How to treat arrhythmias in congenital heart disease patients?

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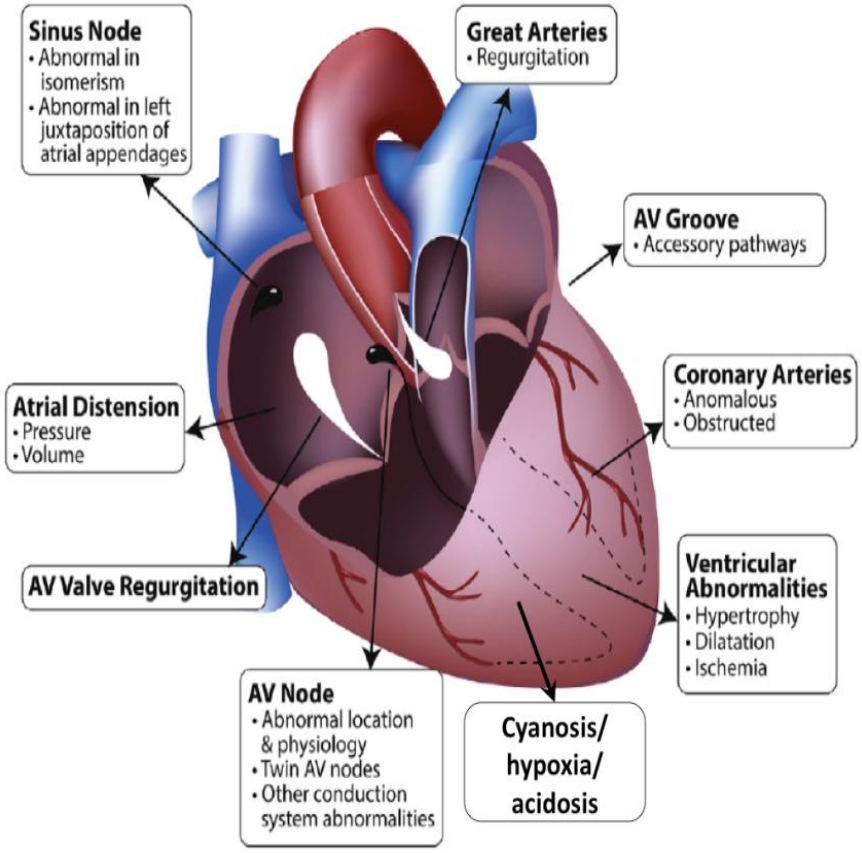
Zapadlí vlastenci

Why?

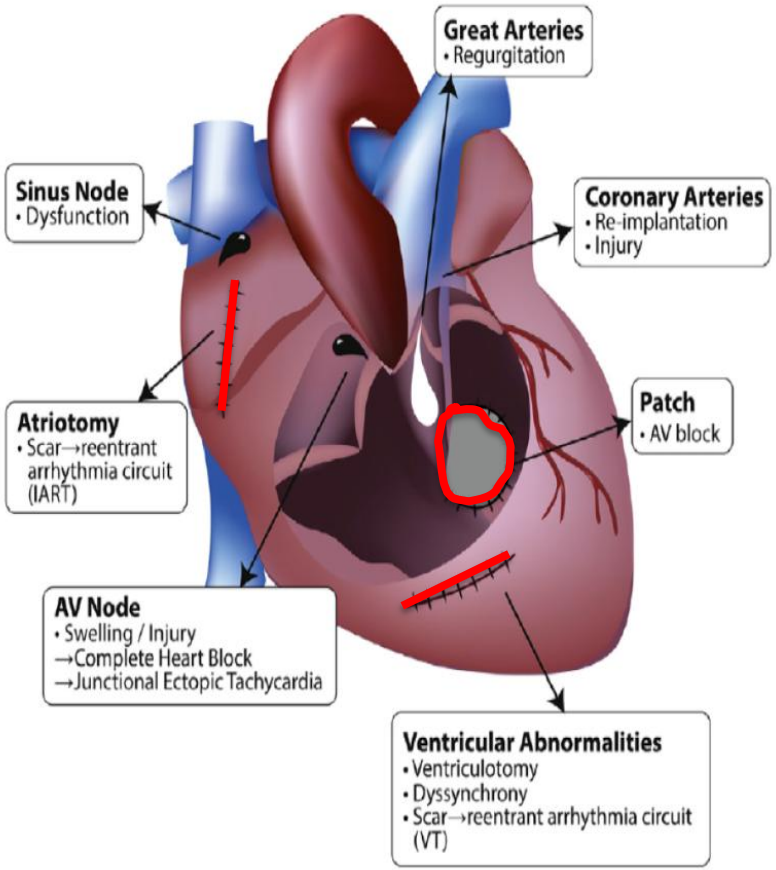
Arrhythmias are beside the heart failure a leading cause of morbidity, hospital admissions, impaired QoL, and mortality in ACHD

FACTORS LEADING TO (LATE) ARRHYTHMIAS IN CHD

Pre-operative

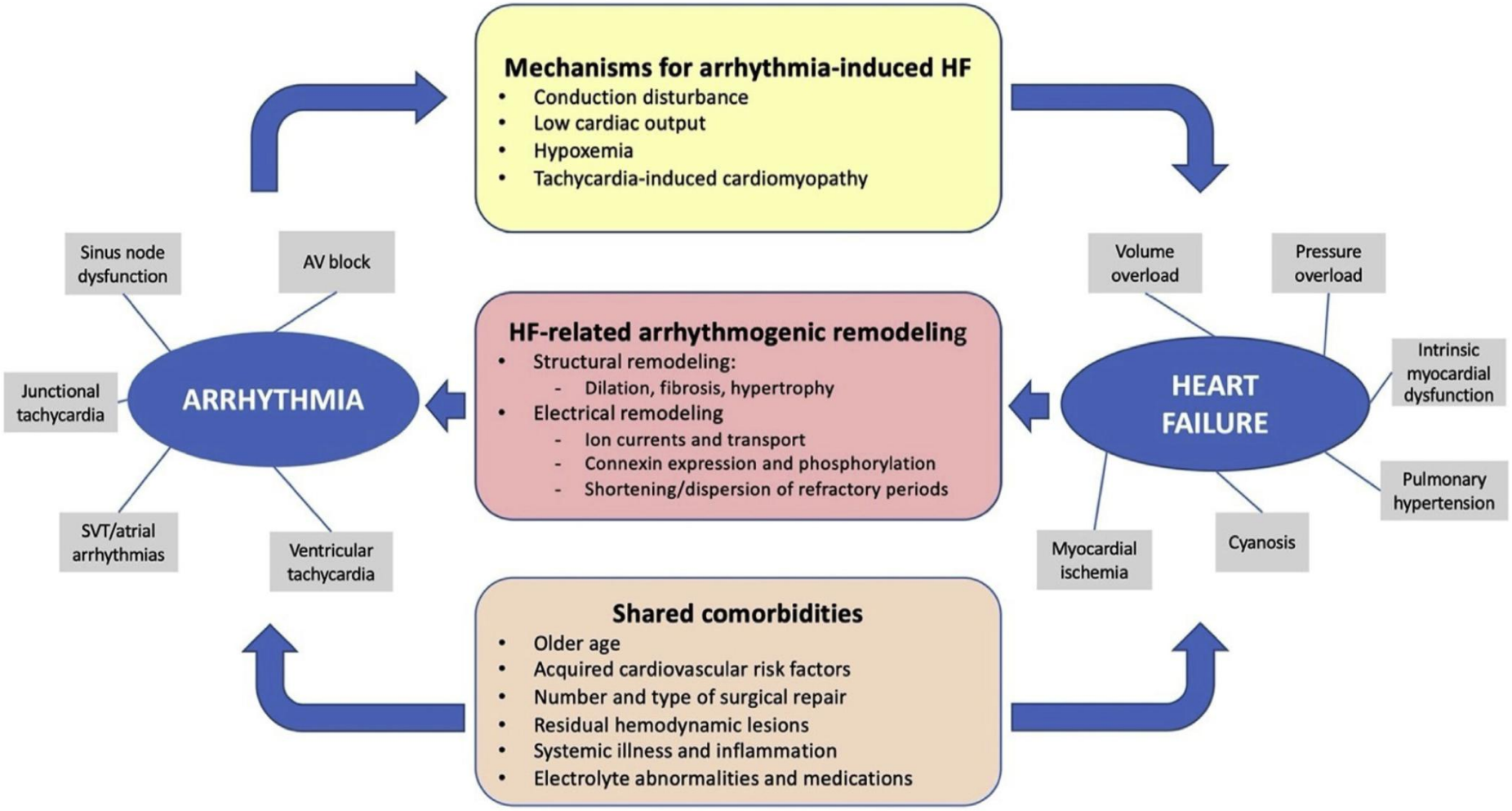


Post-operative



Adapted from Escudero C et al. Can J Cardiol 2013

Arrhythmia & heart failure interactions in CHD patients



Bessiere F et al. Heart Rhythm 2021

Guidelines ?

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ESC European Society of Cardiology

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ESC GUIDELINES

2020 ESC Guidelines for the management of adult congenital heart disease

The Task Force for the management of adult congenital heart disease of the European Society of Cardiology (ESC)

Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Adult Congenital Heart Disease (ISACHD)

	Supraventricular arrhythmias			Ventricular arrythmias and SCD		Bradycardia			
Type of CHD	AVRT	IART/ EAT	AF	Sustained VT	SCD	SND		AV block	
						Congenital	Acquired	Congenital	Acquired
Secundum ASD		++	++			(+)	+		(+)
Superior sinus venosus defect		++	+				+		
AVSD/primum ASD		++	++	(+)		(+)		(+)	++
VSD		+	(+)	+	(+)[a]				+
Ebstein anomaly	+++	++	+	(+)	++[b]		++		
TOF		++	++	++	++		+		+
TGA									
Atrial switch		+++	+	++[c]	+++[b]		+++		+
Arterial switch		+		+[c]	(+)		(+)		
ccTGA	++	+	+	(+)	++[b]			+	++
Fontan operation									
Atriopulmonary connection		+++	++		+[b]		++		
Intracardiac lateral tunnel		++	+		+[b]		++		
Extracardiac conduit		+	+		+[b]		+		
Eisenmenger physiology Incompletely palliated CHD		++	++		++[d]				

©ESC

Empty cells indicate that although not specifically indicated, arrhythmic events may occur (no symbol).

