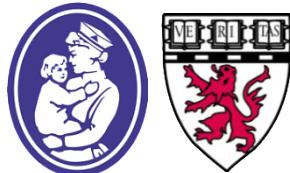

AV Node Reentrant Tachycardia: Approach to Difficult Cases



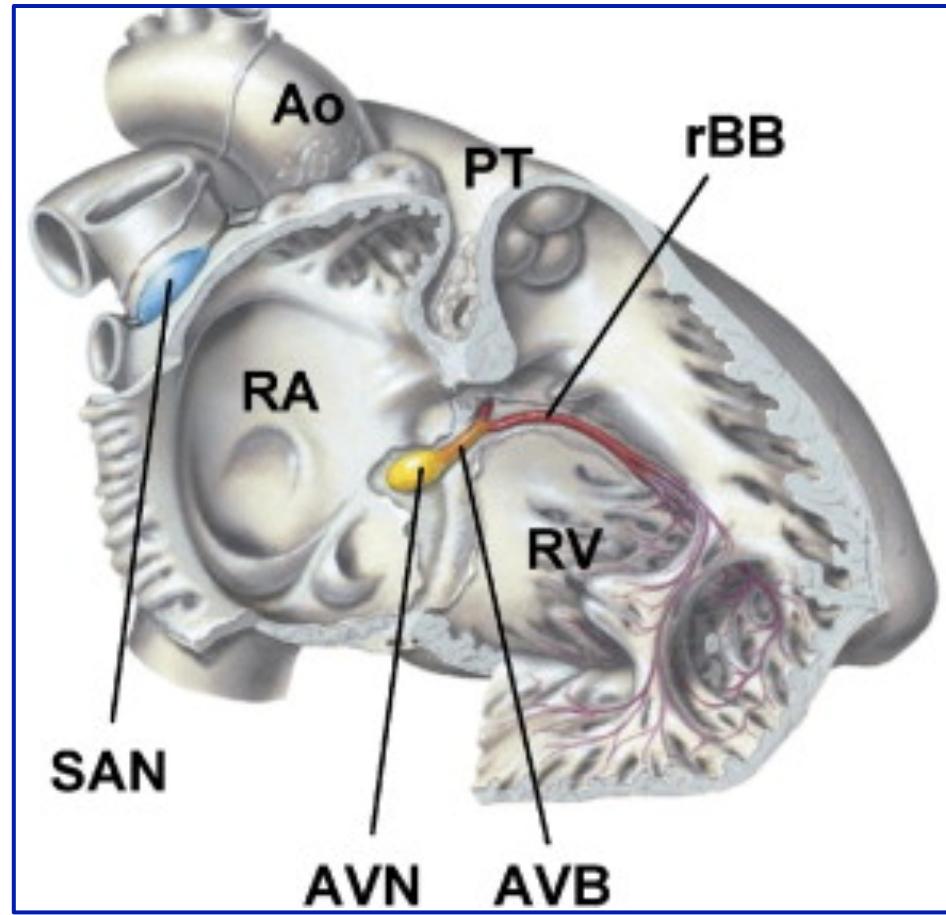
Edward P. Walsh, MD
Boston Children's Hospital
Harvard Medical School

Pedirhythm VII
February 2017

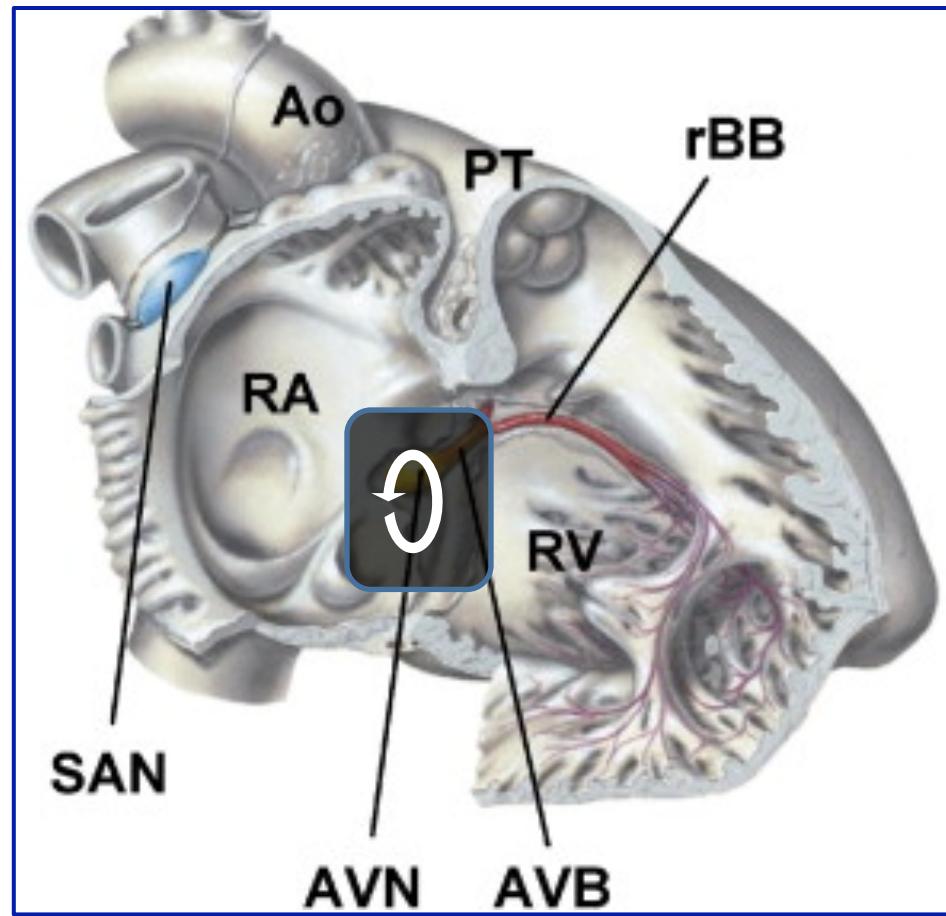
Challenging Slow Pathway Ablation

- **Ablation in the “usual spot” fails**
- **Young age / Small size**
- **Congenital heart disease**
- **Catheter instability**

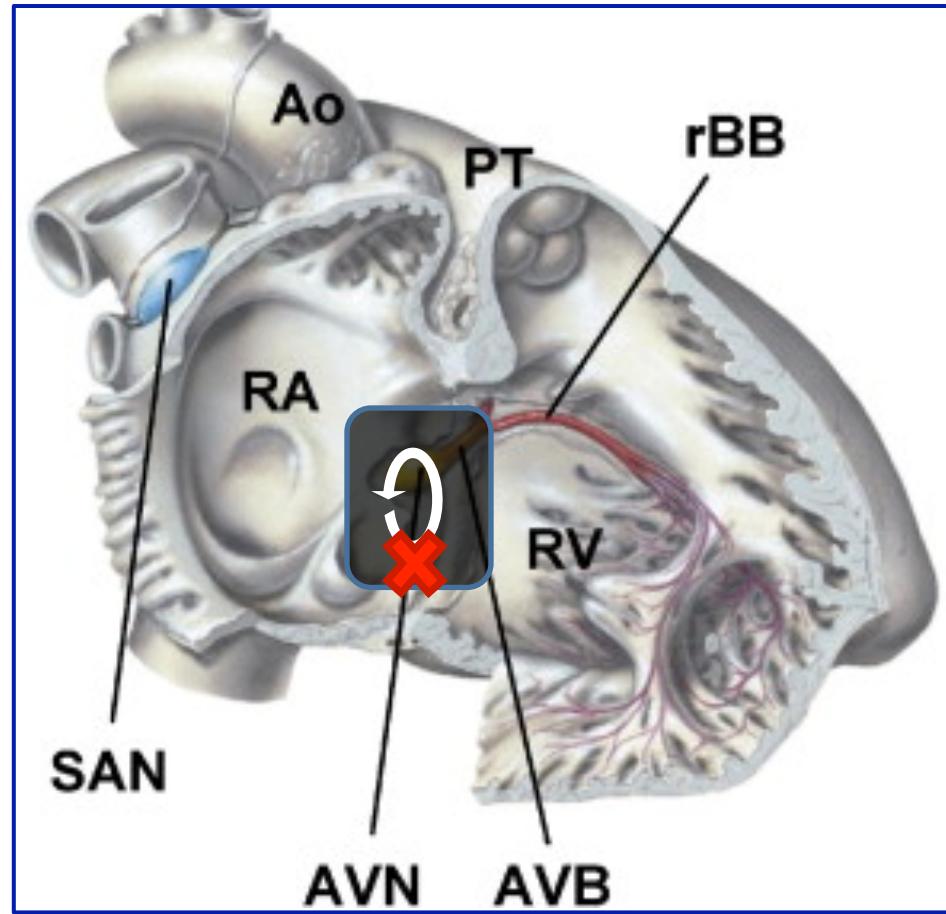
Simplistic View of AV Node



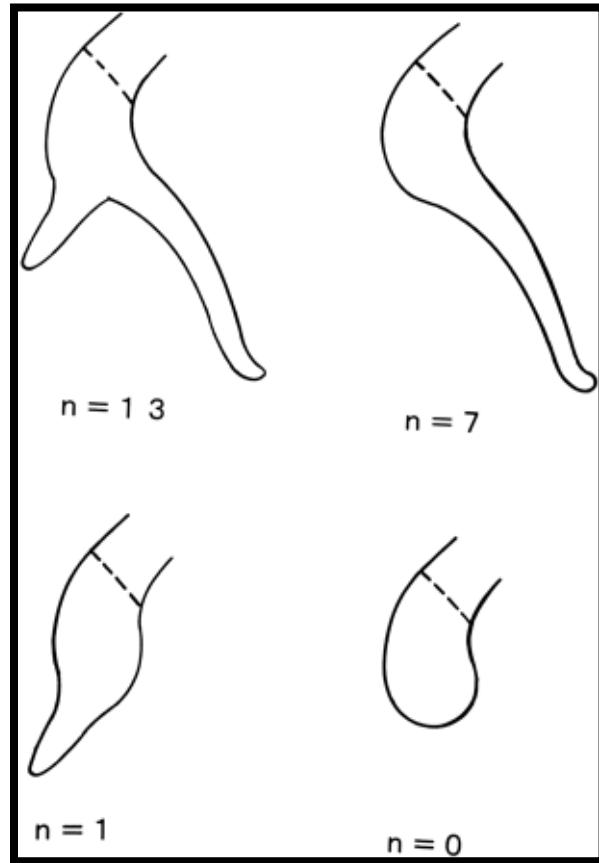
Simplistic View of AV Node



Simplistic View of AV Node

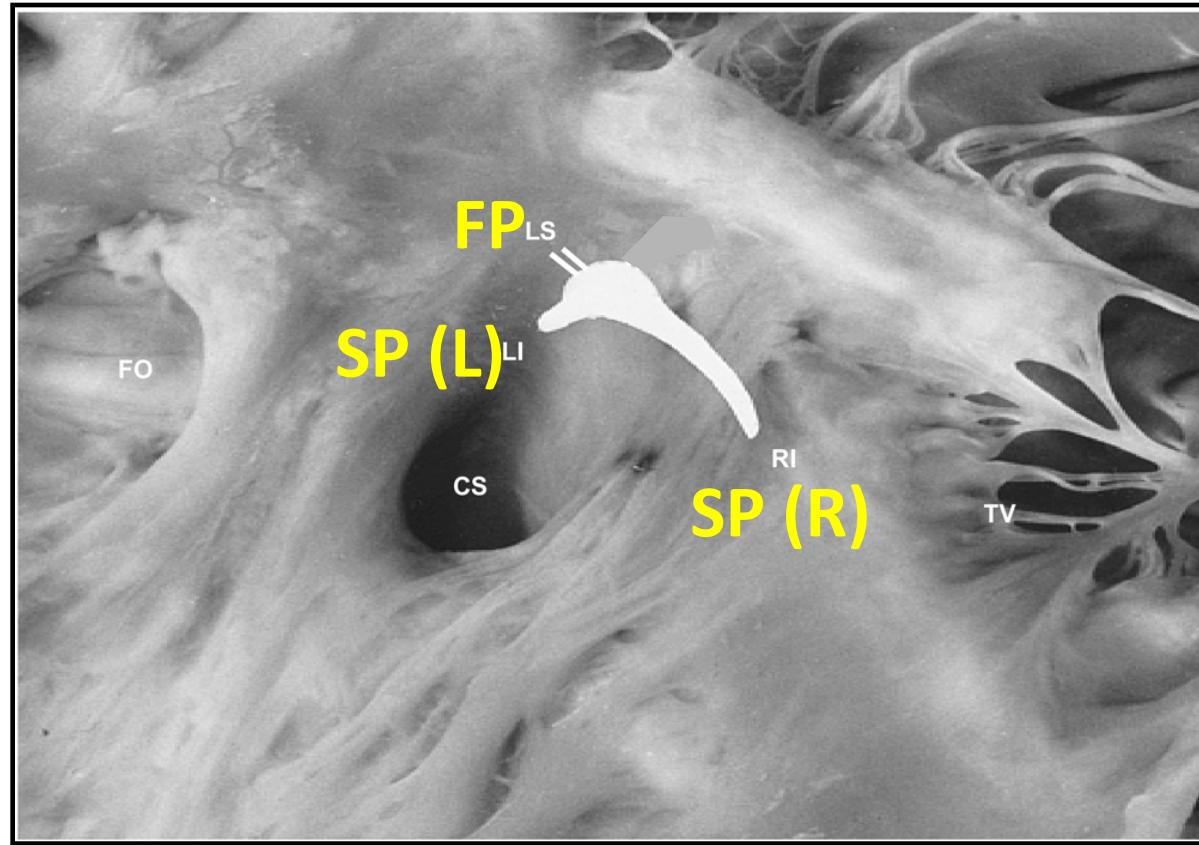


Refined Model AV Nodal Inputs



Inoue and Becker Circulation. 1997:188-193.

Refined Model of AV nodal Inputs



Katritsis and Becker Heart Rhythm;2007:1354

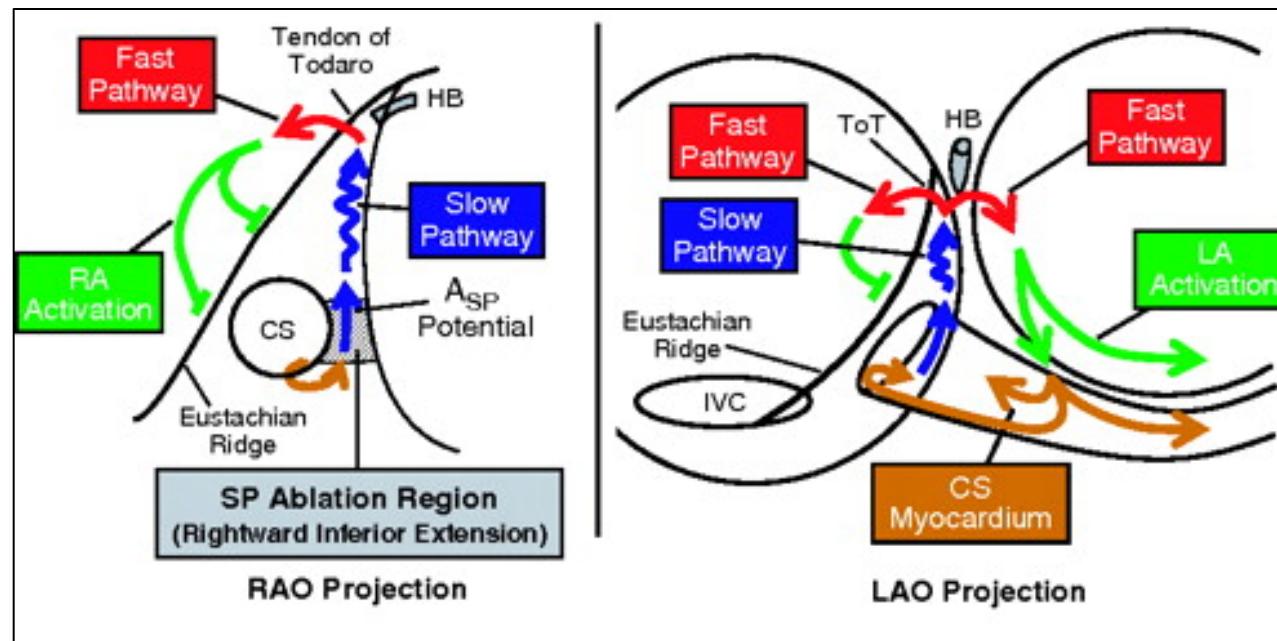
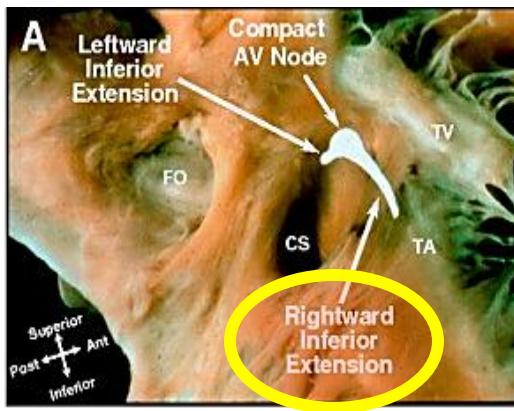
Potential Mechanisms for AVNRT

- SLOW-FAST (SP-R)
- FAST-SLOW (SP-R)
- SLOW-FAST SP(L)
- SLOW-SLOW SP (R) & SP(L)
- SLOW-FAST SP (CS musculature?)

