CATHETERIZATION PROTOCOL
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Cath Procedure: Pulmonary Valve Dilation

Indications:
- Critical pulmonary stenosis = PGE-dependent
- Gradient > 50 mmHg

Hospitalization Requirement: Same day admission and discharge

Pre-Cath Work-up:
- **Blood-work:** CBC, electrolytes, creatinine, urea, cross-match 1 unit
  - Sickle Cell: if of African or Carribean descent
- **Echocardiography:**
  - Degree of RVOT obstruction (peak gradient usually > 50 mmHg)
  - PDA status in patients with critical PS
  - Size of pulmonary artery annulus and MPA
  - Morphology of pulmonary valve (i.e. thin, dysplastic, doming, etc…)
  - Presence of pulmonary valve insufficiency
  - Presence of PFO
- **Previous Cardiac Catheterization:**
  - Previous interventions (i.e. previous dilations, stent placement)
  - Access issues in the past
- **Other Tests:** CXR, ECG

Procedure:
1. Access should be gained through the femoral veins first – in neonates 5F sheath should be used, and in older children a 6-7F sheath should be used depending on anticipated balloon
2. Start with Berman angio catheter to obtain RA, RV pressures. If possible, obtain PAP. Note: critical PS – cannot cross pulmonary valve with catheter (only wire may cross). Note simultaneous sBP with RVSP.
3. RV ventriculogram is also performed to look at pulmonary valve morphology and size. Also assess presence of pulmonary artery stenosis and do pulmonary angiography if indicated.
4. Catheter into RV → MPA → distal LPA or PDA-descAo. Wire into distal PA or through PDA down descending aorta. For infants 4 or 5F Judkins right coronary catheter or 4F Cobra catheter. Wires to cross valve – 0.021” glide wire or 0.014”coronary wire may be needed for critical PS.
   For older children, 6F Gensini or 6 or 7 F Berman end-hole catheter. Wire (0.035/0.25” Terumo, 0.035” Wholley).
5. Balloon catheter diameter range 1.2-1.8x measured annulus. May require double balloon technique for older patients with larger valves.
6. An appropriate exchange guide wire (0.018”, 0.025” or 0.035” depending on balloon) is positioned deep into the left pulmonary artery or descending aorta.
7. Remove catheter leaving guidewire deep in LPA. May need to remove the initial sheath if balloon catheter profile bigger.
8. The balloon catheter is inserted into the over the guide wire and is positioned across the pulmonary valve.
9. The balloon catheter is positioned over the suspected area of stenosis (previously obtained angiograms will be superimposed over the current fluoroscopic image).
10. The balloon is manually inflated with 20cc syringe (in children with intact septa, cardiac output will decrease while the balloon is inflated – ensure child on 100% oxygen prior to dilation)
   a. Should see an initial waist
   b. As the balloon is inflated, the waist should disappear or “pop”
11. Watch blood pressure and cardiac output.
12. The balloon catheter is removed (ensure good negative suction on the syringe attached to the balloon to minimize profile).
13. A end-hole catheter (Gensini/Cobra/Judkins right/Berman end-hole) is inserted over the guide wire into the LPA.
14. Pressures in the MPA and RV are re-measured.
15. A repeat RV ventriculogram is done to assess change in pulmonary valve mobility.
16. If there is an unsuccessful procedure, then a bigger balloon or a balloon which is less compliant may be considered (Steps 10-20) are repeated until there is a satisfactory result. For patients with resistant stenosis e.g. supravalvar, may need a higher pressure balloon with use of an indeflator.

**Caution:**
1. Post balloon pulmonary valvuloplasty, watch for severe dynamic subPS which may cause significant residual RVOTO and factor into interpretation of residual gradients. Extreme scenario: the so-called “suicide RV” of severe RVOTO causing inadequate pulmonary blood flow. Management includes volume +/- beta-blockade.
2. For the critical PS with PDA. Watch for circular shunt where there is systemic steal via PDA via PR into RV into RA (in the presence of TR). DO NOT OVERCIRCULATE THESE PATIENTS WITH OXYGEN ADMINISTRATION.

**Views to Use:**
1. Straight cranial (A plane) and lateral (B plane) good views for the proximal right outflow tract.

**Complications:**
1. Pulmonary insufficiency
2. Tricuspid insufficiency
3. Pulmonary artery dissection
4. Femoral vein occlusion
5. Hypotension/bradycardia (during balloon inflation – transient)
6. Arrhythmia

Prognosis:
2. Suboptimal results: Factors associated with poor outcome
   1. Dysplastic pulmonary valve
   2. Supravalvar stenosis
   3. Small annulus size
   4. A lower balloon-to-annulus diameter
3. Pulmonary Regurgitation: Factor associated with pulmonary regurgitation
   1. Dysplastic pulmonary valve
   2. Small annulus size
   3. Higher balloon-to-annulus ratio
   4. Younger age of intervention
4. Freedom from re-intervention at 1, 10 and 15 years were: 90%, 83%, and 77%.
5. Pulmonary regurgitation (PR) increases during follow-up - 57% of children have moderate or severe PR at last follow-up (reference 1)

References: