Catheter ablation of SVT in complex congenital heart disease

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Complexity

- D-Transposition, Mustard/Senning
- Common ventricle variants

Groin : USG, angio

Complicated approach to target atrium:

1. Transaortic– not in mechanical AV valve
2. Buffle punctures (pulm vein atrium, common atrium
3. Transhepatic, Transpulmonary, Direct Classic Fontan

Fontan: Classic, Intra-Extra TCPC

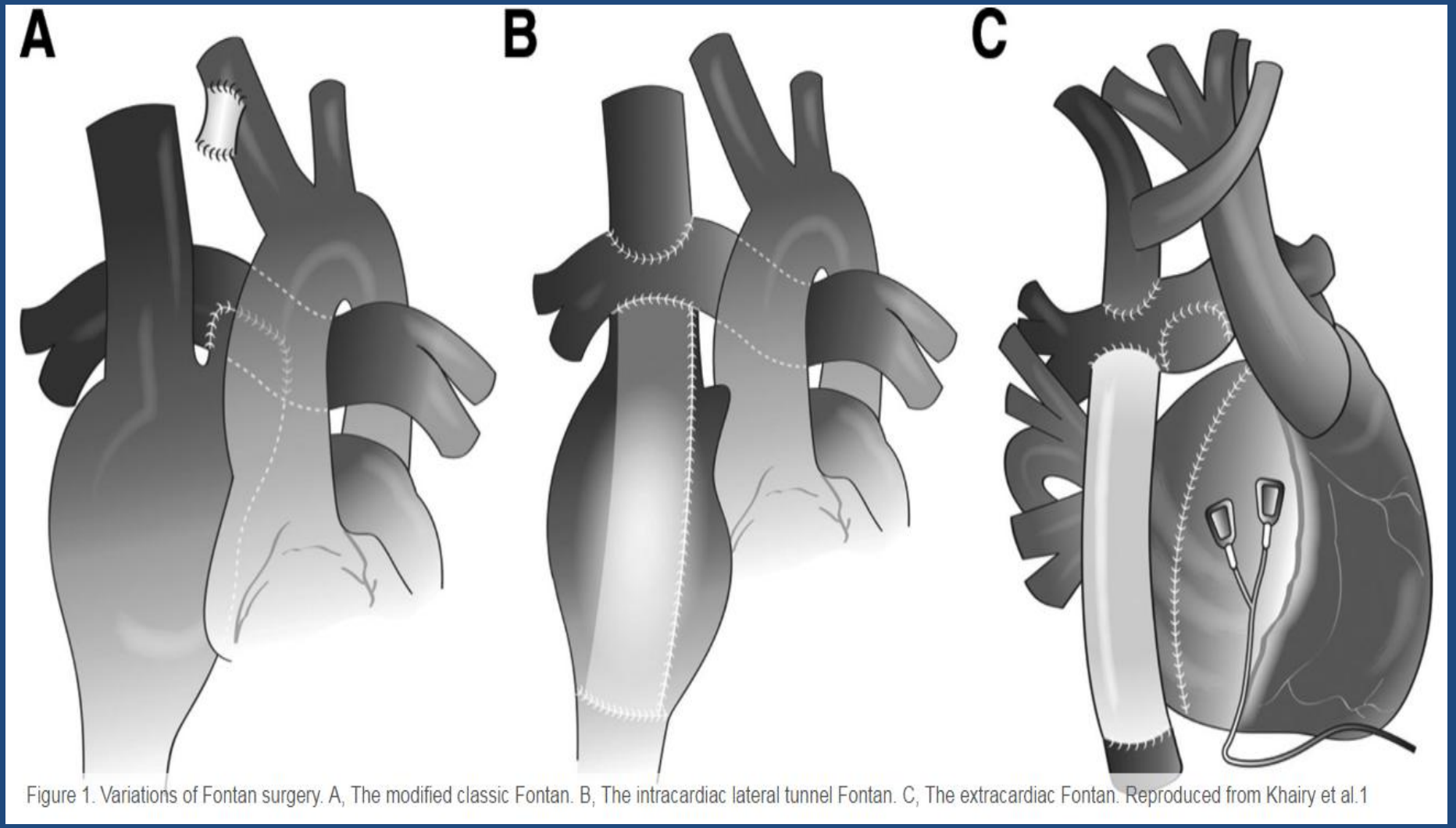
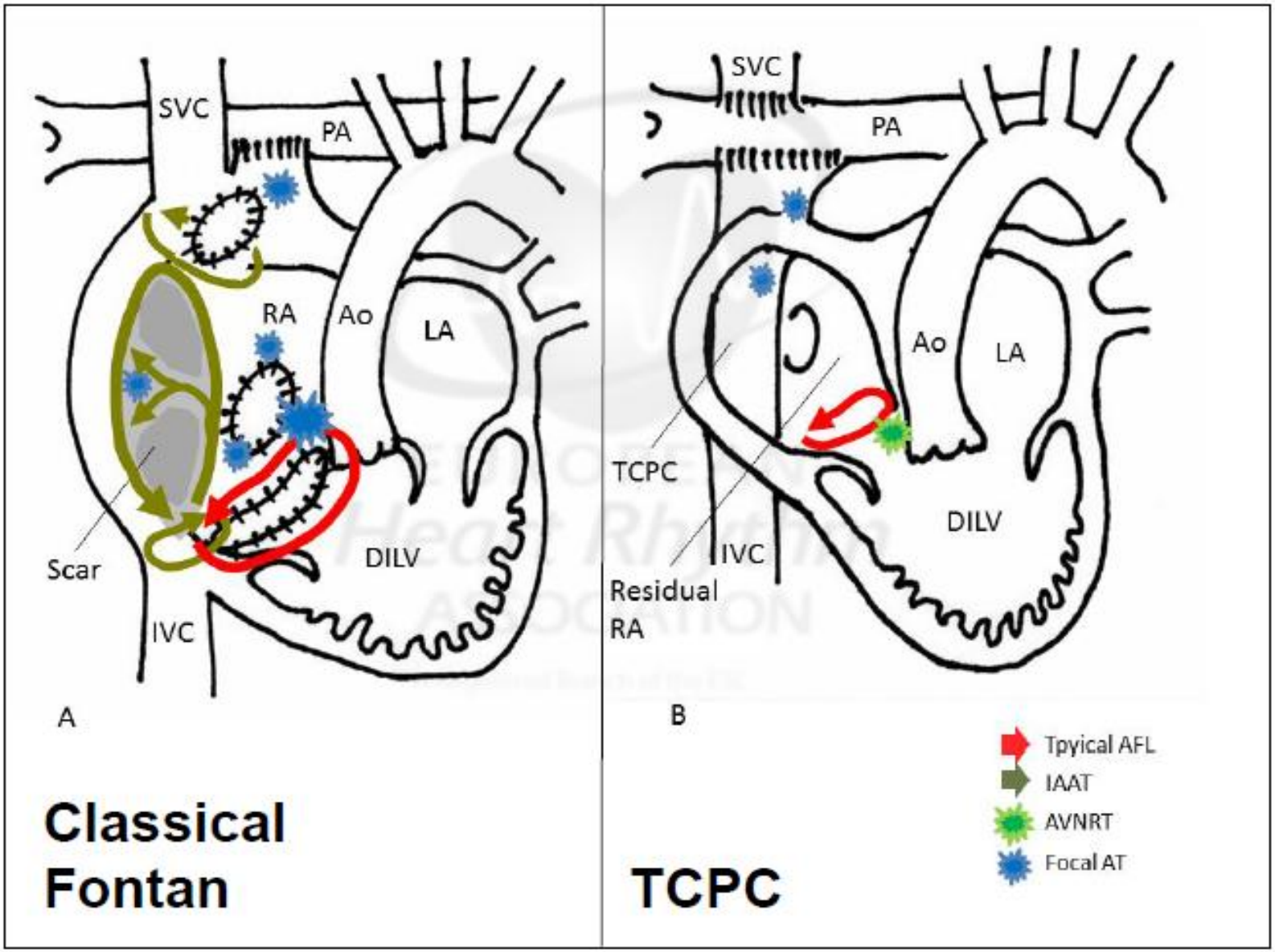
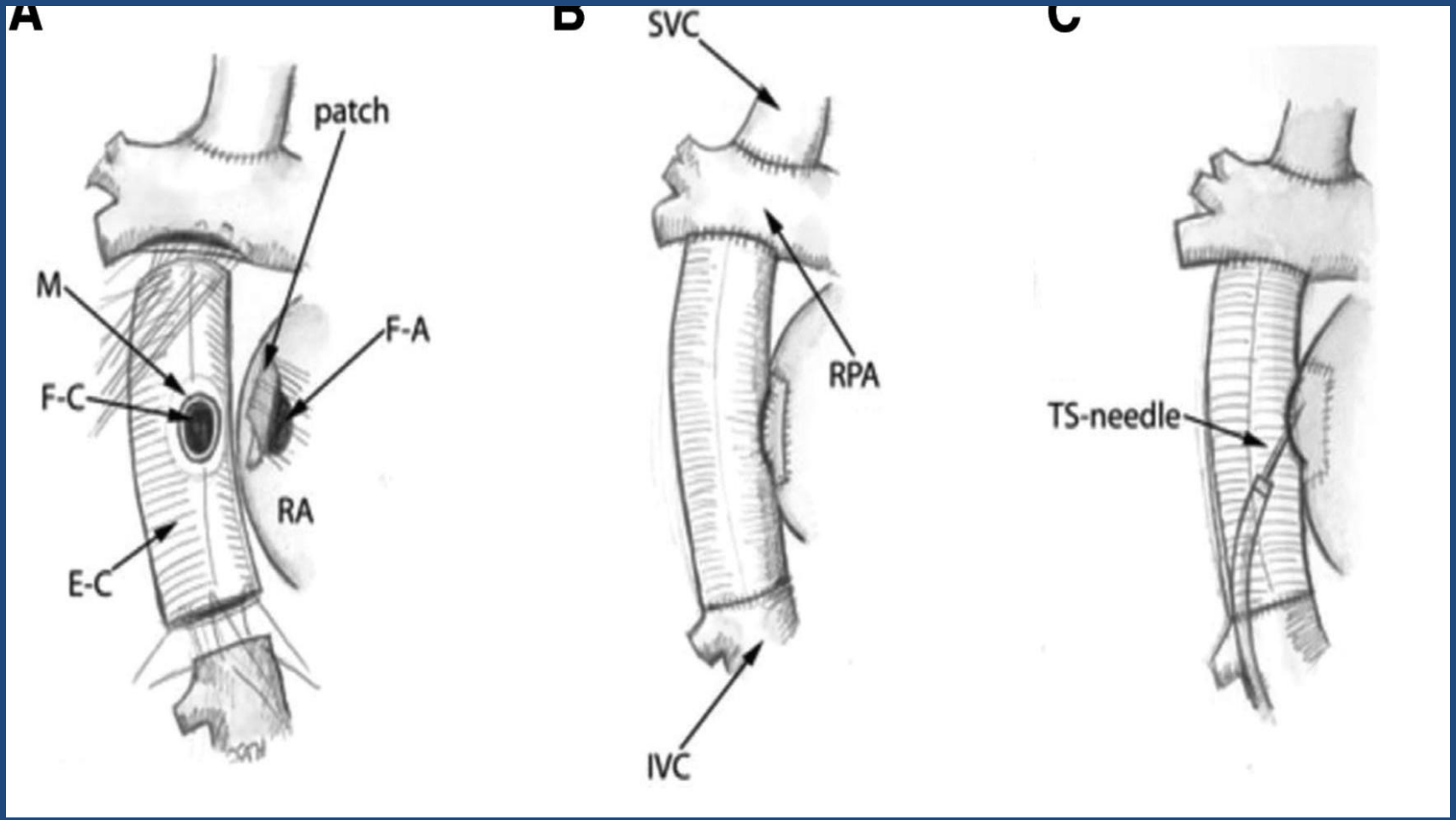


Figure 1. Variations of Fontan surgery. A, The modified classic Fontan. B, The intracardiac lateral tunnel Fontan. C, The extracardiac Fontan. Reproduced from Khairy et al.1



