

3DRA Assessment of cavopulmonary connections: Tips and Tricks

The Heart Center



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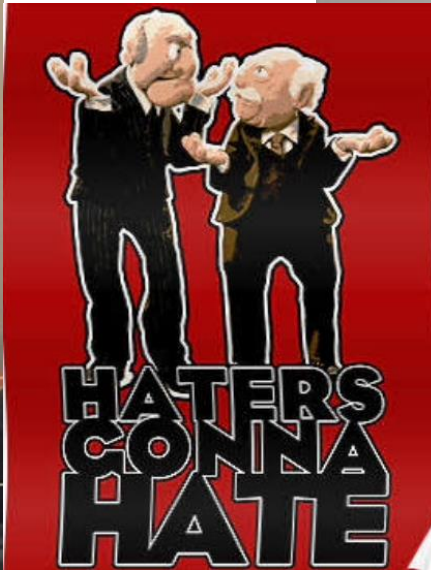


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Objectives

- Quick history of 3DRA
- 3DRA Role in CHD
- 3DRA Assessment of Cavopulmonary connections
 - Glenn
 - Fontan
- Tips and Tricks





History of 3DRA

- First described in 2006
- Neurovascular procedures
 - adjunct to subtraction angiography
 - More sensitive in detecting subtle lesions
- Subsequently, described in the setting of real-time evaluation of
 - spinal interventions
 - abdominal aortic aneurysm repair
 - hepatic vascular chemoembolization
 - PA/IVS case report

3DRA in CHD

Kapins CEB et al. Use of Rotational 3D (3D-RA) in Congenital Heart Disease Patients: Experience with 53 cases. Rev Bras Cardiol Invasiva. 2010;18(2):199-203.

- 2010 – First series describing its use in CHD
 - 53 cases – various diagnoses
- Results
 - 23%, 3DRA revealed anatomic details not shown by 2D angiography
 - 49%, 3DRA findings were used to aid in treatment decisions
 - Exposure to radiation was not statistically different from 2D angiography
 - No complications related to 3D-RA
- Conclusions
 - 3D-RA can provide additional useful information
 - May reduce the number of angiograms needed during a case
 - May limit patient exposure to radiation and contrast medium



3DRA in CHD

The Heart Center

Glatz AC et al. Use of angiographic CT imaging in the cardiac catheterization laboratory for congenital heart disease. JACC Cardiovasc Imaging. 2010 Nov;3(11):1149-57.

- Followed soon thereafter in the US in late 2010
 - 41 caths; range of diagnoses
 - RVOT/central pulmonary arteries; CPCs; pulm veins; distal PAs
- Results:
 - 71%; Diagnostic-quality imaging
 - 12 cases (29%), contributed to clinical outcomes
 - Radiation dose was comparable to a biplane cineangiogram
- Conclusions:
 - In certain cases, 3DRA provides additional anatomic detail and may aid complex catheter manipulation
 - Future work is needed to continue to define applications of this new technology



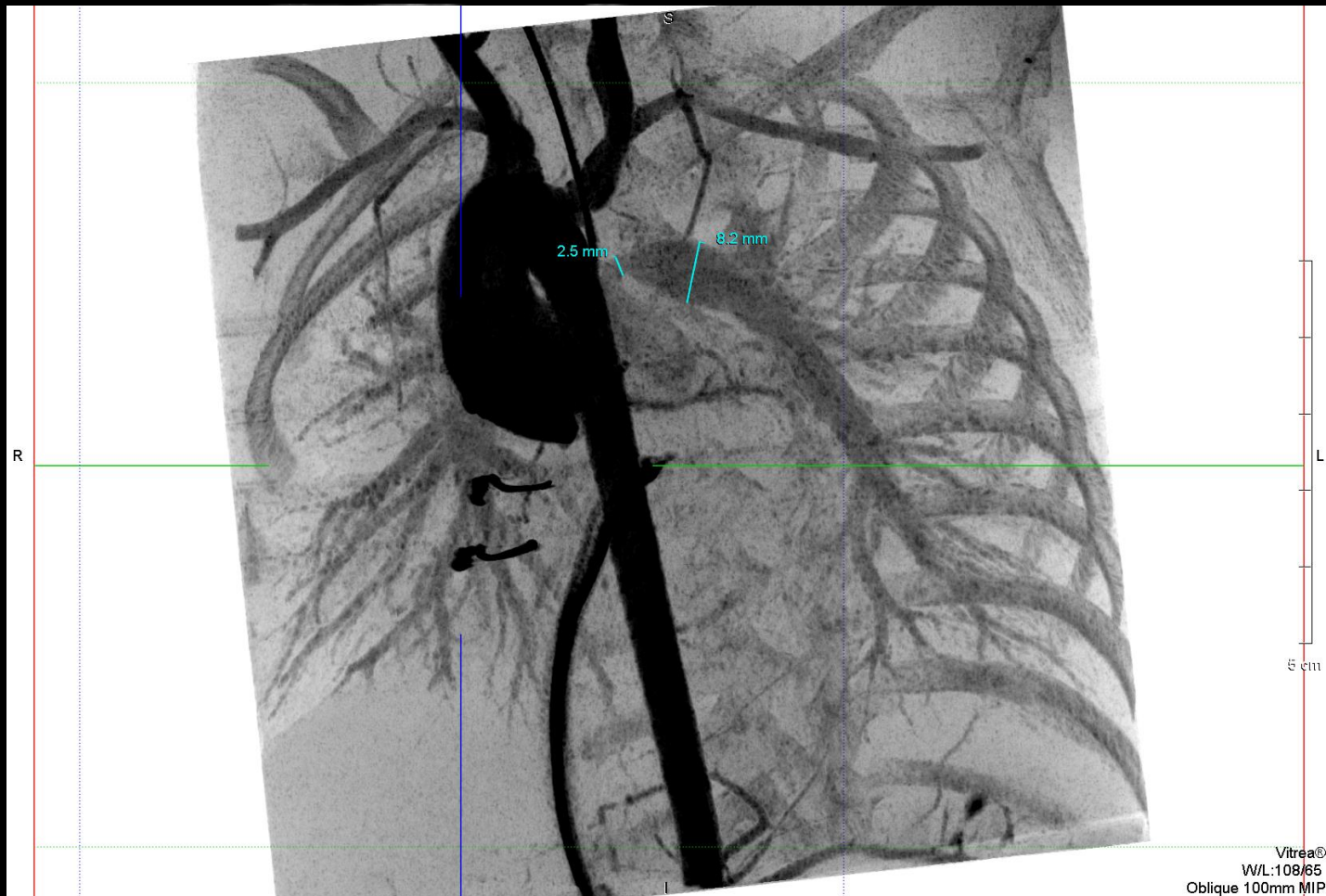
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Zoom:248%
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Pulmonary Arteries Following CPC