(+) = minimal risk + = mild risk ++ = moderate risk +++ = high risk

	Supraventricular arrhythmias			Ventricular arrythmias and SCD		Bradycardia			
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TOF		++	++	++	++		+		+
TGA									
Atrial switch		+++	+	++[c]	+++[b]		+++		+
Arterial switch		+		+[c]	(+)		(+)		
ccTGA	++	+	+	(+)	++[b]			+	++
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©ESC

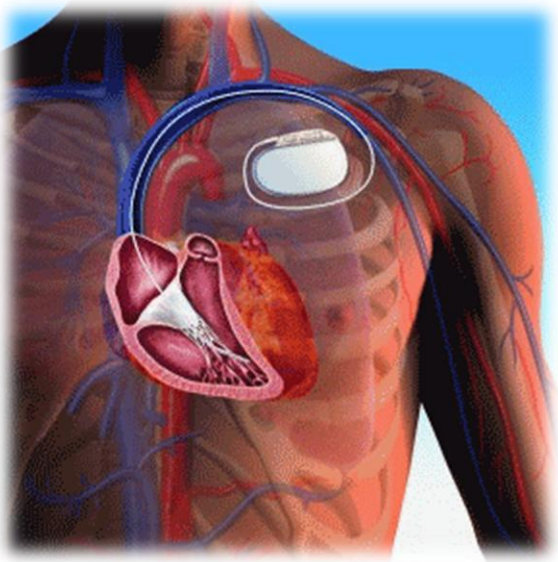
Empty cells indicate that although not specifically indicated, arrhythmic events may occur (no symbol).

(+) = minimal risk + = mild risk ++ = moderate risk +++ = high risk

Arrhythmias after congenital heart surgery

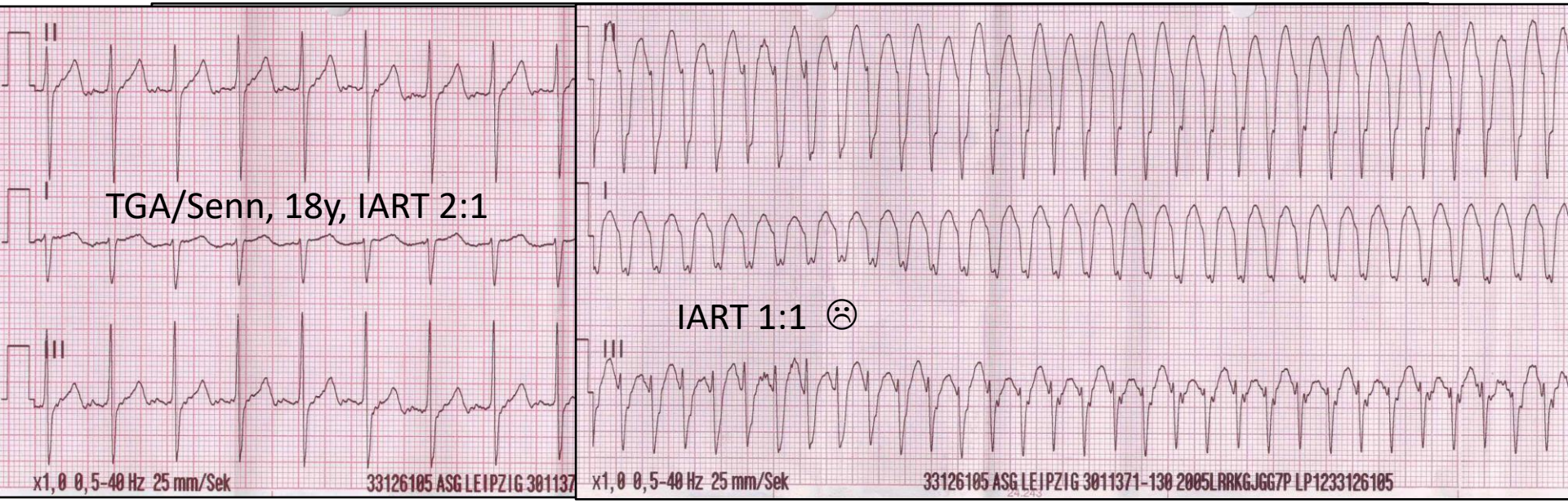
- years/decades after surgery → "maturation" of arrhythmogenic substrates = scars after surgery
- macro- / micro-Reentrant circuits
- atrium / ventricle
- not easy to control by antiarrhythmic drugs

Therapy options



Atrial reentrant tachycardia

- often associated with rapid AV conduction
  -> hemodynamically not tolerated

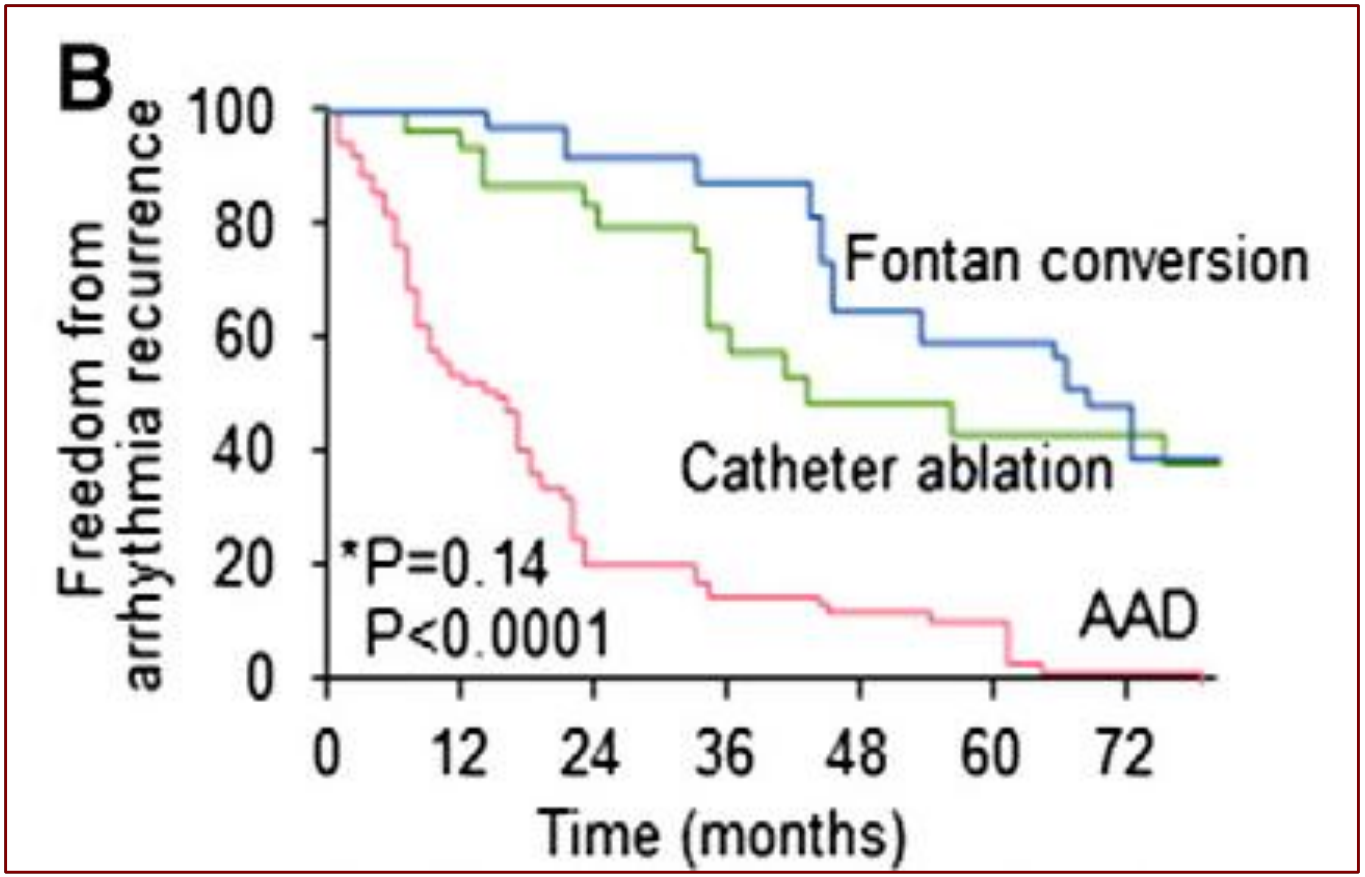


Singh TP, JACC 2001
Hornung TS, Am J Cardiol 2002
Khairy P. Curr Opin Cardiol 2017

Outcomes in adult Fontan patients with atrial tachyarrhythmias

Alexander C. Egbe [a] Heidi M. Connolly [a] Arooj R. Khan [a] Talha Niaz [b] Sameh S. Said [c] Joseph A. Dearani [c] Carole A. Warnes [a] Abhishek J. Deshmukh [a] Suraj Kapa [a] and Christopher J. McLeod [a] *Rochester MN*

- May Clinic 1994-2014, N=264 (APF 81%)
- FuP 6.2y; Age 25y; Time from Fontan op. 13y



