



Mini-Symposium. Long-Term After Fontan Operation

Role of Catheter Intervention After Fontan Completion

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Disclosure Statement

**Nam Kyun Kim has nothing to disclose
about this topic (Role of Catheter
Intervention After Fontan Completion)**



Interventional Techniques for CHD



Dilations

Septostomy

Balloon, Balloon dilation +/- Stent

Balloon dilatation

Valves, Arteries, Veins, Conduits, Surgically created shunts, Baffles, etc.

Stent implantation

Arteries, Veins, Conduits, Surgically created shunts, Baffles, etc.

Occlusions

PDA, ASD, PFO, VSD, AV fistulae, APCAs, Shunts, Fenestrations, Paravalvular leaks, Ruptured sinus valsalva aneurysm

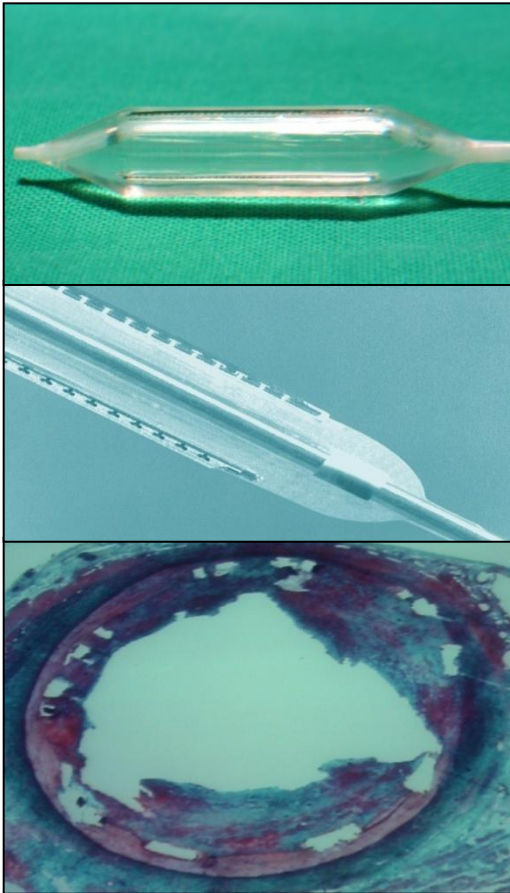
Hybrid or Cooperative Procedures

Intraop stent insertion, Intraop VSD closure, Periventricular VSD closure, Hybrid stage 1 repair for HLHS, Transcatheter Fontan completion from hemi-Fontan, Hybrid valve insertion

Transcatheter Valve Therapies

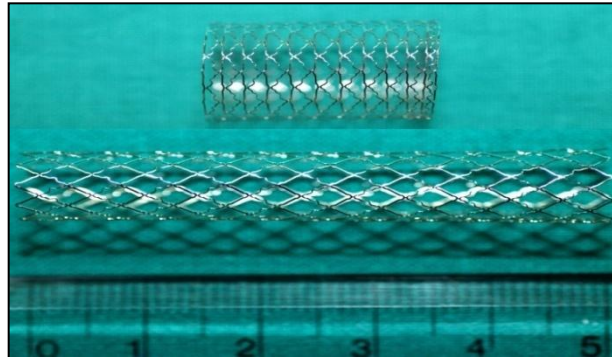
Dilation Techniques Beyond Balloon..

Cutting Balloons

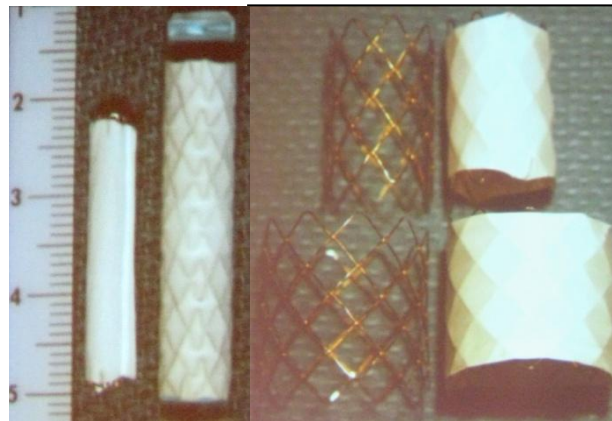


For refractory lesions to conventional balloons

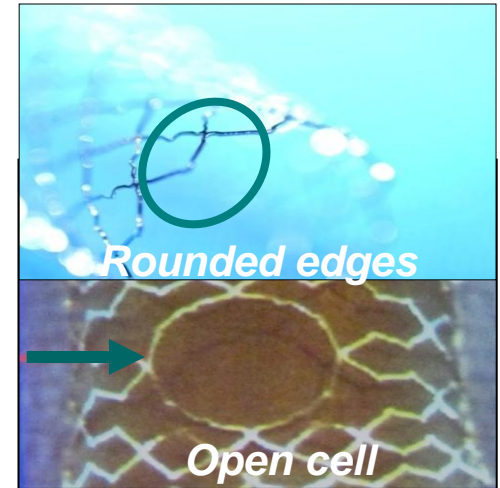
Evolving Stent Technology



Variety of Stent Design & Performance



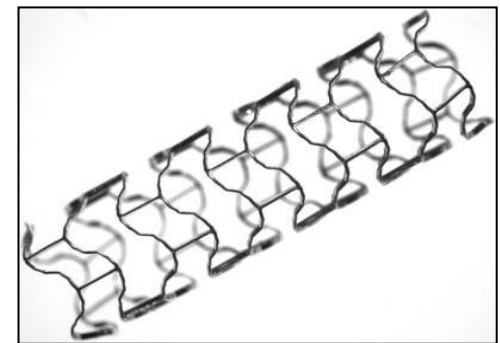
Covered stents:
prevents vascular dissection, bails out thrombus, etc.



