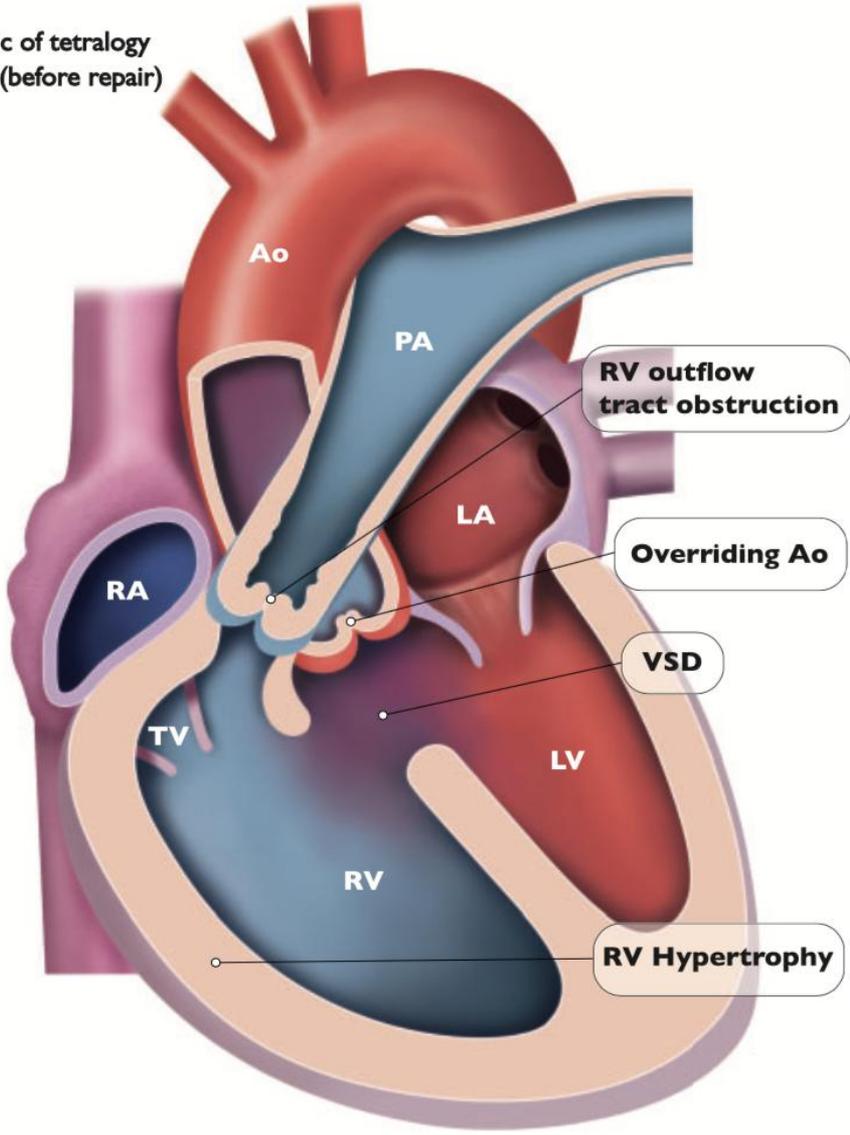# Elektivní elektrofyziologické intervence před pulmonální revalvulací?

Roman Gebauer
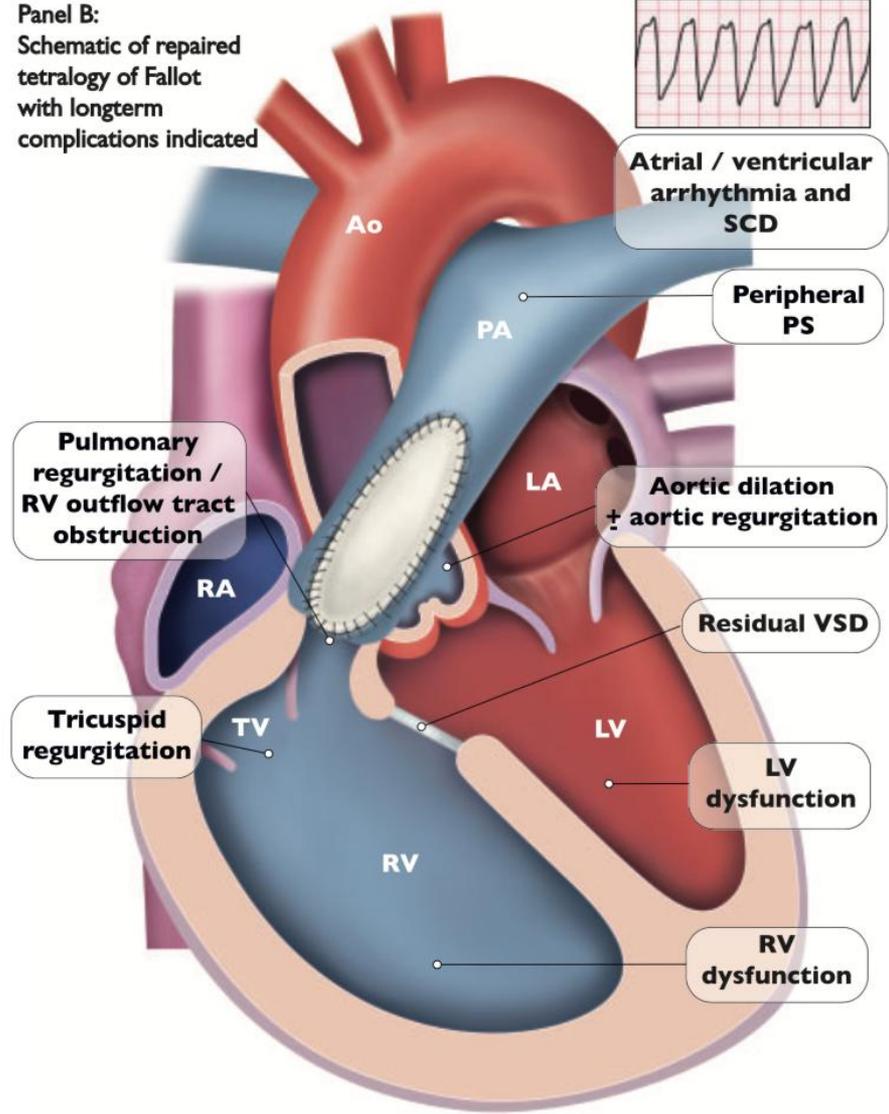
HERZZENTRUM
LEIPZIG
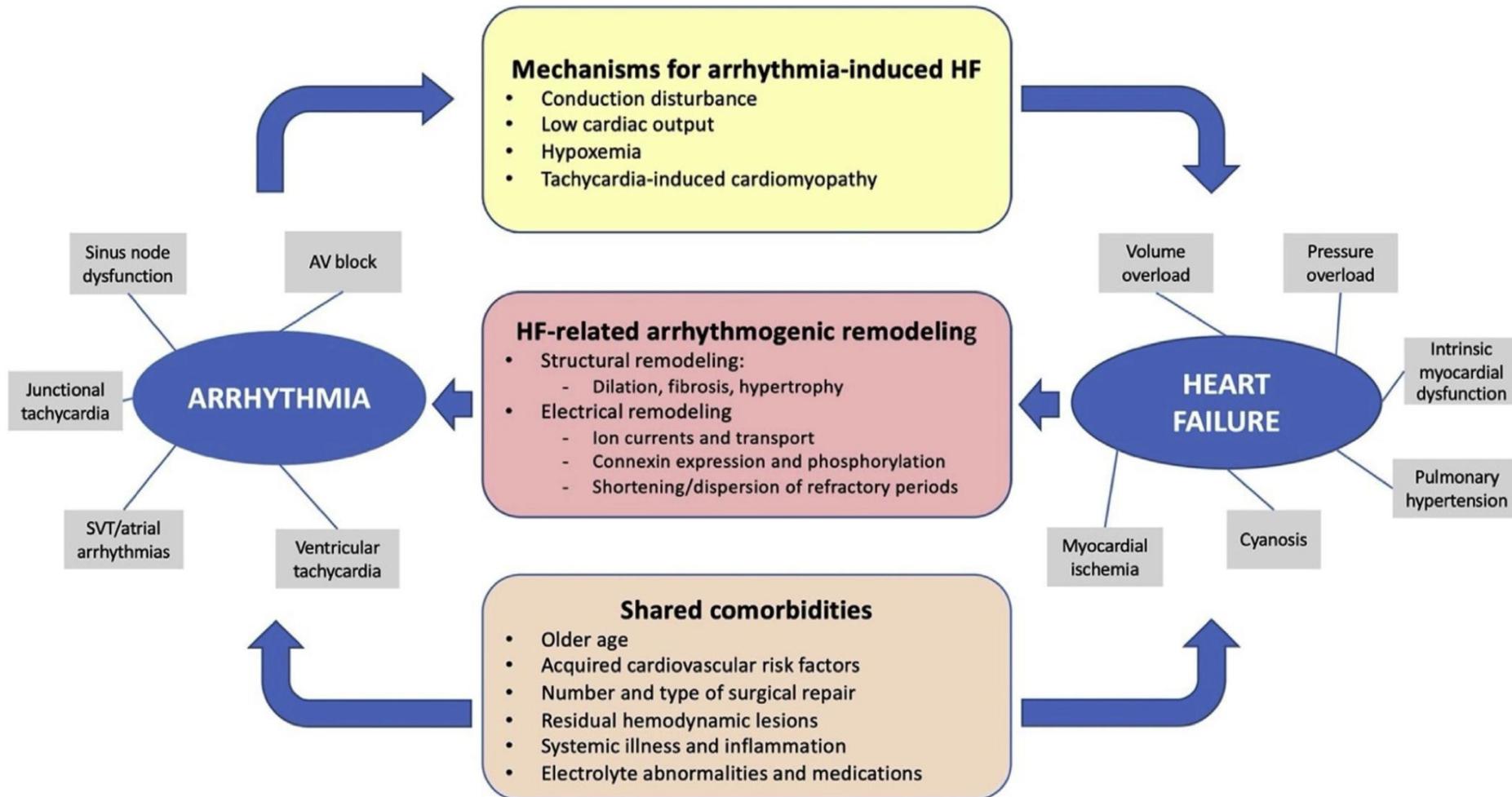
Panel A: Schematic of tetralogy of Fallot (before repair)