Am Heart J 2017

Catheter Ablation

Understanding of rhythm substrate

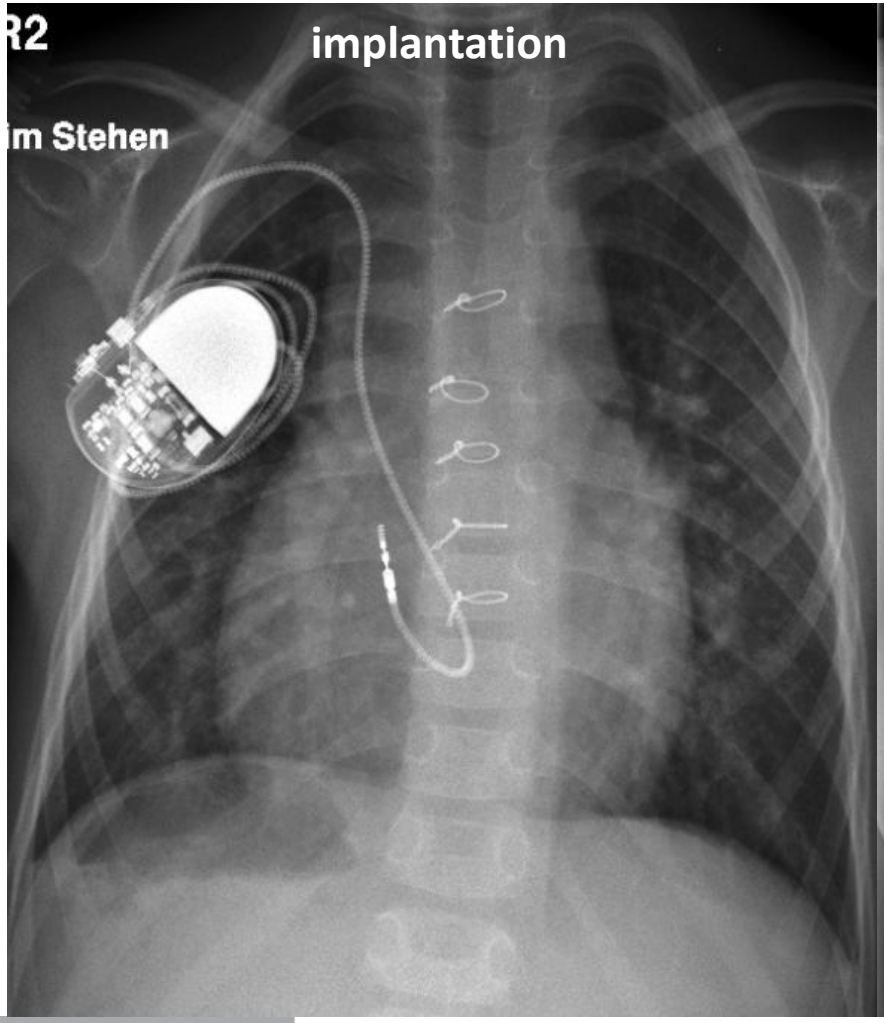
Access to substrate = myocardium

Ability to modify arrhythmogenic substrate

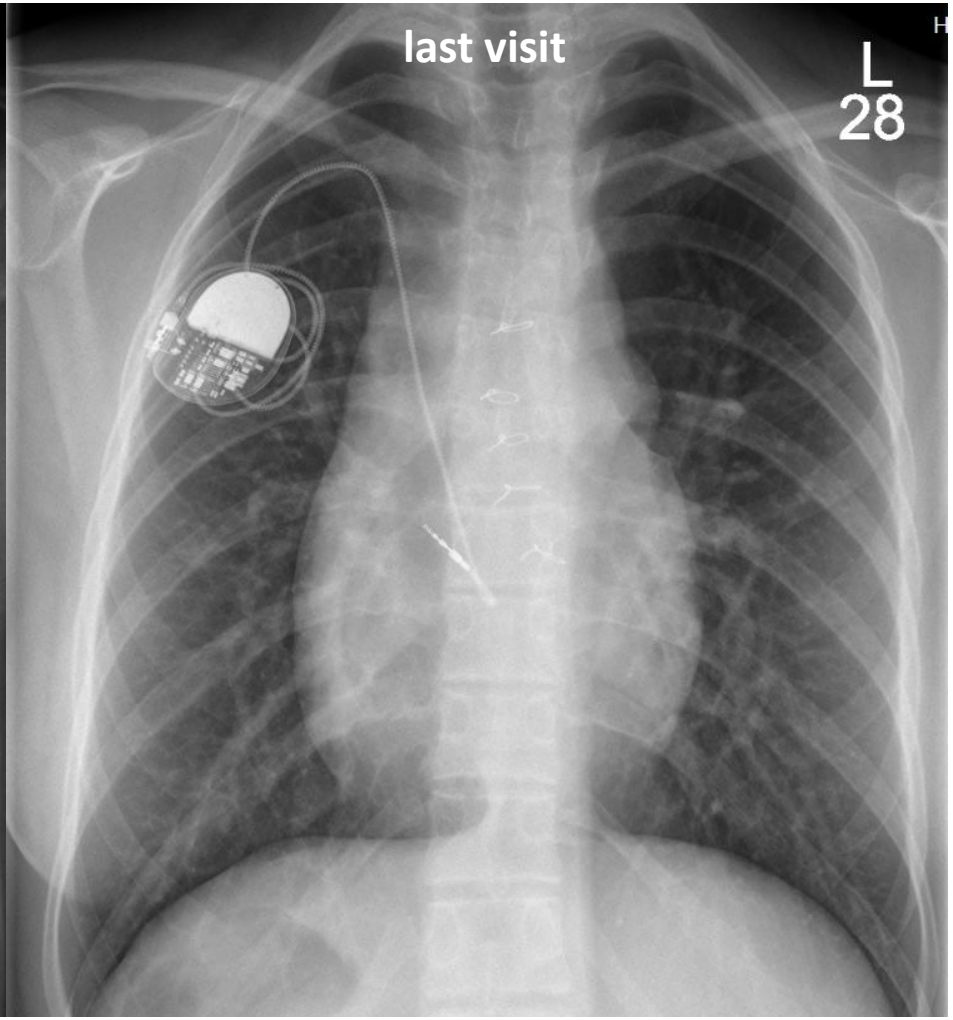
Catheter Ablation in congenital heart diseases

- Detailed knowledge of CHD
  - anatomy & physiology
- Patient's medical history (incl. surgery reports)
- Cardiac imaging before ablation
- Check for venous/arterial access possibilities!
- 3D mapping systems, irrigated ablation catheters
- "Plan B" ready
- Cardiac surgery "stand by"