Rounded edges

Open cell

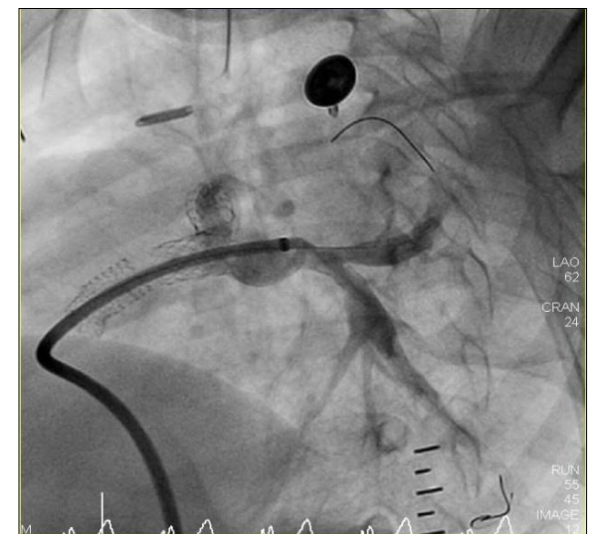
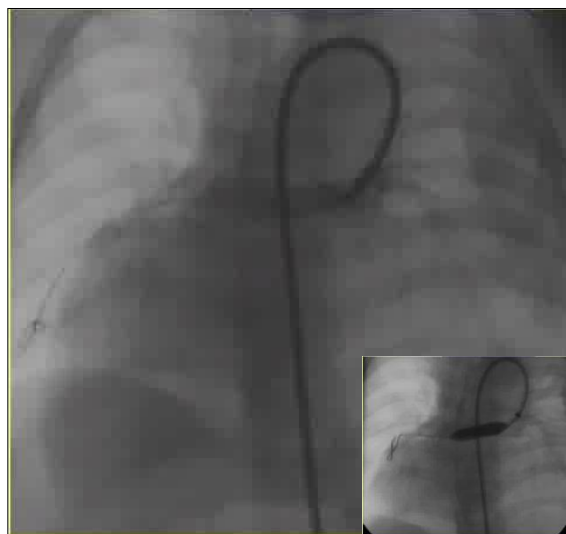
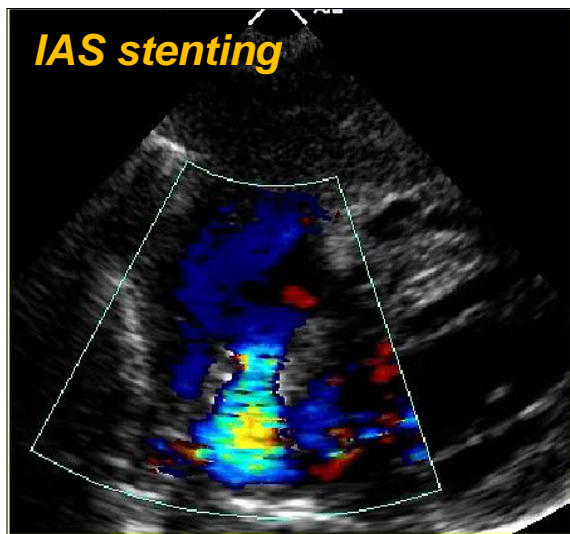
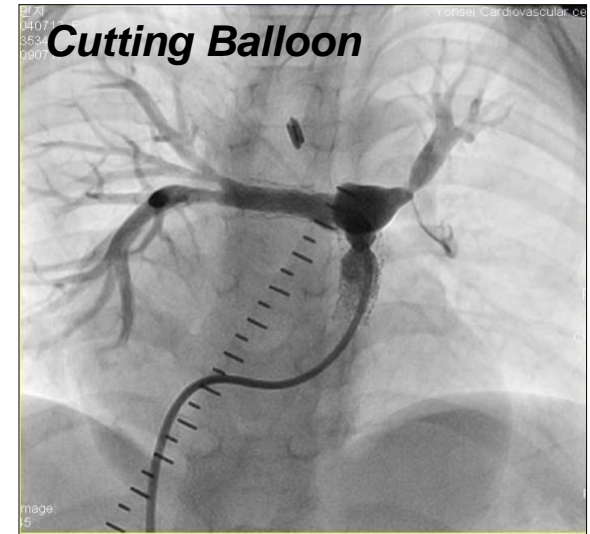
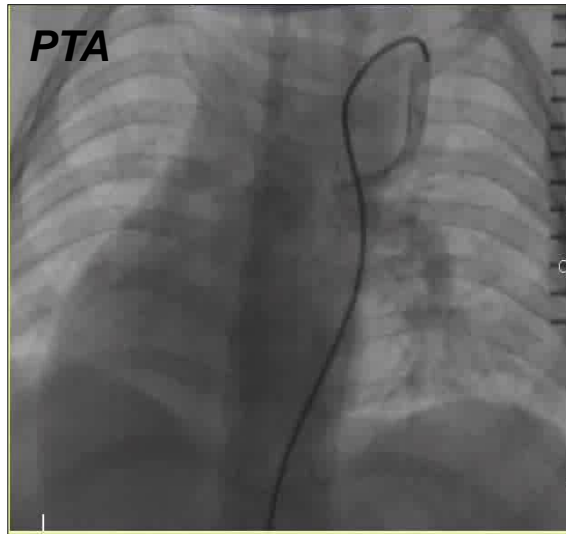
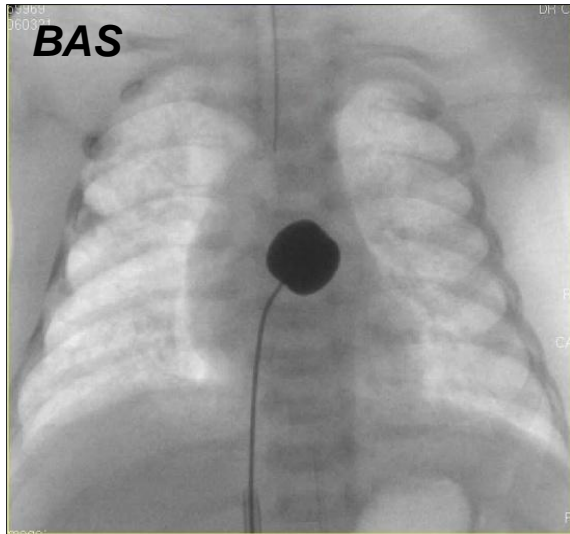
Improved Safety



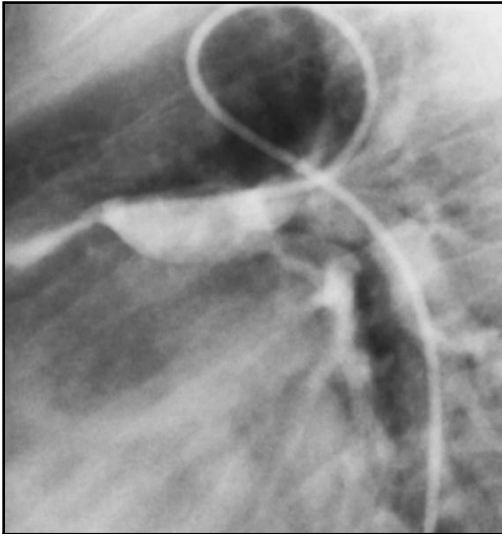
*"absorbable"
Magnesium stent*

Dilation Techniques

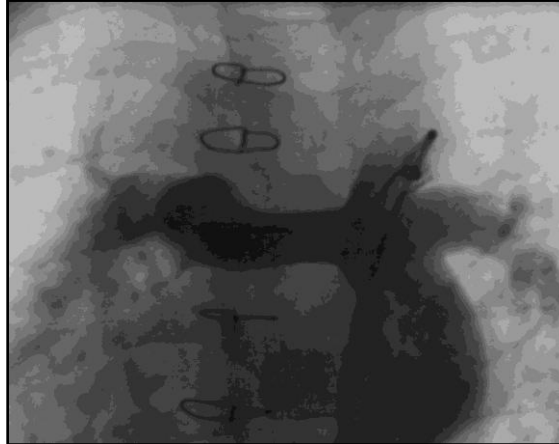
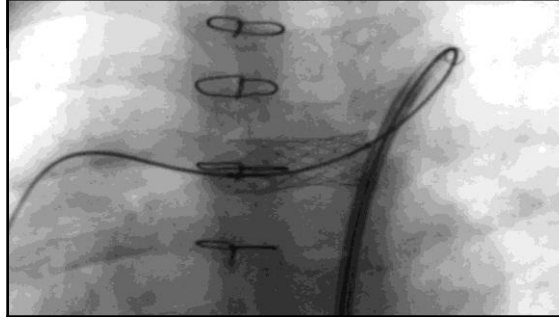
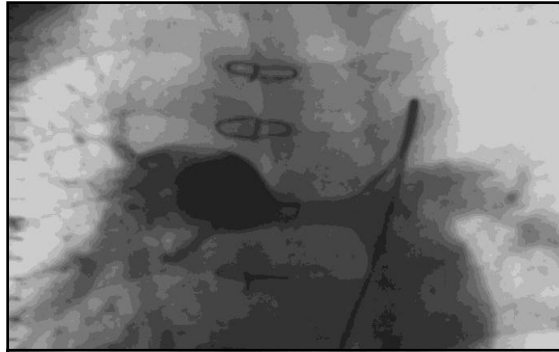
- *BAS, IAS Stent, PTA, Cutting Balloon* -



