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Using the Coronary Chronic Total Occlusion (CTO) Technique to Recanalize Totally Occluded Vessels in the Congenital Heart Disease Patients

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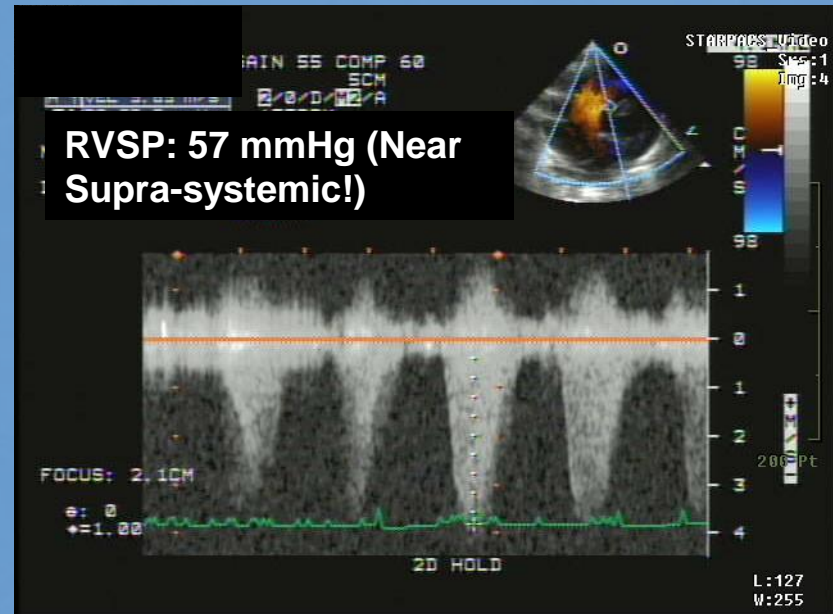
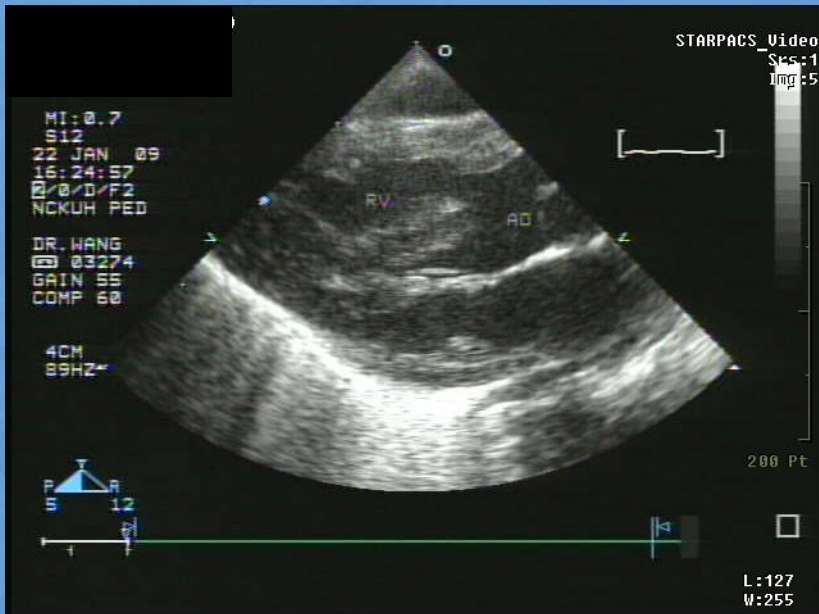
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Birth

A baby with VACTERL association since birth

➤ Prenatal diagnosis: Tetralogy of Fallot



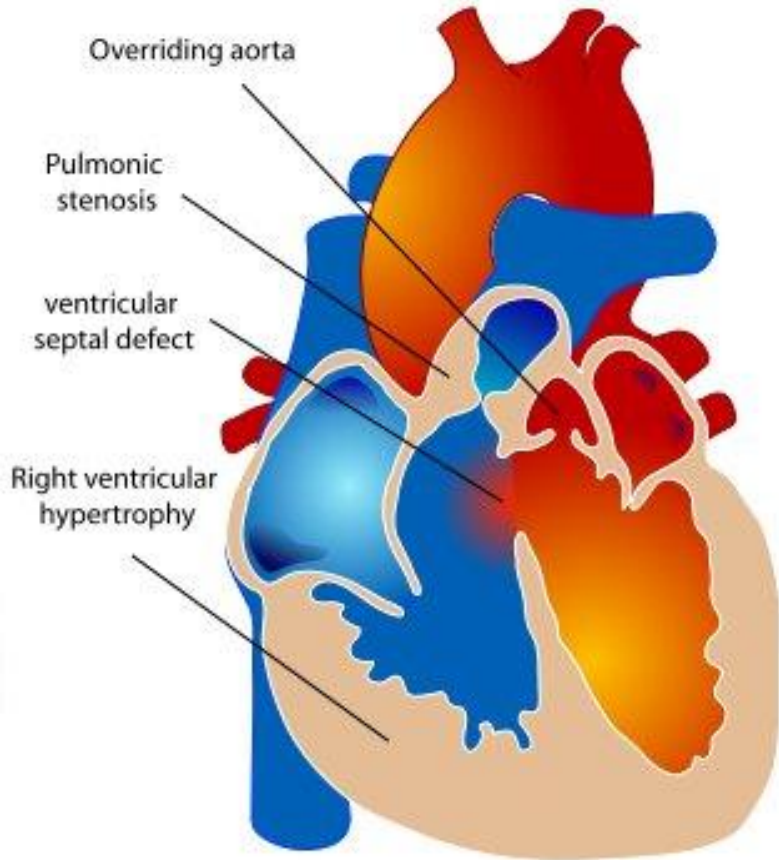
VACTERL association:

- 1) Esophageal atresia with tracheo-esophageal fistula s/p operation at birth
- 2) Tetralogy of Fallot

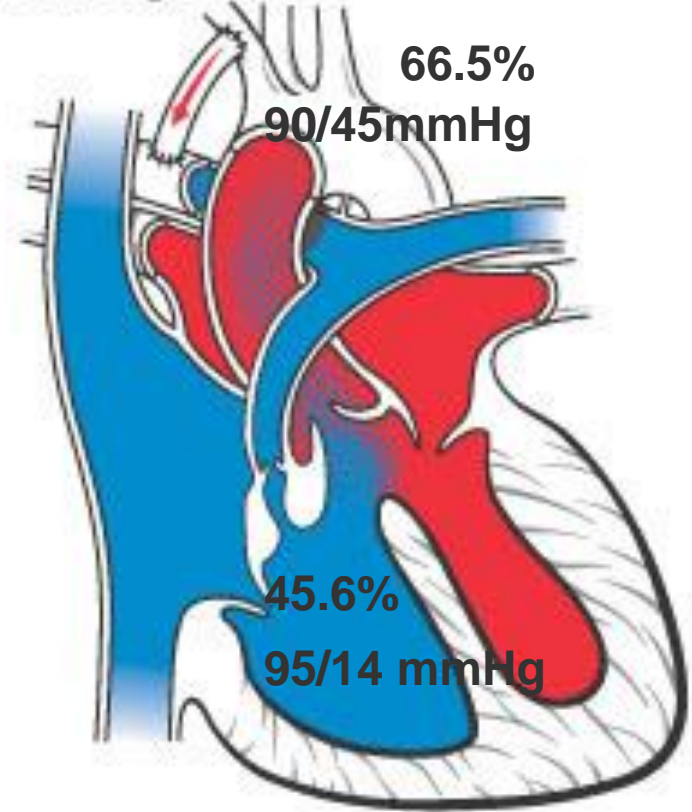
Therapeutic Strategy of TOF

Total Correction? B-T Shunt First?