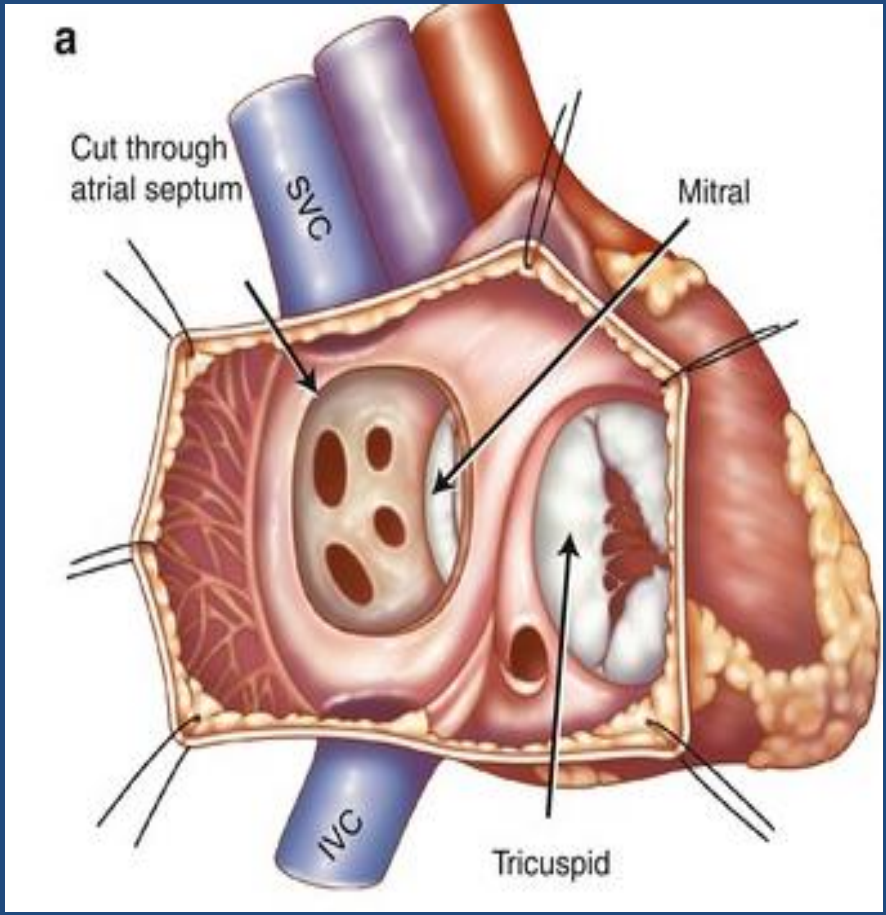
Adapted from S.Ernst, EHRA 2016

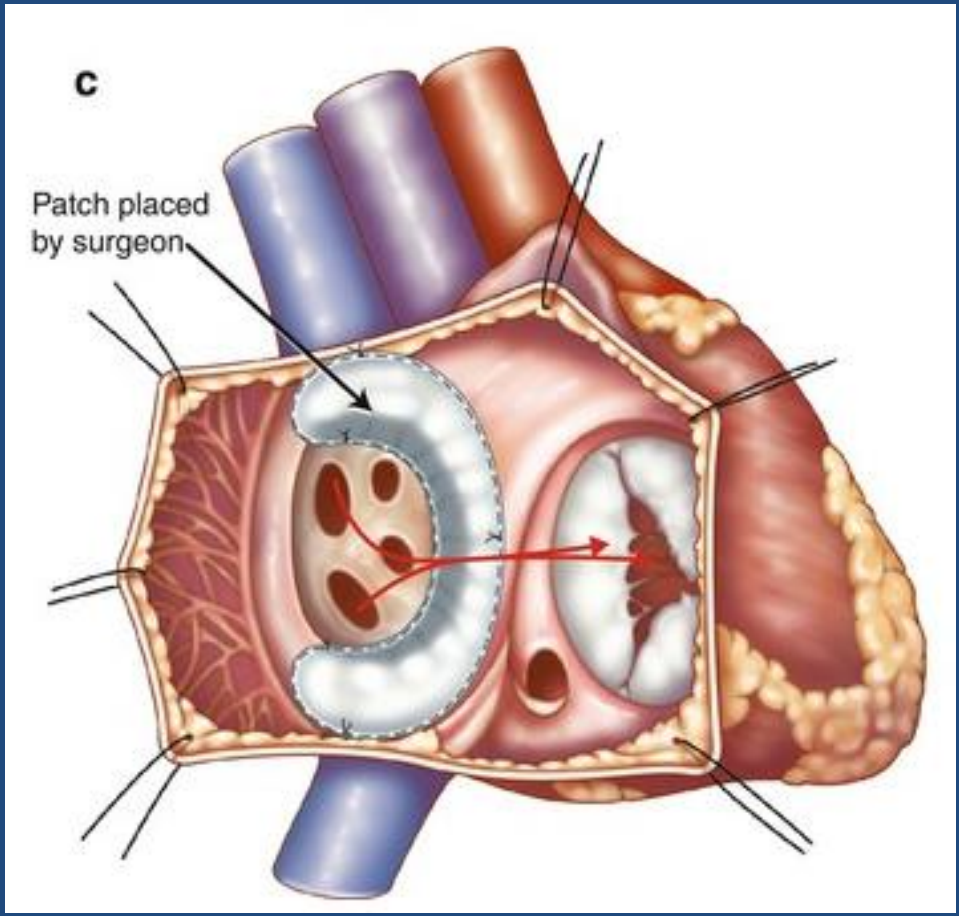
Extracardiac TCPC



Paul Khairy, and Nancy Poirier Circulation. 2012;126:2516-2525

D-transposition: Mustard-Senning





AT by surgery correction

d-TGA - *Mustard/Senning*	• AT (FAT / IART / AFlutt)	≥ 30 % *Warnes Circ 2006; 114:2699-2709* *Kammeraad et al JACC 2004; 44:1095-1102*
Fontan „*classic*“	• ART in Fontan RA • ART in PVA • A Fib	30–50% (5 yrs f.u.) *Deal B, Circulation July 30 2002*
Fontan „*classic*“	• ART (in PVA)	75% *Deal B, Ped. Cardiol. Nov-Dec 28 2007*
„Modern Tunnel“	• late SVTAs	17 % *(5 yrs. fo.-up.)* *Durongpisitkul; Circ.1998; 15/98:1099-107*
	• A.tachy	9.6% *(8.5 yrs. fo.-up.)* *Blaufox; J Thor Cardiovasc Surg. 2008; 136(1):100-7*

Adapted from J. Hoebe, EHRA 2016

ACHD registry n=38.428 pts , AT v.s. nonAT

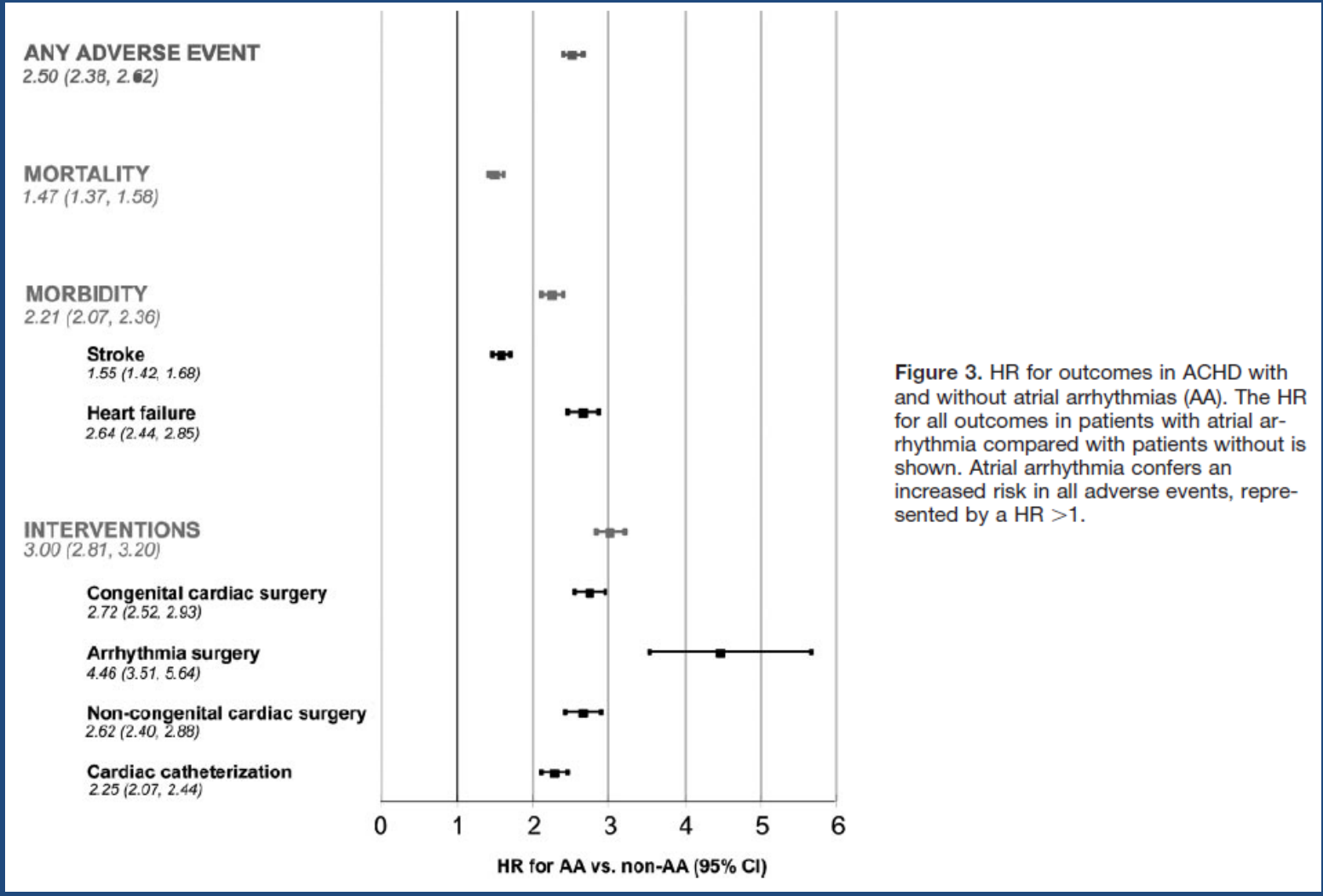


Figure 3. HR for outcomes in ACHD with and without atrial arrhythmias (AA). The HR for all outcomes in patients with atrial arrhythmia compared with patients without is shown. Atrial arrhythmia confers an increased risk in all adverse events, represented by a HR >1.

Circulation. 2009;120:1679-1686.

SVT complex: our approach

18x remote magnetic navigation

4x manual EA mapping

17x transaortic (Fontan, Senning, Mustard)

4x buffle puncture (Mustard/Fontan)

1x transhepatic (IVC discontinuita-Fontan)

1x Classic Fontan

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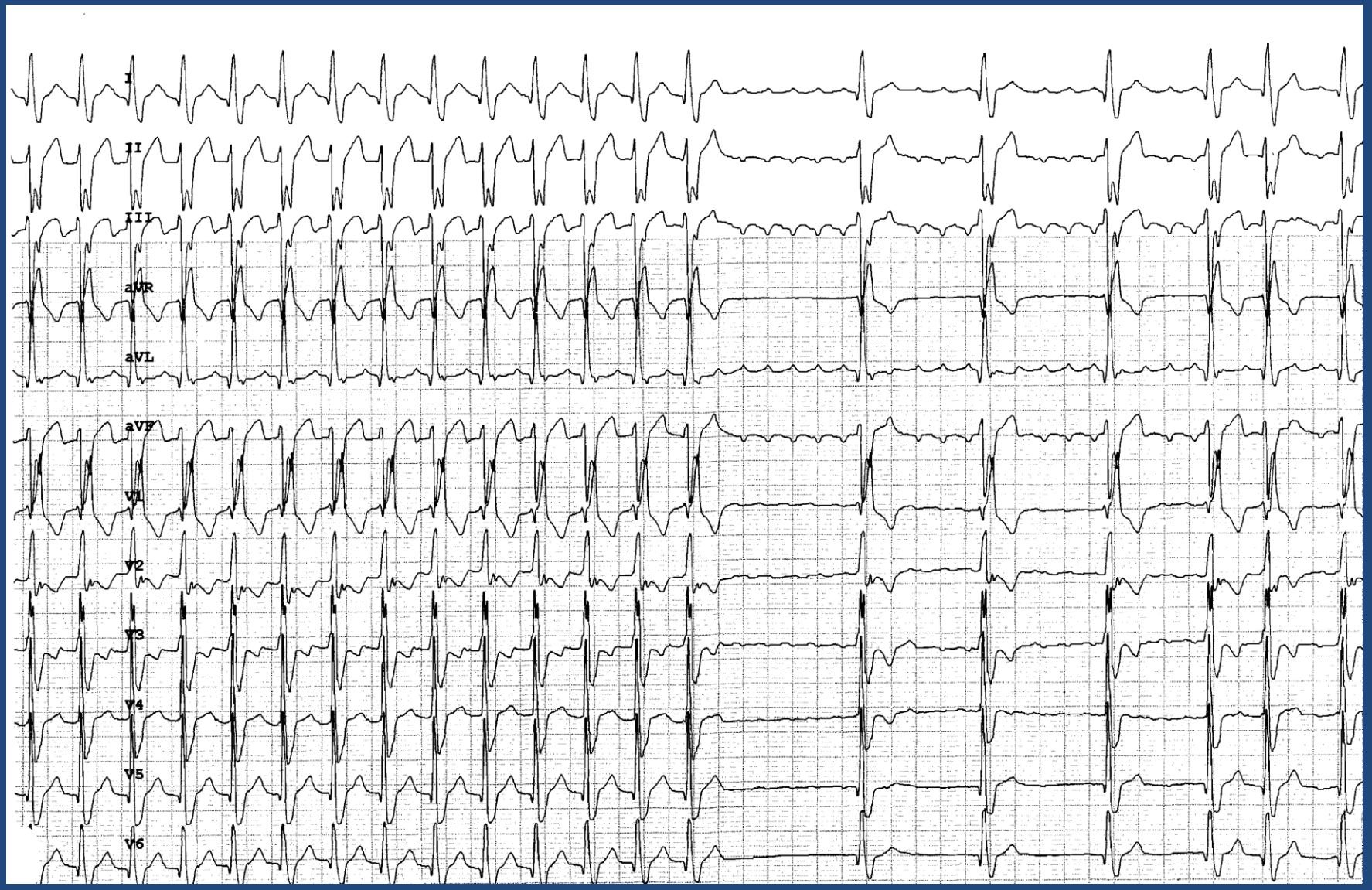
Case 1

- 35 M trikusp. atresia, common ventricle
- BTsin connection
- 7r Fontan Dotty (RAA - PA)
- 19r intraartrial TCPC, MVP ring

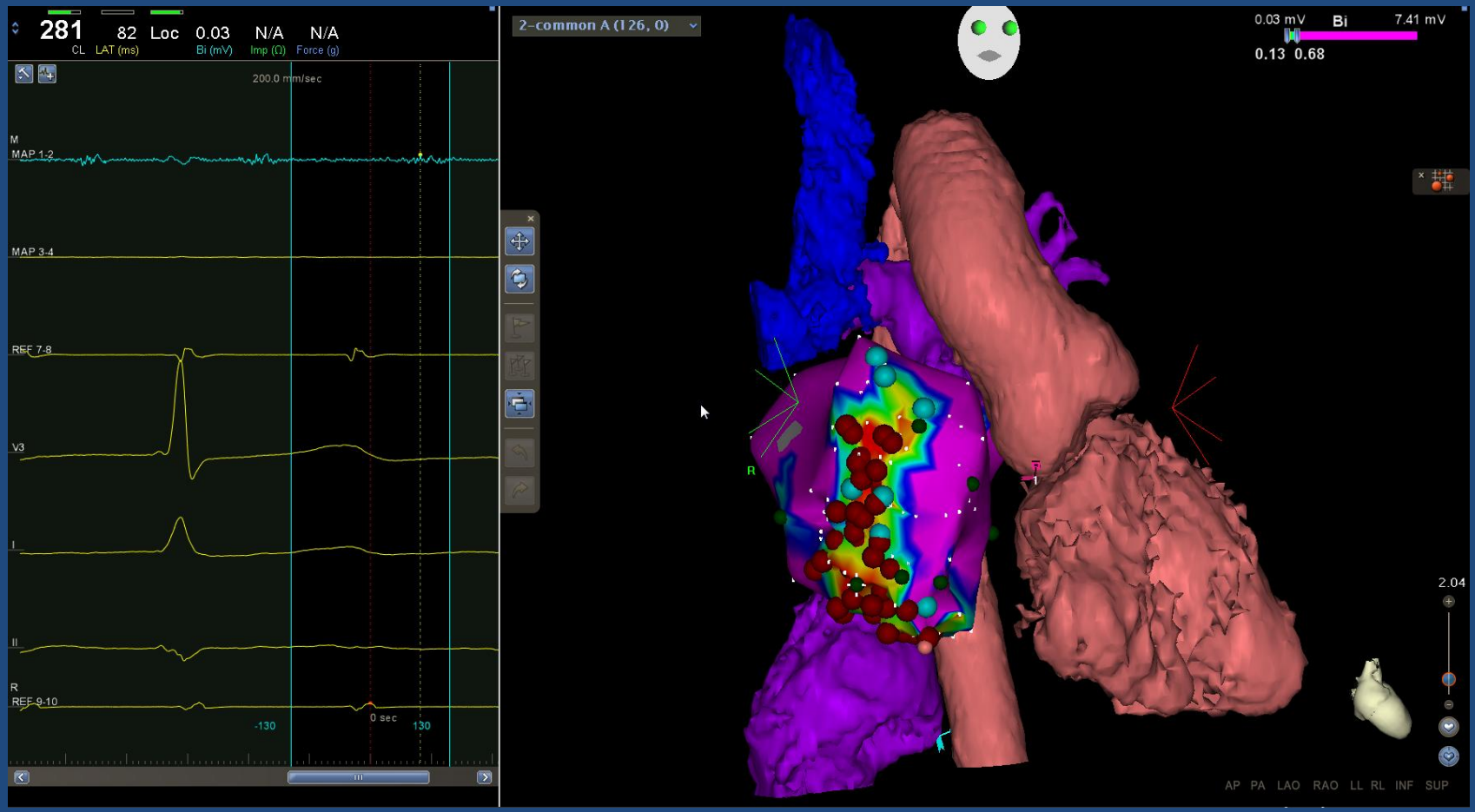
progressive AT ventic. response 170-200min