Ao

PA

LA

RA

TV

LV

RV

RV outflow tract obstruction

Overriding Ao

VSD

RV Hypertrophy

Panel B: Schematic of repaired tetralogy of Fallot with longterm complications indicated

Ao

PA

LA

RA

TV

LV

RV

Atrial / ventricular arrhythmia and SCD

Peripheral PS

Pulmonary regurgitation / RV outflow tract obstruction

Aortic dilation + aortic regurgitation

Residual VSD

Tricuspid regurgitation

LV dysfunction

RV dysfunction

ESC Guidelines for the management of ACHD, Eur Heart J 2021

Arrhythmia & heart failure interactions in CHD patients

Bessiere F et al. Heart Rhythm 2021

Arrhythmia Burden in Adults With Surgically Repaired ToF
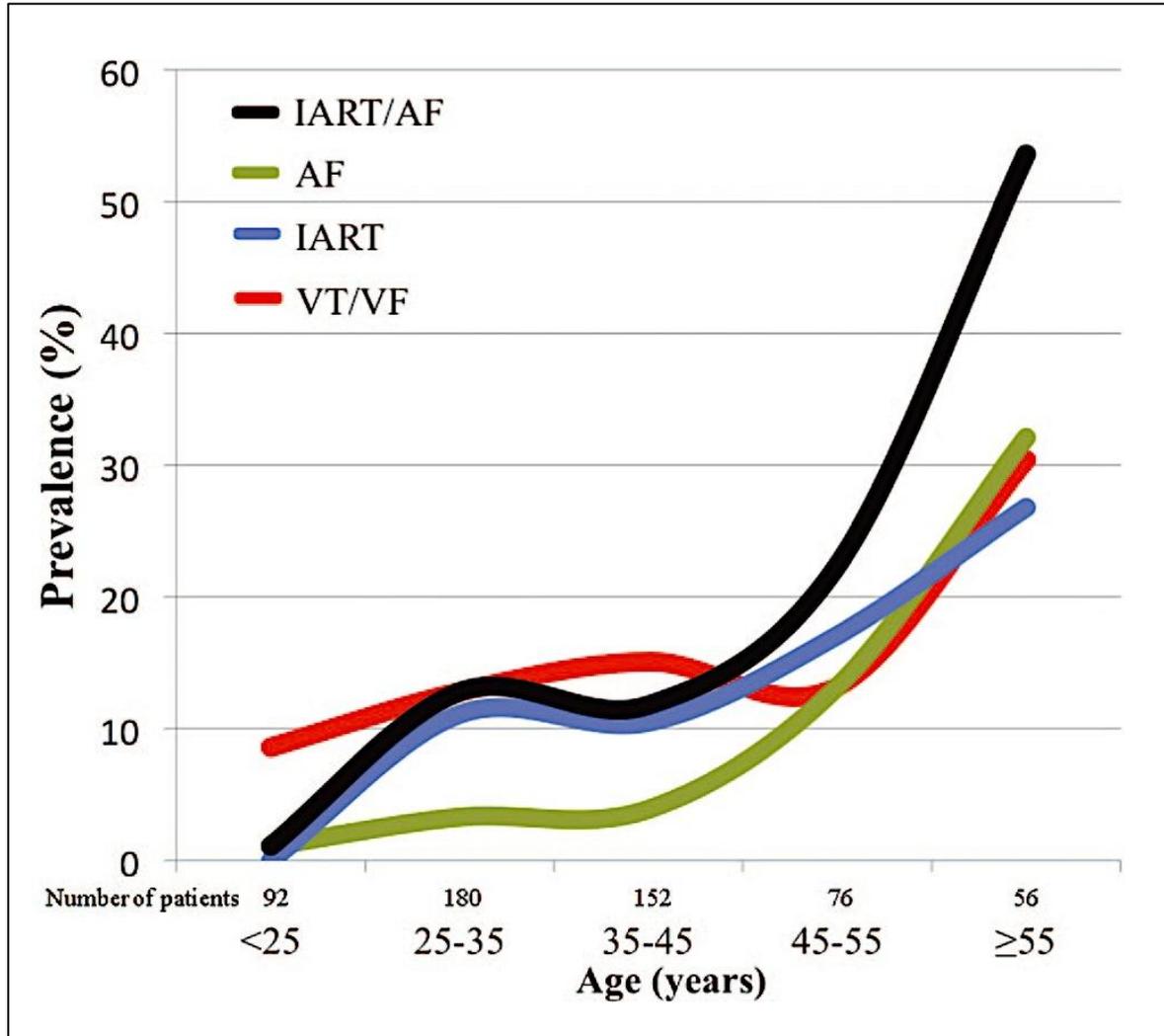
✓N=556 pts,
✓11 centers
✓age 36.8+12 yrs
✓sustained
   VT/VF in 14,6 %

Khairy P et al., Circulation 2010

Update on Interventional Electrophysiology in Congenital Heart Disease
Evolving Solutions for Complex Hearts