Tetralogy of Fallot



Tetralogy of Fallot with Modified Blalock-Taussig Shunt



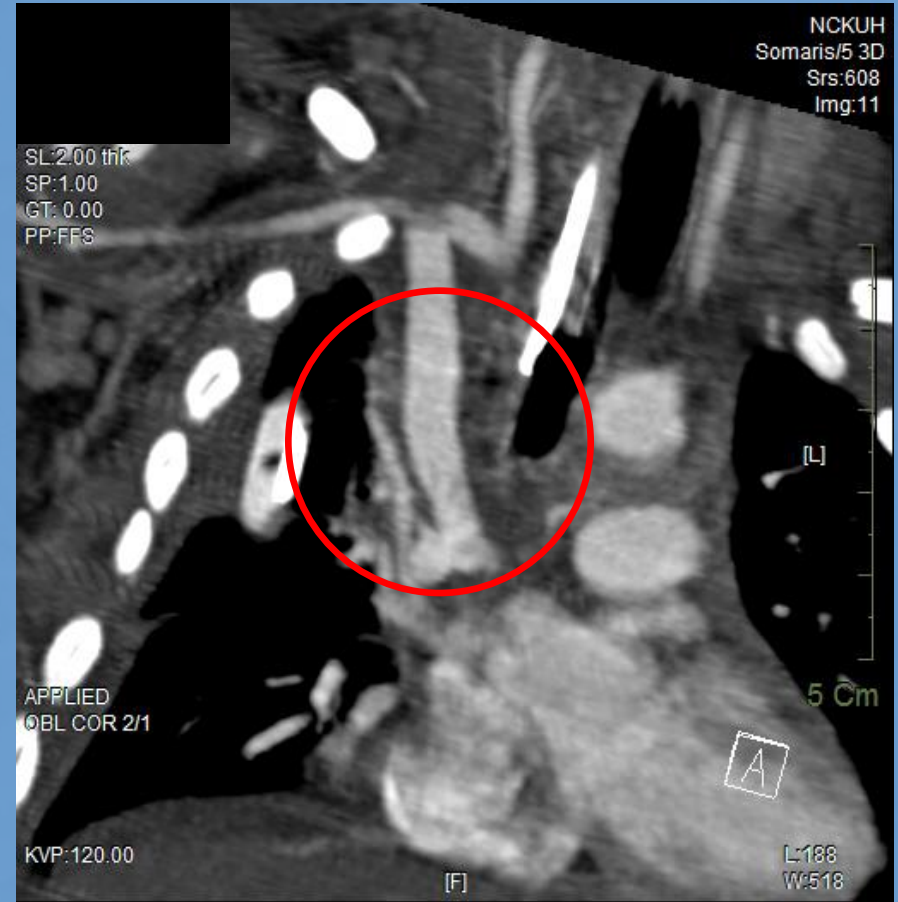
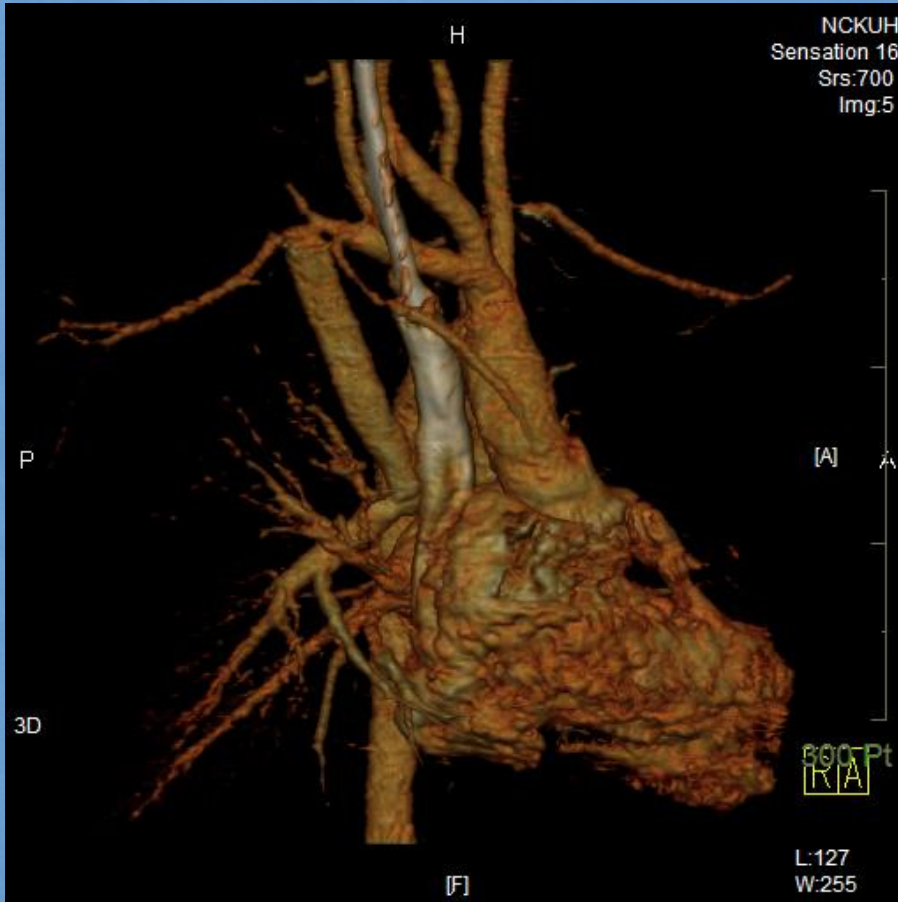
Nakata index (PA index) = RPA area (mm²) + LPA area (mm²). BSA (m²) <200

Birth

9M
BTX2

B-T shunt was done in 9-month Old (6kg)

Follow up CT revealed patent B-T shunt



Birth

9M
BTX2

28M

This time

- Progressive cyanosis of fingers and lip for one month, SaO₂=80%

Echocardiogram

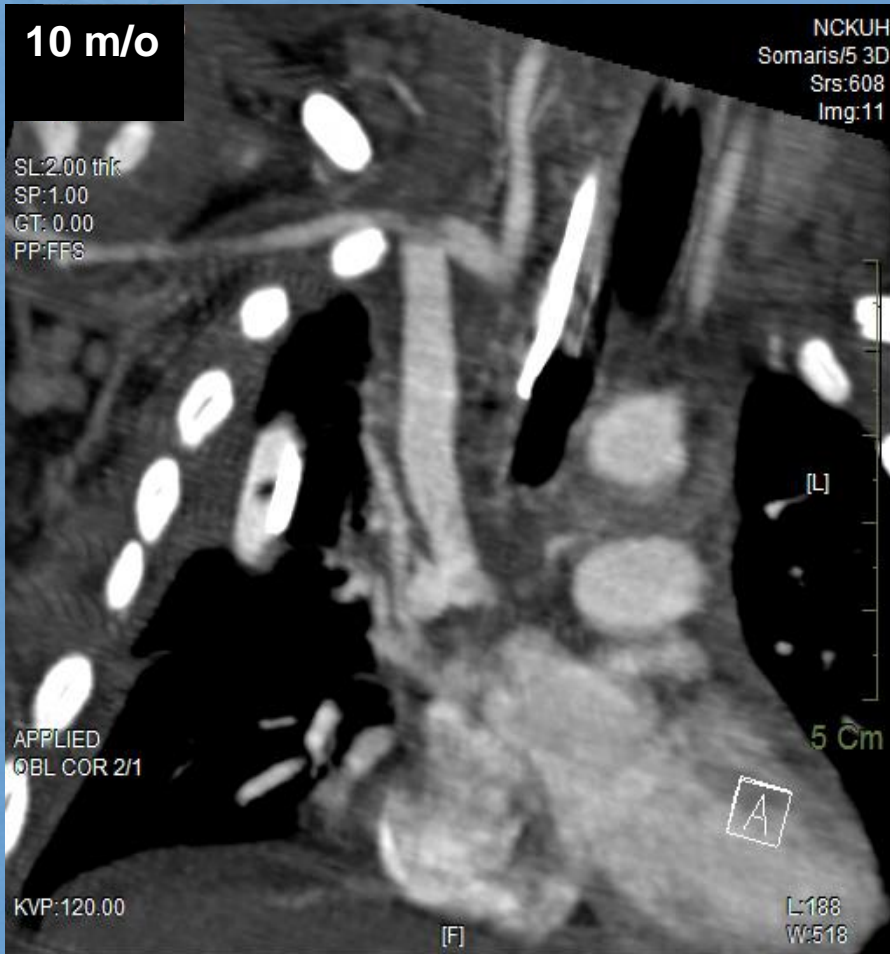
- 1) Overriding of aorta
- 2) An interrupted IVS with bidirection shunt, size: 1.68cm
- 3) Good LV systolic function (LVEF: 59%)
- 4) Severe infundibular and valvular PS
- 5) Suspect hypoplastic RPA
- 6) Can't see right B-T shunt flow, suspect occlusion



