Balloon Valvuloplasty and RF Perforation for PA-IVS and Critical Pulmonary Stenosis

Daniel Levi, MD, FSCAI
Associate Professor of Pediatrics
UCLA Biomedical Engineering
Mattel Children’s Hospital at UCLA,
Division of Pediatric Cardiology
Disclosure Information

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As a faculty member for this program, I disclose the following relationships with industry:


pfm Medical: C
Atrium Medical: C
Neurosigma Vascular: AB
NIH Challenge Grant, AHA Innovative Research Grant
Pulmonary Stenosis

• Pathology
  • Fused leaflets, raphe
  • Doming/windsock
  • Dysplasia
  • Atresia

• History – 60+ years
  • 1950’s Alvarez – ureteral catheter and wire
  • Semb 1979 – Berman pull
  • Kan/Greuntzig – static balloon 1982

Presentation & Indication

• Presentation
  • “critical” PS
  • Moderate-Severe
  • Mild - Non-newborns

• Indications
  • Newborn/cyanosis
  • ECHO gradient (mm Hg): 45? 55? 65?
  • Symptoms? ECG? RVH?

• Awake versus Asleep
• Peak inst versus Peak to peak
Physiology of Pulmonary Regurgitation

• **Prevalence**
  - Common with surgical or BPV
  - “significant” PR: audible VS echo

• **Physiology**
  - 80% of RV output has “diffused” to the distal pulmonary capillaries end systole
  - 20% left for PR to low diastolic Ppa

• **Discrepancy with MRI data**
  - Free PR versus moderate PR
Pulmonary Stenosis: Cath Tips

• Angiogram
  • LAT, AP +/- cranial
  • Measure PV at hinge points/end systole

• Precautions
  • Blood on standby
  • Indwelling arterial line
  • +/- General anesthesia

• Tips
  • Wire – SuperStiff?
  • Use of balloon catheters
  • Length matters!!
  • 2-3cm infants, 3-5 cm in older
Pulmonary Stenosis: Balloon Size and Number

- Single VS Double
  - Advantages to each approach
- Double
  - “venting”, minimizes largest sheath
  - Primarily for older children, adults
- Single
  - Simple, good for smaller patients

- Picking a diameter
  - Mullins 135-150%
  - Rao 120-130%
  - “ball park” approach
Pulmonary Valvuloplasty: Double Balloon

\[
\Pi De = D_1 + D_2 + \Pi D_1/2 + \Pi D_2/2 + 3.14126/2 + 1 = 2.57
\]

\[
\Pi De = 2.57 \times (D_1 + D_2)
\]

\[
De = 0.82 \times (D_1 + D_2)
\]
Pulmonary Valvuloplasty: Outcome

• Comparable to surgical outcomes
  • Immediate/Long Term Results
  • Allows for RV growth

• Long Term Results
  • 80-90% freedom from re-intervention at 10 years, 90+% freedom from PS

• Data from: McCrindle, Kan, Ganty, O’Conner, Masura

• PR is prevalent, significant PR rare
• More PR with B:A ratio >1.4?
Long-term Results After Balloon Pulmonary Valvuloplasty

Brian W. McCrindle, MD, MPH, and Jean S. Kan, MD

**Background.** The objective of this study was to determine the long-term outcome of patients after percutaneous balloon pulmonary valvuloplasty (BPV) treatment of congenital pulmonary valve stenosis.

**Methods and Results.** This study represents a case series with duration (mean±SD) of follow-up of 4.6±1.9 years. Forty-six patients with a median age of 4.6 years (range, 3 months to 56 years) had BPV at one academic institution between June 1981 and December 1986. Mean peak systolic pressure gradients from the right ventricle to the pulmonary artery were as follows: before BPV, 70±36 mm Hg; immediately after BPV, 23±14 mm Hg; at intermediate follow-up by cardiac catheterization or Doppler echocardiography at less than 2 years after BPV, 23±16 mm Hg (n=33); and at long-term follow-up by Doppler at more than 2 years after BPV, 20±13 mm Hg (n=42). BPV acutely reduced the gradient to less than 36 mm Hg for 41 of 46 (89%) patients. Available gradients at long-term follow-up were less than 36 mm Hg for 36 of 42 (86%) patients without additional procedures. A patient age of less than 2 years at the initial BPV was a significant risk factor for gradients over 36 mm Hg at follow-up.

**Conclusions.** BPV provides long-term relief of pulmonary valvular obstruction in the majority of patients. Close follow-up of patients who require BPV at less than 2 years of age is warranted. *(Circulation 1991;83:1915–1922)*


Angiography
Angiography
Pulmonary Valvuloplasty: Balloons

- Cordis Opta Pro
- Nucleus
- Z-Med/Z-Med II
- BIB?
- Coronary Balloons?
- Sterling?
- Atlas/Conquest?
- MiniGhost
- TyShaq
  - Mini
  - TyShaq 2
8mm PV - Balloon Choice?
Pulmonary Valvuloplasty: Complications

- Annular Rupture/disruption
  - B:A ratio >1.4?
  - Higher pressure balloons
  - Post op versus native
- Tricuspid valve damage
  - Double waist?
  - Use of balloon tipped catheter
- Pulmonary artery damage
  - Central versus wedge injury
  - Type of wire
PAIVS – RF Perforation

- Rule-out RVDCC
- Well developed RVOT
- High Risk LAB precautions/discussions
- Equipment
  - Generator
  - Coaxial and Micro- catheters
- Catheter position
  - 5 Fr JR (at least 4.1)
  - BiPlane
  - Real Target
- Stent PDA?
  - Low threshold
  - “Two-fer”
Radiofrequency Perforation in the Treatment of Congenital Heart Disease

Lee N. Benson, MD, David Nykanen, MD, and Amanda Collison, MD

Catheter-directed perforation of cardiac tissue with radiofrequency (RF) energy has expanded the horizon of the interventional cardiologist dealing with congenital heart disorders. The focus of the following discussion will be to detail the biophysical basis behind RF perforation and review its application in the management of congenital heart lesions. Cathet Cardiovasc Intervent 2002;56:72-

Key words: congenital heart disease; radiofreqe

Intact ventricular septum; interventional cardio

100°C: Intracellular water vaporizes
   - cell membranes rupture

70°C: Tissue desiccation

60°C: Protein denaturation

49°C: Tissue coagulation
PAIVS Assessment

• RV injection
  • Direct catheter into RV
  • Shaped or deflected wire
  • Position in RV cavity
  • Berman useful

• Coronary angiography
  • With “decompressed RV”
  • Aortogram (often inadequate)
  • Selective coronary injections
  • Evaluation ALL branches
RVDCC?
RVDCC?
FUTURE?

• Importance of technique
  • PA-IVS
  • PS – get it right
• Long term results
• New Toys
  • Balloons
  • Beyond Nucleus/TyShaq
  • Stereotaxis?
• Transcatheter valves