- Glenn or TCPC
 - No right ventricular pump
 - Relies primarily on residual kinetic energy provided by a single systemic ventricle and the sucking of blood from left atrial diastole
- Unobstructed pulmonary circulation
 - maximizing circulatory efficiency
 - reduce early and late morbidity



Retrospective review: 3DRA used to image the PA's Following CPC

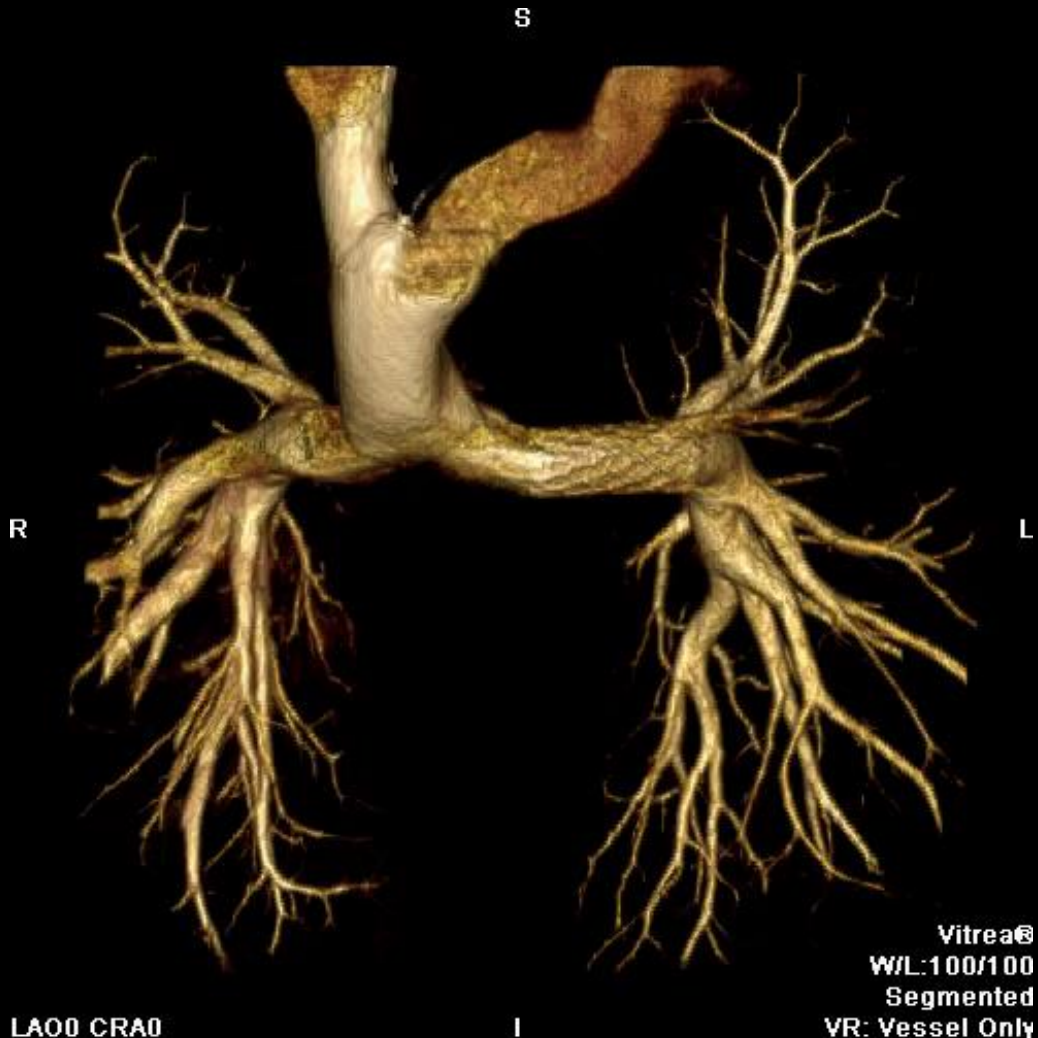
- 37 3DRA's in 32 pts (15 female)
- Median age – 4.3 yrs (0.3 – 19)
- Median weight – 15.7kg (4.3-114)
- Non-gated, breath-held acquisition
- HR manipulation
 - Rapid RV pacing/Adenosine: 14%
 - None: 86%