Potential Mechanisms for AVNRT

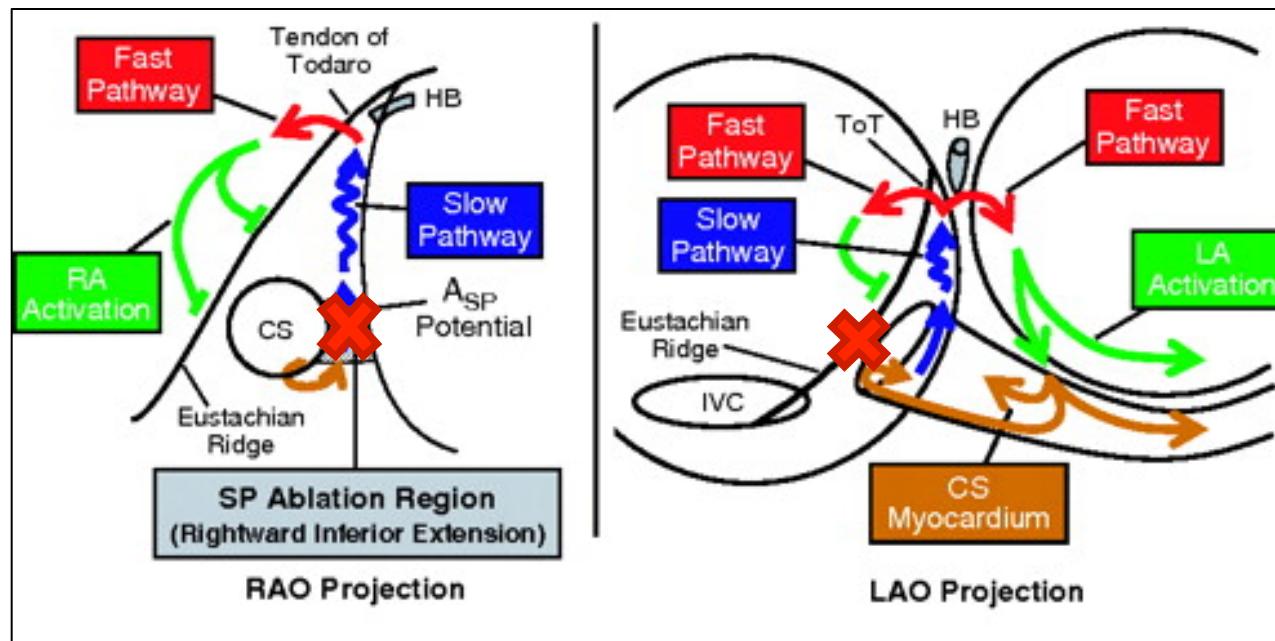
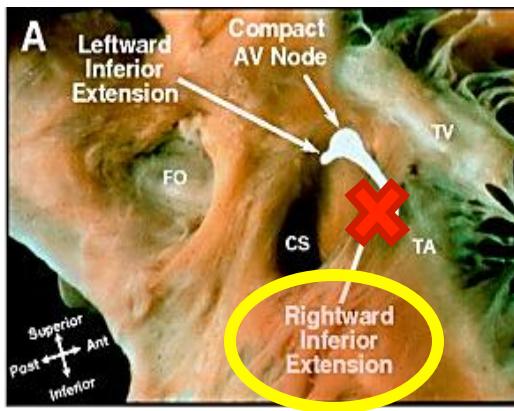
- SLOW-FAST (SP-R) *very common*
- FAST-SLOW (SP-R) *moderately common*
- SLOW-FAST SP(L) *occasional*
- SLOW-SLOW SP (R) & SP(L) *occasional*
- SLOW-FAST SP (CS musculature?) *very rare*

AVNRT (Rightward extension SP)



Nakagawa and Jackman. Circulation 2007;116:2465-2478

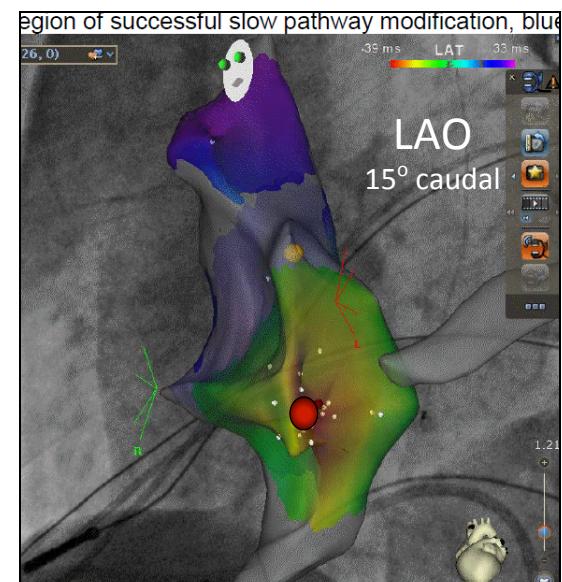
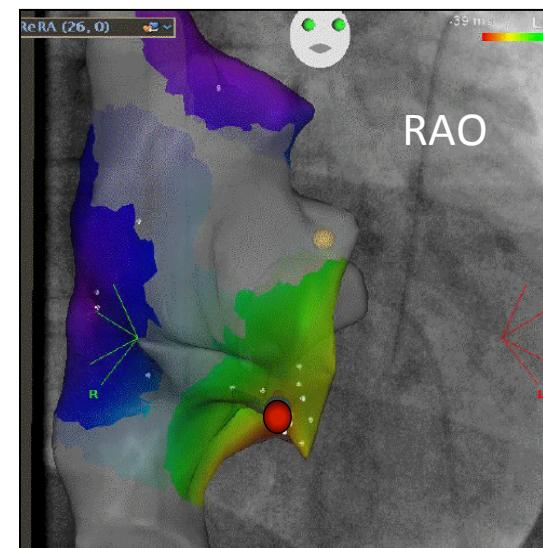
AVNRT (Rightward extension SP)



Nakagawa and Jackman. Circulation 2007;116:2465-2478

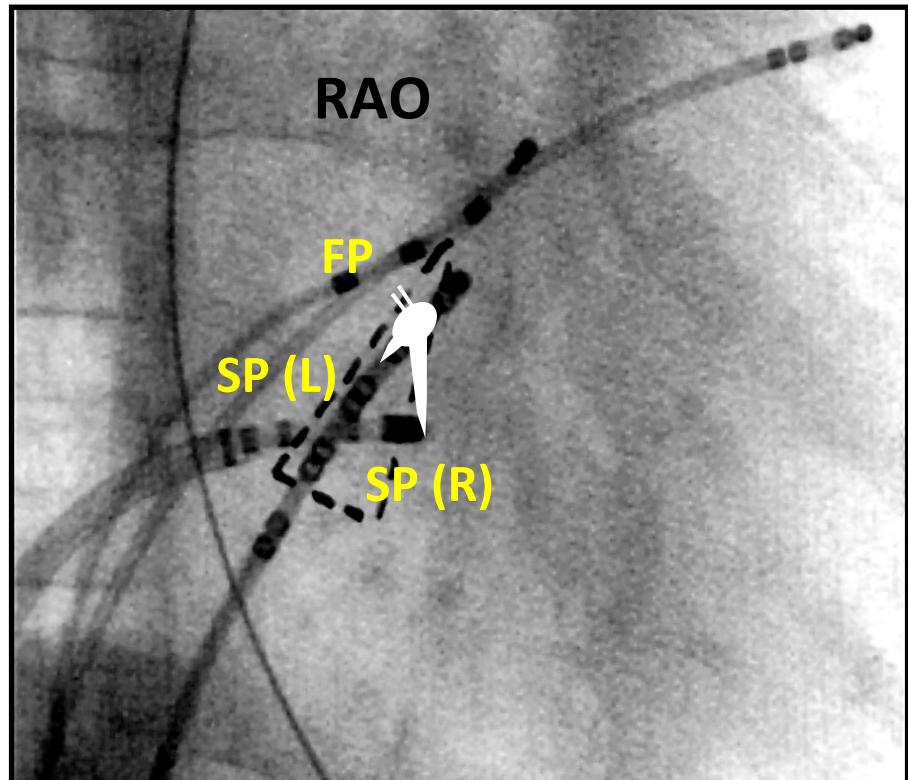
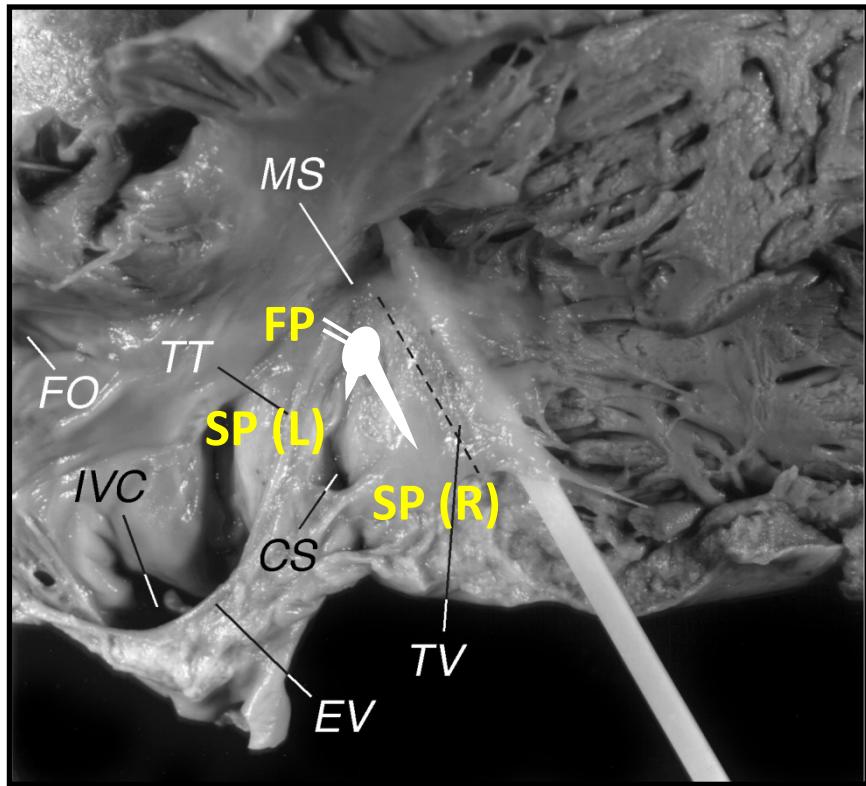
R-Extension SP Mapping

Mapping R-SP retrograde in fast-slow AVNRT

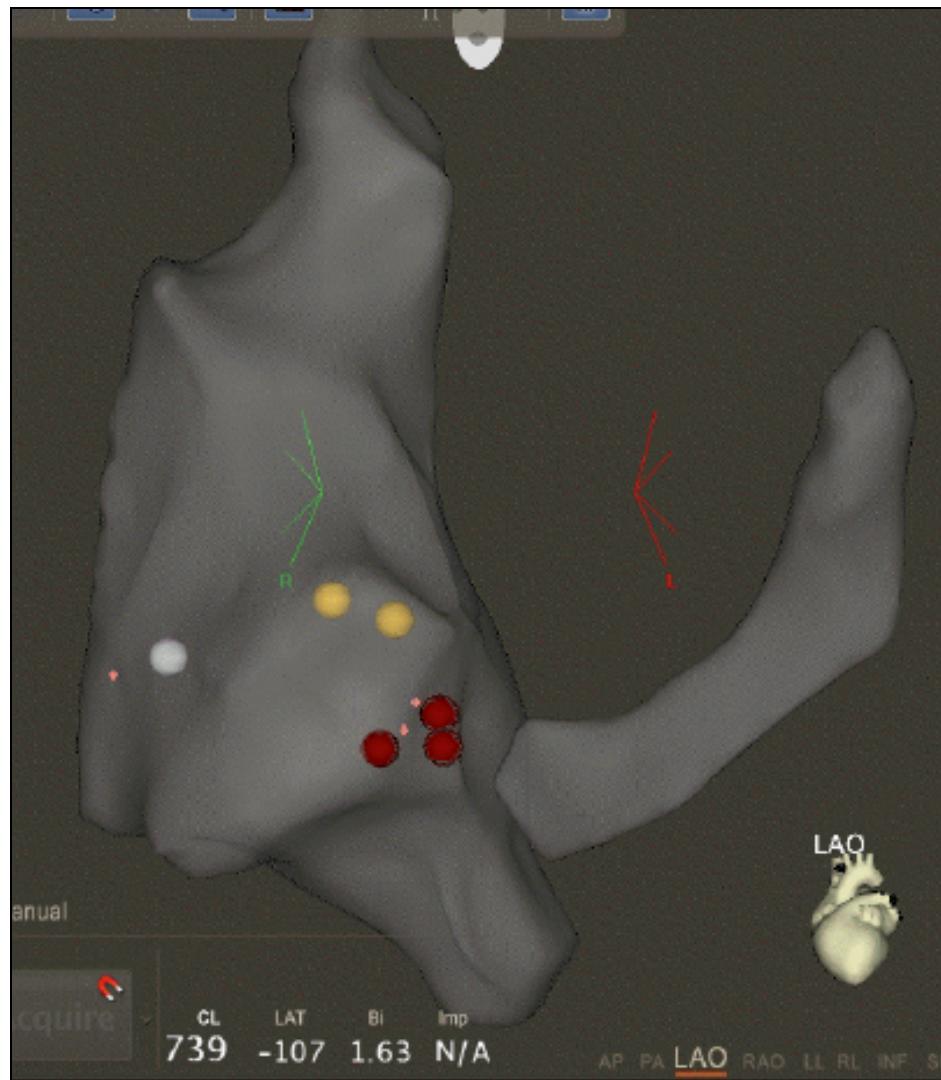


Fluoroscopy: Koch's Triangle and Rightward SP Ablation

Zone

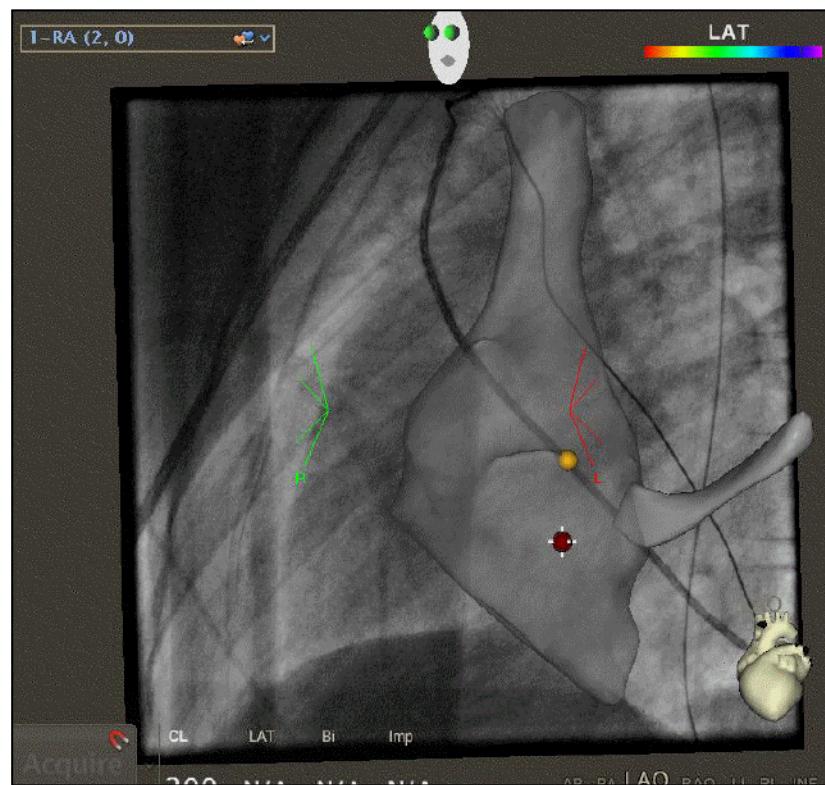
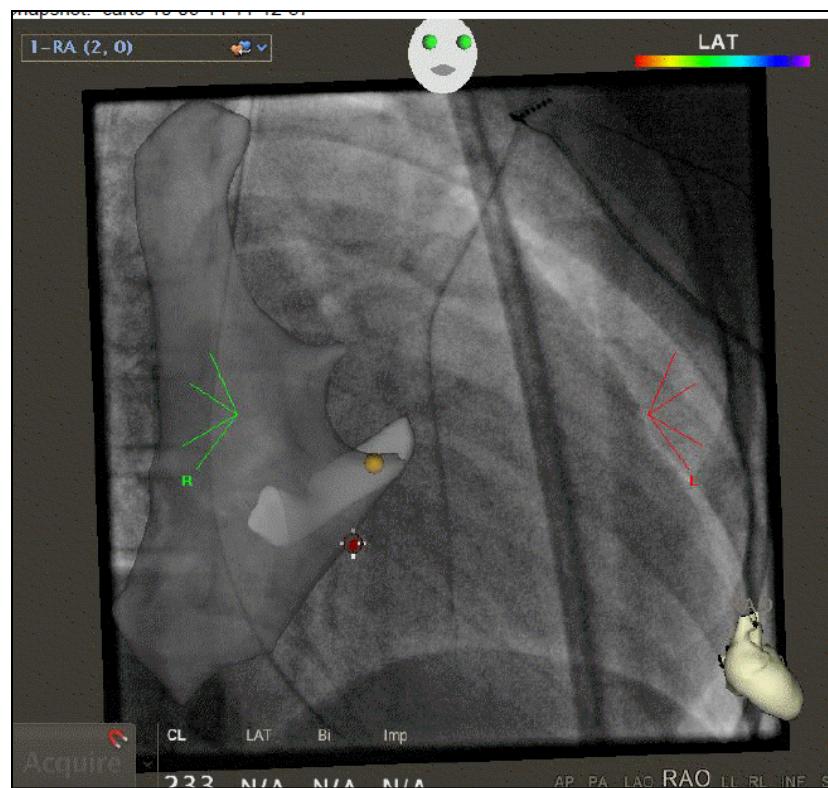