Stents for Vascular Stenosis with CHD



PA junction

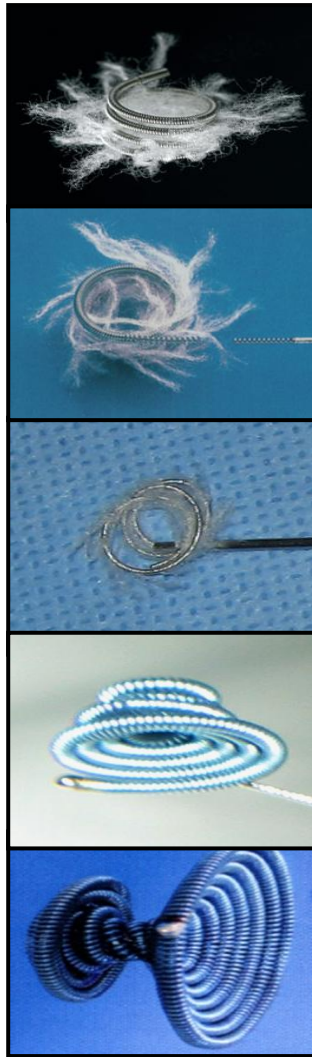


Central PA

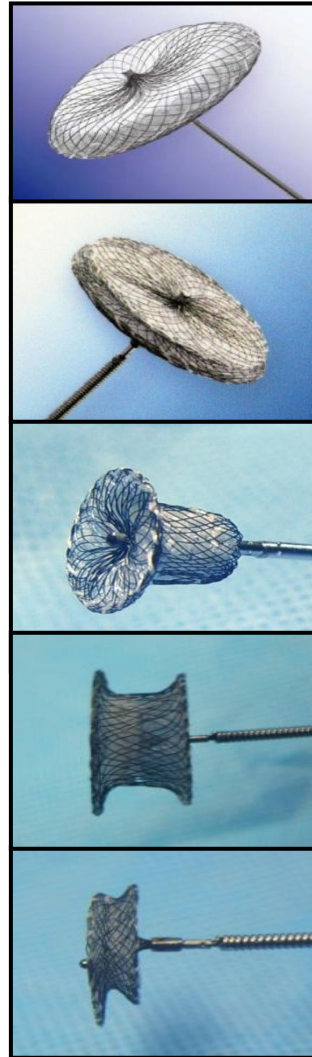


Fontan Circuit

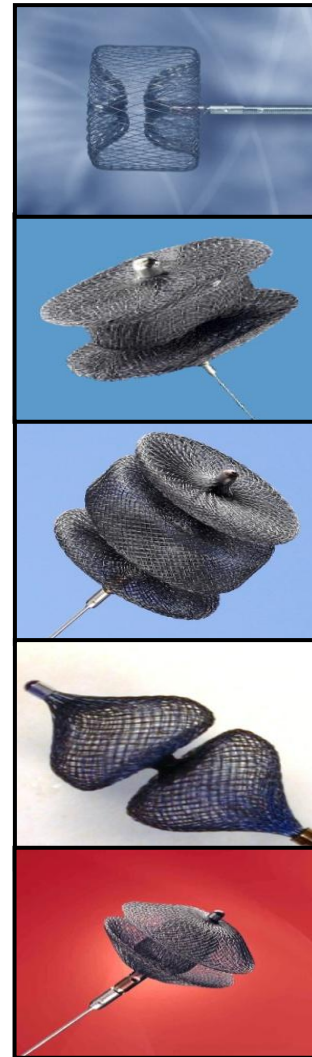
Occlusion Techniques Beyond Coil..



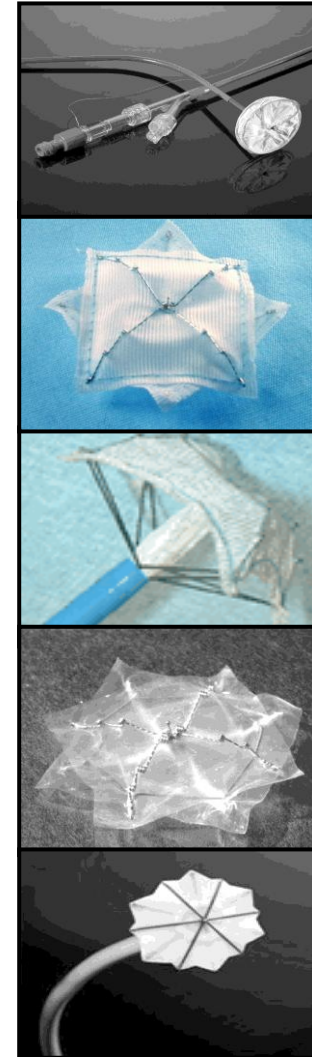
Coil Type



Amplatzer Family

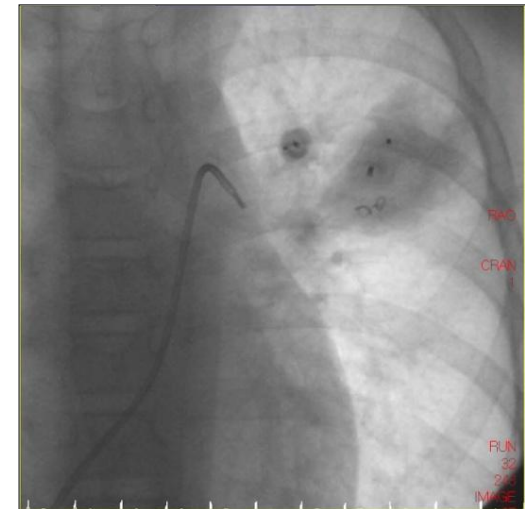
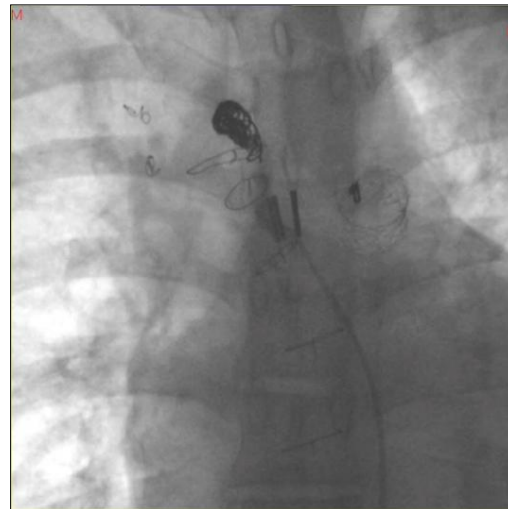
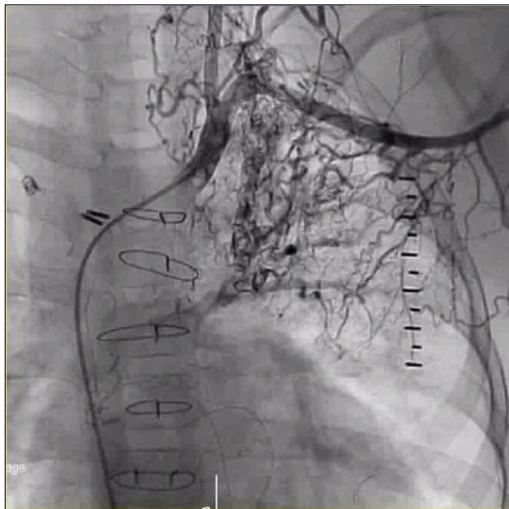
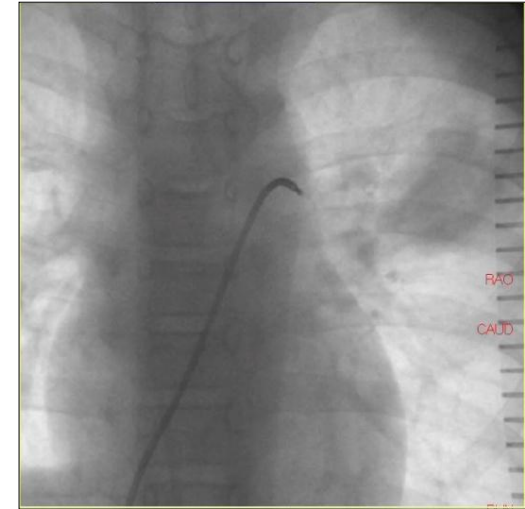