Elizabeth D. Sherwin, MD; John K. Triedman, MD; Edward P. Walsh, MD
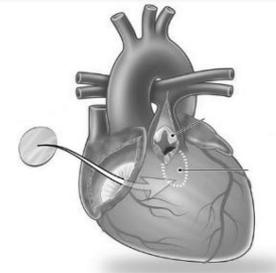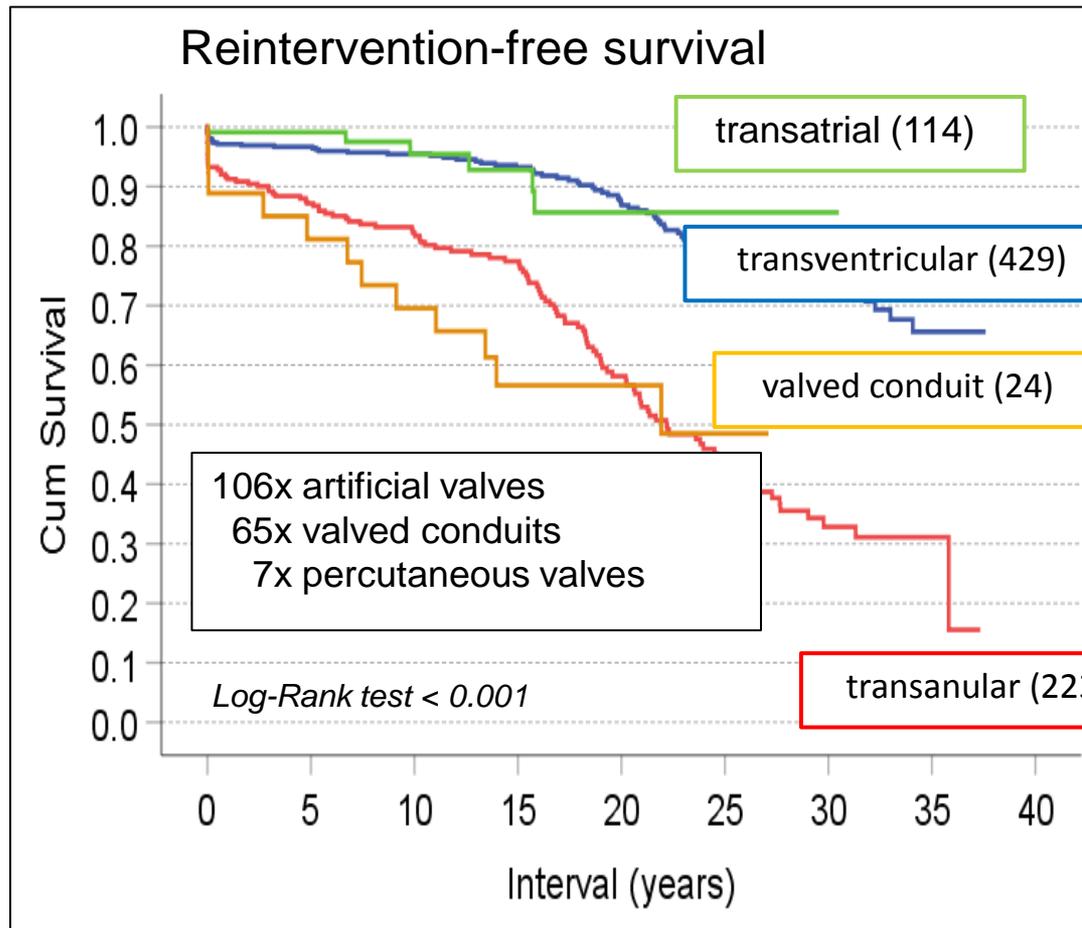
VT/VF substrates in repaired ToF

- Discrete corridors of slow conduction supporting ≥1 monomorphic reentrant VT

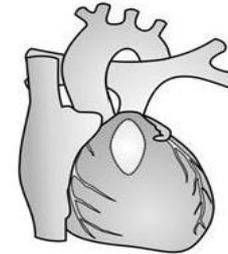Incidence of SCD in ToF adult population is 2.5% per decade of FUP

- Diffusely abnormal myocardium leading to disorganized polymorphic VT and VF
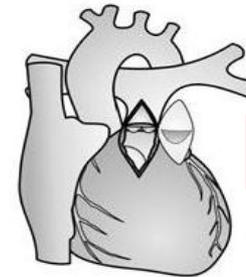 - o Consequence of pressure/volume overload and cyanosis

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Tetralogy of Fallot repair (N = 848)

Pulmonary valve replacement

Reintervention-free survival

transatrial (114)

transventricular (429)

valved conduit (24)

106x artificial valves
65x valved conduits
7x percutaneous valves

Log-Rank test < 0.001

transanular (223)

Transatrial

Transventricular

Transanular

valved conduit

Prof. V. Chaloupecký
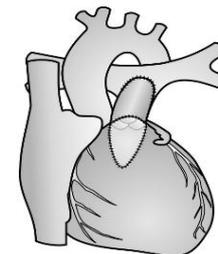
Pulmonary Valve Replacement in Tetralogy of Fallot
Impact on Survival and Ventricular Tachycardia