3D Registration for AVNRT (normal heart)

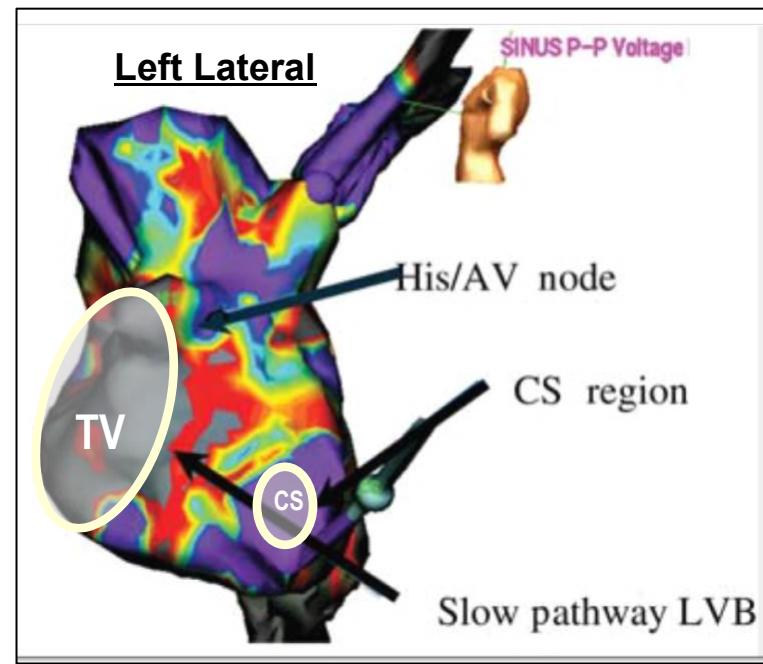
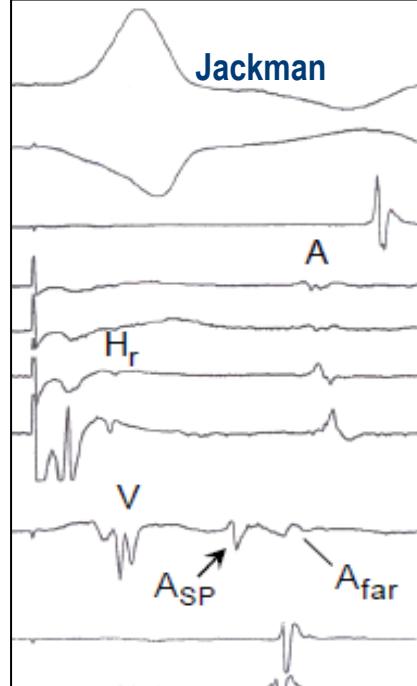
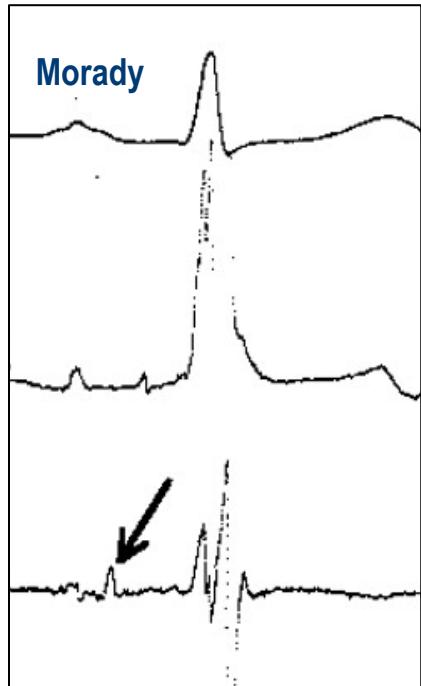
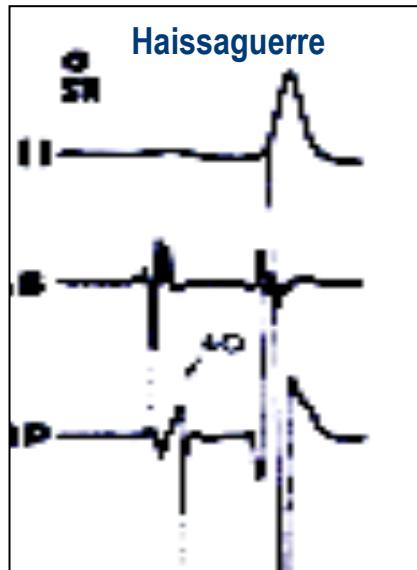


Best of Both Worlds

Merge 3-D Shell / Spot Fluoro

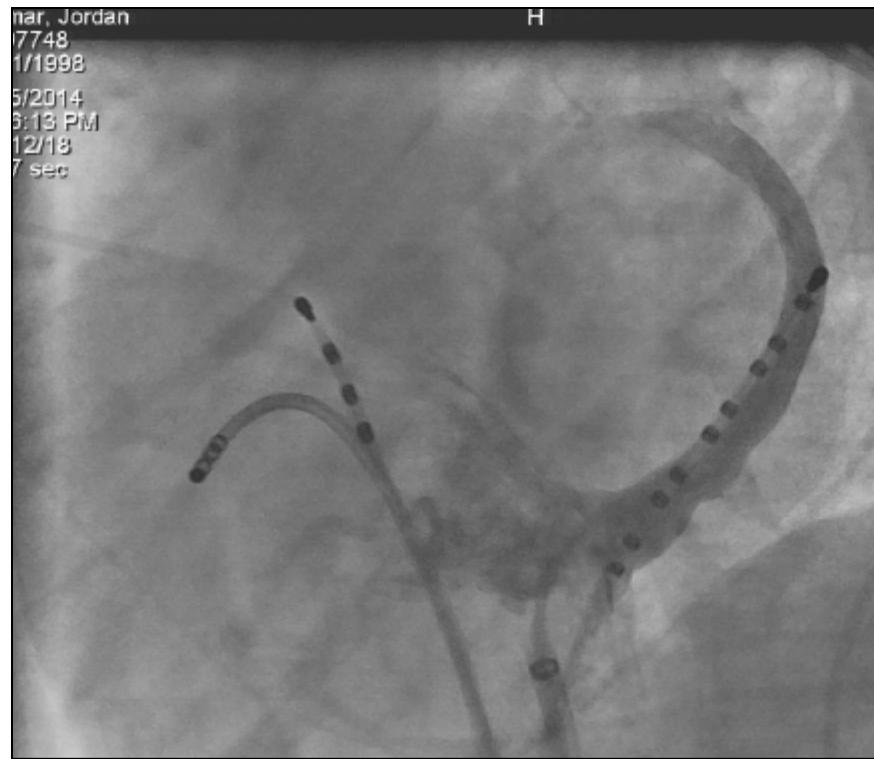


0.1 min fluoroscopy / case

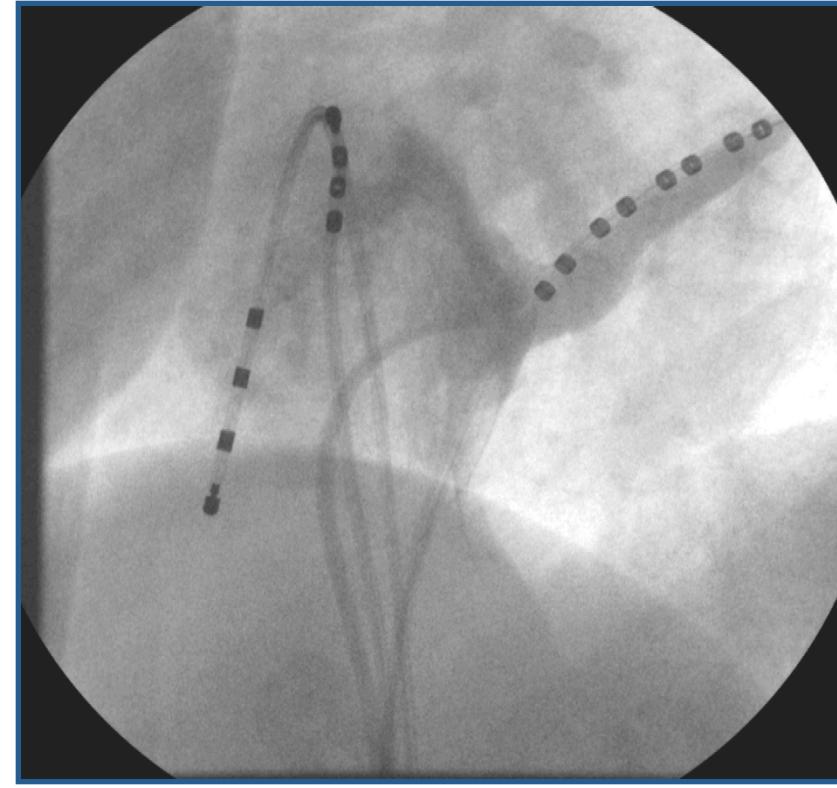
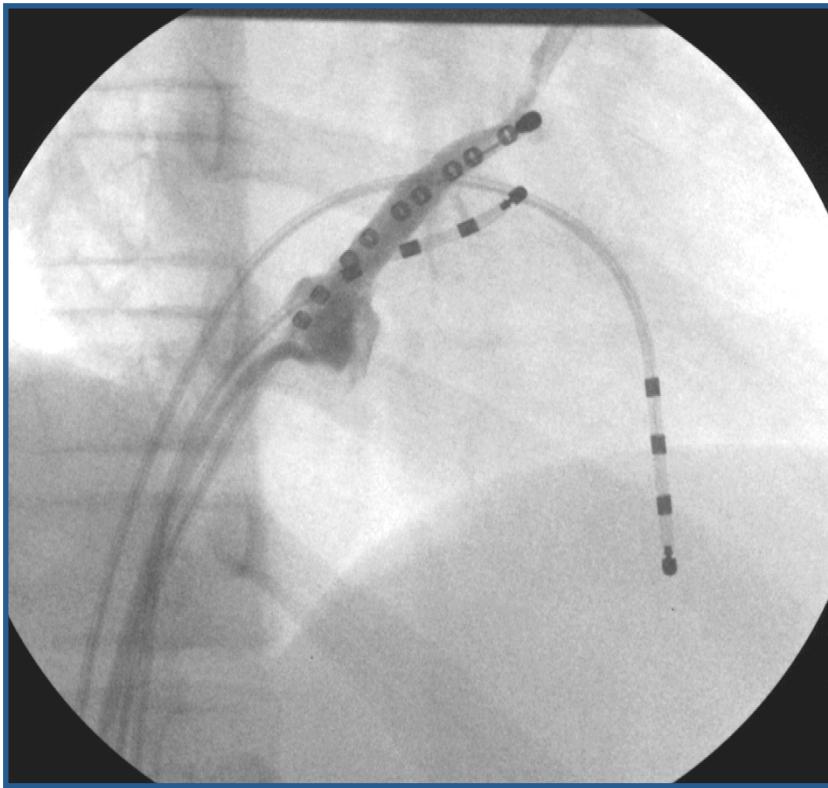


Bailin et al. Europace 2011

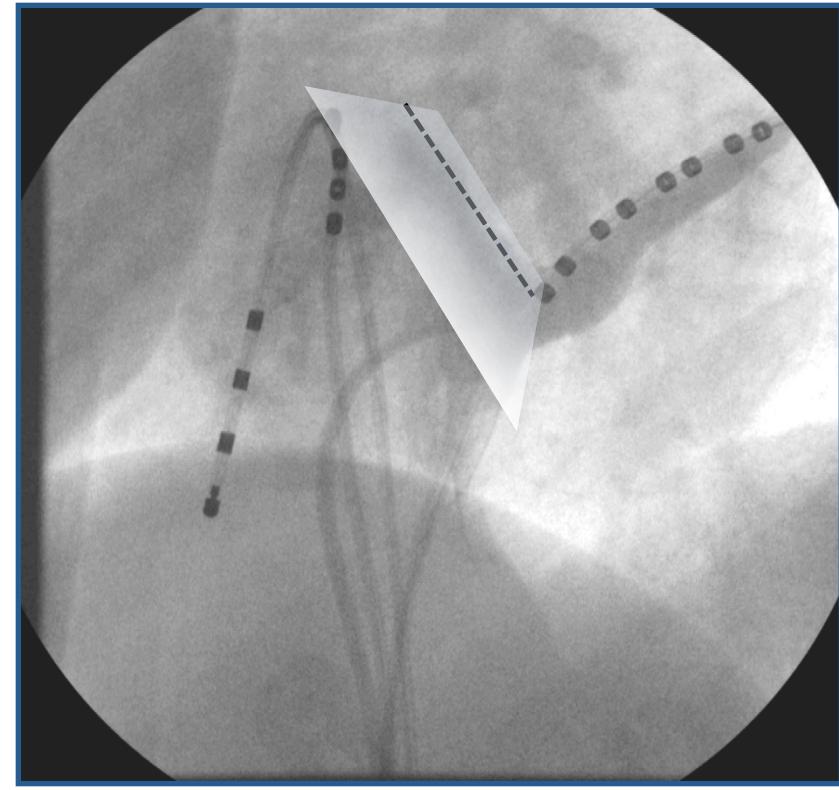
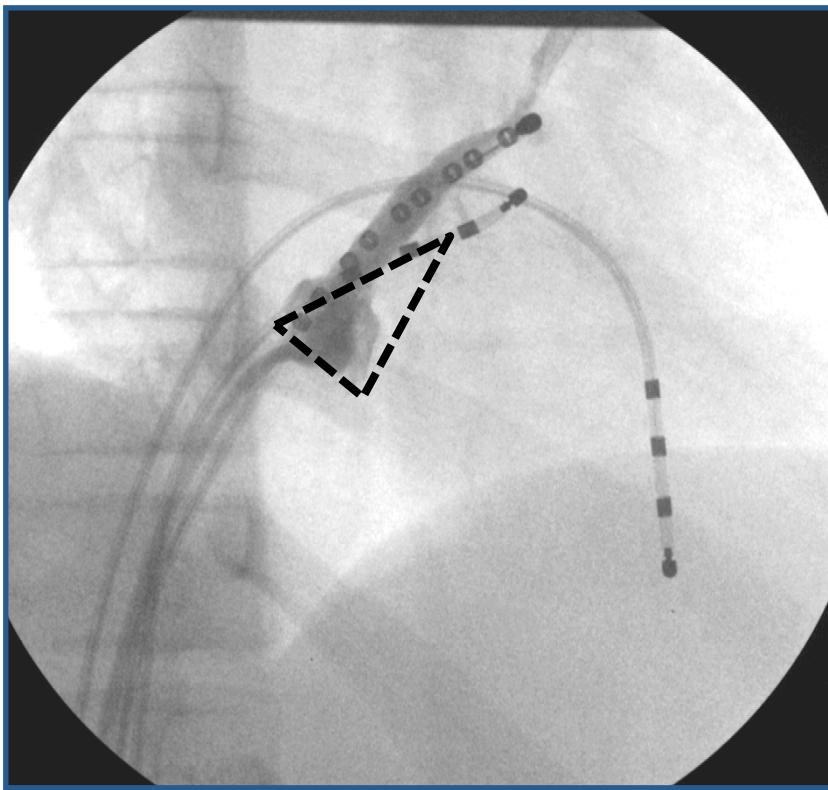
Utility of CS-gram in AVNRT



