality in the laboratory test and APRI. The LS value was much higher in the Fontan group (21.1 ± 8.0 kPa) than that in the RHF group (10.0 ± 9.0 kPa). Serum level of total bilirubin and albumin, white blood cell count (WBC) and APRI showed a significant correlation with LS. Also the age at evaluation (r = 0.42, P = 0.004), the age at the Fontan procedure (r = 0.51, P < 0.001), and IVC diameter (r = 0.35, P = 0.02) were significantly correlated. The frequency of abnormal ultrasound findings increases with LS value (P = 0.002). Eighty-nine percent in the subgroup with the highest LS value (≥30 kPa) showed abnormalities and 44.4% in them showed liver cirrhosis. In catheterization data, the IVC pressure showed the significant inverse correlation with the LS value, IVC diameter, the age of patients, and the duration with Fontan circulation.

**Conclusions:** This study revealed that the congestive hepatopathy have been progressed in a significant number of patients with long-term Fontan circulation, and the TE is a reliable method to assess the risk and the severity of hepatopathy in these patients. It also revealed that the age of patients and the age at the completion of Fontan operation were the risk factors, and the IVC dilatation was a possible marker to reflect the risk and severity of hepatopathy. We suggest that regular screening test using TE is useful in long-term management of the patients with Fontan circulation, to predict the risk of hepatopathy and to sensitively recognize a progression of the liver disease. More longitudinal long-term follow-up studies and liver biopsy studies to validate the diagnostic accuracy of TE and to investigate of the specific LS range in these patients should be needed.
INTERVENTIONAL CATHETERIZATION IN CHILDREN LESS THAN 2.500 G

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Introduction: The role of interventional catheterization for treatment of congenital cardiac disease has grown with the emergence of new devices and the improvement of existing ones, and also the increasing experience of the groups involved. However interventions in premature neonates or infants weighing less than 2.5 kg are still considered a challenge, related to technical difficulties and lack of tools specific to this age group.

Objective: To describe the service experience with these patients in several clinical settings.

Methods: seven patients aged 3–66 days old and weighing 1,000–2,300 g (mean, 1,765 g) were submitted to the following procedures: perforation of the pulmonary valve using guidewire (0.014” SHINOB-PLUD Johnson) in three patients (1,800, 2,000, and 2,080 g) with pulmonary valve atresia with intact ventricular septum; removal catheter shattered in a patient with 1,000 g; STENT implantation for treatment of aortic coarctation in a patient (1,180 g) with refractory cardiac heart failure in controlled ventilation and systemic infection treatment; STENT implantation for the treatment of aortic recoarctation ten days after the surgery due interrupted aortic arch, in a patient (2,300 g) in anasarca and acute renal failure; STENT implantation in the right ventricle outflow tract in a patient with (1,180 g) diagnosed with Fallot’s tetralogy, esophageal atresia, and tracheoesophageal fistula; pulmonary valvuloplasty in a premature infant (2,100 g) also diagnosed with Fallot’s tetralogy, without surgical condition.

Results: All of the procedures were successful, with venous access done by puncture and arterial access obtained by dissection.

Conclusions: Interventions can be performed safely and good results can be achieved in this special group of patients, since the risks, indications, and staff experience are respected.

PERCUTANEOUS CLOSURE OF ATRIAL SEPTAL DEFECT BIGGER THAN 30 MM

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Introduction: Percutaneous closure of atrial septal defect (ASD) has been done with success and is considered the best option nowadays. Therefore, ASD > 30 mm, with small rims, are a challenge to the interventionalist.

Objective: To demonstrate the experience of the group with percutaneous closure of ASD in this special group of patients.

Method: About 64/469 (13, 6%) had ASD > 30 mm. Ages between 8 and 65 years (m = 34, 6), 38/64 (59%) female. Femoral vein was punctured in 63 patients and hepatic vein in one patient. Transesophageal echo was used in 60, transthoracic echo in one and intracardiac echo in three patients, respectively. The balloon and partial deployment of the left disc in pulmonary vein techniques were used to put the left disc in a good position in three and two patients, respectively.

Results: The procedures were done with success in all patients. Three patients had AF converted with amiodarone and one had transient SVT. Sixty-three patients went home 24 hr after the intervention and one stayed in the hospital for six days due to the cardiac surgery after device displacement. All of them had improvement of their functional class. RV diameter decreased to normal or near normal dimensions in all of them also.

Conclusions: The percutaneous closure of large ASD is a challenging procedure but it can be done safely, with high rate of success when the experience of the group has increased. Percutaneous closure of ostium secundum ASD, even the large ones, should be the first choice of treatment.

ONE-YEAR FOLLOW-UP DATA AFTER SUCCESSFUL PARTIAL CLOSURE OF A LARGE ASD WITH SEVERE PHTN USING CUSTOM MADE OCLUCTECH-FLEX II® DEVICE

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Background: Partial closure has been reported for ASD closure in the elderly and in cases of severe PHTN, with variable results. Some case reports describe different techniques of creating the fenestration. We report the one-year postoperative follow-up data of a 36-year-old female with severe PHTN in whom partial closure was successfully achieved using a manufactured fenestrated ASD Oclutech-Flex II® occluder.

Method and Results: Successful partial closure of a Large ASD secundum measuring 39 mm using a manufacturer made fenestrated device; Oclutech Flex II® ASD occluder. The waist measured 48 mm and left atrial disc (LA) disc: 64 mm, with a fenestration of 8 mm. Preload reduction 2 months prior to closure was achieved and heparin for the 1st week, followed by Aspirin for 1 year. Daily TTE follow-up for the first 2 weeks followed by weekly and then monthly till 12 months postprocedure. At 12 months follow-up, the fenestration is still patent. Pulmonary artery pressure (PAP) dropped from 90 mm Hg to 53 mm Hg, right ventricular diastolic dimensions (RVEDD) decreased and left ventricular end diastolic dimensions (LVEDD) increased. NYHA functional class improved from IV to II in one year. No device malfunction or thrombus formation was detected.

Conclusion: Partial closure is safe and succeeds in reducing the magnitude of the shunt when using a custom made fenestrated. Long-term follow-up is crucial to plan total closure of the defect.

A NOVEL MURINE MODEL FOR THE IN VIVO ASSESSMENT OF CORRODIBLE CARDIOVASCULAR IMPLANTS: DETERMINATION OF IRON IMPLANT DEGRADATION KINETICS, CORROSION PRODUCT LOCALIZATION, AND TRANSCRIPTIONAL RESPONSE AFTER IMPLANTATION OF IRON TUBES IN THE TAIL VEIN OF MICE

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For the development of biodegradable medical implants it is necessary to identify suitable materials. To evaluate iron as a degradable biomaterial a new mouse model was developed.

Methods: Iron implants were inserted into the tail vein of 65 mice, 17 underwent sham operation. Implant degradation characteristics as well as cellular and molecular responses were monitored. Follow-up ranged from 1 to 9 months before the mice were euthanized.

Results: Iron degradation proceeded gradually over the time of the follow-up. Ultimately, complete degradation was confirmed by micro-computed tomography. Histological analysis and gene expression data from whole-genome microarray analyses indicated a limited inflammatory reaction. No evidence of cellular responses to excess iron ions was detected. Iron-containing deposits were detected in the vicinity of the implant. In addition, individual cells in various organs reacted positively with an iron-specific stain.

Conclusion: A simple and robust mouse model was established that permits a first detailed in vivo evaluation of novel degradable vascular implant materials. While slowly degrading iron implants lead to a limited local
inflammation without signs of toxicity, degradation products accumulated locally as well as in various distant organs. Gene expression analysis supported the conclusion that the iron accumulated as a metabolically inactive precipitate. The mouse model can therefore reveal cellular and molecular details which serve to identify critical implant material aspects and possibly to reduce the need for more extensive testing in larger animals.

Methods: We reviewed the medical record including echocardiograms, angiograms, and hemodynamic data.

Results: The diagnosis of a large coronary artery fistula was made at birth by transthoracic echo and confirmed by a cardiac catheterization at 3 days of life. At 21 months of age the LV end diastolic dimension (EDD) had increased to a Z-score of 1.2. On cardiac catheterization using a carotid artery cut down approach, the coronary artery fistula measured 13.3 mm in diameter and a 16 mm Amplatzer Vascular plug (St. Jude Medical, St. Paul, MN) was placed with persistent residual flow. At 3 years there was substantial residual flow through the vascular plug with an increase in the LVEDD to a Z-score of 2.1. On repeat cardiac catheterization, multiple coils were placed within the vascular plug with minimal flow on subsequent angiograms. A repeat echo 1 month later showed LVEDD dimensions decreased to a Z-score of 0.5 with trace residual shunt.

Conclusion: Large coronary to LV fistulas can be safely closed using a hybrid carotid artery cut down approach to avoid injury to the femoral artery. Residual shunting through an Amplatzer Vascular Plug can be further occluded by placing coils within the device.

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MULTICENTRIC EXPERIENCE IN ARGENTINE WITH THE “CARDIA ULTRASEPT” DEVICE IN ATRIAL SEPTAL DEFECT CLOSURE

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Objective: Assessment of effectiveness and safety of the CARDIA ULTRASEPT atrial septal defect (ASD) closure device, and short- to medium-term follow-up of patients submitted to ASD closure with it.

Material and Method: The ULTRASEPT is the Vth generation of CARDIA ASD closure devices. It was carried out with a retrospective analysis of 43 patients (pts) submitted to ASD closure with this device between August 2010 and July 2012. Data collection was done by analyzing patient’s clinical histories. During the quoted period, 43 pts were submitted to the procedure. Isolated ostium secundum ASD: 32 pts; multifenestrated ASD: 5 pts; PFO: 5 pts; Fontan fenestration: 1 pt. Age: mean 25 years (range 3–69 years); weight: mean 47 kg (range 12–83 kg). Mean follow-up: 11.02 m. In this study, it was assessed: effectiveness of the implantation procedure, the occurrence of complications related to the procedure or the prosthesis used, and the persistence of residual shunt.

Results: Effectiveness: successful implant in 39 patients (93%). Non-effective procedure in 3 patients (6.9%). In one patient (2.3%), the ASD couldn’t be occluded due to insufficient posteroinferior rim. One patient (2.3%) had a tear in the interatrial septum during procedure, with unstable position of the device and significant residual shunt. The device was recaptured with a snare and the patient sent to a programmed surgery. Complications: In one patient the device embolized at 24 hr, and was sent to surgery to retrieve the device and ASD closure, without complications. One patient had two ASD distance from each other. It was occluded the one with the biggest diameter and was left a 3 mm defect without hemodynamic repercussion in the follow-up (fu).

Residual shunt: Transthoracic echo was done at 24 hr, 1 month, 3 month, and 6 month after procedure, 97.6% (42 pts) of the patient presented complete occlusion at 24 hr control. One patient presented residual shunt after procedure during follow-up. It has 2 ASD distance from each other. There weren’t mortality or significant complications. We haven’t found fracture or an injury due to erosion during the short- and medium-term follow-up.

Conclusion: ASD closure with ULTRASEPT was safe, effective, and well tolerated procedure, with very small number of major complication in our small series of patients.
FETAL PULMONARY VALVULOPLASTY BY PERCUTANEOUS TRANSPATEHIC ACCESS IN A LAMB MODEL

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Background/hypothesis: Fetal pulmonary valvuloplasty may ameliorate hypoplastic right heart syndrome and mitigate postnatal disease. Fetal heart access by direct fetal heart puncture is well-described. We have recently developed a percutaneous transthepatic fetal cardiac catheterization technique, which may be safer and offer technical advantages. We hypothesized that fetal pulmonary valvuloplasty could be performed by a percutaneous transthepatic approach at mid-gestational age.

Materials and Methods: Nine fetal lambs at 97–100 (term 147) days gestation (average weight: 1,215 g) under maternal general anesthesia were studied. Under ultrasound guidance, the fetal hepatic vein was percutaneously punctured using a 16G IV, cannula with needle in situ. A 2.6/1.8 Fr coronary catheter (FineCross™ MG, Terumo) was inserted into the cannula over a 0.014 inch floppy guidewire, and the IVC, RA, RV, pulmonary artery, ductus arteriosus, and descending aorta catheterized. After removing the guiding catheter, but with the guidewire in place, a coronary percutaneous coronary angioplasty (PTCA) catheter was positioned across the pulmonary valve, and several inflations of the balloon were performed simulating a valvuloplasty. Seven fetuses were euthanized postprocedure, and two were euthanized after term-delivery, for postmortem examination.

Results: Percutaneous cannulation of the fetal hepatic vein followed by RA and RV catheterization was successful in all cases. One fetus died during catheterization following RV perforation. In the remaining eight cases the coronary catheter was advanced to the descending aorta. Pulmonary valvuloplasty was successful in five cases using catheters with a 6-mm long balloon, and postmortem showed minimal hemorrhage without cardiac trauma. The procedure was unsuccessful in two cases (both survived) using a 12-mm long balloon which could not be turned into the pulmonary artery, but the fetuses survived and postmortem showed small RV perforations. In one case, the PTCA catheter could not be inserted as the cannula became dilated.

Conclusions: Fetal pulmonary valvuloplasty by percutaneous transthepatic cardiac catheterization is feasible, providing an alternative route for human fetal cardiac intervention.

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DIASTOLIC PERFORMANCE OF SINGLE SYSTEMIC RIGHT VENTRICLE MAY NOT IMPROVE AFTER STAGE 2 PALLIATIVE SURGERY

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Background: Staged single-ventricle palliation relies on passive flow through the pulmonary circuit to generate adequate preload and cardiac output.

Methods: Single center, retrospective review of patients with single-ventricle anatomy undergoing pre-stage 2 (PS2) and/or pre-stage 3 (PS3) hemodynamic evaluation from 1995 through April 2012. Data included demographics, cardiac diagnoses, hemodynamic data, and mortality. Patients with single left ventricles (SLV) were compared to those with single right ventricles (SRV), and PS2 and PS3 data were compared for patients who underwent subsequent stage 3 palliation.

Results: One hundred eight patients underwent PS2 cath, 57 (53%) SLV, and 51 (47%) SRV. At PS2 cath, there was significantly higher mean left atrial pressure in the SRV group (7.7 vs. 5.7 mm Hg, P = 0.002) and a trend toward higher mean left pulmonary artery pressure (15.1 vs. 13.4 mm Hg, P = 0.054). There was no difference in mean right pulmonary artery pressure (13.7 vs. 13.8 mm Hg, P = NS) or pulmonary vascular resistance (1.5 vs. 1.5 iWu, P = NS). Seventy-eight patients underwent subsequent PS3 cath, 44 (56%) SLV, and 34 (44%) SRV. The SRV group had significantly higher mean left pulmonary artery pressure (11.4 vs. 10 mm Hg, P = 0.044), higher mean right and left atrial pressure (5.9 vs. 4.7 mm Hg, P = 0.061), and end-diastolic pressure (9.1 vs. 8 mm Hg, P = 0.054). There was no difference in mean right pulmonary artery pressure (13.7 vs. 13.8 mm Hg, P = NS) or pulmonary vascular resistance (1.5 vs. 1.5 iWu, P = NS). Seventy-eight patients underwent subsequent stage 3 palliation.

Conclusions: In children with single-ventricle anatomy undergoing pre-stage 2 or pre-stage 3 palliation, the SRV group demonstrated significantly higher mean left atrial pressure and pulmonary vascular resistance compared to the SLV group. However, there were no differences in mean right atrial pressure, mean right atrial pressure, end-diastolic pressure, or end-diastolic pressure after stage 2 surgery. SLV patients had a significant decrease in end-diastolic pressure after stage 2 surgery (7.7 vs. 6.6 mm Hg, P = 0.042), but the SRV patients did not (8.6 vs. 7.6 mm Hg, P = NS). Overall mortality was 10%, with 6 (12%) in the SLV group and 5 (11%) in the SRV group, which was not statistically different.

Conclusions: Intrinsic differences in morphology, function, and response to performing as the systemic ventricle between single right and left ventricles may cause a persistently higher ventricular end-diastolic pressure that could limit passive flow through the pulmonary circuit and lead to poorer performance after stage 3 palliation for SRV patients.
Patent foramen ovale (PFO) has been known to be the cause of transient ischemic attacks or stroke, and transcatheter device closure has been the treatment of choice for these defects. Combined defect of abnormal drainage of left superior vena cava (LSVC) to left superior pulmonary vein (LSPV) in PFO patients is not a very common combination, but if present, both can act as a pathway for paradoxical embolism. We believe that simultaneous device closure of PFO, using AMPLATZER PFO occluder, and persistent LSVC, using the Amplatzer vascular plug II is not yet reported in Korea. A 37-year-old female was referred to our hospital with sudden onset of left upper extremity weakness. Brain MRI showed signs of stroke and on transthoracic echocardiography (TTE) performed to exclude a possible cardiac origin of cerebral embolism, PFO was suspected and transcatheter closure of PFO was scheduled. Contrast echocardiography performed via the left upper extremity prior to the procedure showed sequential filling of the bubble in the left atrium (LA) followed by left ventricle and then through the PFO to the right atrium. For a thorough evaluation, heart CT was performed and an abnormal connection of LSVC to left superior pulmonary vein (LSPV), draining to LA was shown, and it was also confirmed in the angiogram. Through the right femoral vein, the abnormal connection between LSVC and LSPV was closed using the AMPLATZER vascular plug II (diameter = 12 mm). Afterwards, transcatheter PFO closure with AMPLATZER PFO occluder (diameter = 25 mm) was also performed. We report a successful closure of persistent LSVC connected to LSPV using an AMPLATZER vascular plug II. Because this combined anomaly of PFO and persistent LSVC can be treated by a single transcatheter intervention, if clinically suspected, a complete evaluation for this anomaly should be considered.

**Results:** Stents were implanted in the right ventricular outflow tract in 13 patients with Fallot-type lesions, in 11 for branch pulmonary artery stenosis (4 post-Fontan), 5 conduit stenosis, 2 Fontan fenestrations, 2 PDA in hybrid stage 1 Norwood and one each SVC and CoA. Stent delivery up to 7 mm was over a 0.014" wire via a 4 Fr/5 Fr sheath or 6 Fr guidecatheter. About 8 mm or 10 mm stents (from March 2012) were placed over a 0.035" wire using a 7 Fr Mullins sheath. Stent tracking and delivery was excellent. There was no stent shortening for dilatation to nominal diameter and beyond. Eighteen stents were primarily or subsequently overdilated without any shortening. The 5 mm stent could be dilated to 10 mm, and the 10 mm stent could be dilated to 17 mm without shortening. There was one circumferential balloon fracture requiring retrieval, and one stent slipped and was removed.

**Conclusion:** The Cook formula stent is a versatile pre-mounted balloon-expandable stent that can be significantly overdilated with virtually no shortening. This allows for precise placement without protrusion into adjacent vessel. It is a great addition to the range of stents for use in the catheter treatment of complex CHD in children.
events occurred in 6/30 (20%) cases: hemothorax (n = 2), reperfusion injury (n = 1), stent migration (n = 1), intra-abdominal bleed after transhepatic access (n = 1), ventricular tachyarrhythmia (n = 1). 18/26 (69%) of patients were successfully weaned from ECMO support, with 16/26 (62%) surviving to hospital discharge.