Vascular Plugs



Double Disc Devices

Embolization Tx Using Various Coils & Devices



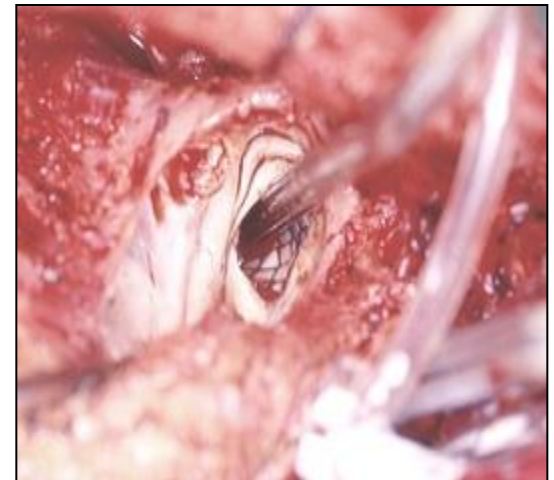
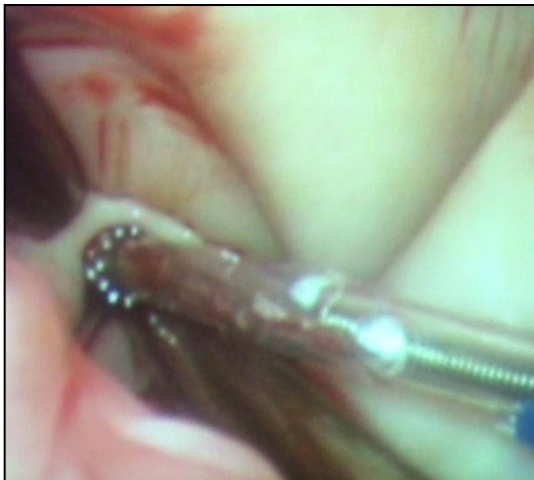
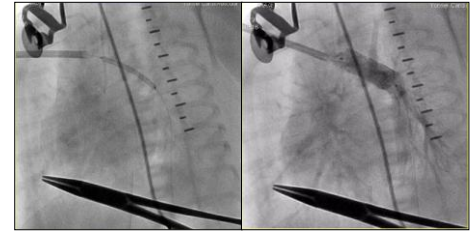
Gianturco Coils

Nester Coils

Vascular Plugs + Gianturco Coils

Hybrid Techniques...

- ✓ improvement of outcome can be achieved by close collaboration between cardiologist and cardiac surgeon using both surgical and interventional techniques
 - *Simplifies procedure*
 - *Shortens procedure time*
 - *Avoid risky manipulation / C-P bypass*
 - *Can be applied to smaller and high-risk patients*



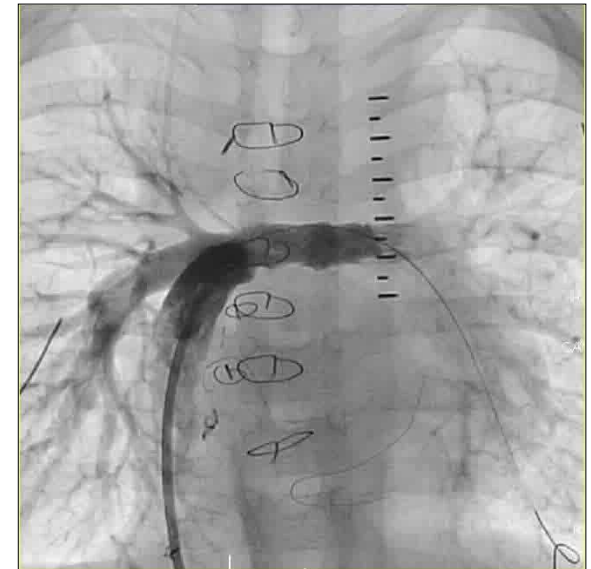
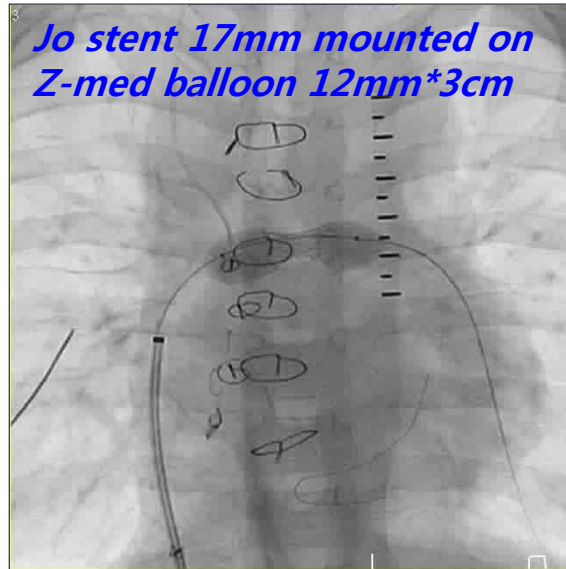
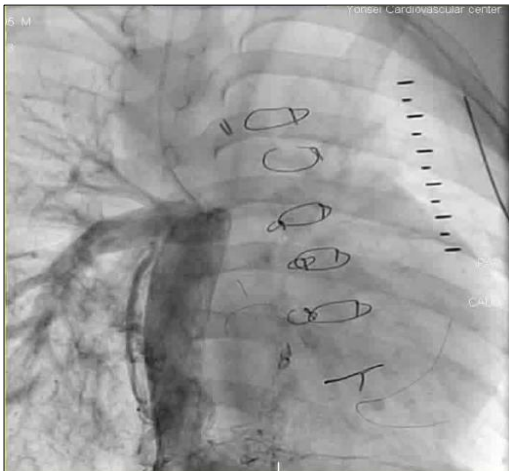
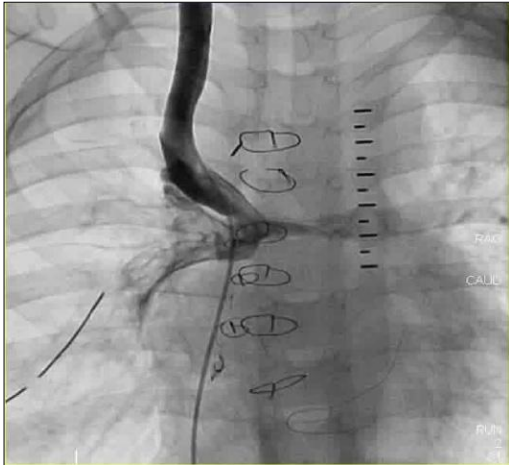
Conventional Tc. Procedures

- After Fontan completion -

- **Tc. closure of fenestration, baffle leak, AV and/or VV collaterals, PAVMs**
- **Balloon angioplasty & stent implantation**
- **Transcatheter fenestration in the baffle**
High pressure in the Fontan circuit / Low cardiac output
Prolonged pleural drainage / Protein losing enteropathy