- Berman DP et al. The use of three-dimensional rotational angiography to assess the pulmonary circulation following cavo-pulmonary connection in patients with single ventricle. Catheter Cardiovasc Interv. 2012 Nov 15;80(6):922-30





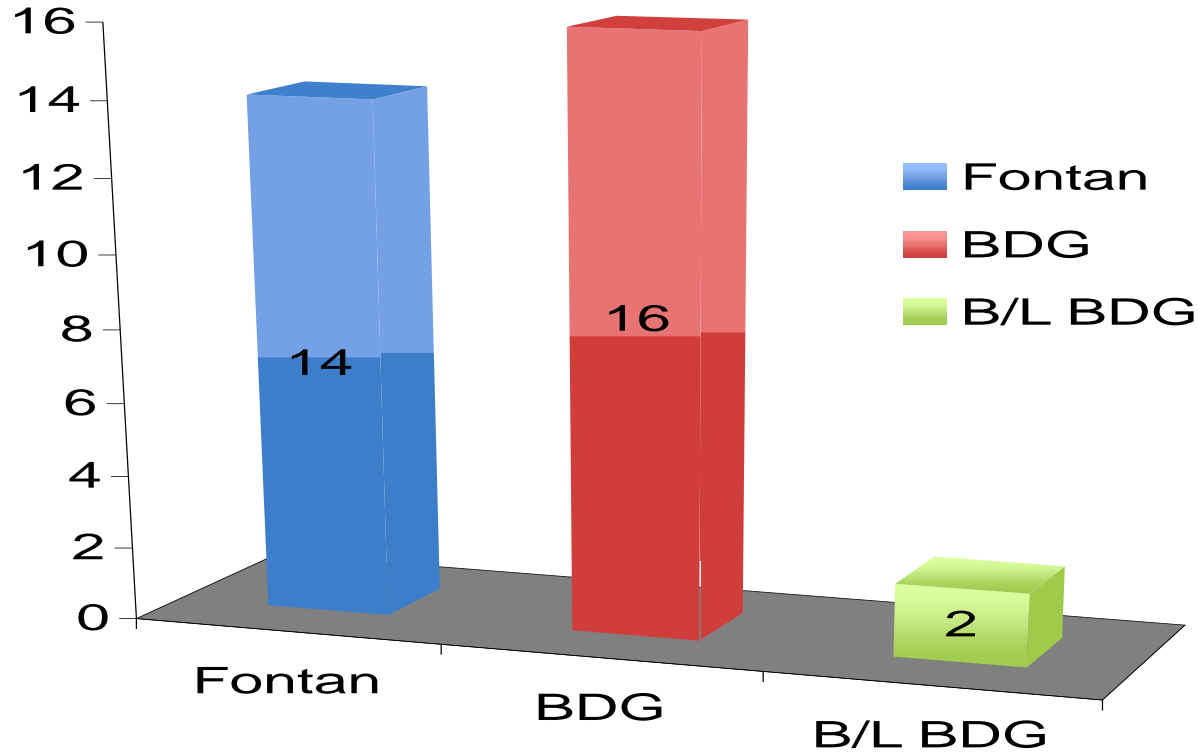
15.1kg female s/p BDG.
30cc injection at 6cc/sec of undiluted
contrast
2.0cc/kg contrast