Carvediol, propafenon, sinus. bradycardia

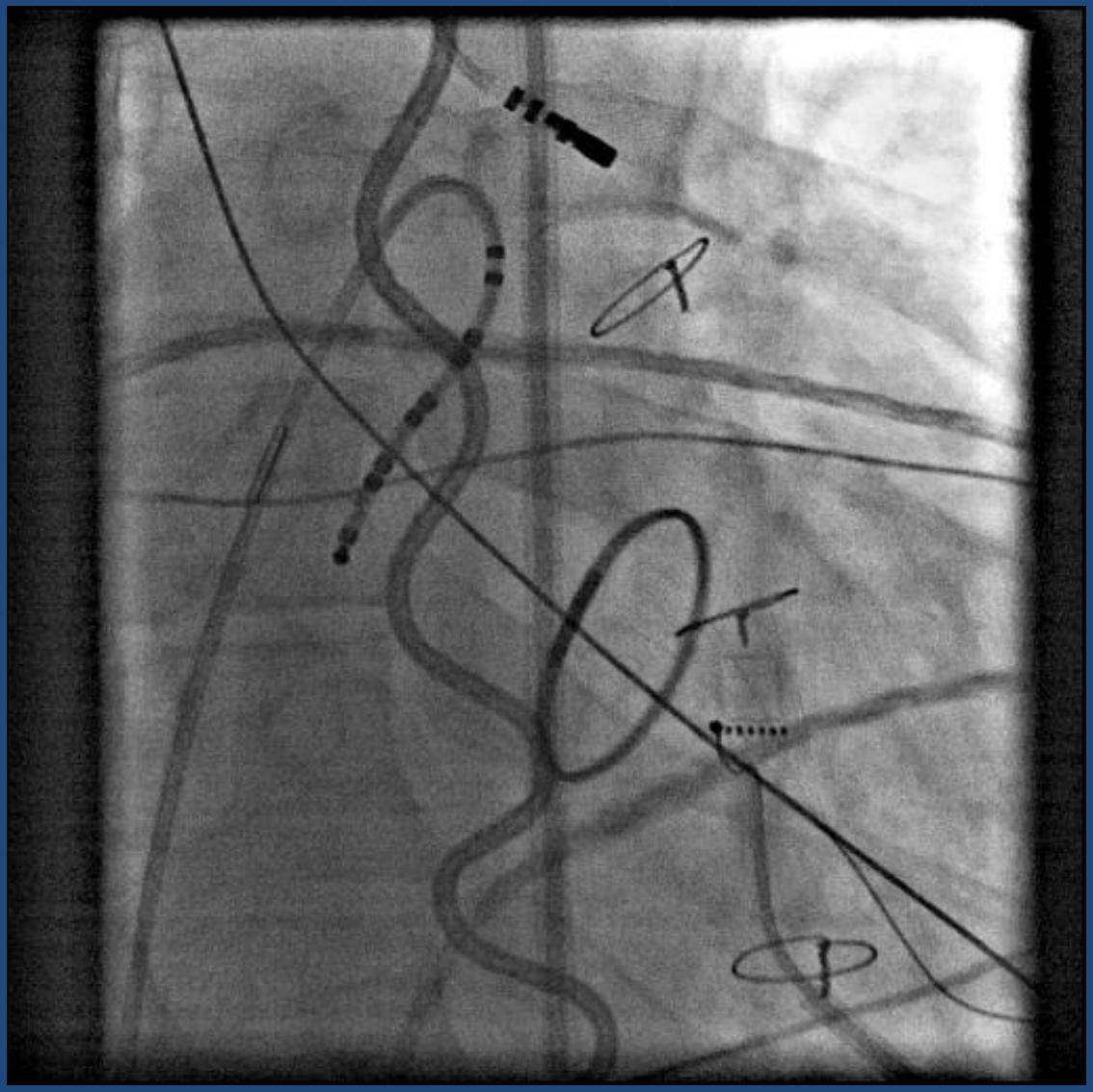
Intratrial TCPC



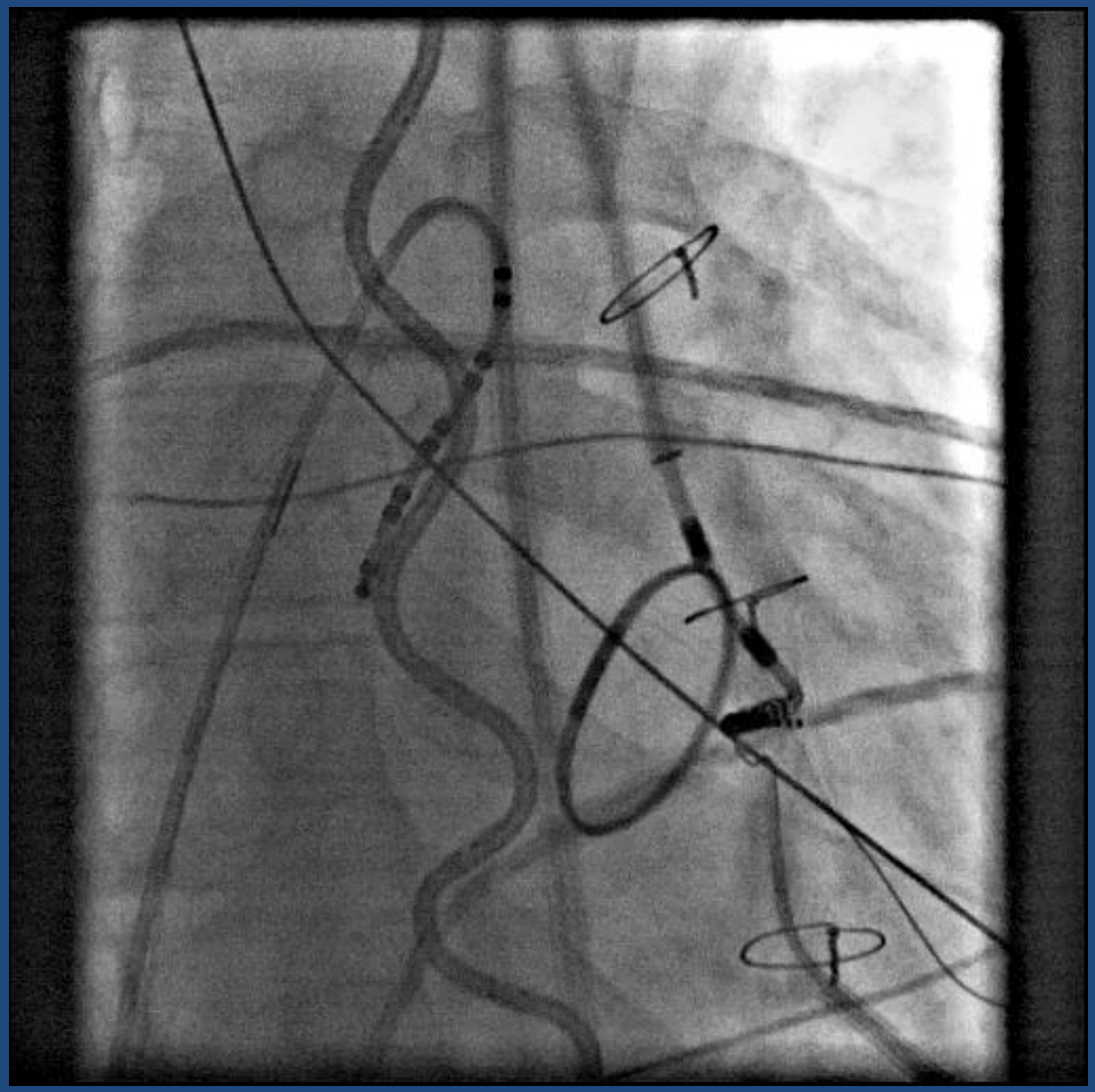
Intraatrial TCPC



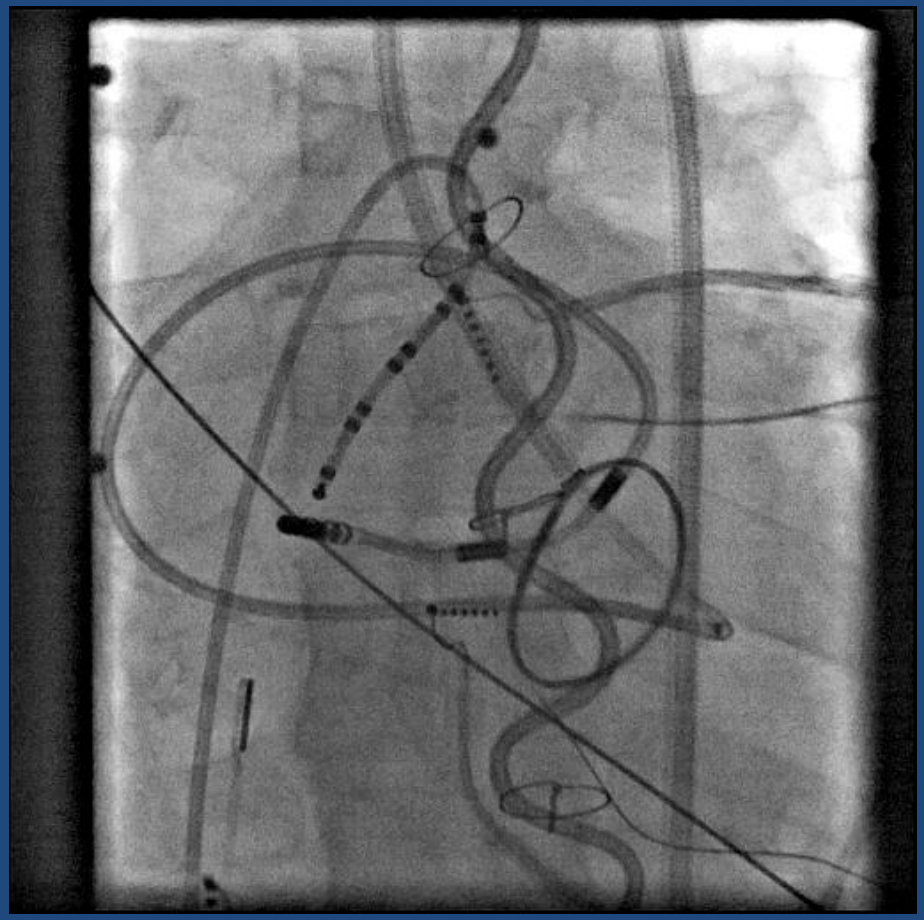
Intra-TCPC, transaortic approach

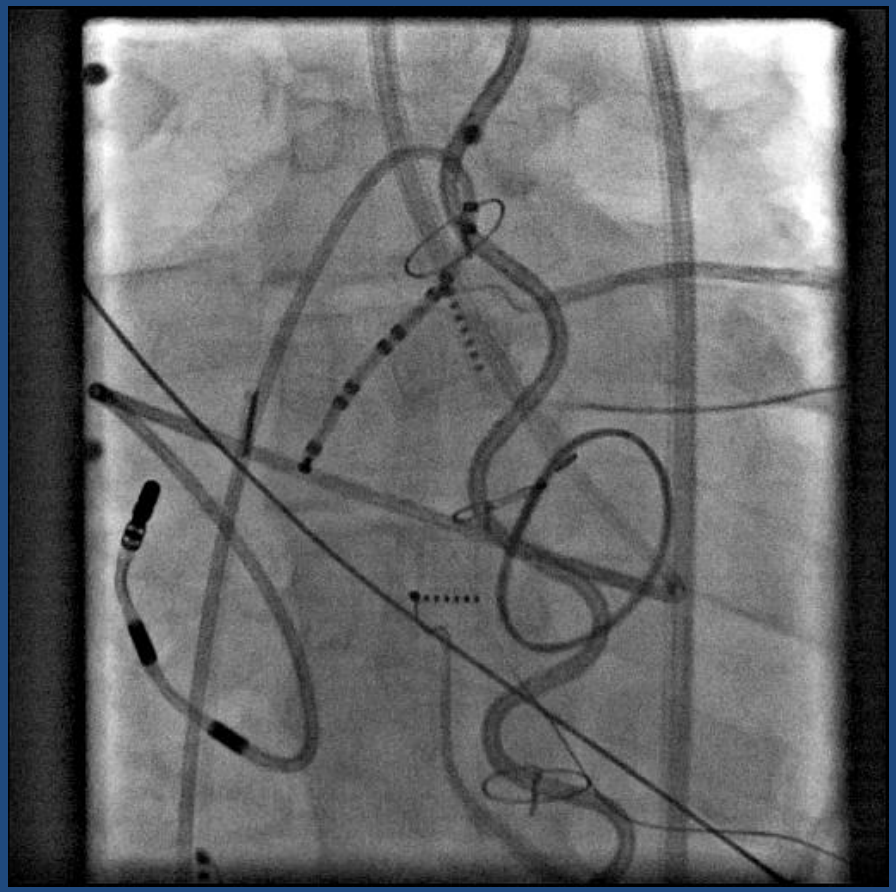


Intra-TCPC, transaortic approach



Fontan TCPC transaortálně IART





Fontan TCPC transaortálně IART

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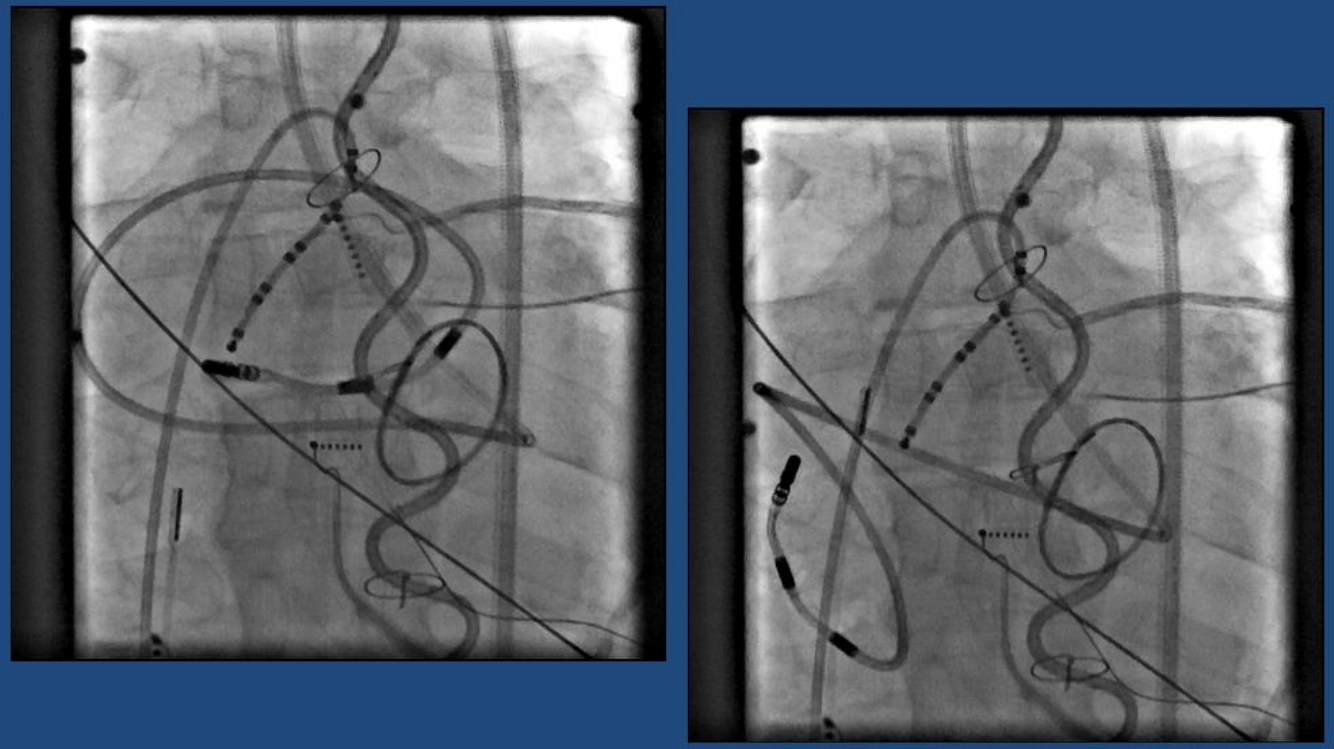
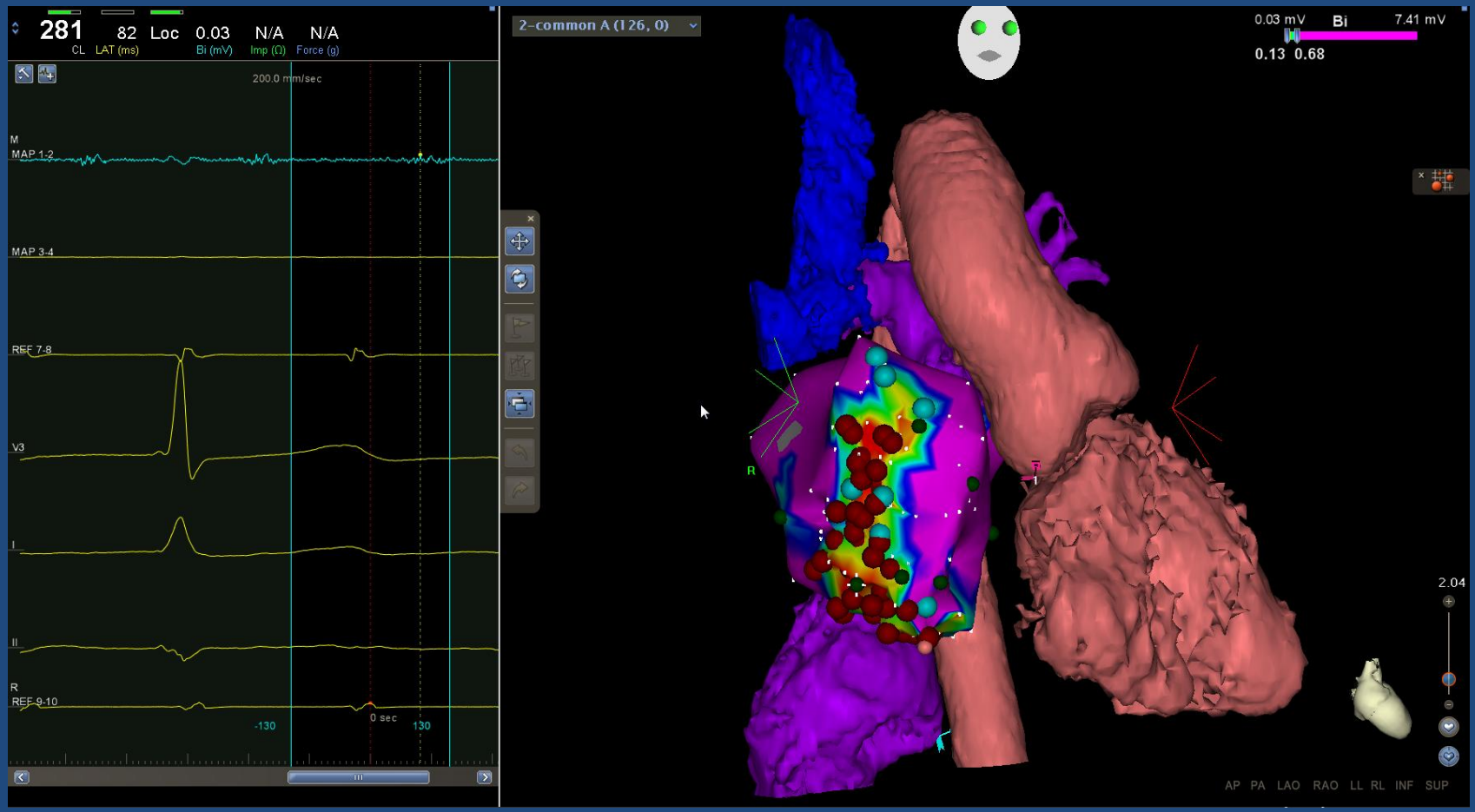