Stent implantation in PostOp. Period

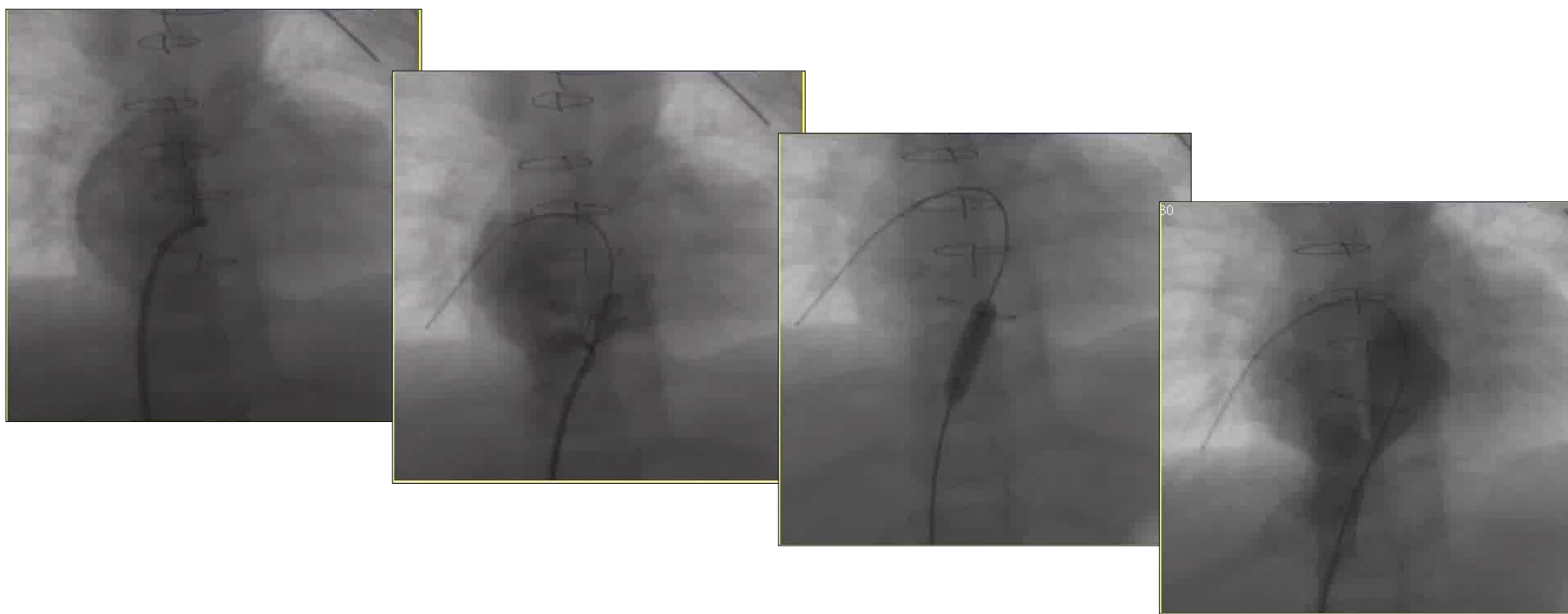
- M/4y, severe MS, hypoplastic LV /c VSD, CoA (HLHS variant)
- Damus-Kaye-Stansel Op (1mo)
- Bilateral Bidirectional Glenn (1y2m)
- ECCF → Post-Op. Prolonged Pleural drainage (4y3m)



→ *Chest tube removed (POD #20)*

Fenestration formation

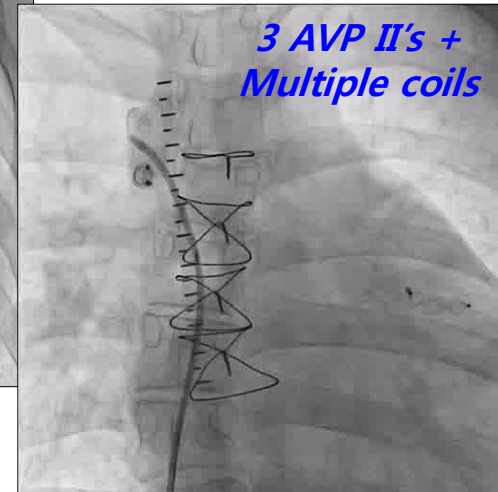
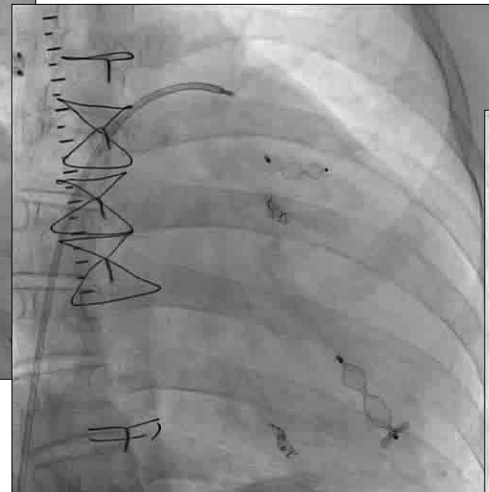
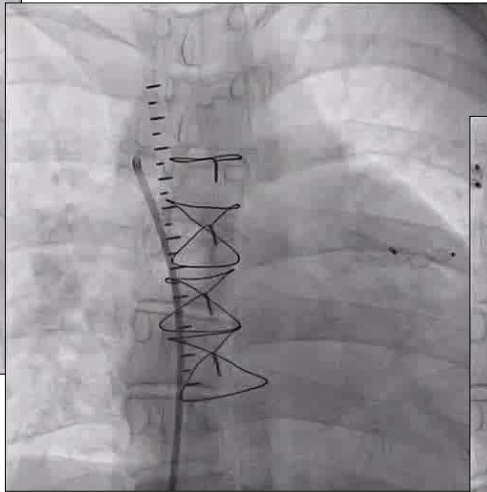
- M/2yr, FSV c DOLV, VSD, Hypoplastic LV
- BCPS (2mo) → LPA stent insertion (1y1m)
- Lateral tunnel TCPC /c fenestration (2yr)
- → post-op low cardiac out put c non-functioning fenestration



***: Clinical condition stabilized after re-fenestration
→ Weaning / C-Tube removal → ICU off***

Embolization of Multiple PAVMs & VV Collaterals

- 19/F, TA type IIB
- TCPC (Intracardiac lateral tunnel, 2y11m)
- Lost to F/U → Progressive desaturation, Exercise intolerance



*SaO₂: 80%
NYHA II ~ III*

*SaO₂: 95%
NYHA I*

Fenestration / PAVMs Occlusion

- F/12yr, Dextrocardia, Complex PA /c VSD, FSV
- MBT at 2mo → BCPS at 1yr → TCPC at 4y3m → ECCF conversion c fenest. At 9yr
- Progressive cyanosis / Exercise intolerance

Before Intervention :

- **SaO²: 84%**

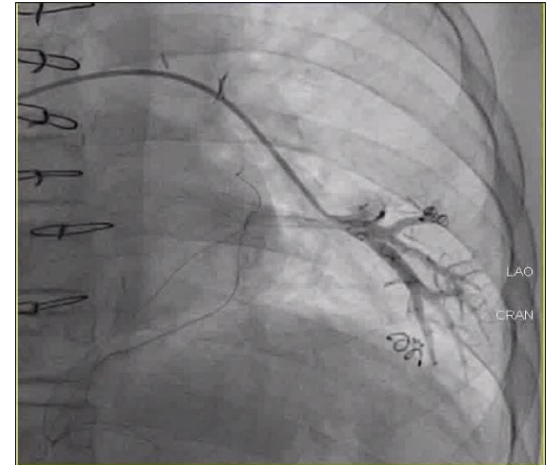
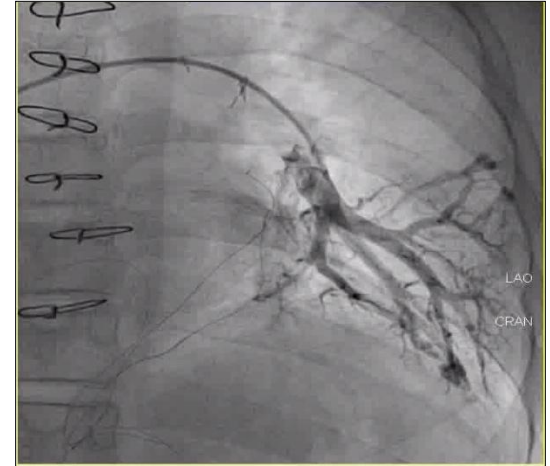
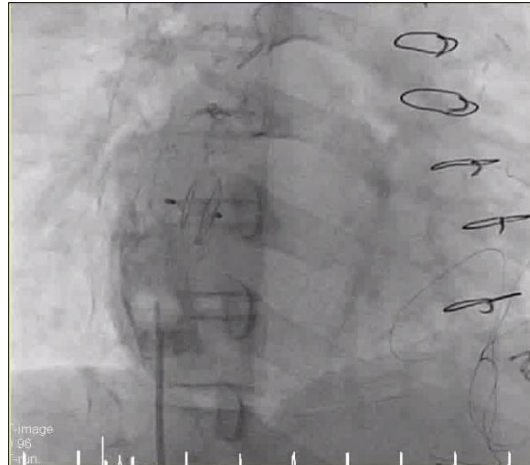
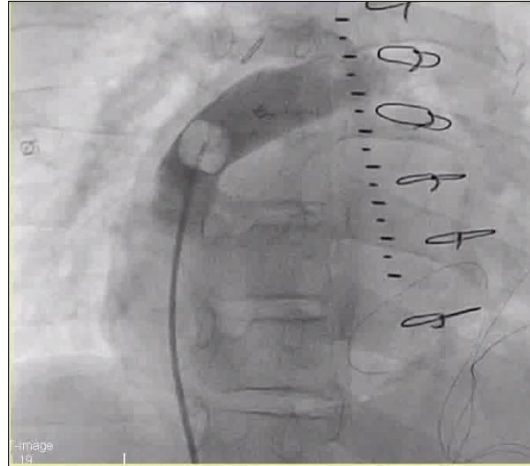
- **Fontan circuit Pr.**
12/8(10) mmHg