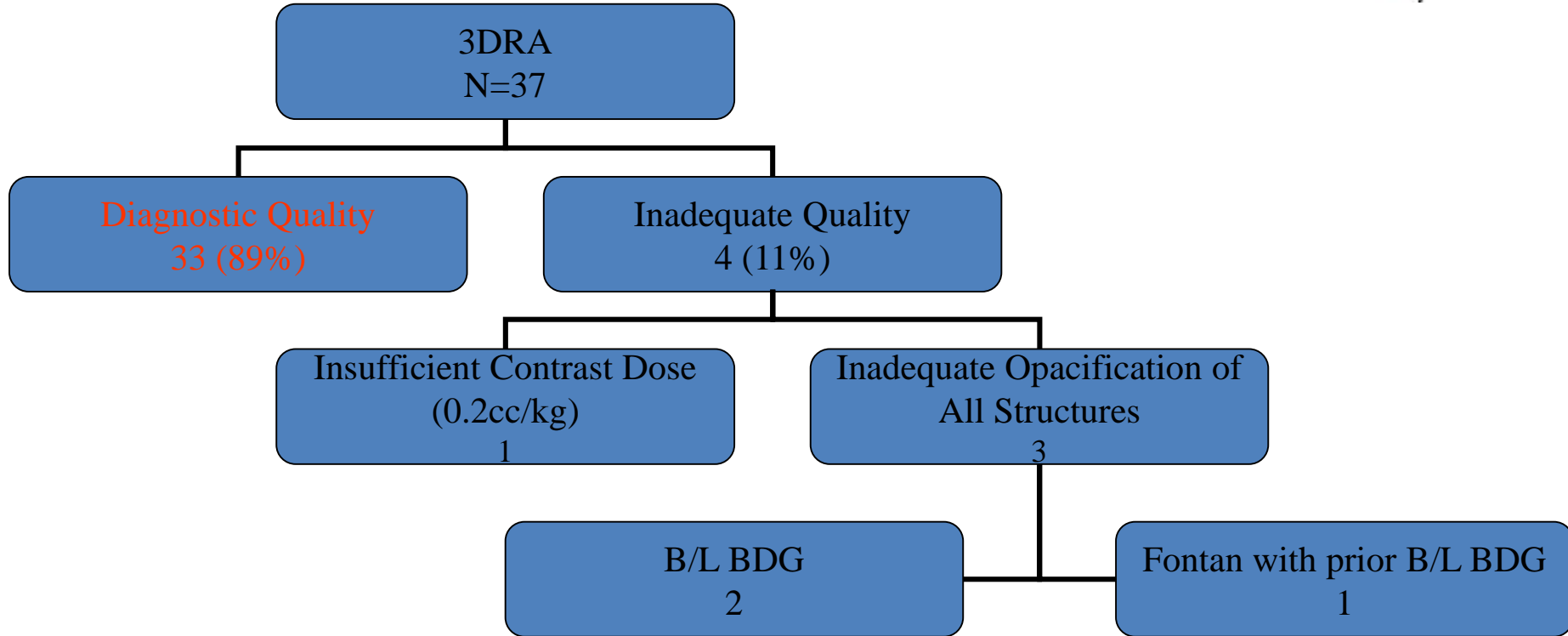
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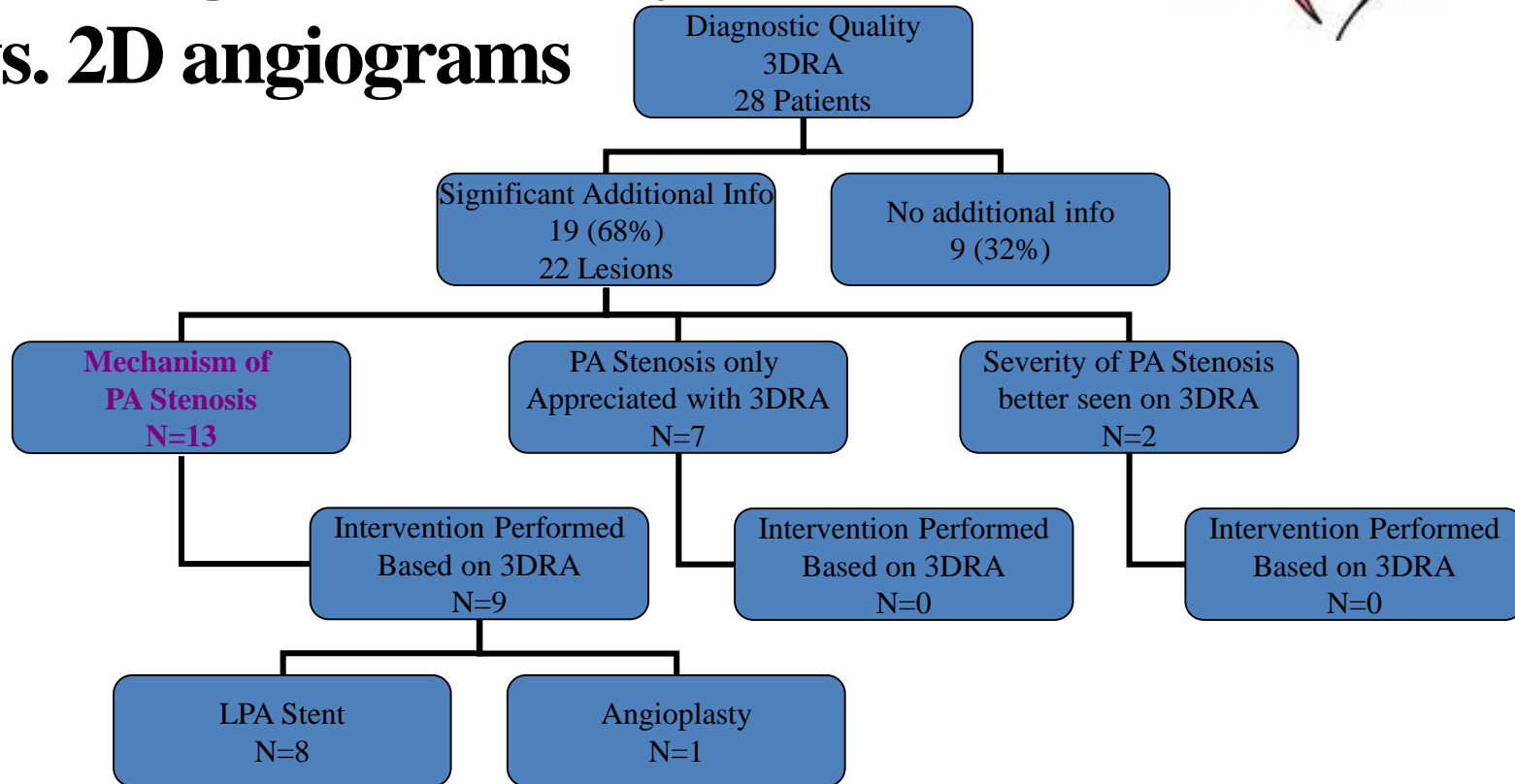
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WL:100/100
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VR: Vessel Only