Intra-TCPC, transaortic approach



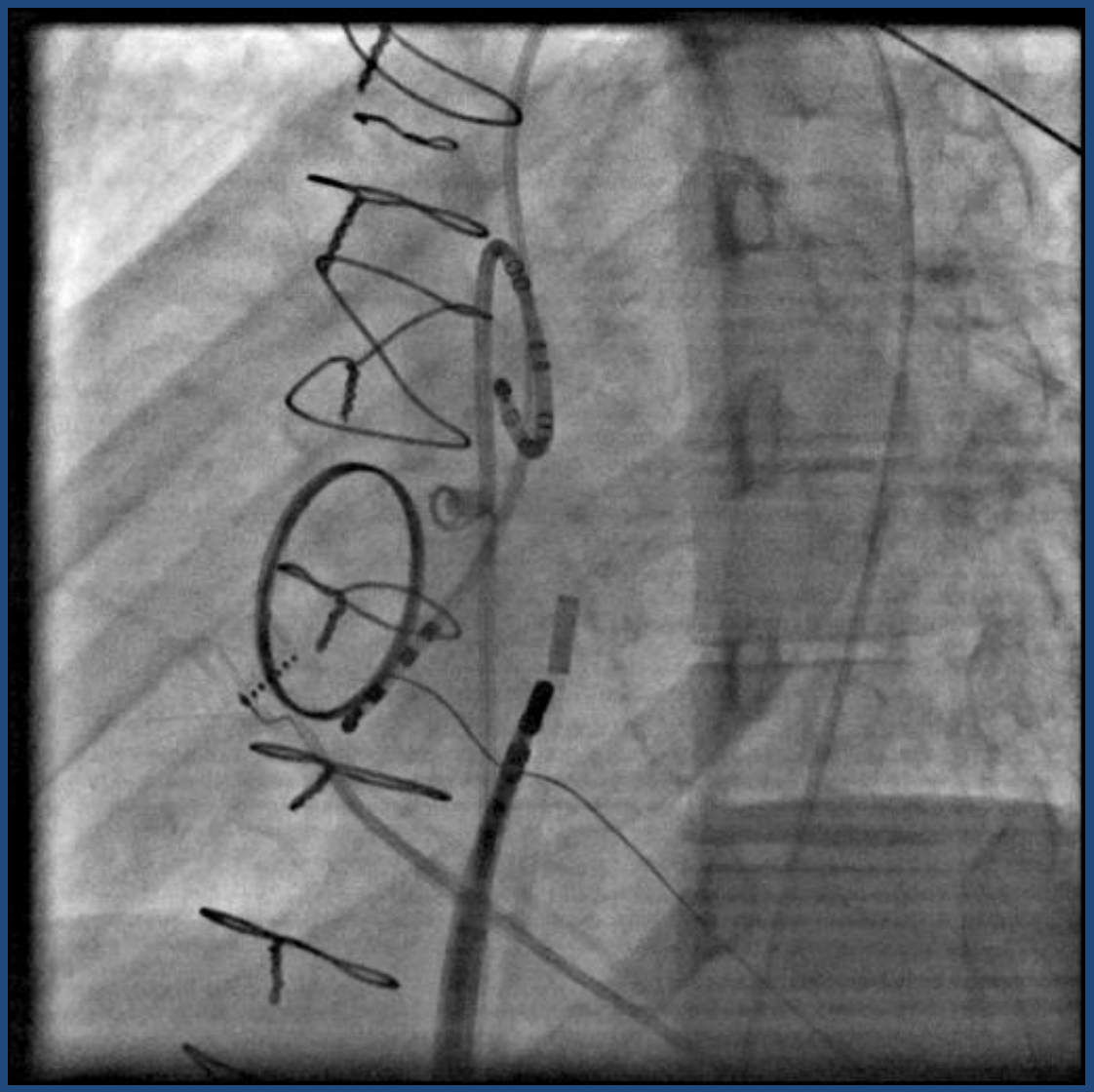
Case 2: Intra- TCPC mechanical AV

- 25y/o/f
- Dextrocardia, dextroisomerism
- DORV common ventricle, complete AV septal defect
- Left persistent SVC , Total anomalous pulm veins to right RA,

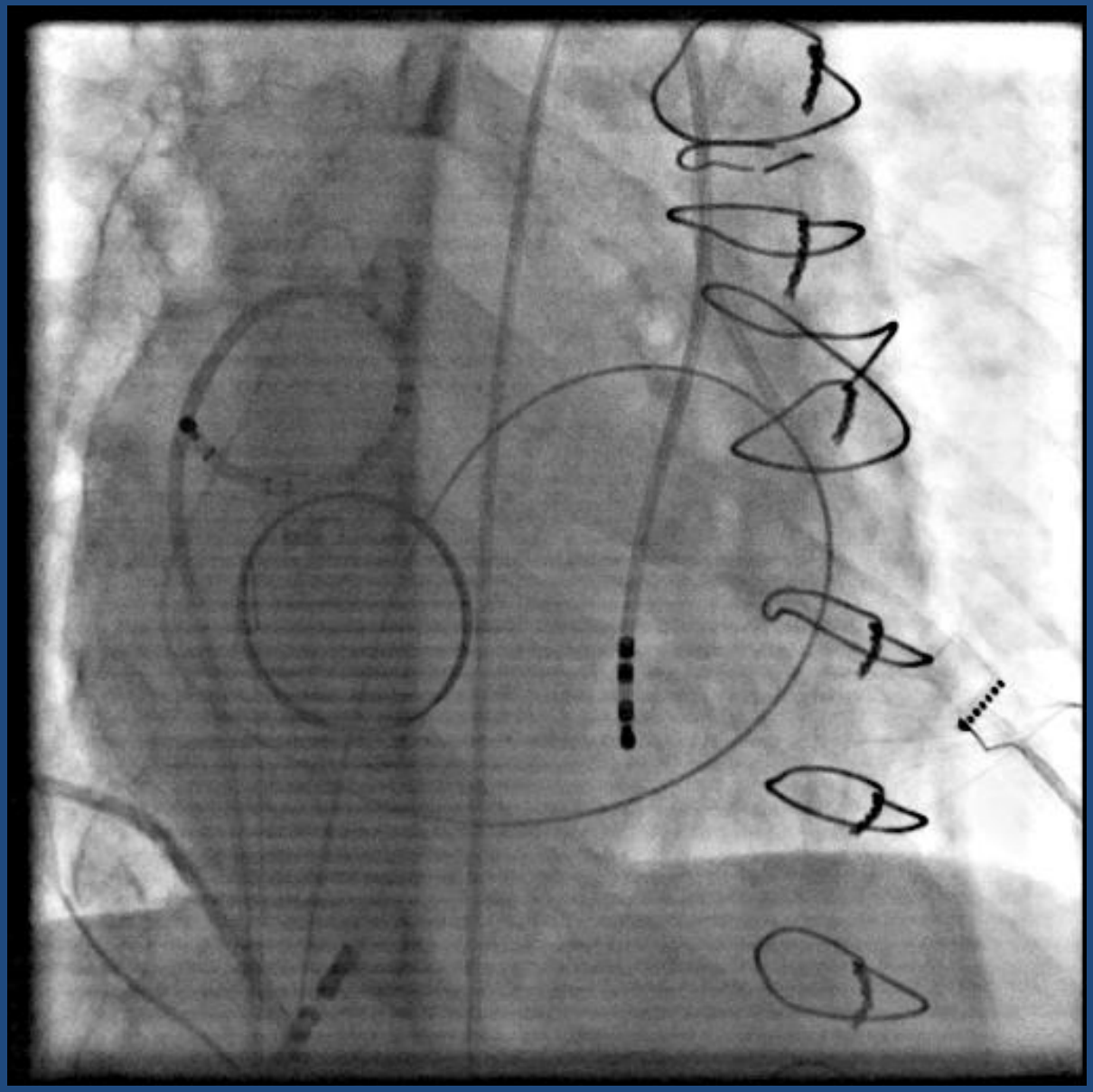
- 2y, BT shunt
- 4y intraatiral goretex TCPC (SVC to right PA, LpSVC to left PA) , BT shunt closed
- 15y ReSurgery TCPC repair
- 24y mechanical common AV valve SJM 33 (severe myxomat. mitral reg)

- After last op new palpitations 2-3x weekly spont term, twice sustastined several hours req. DCCV: IART 2:1, ventricular resp. 170bpm