Conclusions: Cardiac catheterization on ECMO support requires careful consideration of procedural location, transport, and vascular access. Hemorrhagic complications are not infrequent and may be exacerbated by continued need for heparin.

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PDA CLOSURE WITH NIT OCCLUD®: PDA-R IN PATIENTS UNDER 10 KG

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Introduction: We reviewed the outcome of 28 patients (pts) less than 10 kg with patent ductus arteriosus (PDA) that underwent PDA closure with NIT OCCLUD®: PDA-R.

Material and Methods: Between April 2010 and September 1, 2012, 29 PDA closure procedures were performed with NIT OCCLUD®: PDA-R. Mean follow-up (FU): 9 months. Gender: 17 females and 12 males. Age: mean 12.3 months (6–26 m). Weight: mean 7.780 kg (3.400–10 kg). QP/Qs > 2.5:1. Pulmonary pressure: 8/28 patients were normal (17.85%); 20/28 patients (82.15%) had pulmonary hypertension: five mild, seven moderate, and nine severe. Mean pulmonary diameter: 4.04 mm (2.5–4.5 mm). Mean aortic diam: 9.3 mm (5–14 mm). Mean length: 8.8 mm (5–12 mm). Mean device size: 4.3 mm (3–7 mm). One patient was treated with Sildenafil due to high pulmonary arterial pressure. No further complications occurred.

Conclusions: (1) The percutaneous closure of small to moderate size ASD with NIT OCCLUD®: ASD-R and PFO was feasible and safe. (2) All the patients had completely closed ASD at 3 month follow-up. (3) There were no complications in the small number of pts who had 36 months follow-up.

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THE INCIDENCE AND CONSEQUENCE OF INNOMINATE VEIN COLLATERALS IN SINGLE VENTRICLE PATIENTS

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Background: Following the bidirectional Glenn SHUNT (BDG), many patients develop innominate veno-venous collaterals. These collaterals decompress the innominate vein, reduce pulmonary perfusion, and contribute to increased cyanosis. To better understand the ‘natural history’ of venous collateral development and the impact these collateral vessels have on BDG performance and patient survival, we reviewed our institutional experience with the BDG shunt from 2000 through 2011.

Methods: All subjects with adequate pre- and post-Glenn angiographic imaging of the innominate vein, pulmonary arteries, and aortic arch were included. Echocardiographic, hemodynamic, and angiographic data were collected. Comparisons were made between patients with and without venous collaterals.

Results: A total of 158 patients underwent a BDG shunt and had adequate angiography. At pre-Glenn catheterization 51/158 (32.3%) patients had identified innominate venous collaterals. The collaterals measured ≥ 2.6 mm in diameter in 55/1 patients. One patient had coil occlusion and two patients had surgical ligation of the collaterals. No significant differences in hemodynamic or angiographic parameters were noted between patients with and without collaterals. At post-Glenn catheterization 90/153 (58.8%) patients had identified collaterals. The collaterals measured ≥ 2.6 mm in diameter in 40/90 patients. Twenty-one patients had catheter occlusion and six patients had surgical ligation of their collaterals. No significant differences in hemodynamic or angiographic parameters were noted between groups. Following BDG 13 patients died and 6 underwent heart transplantation. 12/14 (85.7%) patients were found to have collaterals at catheterization. Venous collaterals were present significantly less often in the remainder of the cohort 71/139 (56.1%, P = 0.04).

Conclusion: Innominate venous collaterals are common in single ventricle patients before and after the BDG. Many patients spontaneously develop venous collaterals after the BDG. Small venous collaterals noted prior to BDG tend to increase in size when reimaged after surgery. Generally, innominate venous collaterals are well tolerated in single ventricle patients after BDG. However, most of the patients who died or required heart transplantation after BDG were noted to have innominate venous collaterals which may have been poorly tolerated.

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ATRIAL SEPTAL DEFECT CLOSURE WITH NIT OCCLUD®: ASD-R AND PFO (PFM)

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Objectives: The aim of this study is to assess the immediate and midterm results in patients (pts) who underwent percutaneous atrial septal defect (ASD) closure with NIT OCCLUD®: ASD-R and PFO (PFM).

Material and Method: From November 2009 to September 2012, 39 pts underwent endovascular ASD closure with NIT OCCLUD®: ASD-R and PFO. Mean follow-up (FU): 13.5 months (1–36). Gender: 26 females and 13 males. Age: mean 19 years (4–60 years old). Weight: mean 36 kg (15–68 kg). All the procedures were performed under general anesthesia and simultaneous transesophageal echocardiography (TEE). Vascular access was through femoral vein. All the pts with QP/Qs > 1.6:1 and normal pulmonary pressure. The ASD was measured with TEE and balloon sizing with stop flow technique. Balloon sizing was not carried in seven pts due to their thick rims so the size of device used was the diameter by TEE. Mean ASD diameter: 11.3 (8–22 mm).

In three pts the ASD was multifenestrated. Balloon sizing was not performed and a PFO device was selected for these. Follow-up: 24 hr, 3 months, 6 months, 1 year, and annually after procedure.

Results: Immediate results: 29/39 pts (74.3%) had complete occlusion and 10/39 pts (25.3%) had minimal residual shunt. Three months after procedure all pts had complete occlusion. Six pts had 36-month FU in which they did not show complications such as arrhythmias, perforations, thrombus formation, or dislodgment of the device.

Conclusions: (1) The percutaneous closure of small to moderate size ASD with NIT OCCLUD®: ASD-R and PFO was feasible and safe. (2) All the patients had completely closed ASD at 3 month of follow-up. (3) There were no complications in the small number of pts who had 36 months follow-up.
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OCCLUDERS DEVICE USE IN THE TREATMENT OF CONGENITAL HEART

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Objective: To describe the clinical outcomes of treatment with occluder devices in patients with congenital heart susceptible of interventional treatment.

Background: Globally various institutions are using these devices. In our country, the National Institute of Child Health (NICH) is one of the first institutions to use.

Material and Methods: We retrospectively reviewed the medical records of patients with congenital heart disease treated with interventional occluder devices in (NICH) from 2007 to 2010.

Results: Forty-eight patients with PDA (n = 38), ASD (n = 10), and coronary fistula (n = 2) was attempted percutaneous closure of heart defect with occluder devices such PDA occluder (Amplatzer), Nit Occlud PDA, ASD septal occluder (Amplatzer), Solysafe ASD, and Vascular Plug II (Amplatzer). The clinical profile: average age 7.5 years (range of 1–15 years), weight 8.4–50 kg. For cases of PDA minimum diameter pulmonary was 1.6–7.6 mm, using PDA Amplatzer (20 cases) and Nit Occlud PDA (15 cases). Success rate: 35/38 (92%). For cases of ADS, the average size of the defect was 15.4 mm (TEE) using Amplatzer ASD device (7 cases) and Solysafe ASD (2 cases). Success rate: 9/10 (90%). In cases of coronary fistulas, the case no.1 (8 years): right coronary artery fistula to RA was occluded by multiple coils, and case no.2 (10 years): left coronary artery fistula to RA was occluded with Vascular Plug II. No major complications and hospital stay was less than 48 hr and immediate positive developments.

Conclusion: The use of occlusive devices in the treatment of congenital heart defects: patent ductus arteriosus, atrial septal defect, and coronary fistulas became an effective and safe procedure, with short hospital stay and low complication rate.

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OFF LABEL USE OF THE AMPLATZER DUCT OCCLUDER II ADDITIONAL SIZES (ADO II AS) DEVICE

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Aim: To review our institutional experience with the off label use of the new Amplatzer duct occluder II additional sizes (ADO II AS) device in children.

Methods: Retrospective record review of all children who underwent ADO II AS device implantation for off label indications.

Results: We used the ADO II AS device in six patients (median age: 3.75 (range 1.25–9.75) years, median weight: 13.35 (range 8–20) kg for off label indications since January 2011. Three patients underwent implantation to close a previously created stent fenestration of a failing Fontan circulation (two for prolonged pleural effusions and one for bronchiectasis). Devices used were one 3/4, 4/4, 5/4 each. The device was implanted with the appropriate delivery sheath crossing a cell of the stent and anchoring the proximal disc outside the lumen of the stent. The Sa02 were (82%, 88%, and 78%) before the procedure and increased to (95%, 96%, and 95%) after the procedure. Postprocedure angiogram has shown tiny residual flow across the fenestration in all three patients thereby offering the option of re-crossing the stent fenestration, should symptoms recur. Two patients underwent occlusion of major aorta-pulmonary collaterals using a 3/2 and a 3/4 ADO II AS device with good result achieving complete occlusion. Another patient with critical pulmonary valve stenosis who had stenting of PDA and balloon pulmonary valvuloplasty in the past had successful occlusion of the stented PDA with 4/6 ADO II AS device. The median procedure time was 51 (47–236) min. No complications were encountered.

Conclusion: The ADO II AS device can be used effectively and safely for a variety of occlusion procedures.

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TRANSCATHETER RETRIEVAL OF CARDIOVASCULAR FOREIGN BODIES—A 15-YEAR SINGLE CENTER EXPERIENCE

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Background: Transcatheter retrieval of cardiovascular foreign bodies is well established but there are no large pediatric studies in the literature. We reviewed our 15-years experience of transcatheter retrieval of foreign bodies from the cardiovascular system.

Methods: Retrospective record review of all children with transcatheter foreign body retrieval. Cases of retrieval of malpositioned PDA coils were also included.

Results: Transcatheter retrieval of foreign bodies from the cardiovascular system was attempted in 78 patients (median age 4 (0.02–16) years and median weight 15 (1.7–74) kg). During this time period there were 5,500 interventional cardiac catheter procedures performed. Retrieved foreign bodies included embolized devices (n = 46), central venous and arterial line tips (n = 15), guide wires (n = 3), stents (n = 8), ruptured balloon tip (n = 4), fractured ventriculo atrial shunt (n = 1), and fractured sheath introducer (n = 1). The incidence of embolization for ASD, VSD, and PDA devices/coils was 1.9% (9/466), 2.8% (4/140), and 3% (32/1,066), respectively. Retrieval sites included pulmonary arteries (PAs) (n = 33), aorta (n = 11), PDA (n = 9), central veins (n = 7), right atrium (n = 7), right ventricle (n = 3), RV to PA conduit (n = 3), left atrium (n = 1), and left ventricle (n = 4). Transcatheter retrieval was successful in 70/78 (90%) and had to be performed surgically in six patients. In two patients, the PDA coils were embolized into small distal PAs and after unsuccessful transcatheter retrieval attempts they were left in the distal PAs. Mean sheath size was 8 (4–16) Fr. Groosnack snare was the most commonly used retrieval device. Mean procedure time was 100 (15–316) min and fluoroscopy dose was 40 (0.4–320) Gy/cm². There were no procedural deaths. Complications included transient loss of foot pulses in five and excess blood loss requiring transfusion in two.

Conclusion: Transcatheter retrieval of cardiovascular foreign bodies can be performed safely in the majority of children including infants thus obviating need for the surgery. It is essential to have a comprehensive inventory of retrieval equipment and interventional staff conversant with its use.

P-60

VISUALIZATION OF POST-SURGICAL RIGHT VENTRICULAR OUTFLOW TRACT ANEURYSM BY 3-DIMENSIONAL ROTATIONAL ANGIOGRAPHY (3DRA)

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Introduction: Aneurysms can occur after right ventricular outflow tract (RVOT) surgery, especially when distal stenoses are present. Since 1 year, we routinely use 3-dimensional rotational angiography (3DRA) in patients with pulmonary artery (PA) stenoses to visualize complex bifurcation morphology prior to stent implantation. We summarize our experience of formerly unknown RVOT aneurysms (RVOTA) which were discovered by coincidence.

Patients: Five patients, median weight 6 kg (4–60 kg), median age 0.8 years (0.2–25 years), were scheduled for heart catheterisation (HC): two had single ventricle morphology (SV) at stage 1 of palliation (shunt), one truncus arteriosus (TA), and two tetralogy of fallot (ToF). All patients underwent HC under general anesthesia and 3DRA was performed using rapid pacing and multiple site contrast injections.

Results: One rotational angiography with multiple site contrast injections (RVOT and ascending aorta) identified the expected pulmonary stenoses, but furthermore revealed the unexpected RVOTA with high re-
solution in all patients. Two patients received PA stents. RVOTA was resected surgically in four patients. 3DRA delineated the critical proxim- ity between coronary artery and RVOTA in two patients, visualized severe left PA compression by RVOTA in one patient and was essential to exclude the RVOTA with covered stents in one patient scheduled for Melody procedure. One SV patient remains unsuitable for second stage palliation due to elevated pulmonary resistance and the RVOTA was accepted so far.

**Conclusion:** Non-invasive imaging by CT or MRI is the gold standard in congenital heart disease, but is challenging in patients < 5 kg and with high heart rates. When performing HC for PA stenting, 3DRA offers high-resolution information in complex topography “in-one-run.” Furthermore, 3DRA can reveal unexpected and essential findings leading to major changes in interventional or surgical strategy.

**P-61**

**OUTCOMES OF SECUNDUM ASD CLOSURE BY DIFFERENT BRANDS OF DOUBLE DISC DEVICE**

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**Background:** In Thailand, three brands of double disc nitinol devices are now available: Amplatzer septal occluder (ASO); Cocoon septal occluder (CSO), and Occlutech septal occluder (OSO). The aim of this study was to evaluate safety and efficacy in a mid-term follow-up among different brands of double disc device for transcatheter ASD closure in adults.

**Method:** One hundred forty-eight cases were enrolled in the study. Inclusion criteria were those with significant intracardiac shunt, symp- toms related to right heart failure, or pulmonary arterial hypertension (PAH). Patients with ASD diameter > 35 mm, reverse atrial shunt, sys- temic PAH not responding to reactivity testing or contraindication for antplatelet or anticoagulant therapy were excluded from the study.

**Results:** Majority of cases were female (77%). Mean pulmonary artery pressure (mPAP) was 21.7 ± 9.7 mm Hg. Mean age was 40.0 ± 15.4 years. Atrial fibrillation occurred in nine cases (6%). Fifty-seven of cases (37%) had deficient aortic rim. ASO was implanted in 60, CSO in 52, and OOSO in 36 cases. There was no significant difference among age, sex, mPAP, and ASD diameter in each group. Procedural success was 93, 94, and 100% in ASO, CSO, and OOSO group. Median diameter of device implanted in ASO, CSO, and OOSO group was 28, 28, and 24 mm, respectively. Mean follow-up time was 31.3, 21.8, and 19.4 months in ASO, CSO, and OOSO group. Residual shunt in day 1 was 41.7, 42.1, and 42.9% of ASO, CSO, and OOSO group. There was no residual shunt in all groups 1 month after implantation. Device embolization occurred in three cases (1 in each group). Two patients had massive pericardial effusion (1 in ASO, 1 in CSO) requiring surgical treatment. One patient of CSO group with AF developed stroke a month after implantation. There was no mortality in all groups.

**Conclusion:** In midterm follow-up, all three brands of double disc de- vice showed favorable outcomes without significant complications.

**P-62**

**ATRIAL SEPTOSTOMY WITH STENTING IN PATIENTS WITH IDIOPATHIC PULMONARY ARTERIAL HYPERTENSION**

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**Objective:** Atrial septostomy (AS) can be beneficial in patients with severe pulmonary arterial hypertension (PAH) because it procedures a pathway by which systemic cardiac output can increase. The biggest problem is the creation of an appropriate size of ASD without any deter-ioration. The aim of this study was to analyze the result of these proce- dures.

**Methods:** Between January 2006 and September 2012, AS was per- formed in 31 patients with idiopathic PAH. Median age at the time of AS was 14 years (range, 5–34 years). Indication for AS was class III or IV modified NYHA classification with right ventricular dysfunction but normal or slightly decreased cardiac output. The procedure was performed using fluoroscopy, intubation, general anesthesia, and TEE. “Palmaz” stents were inserted in all cases. In all cases but one atrial septum was intact.

**Results:** Cardiac catheterization revealed PAH in all patients. Median systolic pulmonary artery pressure (PAP) was 105 ± 45 mm Hg (range, 80–188 mm Hg). Median systemic blood saturation was 90 ± 2% (range, 88–94%). Sizes of created ASD were 5 mm in 21 patients, 6 mm in 9, and 8 mm in a patient 34 years old. Immediately after, procedure was increasing of PAP in all patients even in patient with PAP of 188 mm Hg (203 mm Hg) and moderate decreasing of systemic blood saturation—89 ± 2% (range, 84–95%). One patient died at the time of ASD creation (2.8%). The cause of death was damage of the right atrial wall. The patients were followed up for a mean period of 25.3 month (range, five month to four years). There were two late deaths (one month and two years after procedure). The estimated probability of survival at one year was 93%, and at two years—87%. In follow-up there was functional improvement in six patients with slightly decreasing of PAP.

**Conclusions:** AS with stent improves clinical status, hemodynamic vari- ables, and possibly survival in selected patients with idiopathic PAH. It may be a real bridge to lung transplantation.

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**ENDOVASCULAR CLOSURE OF CONGENITAL AND ACQUIRED PATHOLOGICAL COMMUNICATIONS USING AMPLATZER OCCLUDERS**

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**Purpose:** To show the possibilities of Amplatzer occluders in the man- agement of patients with different congenital and acquired cardiac and vascular communications.
Material and methods: Amplatzer occluders have been implanted in 72 patients with different pathological, cardiac, and vascular communications. In 26 cases, the occluder was used for the closure of antegrade blood flow in the pulmonary artery trunk after hemodynamic Fontan correction and bidirectional cavopulmonary anastomosis, in 7 cases—for the closure of large aorto-pulmonary collateral arteries (LAPCA), in 7 cases—for the closure of coronary-cardiac fistula, in 7 cases—for the closure of veno-venous fistula, in 6 cases—for the closure of paraprosthetic fistula after MV and AoV replacement, in 4 cases—for the closure of aorto-pulmonary septal defect (APSD), in 3 cases—for the closure of a communication between the RA and the LV, in 3 cases—for the closure of pulmonary veins collector after radical correction of total anomalous pulmonary veins return, in 3 cases—for the closure of arterio-venous fistula, in 2 cases—for the closure of Valsalva sinus rupture into the RV after radical correction of tetralogy of Fallot, in 1 case—for the closure of recanalized systemic-pulmonary anastomosis, in 1 patient—for the closure of a giant aneurysm of the right vertebral artery, in 1 patient—for the closure of fenestration of extracardiac conduit after Fontan operation, in 1 patient—for the closure of anastomosis Blöck-Teussig after Rastelli operation.

Results: Amplatzer occluder was successfully implanted in all 72 patients. After the closure of antegrade blood flow in the PA trunk, clinical improvement was noted in all patients. Occluder implantation also led to successful closure of coronary-cardiac fistula, iatrogenous communication between the LV and the RA, paraprosthetic fistula, aorto-pulmonary septal defect, and other communications mentioned above. Occluder-related complications were encountered neither in early nor in late postoperative period.