Birth

9M
BTX2

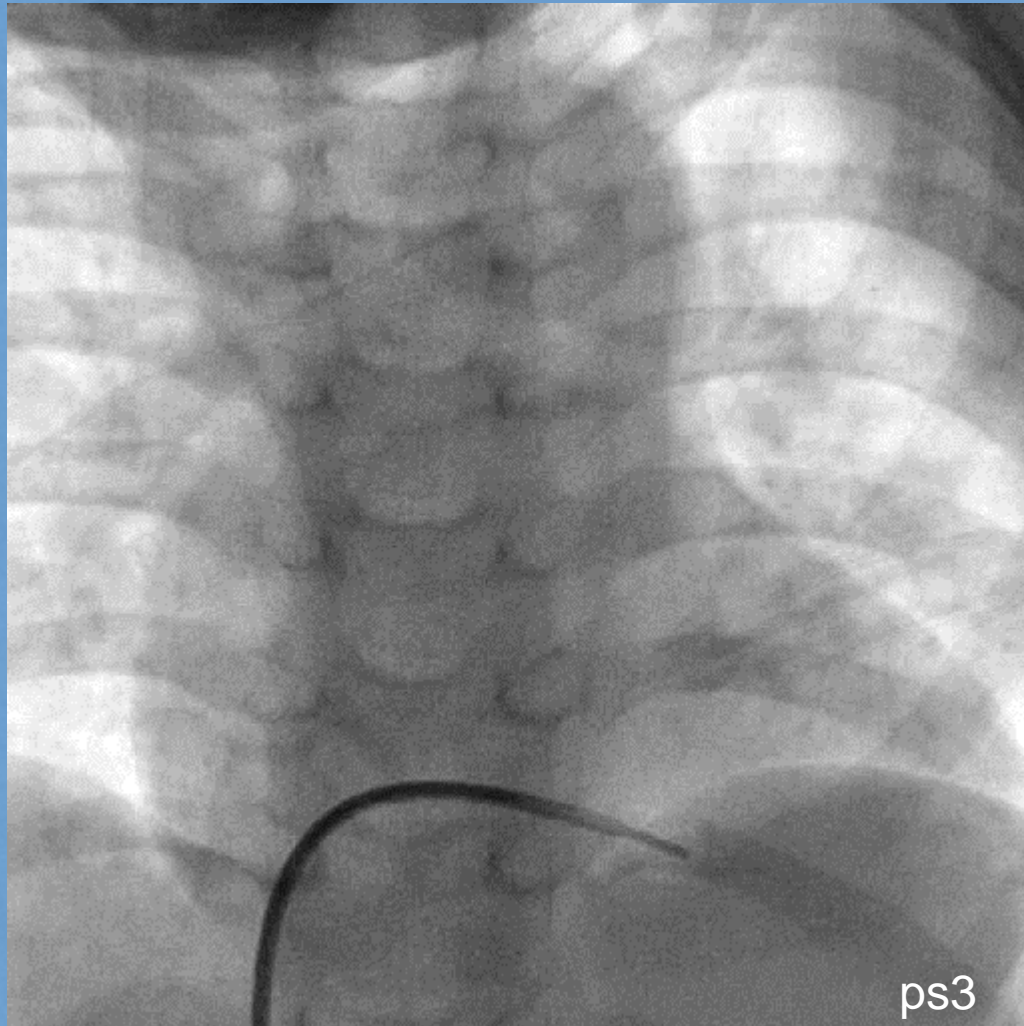
28M

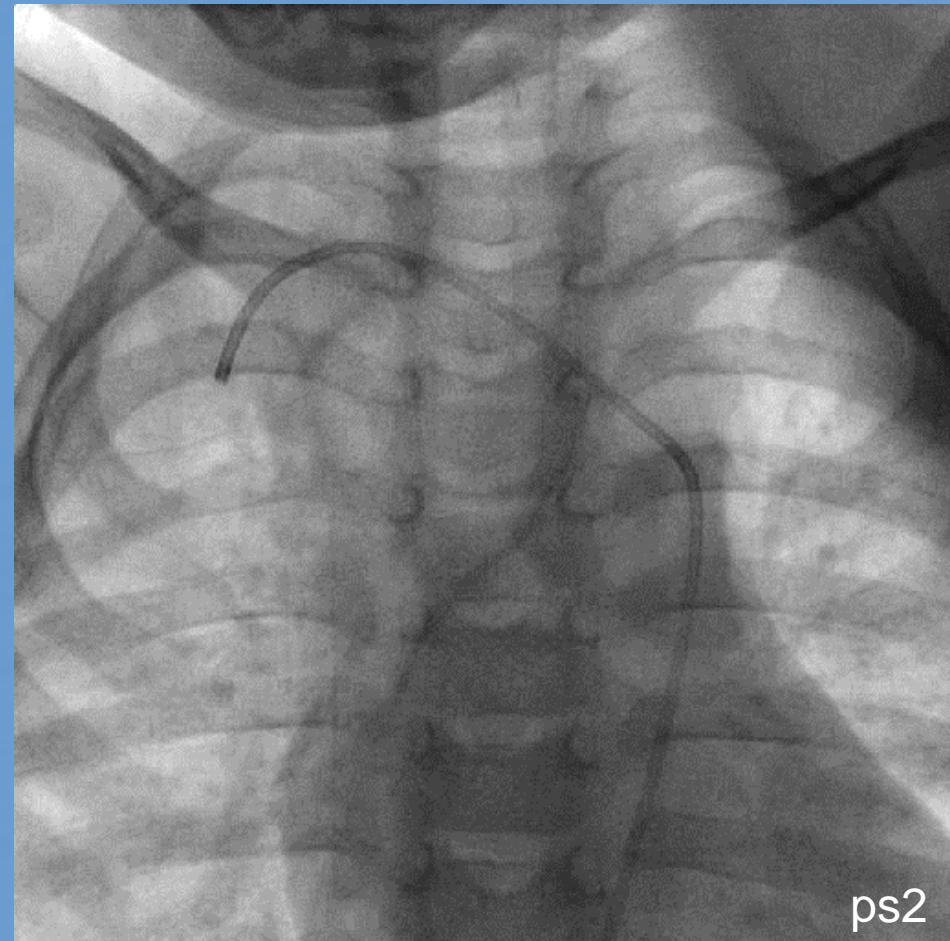
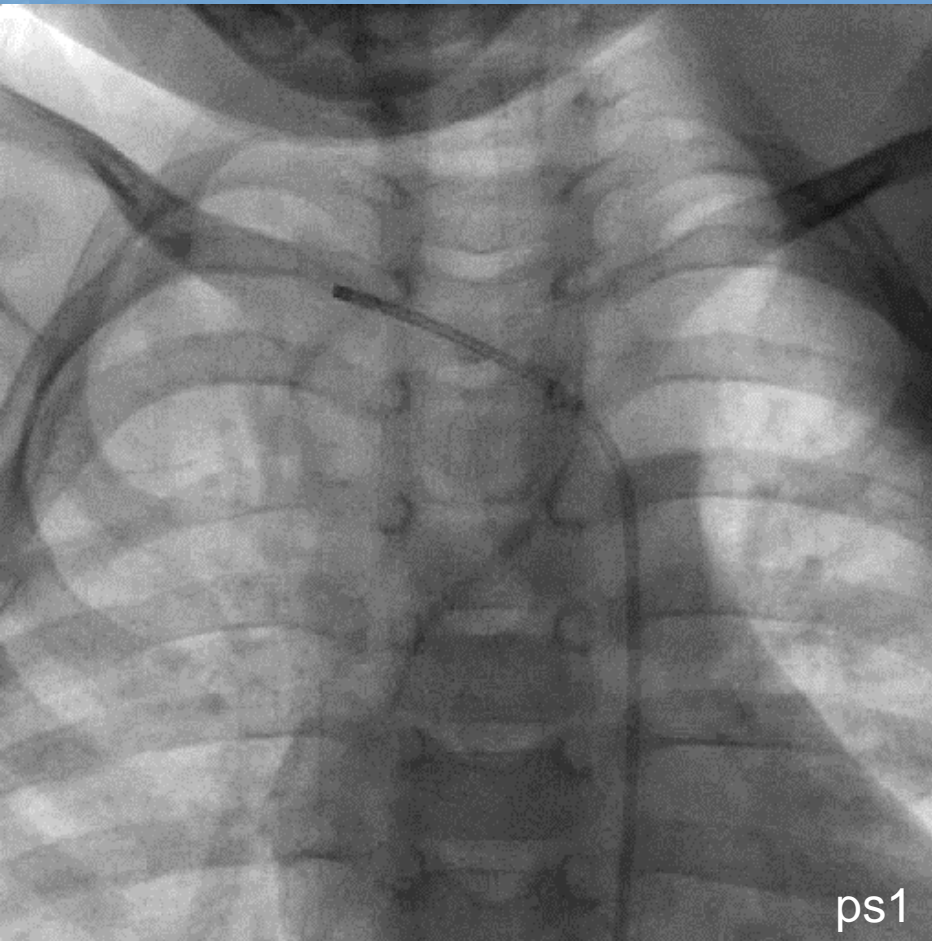


**Chest CT proved the occlusion of B-T shunt;
RPA was not opacified.**

Initial Right Ventriculography

→ Total occlusion of right pulmonary artery





One major aortopulmonary collateral artery from subclavian artery to right pulmonary artery (MAPCA)

We could not find the origin of B-T shunt

What's the Next Step?