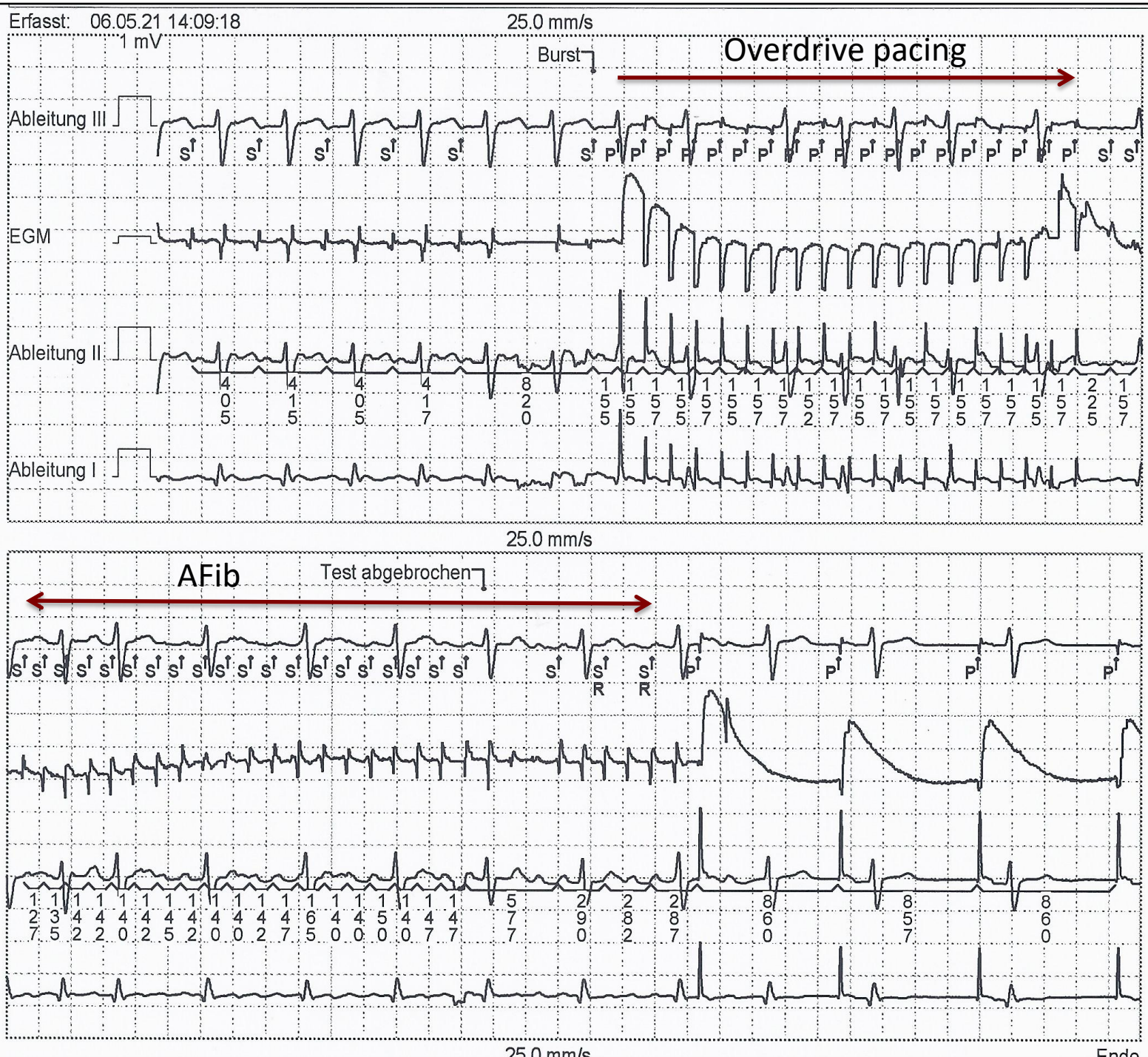
Case #1



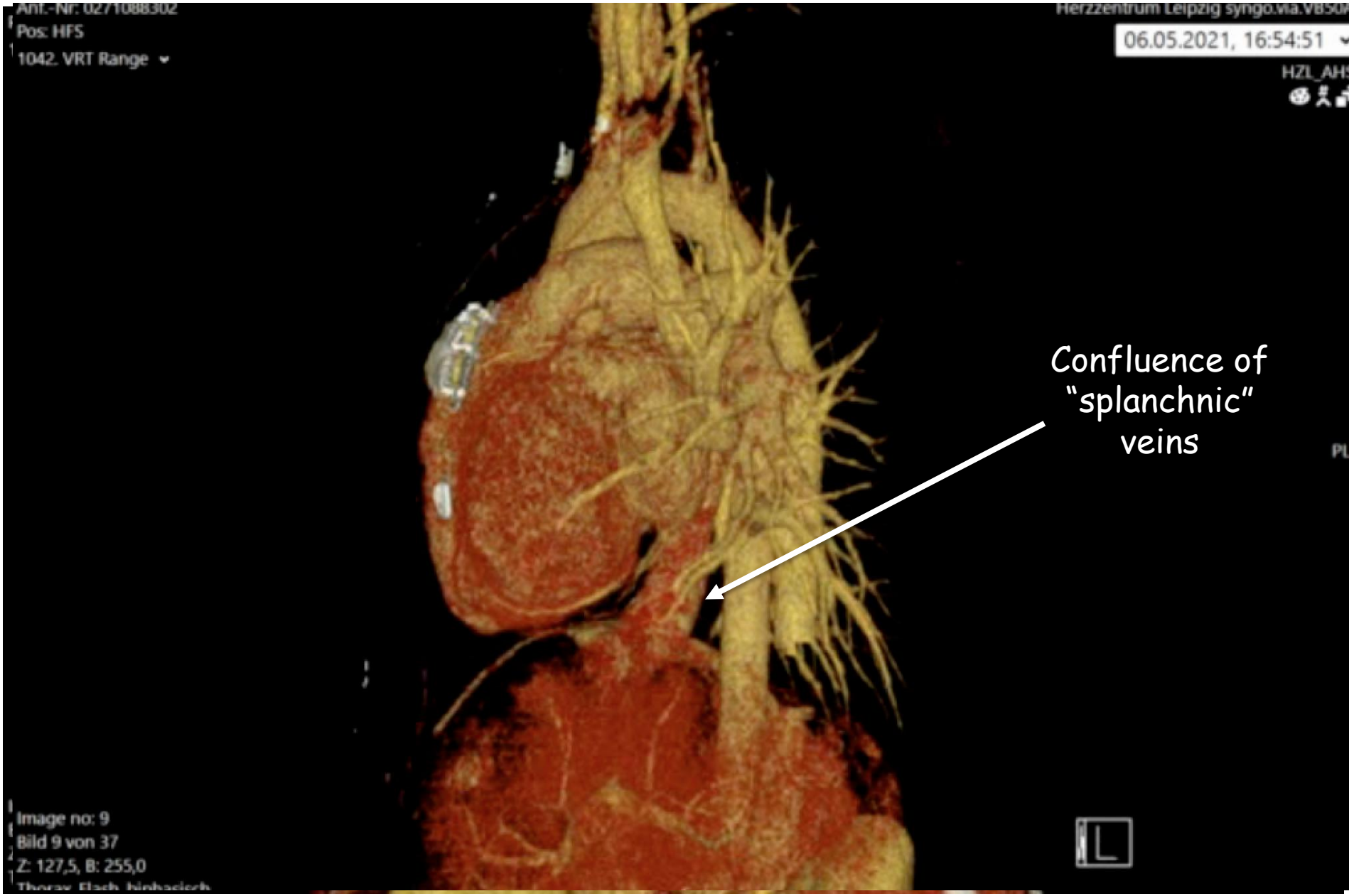
implantation



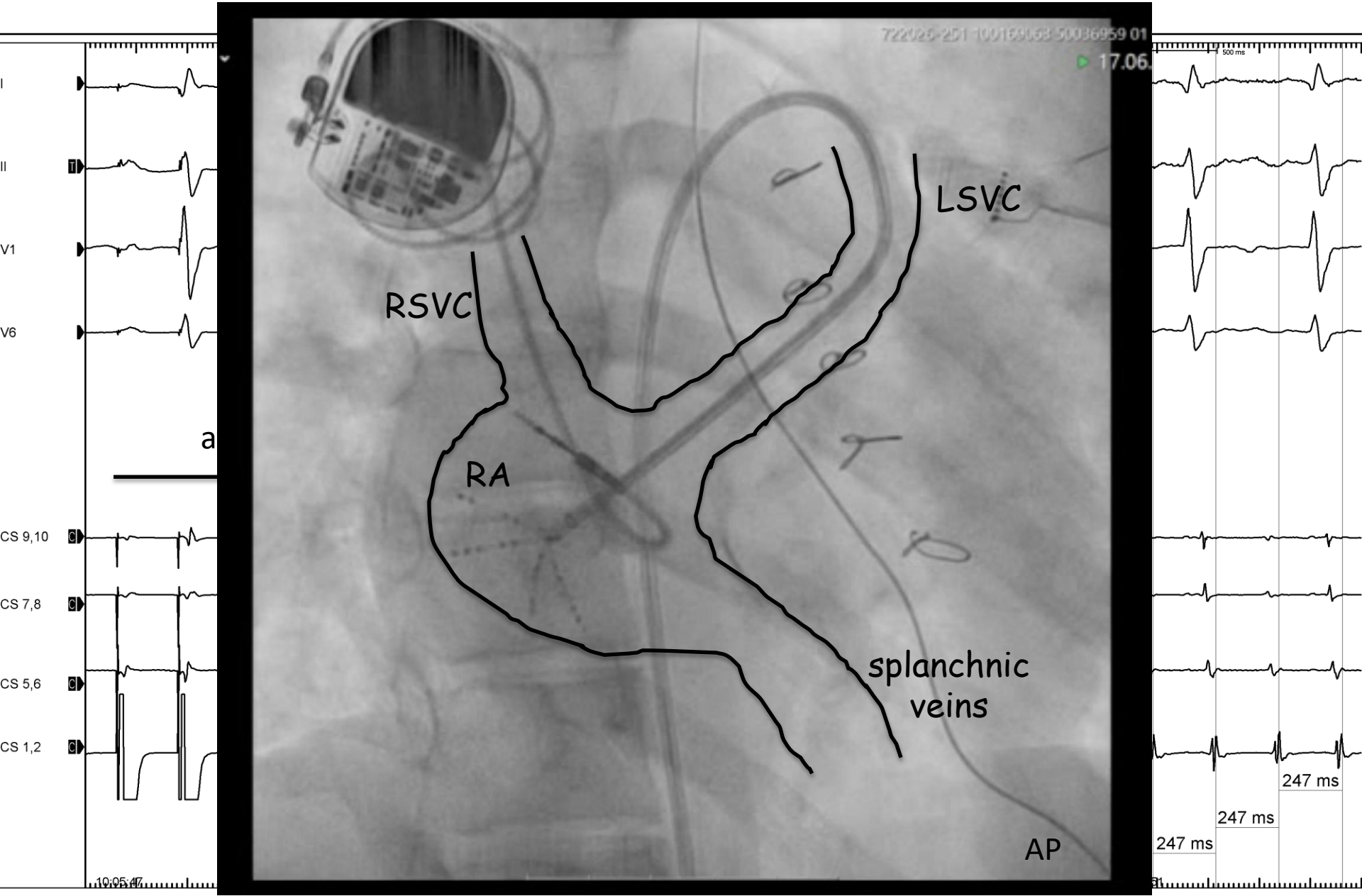
last visit


Erfasst: 06.05.21 14:09:18
25.0 mm/s
1 mV
Burst
Overdrive pacing
Ableitung III
EGM
Ableitung II
Ableitung I
25.0 mm/s
AFib
Test abgebrochen
EGM
25.0 mm/s
Endo