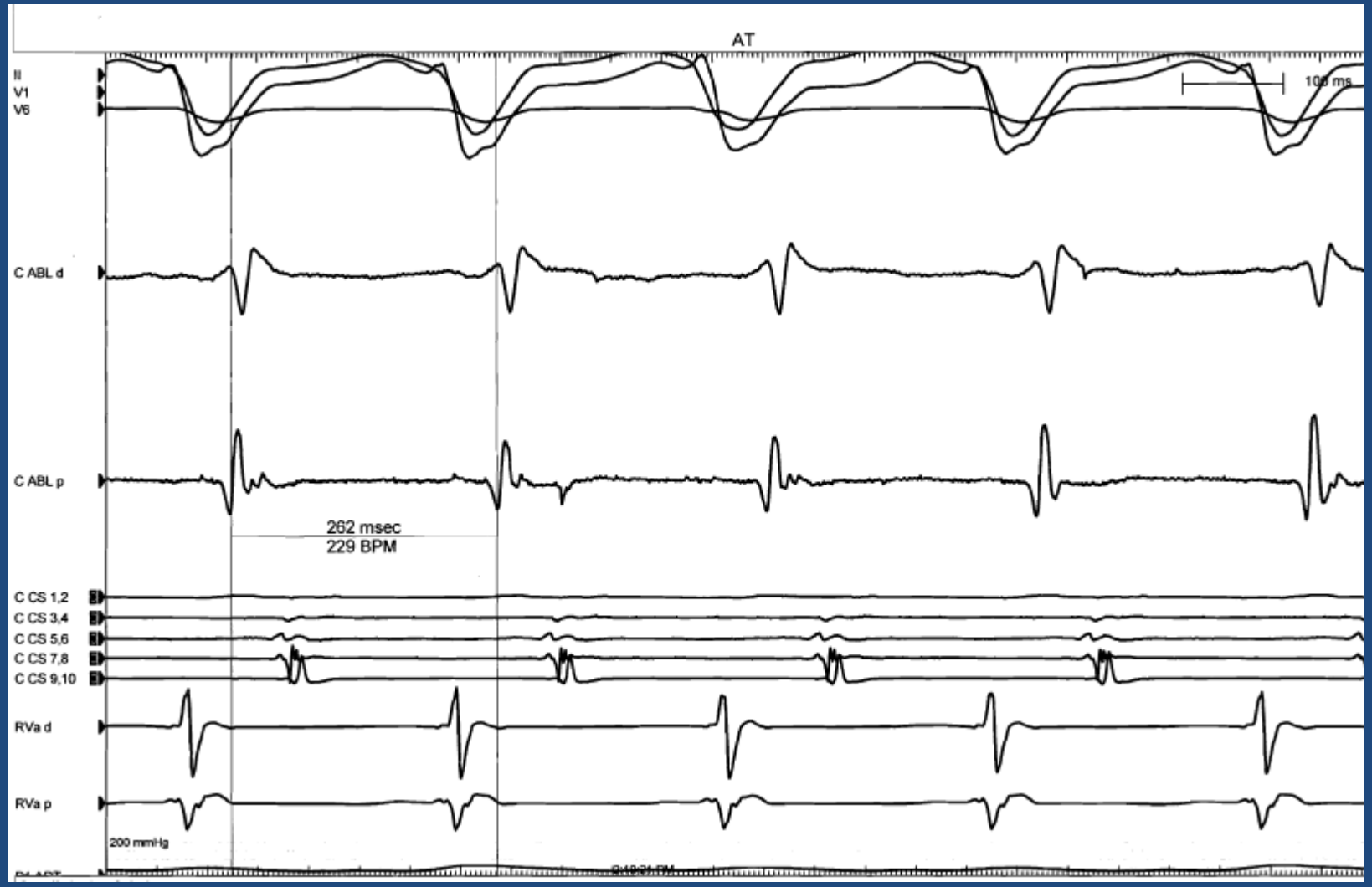
Intra- TCPC mechanical AV



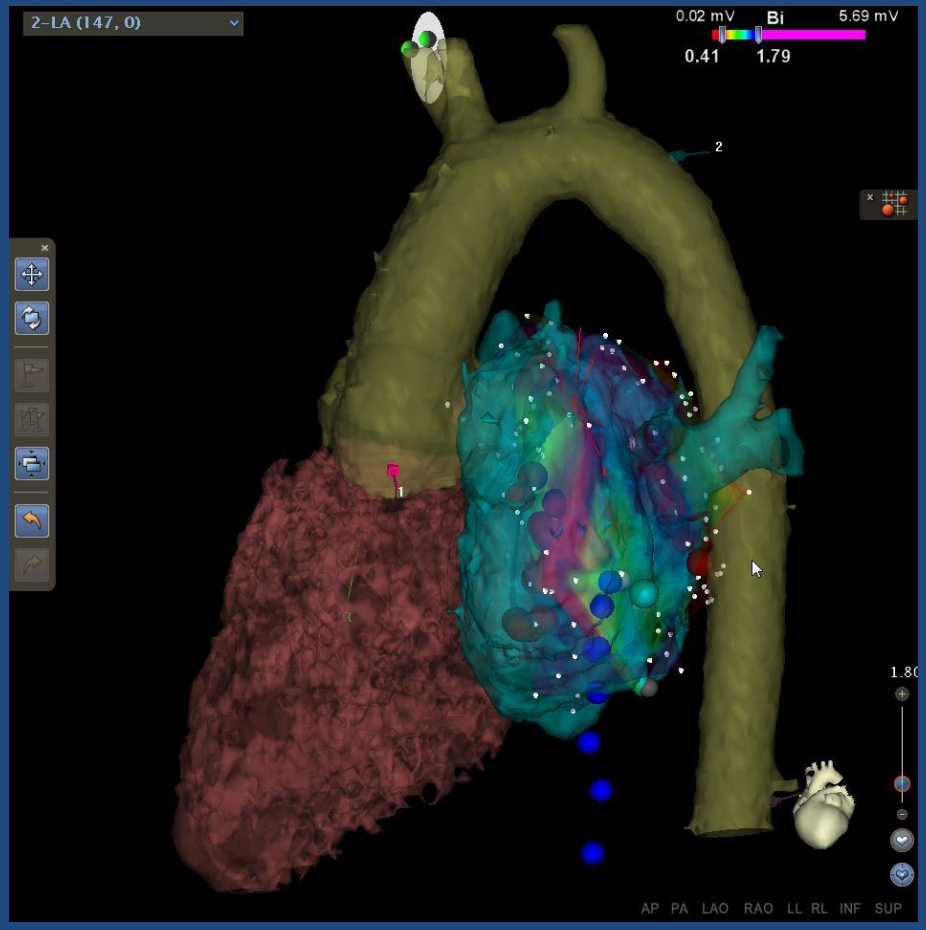
Intra- TCPC mechanical AV

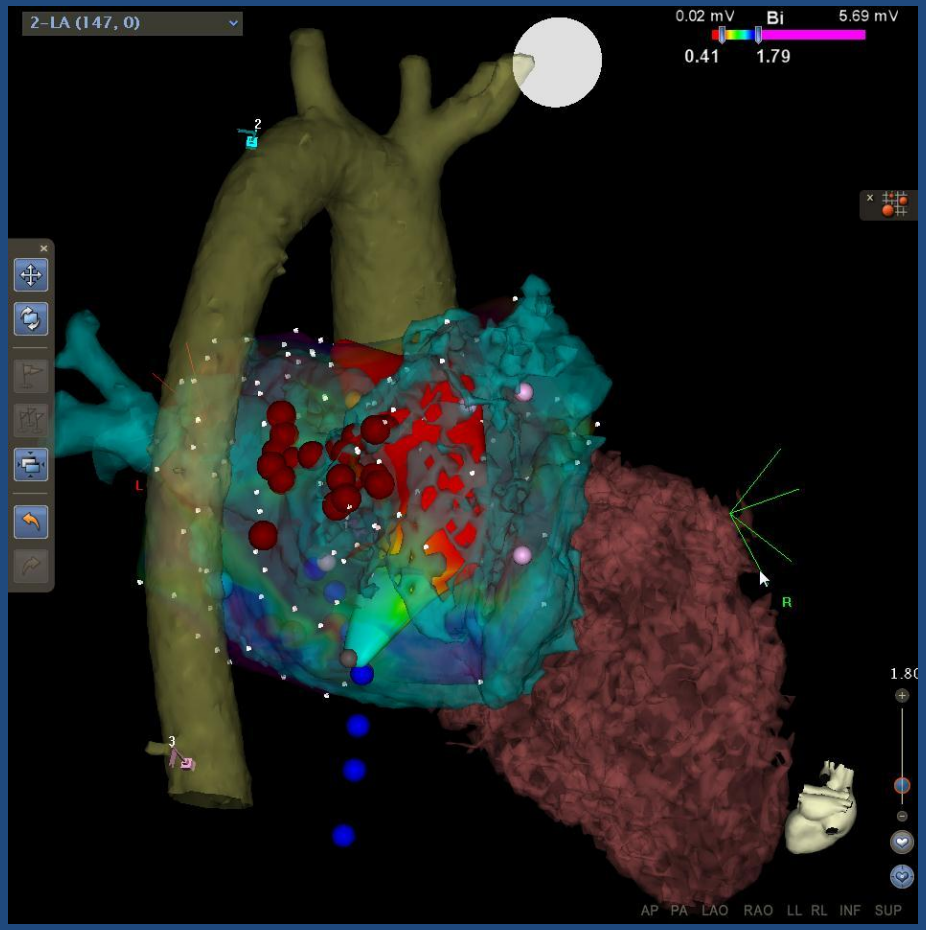


Intra- TCPC mechanical AV

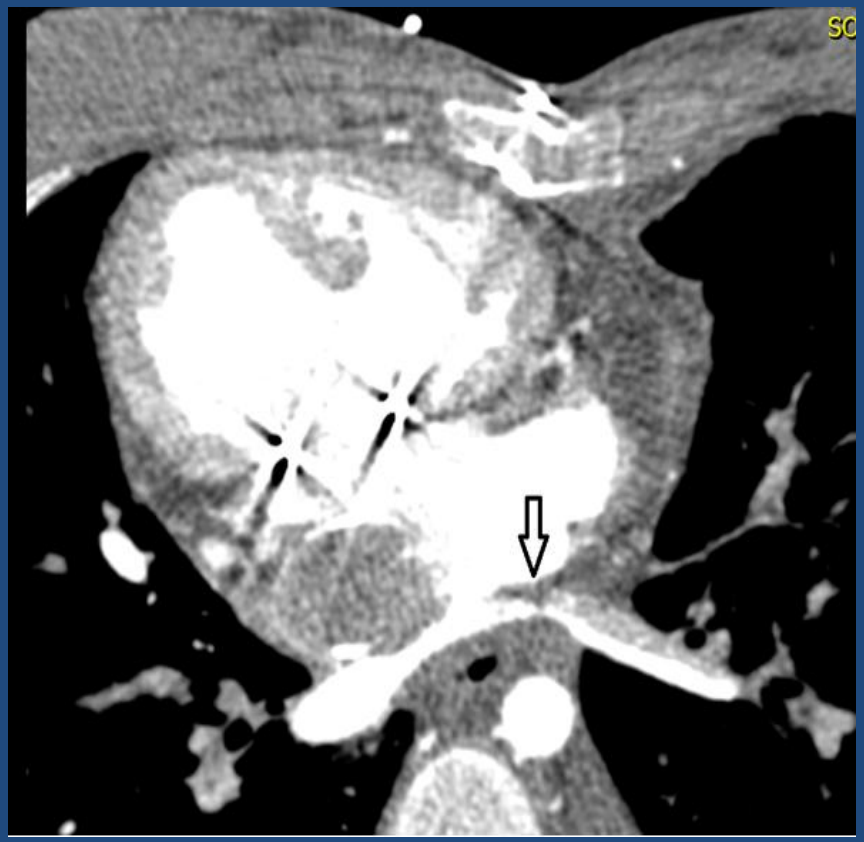


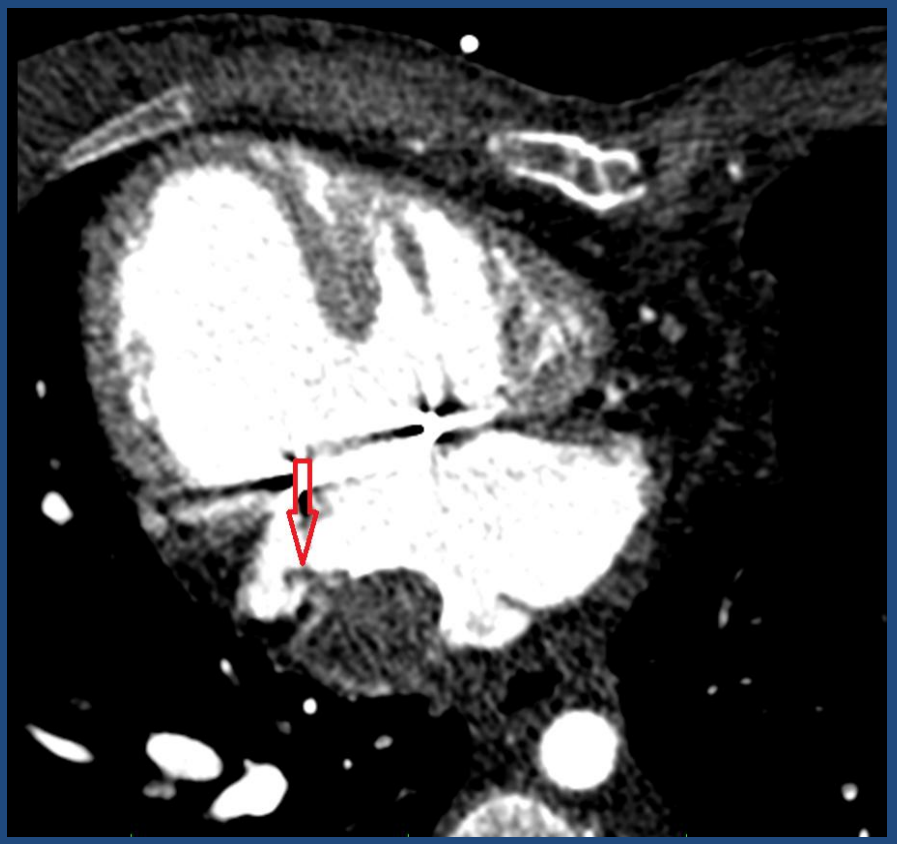
Intra- TCPC mechanical AV



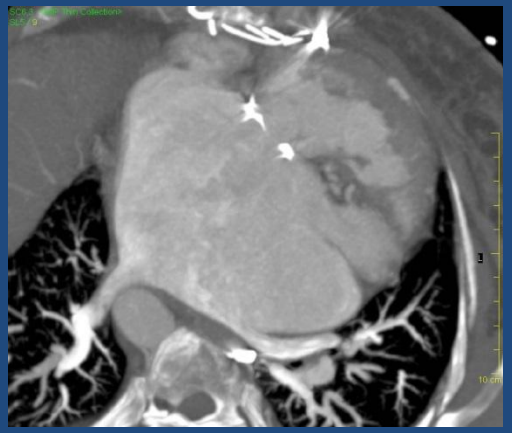


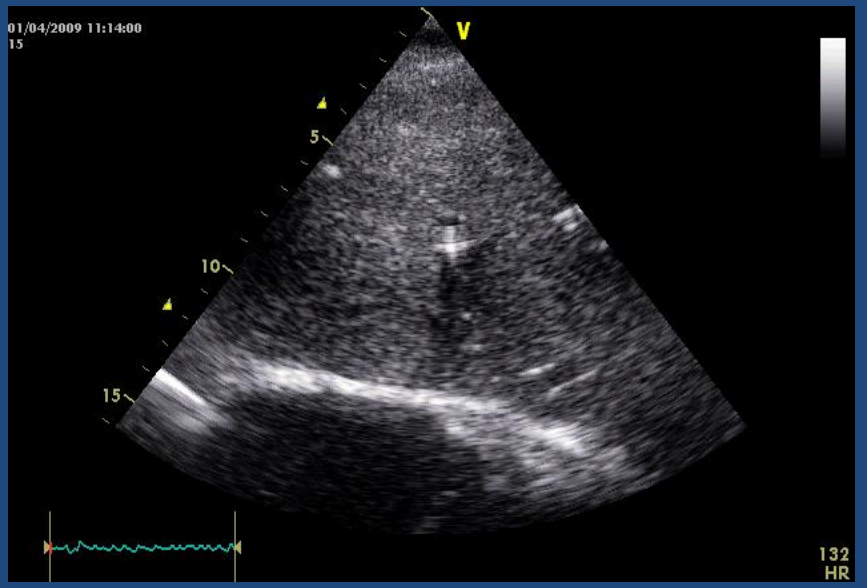
Intra- TCPC mechanical AV

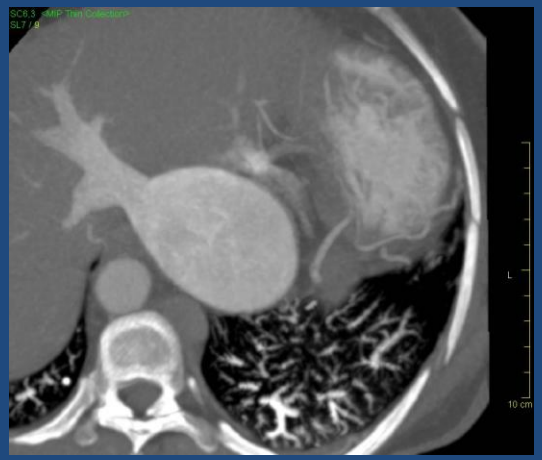