After Intervention :

- **SaO²: 93%**

- **Fontan Pr.**
15/11(13) mmHg

- **Cyanosis / DOE (-)**
- **NYHA II → I**
- **TC SaO² at OPD; 95%**



Fenestration Closure

PAVMs Closure

Baffle Leak / Multiple Venous Collaterals Closure

- M/17, Rt. isomerism, Complex DORV, AVSD
- Fontan OP. (4yr)
- Progressive desaturation
- Resting SaO² - 87%, Cyanosis aggravated on exercise

Before Intervention :

- SaO²: 88%

- Fontan circuit Pr. : 12/8(10) mmHg



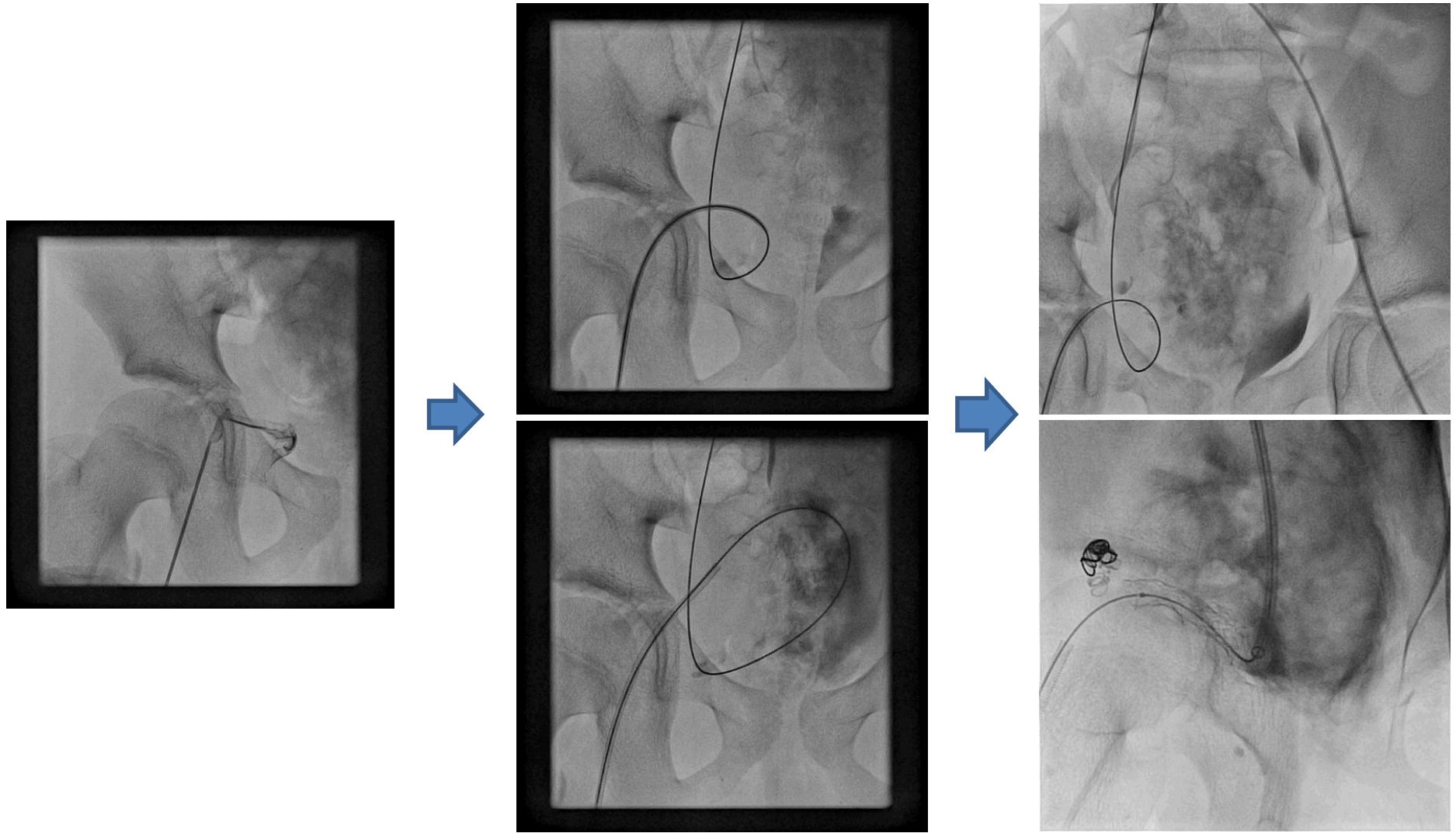
Imm. after Procedure :

- SaO²: 95%

- Fontan circuit Pr. : 14/9(11) mmHg



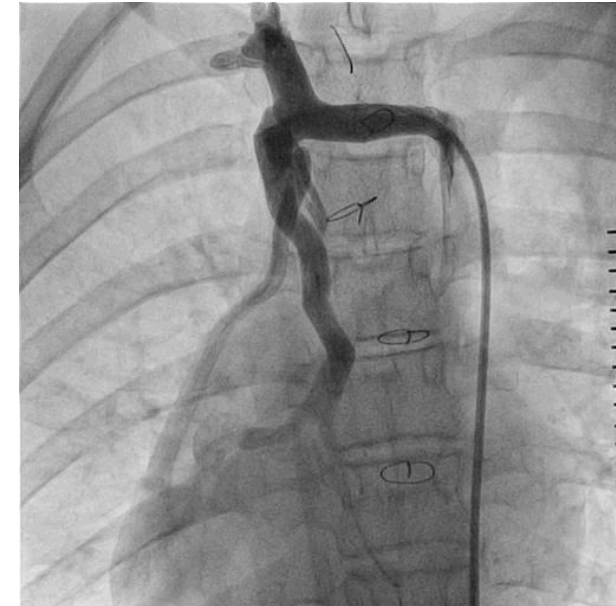
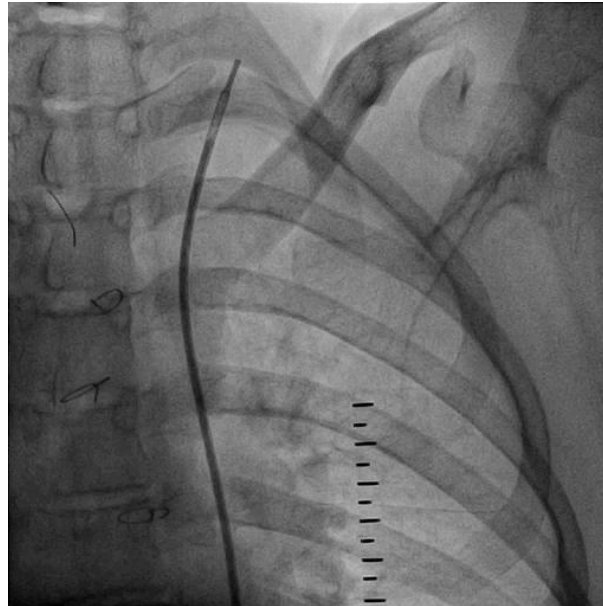
Potential Vascular Complications in Fontan Patients