- We failed to open the BT shunt
- Size of LPA, RPA was 10.9mm and 3.8mm
- **Nakata index 202 mm²/M²>200**

- **Majority of patients with TOF and unilateral PA require palliative intervention as a first step**
- **Evidence showed Nakata index>200 mm²/M² → successful result of complete repair**

(Ann Thorac Surg 2007)

Birth

9M
BTX2

28M
Failed PTA

Total
correct

The Following Course

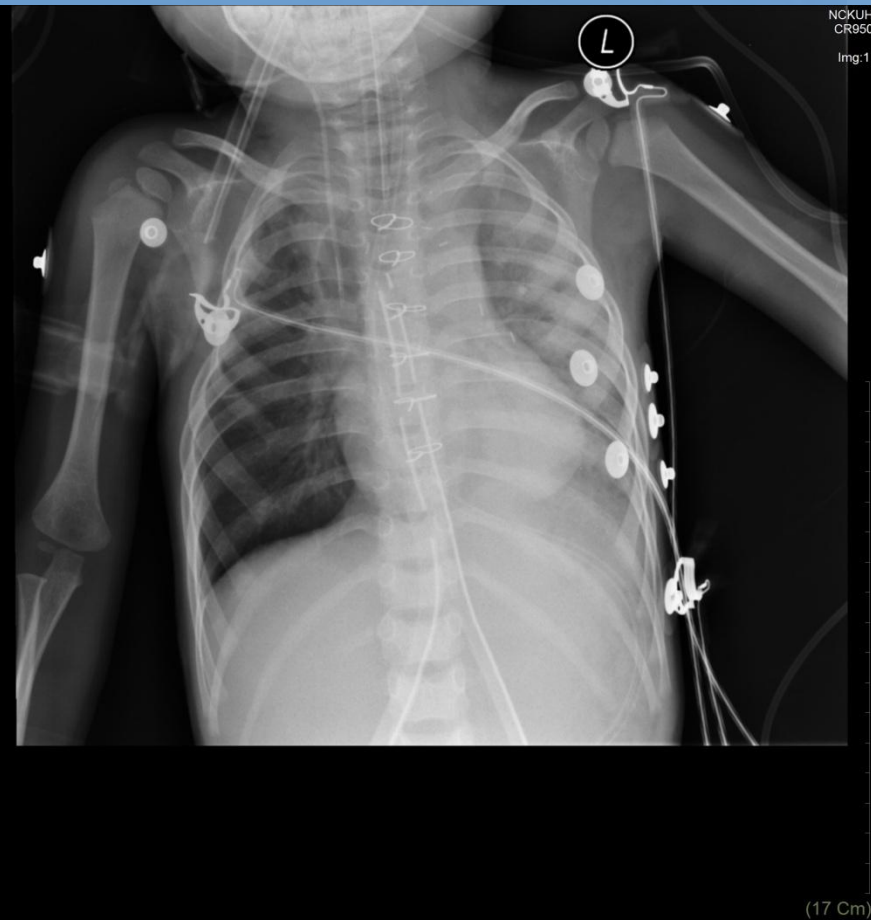
- CVS repaired VSD and corrected over-riding aorta, RVOT obstruction
 - but resulted in persistent left pulmonary edema, desaturation
 - High RV pressure → a 5mm VSD created, **but little benefit**

Then?

Before OP



After OP



**Left lung hyper-infiltration
(cannot afford the over-drained flow!)**

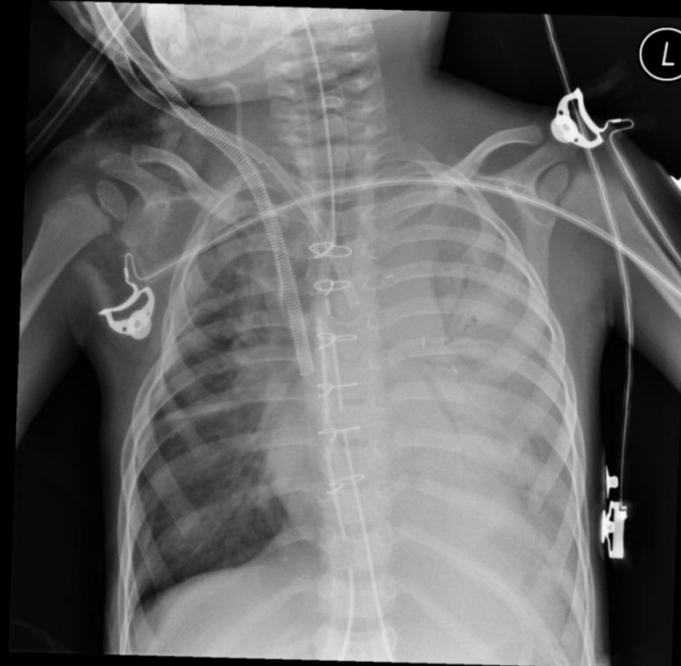
Birth

9M
BTX2

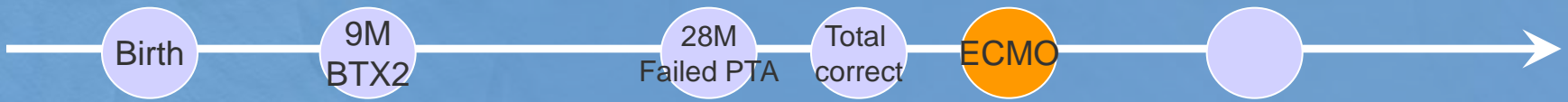
28M
Failed PTA

Total
correct

ECMO



- Persistent high RV pressure after the OP
- ECMO was set due to cardiopulmonary failure



What happens?

- **Left PA overflow after RVOT obstruction and VSD repair**



Next step ?

OP again ?



Treat the major problem!

