CRT
Pre-Procedure Planning

Joshua M. Cooper, MD, FHRS, FACC
Temple University Health System
Philadelphia, PA, USA
What Are My Goals?

• To make the patient feel better (reduce CHF)

• Efficient, effective procedure

• Minimize risk of complications

• Make the device system work as intended, for as long as possible
Historically, 30% Nonresponder Rate

- Selecting the wrong patient
- Placing the lead in a suboptimal location
  - Anatomically suboptimal (not achieving good LV wall synchrony)
  - Electrically suboptimal (phrenic, long stim-QRS, dead tissue)
  - Physically suboptimal (lead migration or dislodgement)
- Inadequate CRT pacing delivery
  - A.fib, PVCs, VT interfering with pacing
  - Poor programming (AV delay, VV timing)
Normal Conduction System
2008 Device Guidelines

Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

Class I

1. For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and sinus rhythm, CRT with or without an ICD is indicated for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms with optimal recommended medical therapy. (Level of Evidence: A)²²²,²²⁴,²²⁵,²³¹
Left Bundle Branch Block

- aVL
- I
- V5
- V6
Right Bundle Branch Block

V1

aVL

I

V5

V6
2012 CRT Guidelines

- ≤ 35% LBBB ≥ 150ms Class III, amb IV
- ≤ 35% LBBB ≥ 150ms Class II
- ≤ 35% LBBB 120-149ms Class II, III, amb IV
- ≤ 35% non-LBBB ≥ 150ms Class III, amb IV
2012 CRT Guidelines

≤ 30%, ischemic LBBB ≥ 150ms Class I

≤ 35% non-LBBB 120-149ms Class III, amb IV

≤ 35% non-LBBB ≥ 150ms Class II

≤ 35% non-LBBB < 150ms Class I, II
Can Following Guidelines Cause Harm?

- 76 yo man, isch CMP, EF 30%
- Class 2 CHF
- VVI ICD 2005
- RBBB, QRS 160ms
- EF dropped to 20%
- Class 4, new PND, edema
- Creat rose, added meds
- IV milrinone
- Refer to BiV Opt clinic

Results from this case study is not predictive of results in other cases. Results in other cases may vary.
LV Lead Pacing Location

Strik M et al, Circ Arrhythm Electrophysiol 2012
Planning Ahead

Vieussens Valve

Valve

Thebesian Valve

Tortuous Vein Branch

Vein Stenosis

Sub-Branch Options

CS Dissection
Having and Knowing Your Toolbox

- **Sheaths**
  - CS access “outer” sheaths
  - Subselection “inner” sheaths
  - Sub-subselection “vein selector” sheaths
  - Worley sheath system

- **Balloons**
  - CS venogram balloon
  - Venoplasty balloons

- **Wires and Catheters**
  - Wholey wire
  - Shaped decapolar catheter
  - Steerable catheter
  - Angled-tip angioplasty wires
  - Stiff vs flexible wires

- **Snares and Other tools**
  - Gooseneck snare
  - Hydrophilic glide catheter
Quadripolar Lead Shape Options

Bos Sci

MDT

St. Jude
Electrode Spacing Options

- St. Jude QUARTET
- MDT PERFORMA
- Bos Sci ACUITY X4
  - Long Tip Bias
- Bos Sci ACUITY X4
  - Short Tip Bias
- Bos Sci ACUITY X4
  - Straight Tip
The Holy Grail of CS Lead Placement

1. Good anatomic location
   - Lateral LV territory, not too apical
2. Good pacing threshold
   - Ensure LV capture and good battery longevity
3. No phrenic nerve capture
   - Ideally none @ 10V on the table, supine
4. Good lead stability
   - Dislodgement usually requires reoperation
Work Flow Plan to Optimize LV Pacing

• Advance Quad lead to wedge position for stability

• Check each electrode at max output in unipolar config to look for phrenic

• Check pacing threshold in each unipolar config

• Assess anatomic location of 4 electrodes

• Check latest activation during native conduction and/or during RV pacing

• Check different vectors using target electrode as cathode
Pulse Generator Features

- Pacing vectors
- Battery longevity
- “Autocapture” feature
- V-V timing options
- Vector data management
- Triggered bi-v pacing
- “Adaptive” CRT
- Latest activation measurement
- Atrial tracking recovery / hysteresis
CRT Response Rates in 2016

• Better understanding of who to implant
• Better implant tools and techniques
• Better knowledge of where and how to pace
• Better leads to achieve “holy grail” of LV implant
• Appreciation for importance of 12-lead ECG

Should now have >90% “responder” rate!