Conclusions: The use of Amplatzer occluders is an effective and safe therapeutic procedure for the closure of different pathological cardiac and vascular communications provided the respect of indications.

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HYBRID METHODS FOR THE TREATMENT OF CONGENITAL HEART DISEASES

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Purpose: To show the feasibility of hybrid treatment for the correction of CHD.

Material and methods: Hybrid interventions have been applied in 146 patients with different congenital heart defects. One hundred eighteen neonates with left heart hypoplasia syndrome (age from 12 to 72 years) underwent bilateral narrowing of the pulmonary artery with subsequent PDA stenting through the pulmonary trunk. In one patient with TF and ductal origin of the left pulmonary artery, the ductus was stented through ascending aortic approach. A 5-months-old patient underwent transventricular closure of 5 mm large perimembranous VSD under echocardiographic guidance. Another 9-years-old patient with tetralogy of Fallot and previous stenting of the pulmonary artery underwent further intraoperative stent deployment with simultaneous radical correction of the defect. A 5-months-old patient with single ventricle and severe aortic coarctation underwent narrowing of the pulmonary artery after successful stenting of the aortic isthmus. The first stage of correction in four patients with valvular aortic stenosis and coarctation of the aorta consisted in balloon valvuloplasty of valvular aortic stenosis, with subsequent correction of aortic coarctation immediately after the endovascular stage (three patients) and in 24 hr (one patient). An outlet into the pulmonary artery was created in three patients with one type pulmonary artery atresia and intact ventricular septum. One patient with common truncus arteriosus and truncal valve stenosis underwent balloon valvuloplasty of truncal valve stenosis after bilateral narrowing of the pulmonary artery. A 2-days-old patient with coarctation of aorta, aortic valve stenosis, and hypoplasia of left ventricle. Intraoperative angiography was performed in 13 cases.

Results: Twenty-one out of 29 neonates with left heart hypoplasia syndrome were discharged in satisfactory condition after bilateral narrowing of the pulmonary arteries and PDA stenting, before the second stage of hemodynamic correction. Stent dislocation into the pulmonary trunk occurred in one patient, urgent Norwood operation was performed. Seven in-hospital deaths were due to increasing multi-organ failure. A patient with TF and ductal origin of the left pulmonary artery died after PDA stenting because of increasing pulmonary edema. Radical correction of the defect was successfully performed in a patient with tetralogy of Fallot, in whom the pulmonary artery diameter has been enlarged intraoperatively from 10 to 15 mm. A patient who underwent aortic coarctation stenting and pulmonary artery narrowing was discharged in satisfactory condition.

Conclusion: Combined use of endovascular and surgical methods of treatment is a new and perspective trend in the treatment of congenital heart defects. Such hybrid techniques including open surgery and endovascular interventions are complementary and rather effective methods of treatment. They permit to decrease the duration of the procedure, and in some cases—to abandon the use of heart-lung machine, to decrease the rate of complications and the duration of in-hospital stay. Bilateral narrowing of the pulmonary arteries and PDA stenting are the first stage of hemodynamic correction in patients with left heart hypoplasia syndrome.

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ENDOVASCULAR TREATMENT OF CRITICALLY ILL NEONATES WITH VALVULAR AORTIC AND PULMONARY ARTERIAL STENOSIS

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Purpose: The analysis of the results of balloon angioplasty of valvular aortic and pulmonary arterial stenoses in critically ill neonates.

Material and methods: From 1998 through 2012, we have operated 75 neonates with valvular aortic stenosis (AS) and 52 neonates with valvular pulmonary arterial stenosis (PS) aged from 2 hr to 30 days. Mean weight of patients was 3.21 ± 0.52 kg. All patients were critically ill. Preoperative left ventricular-aortic peak systolic pressure gradient in patients with AS was 80.8 ± 13.34 mm Hg. Peak pulmonary transvalvular gradient in patients with PS was 95.97 ± 18.9 mg Hg, arterial blood saturation varied from 21% to 88%. We preferred to use Tysshak-mini (Nu Med, Canada) balloons for balloon valvuloplasty (BVP) of the aortic valve and pulmonary artery valve.

Results: Survival after transluminal balloon valvuloplasty for AS was 87.5% (n = 76), the procedure efficacy—96.5%. Peak systolic pressure gradient on the aortic valve decreased by 69% on the average and was 23.9 ± 10.2 mm Hg (P < 0.05). The complications were seen in 29.8% (n = 17) of all patients. Mortality was 12.3% (n = 7). After BVP for PS survival was 97.8% (n = 44), the procedure efficacy was 87.2% (n = 39). Peak systolic pressure gradient on the pulmonary arterial valve decreased by 75.8% on the average and was 23.6 ± 16 mm Hg (P < 0.05). Arterial blood saturation with oxygen increased on the average from 59.7 ± 17.5% to 79.6 ± 11.5% (P < 0.05). The complications after procedure were seen in 6.7% (n = 3) of patients with PS. Long-term follow-up was obtained in 41 (72.1%) patients after BVP for AS and in 37 (84.1%) after BVP for PS. The follow-up duration ranged from 2 months to 10 years. The survival was 100%. Good long-term results were obtained in 41.5% (n = 17) patients with AS and in 89.2% (n = 33) with PS. Aortic valve restenosis was seen in 26.8% (n = 11) (P < 0.05), aortic valve insufficiency of ≥ 2 degree in 12.2% (n = 5) (P < 0.05), restenosis and insufficiency of the aortic valve were revealed in 14.6% (n = 6) (P < 0.05). Reoperations were necessary in 13 (31.7%) patients (P < 0.05). After BVP for PS valvular restenosis was seen in only one patient (3%).

Conclusion: Balloon valvuloplasty for critical valvular aortic and pulmonary arterial stenosis in neonates is an effective procedure. In the long-term follow-up, 68.3% of neonates after BVP for AS did not require reoperations, after BVP for PS restenosis developed in only 3% of neonates.
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STENTING OF AORTIC COARCTATION AND RE-COARCTATION

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Purpose: To show immediate and late results of stenting in patients with coarctation and re-coarctation of the aorta.

Material and methods: By September 2012 stenting for aortic coarctation (CoA) and re-coarctation (reCoA) has been performed in 67 patients. There were 40 patients with CoA and 27 with reCoA. The patient’s age varied from 5 months to 41 years, and the weight from 5 to 90 kg. Depending on angiographic semiotics, we have conditionally divided the stenoses of aortic isthmus into four types. The 1st angiographic type was seen in 28.6%, the 2nd in 32.2%, the 3rd in 21.4%, and the 4th in 17.8% of patients. In aortic isthmus stenoses of the 1st, 2nd, and 3rd types we have implanted bare stents: “Palmaz,” “Palmaz XL,” “Palmaz-Genesis” (Cordis, USA), and “CP” (NuMed, Canada).

Results: Stenting of CoA and reCoA was effective in all cases. Good immediate angiographic, clinical, and hemodynamic results were obtained in 65 patients. In two cases satisfactory results were obtained. Both patients were after surgical resection of aortic coarctation with the creation of end-to-end anastomosis. Three patients (5.1%) had post-stenting thrombosis of the femoral artery, necessitating surgical intervention. After the stenting of the CoA, mean systolic pressure gradient at the stenotic site decreased from 47 ± 9.6 mm Hg to 3.1 ± 1.3 mm Hg, in patients with the reCoA from 46 ± 4.6 mm Hg to 2.7 ± 1.8 mm Hg (P < 0.001). Systolic pressure in the ascending aorta decreased from 147.6 ± 32.5 to 134.5 ± 22.1 mm Hg, and diastolic pressure increased from 82.1 ± 20.8 to 91.2 ± 21.4 mm Hg. Systolic pressure in the descending aorta increased, respectively, from 103.9 ± 28.2 to 125.9 ± 26.4 mm Hg, and diastolic pressure from 81.7 ± 17.1 to 83.8 ± 17.9 mm Hg. In the long-term (13 months after the stenting), one patient had a complication in the form of aneurysm in the stented area. The patient underwent successful endografting of the thoracic aorta with “Valiant” stent-graft (Medtronic, USA).

Conclusions: Aortic isthmus stenting is feasible in most patients with CoA and reCoA of the aorta. In aortic isthmus stenoses of the 1st, 2nd, and 3rd types it is possible to use bare stents, while in cases of the 4th type stenoses and in the presence of para-coarctation aneurysms coated stents are preferable. Technical success of the procedure was 100%. Stenting in aortic CoA and reCoA is a safe method of treatment, which can serve as an alternative to surgical correction in most cases.

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TRANSCATHETER CLOSURE OF A POST-TRAUMATIC MUSCULAR VENTRICULAR SEPTAL DEFECT WITH A NIT-OCCCLUD-PFO DEVICE UNDER INTRACARDIAC ECHOCARDIOGRAPHIC GUIDANCE

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Objectives: Teams treating structural heart disease inside the catheter laboratory are sometimes faced with unusual anatomic situations. We are reporting about a case of post-traumatic muscular VSD (mVSD) in which a transcatheter closure with a non-self-centering double umbrella device was performed utilizing intracardiac echocardiography (ICE) for guidance.

Methods: A 47-years-old male received emergency surgery because of pericardial tamponade after a knife injury to the thorax 1 month ago. A cut of the free right ventricular wall was sutured at this time. However, echocardiography demonstrated a 0.92–1.22 cm oval shaped mVSD with increasing hemodynamic relevance and elevated pulmonary pressures to 46/17–26 mm Hg, over the next 4 weeks. For interventional closure a 20 mm Nit-occlud-PFO occluder, a symmetric double umbrella with a very flat left-sided single layer disc was chosen for defect closure. During the intervention, ICE was used for guiding all stages of device implantation.

Results: The defect was closed by Nit-occlud-PFM device well without protruding parts to the free wall of both ventricles. The flat disc fitted very well onto the left septal wall. In the echocardiography, a little residual shunt was seen through the occluder. There were no signs of hemorrhosis. One month later the residual shunt had vanished and the pulmonary pressure was normalized.

Discussion: The described defect after a knife injury was located very anteriorly inside the septum. A centering umbrella device would have had the risk of affecting the free wall of the ventricles with the risk of perforation and development of malignant arrhythmias. The use of the non-centering Nit-occlud-PFO with the thin and flexible monolayer disc for left side was a good solution for interventional closure of the mVSD in our case. Because of the unusual anatomy of the defect the ICE was more informative than fluoroscopy while closing the defect.

Conclusion: Transcatheter closure is an alternative choice of treatment for post-traumatic mVSD. An unusual defect anatomy forces sometimes the decision for the use of unusual devices in this special situation. ICE provides a reliable method of best control for correct positioning of the device. The open mind for using new different devices and utilizing the best possibility of imaging enlarges the probability of a good result.

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NOVEL TECHNIQUES FOR ADVANCING LARGE SHEATHS THROUGH DIFFICULT ANATOMY DURING MELODY VALVE IMPLANTATION

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Advancing large, long sheaths through difficult anatomy can prove challenging for even the most experienced interventionalist. The recent technique of pre-stenting the RVOT to create a landing zone for transcatheter pulmonary valve implantation requires advancement of relatively large sheaths across surgical anastomotic sites and often calcified conduits, in addition to maneuvering the curves associated with the RVOT. Irregularities and crevices at the transition from native tissue to conduit or within the conduit itself can cause the tip of the dilator or the edge of sheath to “stick” and not advance. We describe two simple and innovative techniques that facilitate accomplishing this sometimes arduous task. The first technique involves inflating a small balloon partially housed inside an advancing sheath. With the leading edge of the balloon protruding from the sheath, one can employ a “bumper-balloon” technique for advancement of the sheath. Alternatively, the “anchoring” technique uses a balloon dilation catheter inflated distal to an obstruction which anchors the guide wire over which a sheath can be advanced without loss of wire position or untoward damage to anatomy. This technique has been successfully used when difficult RVOT or branch pulmonary artery anatomy must be crossed with a large sheath before or after placement of landing zone stents as illustrated by three cases of Melody valve implantation.

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USE OF THE MELODY VALVE IN CONGENITAL HEART DISEASE: TIPS AND TRICKS FROM A SINGLE CENTER

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Background: Experience with the Melody valve has increased significantly since HDE approval in 2010. We report our clinical experience and describe several tips and tricks that have helped to deliver and implant the Melody valve.
Methods: Retrospective data analysis of all Melody valve implantations from August 2010 to May 2012 with Wilcoxon Signed Rank test.

Results: Fifty patients were consented and taken to the cardiac cath lab for possible Melody valve (MV) implantation. MV implantation was not attempted in 23 patients due to adequate relief of RVOT with balloon angioplasty (n = 14), coronary artery compression (n = 3), compliant RVOT (n = 2), or other reasons (n = 4). Twenty-seven patients underwent successful MV implantation with 100% procedural success with a mean follow-up of 46 ± 225 days. For implanted patients, median age was 13 (9–40) years and median weight was 50.3 (22.6–113) kg. Primary diagnosis included TOF (13), pulmonary atresia (8), aortic stenosis s/p Ross procedure (3), d-TGA with pulmonary stenosis (2), and truncus arteriosus (1). Indication for valve implantation included stenosis (10), regurgitation (3), and mixed (14). Type of RVOT conduit consisted of homograft (15), porcine pericardial (7), bovine jugular (3), porcine cardiac (1), and monocusp PTFE (1). A prior conduit stent was present in 9. Procedural variations included heat curving the blue tip of the delivery system to allow smooth passage around the curvature of the RVOT in 27, “figure of 8” stich for venous hemostasis in 21, pre-stenting for additional structural support in 12, IJ access for delivery of valve in 1, MV implant under conscious sedation in 1, “valve-in valve” implant for a stenotic (1), and conduit diameter increased (6). There were eight minor complications including arrhythmia (3), transient pulmonary edema (2), fever (2), and small hematoma (1).

Conclusion: Procedural variations can improve and permit effective and safe implantation of the Melody valve in a variety of clinical presentations.

P-70

VARITY OF COMMUNICATIONS OF THE HEART CHAMBERS AND LARGE VESSELS AND THEIR POSSIBLE TRANSCATHETER CORRECTIONS

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Aim: Vessels and communications between large vessels leading to significant hemodynamic alterations with the need for treatment.

Background: There are broad variation possibilities of communications between heart chambers and large vessels or between vessels. The type of interventions depends on the anatomy and physiology of the communications.

Methods: Five patients having communication anomalies were chosen. Patient 1, 1.5 years, large ventricular septal defect (VSD), patent ductus arteriosus (PDA), and communication/fistula from descending aorta to pulmonary artery. Pulmonary hypertension (PH) with Qp/Qs 1.1. Patient 2, 12 years, with a tunnel between right coronary sinus and left ventricular. Patient 3, 2.4 years, fistula between pulmonary artery and left atrium. Patient 4, 3 years, fistula between the vertebral artery and vena cava superior with left/right shunt. Patient 5, 14 years, fistula between right coronary sinus and right atrium.

Results: Because of the PH in the patient 1 the fistula and the PDA were closed by a Vascular Plug II and a PDA occluder II as a first step of correction. In 3 months when Qp/Qs became 1.6 with decreasing PVR the VSD was surgically treated. For patient 2, a test occlusion with an Opto Pro balloon catheter was performed with positive result. A Vascular Plug II was stable established on the neck of the tunnel and closed the tunnel without shunt. But in angiography the occluder was situated too close to the right coronary artery (RCA) and because of a high risk of total occlusion of the RCA after release the occluder was not left. In patient 3, a membranous VSD occluder was positioned into the fistula. Oxygen saturation raised from 70 to 100% after implantation.

P-71

INTERVENTIONAL TREATMENT OF AORTIC ARCH OBSTRUCTION IN PATIENTS AFTER NORWOOD PROEDURE

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Background: Aortic arch obstruction (COA) after the Norwood procedure (NP) remains a significant problem. It has been associated with atriointerventricular valve regurgitation, deterioration of ventricular function, and with increased risk for death. We report our experience in arch interventions in patients after NP.

Methods: Between December 2002 and August 2012, 42 patients underwent 55 catheterizations for COA after NP. Median age and weight were 6 months (1.2–62.6) and 6.1 kg (2.8–14.8) respectively. Thirty-six patients were after NP and 6 after BDG. Femoral vein access was used in 33 patients, femoral artery in 9. Single balloon was used in 28 patients, 2 balloons in 13 and 3 in 1. The first and largest balloon-to-coa ratio were 2.4 ± 0.6 and 2.7 ± 1.1 respectively.

Results: Median PG decreased from 26 (7–82) to 8.5 mm Hg (0–34) (P < 0.0001). The first intervention was successful in 29/42 (69%) patients—PG < 10 mm Hg. Median coarctation index (CI) increased from 0.47 (0.19–0.75) to 0.8 (0.6–1.1) (P < 0.001). Patients with successful and unsuccessful first intervention did not differ significantly in age, CI, and largest balloon-to-coa ratio. The former had higher weight 6.3 kg (4.6–14.8) vs. 5.5 (2.8–7) (P = 0.023) and lower initial PG 25 mm Hg (7–48) vs. 38 (15–82) (P = 0.048). In the median follow-up of 2.9 years (0.01–8.7) four patients died, 26 advanced to BDG, 6 to Fontan, and 1 to biventricular repair. Ten (23.8%) patients required 13 reinterventions (balloon angioplasty—9, stent placement—4) after median time of 4.1 months (0.07–21.3). Patients with (10) and without reintervention (32) did not differ significantly in age, weight, and CI, whereas the former had higher largest balloon-to-coa ratio 2.9 (1.6–5.3) vs. 2.3 (1.5–4.2) (P = 0.026) and PG after the first intervention 12 mm Hg (1–34) vs. 7.5 (0–17) (P = 0.014). For the whole 55 catheterizations II/III degree a-v block occurred in two patients, supraventricular tachycardia (requiring cardioversion) in one, stent fragmentation (removed through carotid cut-down) in one, femoral vein thrombosis in five, and loss of femoral pulse in seven (transient—4, permanent—3).

Conclusions: Percutaneous treatment of COA in patients after NP resulted in high acute success rate especially among patients with higher weight and lower initial gradient. Those with reinterventions had higher PG after the first intervention and higher largest-balloon-to-coa ratio.

P-72

TRANSFEMORAL STENT IMPLANTATION AS A BRIDGING THERAPY IN A CRITICAL, VERY-LOW-BIRTH-WEIGHT GEMINI NEWBORN OF 700 G WEIGHT

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Background: In newborns, surgical treatment is the therapy of choice when aortic coarctation is present. In very low birth weight (VLBW) critical newborns, the situation can differ when surgery cannot offer therapeutic option. Coronary-stent implantation can be used in critically ill VLBW newborns as a bridging-therapy.

Objective: We report about a 700 g VLBW gemini with critical duct dependent aortic coarctation.

Methods: Clinical, echocardiographic, and angiographic data were reviewed for the patient who underwent CoA stenting at 7th day of life. Evident ethic aspect due to the very low weight was present at all moments of discussion pre- and postinterventionally.