**Right pulmonary artery
endovascular intervention**

Birth

9M
BTX2

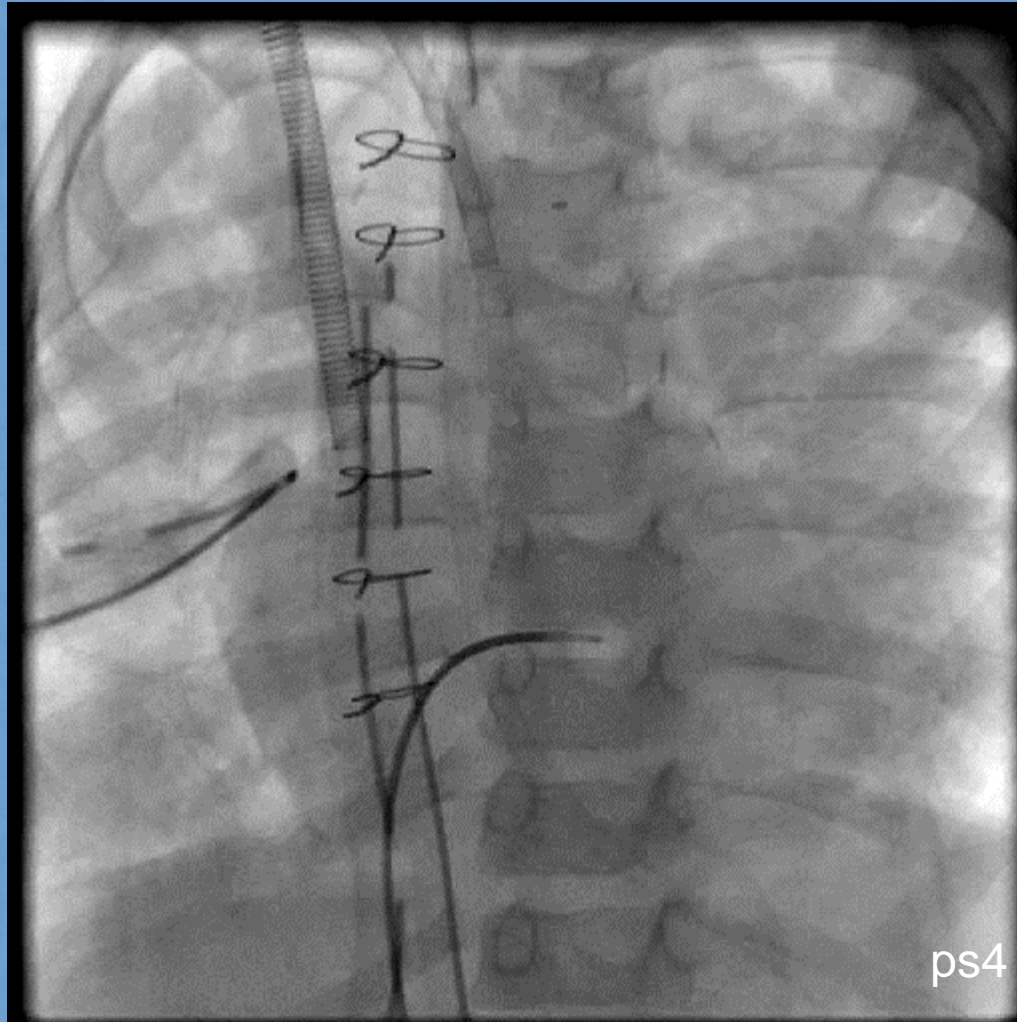
28M
Failed PTA

Total
correct

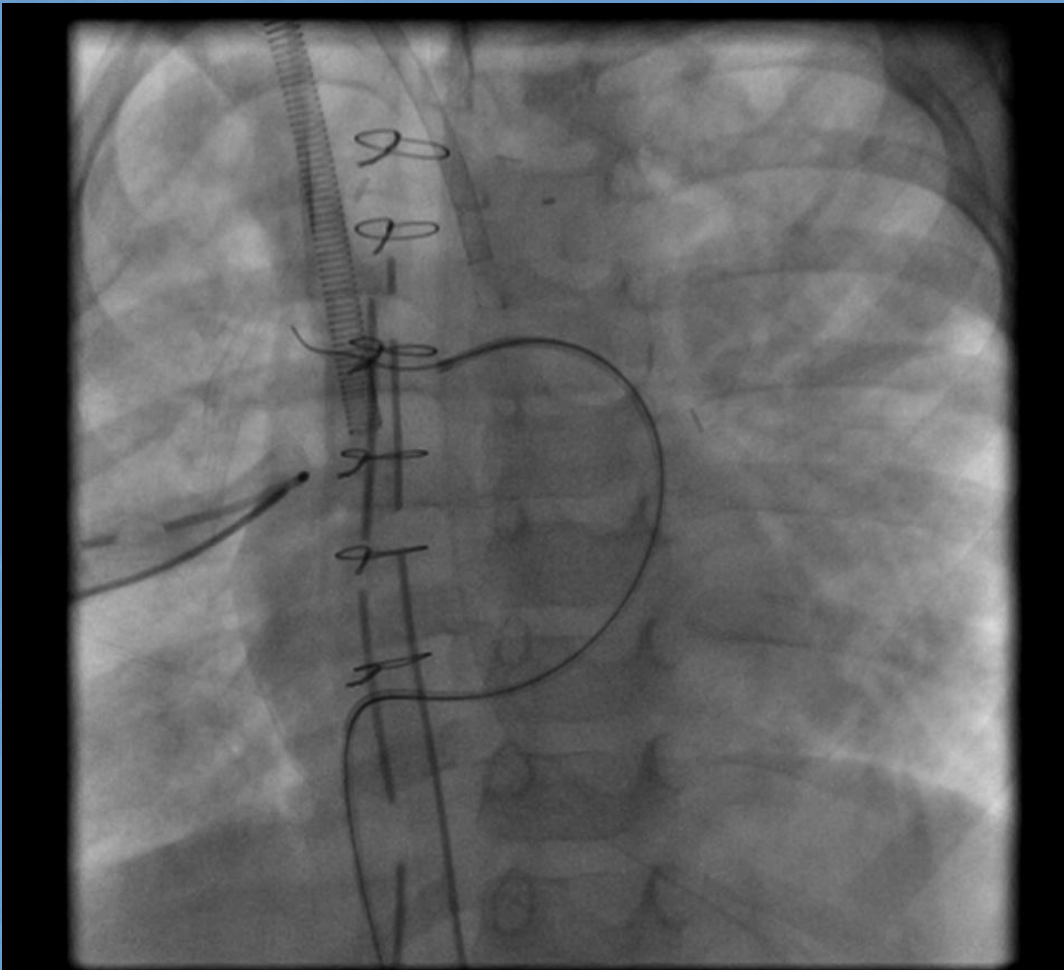
ECMO

PTA
for PA

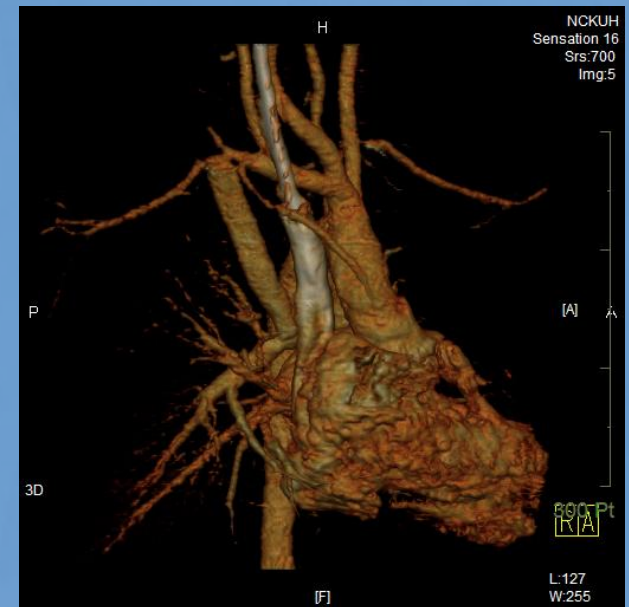
Right ventriculography → total occlusion of right PA



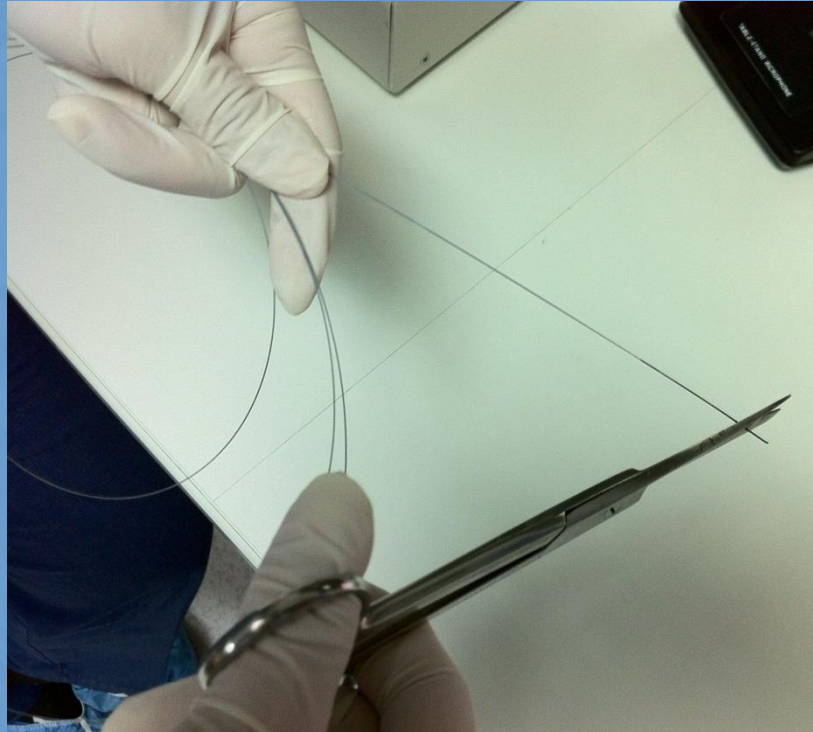
Under a 5Fr. JR4 (cordis) support, 0.035 Terumo wire, then 0.014 Fielder wire (Asahi) under microcatheter support → failed
We tried 0.018 V-18 wire but still failed