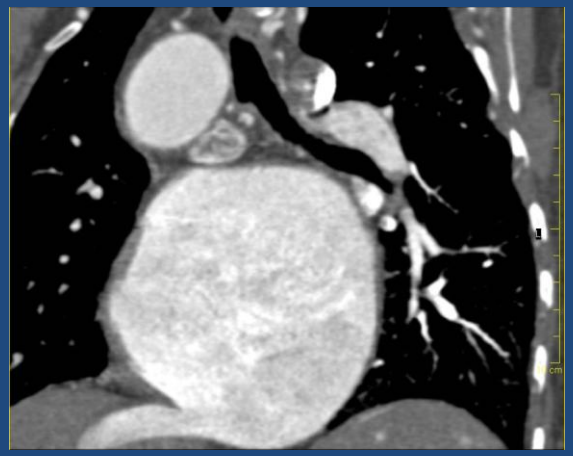


IART transhepatic, IVC diskontinuita, spol. komora, spol. síň, TCPC Kawashima









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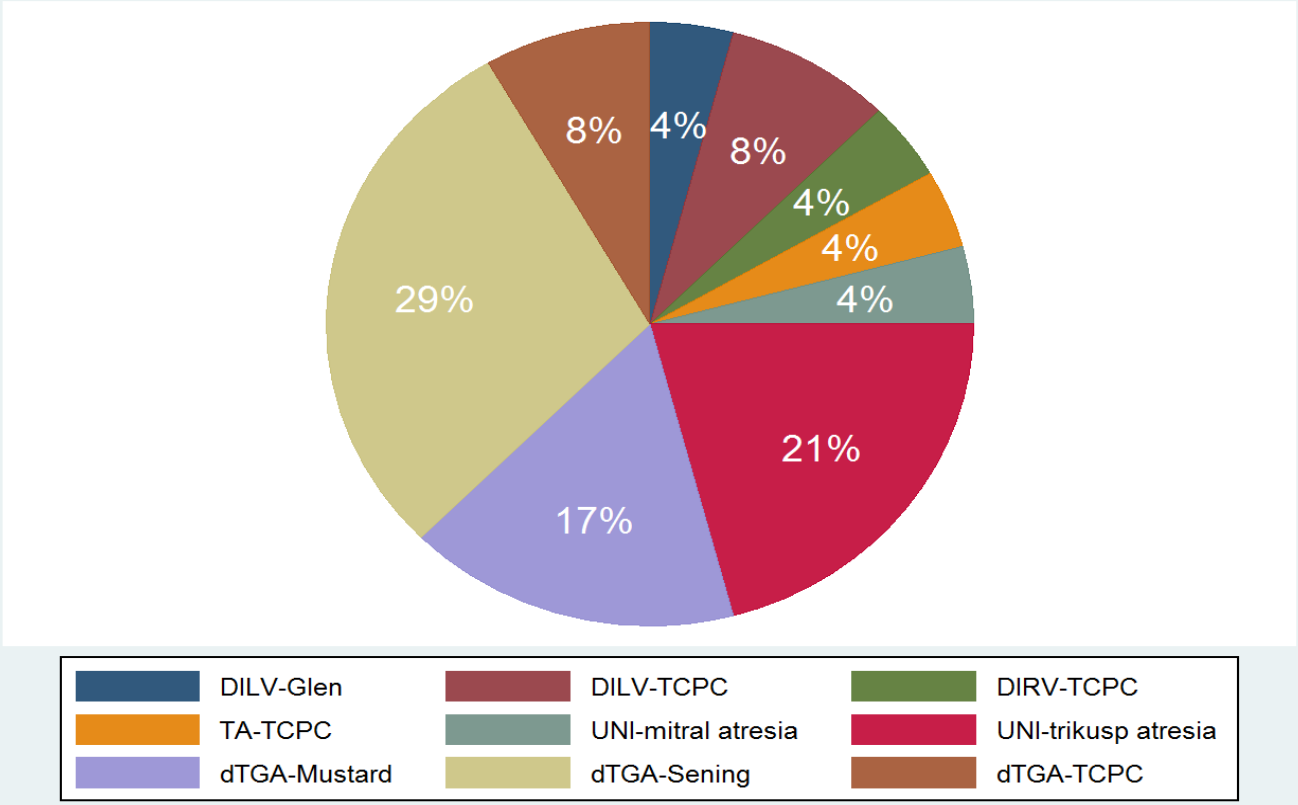
Types of Complex CHD



-> Group = Complex CHD

DG	Freq.	Percent
DILV-Glen	1	4.17
DILV-TCPC	2	8.33
DIRV-TCPC	1	4.17
TA-TCPC	1	4.17
UNI-mitral atresia	1	4.17
UNI-trikusp atresia	5	20.83
dTGA-Mustard	4	16.67
dTGA-Sening	7	29.17
dTGA-TCPC	2	8.33
Total	24	100.00