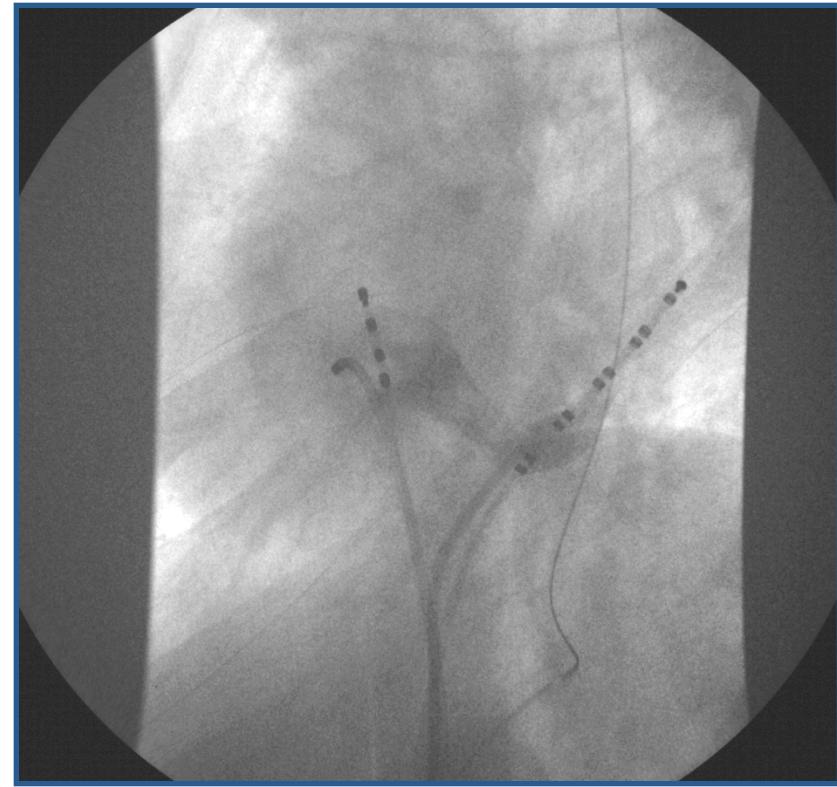
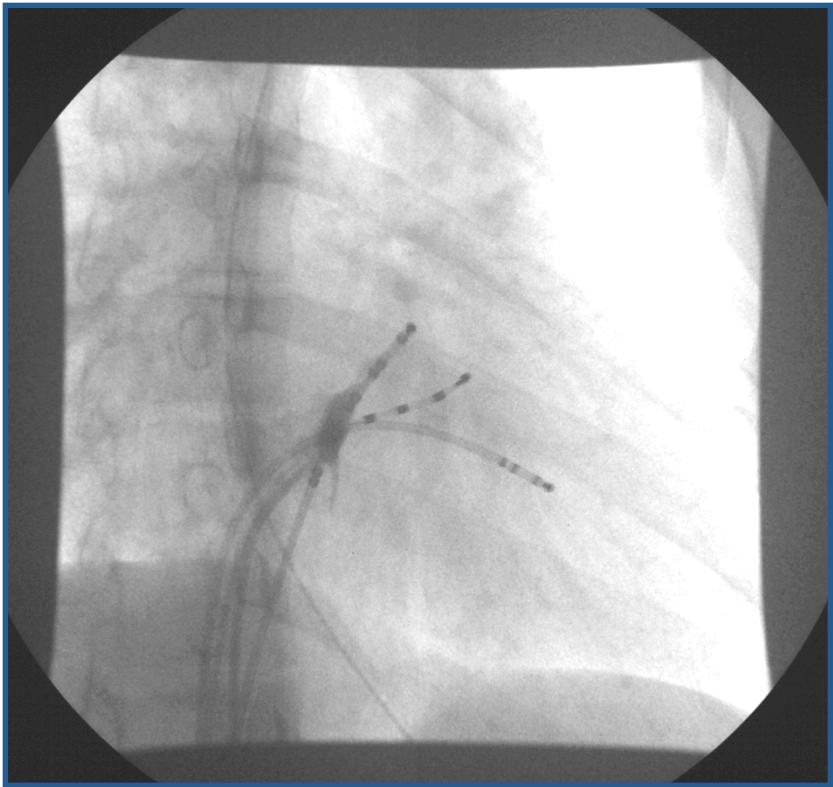
CS-gram (normal septal orientation)



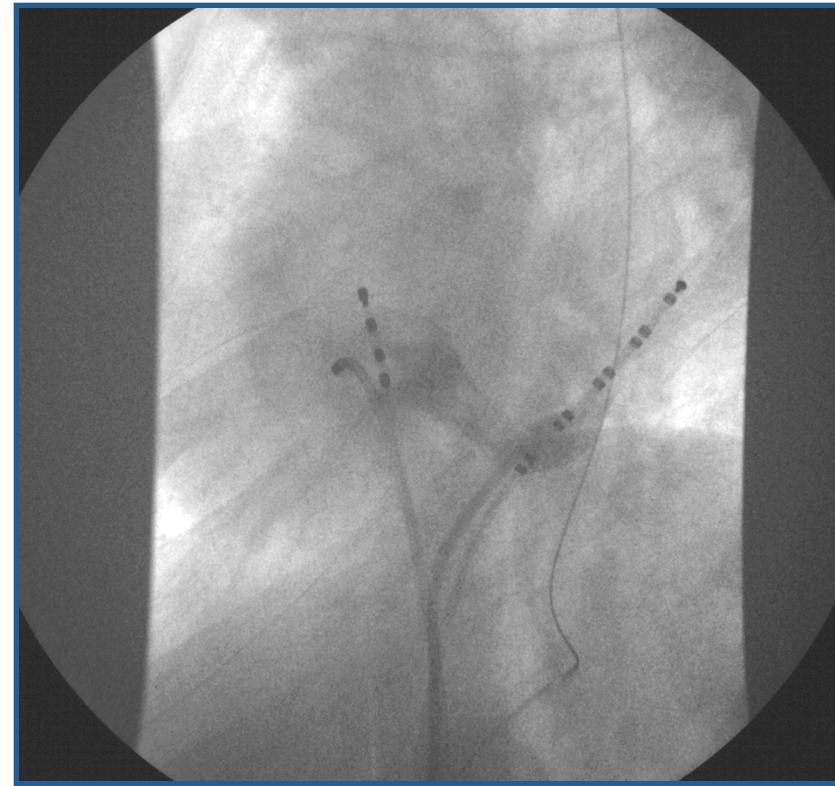
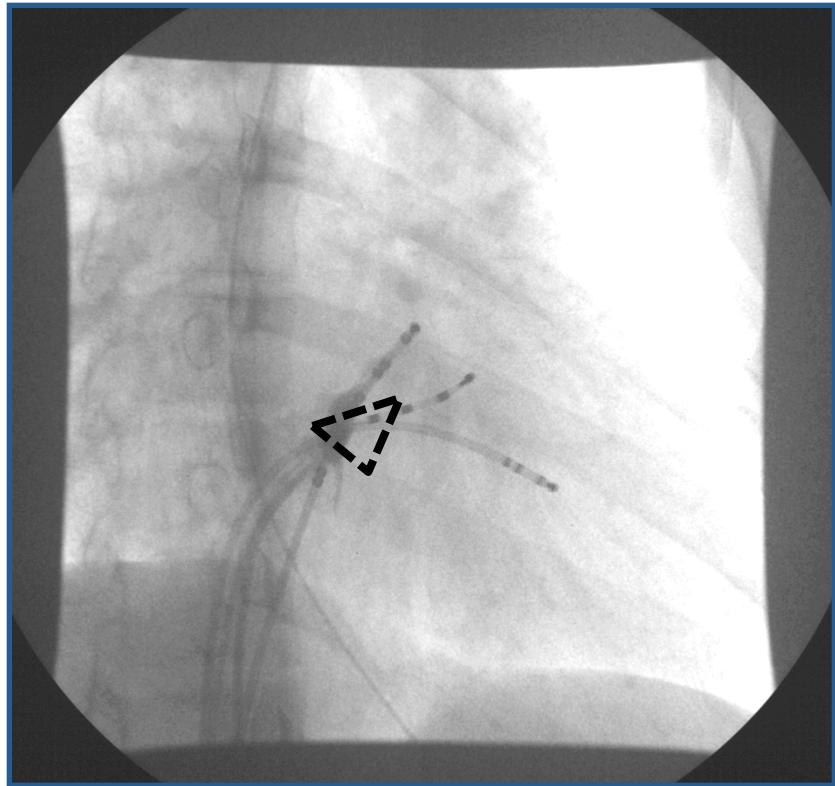
CS-gram (normal septal orientation)



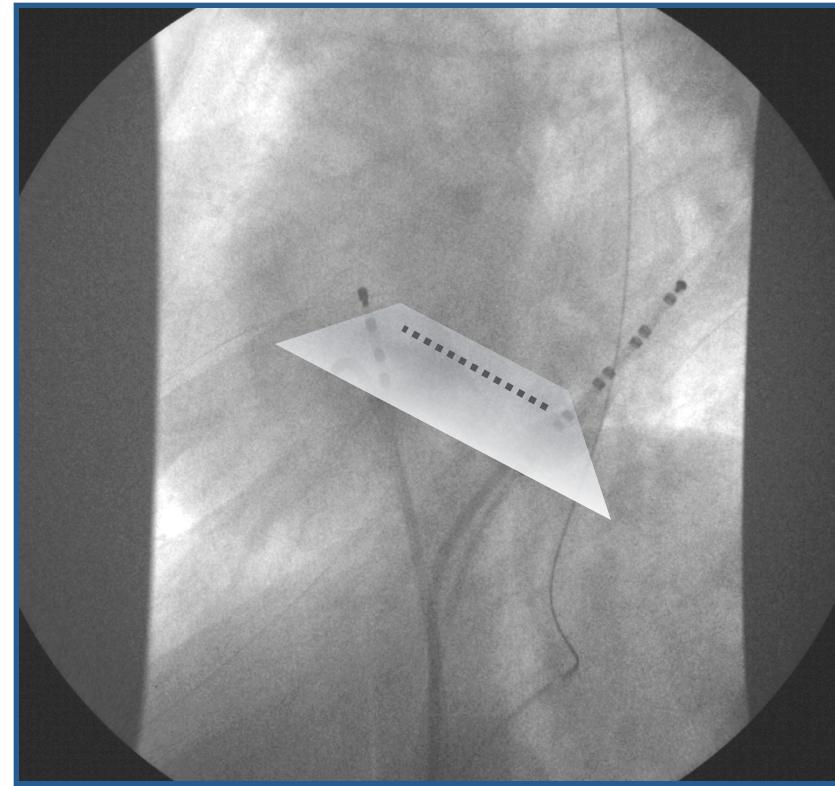
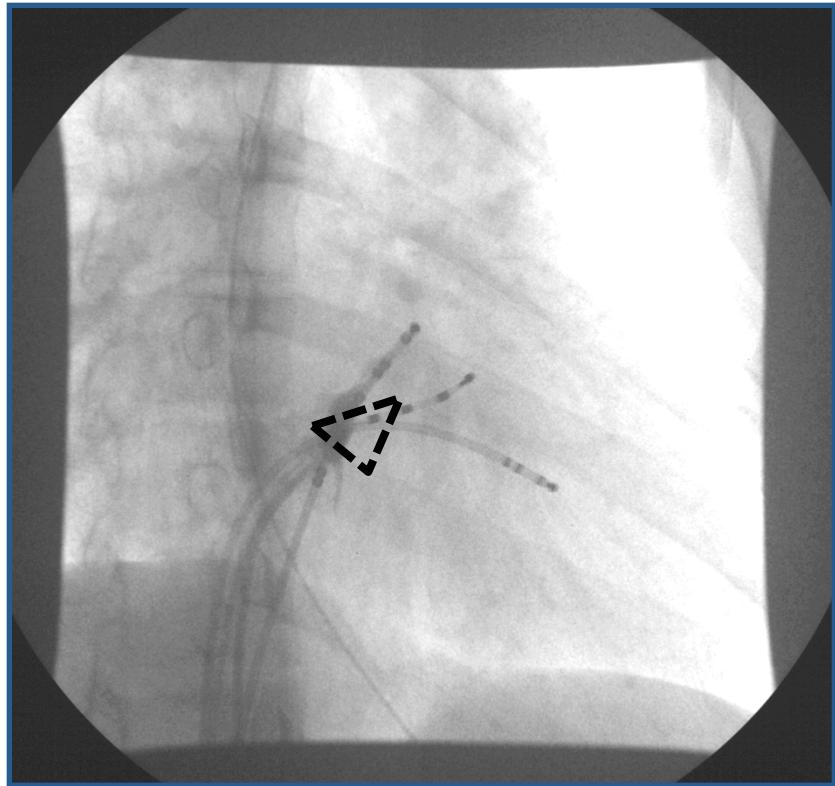
CS-gram (? Small triangle of Koch ?)



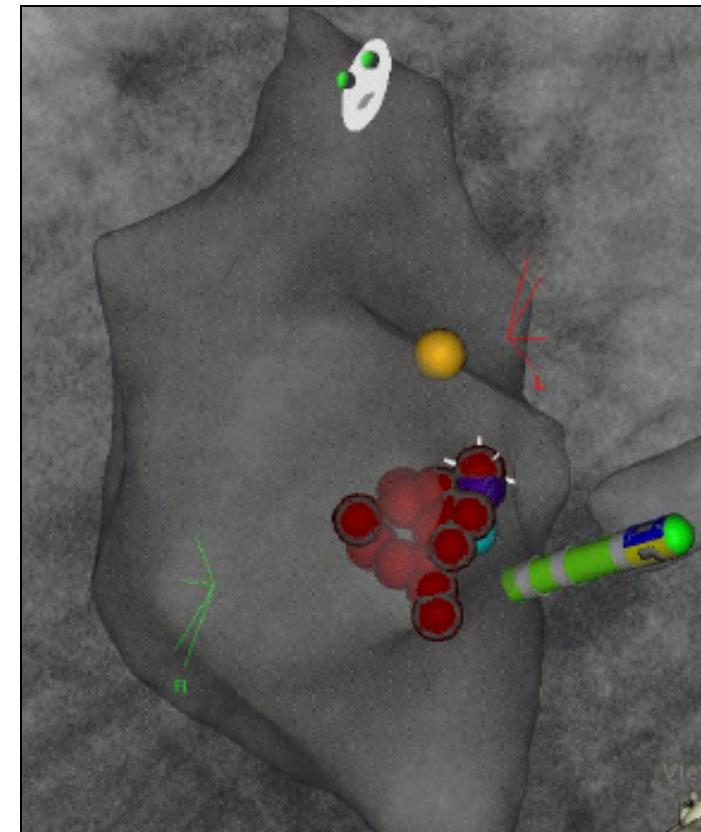
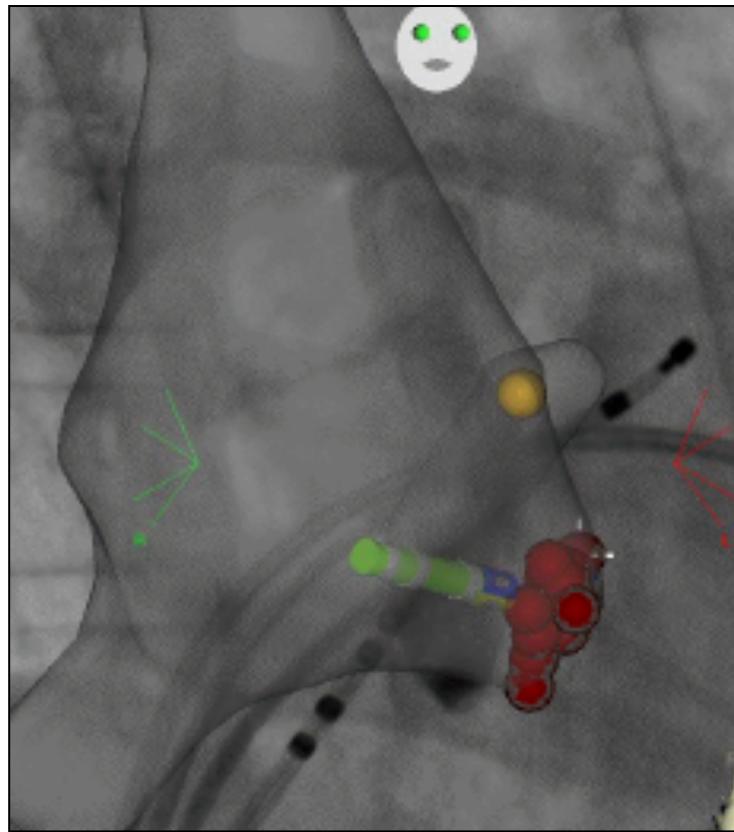
CS-gram (? Small triangle of Koch ?)