By CT anatomy guided



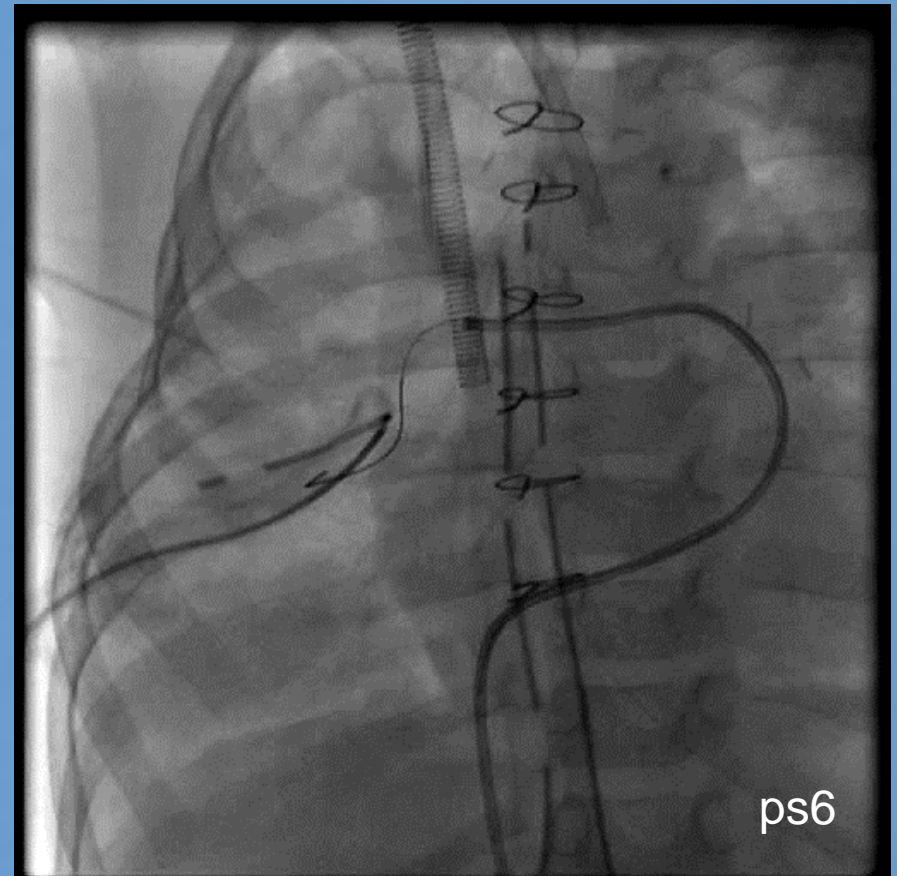
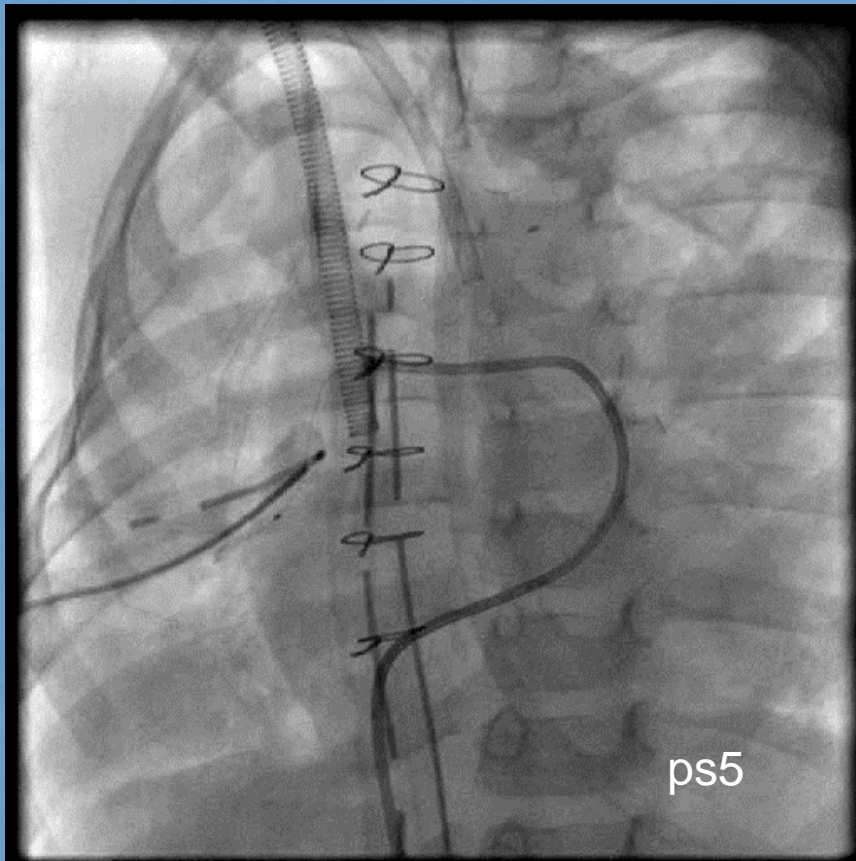
The Tip of 0.018 V-18 wire was cut
for **better penetrating power**



V-18™ Control Wire® Guide Wire

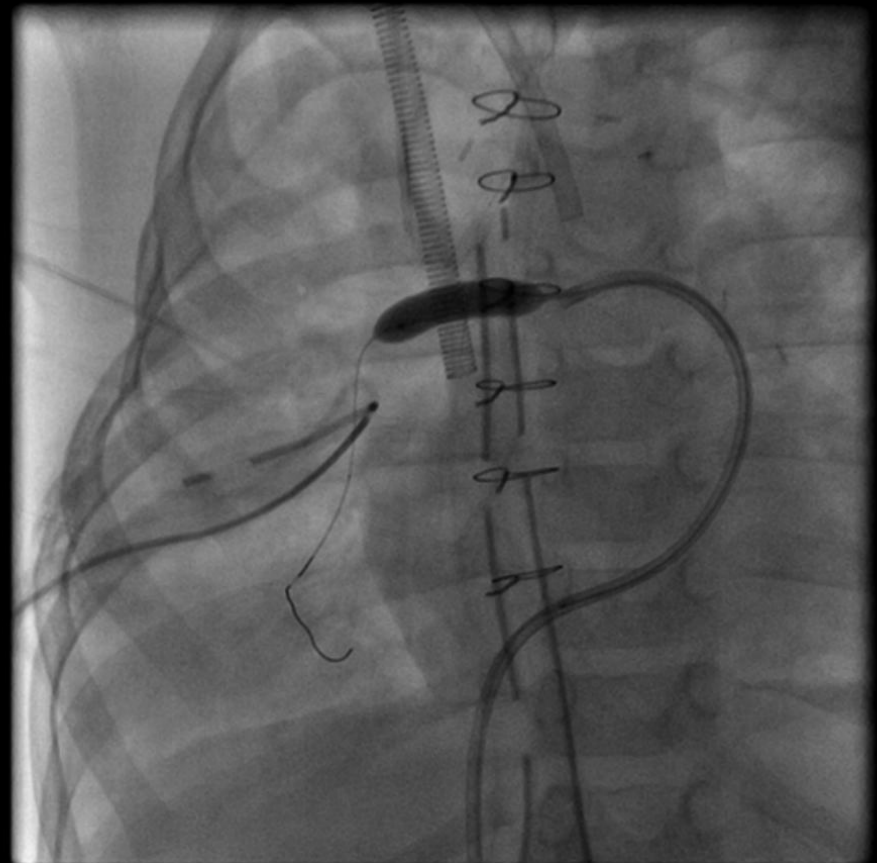
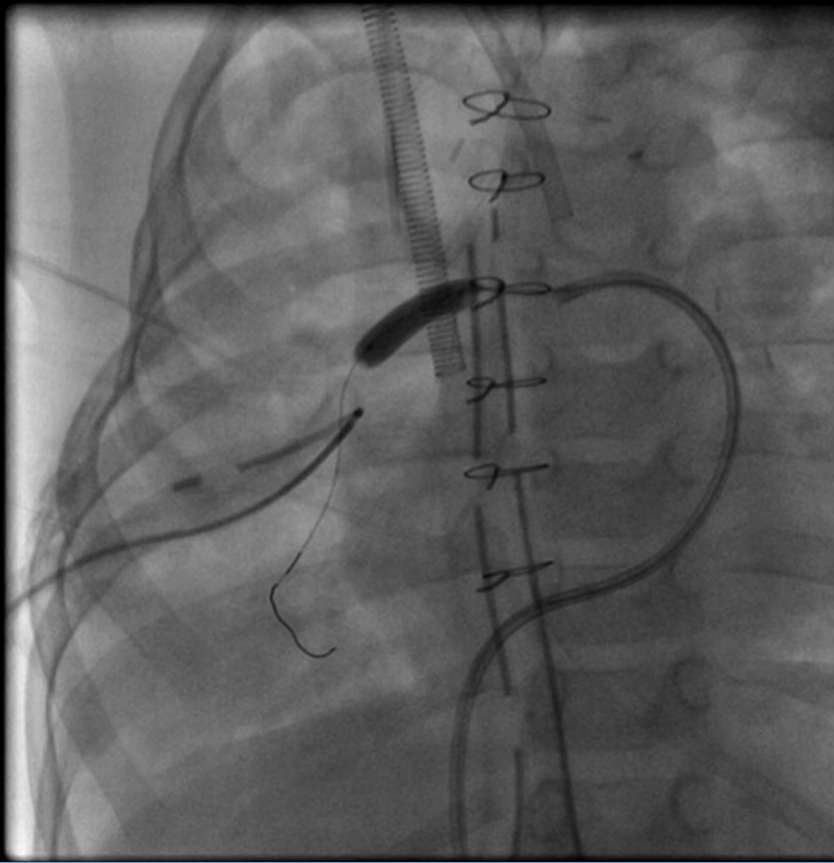
0.018" hydrophilic for distal peripheral access and stiff for contralateral approaches.