Results: The patient was on intravenous infusion of 20 ng/kg/min Prostaglandin E2. When seven days old she showed clinical signs of severe pulmonary hyperperfusion and low systemic output. Neurological evaluation revealed no signs for cerebral bleeding and no other VLBW typically related comorbidity was present. Cardiosurgically resection of the coarctation was dismissed due to small size of the newborn and expected risk. After profound ethical discussion in the team and with the parents, stent implantation was performed using a 5.5 mm × 16 mm cobalt-chromium coronary-stent. During high-pressure-dilatation, a 50% stenosis-waist in the stent resolved at 14 atm (picture) and the pressure-gradient dropped from 40 to 0 mm Hg. The stent was in good position and left subclavian artery remained unobstructed. The right femoral artery did not re-perfuse after intervention but sufficient collaterals had developed. At 8 month follow-up, the child clinically still presented well with a weight of 5.8 kg, an aortic descenders gradient of 25 mm Hg (CW-Doppler and non-invasive pressure measurement). Surgical intervention was performed with longitudinal incision of the stent and patchangioplasty.

Conclusions: The course of this individual case is encouraging and the child develops in a normal way. Up to now our experience in CoA stenting in VLBW newborns with a weight below 1 kg is limited to two cases. Because of absence of comorbidity and the unproblematic follow-up the decision for intervention seems to have been made right.

P-73

CLOSURE OF EXTRACARDIAC FONTAN FENESTRATIONS WITH VARIOUS DEVICES

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Background: Fenestration allows for decompression of the Fontan circuit and augmentation of cardiac output; however it results in subnormal systemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke. Aim of this study is to report sin-gsystemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke. Aim of this study is to report sin-gsystemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke. Aim of this study is to report systemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke. Aim of this study is to report systemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke. Aim of this study is to report systemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke. Aim of this study is to report systemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke. Aim of this study is to report systemic arterial oxygen saturation and exposes the patient to the risk of paradoxical embolization and stroke.

Methods: Between May 2004 and August 2012, 56 patients underwent closure of the fenestration. Patients were divided into three groups: group I: ASO (n = 31; 4–3 mm, 5–24 mm, 6–3 mm, 7–1 mm); group II: ADOII (n = 15 patients: 5/4–9 mm, 4/4–5 mm, 3/4–1 mm); group III: covered stent (n = 10; V12–3, CP–7).

Results: Median age and weight for the whole population were 6.4 years (2.45–16.18) and 20 kg (9.4–114), respectively. Mean O₂ saturation and venous pressure in the tunnel increased from 84.8% ± 4.7 to 97.3% ± 2.1 (P < 0.001) and from 13.9 mm Hg ± 2 to 14.6 ± 2 (P < 0.01). Median dose-area-product and time of fluoroscopy were 264.2 mcGcm² (23.3–1,418) and 13.3 min (5.6–79.4), respectively. Comparison between groups showed that patients in group III were significantly older (8.4 vs. 5.9 years), heavier (27 vs. 18 kg), received more radiation (451.6 vs. 262.4 mcGcm²) and were referred for the interventions later after Fontan operation (25.9 vs. 13.1 months) than patients from group II. There were no significant differences between group I and II. Immediate closure of the fenestration (group I vs. group II vs. group III) occurred in 11 patients (21%), 0, 6 (60%) respectively and closure at discharge in 19 patients (61%), 7 (46%), 10 (100%) respectively. In the median follow-up of 23 months (1–99), closure of the fenestration was documented in 30 patients (97%), 14 (92%), 9 (90%), respectively. In one patient after im-plantation of AV12 stent, late reintervention with balloon dilatation was performed due to recurrence of flow across the fenestration.

Conclusions: Fenestration closure with covered stents was performed in older, heavier patients and resulted in more patient radiation. Despite differences in the acute success rate, comparable, high percent of complete occlusion was observed in the follow-up.

P-74

RETROSPECTIVE REVIEW OF A SINGLE CENTER EXPERIENCE WITH THE AMPLATZER VASCULAR PLUG I AND II

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Background: The Amplatzer Vascular Plug is an established embolic device approved in 2004 for peripheral vascular embolizations. Since its approval, the Amplatzer Vascular Plug has been utilized for the occlusion of various vascular and intracardiac structures, and has been modi-fied to include multiple versions. Although there are several publications relating to this, we provide the experience of a single institution that includes a patient population, not included in previous publications.

Objective: To review the clinical applications, effectiveness, and comp-lications of utilizing the Amplatzer Vascular Plug I and II to occlude vessels and intracardiac structures in patients with congenital cardiovas-cular disease.

Methods: Perform a retrospective review of all cardiac catheterizations in which an Amplatzer Vascular Plug I or II was used at Cardinal Glenn-on Children’s Medical Center, in Saint Louis, Missouri, since the de-vice was approved in 2004, as well as follow up data.

Results: Forty-four patients with congenital cardiovascular disease underwent vascular occlusion of 46 structures using an Amplatzer Vascu-lar Plug. Seven (15.2%) vessels were occluded with the Amplatzer Vascular Plug I and 39 (84.8%) vessels were occluded with the Amplatzer Vascular Plug II. The patients had a mean age of 5.83 years (range 0.38–21.7 years) and mean weight of 18.4 kg (range 6.3–59 kg). Of the 46 vessels occluded, there were 22 (47.8%) extracardiac Fontan fenes-trations using a Gore-Tex tube, 7 (15.2%) patent ductus arteriosus (PDA), 4 (8.7%) superior vena cava (SVC), 2 (4.3%) venous collaterals, and 11 (23.9%) miscellaneous structures. Complete occlusion was observed in 91.3% of vessels either at the time of the catheterization or during subsequent follow-up imaging. Only minimal residual flow was observed in the remaining 8.7% of the vessels. There were no complications related to the use of the Amplatzer Vascular Plug.

Conclusion: The Amplatzer Vascular Plug I and II is a safe and effect ive occlusion device for use in a wide variety of cardiovascular struc-tures in congenital heart disease, and is an excellent device to occlude extracardiac Fontan fenestrations utilizing a Gore-Tex tube.

P-75

EXPERIENCE IN PERCUTANEOUS CLOSURE OF PATENT FORAMEN OVALE—EVALUATION, FOLLOW-UP, AND RESULTS IN SHORT-, MID-, AND LONG-TERMS

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Introduction: Patent foramen ovale (PFO) is present in 25% of the adult population. PFO importance has been growing because of its asso-
cation with cryptogenic ischemic stroke due to paradoxical embolism and migraine. This study demonstrates our center’s protocol for selecting and following up patients treated by percutaneous closure, as the results in short-, mid-, and long-terms.

Methods: The including criteria were stroke or transient ischemic attack due to paradoxical embolism, severe chronic migraine without response to pharmacological treatment, Patent Ductus Arteriosus, or pulmonary shunts with major right to left shunts and right ventricular hypertrophy. Patients were submitted to clinical and hematologic evaluations and graduated of migraine; Cranial CT scan or MRI; transesophageal echocardiogram and Doppler; 24 hr Holter; and Carotid Doppler. After the percutaneous treatment, all patients were submitted to the same clinical and complementary evaluation.

Results: One hundred thirty patients in different age groups were included on the study, 80% of them with cryptogenic stroke. All patients except four evolved with great reduction of the migraines’ crisis. Patients with thrombophilia were submitted to anticoagulation treatment after the percutaneous closure. The devices implanted were Amplatzer, Occlutech, Cardia, Helex, and SolySafe; six patients received two devices, simultaneously or subsequently. Four patients had residual shunts: one was submitted to a second successful procedure, one went through surgical treatment and two were kept with clinical following up. After the percutaneous treatment, one patient with diabetes and hypertension had a second stroke and one with thrombophilia had a possible transient ischemic attack.

Conclusions: In our experience, the percutaneous closure of patent foramen ovale is a safe and effective way to prevent new strokes due to paradoxical embolism, as an important adjuvant migraine treatment.

P-76

CHALLENGES OF TRANSCATHETER INTERVENTIONS FOR CONGENITAL HEART DISEASES IN DEXTROCARDIA

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Background: Several challenges are faced by interventional cardiologists while performing various percutaneous interventions for congenital heart disease (CHD) in patients with dextrocardia. The anatomical alterations in dextrocardia especially the lie of the interventricular septum (IVS) can cause impediment for device closure of ventricular septal defect (VSD) and atrial septal puncture, respectively.

Aim: The aim of our study is to evaluate the challenges, feasibility, and efficacy of transcatheter interventions in children with CHD in dextrocardia.

Materials and Results: Out of 60 patients of CHD with dextrocardia catheterized, only 9 patients (15%) underwent transcatheter interventions. The age ranged from 4 months to 16 years (mean 5.4 years), weight ranged from 4.0 to 40 kg (mean 14.3 kg). Eight patients had situs inversus with dextrocardia (mirror image dextrocardia) whereas only one patient had situs solitus, dextrocardia (isolated dextrocardia). Three patients underwent successful device closure for patent ductus arteriosus (PDA). Two cases of MVSD were closed with Amplatzer septal occluder and Amplatzer duct occluder II (ADO II). Successful balloon valvuloplasty was done simultaneously for aortic stenosis and mitral stenosis in one patient of right sided May Thurner Syndrome (MTS). Balloon valvuloplasty was done in one case each with severe pulmonary stenosis and aortic stenosis. One very sick patient with inferior vena cava web died after valvuloplasty and stenting. Acute hemodynamic results were satisfactory and no complications were encountered in any of the patients.

Conclusion: The catheter interventions in CHD with dextrocardia though difficult are feasible. The device closure of PDA and MVSD is not difficult especially with ADO II. The balloon mitral and aortic valvuloplasty in the complex cardiac anatomy of situs inversus totalis is feasible and safe. Rarely right sided MTS may come in the way of right femoral access during transcatheter procedure.

P-77

SPECTRUM OF MIDAOARTIC SYNDROME PATIENTS PRESENTING TO A TERTIARY CHILDREN’S HOSPITAL

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Background: Midaortic syndrome (MAS) is a rare condition presenting as systemic hypertension, claudication, mesenteric ischemia, or renal dysfunction. Surgical repair and percutaneous interventions remain challenging.

Aim: To evaluate outcomes of MAS using various treatment strategies.

Methods: Single centre retrospective review of patients (pts) presenting from January 1991 to August 2012.

Results: There were 11 pts (3 males), aged 19 ± 14 years (range 0.1–27 years) at time of treatment. Four patients had discrete abdominal aortic (AA) stenosis, six had long segment narrowing, and one had aneurysm without stenosis. Diagnoses included: Takayasu aortitis (n = 3), idiopathic (6), neurofibromatosis type I (1), William syndrome (1). Location of AA stenosis was inter-renal (n = 5, 46%), supra-renal (4, 36%), and infra-renal (2, 18%). Initial interventions included medical management (2), surgery (3, at 10.7 ± 9.7 years), balloon angioplasty (AA) ± stent (n = 6, at 12.6 ± 8.9 years, 37.3 ± 26.9 kg). 4/6 pts received interventions on abdominal aorta only, and 2/6 received sidebranch interventions (renal, celiac, iliac). AA balloon diameters ranged from 4 to 14 mm, and inflation pressures were 5–12 atm. 4/6 pts received stents. AA catheter interventions reduced the gradient from 53.2 ± 29.3 to 18.2 ± 14.2 mm Hg (n = 4). One patient with diffuse hypoplasia failed BA and developed non-flow limiting dissection and was referred for surgery. Four patients who underwent percutaneous treatment required repeat intervention after a mean follow up period of 6.2 ± 5.2 years; of these, two had delayed surgical graft placement and one underwent emergency surgery due to post-catheterization retroperitoneal hematoma. There was one procedural death (post-neonatal repair of AA aneurysm) and one death in a neonate presenting with complete occlusion of renal arteries in whom no interventions were performed.

Conclusion: MAS is a heterogeneous condition, for which no ideal therapies exist. For MAS with discrete lesions, BA ± stent implantation may be tried, but the risk of complications and need for repeat interventions remain high. Patients with diffuse disease or presenting in early childhood are particularly problematic, and remain at high risk, regardless of surgical or percutaneous approach.

P-78

TRANSOCATHETER AORTIC VALVE REPLACEMENT IN THE REAL WORLD: EARLY EXPERIENCE IN A SINGLE CENTER

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Introduction: Transcatheter aortic valve replacement (TAVR) has revolutionized the world of interventional cardiology. The PARTNER trial demonstrated superiority of the Edwards SAPIEN valve to standard medical therapy in patients with severe aortic stenosis who were considered to be inoperable and showed the valve to be non-inferior to surgical aortic valve replacement in patients considered to be at high risk for surgery. This lead to the approval of the SAPIEN valve by the FDA for use in-inoperable patients with severe aortic stenosis. We report our experience with the SAPIEN valve in our first 18 patients.

Methods: All patients who underwent TAVR at our center either through the PARTNER IIA or IIB trial or who had commercial placement of the SAPIEN valve were reviewed. Patient demographics, procedural records, and echocardiograms were reviewed and analyzed.

Results: Between June 2011 and September 2012, 19 consecutive patients (11 females) underwent attempted TAVR at our institution. The mean age was 85 (± 8.6) years. Five patients underwent commercial TAVR with the SAPIEN valve and 14 patients underwent TAVR as
part of the PARTNER II protocol with the SAPIEN XT valve (3 were in the IIA arm and 11 were in the IIB arm). All patients had NYHA class III–IV symptoms. Procedure times ranged between 75 and 192 min and fluoroscopy times ranged from 22.5 to 55.7 min. The procedure was successful in 18 of the 19 patients (94.7%) with the one unsuccessful case being because of inability to advance the 24 Fr in a patient with peripheral vascular disease and tortuous iliac vessels. There were no procedural deaths. There were three procedural complications (16.7%) including one patient with ventricular fibrillation requiring cardioversion and chest compressions during balloon valvuloplasty of the aortic valve, one pericardial effusion requiring pericardial drain, and one valve embolization into the ascending aorta. Thirty day mortality was 16.7%. The mean aortic valve gradient was reduced from 57.5 mm Hg before TAVR to 11.2 ± 3.3 at 30 days (P < 0.001). Fifteen of the 18 patients (83.3%) had NYHA class I or II symptoms at 30 days.

Conclusions: Single center short-term follow-up of a cohort of 18 patients undergoing TAVR with the Edwards SAPIEN and SAPIEN XT valves confirms procedural safety and efficacy as reported by the PARTNER trial.

**P-79**

INITIAL PEDIATRIC EXPERIENCE WITH A NOVEL 3.3 FRENCH CATHETER SYSTEM

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Background: Since its inception, pediatric interventional cardiology has been challenged by a significant paucity of catheters and devices designed specifically for use in children. The Mongoose 3.3 Fr catheters (PediaCath, Cleveland, OH) are a new group of catheters designed and FDA approved specifically for use in children. These catheters can be used with a 3 Fr sheath that provides a significant reduction in diameter of the sheath in comparison to a standard 4 Fr sheath. The Mongoose catheters are available in pigtail, JR, JL, JB1, multipurpose, and cobra tip shapes. This abstract highlights the initial use of the Mongoose catheters in children less than 15 kg.

Methods: Three patients undergoing interventional cardiac catheterization had femoral arterial access obtained with a modified Seldinger method and placement of 3 Fr PediaCath sheaths in the artery. Patient 1 was a 4 month old male weighing 6.8 kg with a diagnosis of severe valvar pulmonary stenosis causing suprasystolic RV pressure. A 3.3 Fr Mongoose pigtail was used for monitoring during the pulmonary valvuloplasty. There was a question of a small PDA on echocardiography and so an aortogram was performed with a power injection of 8 cc at 13 cc/sec. Patient 2 was a 3 year old 13 kg girl with a moderate secundum atrial septal defect. She underwent device closure of the ASD and a 3.3 Fr Mongoose pigtail was used for arterial monitoring during the procedure. Patient 3 was a 3 year old 12.5 kg girl with severe valvar pulmonary stenosis. She underwent balloon valvuloplasty and a 3.3 Fr Mongoose JR catheter was used to cross the pulmonary valve antegrade. A 3.3 Fr Mongoose pigtail was used for arterial monitoring during the procedure.

Results: Interventions were completed successfully in all patients. In no patient was it necessary to upsize the sheath in order to use a larger catheter for monitoring or angiography. Waveforms were not dampened. In the one patient who had an angiogram performed using a Mongoose pigtail, the injection was made with a power injector, which delivered 13 cc/sec without any problem. The angiogram was of a good quality, and indistinguishable to the operators from angiograms made with 4 Fr catheters. There were no vascular complications.

Conclusions: The 3 Fr sheath used in these patients has an OD = 0.065 mm, whereas a 4 Fr sheath has an OD = 0.080 mm. This represents a 19% reduction in the diameter of the arterial sheath, which we hypothesize will provide a reduction in vascular complications secondary to access for cardiac catheterization in neonates and small children. Further experience and study will be necessary to determine whether comparison to standard 4 Fr sheaths will result in observable decreases in incidences of loss of pulse, femoral arterial thrombosis, and other vascular complications, which are common in infants and small children.

**P-80**

INITIAL MEXICAN EXPERIENCE WITH THE AMPLATZER VASCULAR PLUG IV IN A PATIENT WITH TETRALOGY OF FALLOT AND COLLATERAL AORTOPULMONARY CIRCULATION

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Objective: Evaluate the recently FDA-approved AMPLATZER® Vascular Plug IV in the embolization of vascular lesions associated with congenital heart disease (CHD).

Case report: We present the case of a 3-year-old female patient with tetralogy of Fallot (TOF) with hypoplastic pulmonary arteries (PA) and multiple direct and indirect collateral circulation to both lungs. The case was accepted for stent placement in the right ventricle outflow tract (RVOT) and collateral embolization looking forward to future PA growth and hopefully biventricular repair. Right and left cardiac catheterization was performed, through an antegrade approach. A Palmaz genesis (PG3910b) stent mounted on a Power Flex 8 × 40 mm balloon was successfully placed in the RVOT. Afterwards, retrograde angiography at the right subclavian artery was performed to show an indirect tortuous aorto-pulmonary collateral supplying the apical portion of the right lung. An Amplatz vascular plug II (AVP II) 10 mm was used for closure. Left subclavian angiography revealed a tortuous collateral supplying the left lung requiring an AVP II 8 mm for closure. Finally, descending aorta angiography revealed a direct aorto-pulmonary collateral dividing into two branches, the right branch supplying the basal portion of the right lung and the left branch irrigating the basal portion of both the right and left lung. A multipurpose catheter was advanced to the origin of the collateral and an Amplatz vascular plug IV 4 mm was advanced and placed successfully with total occlusion after control angiography. Procedural time was 130 min.

Conclusion: In our first experience with the AVP IV, successful closure of a tortuous aorto-pulmonary collateral was performed. This device is suitable for small vascular defects requiring percutaneous embolization. No major or minor complications were encountered.