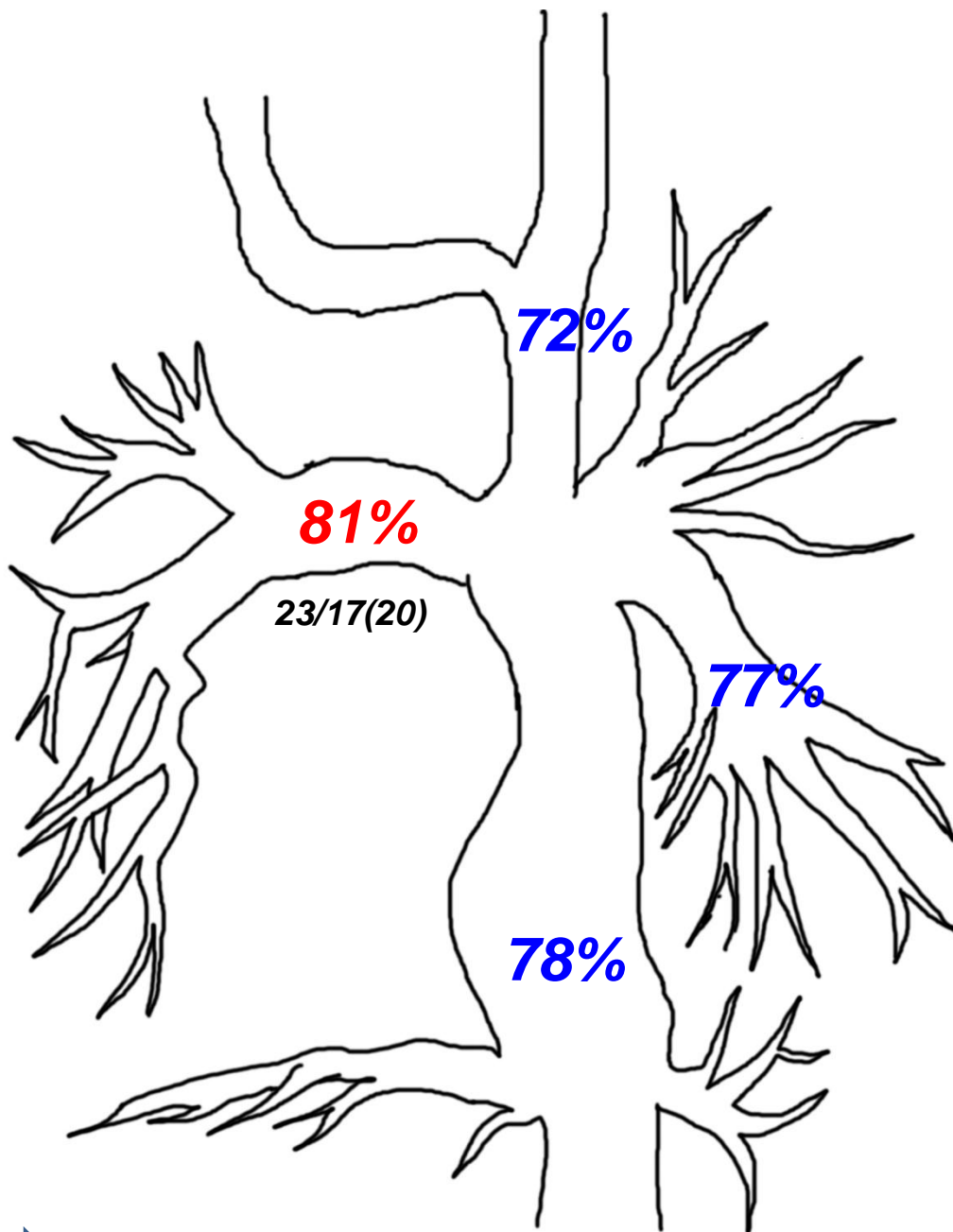




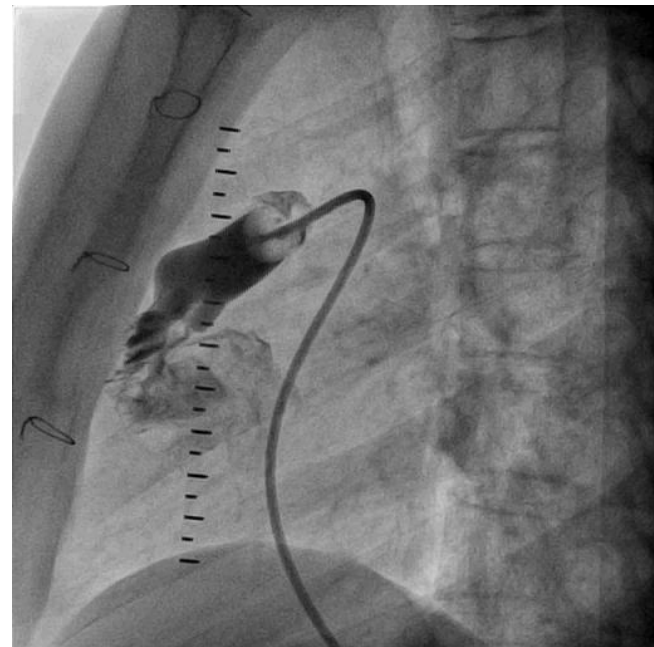
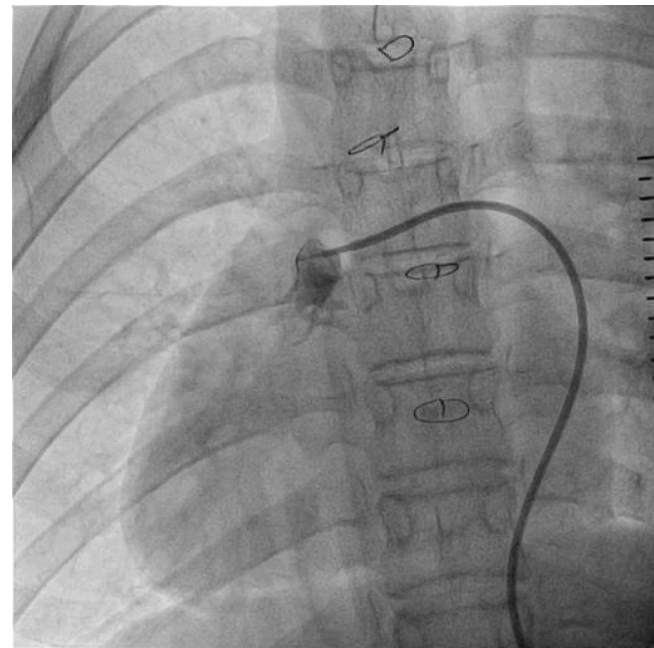
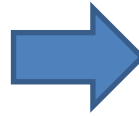
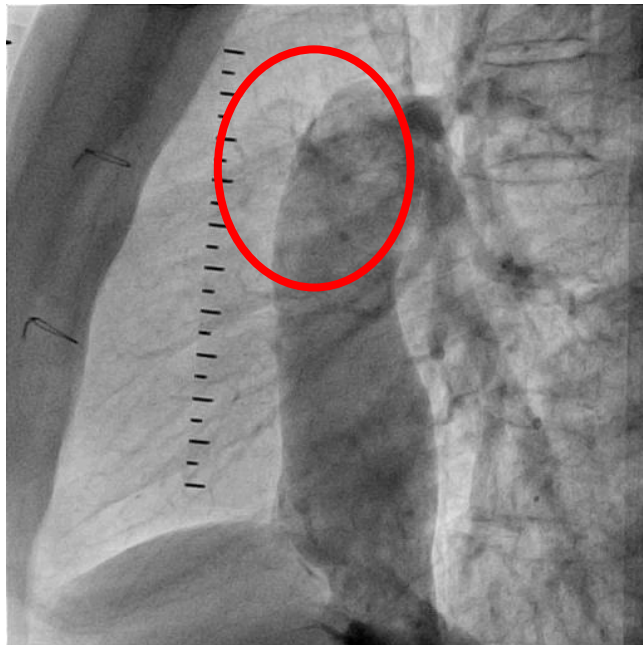
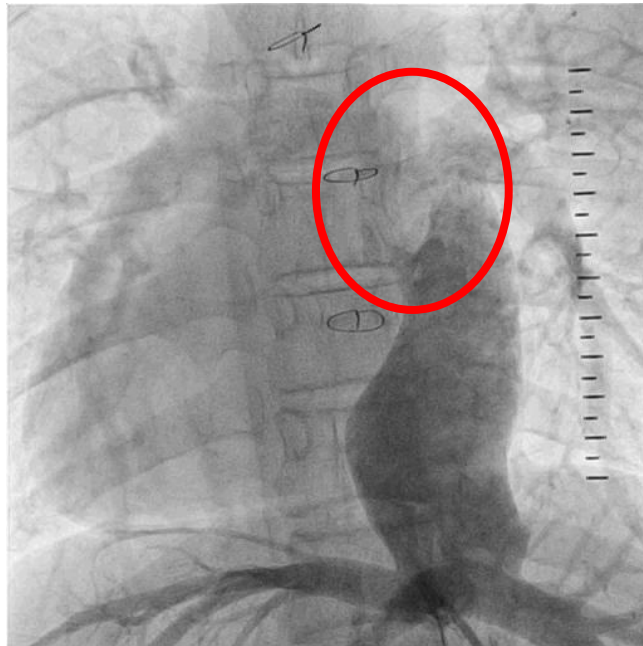
Role of Cardiac Catheterization in Dx & Tx