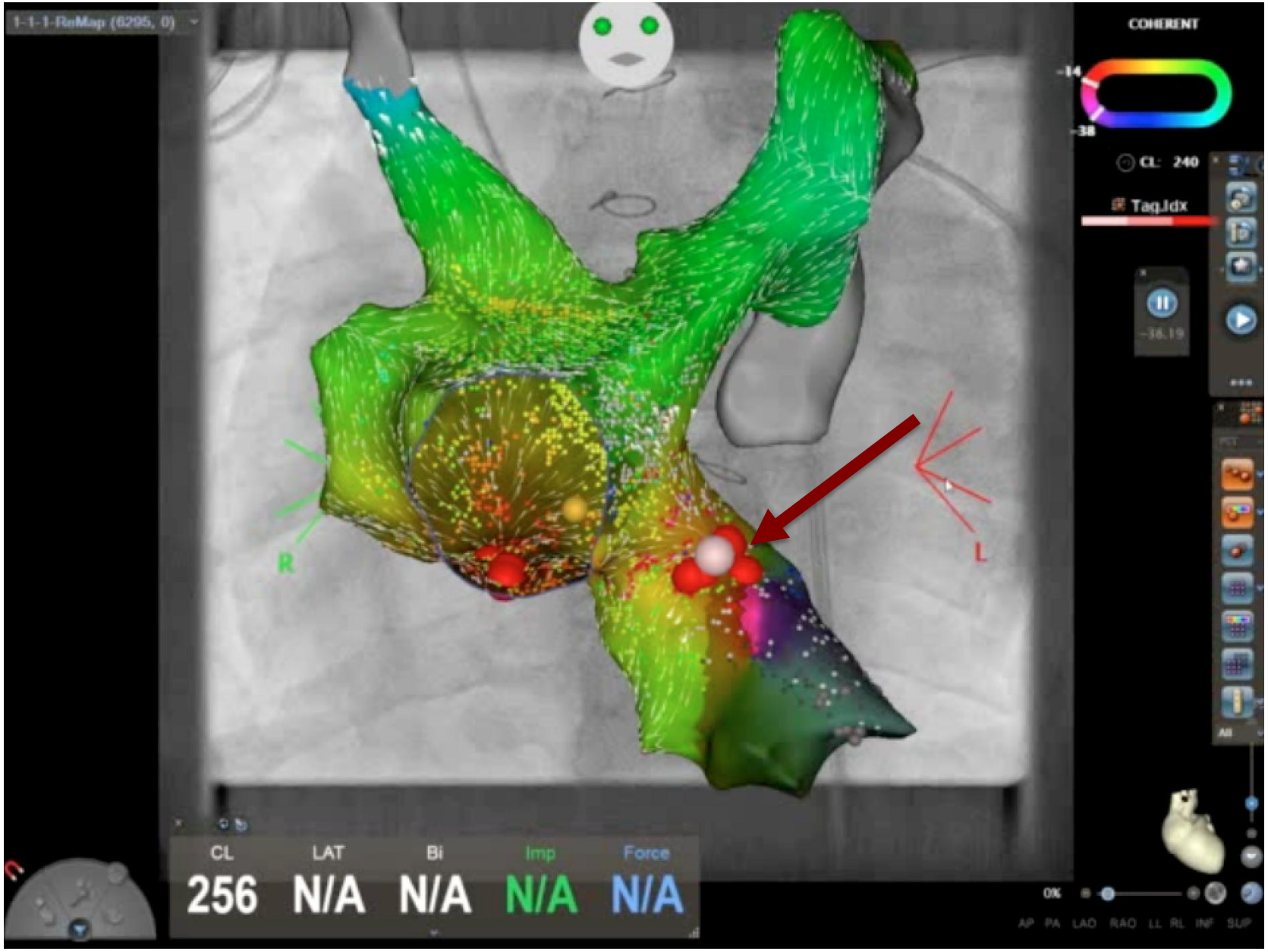
Pre-procedural imaging - CT



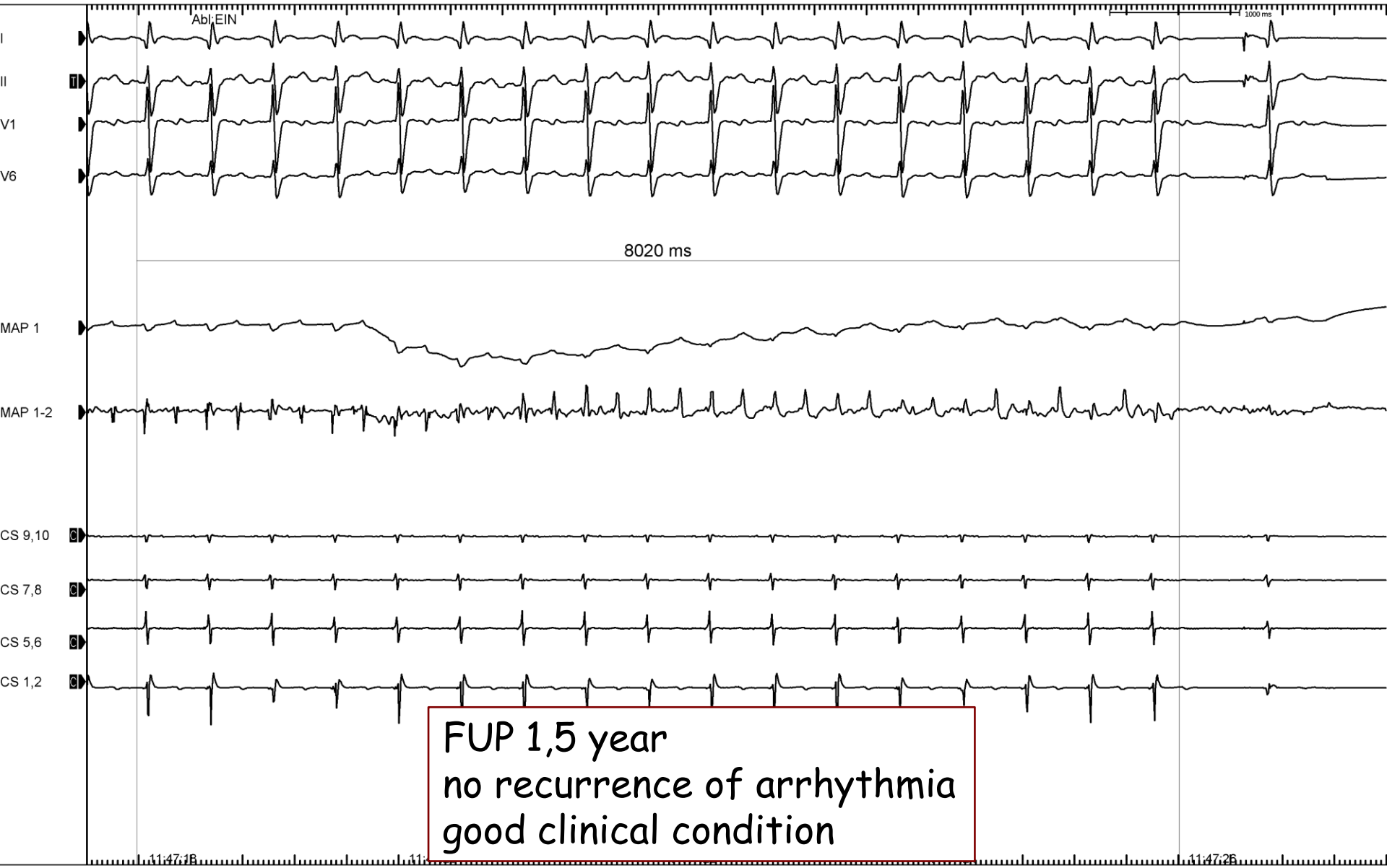
Catheter Ablation



Catheter Ablation – 3D mapping system Carto



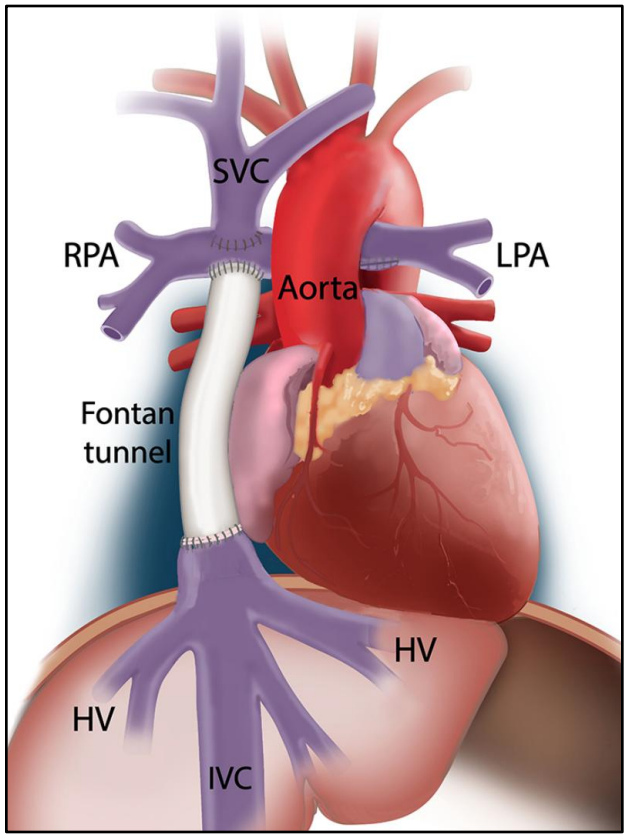
Catheter Ablation



FUP 1,5 year
no recurrence of arrhythmia
good clinical condition

Case #2

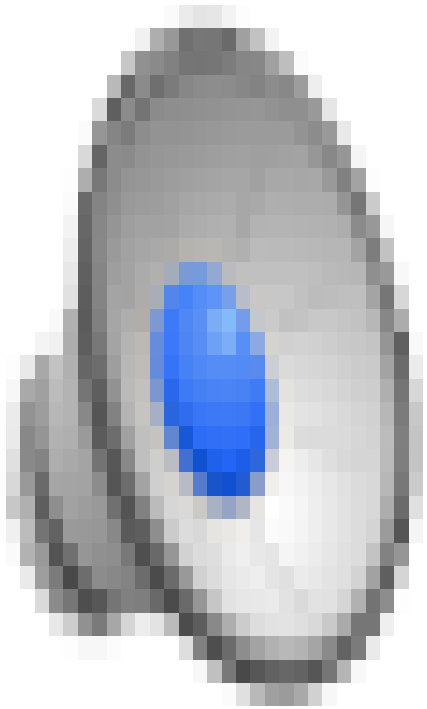
- HLHS
- Norwood I, Sano-shunt (6 d)
- Glenn anastomosis (4 mo)
- Stent implant. - LPA
- TCPC 16mm extracardiac conduit (2,5 y)
- reduced RV Fx, mild TR

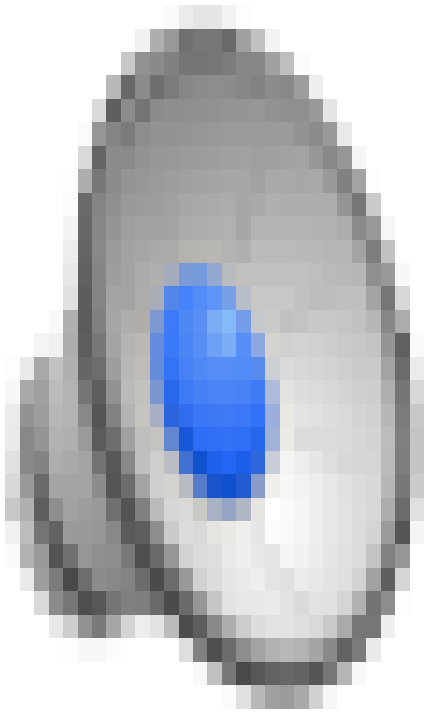


New problem (17y): sustained supraventricular tachycardia, HR 170 bpm, terminated after verapamil i.v.