David M. Harrild, MD, PhD; Charles I. Berul, MD; Frank Cecchin, MD; Tal Geva, MD;
Kimberlee Gauvreau, ScD; Frank Pigula, MD; Edward P. Walsh, MD
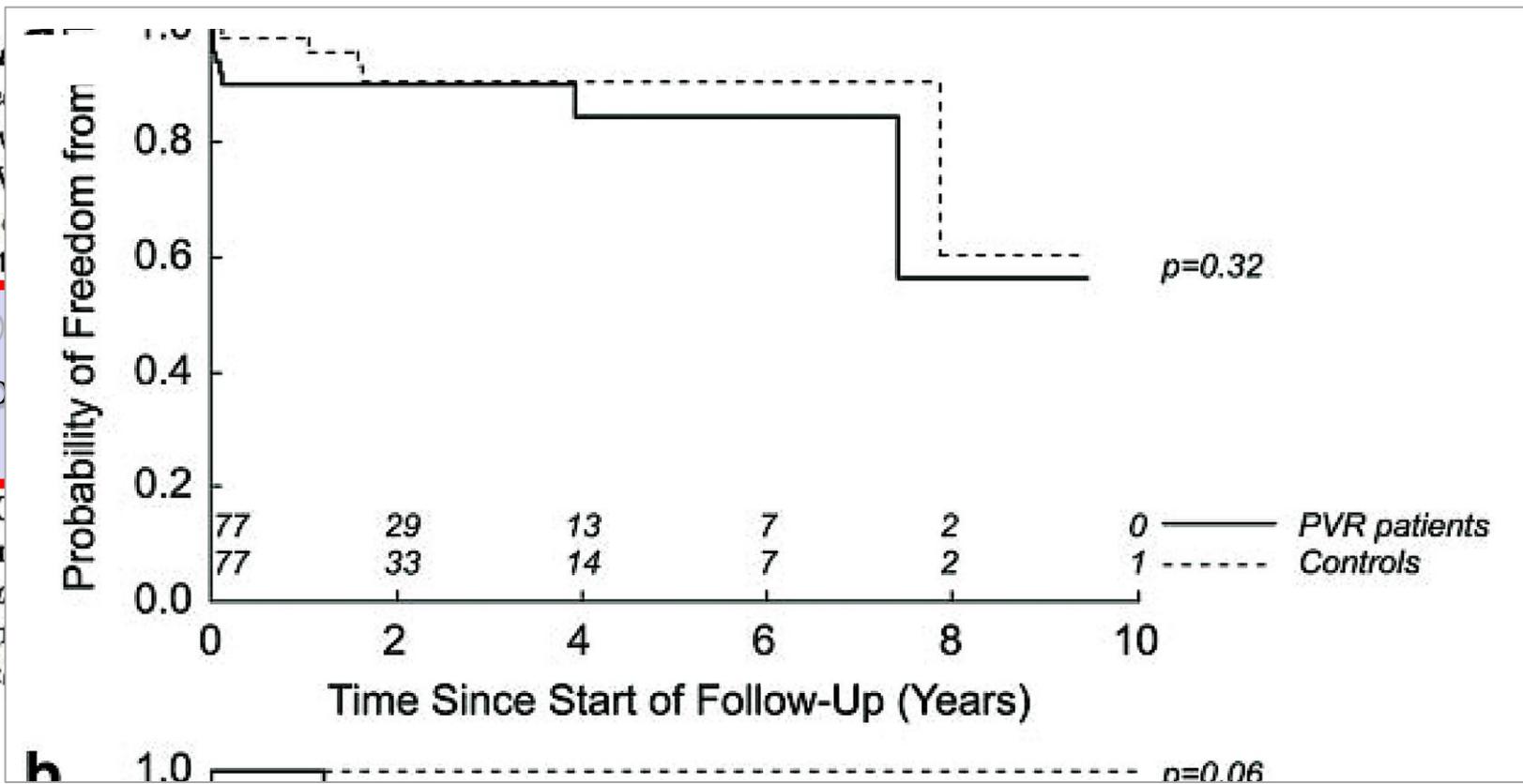
...late PVR for symptomatic pulmonary regurgitation/RV dilatation did not reduce the incidence of VT or death...
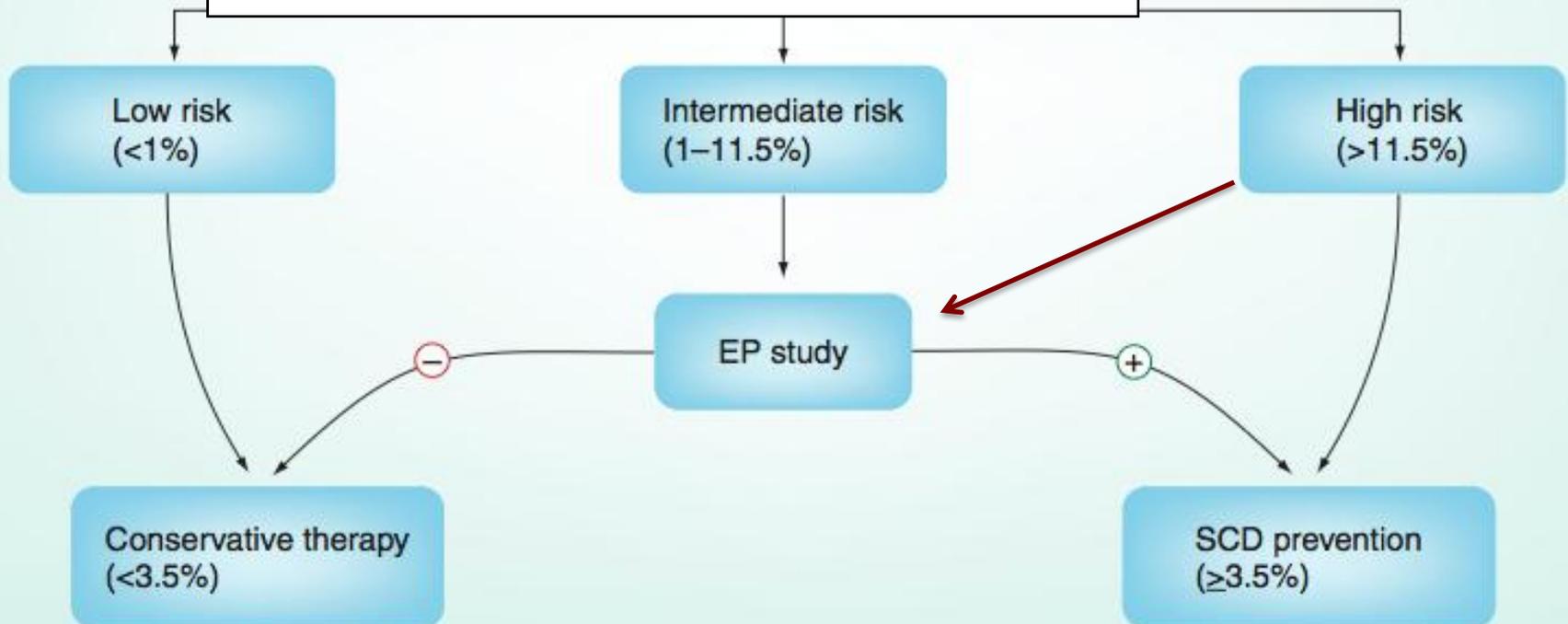
Do we have reliable risk stratification?

Modified Risk Stratification Approach in TOF

Table 3. Risk Score for Appropriate ICD Shocks in Primary Prevention

Variable	Exp(β)	Points Attributed
Prior palliative shunt	3.2	2
Inducible sustained ventricular tachycardia	2.6	2
QRS duration ≥180 ms	1.4	1
Ventriculotomy incision	3.4	2
Nonsustained ventricular tachycardia	3.7	2
LVEDP ≥12 mm Hg	4.9	3
Total points	…	0–12

Risk score	Risk category
0-2	Low
3-5	Intermediate
6-12	High

Low risk (<1%)

Intermediate risk (1–11.5%)

High risk (>11.5%)

EP study

Conservative therapy (<3.5%)

SCD prevention (≥3.5%)

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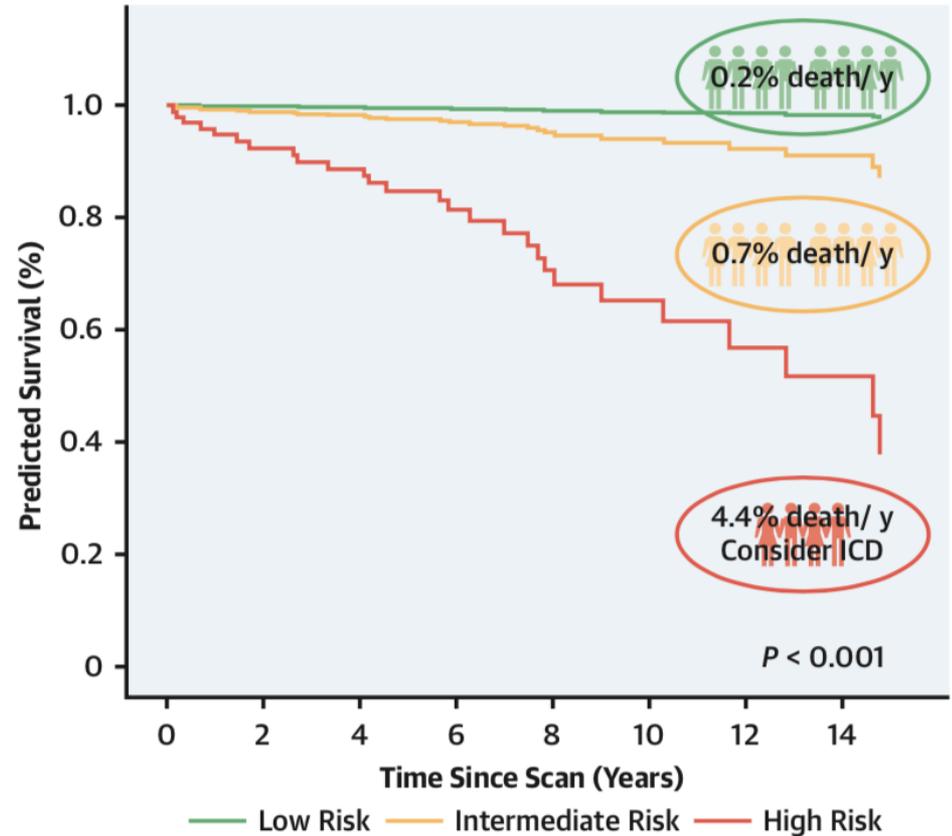LEIPZIG

Khairy P, Expert Rev Cardiovasc Ther 2009

Predicting Survival in Repaired Tetralogy of Fallot

CENTRAL ILLUSTRATION   Risk Score to Predict Mortality in Patients With Tetralogy of Fallot

Mild RVLGE

Moderate RVLGE
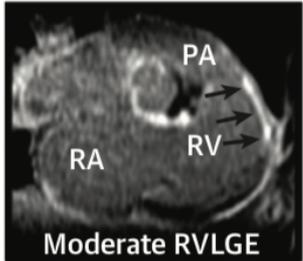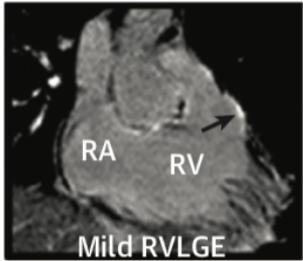
Severe RVLGE