**P-81**

SINGLE CENTER OUTCOME ANALYSIS COMPARING RE-INTERVENTION RATES OF SURGICAL ARTERIOPLASTY WITH STENTING FOR BRANCH PULMONARY ARTERY STENOSIS IN A PEDIATRIC POPULATION

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Introduction: Although catheter-based intervention is generally accepted as the treatment of choice for branch pulmonary artery stenosis, there are no data comparing need for re-intervention and time to re-intervention in patients undergoing transcatheter stenting versus surgical arterioplasty.

Methods: Single center retrospective cohort study comparing patients who underwent surgical pulmonary arterioplasty and branch pulmonary artery stent placement between January 2008 and May 2012. All patients < 18 years who underwent surgical intervention or stent placement were included in the study. Need for re-intervention and the average time to re-intervention were assessed using chi-squared and independent sample t-test.

Results: A total of 42 patients were included in the study. Seventeen patients (12 males) underwent surgical intervention and 25 patients (9 males) underwent stent placement. The mean weight at intervention of the surgical group was 11.3 ± 9.1 kg and the stented group was 20.1 ± 16.2 kg (P = 0.028). On mean follow-up of 828.3 ± 431.8 days, 53% (9/17) of the surgical cohort, and 12% (3/25) of the stented cohort required re-intervention (P = 0.004). In all but two cases re-intervention was catheter-based. One patient had surgery performed at re-intervention and the other had a hybrid procedure. The average time to re-intervention for the surgical group was 337.4 ± 2 days, and for the stent group
it was 250 ± 285.5 days ($P = 0.677$). When assessing only patients under 35 kg the mean weight at intervention was 11.3 ± 9.1 for the surgical group and 13.0 ± 6.8 for the stented group ($P = 0.532$). Fifty-three percent (9/17) of the surgical cohort, and 15% (3/20) of the stented cohort required re-intervention ($P = 0.014$). The average time to re-intervention remained the same as above.

**Conclusion:** Children undergoing primary surgical branch pulmonary arteryoplasty are more likely to require re-intervention than those undergoing stent placement. There was no significant difference in the time to re-intervention between the cohorts.

**P-82**

**SUCCESSFUL TRANSCATHETER PERFORATION OF PULMONARY VALVE USING THE HIGH-PENETRATION GUIDE WIRE USED FOR CHRONIC TOTAL CORONARY ARTERY OCCLUSION (CTO WIRE) AND 2.7 FRENCH MICRO-CATHETER WITHOUT REACHING THE TIP OF 4 FRENCH GUIDING CATHETER ONTO PULMONARY VALVE IN PULMONARY ATRESIA WITH INTACT VENTRICULAR SEPTUM: TWO CASE REPORTS**

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**Background:** Sometimes it is very difficult to deliver the tip of 4 or 5 Fr guiding catheter onto pulmonary valve in procedure of antegrade perforation of pulmonary valve in pulmonary atresia with intact ventricular septum (PAIVS).

**Case 1:** 16 days old neonate with PAIVS. Body weight was 3.5 kg, end-diastolic volume of right ventricle was 8.1 ml (110% of normal) with tripartite portion (Alwi group A). Diameter of pulmonary valve was 7.8 mm in measurement of lateral angiography of main pulmonary artery. There was no sinusoid communication. At first, we put a retrograde snare catheter (EN Snare, Merit Medical systems Inc. USA) onto pulmonary valve as a landmark to grasp precise position of pulmonary valve, and for snaring the wire after perforation of pulmonary valve, from 4 Fr femoral artery introducer sheath through a patent ductus arteriosus. We tried to deliver the tip of various types of 4 Fr guiding catheter onto pulmonary valve through the femoral introducer sheath, but any guiding catheter did not reach to valve. Finally, we use a tip of 4 Fr guiding catheter (Amplatz II Judkins Right, Technowood Inc. Japan) at proximal side of right ventricular outflow tract as a supportive catheter. Subsequently, we used 2.7 Fr micro-catheter (Akatsu, Cathex Inc. Japan) through the guiding catheter, using 0.014 inch micro-wire (014 Begin PLUS, ASAHI INTECC inc. Japan) as a guiding, and succeeded to deliver a tip of AKATSUKI onto pulmonary valve. We exchanged a micro wire to chronic total coronary artery occlusion (CTO) wire (Astato XS 9-12, ASAHI INTECC Inc. Japan), and were able to perforate pulmonary valve using slowly twisting maneuver with torque. After successful perforation, AKATSUKI slid into main pulmonary artery. We exchange the Astato to 0.014 inch long stiff wire. EN Snare retrieved the wire and exteriorized through the right femoral introducer sheath, and fixed in place with clamps at its soft tip ends (arteriovenous railway technique). Progressive percutaneous transluminal pulmonary valveoplasty was done from a diameter of 2.0 mm to a maximum diameter of 8.0 mm. Reduction in the right ventricular pressure was from 76 to 48 mm Hg.

**Case 2:** Four days old neonate with PAIVS. Body weight was 3.6 kg, end diastolic volume of right ventricular was 6.4 ml (76% of normal) with tripartite portion (Alwi group A). Diameter of pulmonary valve was 6.9 mm. It was also impossible to deliver the tip of guiding catheter onto pulmonary valve, we put the tip of guiding catheter (GLIDECATH II COBRA, TERUMO Inc. Japan) in trabecular portion of right ventricle, and delivered only AKATSUKI to pulmonary valve without using a micro-guiding wire, and made perforation of valve using CTO wire (Astato 30, ASAHI INTECC Inc. Japan). With the same subsequent procedure, pulmonary valvotomy was successful. Reduction in the right ventricular pressure was from 96 to 30 mm Hg.

**Discussion:** The Astato 30 is a high-penetration guide wire specially designed with tapered hydrophobic tip and 30 g tip load (Astato 30 9-12 is 12 g tip load) for the lesion of CTO. Although radiofrequency valvotomy has become the standard of primary care of PAIVS, it is not permitted to use in Japan, and the feasibilities of CTO wire for valvotomy have been reported recently from some institutions. It is necessary for safe perforation of pulmonary valve that the tip of guiding catheter should reach to the valve with stability. But sometimes it is very difficult, because of great morphological variability in PAIVS, such as enlarged right atrium, small diameter of tricuspid valve, and trabeculation of right ventricle. It should be feasible procedure to use the combination of antegrade micro-catheter and CTO wire for perforation of pulmonary valve in PAIVS, under the condition that guiding catheter dose not reach to pulmonary valve.

**P-83**

**PALLIATION OF OBSTRUCTED INFRADIAPHRAGMATIC TAPVR IN SINGLE VENTRICLE HETEROXYA VIA DUCTUS VENOSUS STENTING**

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Two single ventricle patients with heterotaxy and infradiaphragmatic total anomalous pulmonary venous return (ID-TAPVR) underwent transcatheter palliation with stenting of the DV (Ductus Venosus). A third case involving DV stenting in a biventricular child with obstructed ID-TAPVR and coarctation was also palliated in this fashion. Records of all three cases of DV stenting were reviewed retrospectively. The two children with single ventricle (SV), heterotaxy, and obstructive ID-TAPVR were diagnosed prenatally by ultrasound and MRI. Both infants were delivered next door to the cardiac catheterization laboratory by C-section with surgical standby. Angiograms and echocardiograms were performed to assess the ductus venosus and verteal vein (VV) anatomy. The DV was crossed using coronary wires and a 5 Fr sheath was placed across the DV via the UV. Four, 4.5 and 5 mm coronary multilink ultra stents were used to stent the DV. All cases were technically successful and the DV was successfully stented open in all neonates. In both cases, heterotaxia, SV, the oxygen saturations improved acutely by 30-40% (pre-stent 50-55%, post 85-90%) and venous congestion on CXR resolved. In both cases, the patients went on to have successful selective TAPVR repairs with BT shunts, without venous congestion at the time of repair. Stenting of the DV can successfully palliate obstructed ID-TAPVR. This can be especially useful in SV patients with obstructed TAPVR as it allows for surgical shunt placement or stenting of the DV electively and without pulmonary venous congestion. The course of the VV and cause of obstruction must be well defined as stenting of the DV does not always relieve and can even worsen the obstruction. In some cases, a jugular approach may be needed. Angiogram showing the venous return to the heart via the narrowed ductus venosus with notable pulmonary congestion (A). Angiogram after successful stenting of the ductus venosus with significantly less pulmonary congestion and appropriate blood return to the heart (B).
SUCCESSFUL TRANSCATHETER CLOSURE OF PERIMEMBRANOUS VENTRICULAR SEPTAL DEFECT WITH INLET EXTENSION USING ADO I

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Introduction: Transcatheter closure of perimembranous ventricular septal defect (PM VSD) is abandoned in many center and in some became restricted to certain age and criteria because of the risk of complete heart block (CHB). The risk of damaging the tricuspid valve (TV) in the presence of inlet extension is another risk. The authors present successful closure of such defect using Amplatzer occluder device for PDA with reasonable follow-up period in Prince Sultan Cardiac Center PSCC.

Method: Through 2011, four patients underwent transcatheter closure of PM VSD with inlet extension, all patients were consented and procedure was done under general anesthesia. Transesophageal echocardiography was done in all, one has 3D assessment. Hemodynamics were assessed preprocedural, A-V loop was applied in two patients, ADOI were used in all, heparin and antibiotics were given during and 24-hr postprocedure, three patients were extubated same day and one the following day, all patients were kept on aspirin for 6 months.

Result: Median age 17 kg, 3 females and 1 male, median age 7 years, median ventilatory duration is one day, median hospital stay is 2 days, median follow-up is 16 months, no immediate or early complication or deaths, normal ECG immediately and during follow-up period, normal echocardiography with no residual leak during follow-up period.

Conclusion: In selected patients with PM VSD and inlet extension, ADOI device can be used safely and effectively to close the defect with no immediate or early complications.

P-85

PROSTHETIC VALVE THROMBOSIS: INITIAL EXPERIENCE WITH TISSUE PLASMINOGEN ACTIVATOR

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Prosthetic valves thrombosis (PVT) is usually a life threatening condition requiring prompt treatment.

Methods: This is a prospective study of eight consecutive patients with mechanical mitral valve thrombosis who received intravenous thrombolytic treatment with tenectaplastase in our institution between January 2011 and May 2012. There were three females and five males in the study group. The mean age was 28.12 years. They presented with recent and sudden onset dyspnea and were in NYHA functional class III or IV. Three of these patients presented with biventricular failure. Prosthetic valve clicks were absent. Patients with contraindication to thrombolytic therapy were excluded. The mean time between mitral valve implantation and the thrombotic episode was 33.62 months (range 5–72 months).

Thrombosed valves comprised three bileaflet valves (Saint Jude) and five tilting disc prostheses (Omniscience). Six of these patients were not mechanical valves. Thrombosis comprised three bileaflet valves (Saint Jude) and five tilting disc prostheses (Omniscience). Six of these patients were not mechanical valves. Thrombosed valves comprised three bileaflet valves (Saint Jude) and five tilting disc prostheses (Omniscience). Six of these patients were not mechanical valves.

and was observed six patients. In two patients there was a dramatic clinical improvement but gradients were persistently between 8 and 10 mm Hg. There were no failures. There was one complication in the form of a transient ischemic stroke, which recovered spontaneously .after 48 hr.

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HOW DOES THE ALTERATION IN THE EARLY-STAGE PALLIATION FOR HYPOPLASTIC LEFT HEART SYNDROME INFLUENCE OUR SUBSIDIARY TRANSCATHETER THERAPY?

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Objectives: The prognosis of hypoplastic left heart syndrome (HLHS) has improved dramatically with development of surgical techniques and periproductive care. The patients are more likely to require catheter interventions between staged palliative operations in order to maintain appropriate hemodynamics during early infancy. The pulmonary blood source in the Norwood procedure (NP) has evolved from the right ventricle-pulmonary artery conduit (VPC) and modified Blalock-Taussig (BTS) shunt in our institute around 2005. Few reports have been published regarding whether the change in surgical strategy has affected catheter interventions.

Methods: Overall 47 infants with HLHS received NP during the period from January 2000 to September 2012. Twenty-nine patients underwent NP with VPC, and 14 patients underwent NP with BTS. Two patients who had NP with a Glenn shunt were excluded. The incidence, location of interventions before Glenn shunt, and adverse event were retrospectively analyzed.

Results: Overall, 69 catheterizations in 44 patients were performed, including 60 interventions in 33 (73%) patients, for closure of aorto-pulmonary collaterals (VPC n = 15, BTS n = 11; P = 0.249), dilatation of the shunt (VPC n = 7, BTS n = 7; P = 0.185), stent implantation in the shunt (VPC n = 5, BTS n = 2, P = 0.702), dilatation of the aortic arch (VPC n = 5, BTS n = 2, P = 0.702) or balloon atrioseptostomy (BAS; VPC n = 4, BTS n = 1, P = 0.403). Of them, two patients in BT underwent a catheter intervention before NP (BAS n = 1, dilation of the pulmonary artery n = 1). Mean age and body weight at the first catheterization were 3.9 ± 1.4 months and 2,847 ± 427, 3.9 ± 1.9 months (P = 0.186) and 2,847 ± 379 g (P = 0.545), respectively. Complications included cardiopulmonary resuscitation (n = 1), and temporary heart block (n = 4) in VPC (18%), while no complication occurred in BTS (P = 0.07). Early mortality was observed in two cases in VPC after stent implantation, due to increased pulmonary blood flow and low cardiac output.

Conclusions: No significant difference in catheter interventions was observed in respect of the type of shunt at NP. However, there was a tendency that catheter interventions were accomplished more safely to patients with HLHS with BTS, which might improve the morbidity and mortality among the patients.

P-87

PULMONARY ARTERY THROMBOSIS AFTER COMPREHENSIVE STAGE 2 SURGICAL PALLIATION: INCIDENCE AND TREATMENT

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Background: Pulmonary artery thrombosis (PAT) is reported in a small percentage of patients after superior cavo-pulmonary anastomosis (SCPA). With the hybrid approach for single ventricle palliation, an aortic arch reconstruction, PDA stent removal, atrial septectomy, and SCPA
Methods: All comprehensive stage 2 (November 2002 to July 2010) were retrospectively identified from our institutional surgical database and cross-referenced to catheterization, echocardiographic, and autopsy reports documenting PAT. Demographics, surgical, transcatheter, and medical therapies employed and outcomes were reviewed.

Results: Six cases of PAT were documented (10% of comprehensive stage 2 operations). Median age was 5.6 months (range 4.1–7.2) and weight of 5.8 kg (range 4.2–6.5). There was no difference in age, CPB time, cross clamp time, or echocardiographic parameters in those that developed PAT compared to those that did not. Most cases (5/6) occurred in the immediate post-operative period (median 5 days, range 1–7). Clinical suspicion was hypoxia in (5/6), SVC syndrome (3/5). PAT was identified in one patient during catheterization on postoperative day 34 due to persistent chyloous effusions. All six patients were treated with interventional catheterization with thrombus identified in the Left pulmonary artery in 6/6 cases, right pulmonary artery in 2/6 cases, and within the SVC in 1/6 cases. Angiojet (2/6 cases), angioplasty (3/6 cases), and stent therapy (3/6 cases) were performed with improved saturations (median 41%, range 26–61 vs. 70% range 41–80, P = 0.03) and angiographic flow. Local infusion of alteplase was utilized post-catheterization in three cases with systemic alteplase utilized in the remaining three cases. A 30-day mortality was 50% (3/6) with only one long-term survivor in the group who required cardiac transplantation.

Conclusion: The incidence of pulmonary artery thrombosis after comprehensive stage 2 palliation was 10% with significant associated mortality. A new standard care protocol has been developed to prevent PAT after Comprehensive stage 2.

P-88
SAFETY AND PRELIMINARY RESULTS OF A STANDARD CARE PROTOCOL TO PREVENT PULMONARY ARTERY THROMBOSIS AFTER COMPREHENSIVE STAGE 2
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Background: Pulmonary artery thrombosis has been identified as a potential complication after comprehensive stage 2 surgery. We developed a standard care protocol that included (1) intraoperative exit angiography, (2) aggressive anticoagulation, and (3) prospective monitoring for thrombotic complications. We hypothesized that our standard care protocol would decrease mortality, morbidity, and be safe compared to our historical control group.

Methods: Analysis of outcomes and complications for 19 patients after comprehensive stage 2 standard care protocol implementation (August 2010 to July 2012) compared to 60 historical controls (February 2002 to July 2010).

Results: Nineteen patients underwent comprehensive stage 2 with our standard care protocol compared to 60 historical controls. Exit angiography was performed in all 19 cases and resulted in management changes in 4/19 cases (21%) including stent therapy in three patients and surgical revision for left pulmonary artery stenosis in one patient. Anticoagulation was initiated at 26 ± 6 hr postoperatively. There were no incidents of bleeding after anticoagulation was initiated which required intervention, even with temporary interruption of anticoagulation for removal of invasive devices. Two (10%) patients demonstrated an intracranial bleed (both small subdural hematomas) on clinically indicated neurological imaging while undergoing anticoagulation compared to 1/60 (18%) patients (subdural hemorrhage 6/11, intracerebral hemorrhage 5/11) before protocol initiation (P = 0.7). There have been no postoperative pulmonary artery thrombosis events (0/19 (0%) vs. 6/60 (10%), P = 0.18). There has been a trend toward decreased mortality with anticoagulation protocol (1/19 (5%) vs. 12/60 (20%), P = 0.17).

Conclusion: A standard care protocol involving anticoagulation after comprehensive stage 2 has not resulted in increased bleeding complications and demonstrates a trend toward decreasing pulmonary artery thrombosis and increasing survival.

P-89
COMPARISON OF ULTRA-HIGH-PRESSURE BALLOON AND HIGH-PRESSURE BALLOON ON PERCUTANEOUS TRANSLUMINAL PULMONARY ANGIOPLASTY
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Background: It has been reported that ultra-high-pressure balloon (UHPB) is effective on percutaneous transluminal pulmonary angioplasty (PTPA), but there is lack of data about the appropriate balloon diameter (BD) selection compared to conventional high-pressure balloon (HPB).

Objective: To assess the effectiveness and recommended BD of UHPB in contrast to HPB.

Methods: Retrospective review of post-surgical congenital heart disease patients underwent PTPA in our institution between November 2002 to April 2012. Twenty-four lesions in 12 patients applied UHPB (CONQUEST) and 20 lesions in 19 lesions applied HPB (FOX or SYNergy) were enrolled.

Results: The mean age in UHPB group and HPB group were 6.8 ± 3.4 years and 4.3 ± 3.4 years old (P > 0.05) and the mean body weight were 18.2 ± 6.6 kg and 13.4 ± 5.7 kg (P > 0.05) at the time of PTPA, respectively. BD and minimal lumen diameter (MLD) were significantly smaller in UHPB than HPB, BD: 8.4 ± 1.8 mm and 3.6 ± 1.3 mm (P = 0.008); MLD: 9.7 ± 1.2 mm and 4.4 ± 0.8 mm (P = 0.013). Although there are no significant differences about the ratio of BD to MLD, gain of MLD after PTPA was significantly larger in UHPB group than HPB group (UHPB: 164 ± 5.9%, HPB: 135 ± 2.7%, P = 0.0041).