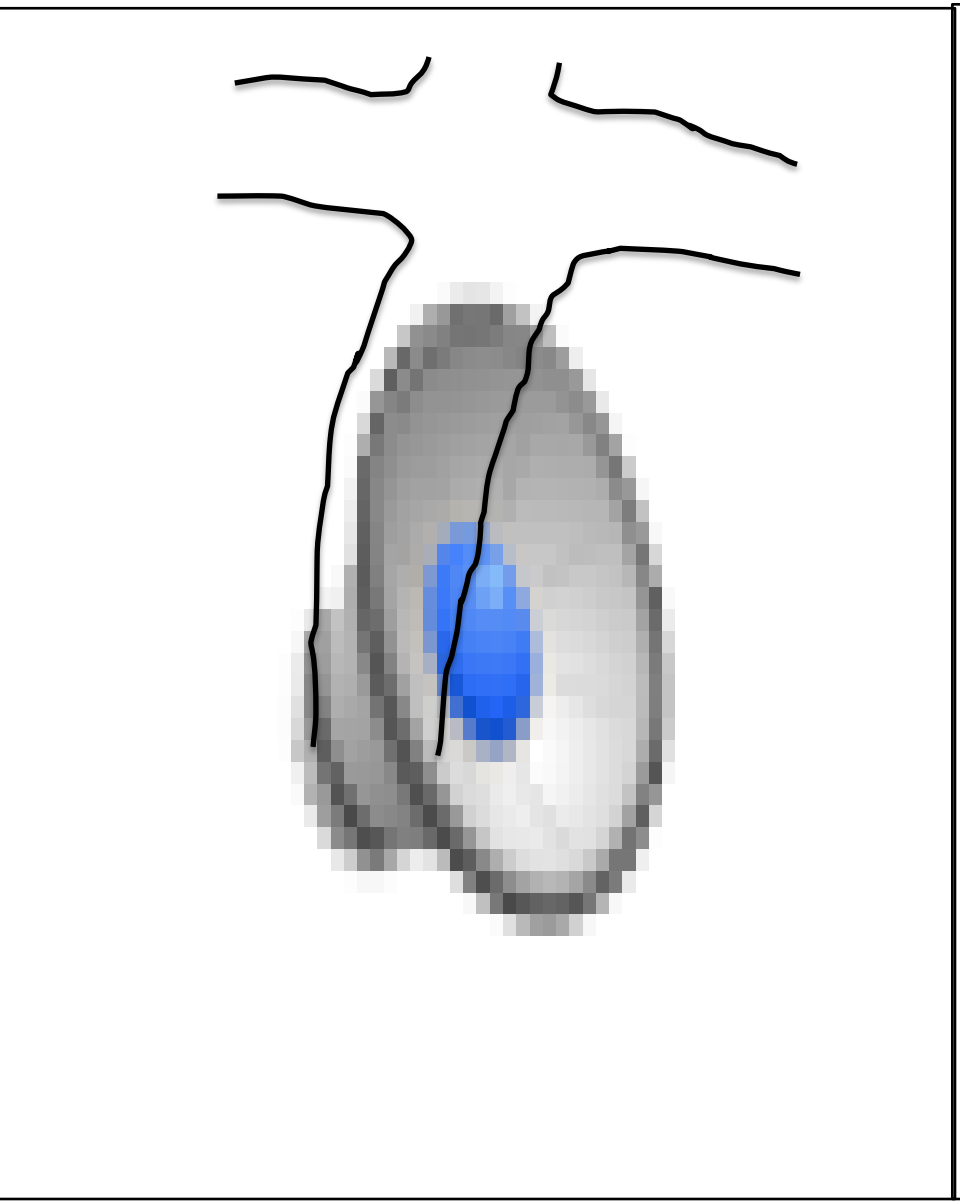
Catheter Ablation

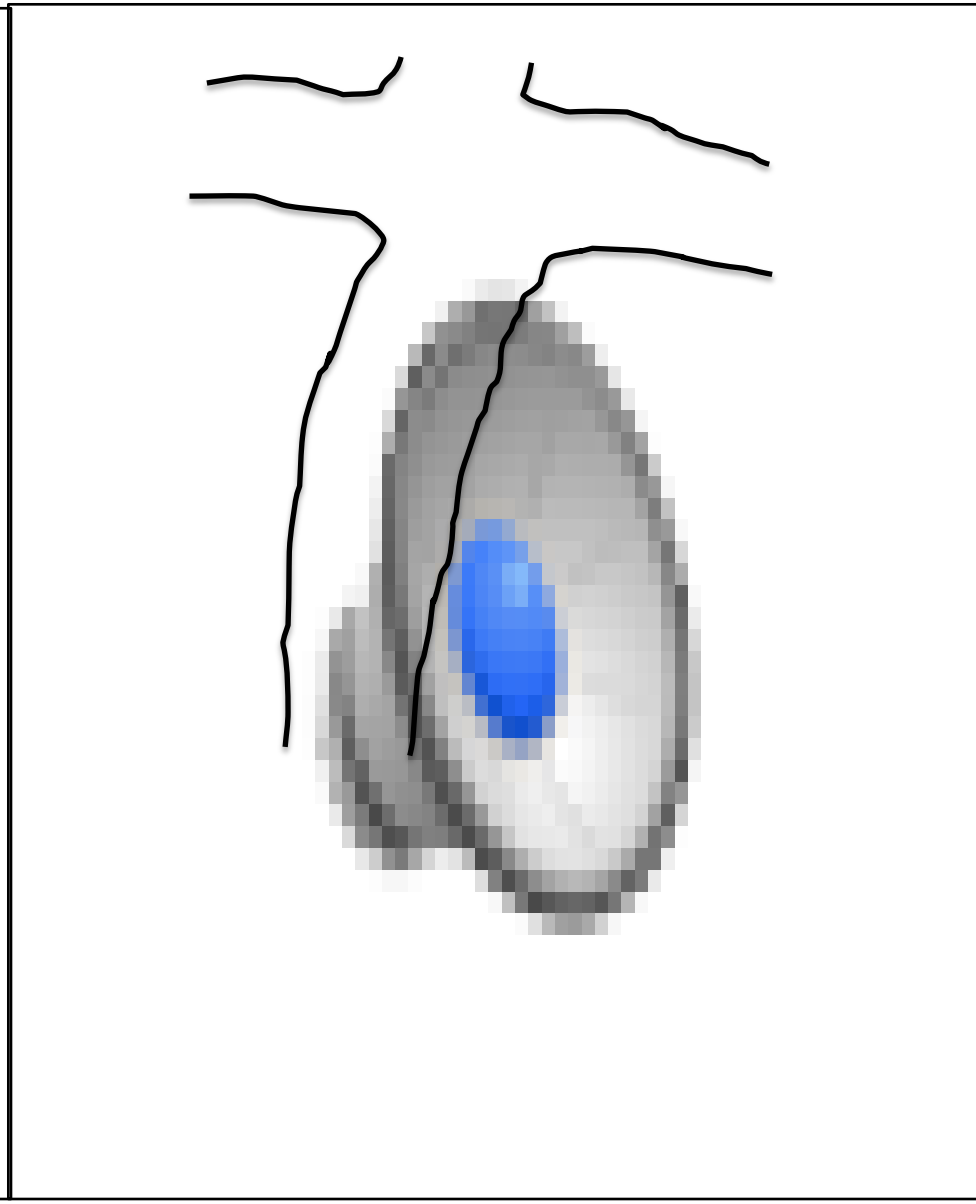
Pre-procedural imaging - CMR



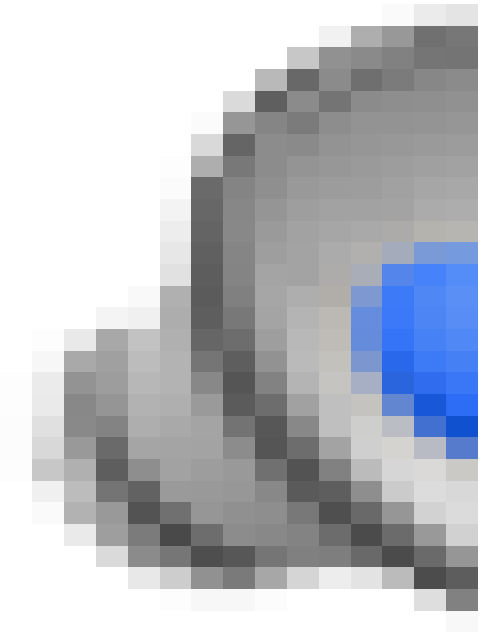


Access to the RA – puncture of extracardiac TCPC conduit

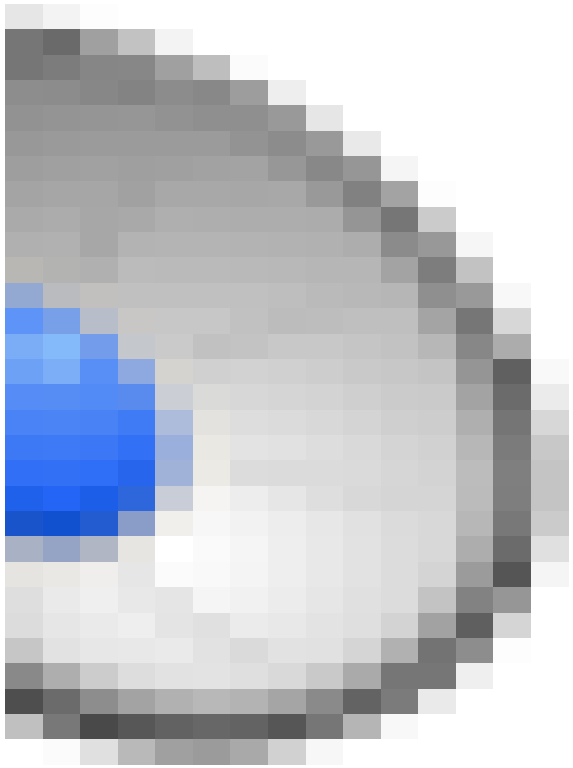




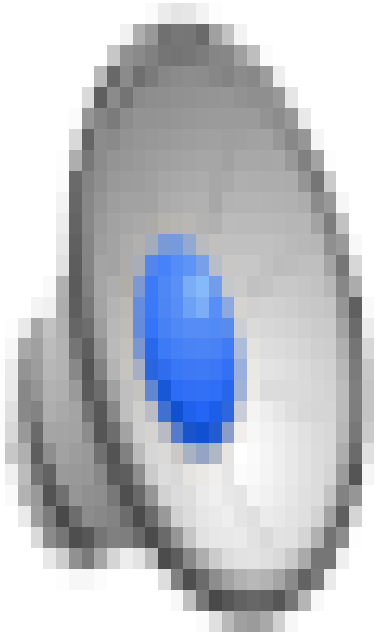
3D mapping system CARTO activation map + CT scan