Angiographic Results



Compared Diagnostic Quality 3DRAs vs. 2D angiograms



Aortic Compression

D

A

R

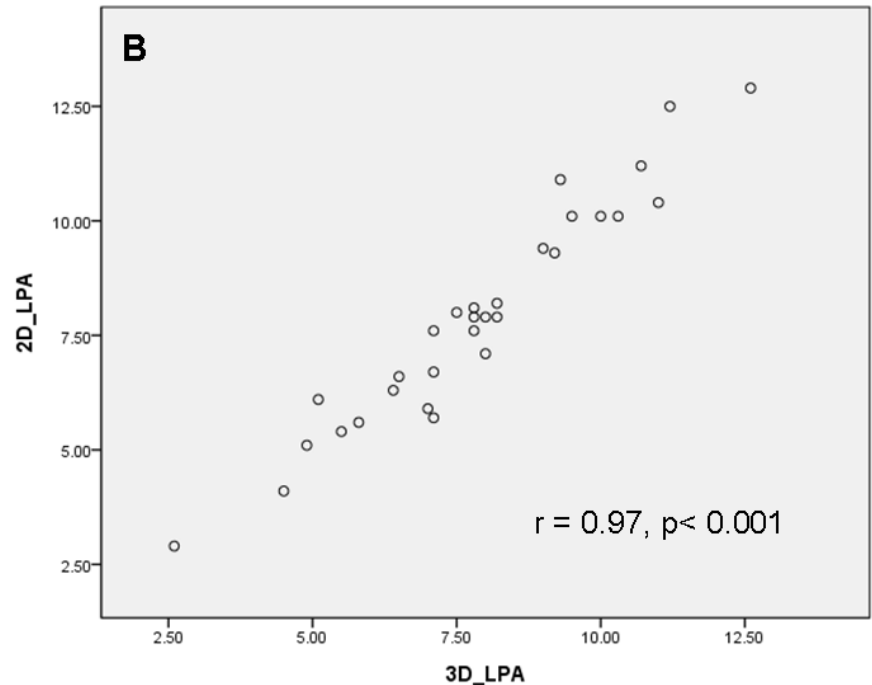
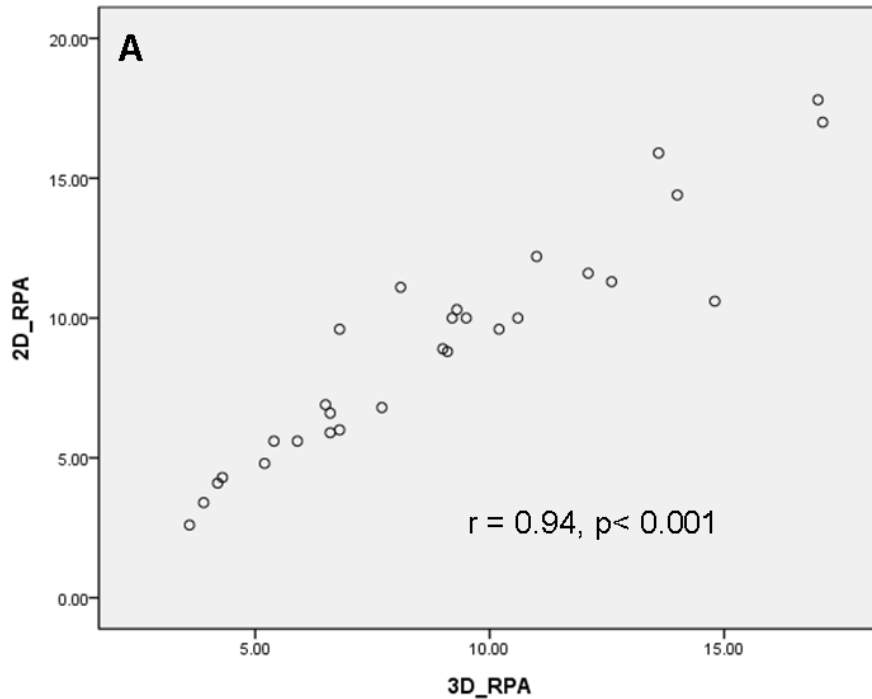


L
2 cm

P



2D vs. 3D Quantitative Measurement Correlation



3DRA: PA's Following CPC

- Safe
- Diagnostic quality in ~90%
- Additive information in ~70%
 - Guided interventions
- Pulmonary artery measurements
 - excellent correlation between modalities



TIPS and TRICKS

The trouble with doing something right the first time is that nobody appreciates how difficult it was.

(Anonymous)

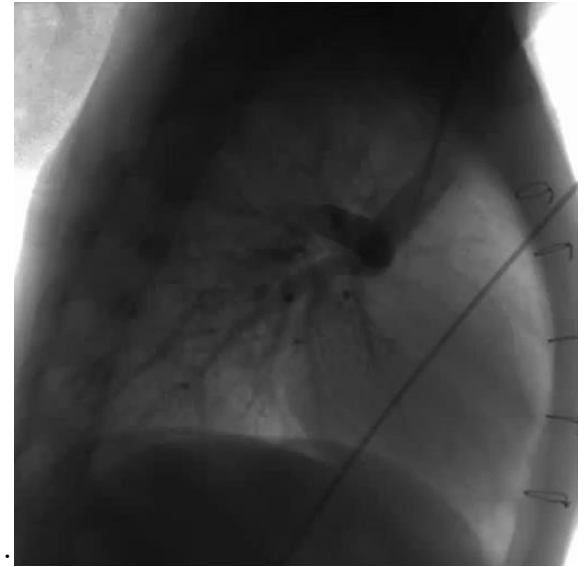
1. If new to 3DRA
 - Utilize your resources
 - Ask questions of your peers
 - Ask questions of your vendor
2. Want to have success early
 - Start with the PA's in CPC