- *F/15, Rt. isomerism, Complex DORV, AVSD*
- *Fontan OP. (2yr)*
- *Progressive desaturation*
- *Resting SaO² - 88%, Cyanosis aggravated on exercise*

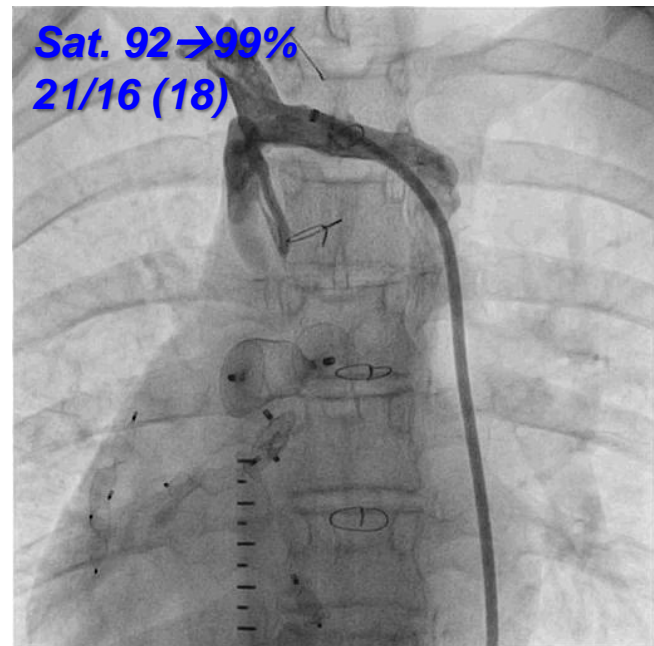
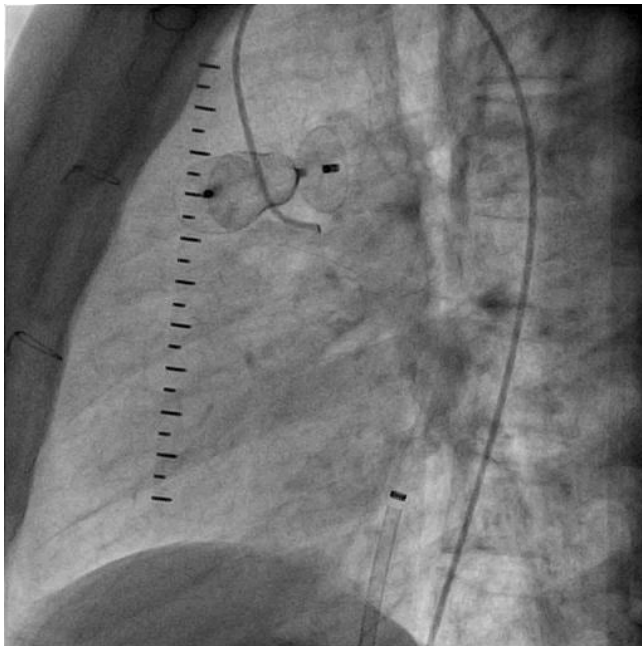
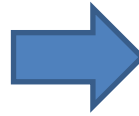
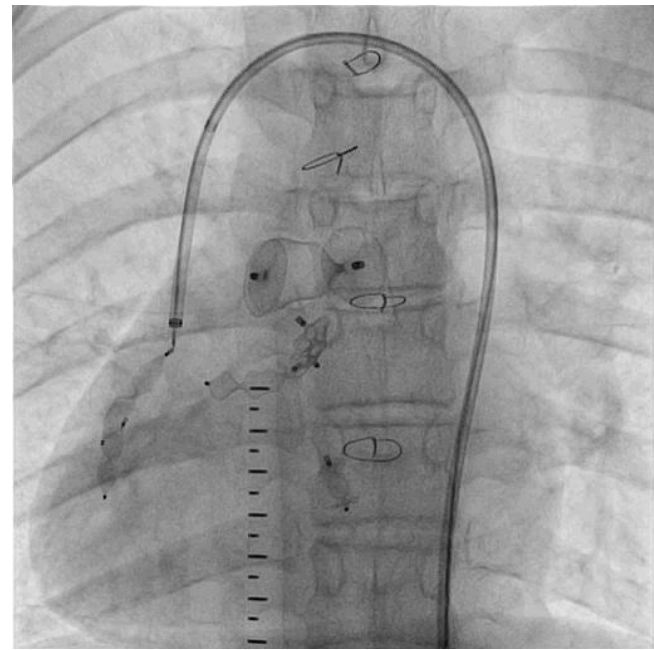
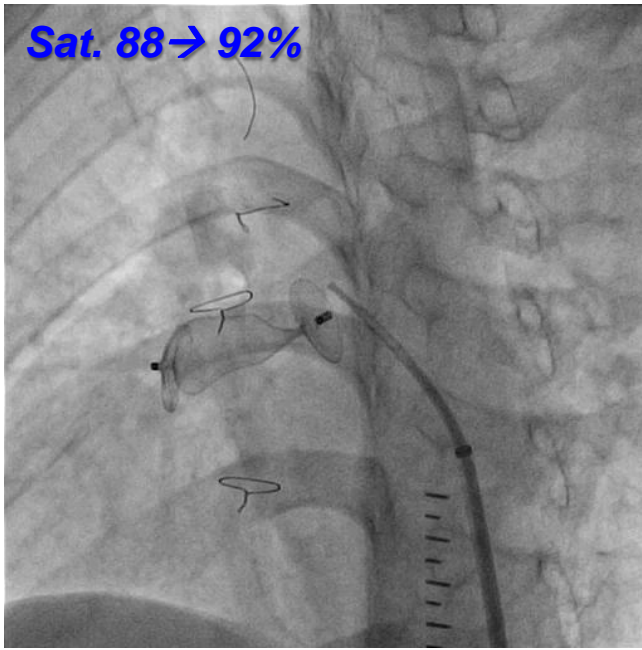




22/16(18) → 32/25(28)



Sat. 88 → 92%





- Conclusions -

- Evolvments of transcatheter technology have also attributed to improve the quality of management for patients with univentricular heart after Fontan palliation.
- It is crucial for both pediatric interventionalist and congenital cardiac surgeon to understand each other's capability as well as to cooperate for the best outcome.
- Ongoing evolvment in this field will further contribute to reduce the risk and improve the outcome in patients with CHD including Fontan candidates.



Thank you for your attention