3D mapping system CARTO voltage map



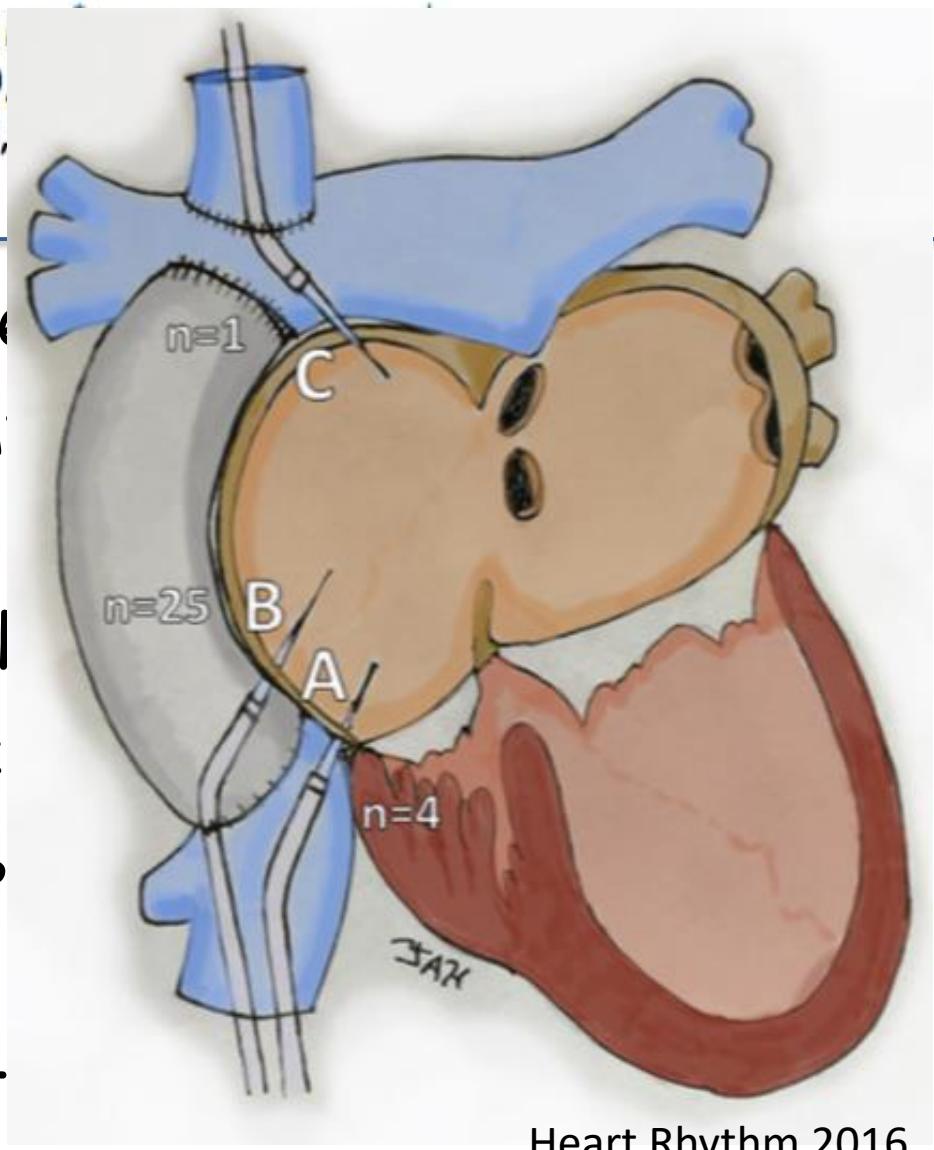
FUP 1 year, no recurrence of arrhythmia,
mild desaturation during exercise
-> cardiac catheterization



Catheter ablation of supraventricular tachyarrhythmia after extracardiac Fontan surgery

Jeremy P. Moore, MD, MS, FHRS,* Kevin M. Shannon,
Stephen P. Seslar, MD, PhD,‡ Jason M. Garnreiter, MD,
Ronn E. Tanel, MD, FHRS,¶ Andrew A. Papez, MD, FHRS,
Seshadri Balaji, MBBS, FRCP (UK), PhD††

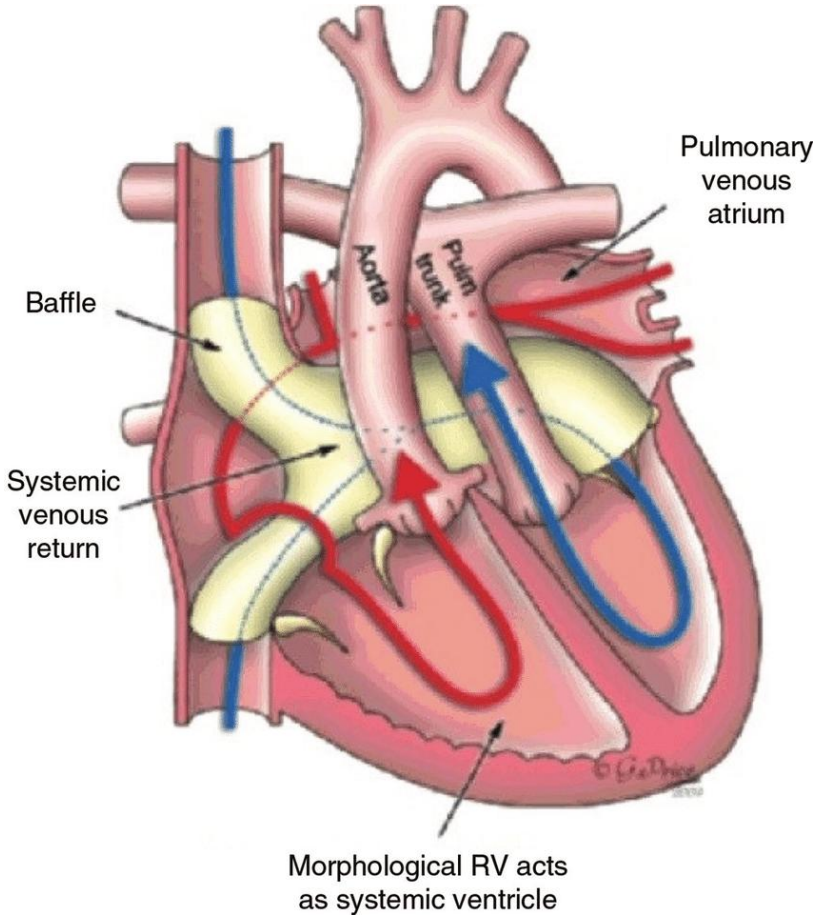
- multicenter (9) , 46 proc
- E-TCPC 24 pts, TCPC con
- "trans-conduit puncture"
- IART in 21 pts (58%) – al
- Acute success in 38 proc
- Recurrence in 6 pts (17%
- Complications in 8 pts (0
- FUP median 0.4 yrs (0.1 –



Heart Rhythm 2016

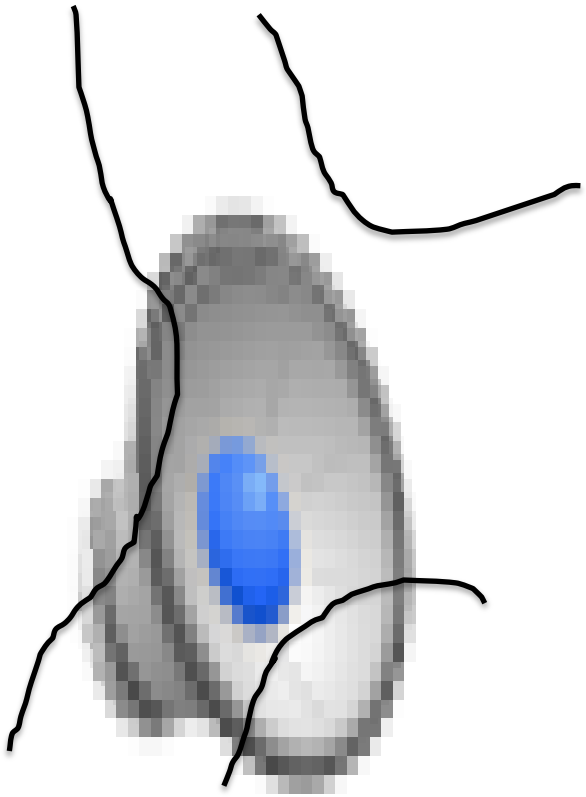
Case #3

- 49 yo male
- TGA after Senning operation
- 2014 catheter ablation of IART (Stereotaxis)
- Recurrence of IART -> re-ablation via puncture of intra-atrial baffles