TIPS and TRICKS

3. Do **NOT** need to manipulate HR during image acquisition → no RRVP needed

- Slow inefficient transit time through the PA's
 - perfect physiology for 3DRA image acquisition
- One less thing to have to consider during acquisition



TIPS and TRICKS

4. Contrast dose → 1.5-2cc/kg

- >15kg → Pure contrast
- <15kg → Diluted contrast
 - Allows for a larger volume injection
 - 1:1 or 2:1 contrast:saline
- Develop a dilution strategy that works for you and be consistent

TIPS and TRICKS

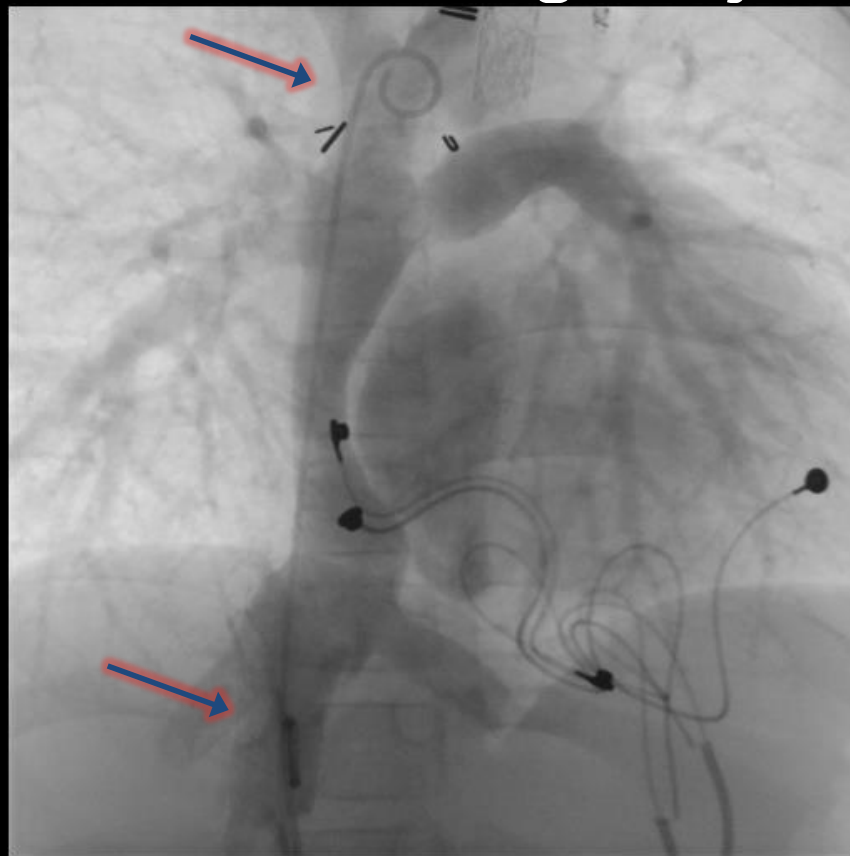


5. Catheter positioning

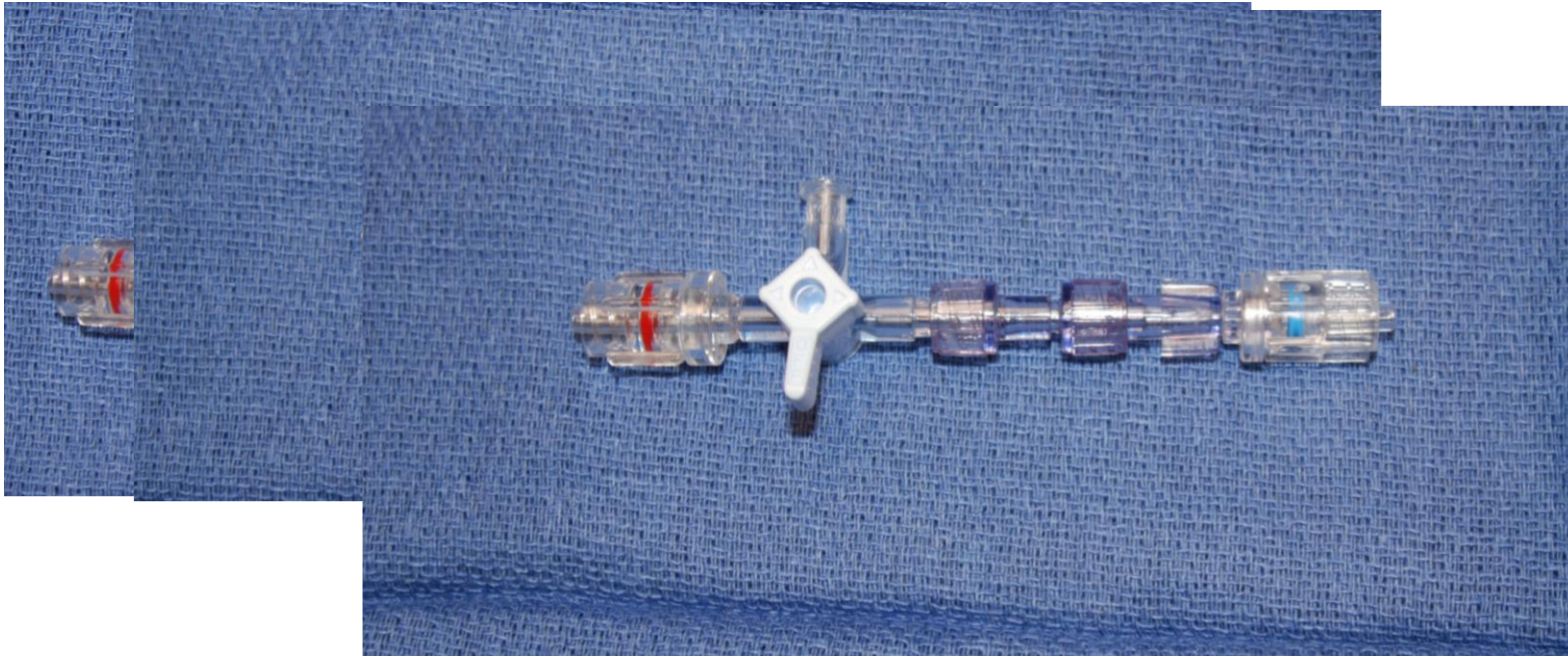
- Glenn (BDG, HemiFontan)
 - Single catheter injection
 - Proximal to area of interest
- b/l SVC or Fontan
 - Multiple site + simultaneous injections
 - Power injection through one + Hand injection
 - “timed just right”
 - Simultaneous power injection through 2 catheters