We modified 0.018 wire tip (**cut**) → we penetration right PA plaque by V-18 → change to Fielder 0.014 wire → dye test via **OTW 1.25/10 balloon**

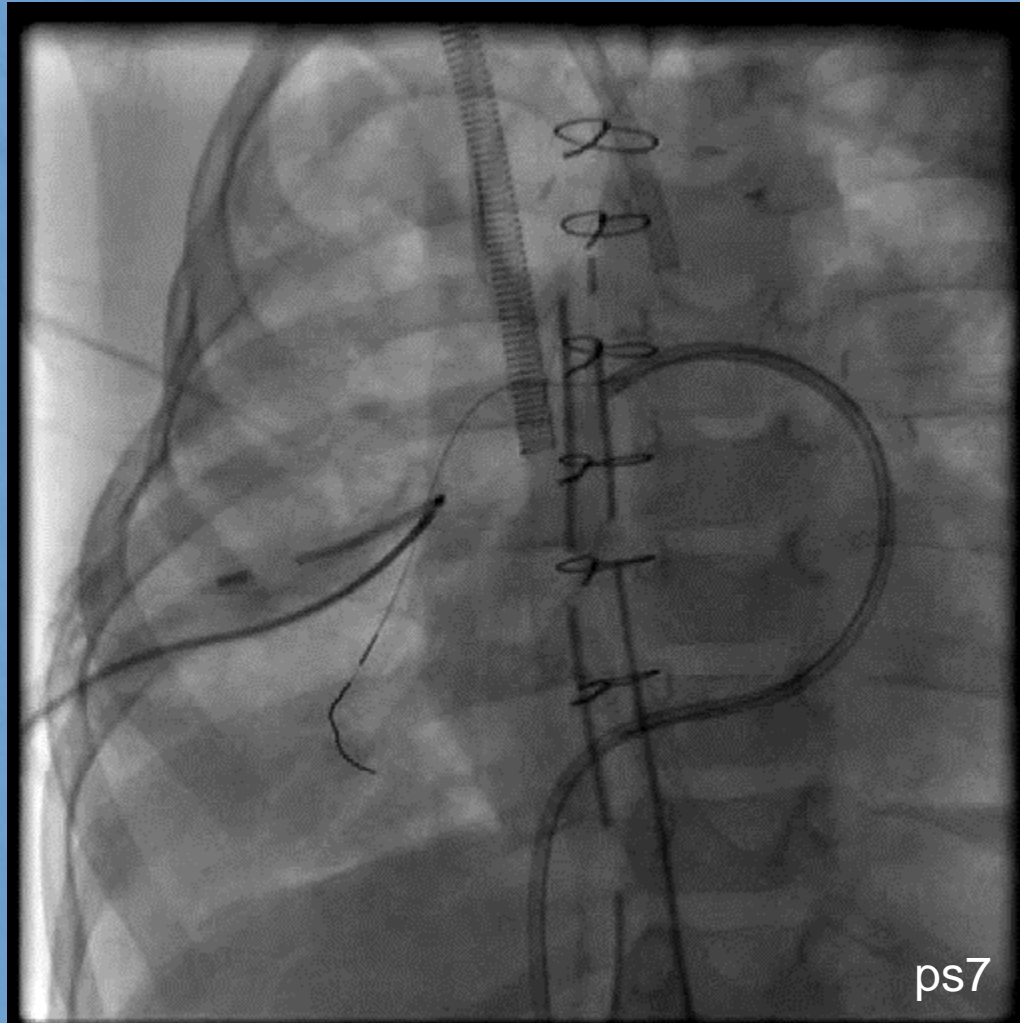


The distal part is in the true lumen!!

5.0/20mm Apex Balloon (Boston) up to 8 bars



Final Result



ps7

Birth

9M
BTX2

28M
Failed PTA

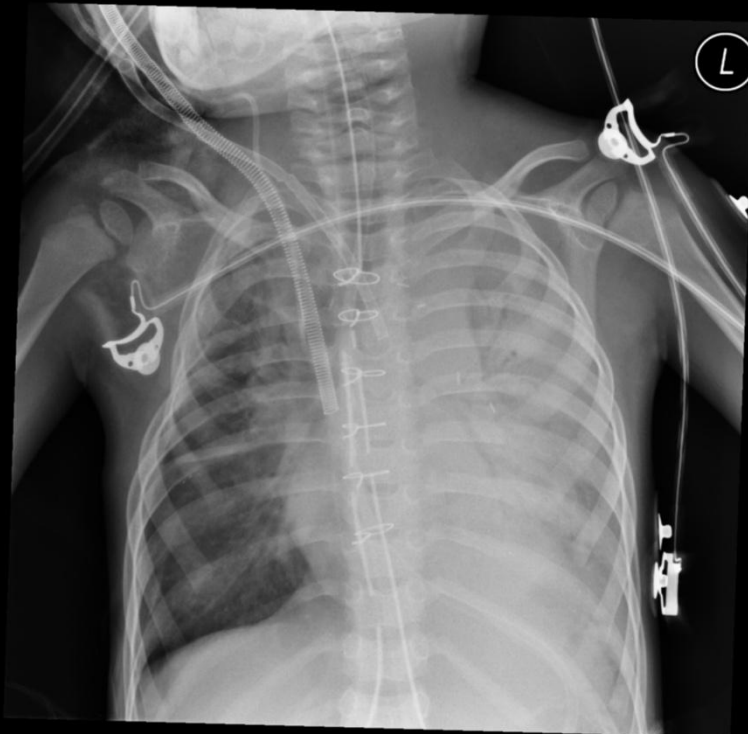
Total
correct

ECMO

PTA
for PA

After PTA for RPA

- Successful ECMO weaning
- Right PA overflow developed (white -out of right lung)