Access to the cavotricuspid isthmus (CTI) puncture of the atrial baffle

AP



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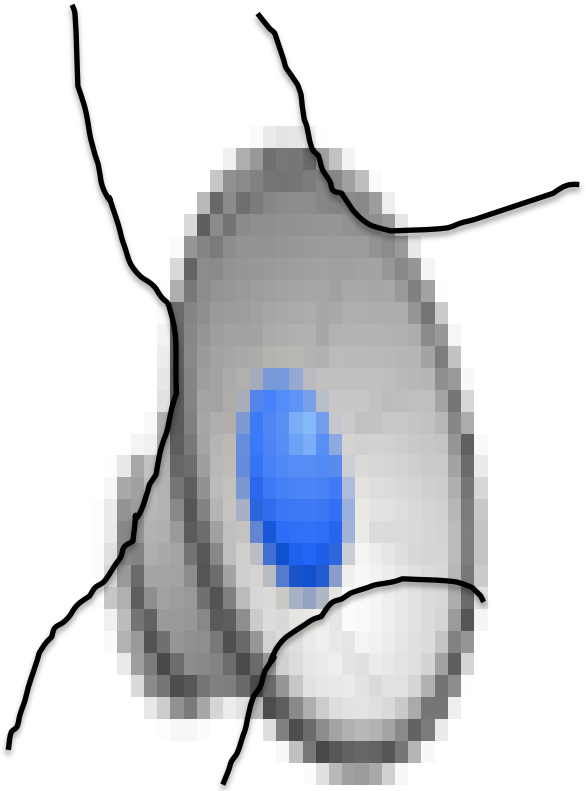
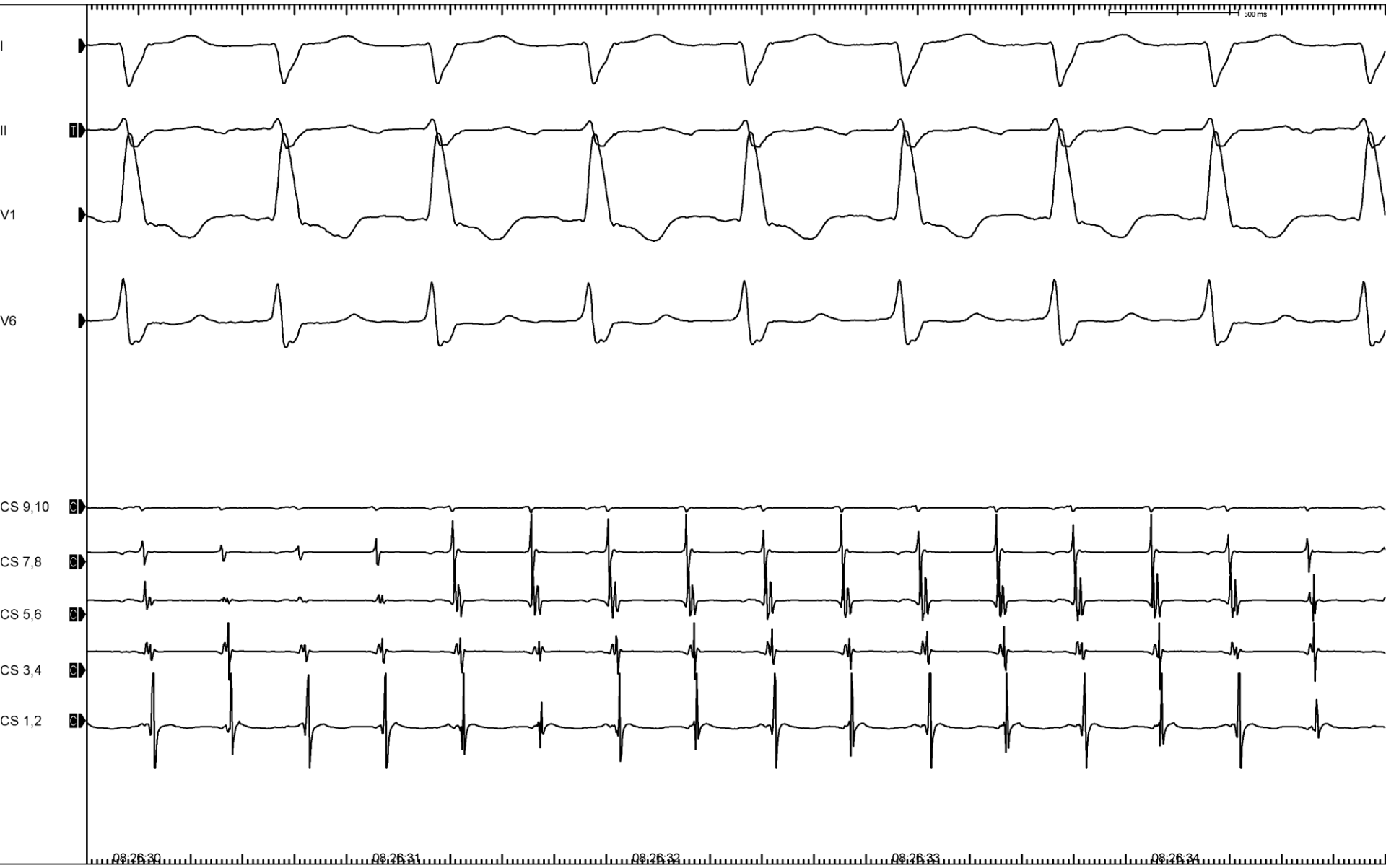
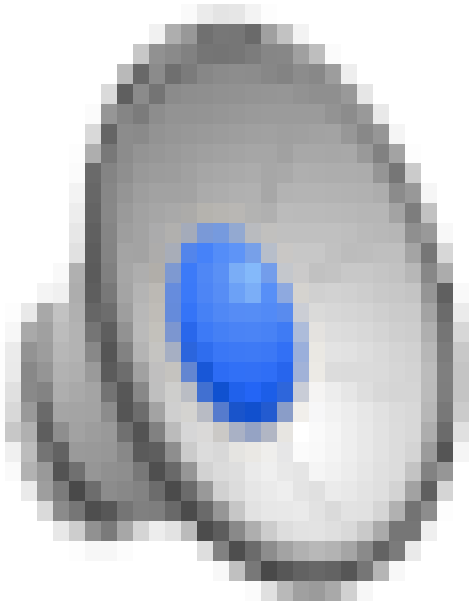


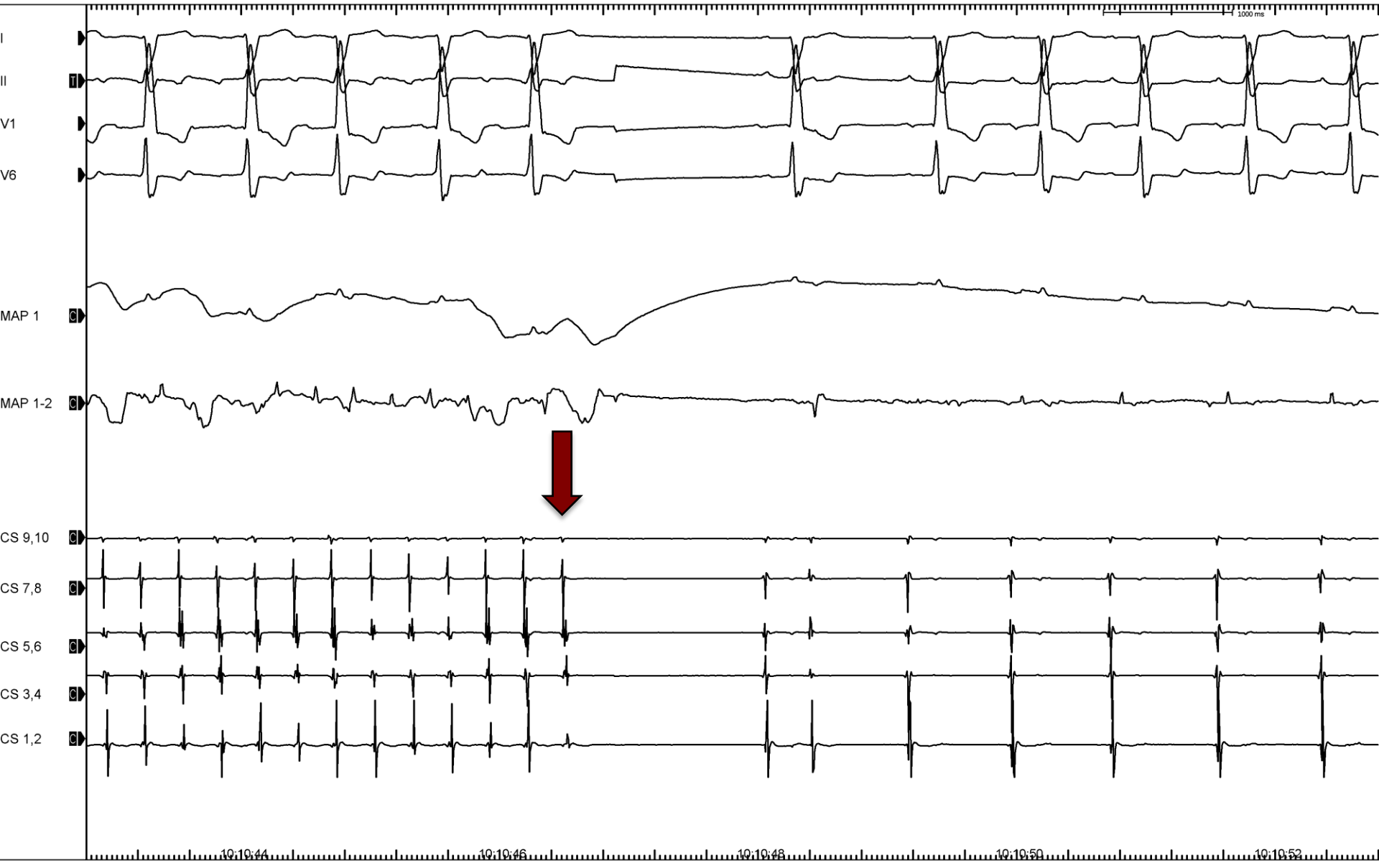
Catheter ablation



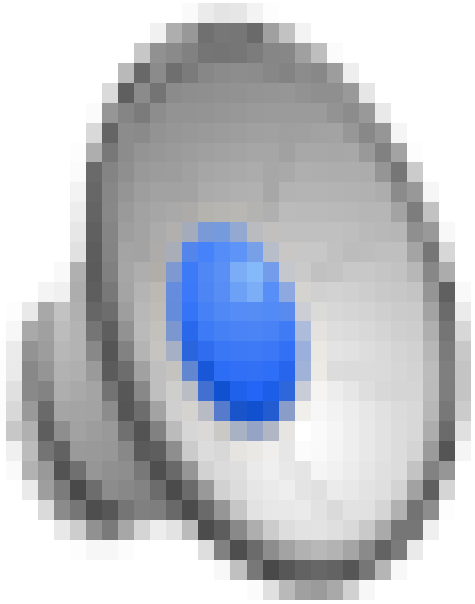
3D mapping system CARTO activation map



Catheter ablation of cavotrikuspid isthmus from both sides – SVA & PVA ☺



Check of conduction block on cavotrikuspid isthmus after ablation



Summary

- Incidence of arrhythmias in GUCH increases in time after surgery
- Pharmacological therapy is often ineffective / side effects ☹
- Catheter ablation is only one causal therapy of SVT (VT) in CHD pts.
- Pre-procedural preparation is essential!
- 3D mapping system & irrigated catheter
- New technologies are coming soon... ☺

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