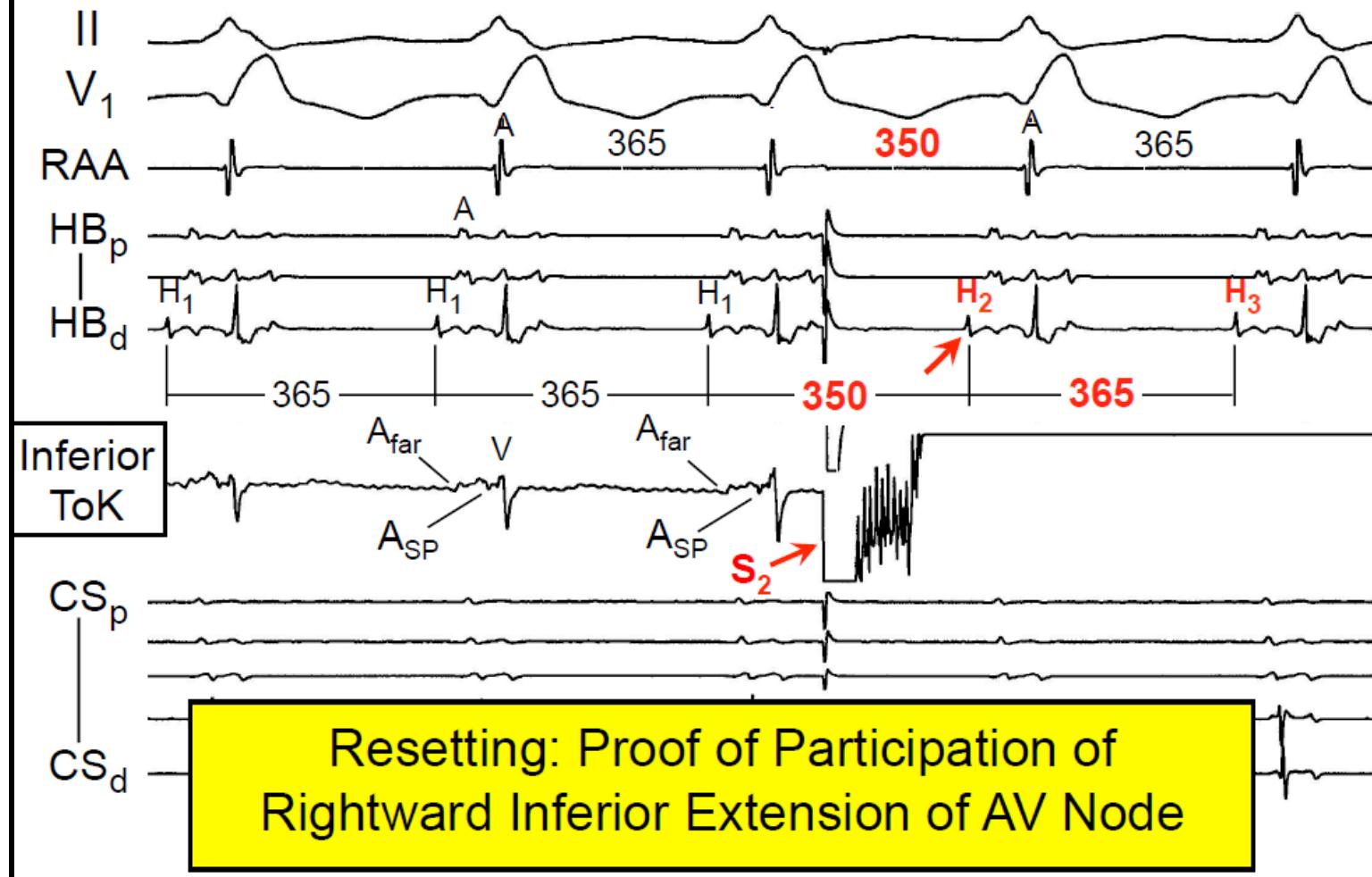
CS-gram (? Small triangle of Koch ?)



SP-R area covered, but still no success

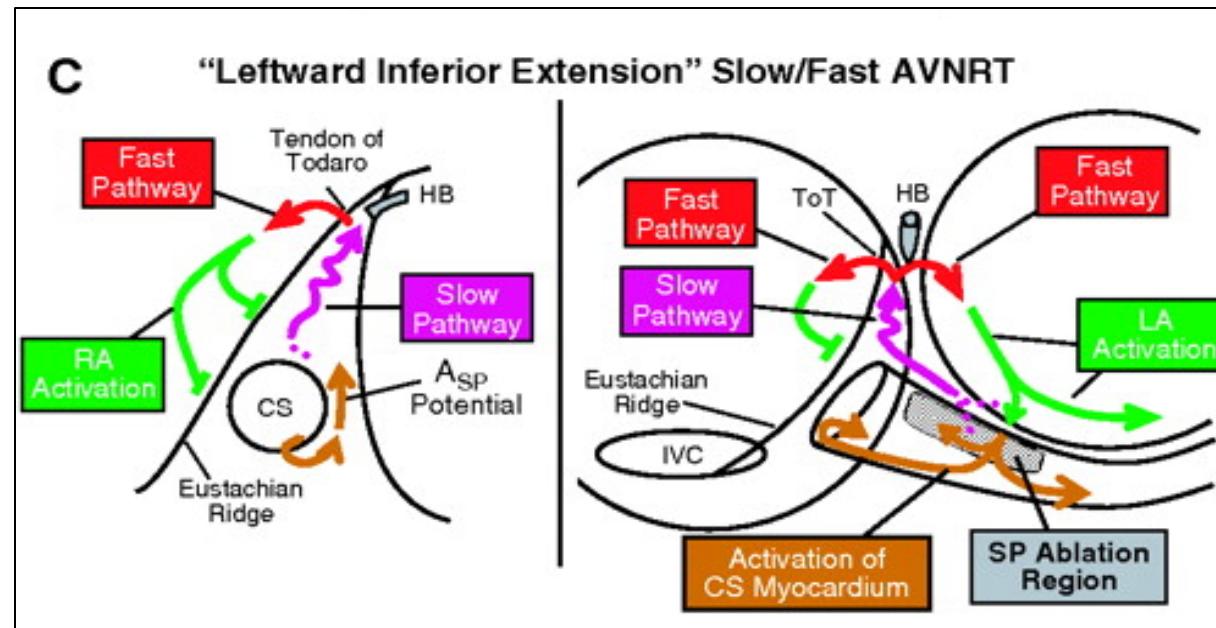
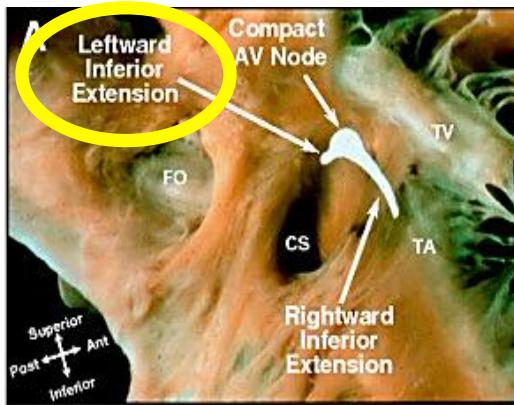


Resetting Slow/Fast AVNRT Using a Single Extrastimulus Delivered to Inferior Triangle of Koch



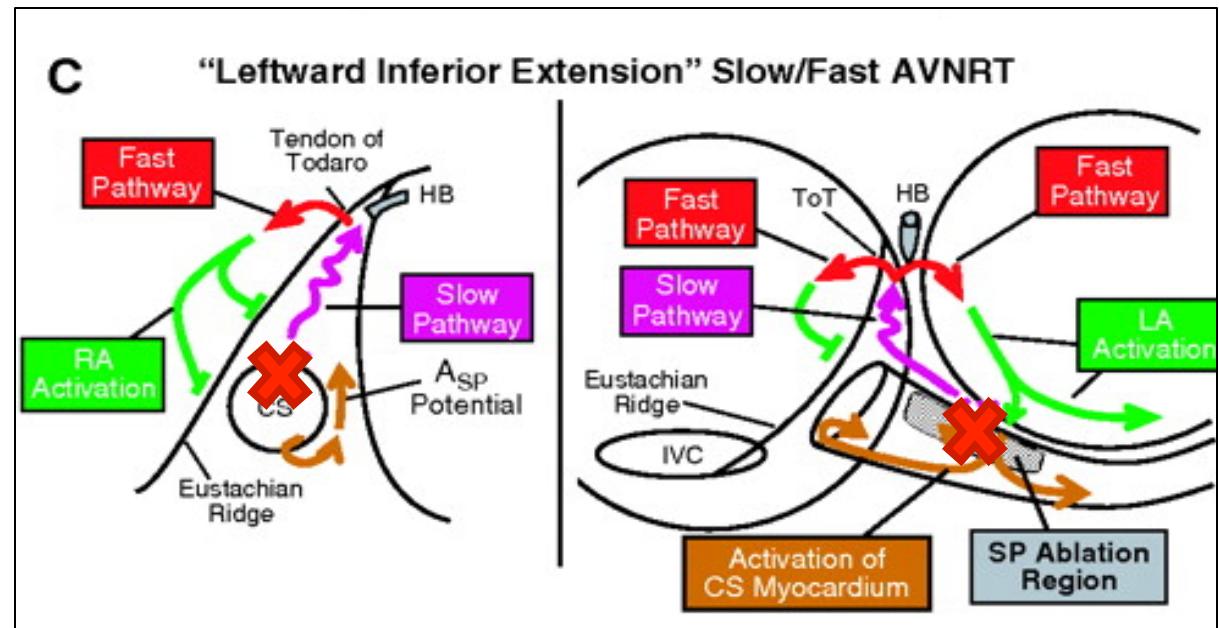
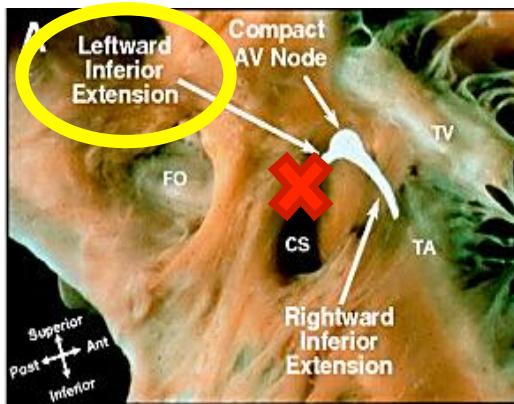
c/o Sonny Jackman

AVNRT (leftward extension SP)



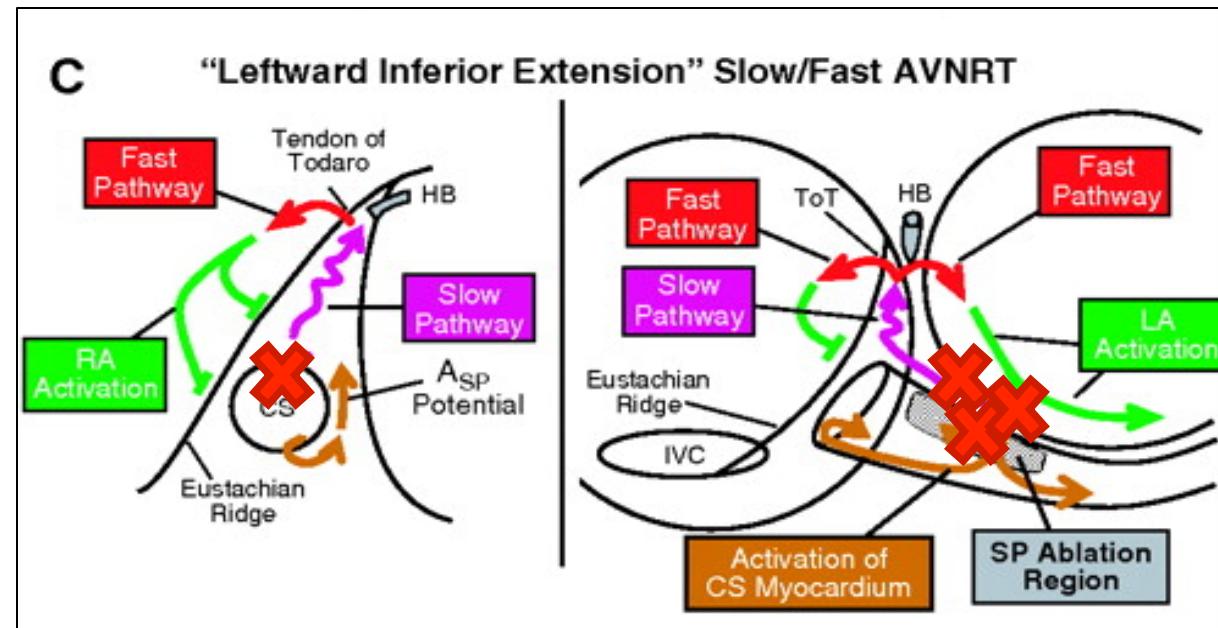
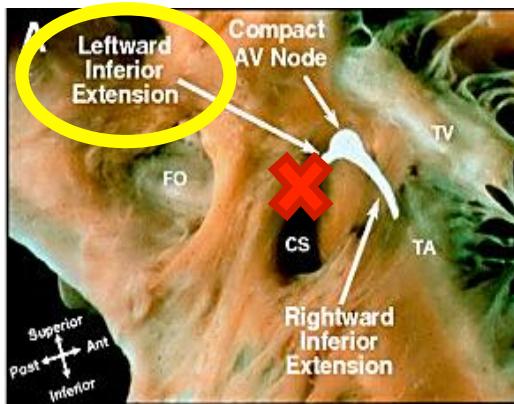
Nakagawa and Jackman. Circulation 2007;116:2465-2478

AVNRT (leftward extension SP)



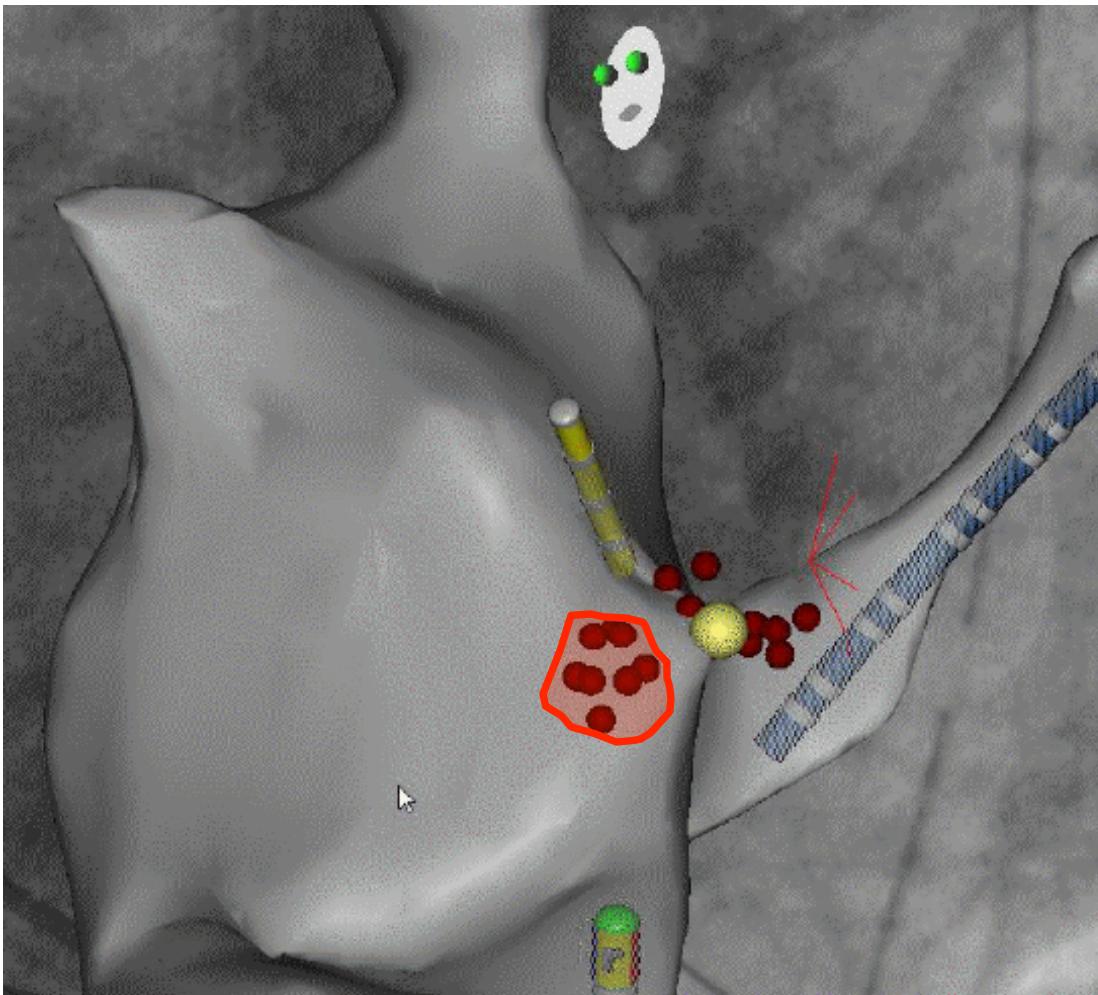
Nakagawa and Jackman. Circulation 2007;116:2465-2478