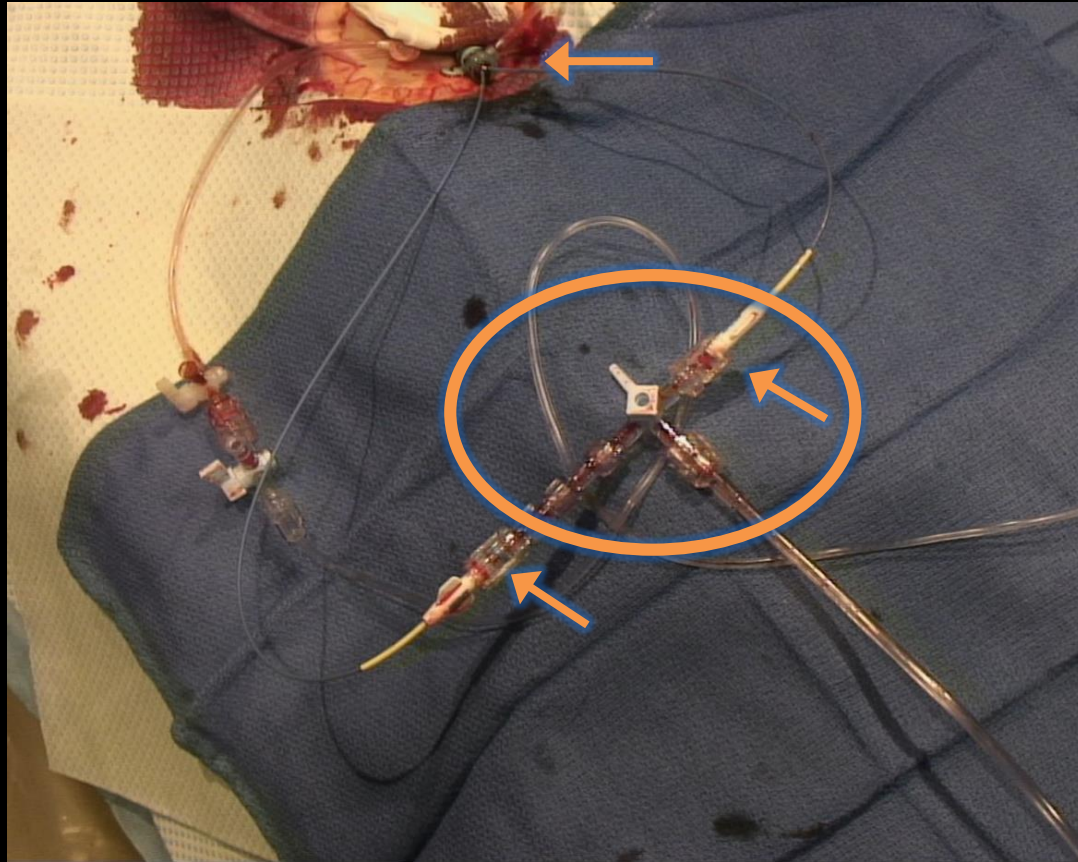
Simultaneous injection technique: Two catheters single injector