Mortality Risk	Points
RVLGE extent	
Minimal/mild extent	0
Moderate extent	24
Severe extent	40
LVLGE present	
No	0
Yes	6
RV ejection fraction	
>47%	0
36%-47%	4
≤35%	10
LV ejection fraction	
>55%	0
36%-55%	4
≤35%	12
Peak oxygen uptake	
>17 ml/kg/m^2	0
≤17 ml/kg/m^2	6
B-type natriuretic peptide	
<127 ng/l	0
≥127 ng/l	12
Sustained atrial arrhythmia	
No	0
Yes	8
Age over 50 years	
No	0
Yes	6
Total	/100

0.2% death/ y

0.7% death/ y

4.4% death/ y
Consider ICD

$P < 0.001$

— Low Risk   — Intermediate Risk   — High Risk

Risk Score	Mortality	%	Mortality/Year
0-20	2/223 (0.9%)	41	0.2%
21-50	9/272 (3.3%)	49	0.7%
≥51	16/55 (29.1%)	10	4.4%

Based on prospective data with follow up 6.4 (±5.8 years); total 3,512 years

Ghonim, S. et al. J Am Coll Cardiol Img. 2022;15(2):257–268.

Slow Conducting

CONCLUSIONS
- ✓ A narrow QRS interval does not exclude VT-related SCAI
- ✓ In the presence of RBBB, SCAI further prolongs QRS duration
- ✓ QRS duration >150 ms is highly suspicious for SCAI or isthmus block distinguishable by EA mapping.
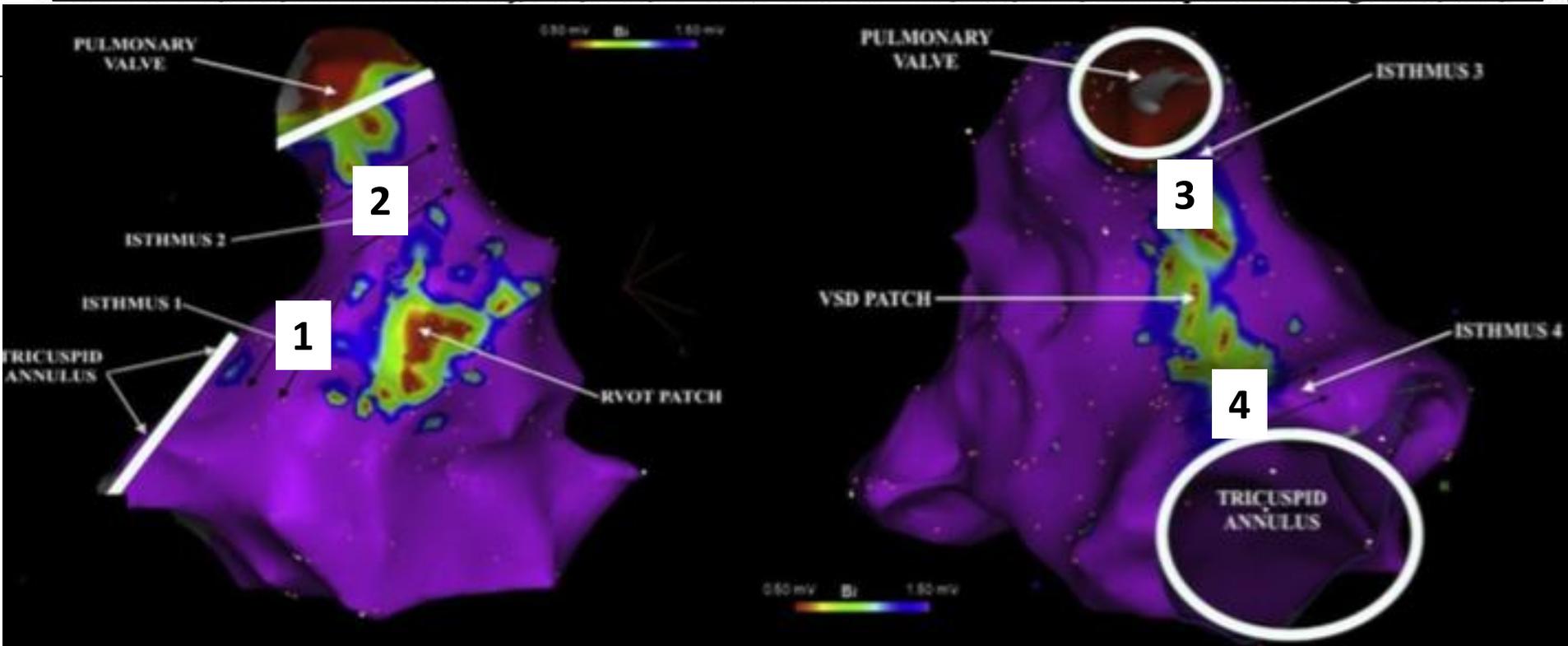
Re-Entry Using Anatomically Determined Isthmuses
- A Curable VT in Repaired Congenital Heart Disease -
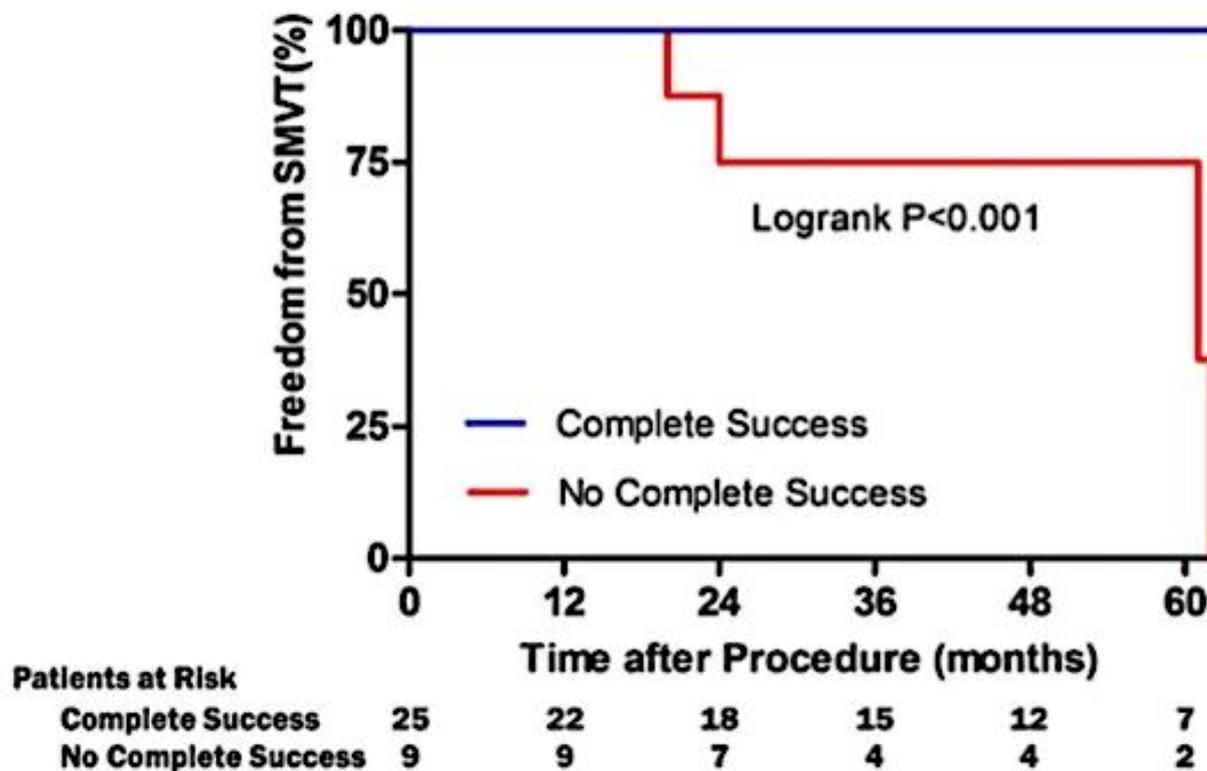### Kapel GF et al., Circ Arrhythmia Electrophysiol 2015