AVNRT (leftward extension SP)

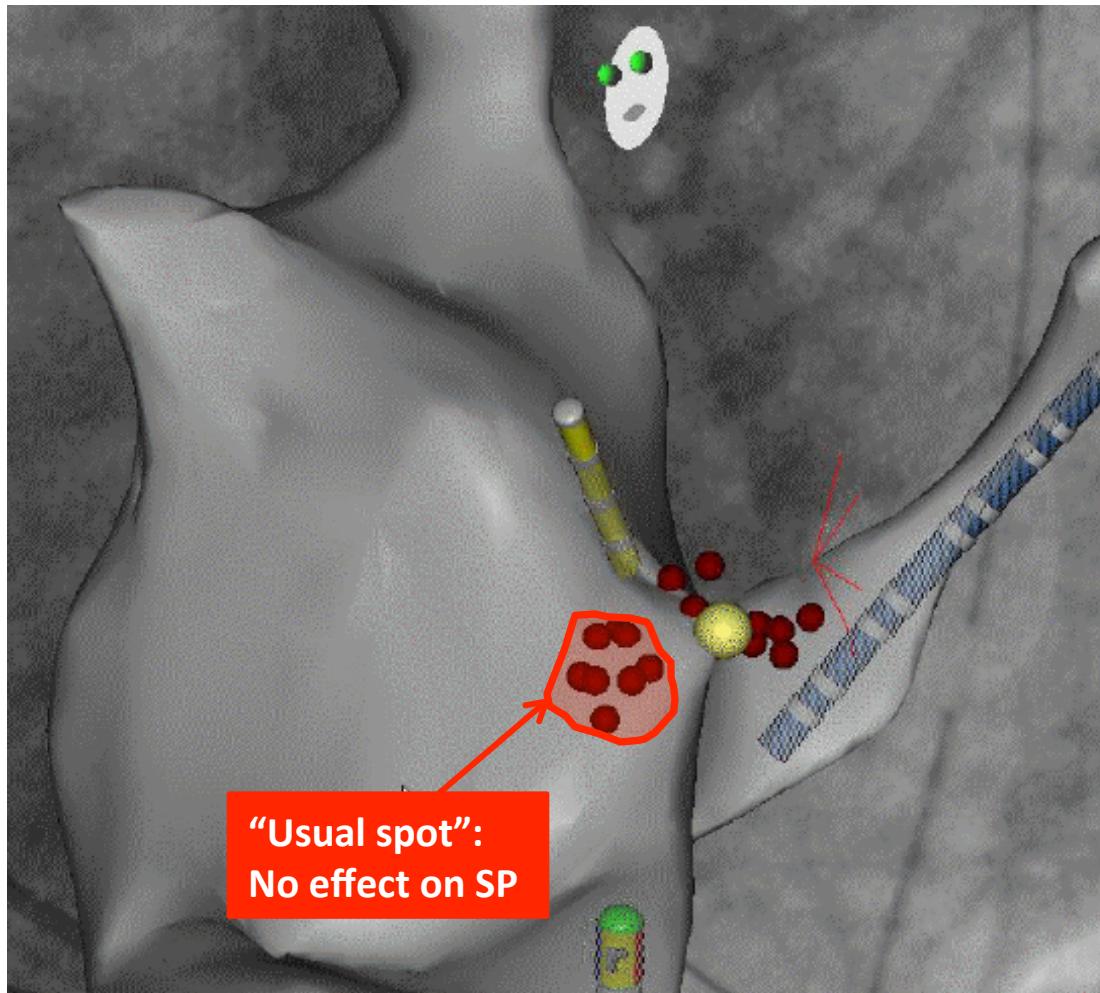


Nakagawa and Jackman. Circulation 2007;116:2465-2478

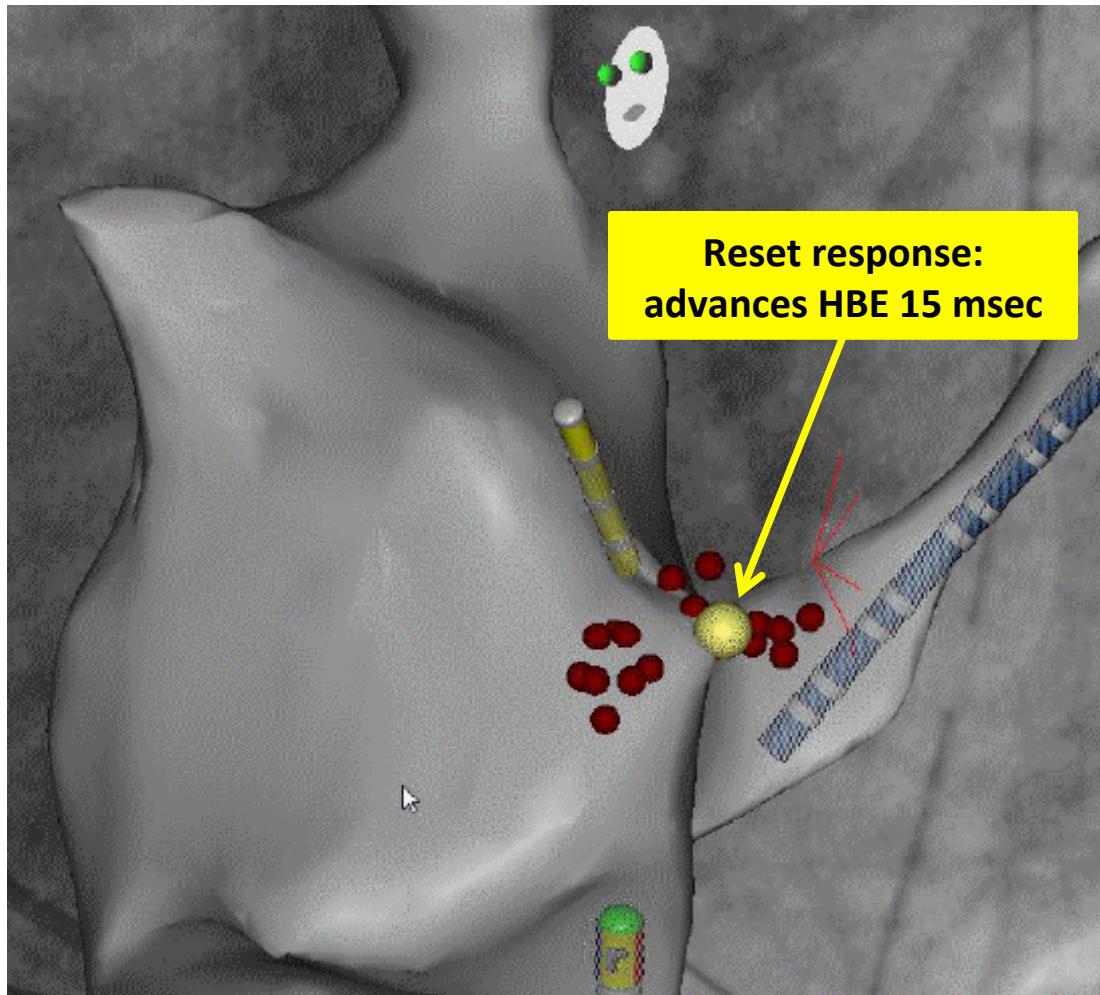
Ablation L-Extension SP



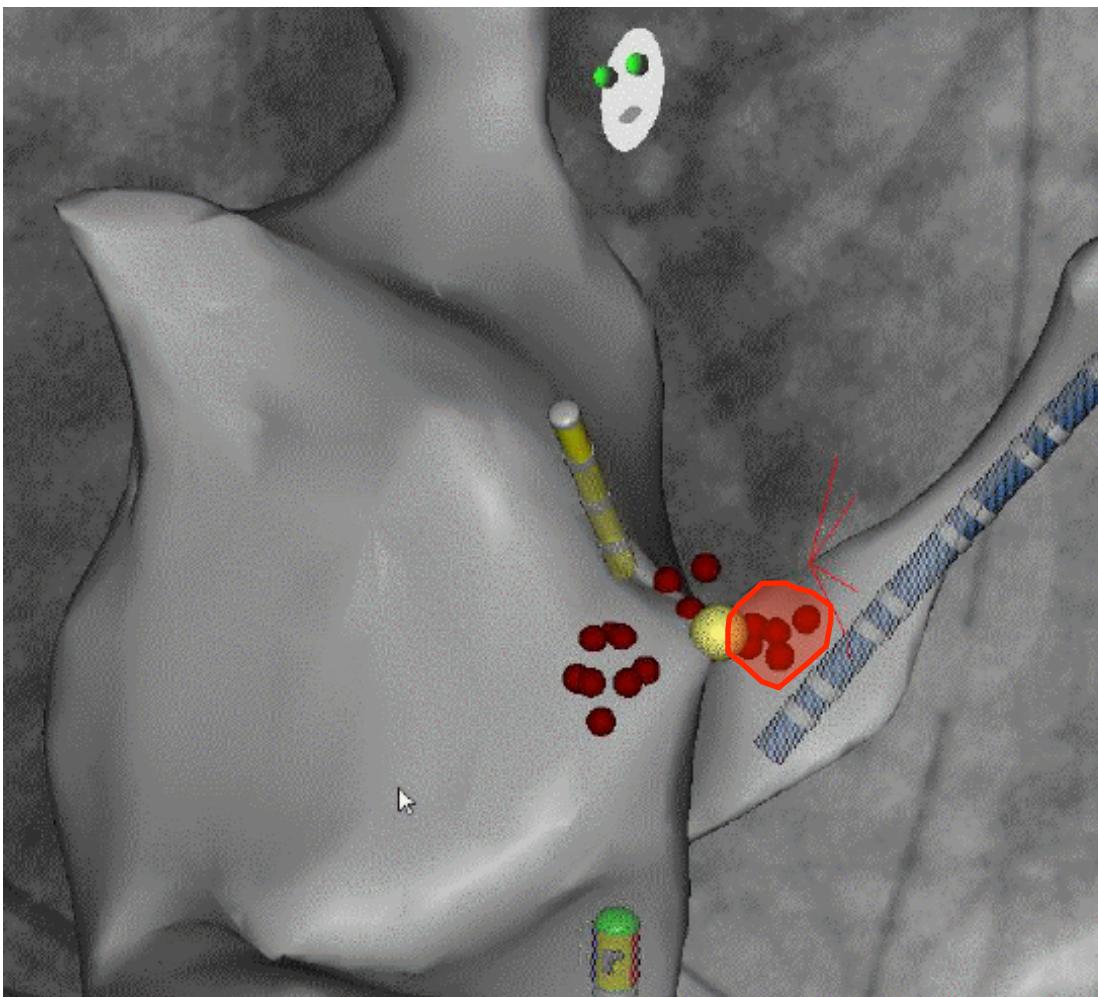
Ablation L-Extension SP



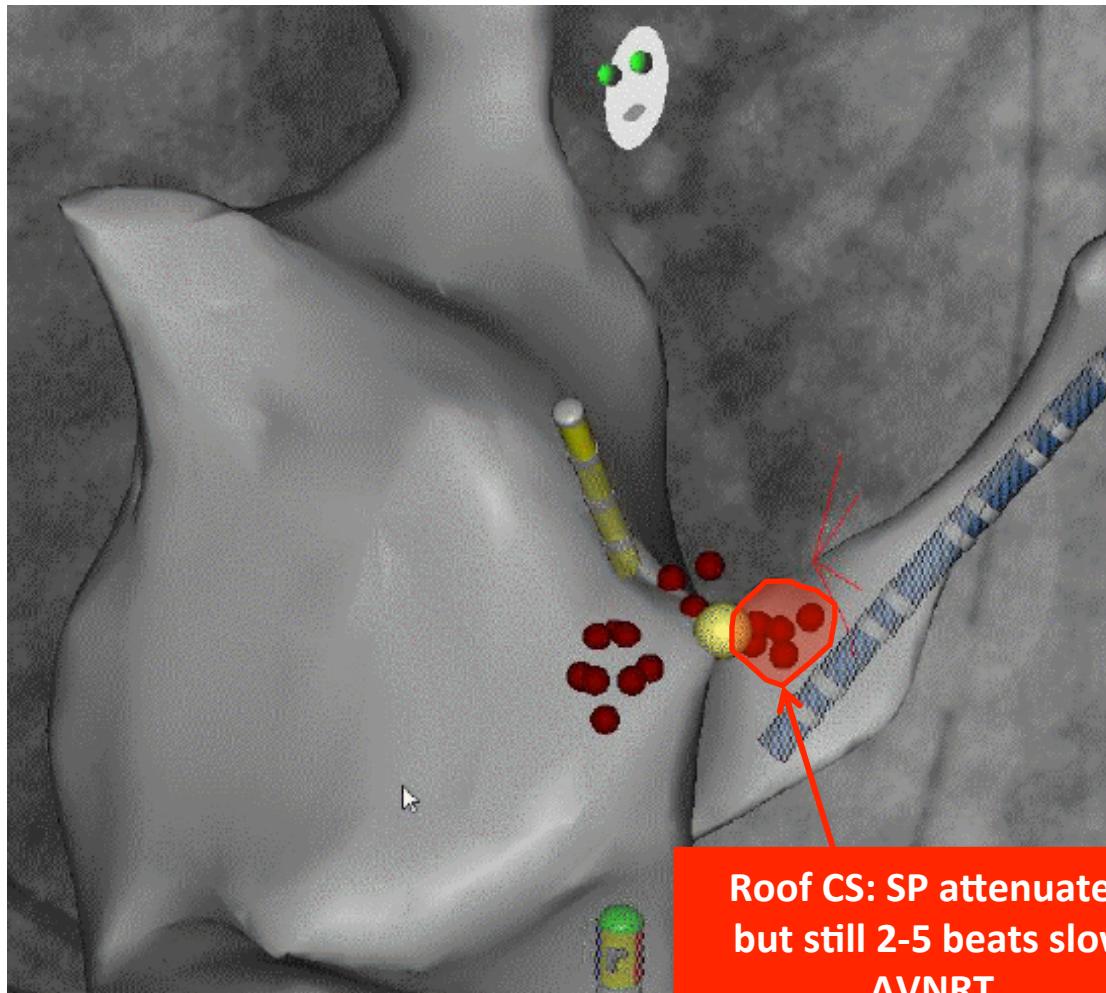
Ablation L-Extension SP



Ablation L-Extension SP



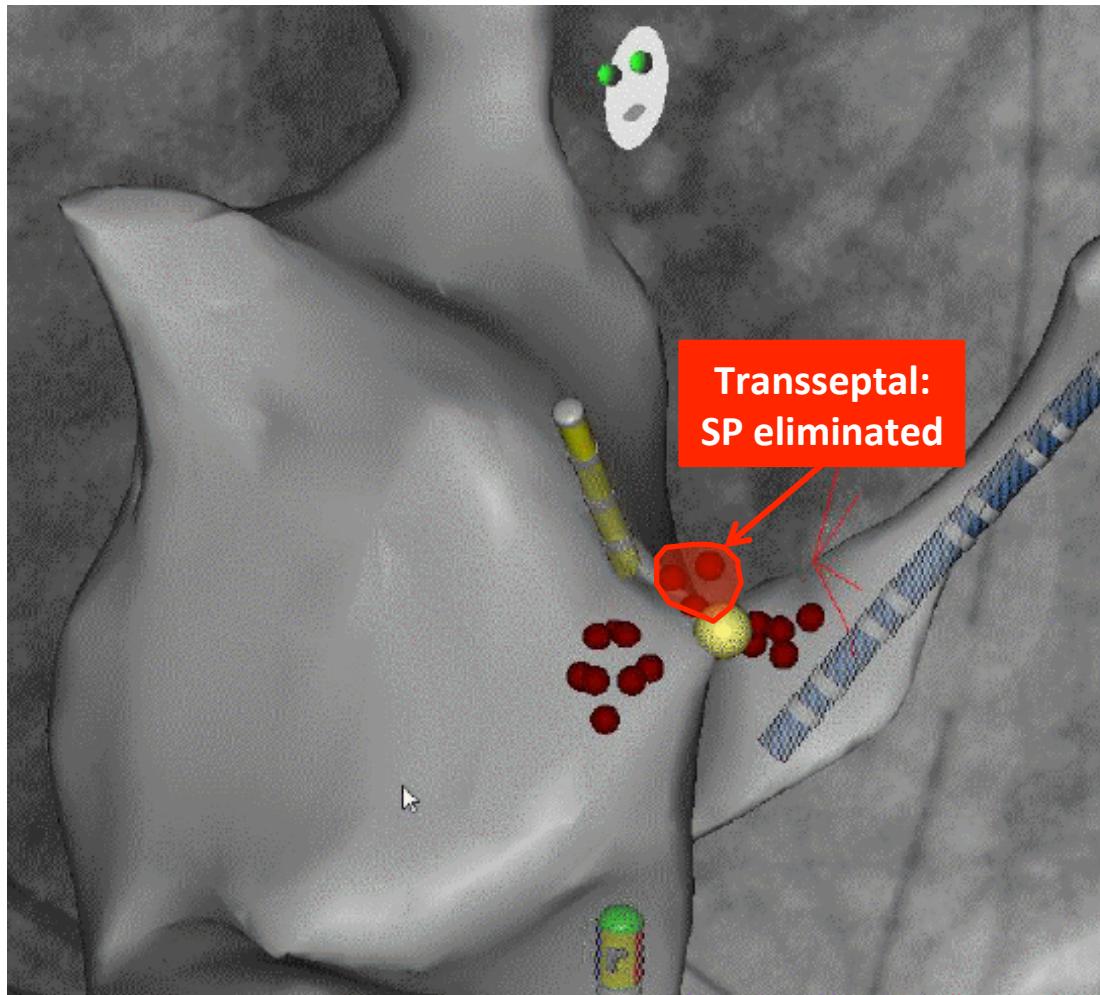
Ablation L-Extension SP



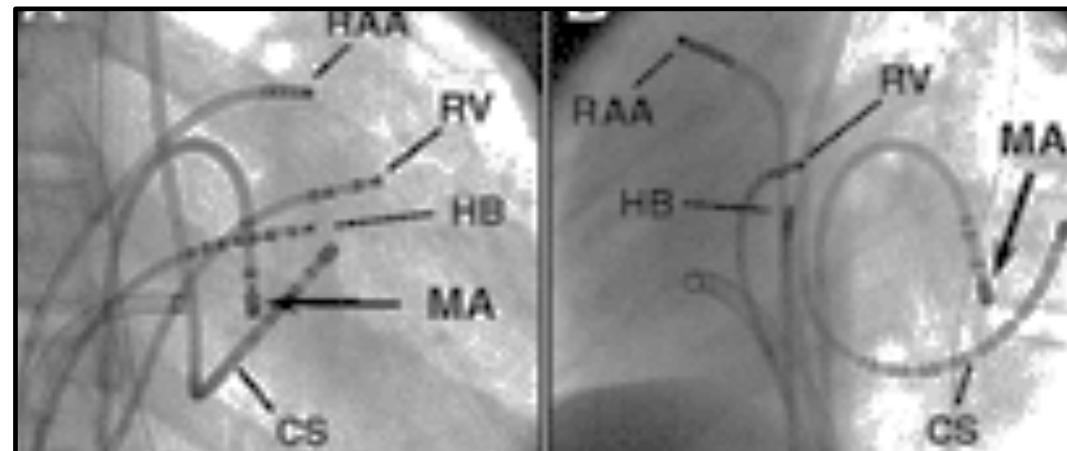
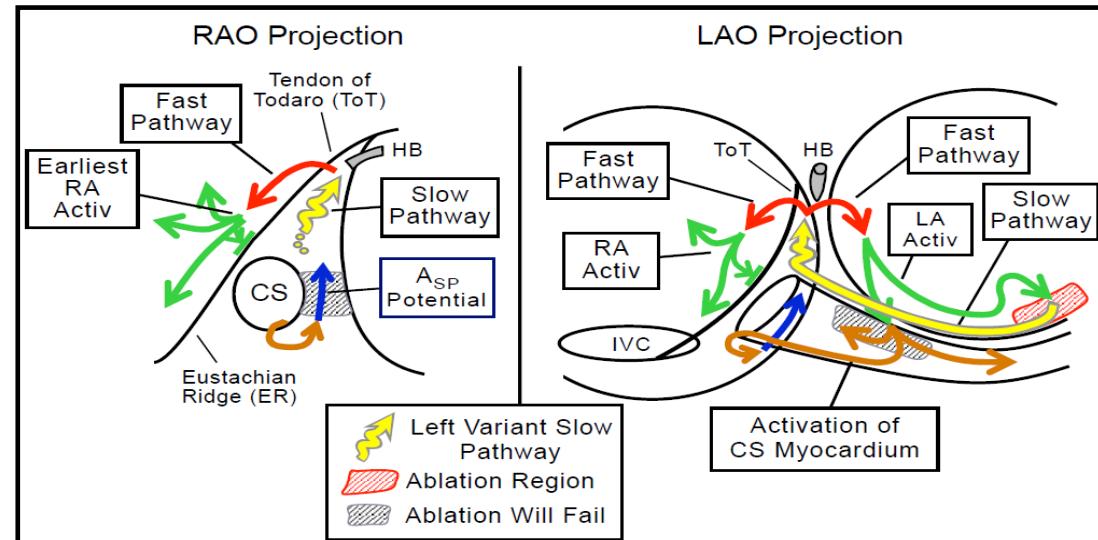
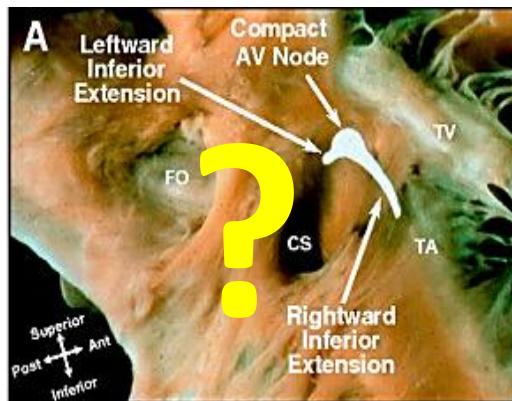
Ablation L-Extension SP



Ablation L-Extension SP

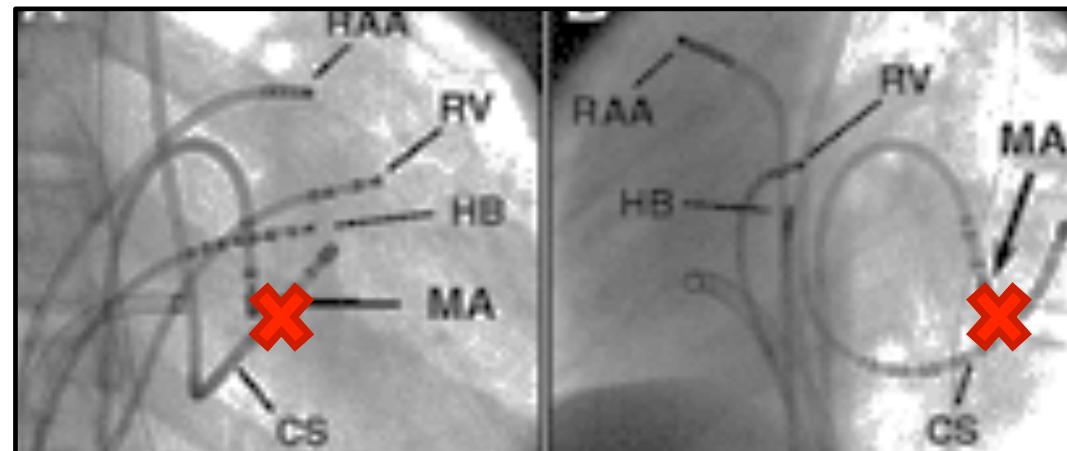
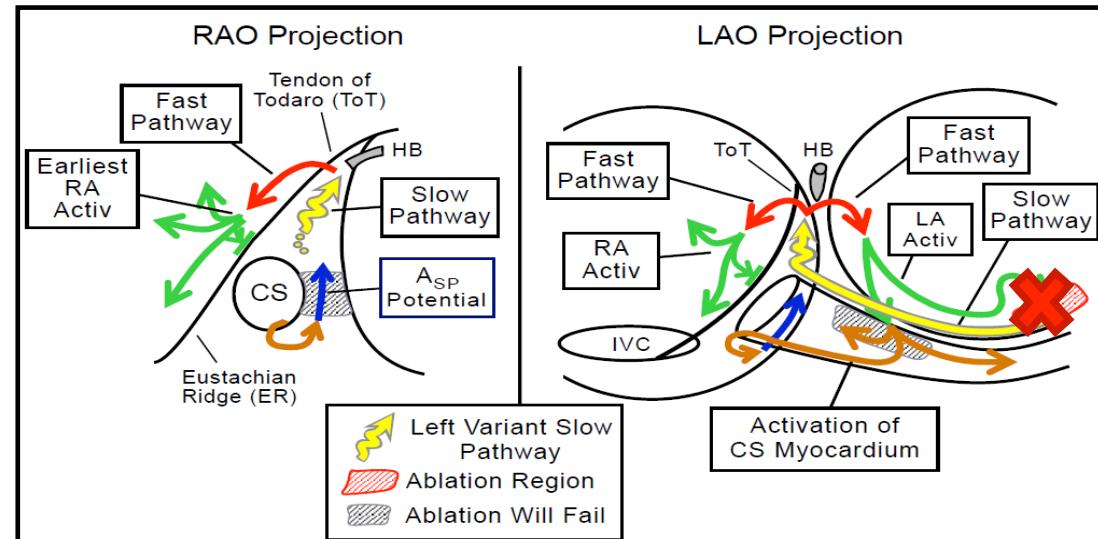
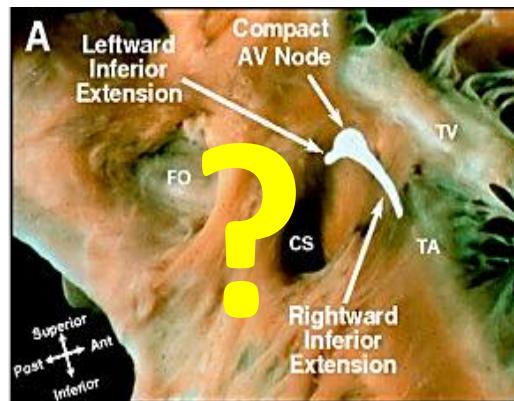


AVNRT (far-left SP..... ?CS musculature?)



Nakagawa and Jackman. Circulation 2007;116:2465-2478

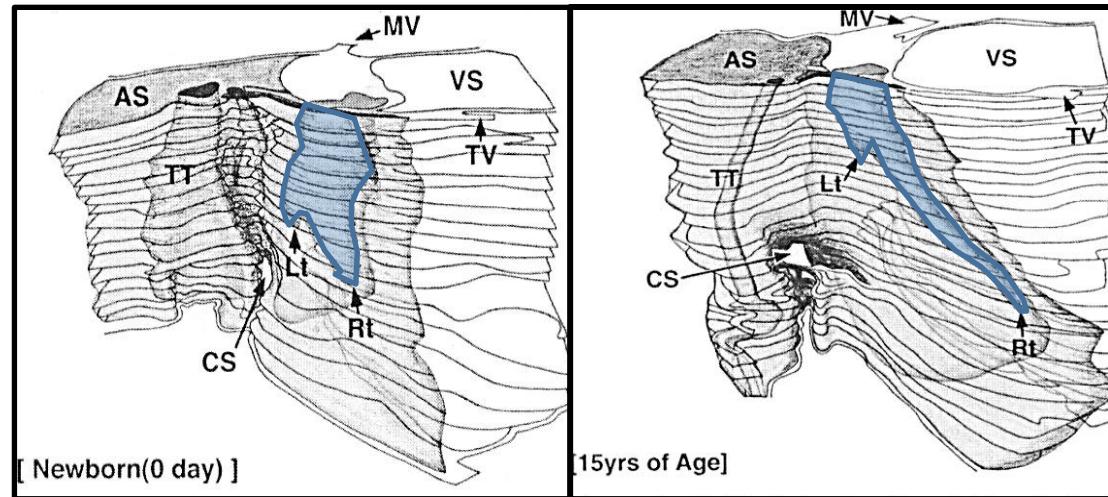
AVNRT (far-left SP..... ?CS musculature?)