Simultaneous injection technique: Two catheters single injector



Simultaneous injection technique: The Heart Center Two catheters single injector



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Volume Render S T A P L R O

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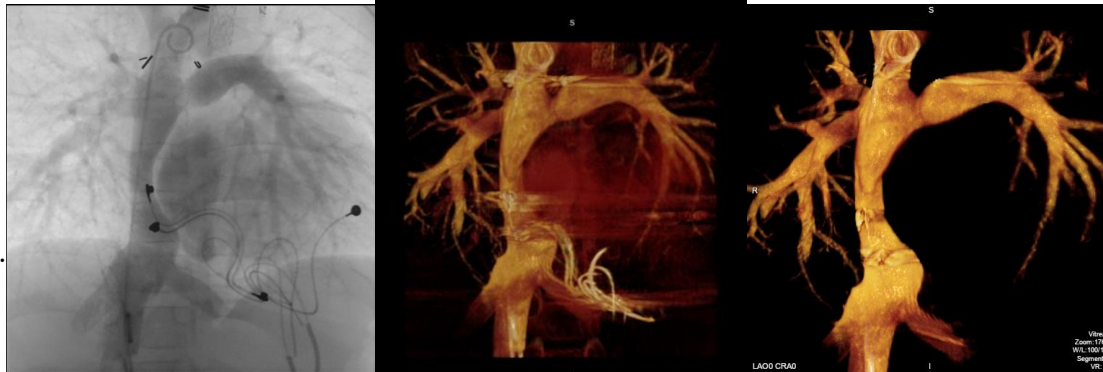
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TIPS and TRICKS

6. Empower and teach your clinical staff about 3DRA

- Encourage “Superusers”
 - 3D software, post-processing, trouble shoot problems
- Improves procedural efficiency
 - Continue to work while team post-processes for/with you



TIPS and TRICKS



7. Perform the 3DRA early in the procedure

- Delineates mechanisms
- Provides optimal angles for additional biplane imaging
- Maximizes efficiency
- May reduce total case contrast and radiation



TIPS and TRICKS



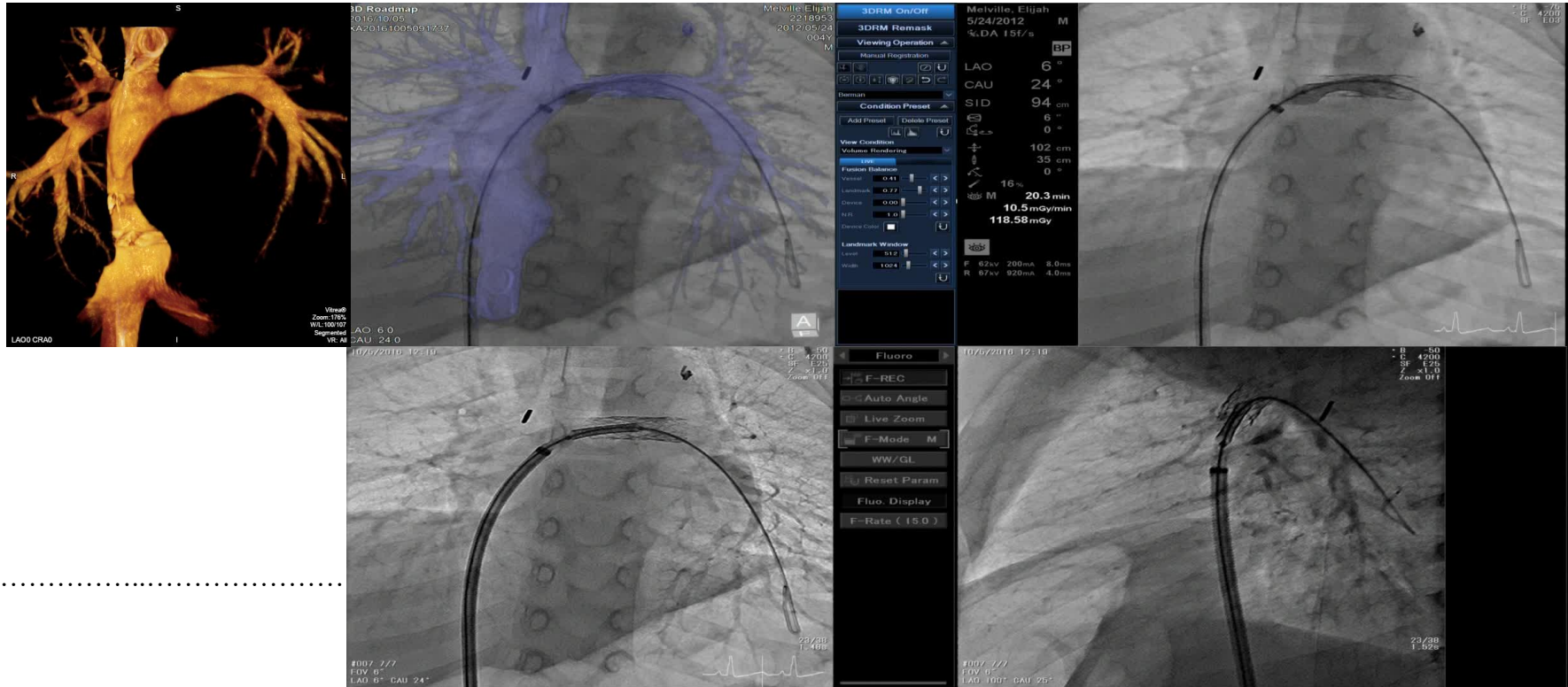
8. Use the CT-tomographic data



TIPS and TRICKS



9. Utilize fusion overlay



Conclusions



- **3DRA in the assessment of CPCs is:**
 - Easy and safe to do
 - Contributes important and additive information
 - **New 3DRA users and future 3DRA users**
 - Benefit from starting with this anatomy
 - **Like anything else we do in the cath lab**
 - 3DRA is a team sport
 - Utilize your peers and team members around you effectively
-



Thank you

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