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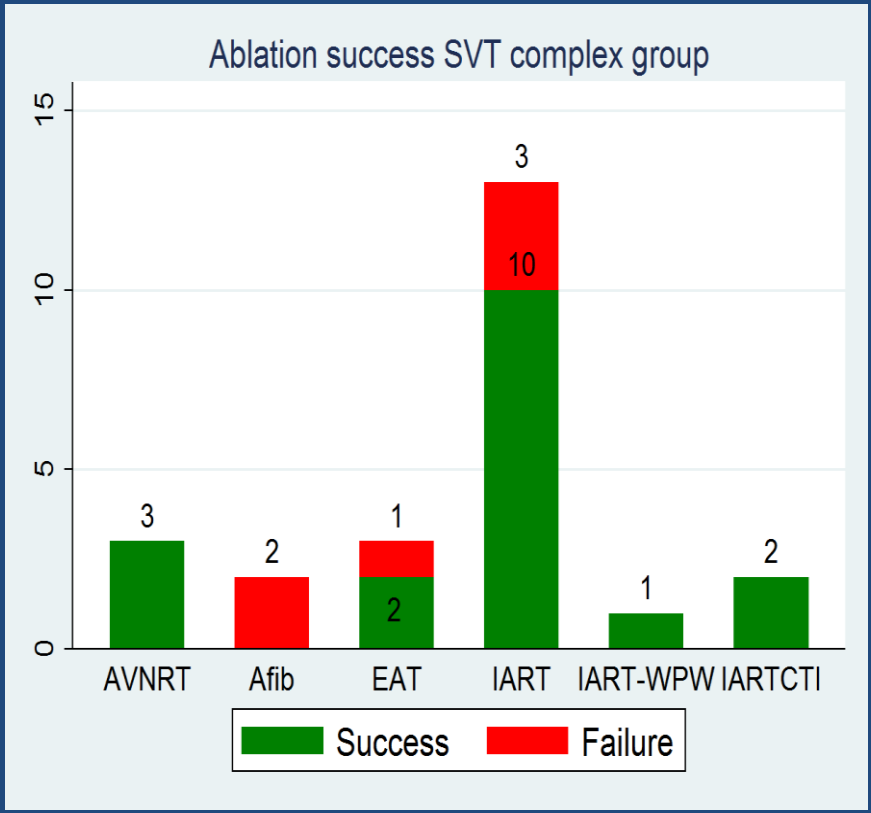
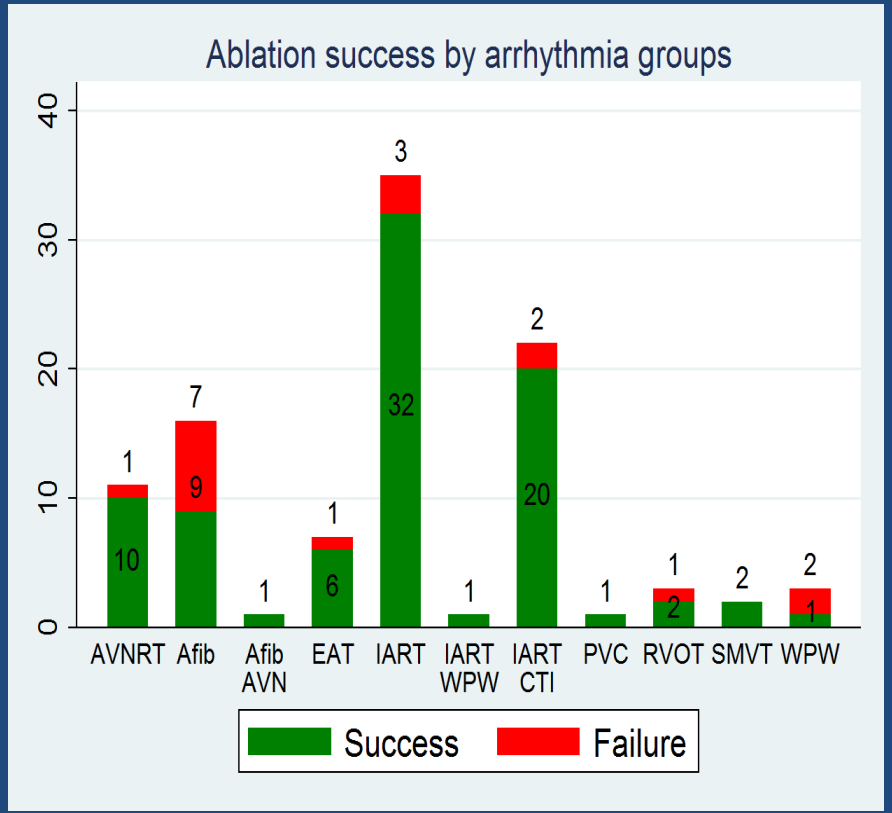
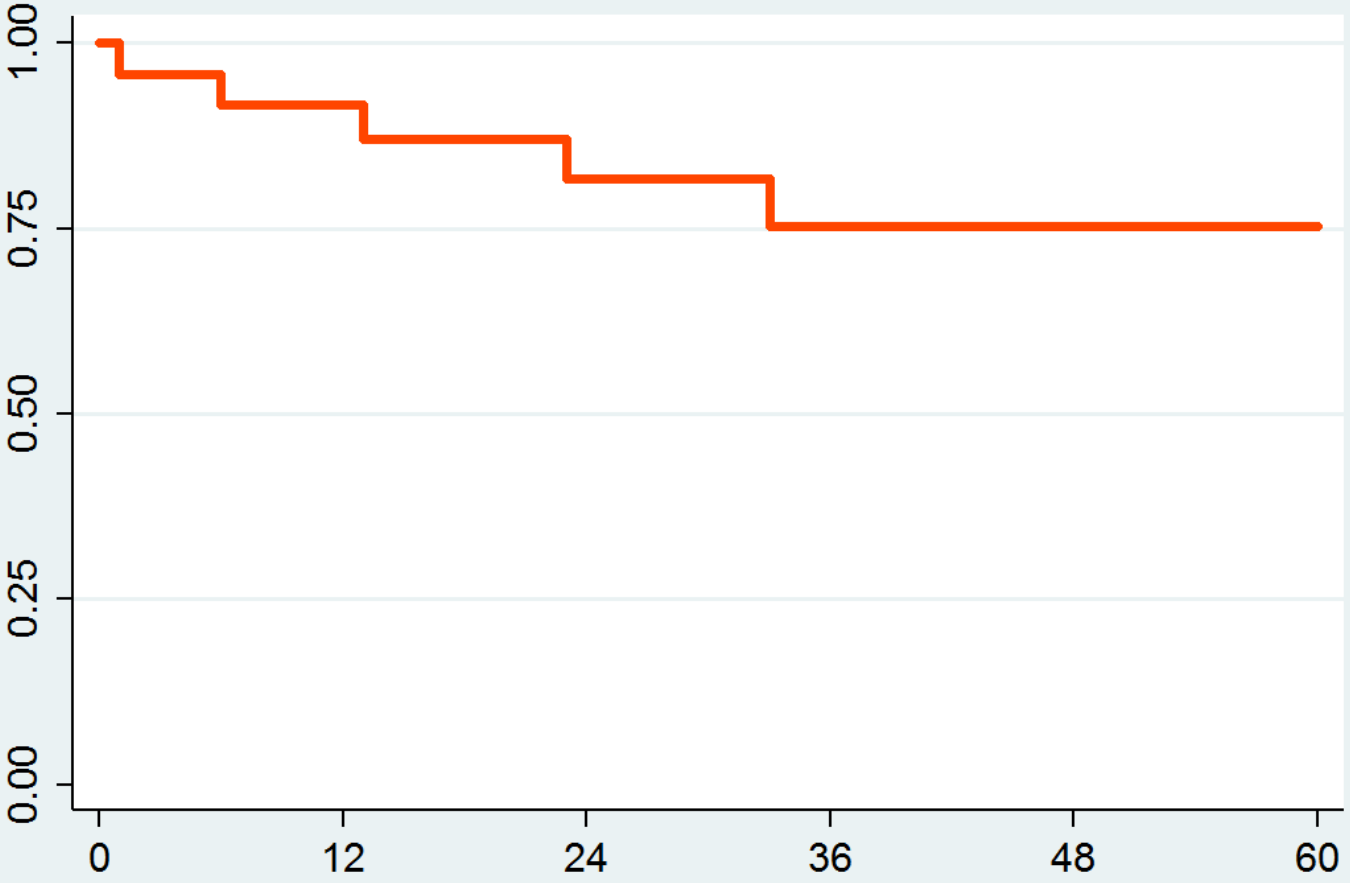
Complex SVT Homolka Hospital

- 2005 – 2016, 24 from 102 catheter ablations





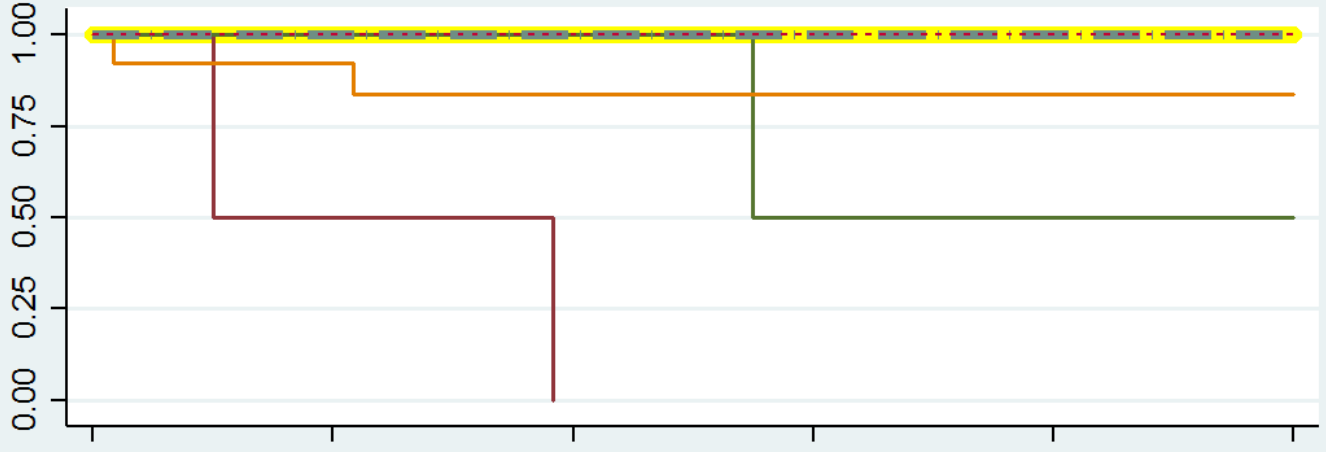
Kaplan-Meier overall long term success: SVT- complex



Number at risk

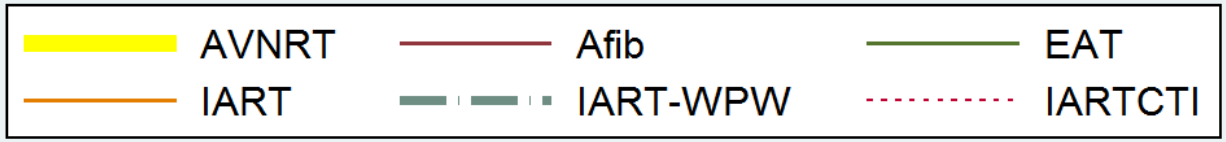
24	20	13	12	10	9

Complex SVT Homolka Hospital



Number at risk

AVNRT	3	3	3	3	2	2
Afib	2	1	0	0	0	0
EAT	3	2	2	1	1	1
IART	13	11	5	5	5	4
IART-WPW	1	1	1	1	1	1
IARTCTI	2	2	2	2	1	1



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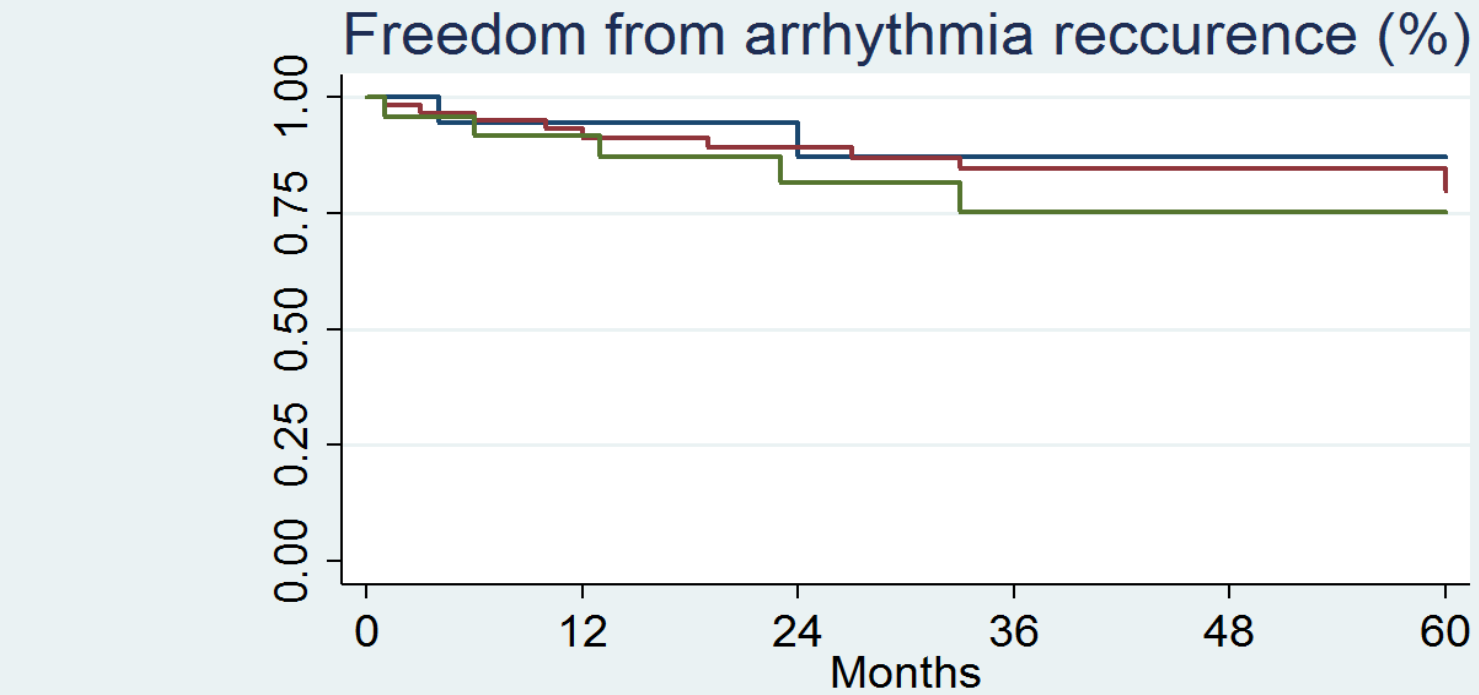
5 years results – complexity CHD groups



	Hazard ratio	Std. Err.	Unadjusted z	Unadjusted P>|z|	Unadjusted [95% Conf.	Interval]
Group						
Moderate CHD vs Light CHD	1.397488	1.093515	0.43	0.669	.3015054	6.477409
Complex CHD vs Light CHD	2.028631	1.698015	0.85	0.398	.3933021	10.46357
Complex CHD vs Moderate CHD	1.451627	.8104493	0.67	0.504	.485988	4.335951

Complications

- 6 redo cases in complex SVT group (Fontan retrograde, puncture, Mustard) Afib, EAT, IART)
- 2x AVB (Mustard, classic Fontan) to surgery
- 1x intra TCPC buffle tear and pulmonary vein stenosis to surgery
- 1x prolonged skin heeling after RF occlusion of transhepatic puncture approach

Conclusions

- Catheter ablation of SVT in complex CHD is feasible, carefull procedure planning with using 3D mapping systems and imaging integration is obligatory.
- Complication rate is elevated by complexity, team approach required (anesteziologist peri/post care, radiologist, surgeon standby)
- Remote magnetic navigation is helpfull in high complex CHD, avoiding buffle punctures.
- Persistent Afib in complex CHD has limited outcome, hybrid approach with surgery – MAZE procedures

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