Nakagawa and Jackman. Circulation 2007;116:2465-2478

Age Considerations: Maturational Changes in Nodal Extensions

	Compact Node	R-extension	L-extension	R-ext:Node
< 1 yr	1.6 <u>±</u> 0.4	0.6 <u>±</u> 0.3	0.3 <u>±</u> 0.4	0.4
1-12 yr	2.6 <u>±</u> 0.5	1.4 <u>±</u> 0.6	1.2 <u>±</u> 1.0	0.5
> 12 yr	3.5 <u>±</u> 0.8	3.3 <u>±</u> 1.8	1.5 <u>±</u> 1.0	0.9



Waki, Kim, Becker. JCE 2000;11:1144.

AVNRT in CHD

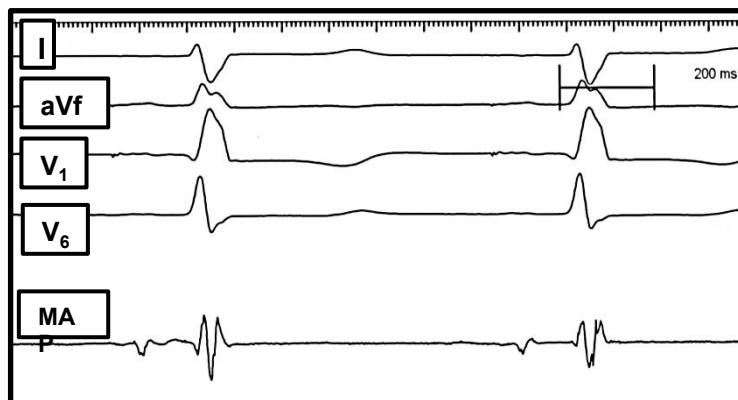
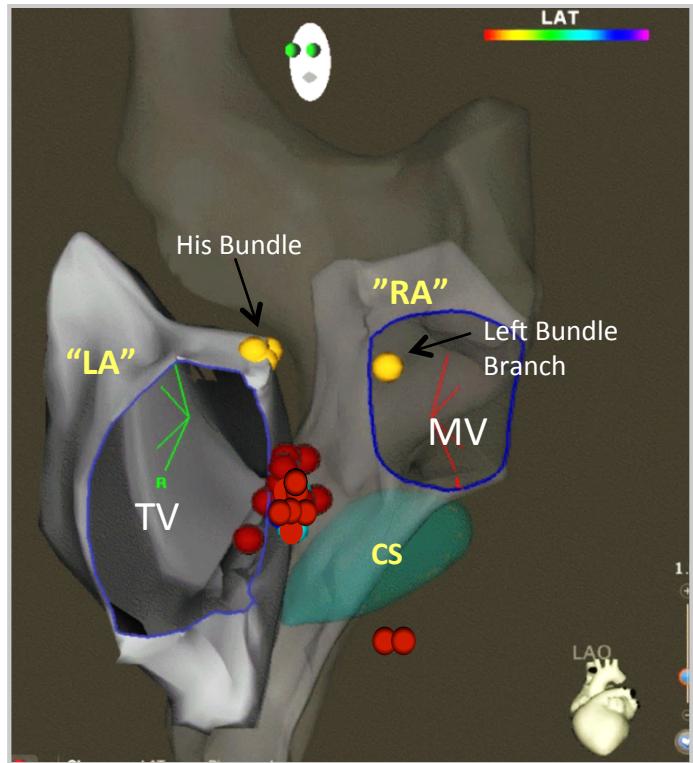
UNDERLYING ANATOMY	N=49
1. D-TGA status post arterial switch operation	N=6 (Mustard 3, Senning 3)
2. Physiologically corrected TGA	N=4(S'L'L 2;I'D'D 2)
3. Ebstein anomaly	N=4
4. Tetralogy of Fallot	N=5 (2 with TOF + Pulmonary Atresia)
5. Single ventricle	N=16
6. Venous anomalies	N=7 (LSVC 4, CSO atresia 1, TAPVR 1, PAPVR 1)
7.Others	N=7 (secundumASD, AS post Ross , Shone'scomplex 2, transitional AVCD, PS, DORV)