Figure 3. Occurrence of sustained monomorphic ventricular tachycardia (SMVT) during long-term follow-up.

n=34, age 49±13 years, successful RF ablation of VT in 25/34 (74%; ICD in 18)
Mean follow-up 46±29 months

Risk assessment

Procedural risk of EPS/ablation

Pro-arrhythmic risk of ablation – incomplete ablation line
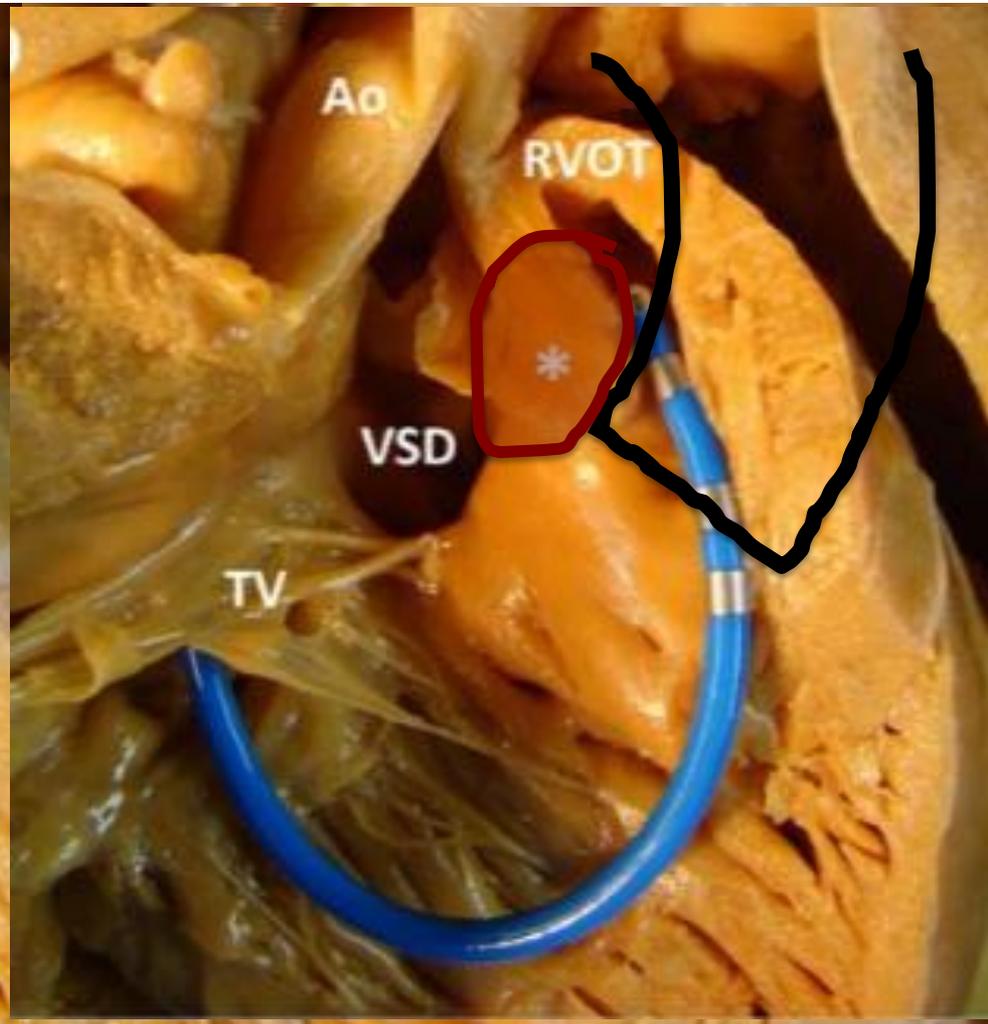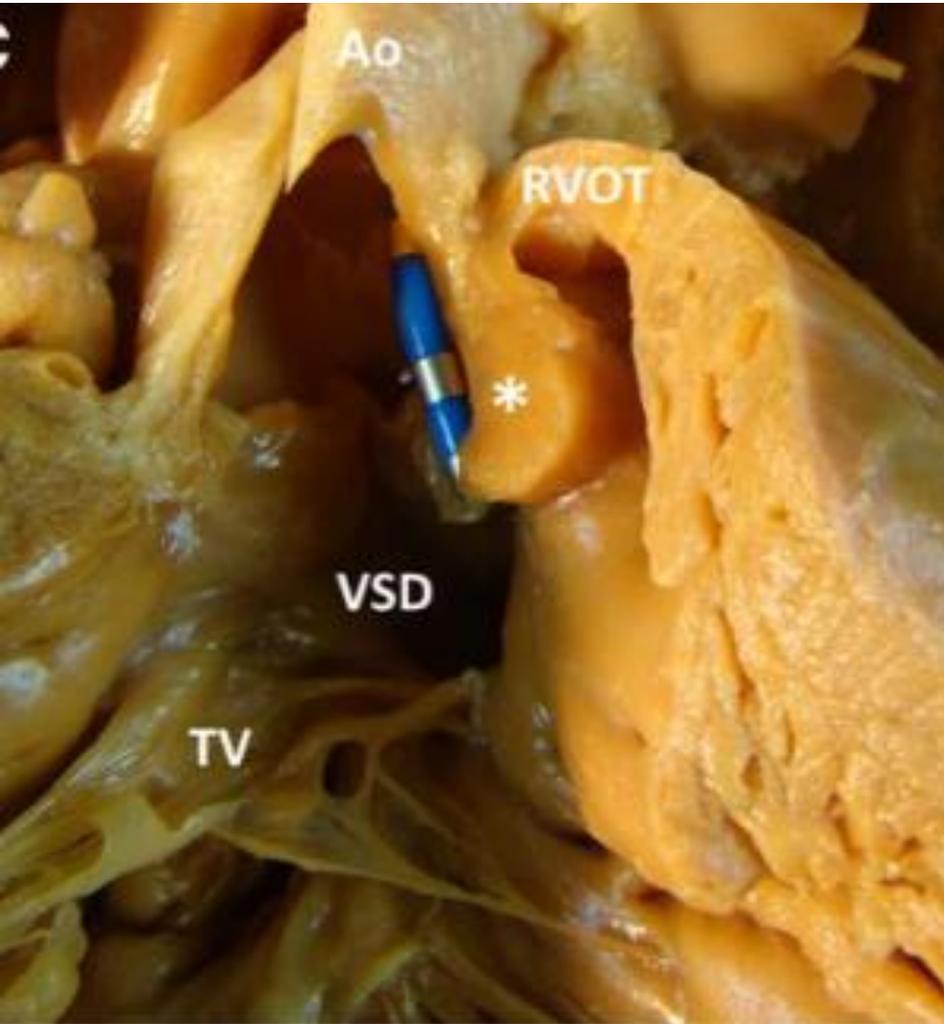
Inducible VT in asymptomatic pat. ≠ clinical VT

Unsuccessful ablation (=VT still inducible)
-> ICD implantation ???