Conclusion: In PTPA with UHPB, the recommended BD revealed to be 2 to 3 times of MLD, which can provide superior advantage than conventional HPB.

P-90
PULMONARY ARTERY GROWTH AFTER STENTING OF THE RIGHT VENTRICULAR OUTFLOW TRACT
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Objective: To assess the growth of the branch pulmonary arteries after stenting of the right ventricular outflow tract (RVOT) in the management of severely cyanotic patients as initial palliation.

Methods: Retrospective case note review and serial echocardiographic analysis of patients who underwent RVOT stenting as initial palliation at a single tertiary centre over a 7-year period.

Patients: Between 2005 and 2012, 46 patients underwent percutaneous stent implantation in the RVOT to improve pulmonary blood flow. Median age at stent implantation was 64 (range 7–501) days. Median weight was 4.01 (1.7–12.2) kg, with 10 patients weighing less than 3 kg. There was one procedural death (2.2%). One patient required emergency surgery and two needed a BT shunt within 2 weeks postprocedure (6.6%). Six further patients were excluded from analysis, as data were incomplete or follow-up was less than 90 days.

Results: Thirty-six patients were available for longitudinal analysis of PA growth. Median RPA Z-score increased from −2.02 (−4.68 to −1.77) to −0.65 (−2.04 to −0.29) (P < 0.05) and median LPA Z-score increased from −1.27 (−2.87 to −0.19) to 0.11 (−4.12 to 1.97) (P < 0.05). Saturations increased from 77 (45–95)% to 92(81–100)% [P < 0.001]. Twenty-eight patients underwent delayed surgery (complete repair in 25, palliative in 3) at a median of 252 (2–758) days post-stenting.

Conclusion: Stenting of the RVOT provides good palliation and excellent growth of the central pulmonary arteries.
STENTING OF THE RIGHT VENTRICULAR OUTFLOW TRACT PROVIDES EXCELLENT INITIAL PALLIATION

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Objective: To review the indication and outcome of stenting of the right ventricular outflow tract (RVOT) in the management of severely cyanotic patients as initial palliation.

Methods: Retrospective case note review and data analysis of patients undergoing RVOT stenting at a single tertiary centre over a 7-year period.

Patients: Between 2005 and 2012, 51 selected patients underwent cardiac catheterization with a view to stent a very narrow RVOT to improve pulmonary blood flow. In all, cardiac surgical intervention was deemed high risk due to presenting condition, weight, associated defects, underlying anatomy, or co-existing syndromes. In five patients the procedure was abandoned due to unfavorable anatomy or good response to balloon dilatation. Median age at stent implantation was 64 (range 5–406) days. Median weight was 3.9 (1.7–12.2) kg, with 15 patients weighing less than 3 kg.

Results: Forty-six patients underwent stent implantation. Premounted coronary stents were used in 30 patients, premounted renal stents in 10 patients. Median procedure time was 58 (24–260) and fluoroscopy time 16 (5.5–73) min. Saturations increased from 71 (52–83)% to 92 (81–100)% [P < 0.001]. There was one procedural death (2.2%). One patient required emergency surgery for RVOT perforation and two needed a systemic-pulmonary artery shunt within 2 weeks postprocedure (6.6%). One patient suffered severe tricuspid valve damage. Fifteen further catheter interventions were carried out (balloon in 6, further stent in 9). Twenty-eight patients underwent delayed surgery (complete repair in 25, palliative in 3) at a median of 252 (2–758) days post-stenting. Thirteen patients remain well palliated after 127 (20–346) days.

Conclusion: Stenting of the RVOT is an effective treatment option in the initial management of selected patients with much reduced pulmonary blood flow. Mortality is low compared to published results of surgical palliation or early repair.

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FETAL INTERVENTIONS FOR CONGENITAL HEART DISEASE. ARE OUTCOMES REPRODUCIBLE?

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Background: Fetal cardiac interventions have been performed in a few centers in the world, which raises the question of their reproducibility, safety, and efficacy.

Objectives: To report a preliminary experience with cardiac fetal interventions.

Methods: From October 2007 to September 2012, 21 interventions were performed in 20 fetuses (median age 29 weeks) under maternal blockade and fetal anesthesia by a multidisciplinary team. Twelve fetuses had critical aortic stenosis (AS) (two with hypoplastic left ventricles (LV) and three with severe mitral regurgitation (MR) and hydrops). Four had hypoplastic left heart syndrome (HLHS) and intahighly restrictive atrial septum, one had pulmonary atresia and three critical pulmonary stenosis (CPS/IVS) and intact ventricular septum. Measures of outcomes included rates of procedural success, maternal, fetal and pregnancy complications, neonatal morbidity and mortality, and eventual type of circulation (biventricular, BV).

Results: Success was achieved in 19 procedures (90.5%) with one failed aortic and one pulmonary valvuloplasties. There was one fetal loss. No maternal complications occurred. All patients with critical AS, severe MR, and hydrops died within 5 months. All patients with HLHS and restrictive atrial septum died after interventional/surgical procedures and prolonged hospitalizations. Patients with CPS/IVS achieved a BV circulation after neonatal valvuloplasty and ducal stenting. A BV circulation was achieved in 4/7 patients with critical AS (one still in utero), including two with initial borderline LV in whom a surgical LV overhaul was performed at 9 months of age.

Conclusions: The feasibility, safety, and efficacy of fetal cardiac interventions seem to be reproducible in this preliminary experience.

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STENTING OF THE RIGHT VENTRICULAR OUTFLOW TRACT PROVIDES EXCELLENT INITIAL PALLIATION

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Background: There has been an increasing use of covered stents (CS) in the percutaneous treatment of coarctation of the aorta (CoA).

Objective: To report the acute and mid-term outcomes of CoA stenting with the new premounted Advanta V12 CS.

Methods: From December 2009 to September 2012, 36 patients (pts) (median age and weight: 18 years and 55 kg, respectively) underwent CoA stenting under general anesthesia through a percutaneous femoral approach (sheaths 8–12 Fr).

Results: Successful implantation with 12, 14, and 16 mm balloons was achieved in all patients with no stent migration. Post-dilatation was employed in 25 patients due to slight stent recoil (average 1.8 mm). CoA diameter increased from a median of 4 mm (0–10) to 15 mm (11–20) (P < 0.001) and the gradient across the CoA decreased from a mean of 36 ± 12 to 4 ± 3 mm Hg (P < 0.001). There was one pulse loss that required a Heparin drip. Follow-up was available for 34 patients (median 1.5 years). Normal blood pressure was observed in 28 patients with 20 patients requiring no anti-hypertensive meds. Angio CT was performed after 1 year in 20 patients. All stents remained in their original position and there were no stent fractures and no aortic wall abnormalities. No patient underwent reintervention.

Conclusions: In this preliminary experience with limited number of patients from a single center, the use of the new V12 Advanta CS resulted in excellent clinical outcomes with no aortic wall abnormalities on imaging follow-up studies. Although these findings are encouraging, more patients and a longer follow-up are needed.

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BALLOON DILATION OF SUPRAVALVAR PULMONARY STENOSIS FOLLOW ARTERIAL SWITCH OPERATION

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Background: Pulmonary stenosis in the single ventricle population is a frequent occurrence. The natural history of supravalvar pulmonary stenosis was characterized by repeated surgical interventions and high mortality. Balloon angioplasty has been shown to provide significant and sustained relief of symptoms. This study examines the outcomes of percutaneous balloon dilation in a series of children with supravalvar pulmonary stenosis following arterial switch operation.

Methods: Between 1992 and 2012, 24 patients with supravalvar pulmonary stenosis following arterial switch operation were operated on at our institution. All patients underwent transcatheter balloon dilation of supravalvar pulmonary stenosis. The results were compared to those of other reports of similar procedures.

Results: The procedure was successful in all patients. There were no complications. The mean age at the time of the procedure was 18 months with a median of 12 months. The mean weight was 8 kg. The peak-to-peak gradient across the stenosis decreased from a mean of 40 mm Hg to 8 mm Hg. The mean diameter of the stenosis decreased from a mean of 12 mm to 5 mm. The mean balloon size used was 12 mm. The mean procedure time was 10 minutes. The mean fluoroscopy time was 2 minutes. There were no complications. The procedure was repeated in two patients at 12 and 18 months with complete resolution of symptoms.

Conclusions: Percutaneous balloon dilation of supravalvar pulmonary stenosis following arterial switch operation is a safe and effective procedure. The procedure is associated with a low risk of complications and offers a non-invasive alternative to surgical intervention.

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COARCTATION STENTING WITH THE NEW ADVANTA V12 COVERED STENT. MID-TERM OUTCOMES

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Objective: To review the indication and outcome of CoA stenting with the new premounted Advanta V12 CS.

Methods: From December 2009 to September 2012, 36 patients (pts) (median age and weight: 18 years and 55 kg, respectively) underwent CoA stenting under general anesthesia through a percutaneous femoral approach (sheaths 8–12 Fr).

Results: Successful implantation with 12, 14, and 16 mm balloons was achieved in all patients with no stent migration. Post-dilatation was employed in 25 patients due to slight stent recoil (average 1.8 mm). CoA diameter increased from a median of 4 mm (0–10) to 15 mm (11–20) (P < 0.001) and the gradient across the CoA decreased from a mean of 36 ± 12 to 4 ± 3 mm Hg (P < 0.001). There was one pulse loss that required a Heparin drip. Follow-up was available for 34 patients (median 1.5 years). Normal blood pressure was observed in 28 patients with 20 patients requiring no anti-hypertensive meds. Angio CT was performed after 1 year in 20 patients. All stents remained in their original position and there were no stent fractures and no aortic wall abnormalities. No patient underwent reintervention.

Conclusions: In this preliminary experience with limited number of patients from a single center, the use of the new V12 Advanta CS resulted in excellent clinical outcomes with no aortic wall abnormalities on imaging follow-up studies. Although these findings are encouraging, more patients and a longer follow-up are needed.
improved to 0.53 (±0.07, P < 0.001). MPA narrowing increased to 7.6 mm (±1.9 mm, P < 0.001), and gradient reduced to 16 mm Hg (±5.2 mm Hg, P < 0.001). Follow-up echocardiogram gradient of 2.7 m/sec (±0.5 m/sec, P < 0.01) was obtained at an average follow-up of 4.4 months (0–9 months). Procedural complications included one small MPA aneurysm that was stable on follow-up angiography. During the follow-up period, one patient died secondary to ongoing intractable chyloous drainage, anasarca, and respiratory failure. No patient has required repeat catheter intervention or cardiac surgery. Conclusion: Balloon dilation is a safe and effective treatment of discreet supravalvar pulmonary stenosis following arterial switch operation. Longer follow-up data are necessary to determine whether further interventions will be necessary.

**P-95**

TRANSHEPATIC ACCESS REVISITED IN THE MODERN ERA OF INTERVENTIONAL CARDIOLOGY FOR CONGENITAL HEART DISEASE

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**Background:** Transhepatic access has been proposed as an alternative vascular route to the heart in patients (pts) with limited access through the more standard femoral and jugular veins.

**Objective:** We report our experience with this approach in the modern era of interventional cardiac catheterization for congenital heart disease (CHD).

**Methods:** From January 2005 to September 2012, 30 catheterizations were performed under general anesthesia in 28 pts with heterogeneous CHD (median age and weight: 5 months [1 day–62 years] and 6 kg [1–84], respectively) through the hepatic access. Sixty percent of the patients had occluded standard vascular accesses, 30% had absence of the hepatic portion of the inferior vena cava, and the remaining were premature infants < 2 kg. Regular pediatric 20/21 G puncturing needles, 15 cm 20/21 G Chiba needles, and transpetal Brockenborough needles were employed according to the size of the patient. A hepatic vein was entered under sole fluoroscopic guidance using standard techniques. Sheaths from 4 to 12 Fr were used according to the type of procedure. Most (>90%) pts underwent interventional catheterizations including atrial septostomy (Rashkind, static, stenting), pulmonary valvuloplasty ± ductal stenting, antegrade aortic valvuloplasty, pulmonary artery angioplasty (ballooning/stenting), atrial septal defect occlusion, and RF ablation of arrhythmic pathways. Closure of the hepatic tract was performed using coils or vascular plugs.

**Results:** Vascular access was successfully obtained in all pts at a median time of 5 min (1–30), including two patients in whom the hepatic approach was employed twice. All, except one, intended procedures were completed successfully through the liver. Devices were implanted in the hepatic tract with no malposition. One 1.4 kg pt had transient heart block during progression of a 4 Fr dilator over a coronary wire. Another neonate had subcapsular hematoma with decreasing hematocrit requiring blood transfusion and aminocaproic administration in the intensive care unit. No patient died in the catheterization laboratory.

**Conclusions:** Transhepatic access was feasible, safe, and effective in terms of enabling a variety of interventional procedures in a heterogeneous group of pts weighing 1–84 kg with CHD. The interventionalist should not hesitate to employ this strategy in cases with difficult standard vascular access.

**P-96**

HEMOPHTYSIS IN CONGENITAL HEART DISEASE

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**Introduction:** Hemoptysis is a serious complication of congenital heart disease (CHD). We aim to identify risk factors for hemoptysis and describe when diagnostic work-up was high-yield and management effective.

**Methods:** We searched our admission and discharge, catheterization and echocardiography databases between January 1, 1992 and February 1, 2012. Patients without CHD and those with pulmonary hemorrhage postoperatively were excluded. We described the subjects’ demographics, previous postoperative course, severity of presentation, management, and outcomes. We analyzed the event-free survival after aorto-pulmonary collaterals (APCs) embolization.

**Results:** We identified 26 patients with 62 hemoptysis episodes. Age range was 1.2–40 years, 13 were males and 15 had recurrent symptoms. Thirty patients had single ventricle physiology, six had pulmonary vein (PV) stenosis, six had restricted pulmonary blood flow with hypertrophied APCs, and one had scimitar syndrome with APCs. Possible risk factors for hemoptysis were: chronic cyanosis (32%), delayed stage II palliation of single ventricle patients (average age 29 months in this group), and high grade APCs (grade III or IV in all our patients). CT scan was valuable in identifying patients with lung disease and proximity of previously placed stents and devices to airway. Bronchoscopy was helpful in reaching a diagnosis or locating site of bleeding in 14 out of 18 studies done at our institution. Catheterization interventions were done in 34 including APCs embolization (29), PA stenting (1), and PV dilation (4). APCs embolization was successful in stopping acute bleeding in 73% of cases with adequate data. Only 45% of patients were free of symptoms after 84 months of follow-up. Five patients were deceased (19%), three died during an admission for hemoptysis and two died as a direct result of hemoptysis (8%).

**Conclusion:** Hemoptysis can be a serious cause of morbidity and mortality in CHD. We identified chronic cyanosis, delayed stage II palliation, and high-grade collaterals as risk factors. Bronchoscopy can be helpful in locating bleeding site in acute cases and collateral artery embolization can be effective in stopping the acute bleed but recurrence is common.

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COMPLETE DUCTAL SPASM DURING PERFORMANCE OF TRANSCATHETER DUCTAL OCCLUSION

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**Objectives:** To highlight the possibility of ductal spasm. Complete intracatheterization ductal spasm may mislead the physician and result in failure to occlude a hemodynamically significant patent ductus arteriosus (PDA).

**Background:** Transcatheter ductal occlusion is a common procedure. Technology now allows for PDA occlusion in very small patients. Also, premature infant survival rates are improving. Current data suggest that PDAs in premature children are similar to fetal ductuses, suggesting they may remain patent.

**Methods:** We reviewed angiograms from all transcatheter PDA occlusions performed at our institution since 2001 (N = 284). Six cases were identified. Ages ranged from 10 to 80 months (median 15.5) and gestational age ranged from 24 to 37 months (median 28 months). Retrospective data were collected including: gestational age, age at procedure, preprocedure echocardiographic parameters, PDA type and minimal size (after relief of spasm), occlusion device, and most recent clinical and echocardiographic follow-up data.

**Findings:** Five patients were born prematurely. None had significant symptoms. All the PDAs were pressure restrictive and four of the six had echocardiographic evidence of left-heart volume overload. All patients had auscultatory examinations by the catheterization physicians; all had murmurs consistent with a PDA. When reauscultated (3 of 6), the murmur was absent during ductal spasm. Minimal PDA diameters ranged from 1.5 to 4 mm (median 2 mm). The 5 premature patients required devices; the full-term child had coil placement. No complications occurred; all patients are well at follow-up.
Discussion: The etiology of ductal spasm is unclear, but our experience suggests it is more common in premature children. More data are needed to understand how PDAs respond to transcatheter closure. Given the change in cardiac examination during ductal spasm, we recommend all interventionalists examine their patients in the laboratory to avoid a failure to occlude a hemodynamically significant ductus.

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WHICH PATIENT IS SUITABLE FOR MITRACLIP? WHO IS THE SUPER RESPONDER?

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Background: The MitraClip system is effective in reducing mitral regurgitation (MR) and improving symptoms in patients with both functional and degenerative etiology. It is also a low risk procedure. However it is an expensive procedure. The aim of this study was to try to find the patients who will benefit the most from the MitraClip intervention.

Method: Thirty consecutive patients with a mixed etiology of functional and degenerative mitral regurgitation were included in this study to evaluate who are the most eligible patients for the intervention. All patients had been denied open heart surgery at a thoracic conference due to high age and/or high comorbidity.

Results: The group consisted of 20 men and 10 women with a mean age of 74 years. The average age among the women was 80 years. We decided based on 1 month follow-up with Minnesota living with heart failure questionnaire (MLWHF) to divide the patients into three groups: non responders (NR), <5 steps improvement; responders, >4 steps improvement; and super responders (SR), >24 steps improvement. In the material 40% of the women qualified as SR while 25% of the men were SR. Forty percent of the men were NR and 10% of the women were NR. Twenty-two patients also did 6 min walk test on follow-up confirming the results of the MLWHF. A multivariable analysis including gender, age, body mass index, ejection fraction, New York Heart Association class, grade of MR, result of MLWHF before the procedure was performed. The dependant variable outcome can be predicted from a linear combination of the independent variables: Gender P 0.022 and MLWHF before the procedure P <0.001.

Conclusion: This study indicates that the female gender and a high scoring on the MLWHF may predict a responder or super responder to the MitraClip procedure.

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VALIDATION OF A PRE-SCREENING PROGRAM FOR TRANSCATHETER ATRIAL SEPTAL DEFECT CLOSURE

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Background: While many secundum atrial septal defects (ASD) are amenable to transcatheter device closure, obviating the need for an open surgical procedure, there are some ASDs which may not be suitable for device placement. Prior to initiation of a formal prescreening program, approximately 25% of patients referred for device closure at our institution ultimately were determined to be unsuitable for device placement. This determination occurred on the day of the procedure, resulting in inefficiencies in work flow, staff utilization, and inconvenience for families. Furthermore, detailed discussion of the risks and benefits of device closure occurred only on the day of the procedure. We report our experience with an ASD prescreening evaluation and family consultation process.