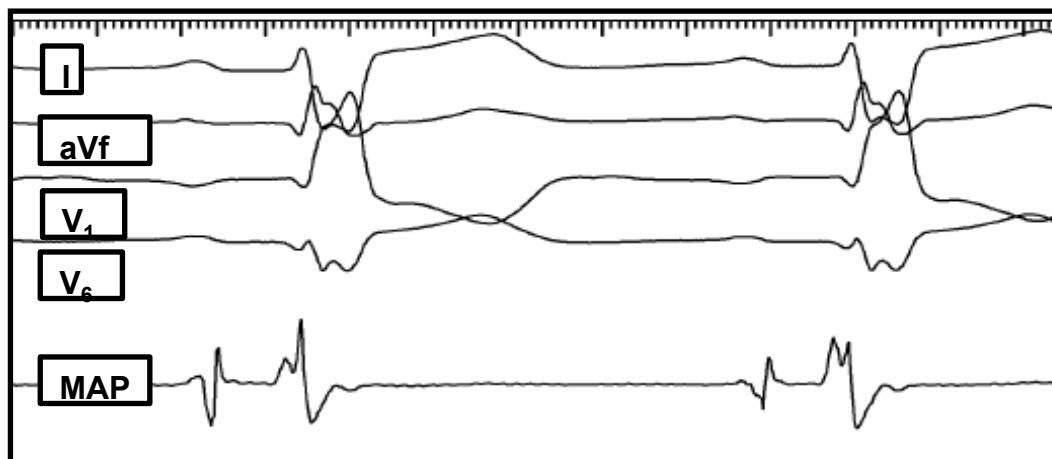
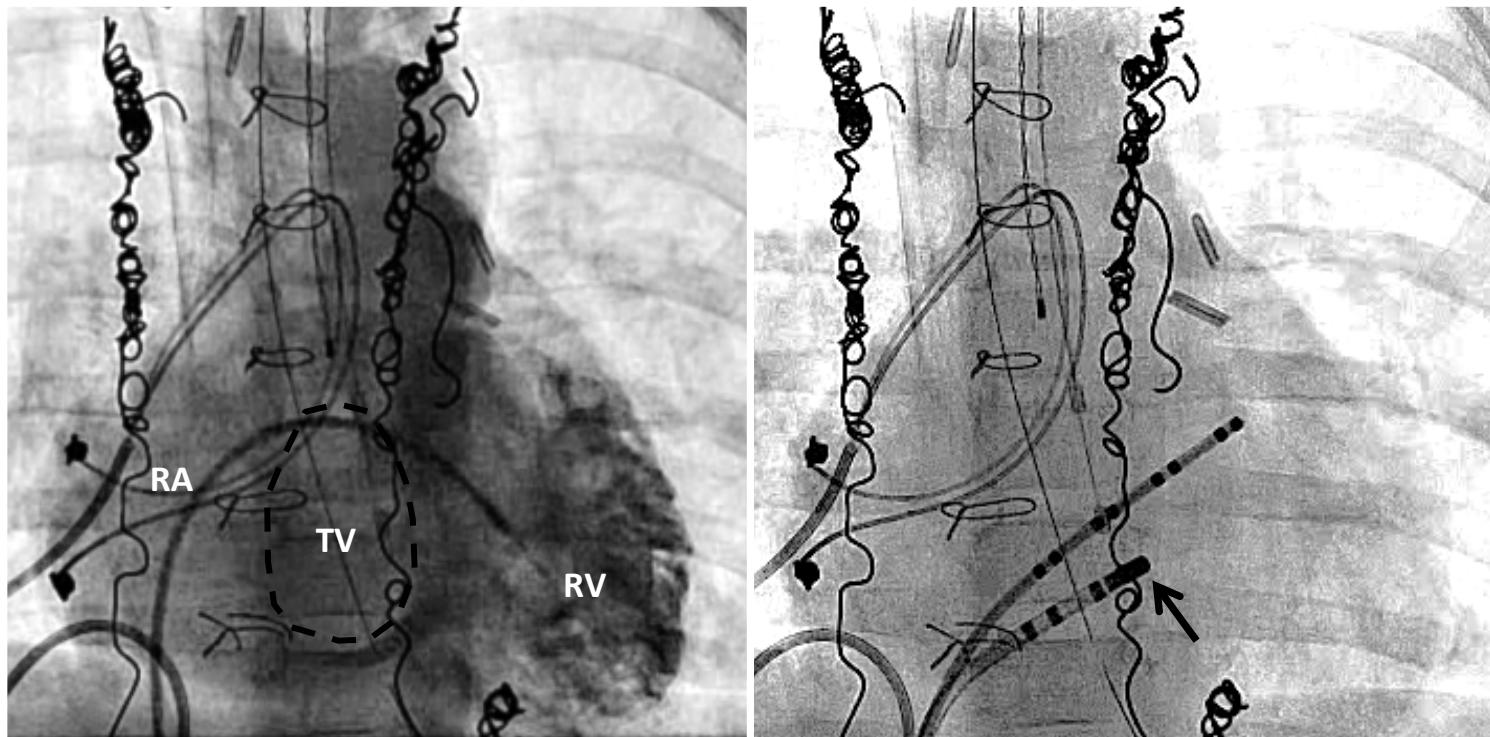
39 ablations:

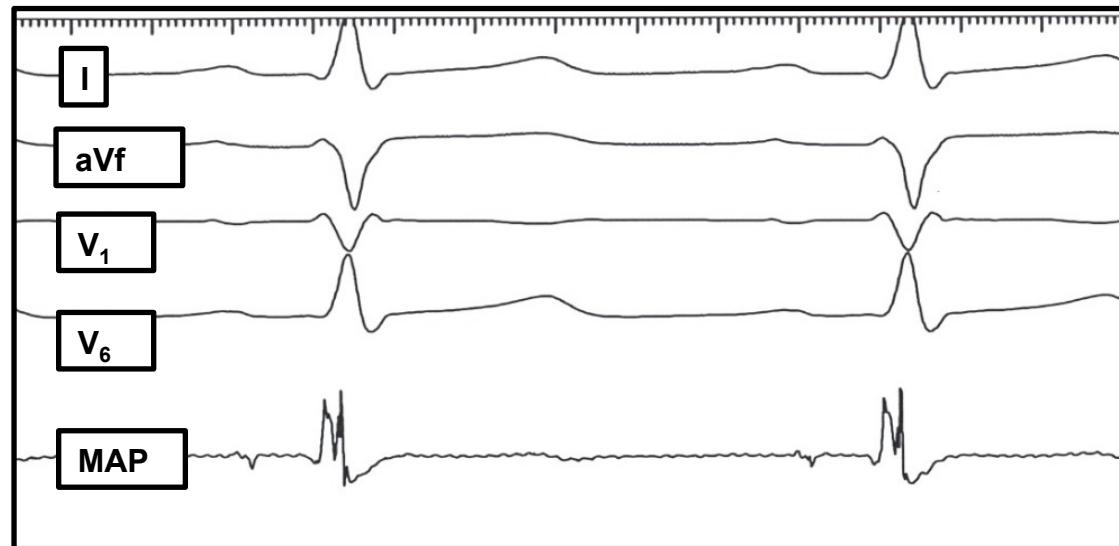
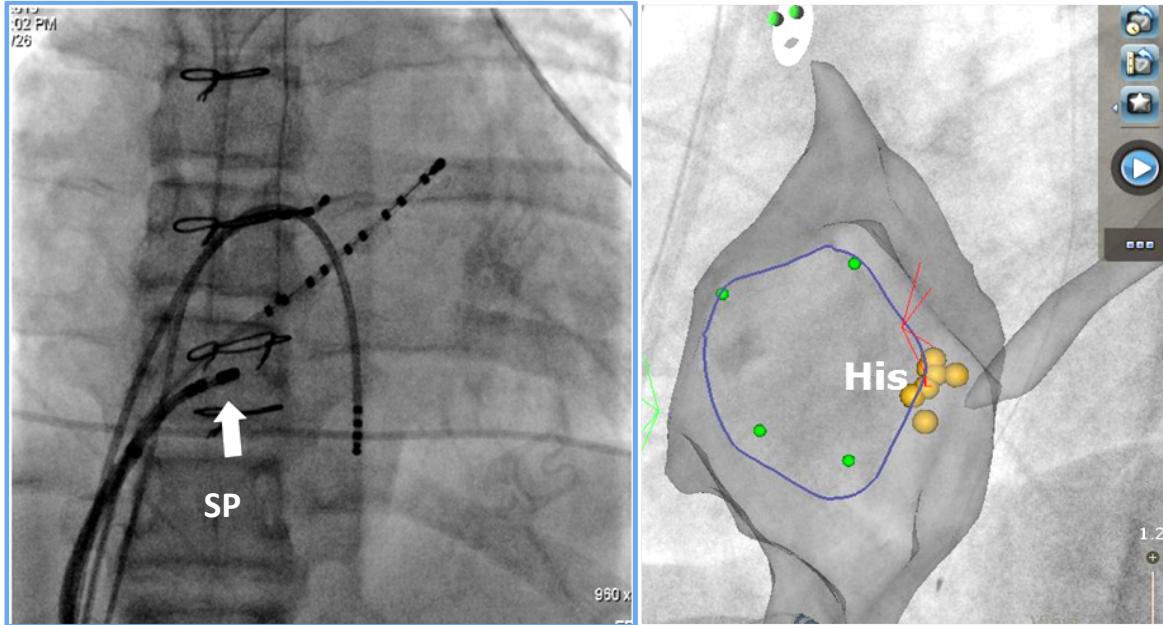
36 success (92%), recurrence (3%)

10 deferred:

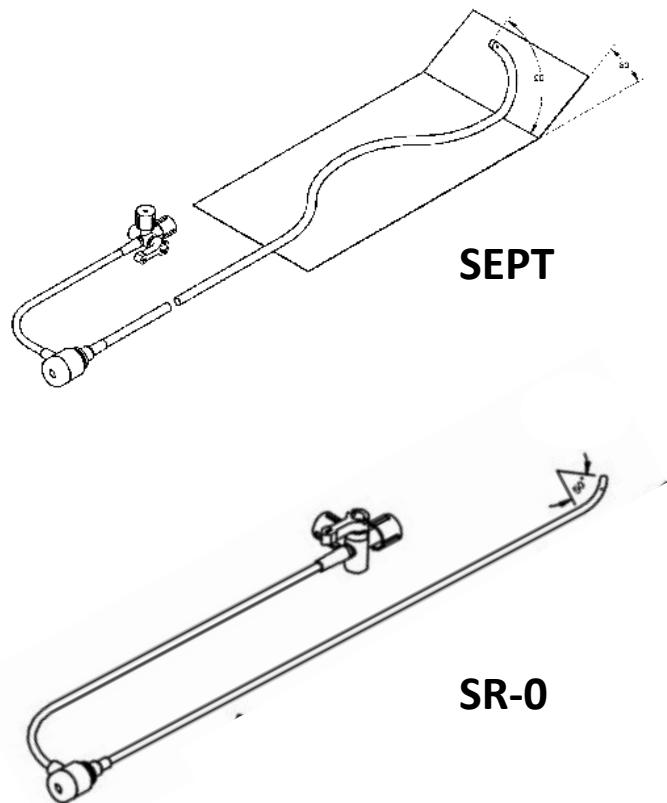
mostly single V with alternate SVT mechanisms







Improving Catheter Tip Maneuverability and Stability



Fixed curve long sheaths

Deflectable sheaths

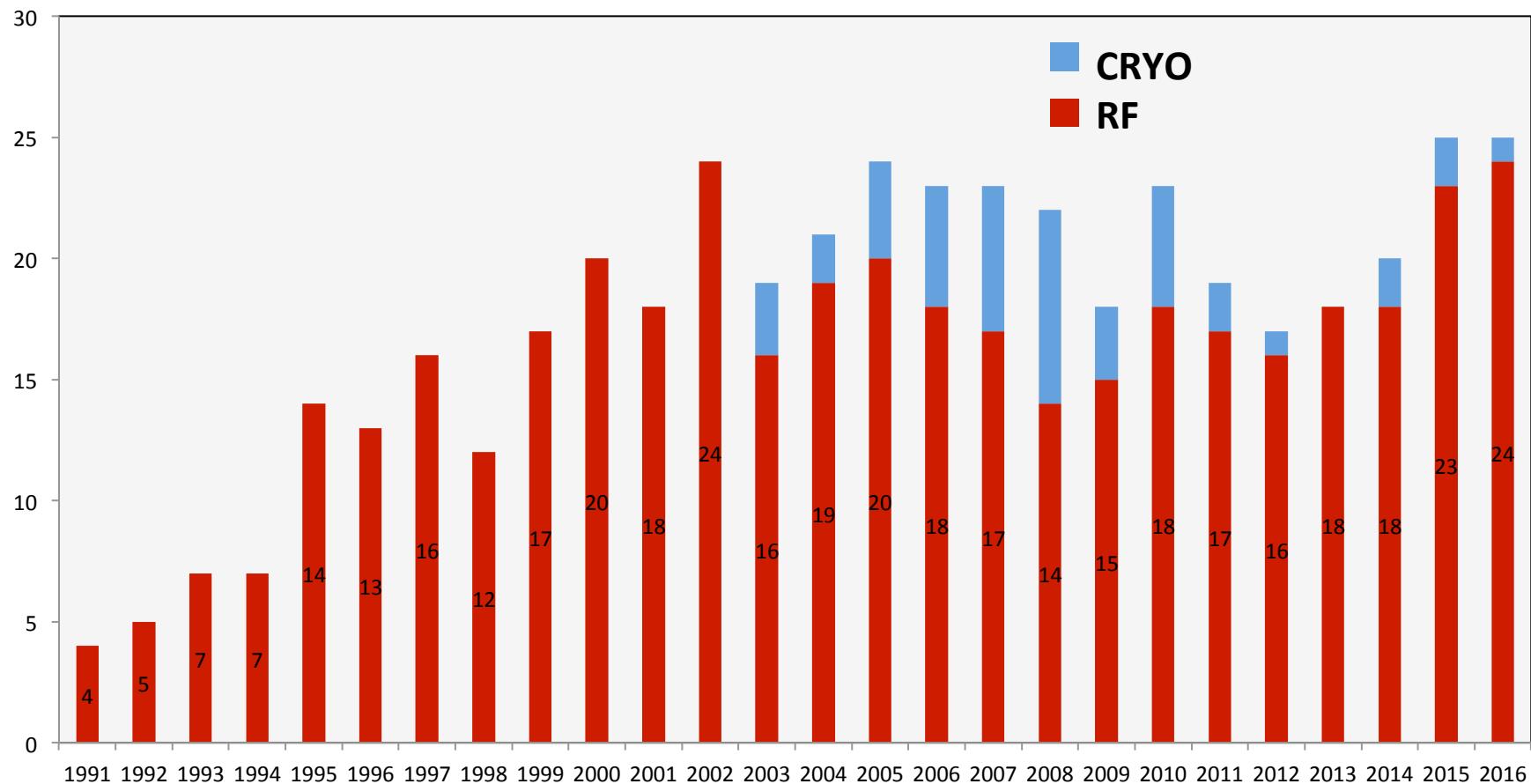
Held-ventilation (intubated)

Cryo-adherence

Stereotaxis

SP Modification for AVNRT : Personal Experience (n = 458)

All “Intention-to-treat” cases



Age 8mos-44yrs (m=11yrs)
CHD 26 (6%)
CRYO 43 (9%)

AVB 1st degree (cryo) 1
AVB 2nd degree -
AVB 3rd degree -

Acute Failure 2
Known Recurrence 7 (1.5%)
Final “Cure” 449 (98%)

Take-Away Messages from Clinical Experience

- SP modification is an excellent clinical procedure
 - Quick learning curve
 - Very good outcomes in general
 - Many tools will get the job done
- ~85% of AVNRT cases are relatively simple. For the remaining 15%, success demands focus on anatomy & biology, not technology.