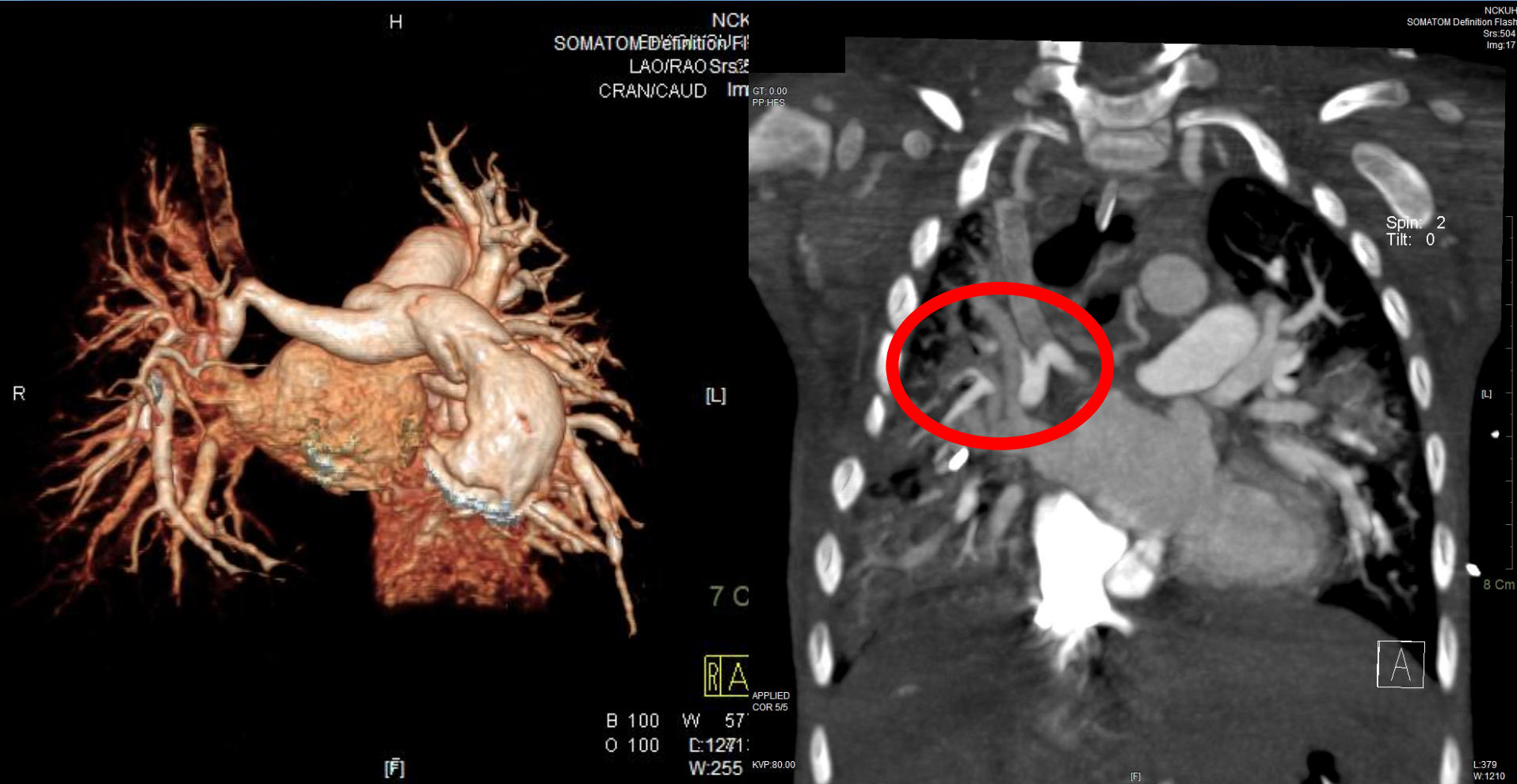
Before PTA

NCKUH
CR950
Img:1



After PTA

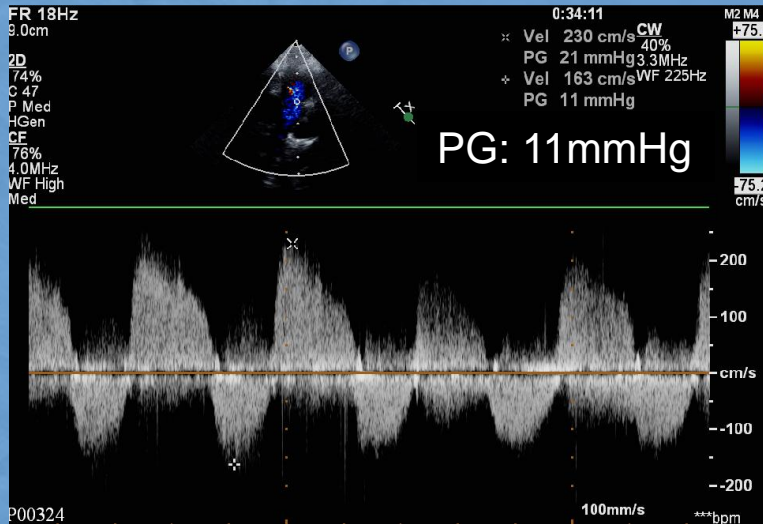
Repeated CTA on post-Op Day 7



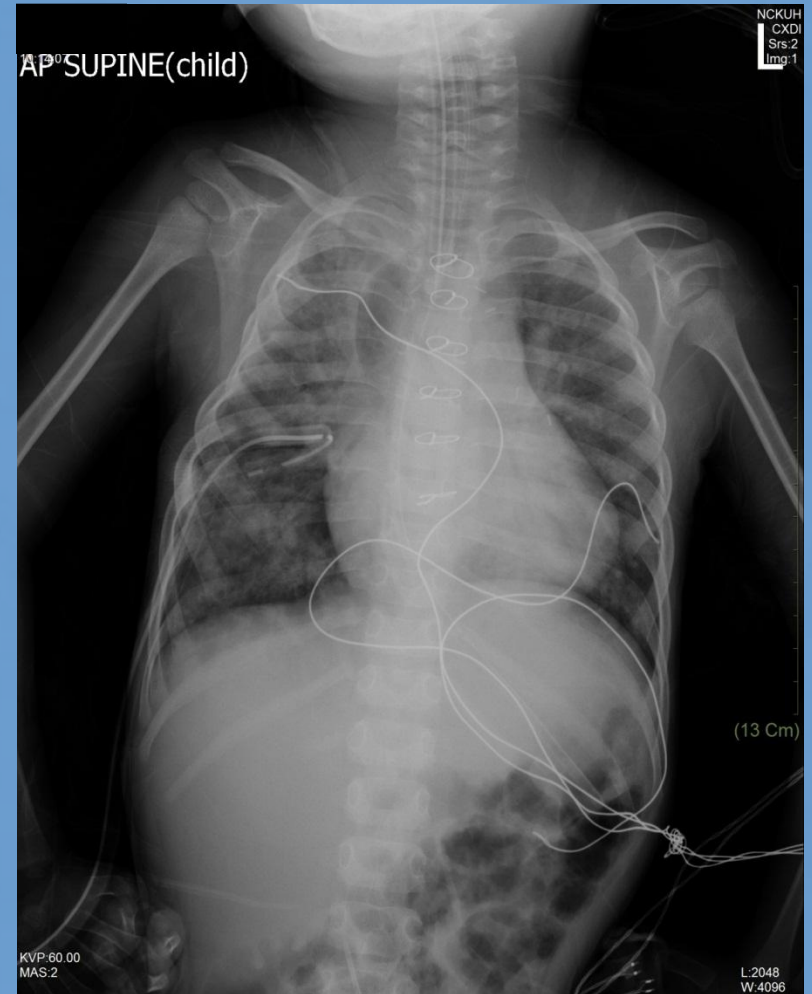
Still occluded B-T shunt but appearance of right PA flow

The Following Course

- After Diuretics, Digoxin, steroid tx taper off Dobutamine
→ Pulmonary edema improved



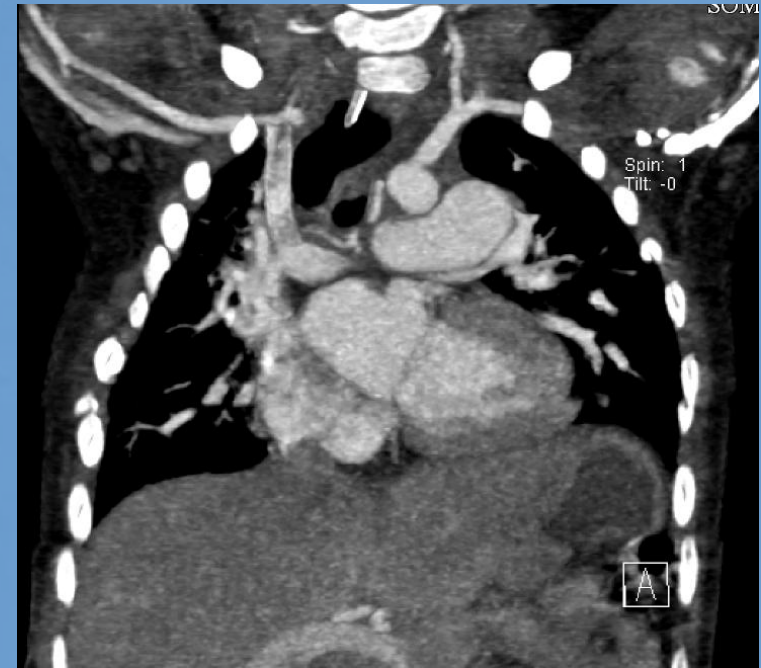
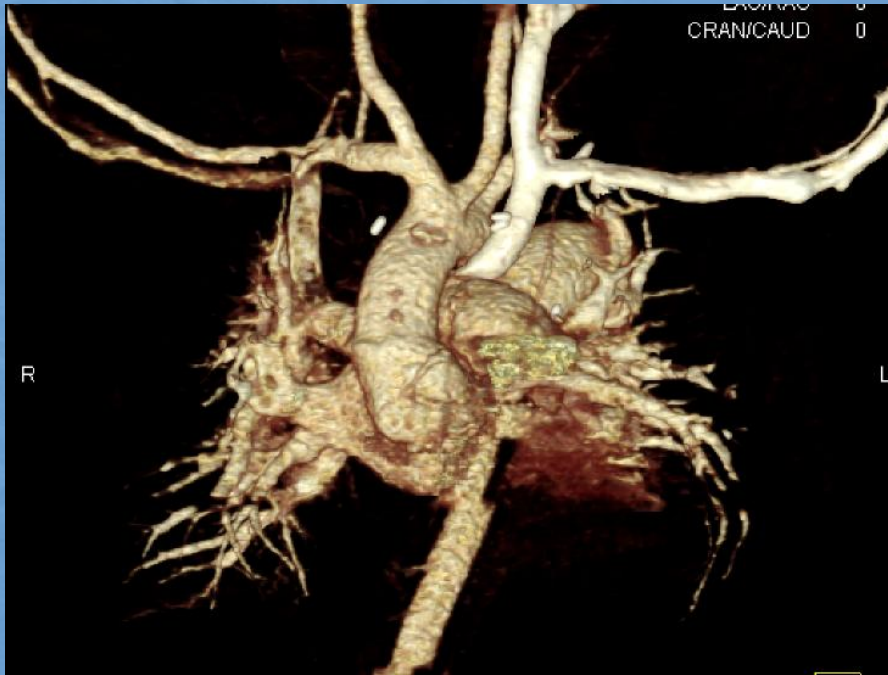
- He was extubated successfully and discharge 3 weeks later



Follow up CT 5 months

Stenting for RPA ?

- Possible mismatch in a growing baby
- The f/u CT showed still patent RPA



Conclusion

- **Coronary** and **peripheral CTO intervention** skills could be carefully applied in occluded **pulmonary artery intervention**
- 5 Fr guiding catheter and 0.018, 0.014 system devices are feasible in a 28 month-old baby

Thanks for your attention!!



National Cheng Kung University Hospital, Tainan, Taiwan