Results: Between June 30, 2009 and July 1, 2012, 84 patients referred for device occlusion of ASD underwent a comprehensive prescreening process including detailed transthoracic echocardiography and family consultation. Significant differences were noted in defect size, location, and rim assessments compared to the previous outpatient evaluation. Seventeen patients were determined to have an ASD that was not amenable to device closure (20%). Of those who underwent attempt at transcatheter device closure, all had successful device closure of the ASD. After detailed discussion with families, four (6%) elected to undergo surgical rather than device-based ASD closure.

Conclusions: With the addition of a prescreening program for transcatheter ASD closure, our institution has decreased the incidence of same day procedure cancellation from 25% to 0%. The use of a comprehensive evaluation process for ASD device closure improves the likelihood of successful device implantation, increases workflow efficiencies, decreases extraneous costs, and improves informed consent.

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CLOSURE OF LARGE ATRIAL SEPTUM DEFECTS WITH DEFICIENT RIM BY USE OF A STEERABLE LONG SHEATH

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Background: Closure of secundum type atrial septum defects (ASD) with an Amplatzer septal occluder (ASO) can be challenging in large defects with deficient aortic, posterior, or inferior rim. Different techniques have been described to manipulate the ASO during placement to prevent the cranial part from slipping through the ASD, i.e. ‘‘left upper pulmonary vein technique’’ (LUPV), ‘‘balloon assisted technique’’ (BAT), or modified delivery-sheath with diagonal orifice. We report over successful ASD closure with ASO using a steerable sheath (Bard USA, 8.3 and 9.8 Fr).

Patients and Method: A large ASD with deficient rim was diagnosed in four adult patients by transthoracic echocardiography (TTE). The patients underwent percutaneous ASD closure under general anesthesia. The ASD morphology was studied by transthoracic echocardiography (TEE) and TTE, deficient rim stated and balloon sizing performed which revealed diameters from 28 to 32 mm. Different techniques of modified device-implantation had been used as LUPV, vertical device-alignment achieved by pushing the device with a second catheter and the use of a steerable long sheath.

Results: In all four patients the use of a steerable long sheath (Bard, USA) led to successful device-closure of the ASD. Sheath-deflection af-
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BIDIRECTIONAL CAVO-PULMONARY ANASTOMOSIS WITH ADDITIONAL PULMONARY FLOW VERSUS DISCONNECTED PULMONARY ARTERIAL SUPPLY

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Background: The bidirectional cavo-pulmonary shunt is a standard procedure in the palliation of patients with a functional single-ventricle heart until the Fontan operation. Most cavo-pulmonary anastomosis procedures are associated with disconnection of pulmonary forward flow or any other additional pulmonary flow. However in Egypt there is tendency to leave any additional pulmonary flow in order to gain time till the Fontan procedure.

Methods: All patients with bidirectional cavo-pulmonary shunts attending pediatric cardiology outpatients in Cairo University and Ain Shams University were included in this comparative study. There were 45 cases followed up over a period of 1 year from January 2012 till present. Median age at operation was 11 (6–24 months old). Only three patients (6%) had the completion of Fontan operation during the study period.

Results: Median time between the cavo-pulmonary anastomosis and catheter study was 28 months. The patients were divided into two groups: group 1 with extra source of pulmonary flow (33 patients (66%)) and group 2 without other source of pulmonary flow (12 patients (34%)). There were no significant differences between the two groups in age, weight, or percentage of prior palliation at the time of surgery. The diagnoses were similar in the two groups. At follow-up in outpatient clinic: weight in group 1 was significantly better than group 2 (P < 0.05). The oxygen saturation was significantly lower in group 2 (P < 0.01). Four patients from group 1 had procedures to minimize the extrapulmonary flow: one had surgical rightening of the band and three patients had catheter interventional procedures either closure of the shunts, collaterals, and/or device occlusion of the forward flow. Twenty-five patients had hemodynamic studies in preparation for Fontan operation, there was significant difference in pulmonary artery (PA) mean pressure, Q1/Qp, and PA branches size. There was no significant difference between subgroups of group 1: with shunt, forward pulmonary flow, or aorto-pulmonary collaterals.

Conclusion: To our knowledge the use of a steerable long sheath for ASD closure was not published yet. In each of the four patients, the large ASD had been closed with ASO (28–32 mm) by use of the steerable sheath. With an inner diameter of 9.8 Fr the largest ASO to be delivered is 32 mm of size. This sheath-device is typically used for electrophysiological purpose but also suits the demands of ASD closure very well. Deflection and rotation can be easily controlled for closure of complex ASDs.

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CENTRAL BLOOD VOLUME INDEX AS VOLUMETRIC PRELOAD INDICATOR IN PATIENTS UNDERGOING CARDIAC CATHETERIZATION

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Introduction: Accurate assessment of volumetric preload is important in the management of critically ill patients. Central venous pressure (CVP), which is frequently used to assess preload, has been shown to be inaccurate. The COstatus system (Transonic Systems Inc., NY) routinely measures cardiac index (CI) and central blood volume index (CBVI: blood volume in the heart, lungs, and major vessels normalized over body weight). The aim of this study was to compare stroke volume (SV) measured by the Fick method with CVP and CBVI in patients undergoing cardiac catheterization.

Methods: Six patients (aged 19 ± 8 years) admitted to the cardiac catheterization lab were studied per the IRB approved protocol. For COstatus, an extracorporeal arteriovenous loop set was connected between in situ catheters and warm isotonic saline was used as an indicator. For the Fick CO, oxygen content from pulmonary artery and arterial blood were used, while VO₂ was obtained from published normal values. Measurements were corrected for sheath priming volumes.

Results: SV (Fick) ranged between 46 and 76 ml/beat while SV (COstatus) ranged between 45 and 93 ml/beat; CVP ranged between 9 and 19 mm Hg; CBVI ranged between 14 and 34 ml/kg. Correlation between SV (Fick) vs. CVP was r² = 0.05; SV (Fick) vs. CBVI was r² = 0.84; CVP vs. CBVI was r² = 0.602; SV(Fick) vs SV (COstatus) was r² = 0.95.

Conclusion: CO status measured CBVI showed a strong correlation with stroke volume measured by Fick while CVP showed a poor correlation, suggesting that CBVI is potentially a better marker of volumetric preload. Further studies are ongoing to statistically establish the relationship.
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PROSPECTIVE RISK STRATIFICATION OF PEDIATRIC CARDIAC CATHETERIZATION PROCEDURES: A SIMPLE SCORING SYSTEM

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Introduction: We sought to develop a simple scoring system to be applied to pediatric cardiac catheterization procedures in an effort to risk stratify patients prospectively for serious adverse events.

Methods: Sequential cardiac catheterization data were prospectively collected using a multicenter international registry developed by the congenital cardiovascular interventional study consortium (CCISC). A simple 20-point scoring system was developed based on the literature and consensus opinion to prospectively assign risk of a serious adverse event (SAE). The original score was then modified to a 9-point scale using logistic regression and the backward stepwise model selection method. The predictive value of these two scores were compared to the assigned American Society of Anesthesia (ASA) score in terms of their ability to predict SAE using Sawa’s Bayesian information criterion (BIC) and area under the receiver operator curve (AUC).

Results: Among 11,489 registered patients from 17 centers between 2008 and June 2012 there were 9,148 (79.6%) patients less than 19 years old at the time of catheterization. Mean (±SD) age was 5.7 ± 3.7 years with range (0–18 years). Mean weight was 23.1 ± 14.7 kg with range (0.3–149 kg). The incidence of SAE was 6.8% and 2.4% in children aged <1 year and 1–18 years (P < 0.001), respectively. Utilizing logistic regression to model the risk score; weight, cardiac diagnosis, procedure, inotropic support, and physiologic score were found to be significant predictors of SAE. The AUC for ASA was least predictive of the three models (0.608). It was greatest for the modified score (0.720) followed by the original score (0.703); indicating superiorit of the modified score.

Conclusions: It is possible to prospectively risk stratify pediatric patients undergoing cardiac catheterization for SAEs utilizing a simple scoring method. This method may have broad application in clinical practice regarding outcomes analysis and development of quality assurance measures.

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NEW THERAPEUTIC STRATEGIES FOR PATIENTS WITH ATRIAL SEPTAL DEFECT AND SEVERE PULMONARY ARTERIAL HYPERTENSION: COMBINATION OF ADVANCED MEDICAL THERAPY AND CATHETER CLOSURE

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Background: Therapeutic strategy for atrial septal defect (ASD) patients who complicated with severe pulmonary artery hypertension (PAH) still remains controversial. Recent advanced therapy for PAH and catheter intervention may provide new therapeutic approach in these patients.

Method: Four ASD patient complicated with severe PAH (mean PAP > 50 mm Hg) were studied. Estimated initial systolic pulmonary pressure of onset ranged from 80 to 100 mm Hg, and Qp/Qs from 1.1 to 2.1. Medication for PAH which included prostacyclin analog (n = 1), phosphodieterase5 inhibitor (n = 2), and endothelin receptor antagonist (n = 4). After the confirmation of therapeutic efficacy of PAH therapy, catheter closure of ASD was performed. Mean device size was 28.5 mm.

Results: Combination of advanced medical therapy for PAH and catheter closure of ASD may expand the therapeutic indication in this patient population.

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INTRAVASCULAR ULTRASOUND FACILITATES PERCUTANEOUS CLOSURE OF PERIVALVAR LEAK AFTER TRANSCATHETER AORTIC VALVE REPLACEMENT

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Background: Transcatheter aortic valve replacement (TAVR) is an established treatment for patients with severe aortic stenosis and prohibitive surgical risk. Paravalvular aortic regurgitation (AR) after transcatheter aortic valve replacement is common and, when more than mild, is independently associated with increased morbidity and mortality. Nodular calcification at the valvular commissure is associated with paravalvular AR after TAVR. Angiography and transesophageal echo does not define the precise anatomy associated with paravalvar leak making device closure difficult and incompletely effective.

Methods: Three patients underwent TAVR complicated by at least moderate paravalvular aortic regurgitation related to native aortic valve nodular calcification. Percutaneous device closure with a single Amplatzer AVP 2 vascular plug was accomplished readily in each case from a retrograde aortic approach guided by coronary intravascular ultrasound (IVUS) imaging. The paravalvular leak was crossed easily retrograde with standard coronary guidewires through a 6 Fr guide catheter or 6 Fr sheath. A coronary IVUS pullback from left ventricle to ascending aorta next to the implanted valve clearly demonstrated the paravalve opening facilitating Amplatzer device sizing. Paravalvular leak closure was nearly complete immediately and resulted in dramatic clinical improvement in all. At follow-up, no significant leak was seen.

Findings: Intravascular ultrasound facilitates percutaneous closure of paravalvular leak after transcatheter aortic valve replacement. Guided by IVUS, paravalvular leak closure can be accomplished readily at the same time as aortic valve implantation.

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P-107
INITIAL EXPERIENCE IN NATIVE AORTIC COARCTATION STENTING WITH ADVANTA V12 LD COVERED STENT IN CHILDREN WEIGHING LESS THAN 25 KG

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Coarctation of the aorta may present in infant, children, and adults as 4 to 5% of congenital cardiac abnormalities. Stent therapy has become an accepted alternative treatment in native aortic coarctation, but requires a large delivery system. The Advanta V12 LD covered stent is pre-mounted and requires a 9–11 Fr delivery system.

Objectives: To report the initial experience using Advanta V12 LD stent in children less than 25 kg with the smallest possible delivery system.

Methods: From April 2010 to August 2012, patients with native aortic coarctation weighing less than 25 kg were treated with Advanta V12 stent implantation using 7–11 Fr delivery system and high pressure balloon dilatation.

Results: Eight patients with aortic coarctation aged 4–11 (mean age 6.12) years, with 16–23 kg (mean19.8 kg) underwent stent implantation. Coarctation diameter of (5.5 ± 2.5 mm) increased to (13.5 ± 2.2 mm). Peak pressure gradient decreased from 34.3 ± 15 mm Hg to (2.5 ± 2) mm Hg. The stent achieved the desired diameter in all cases. In two patients concomitant PDA were closed with stenting. Two patients required femoral artery embolectomy because of total vascular compromise. We did not find it more difficult to take the catheter from these positions.

Conclusion: Access to the umbilical veins and arteries can successfully and safely be obtained in small infants who are either too sick for surgery or the patients is small increasing the risk of femoral access and vascular compromise. We did not find it more difficult to take the catheters from these positions.

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PLACEMENT OF ENDOCARDIAL PACEMAKER IN DDDR MODE IN A CHILD UNDERGOING POSTOPERATIVE COMPLEX CARDIAC SURGERY. A CASE REPORT

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Objective: Children with complex congenital heart disease (CHD) are operated multiple times presenting rhythm disorders and require pacemaker placement. They have a heart structurally different, to be a challenge for group cardiologists, surgeons, and interventionalists to make the best decision. We report a case.

Case report: Male with congenitally corrected TGA (CC-TGA) with ventricular septal defect (VSD), persistent ductus arteriosus (PDA), and coarctation of the aorta, who underwent at two years of age a coarctectomy with PDA closure and pulmonary artery banding. In follow-up at 5 years of age, there was evidence of aortic recoarctation. Angioplasty with stent was performed. At 7 years of age, a double switch operation was performed. During the immediate postoperative, the clinical outcome was regular. So was the catheterization laboratory was concluded infundibular stenosis, was operated on again, an extensive infundibular resection. His evolution was favorable and was discharged. Two months after surgery there was complete AV block with low cardiac output. Was agreed endocardial pacemaker placement in DDDR mode.

Method: Angiography evidenced appropriate solution over the baffle contrast to right ventricle (RV), to the left, then to the confluent pulmonary arteries. Indirectly observed opacification of the left appendage. The pulmonary veins come to LA with passage of contrast medium to LV, located right across the baffle without obstructions. Left subclavian vein is punctured with introducer, two metal clips are passed by, a long introducer ventricular pacemaker lead with active fixation is passed to the apex of the RV to the left, with adequate capture and corroborating suitable parameters. The atrial pacemaker lead with active fixation is positioned at the origin of the left atrial appendage and confirms adequate capture, setting the pacemaker generator in subepicardial region.

Conclusions: At follow-up the patient is in class I of the NYHA. We propose as an alternative using endocardial pacemaker in DDDR in patients after complex CHD surgery, but the literature is still limited in children operated on for complex CHD.
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APPLICATION OF A NOVEL ELECTROMAGNETIC CATHETER TRACKING SYSTEM TO ELIMINATE FLUOROSCOPY DURING GUIDANCE OF HEART CATHETERIZATIONS

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Background: To date, radiation dose reduction in cardiac catheterization has aimed at modifying the existing technology to limit dose delivery. The inherent limitation of this approach is that ionizing radiation remains the principal imaging modality. We propose a paradigm shift away from ionizing radiation toward the use of a radiation-free, electromagnetic imaging modality (EMIGS) for guidance of heart catheterization. We sought to apply a prototype tracking system in a phantom model to guide mock catheterizations.

Methods: An image loading engine was created to load and rescale DICOM images to an isotropic volume. An Aurora16 magnetic tracking system (NDI, Waterloo, ON) was used with a 0.5M cubic field in conjunction with a 6-DOF sensor-embedded Goodale-Lubin catheter. Validation was performed utilizing a Procrustes affine rigid point based registration algorithm with an iterative closest point surface-based registration. The catheter was represented by a single dot at the catheter tip, superimposed on a brief fluoroscopic loop. A simplified cardiac phantom was constructed to mimic the cardiac atria with a septal defect. Mock catheterizations were performed by a single user. Time was recorded to maneuver the catheter from IVC, across the septal defect, into the pulmonary vein orifice, withdrawn back to the right atrium and advanced to the SVC. Forty catheterizations were performed using fluoroscopy, then repeated using EMIGS. Times were compared by student’s T-test.

Results: All mock catheterizations were successfully completed. There was no significant difference between fluoroscopy and EMIGS in time across the mock septal defect (Fluoroscopy = 7 sec, EMIGS = 6.5 sec) while total procedure time was significantly lower using EMIGS (Fluoroscopy = 25.7 sec, EMIGS = 21.8 sec).

Conclusions: The EMIGS prototype performed well and was comparable to fluoroscopy in guiding simplistic, ex vivo, mock catheterizations with no radiation exposure. Electromagnetic catheter representation appears to be a promising imaging modality to augment, and potentially replace fluoroscopic catheter guidance for certain cardiac catheterizations. Further development is warranted.

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MEDIUM-TERM CT EVALUATION OF STENT GEOMETRY AND INTEGRITY OF THE EDWARDS SAPIEN TRANSCATHETER HEART VALVE IN THE PULMONARY POSITION

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Background: Distortion of transcatheter heart valve (THV) stent shape and morphology secondary to stent fracture has been shown to impact on THV function. Follow-up evaluation of stent geometry may be an important indirect indicator of valve function.

Objective: To evaluate and report medium-term CT follow-up data on stent geometry and consequent valve function in a group of patients undergoing transcatheter valve replacement with the Edwards SAPIEN THV.

Methods: All patients were enrolled in the COMPASSION trial. Multi-slice computed tomography (MSCT) was performed as part of the study protocol at 6 and 12 months and yearly thereafter following valve implantation. Prosthesis eccentricity indices (EI), circularity ratios (CR), and expansion ratios (ER) were calculated. Valve function and re-intervention rates were correlated with MSCT findings. A circular deployment was defined as an eccentricity index < 0.1 and under-expansion by expansion ratio <90%.

Results: Eighteen consecutive patients from a single implanting institution were included with a mean age of 24.98 ± 13.70 years. All patients underwent pre-stenting. Peak Doppler gradients across the RVOT were reduced from 52.7 ± 19.2 mm Hg to 25.1 ± 9.5 mm Hg as calculated by Doppler on transthoracic echocardiography (P < 0.001). The mean EI, CR, ER, and Doppler gradients at 6, 12, and 24-months follow-up are outlined in Table I. The valve–stent complex maintained excellent symmetrical geometry throughout the follow-up period. Three patients required re-intervention. ER in those requiring re-intervention was significantly less than those not requiring re-intervention (P = 0.04). There was a weak correlation between the pressure gradient across the RVOT and the expansion ratio (R² = 0.27). There were no stent fractures seen on follow-up.

Conclusion: The Edwards SAPIEN THV in the pulmonary position maintains excellent symmetry and geometry without stent fracture on medium-term follow-up. ER was lower in those who required re-intervention. ER may predict the need for re-intervention, however, larger cohorts are required to corroborate these findings.

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PULMONARY FLOW CONTROL USING BALLOON ANGIOPLASTY FOR RIGHT VENTRICULAR-PULMONARY ARTERY SHUNT WITH A HEMOClip IN HYPOPLASTIC LEFT HEART SYNDROME

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Background: In order to control pulmonary flow for infants with hypoplastic left heart syndrome (HLHS), we recently applied Norwood using right ventricular-pulmonary artery (RV-PA) shunt with a hemoclip. Our concept is that restrictive pulmonary flow by a hemoclip contributes to stability of hemodynamics at early period and that balloon angioplasty for RV-PA shunt with a hemoclip improves infants oxygen saturation. We sought to evaluate the efficacy of balloon angioplasty for RV-PA shunt with a hemoclip.