No access to ablation target after PVI – slow conducting zones covered by stent / conduit ☹

Anatomical aspects

Characterization of Anatomic Ventricular Tachycardia Isthmus Pathology After Surgical Repair of Tetralogy of Fallot

Jeremy P. Moore, MD; Atsuko Seki, MD; Kevin M. Shannon, MD;
Ravi Mandapati, MD, FHRS; Roderick Tung, MD, FHRS; Michael C. Fishbein, MD
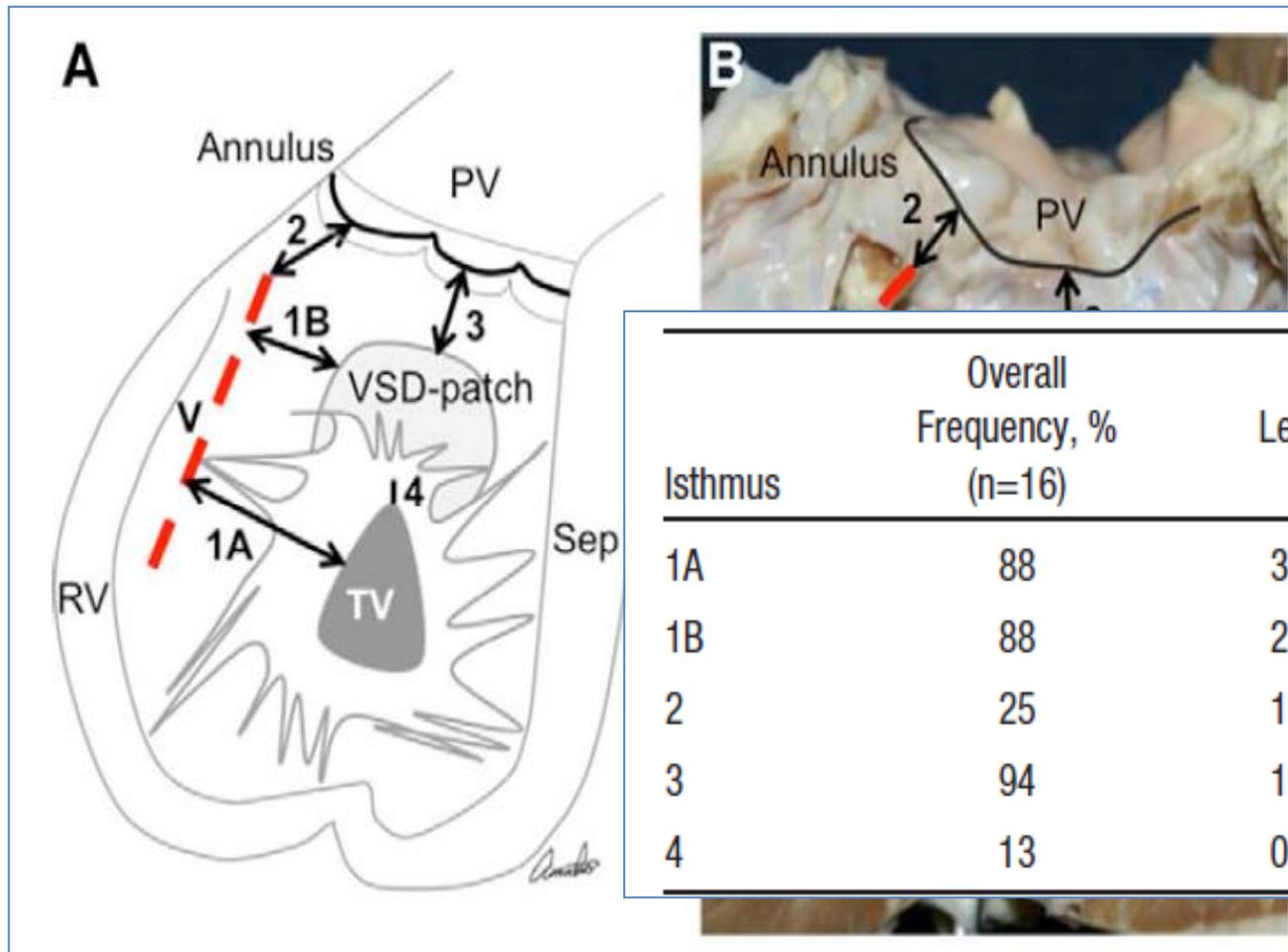
Isthmus	Overall Frequency, % (n=16)	Mean Length, cm (n=16)	Mean Wall Thickness, cm (n=16)
1A	88	3.9 (1.08)	1.5 (0.29)
1B	88	2.4 (0.75)	1.1 (0.43)
2	25	1.5 (0.47)	0.5 (0.15)
3	94	1.4 (0.77)	0.6 (0.25)
4	13	0.6 (0.35)	0.3 (0.04)

ESC

European Society
of Cardiology

2020 ESC Guidelines for the management of adult congenital heart disease

Whether pre-interventional mapping and preventive ablation of slowly conducting anatomical isthmuses before or during intervention in patients *without* documented spontaneous sustained VT is beneficial is under investigation.

|		
Electrophysiologic evaluation, including programmed electrical stimulation, should be considered for risk stratification for SCD in patients with additional risk factors (LV/RV dysfunction; non-sustained, symptomatic VT; QRS duration ≥180 ms, extensive RV scarring on CMR).	**IIa**	**C**
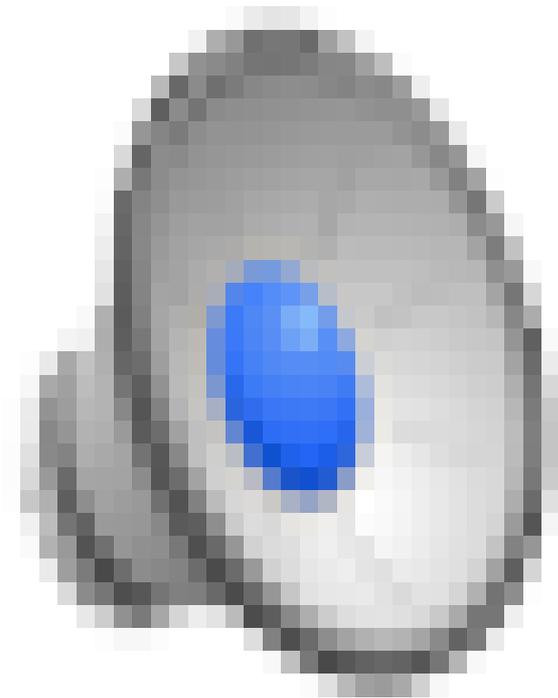
HERZZENTRUM

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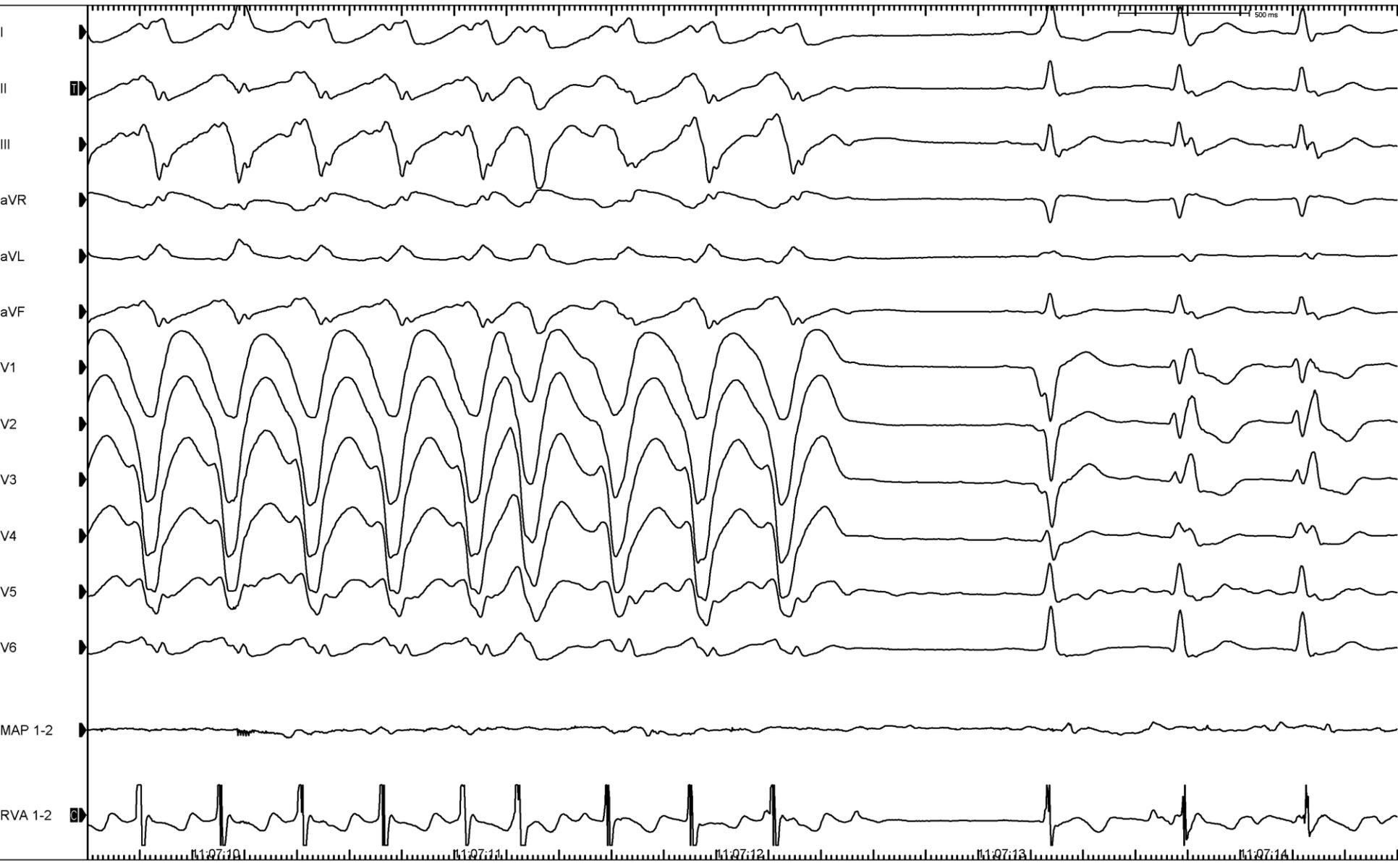# 49 J., TOF/corr. TAN, Melody impl., mmVT