Methods: We retrospectively reviewed 10 infants, who underwent balloon angioplasty for RV-PA shunt with a hemoclip between July 2008 and August 2012.

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<tr>
<th>TABLE I.</th>
<th>6 months, N = 15</th>
<th>12 months, N = 13</th>
<th>24 months, N = 9</th>
<th>Reintervention cases, N = 3</th>
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<tr>
<td>Eccentricity index</td>
<td>0.085 ± 0.15</td>
<td>0.09 ± 0.13</td>
<td>0.108 ± 0.15</td>
<td>0.96 ± 0.002</td>
</tr>
<tr>
<td>Circularity ratio</td>
<td>96% ± 4.2%</td>
<td>97% ± 5%</td>
<td>99% ± 6%</td>
<td>98% ± 2%</td>
</tr>
<tr>
<td>Expansion ratio</td>
<td>87% ± 10%</td>
<td>89% ± 13%</td>
<td>89% ± 15%</td>
<td>66% ± 4%</td>
</tr>
<tr>
<td>RVOT gradient (mm Hg)</td>
<td>29.2 ± 12.8</td>
<td>30.5 ± 15.4</td>
<td>32.9 ± 20.7</td>
<td>45.3 ± 8.2</td>
</tr>
</tbody>
</table>
Results: After balloon angioplasty for RV-PA shunt with a hemoclip, arterial saturation significantly improved (68.3 ± 4.2% to 81.6 ± 2.1%, P < 0.001) and the diameter of stenotic portion by a hemoclip significantly increased (2.5 ± 0.5 mm to 3.7 ± 0.4 mm, P < 0.001). Nine infants have completed stage II, one infant is awaiting for stage II.

Conclusion: Balloon angioplasty for RV-PA shunt with a hemoclip was effective. Norwood using RV-PA shunt with a hemoclip could facilitate pulmonary flow control during stages.

P-113
INCIDENCE OF ACUTE KIDNEY INJURY FOLLOWING ROUTINE PRACTICE OF CARDIAC CATHETERIZATION WITHIN 48 HOURS OF CARDIOPULMONARY BYPASS
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Background: Acute kidney injury (AKI) following either cardiopulmonary bypass (CPB) or contrast administration is described. Cyanosis is another risk factor for AKI. Preoperative cardiac catheterization (PCC) followed by CPB within days is common practice in large tertiary centers. The nephrotoxic effect of contrast followed by CPB within days has not been evaluated in pediatric patients.

Methods: AKI in cyanotic single ventricle patients undergoing PCC either < 48 hr or > 5 days prior to CPB. AKI was defined as an absolute increase in serum creatinine (SCr) 0.3 mg/dL, a percentage increase of > 50% from baseline (based on pre-catheterization SCr) or reduction in urine output < 0.5 ml/kg/hr for > 6 hr. Duration of CPB, contrast dose, length of stay, and the requirement of dialysis were also evaluated.

Results: One hundred twenty-two patients had a PCC and CPB in the study period, with 113 having complete data available for review (55 BDG, 58 Fontan). In both groups, there were no differences in weight, age, contrast dose, CPB time, ICU stay, and total length of stay. The median contrast dose was < 6 ml/kg for all groups. No patients required dialysis. In the BDG group, AKI occurred more often in patients with PCC >5 days prior to CPB (15/37) vs. < 48 hr (2/18) (P = 0.032). In the Fontan group there was more AKI in the > 5 days group (22/39) but this did not reach significance (P = 0.26). Logistic regression analysis only revealed presurgery SCr in BDG patients was a risk factor for post-CPB AKI (P < 0.001). Presurgery SCr in the Fontan group was not associated with AKI. All other variables including PCC SCr were not significant for either group.

Conclusion: PCC within 48 hr of CPB and contrast load do not increase the risk of AKI post-CPB.

P-114
TRANSCATHETER INTERVENTION FOR INFERIOR VENA CAVA OBSTRUCTION: TECHNIQUES AND OUTCOMES
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Introduction: Inferior vena cava (IVC) obstruction may present with acute or chronic venous insufficiency, or be discovered incidentally at catheterization (cath). There are limited data on transcatheter treatments for IVC obstruction and their outcomes.

Aim: Review techniques and outcomes of transcatheter treatment of IVC obstruction.

Methods: Single center review of patients (pts) undergoing percutaneous intervention for IVC obstruction over a 10 year period at a large tertiary children’s hospital.Pts with inferior systemic venous baffle stenosis after atrial switch operations were excluded.

Results: 15 pts (male = 7) had 32 caths (median 2, range 1–3). Median (range) age at initial cath = 12 years (3 weeks–31 years) and weight = 35.3 kg (2.3–73.8). Cath indications included acute leg edema (n = 2), post-thrombotic syndrome (n = 8), or incidental finding at cath (n = 5). Obstruction location: suprarenal IVC (2 pts), infrarenal (5), suprarenal (3), common iliac (1), external iliac (2), and renal (1) veins. Total occlusions were encountered in 11 pts, and were crossed with the soft end (4) or stiff end of a wire (5), or transseptal needle (2). Primary cath (fluorine time = 60.7 min, 13.3–118) involved balloon angioplasty (BA) alone in 5/15 pts, with 10/15 pts having 4 (1–15) stents, with adjunctive mechanical thrombectomy in 2. 14/15 pts had successful IVC interventions; only one had unsuccessful IVC recanalization. 3/5 pts who received primary BA required subsequent stent placement due to restenosis. Complications occurred in 4/32 caths, of which 3 were related to IVC interventions (suprarenal IVC stent embolization (n = 1), aorto-IVC fistula (1), 1 acute stent thrombosis requiring thrombectomy), and 1 was unrelated to IVC intervention (atrial septal stent embolization in 1). At follow-up of 3 years (1–5.4 years), 6/10 patients with symptoms had satisfactory resolution, 2 with partial resolution, 1 with no resolution (failed procedure), and 1 pt had a successful procedure but died later of unrelated causes. Remainder of patients was alive at last follow-up. Imaging follow-up available in 8 pts showed patent IVC in all pts with initially successful procedure.

Conclusions: Transcatheter intervention for stenosis/occlusion of the IVC is feasible and can be performed with low risk and good mid-term outcomes. Re-interventions are commonly required, both to treat recurrent obstruction and to accompany somatic growth.

P-115
EARLY EXPERIENCE WITH TRANSCATHETER PULMONARY VALVE REPLACEMENT IN PATIENTS WITH A DYSFUNCTIONAL GORE-TEX BIVALE
Jeremy Ringwald, Jeffrey Jacobs, Richard Martinez, Elsa Suh, Congenital Heart Institute of Florida, Tampa Bay, FL, USA

Introduction: Transcatheter pulmonary valve replacement (TCPVR) has led to a paradigm shift in the care of patients with congenital heart disease. TCPVR has been predominantly performed in patients with dysfunctional right ventricle to pulmonary artery conduits and other tissue valves. The Gore-Tex® bivalve (GBV) is an additional option for surgical pulmonary valve replacement. We hypothesized that some patients with dysfunctional GBVs would be candidates for TCPVR. We report our early experience with TCPVR in patients with a dysfunctional GBV.

Methods: Retrospective review of all patients taken to the cardiac catheterization laboratory for attempted TCPVR following surgical GBV pulmonary valve replacement.

Results: Since April 2011 six patients have been brought to our cardiac catheterization laboratory with a dysfunctional GBV for possible TCPVR. All had undergone GBV 7–11 years previously, 4/6 were male and mean age was 27 years (range 19–41 years). All patients had marked pulmonary valve dysfunction: 4/6 with combined PS and PR, 2/6 with PR alone. 4/6 were symptomatic and 2/6 had ventricular arrhythmia. All underwent hemodynamic and angiographic assessment and balloon sizing of the GBV. 3/6 patients were judged to have a landing zone in the GBV adequate to consider TCPVR. This decision was based on the angiographic appearance of the GBV leaflets (annular integrity with diminished excursion), and a fluoroscopic circular waist < 23.5 mm in multiple views with balloon sizing. All three patients then underwent successful TCPVR with a Melody® valve delivered on an Ensemble® delivery system. There were no major AEs. Follow-up for the three successfully implanted patients is brief at 5–8 months but by echocardiography all valves demonstrate < 1 PR and minimal PS.

Conclusions: Although numbers and follow-up are limited, it appears feasible that some patients with a dysfunctional GBV are TCPVR candidates with encouraging early outcomes.
TRANSCATHETER DEVICE CLOSURE OF RUPTURED SINUS OF VALSALVA: HAVE WE ACHIEVED THE DESIRED OBJECTIVE?

Neeraj Awasthy, S. Radhakrishnan, Savitri Shrivastava, Munesh Tomar, Fortis Escorts Heart Institute, Delhi, India

Introduction: Ruptured sinus of Valsalva (RSOV) has traditionally been managed by surgery. There are a few case series which do highlight the significant role of percutaneous intervention for RSOV. The relative concern about the interventional procedure has been persistent unsupported aneurysm that persists even after closure of the defect which would only reflect in follow-up studies.

Study Design: Patients with isolated RSOV who underwent transcatheter device closure were reviewed with their follow-up.

Results: There were a total of 13 patients. The mean age of presentation was 39 ± 10.0 years. New York Heart Association (NYHA) class at the time of presentation was II (six patients) III (six patients), and class IV (one patient). The RSOVs were all closed using a patent ductus arteriosus device. The mean procedural time was 30 ± 5.4 min, while the fluoroscopic time was 20 ± 7 min. The average hospital stay was 2 ± 1.1 days. There were no major complications. The patients were followed up for a mean of 3 years (ranging from 1 month to 5 years). All had complete closure of the shunt in follow-up. During the learning curve we modified the technique making subtle changes such as use of buddy wire, kissing technique for right ventricular outflow tract opening, and use of braded sheaths for the same. At the time of the last follow-up, all the patients were in NYHA class I and there was one hospital mortality, latter highlighting the importance of case selection for the procedure. No increase in distortion indices viz aortic annulus, aortic root, St junction, and ascending aortic dimensions were seen.

Conclusion: We conclude that transcatheter closure of isolated RSOV is a viable alternative to surgical repair with good outcome on echocardiographic follow-up. Though a long-term data is required particularly with respect to aortic root distortion evaluated by other imaging modality like CT scan or MRI.

HYPONATREMIC-HYPERTENSIVE SYNDROME: A RARE PRESENTATION IN A CHILD WITH TAKAYASU ARTERITIS

Neeraj Awasthy, Sanjay Khatri, Atul Mathur, S. Radhakrishnan, Fortis Escorts Heart Institute, Delhi, India

Hyponatremic-hypertensive syndrome (HHS) is a very uncommon disorder, in which hypertension is associated with profound hyponatremia. Although this condition is reported in adults, it is very uncommon in children. The most common cause of this disorder in children is known to be unilateral renal artery stenosis. Our patient presented symptomatic hyponatremia with hypertensive emergency with underlying unilateral renal artery stenosis as a part of Takayasu arteritis. To the best of our knowledge, this is the first reported association of Takayasu disease with HHS. The patient improved completely with normalization of blood pressure after successful percutaneous transluminal angioplasty. We wish to highlight this unique association because when diagnosed and appropriately managed, the patient may be completely cured of the potentially dangerous manifestations of HHS, as seen in our case.
P-120
TREATMENT OF EXTREMELY TORTUOUS AND HYPOPLASTIC AORTIC ARCHES BY IMPLANTATION OF JOTECTM E-XL AORTIC STENTS
Axel Moysich, Kai Thorsten Laser, Deniz Kececioglu, Nikolaus A. Haas, Heart- and Diabetes Centre North-Rhine-Westphalia, Department of Congenital Heart Disease, Bad Oeynhausen, Germany

Introduction: Extremely tortuous aortic arches combined with arch hypoplasia and stenosis is a rare finding. Even after successful stenting of the transverse arch, the blood pressure may stay high because of the anatomical course of the aortic arch. Therefore in many centers a surgical approach is preferred. The E-XL Aortic Stent (JOTEC GmbH, Germany) was initially manufactured for aortic lesions, e.g. dissections. This retrospective study describes the immediate effectiveness of these stents in this specific patient group.

Methods: We report on three patients (9, 11, and 23 years) with the described anatomy who were treated in our center. Despite successful stent-implantation in the transverse arch region, a relevant brachiocephalic hypertension and resting blood pressure gradient (20–40 mm Hg) remained. After angiographic documentation and measurements of the anatomy, the optimal stent size was selected. In two patients (9 and 11 years), 18 x 70 mm E-XL aortic stents were implanted using a 12 Fr delivery system, in the GUCH-patient a 24 x 100 mm stent was used via a 14 Fr sheath by a transfemoral approach.

Results: In all cases, stent implantation was successfully performed without complications. Due to the length and size of the stents implanted, the aortic arches were straightened up and their diameter adequately extended in all patients. Only minimal residual pressure gradients (< 10 mm Hg) were documented immediately after implantation.

Discussion: Extremely tortuous aortic arches with hypoplasia and coarctation usually cause brachiocephalic arterial hypertension and interventional treatment may be a therapeutic challenge. The combination of the closed cell design with a high radial force at its ends and the open cell design in the middle section makes the E-XL aortic stent an interesting alternative to common stent implantation in these patients. Kinking seems to be avoided and the tortuous anatomy can be straightened up. This combination makes these stents useful offer these challenging patients an interventional treatment modality.

P-121
IMPLANTATION OF THE NEW NIT-OCCCLUD PDA-R DEVICE IN CHILDREN BELOW 10 KILOGRAMS
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Introduction: Interventional closure of a patent arterial duct (PDA) has become a common and safe procedure in most pediatric cath labs. However, despite modern devices available, it still remains a challenge in those children with low body weight and a large PDA. Several new PDA occluder systems have been developed in the last years. One of them is the Nit-Occlud PDA-R device which was especially designed for large PDAs. The clinical experience and initial trial with this occluder published so far accepted only children with a body weight greater than 10 kg.

Methods: We report our most recent experience in seven children (age 1–10, median 6 months) with a body weight from 4.1 to 9.7 kg (median 5.9 kg) with large PDAs. The occluder size is determined by the minimum diameter of the PDA, the occluder stent must be at least 1.5 times, better 2 times greater: in six cases, the Nit-Occlud PDA-R with an aortic disc of 12 mm, a stent of 7 mm, and a length of 8.5 mm was selected and in the seventh case one with an aortic disc of 14 mm, a stent of 8.5 mm, and a length of 9.5 mm. All devices were implanted using the femoral venous access with a 6 Fr sheath.

Results: All seven devices were successfully implanted under sedation, without general anesthesia and without complications, e.g. dislocation with pulmonary or aortic obstruction. A sufficient occlusion of the PDA was documented by angiography and echocardiography in all cases. The patients were discharged from hospital two days after implantation.

Discussion: The new Nit-Occlud PDA-R device is suitable even in children with a body weight below 10 kg, when a relative large PDA is present. The reinforced retention disc allows an optimal positioning in the aortic ampulla without obstruction and the flexible cylindrical plug helps to adapt this device to various duct anatomies.

P-122
INTERVENTIONAL CLOSURE OF VENTRICULAR SEPTAL DEFECTS WITH THE NEW NIT-OCCCLUD LÊ VSD DEVICE—24 MONTH EXPERIENCE
Axel Moysich, Kai Thorsten Laser, Deniz Kececioglu, Nikolaus A. Haas, Heart- and Diabetes Centre North-Rhine-Westphalia, Department of Congenital Heart Disease, Bad Oeynhausen, Germany

Introduction: Interventional ventricular septal defect (VSD) closure is not performed in all pediatric cath labs because of bad risk of AV-blocs. In our cath lab we are using the Nit-Occlud LÊ device since 24 month. This retrospective study describes the effectiveness and complications implanting this occluder.

Methods: We report on 17 children with a body weight from 7.4 to 48.7 kg (median 18 kg) with perimembranous VSD (10 patients) or muscular VSD (7 patients). After adequate angiographic documentation and measurements interventional VSD closure was performed with Nit-Occlud LÊ devices in all cases.

Results: All devices were successfully implanted under sedation, without general anesthesia and without periprocedural complications, e.g. embolization. A sufficient occlusion was documented by angiography in nine cases, residual shunt in eight cases, but disappeared 48 hr later. In two cases, hemolysis occurred transiently. In one case, a right bundle branch block appeared after releasing the occluder. This child developed a complete AV-block after one week, but was successfully treated with prednisolone.

Discussion: Comparing the other currently available VSD occlusion systems the Nit-Occlud LÊ device is built up of a flexible nitinol coil layer that adapts perfectly to the anatomy of the defect. Therefore, no permanent AV blocks were documented. Due to the polyester fibers in the distal part of the coil a rapid occlusion was expected, but transient hemolysis occurred in two cases.

P-123
OCCLUSION OF PULMONARY ARTERIO-VENOUS MALFORMATIONS IN INFANCY AND CHILDHOOD, USING AMPLATZER VASCULAR PLUG II (AVP II) AND COILS
Varun Aggarwal, Danyal Khan, Miami Children’s Hospital, Miami, FL, USA

Background: Pulmonary arterio-venous malformations (PAVMs) are abnormal direct connections between a pulmonary artery and a pulmonary vein without an intervening capillary bed. This leads to a right to left shunt resulting in low systemic oxygen saturation and possibly causing paradoxical embolism resulting in stroke, cerebral abscess, etc. Treatment of PAVM has ranged from surgical lobectomy to transcatheter embolization to medical treatment with Interferon.

Methods: We retrospectively reviewed the catheterization records at Miami Children’s Hospital over the last 10 years. We found three patients who were brought to the cath lab for PAVM and underwent transcatheter embolization.
Results: The ages of the patients were 2 weeks, 4 months, and 16 years. The two infants had presented with low oxygen saturations while the 16 year old presented with polycythemia. One of the infants had been placed on extra corporeal membrane oxygenation (ECMO) while the older infant had been intubated and placed on nitric oxide due to persistent hypoxia. Echocardiograms on the infants demonstrated normal intracardiac anatomy. Due to a high index of suspicion, on repeat echocardiogram, a bubble study (using agitated saline) demonstrated the presence of bubbles returning from the pulmonary veins, thereby indicating the presence of PAVM. The 16 year old was found to have a shadow on a chest X-ray. A CT scan of the chest diagnosed the PAVM. All the three patients underwent catheterization and the arterial feeding vessels to the PAVM were occluded using coils and Amplatzer vascular plug II (AVP II). The patients had an immediate improvement in saturations. No complications occurred during the catheterizations. Two patients had family history of telangiectasia but did not meet the full criteria for hereditary hemorrhagic telangiectasia (HHT).

Conclusion: In patients with persistent unexplained hypoxia and a normal echocardiographic study, there should be a high index of suspicion for PAVM. PAVM can easily be diagnosed by supplementing the echocardiographic study with an intravenous injection of agitated saline (bubble study). PAVM can be effectively treated by transcatheter embolization.
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