49 J., TOF/corr. TAN, Melody impl., mmVT
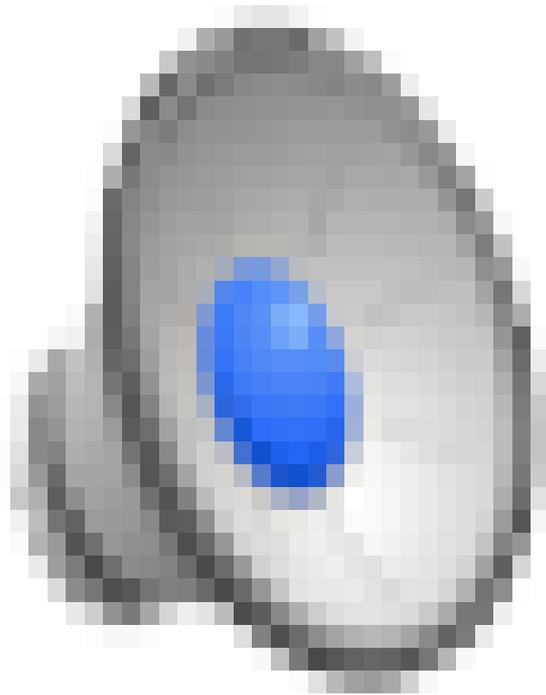
49 J., TOF/corr. TAN, Melody impl., mmVT
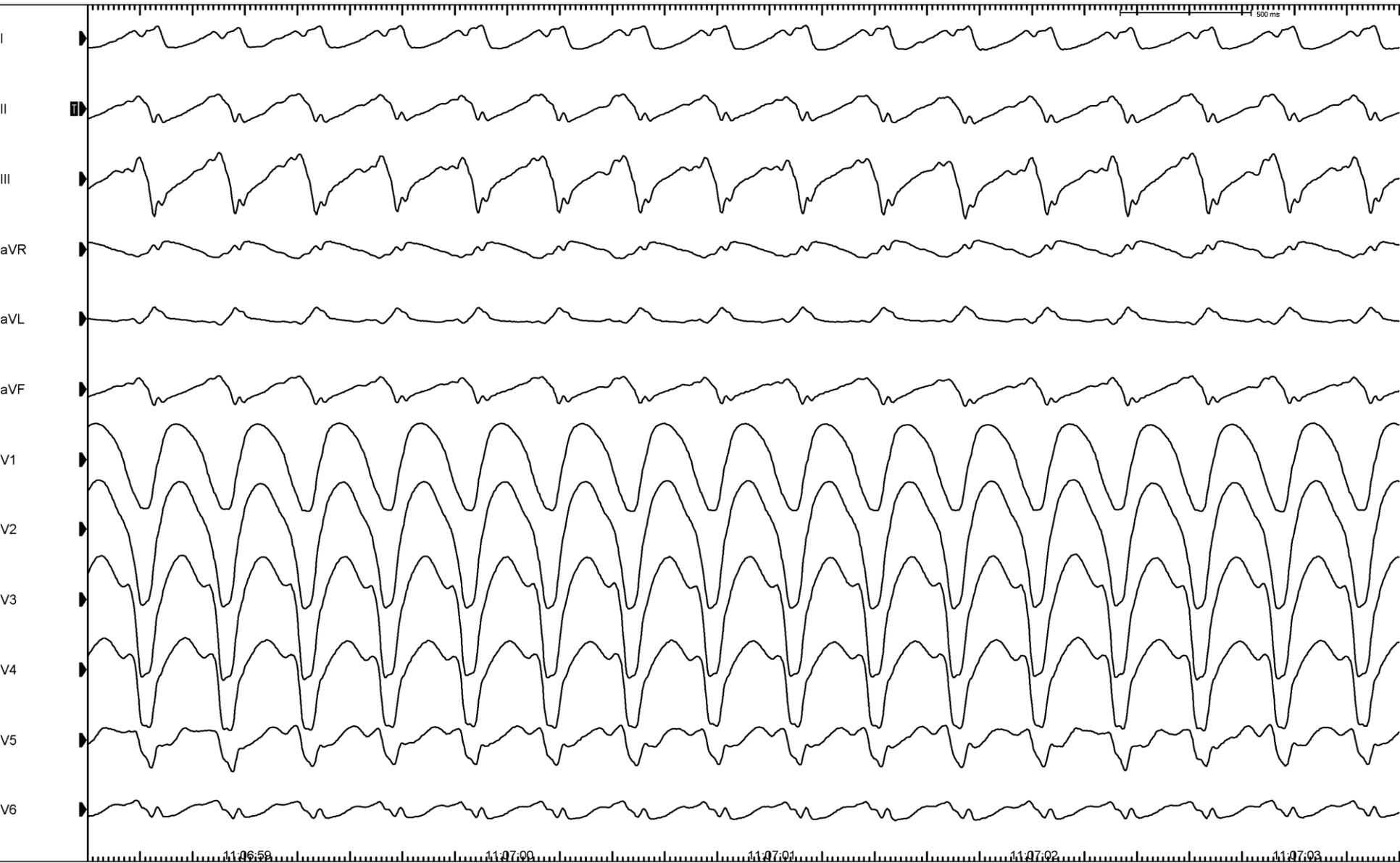
49 J., TOF/corr. TAN, Melody impl., mmVT

Conclusions
pre-PVI preventive ablation

- Lack of data –> no GL available
- Little "mid-term" data about non-proarrhythmic effect of cryo-/RF ablation
- "Leipzig approach" -> Pre-procedural EPS/ablation of SCAIs in pts. indicated to surgical / percutaneous PVI
- Shared decision making process (!)

Thank you!

Roman Gebauer, MD
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Germany
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"Leipzig Approach"

- N=35 pts. (2019-2022)
- Age 42.3 yrs
- inducible VT in 16/35 pts. (SCAI in all)
- unsuccessful ablation in 2/35 pts.
  - ✓ Melody before abl. in 1 pts.
- non-inducible VT in 19 (SCAI in 14/19 pts)
- Ablation only in pts. with SCAI
- FuP 1.4 y (mean)
  - ✓ no VT/VF/SCD in all pts.