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The role of QLV in predicting the effect of CRT

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How/When to optimize CRT

1. **Before implantation**
   - Selection criteria

2. **During implantation**
   - Lead(s) position
   - Lead type - multipolar

3. **After implantation**
   - AVD, VVD programming
   - %VP
   - Pharmacotherapy

LV lead position - methodology

1. Anatomical

2. Electrical – local LV activation – QLV, RVstim-LV

3. Echocardiographical – delayed contraction

The impact of LV lead positioning was underestimated for a long time

Predictive value of anatomic LV lead position

- MADIT CRT subanalysis [1]: n=799, anterior-lateral-posterior, p=0,65
- REVERSE subanalysis [2]: n=346, lateral-non lateral, HR 0,44, p=0,04
- Wilton [3] n=250, ant-lat-post, lat=post, ant predict non response, p=0,001
- Foley [4] n=560, ant=lat=post

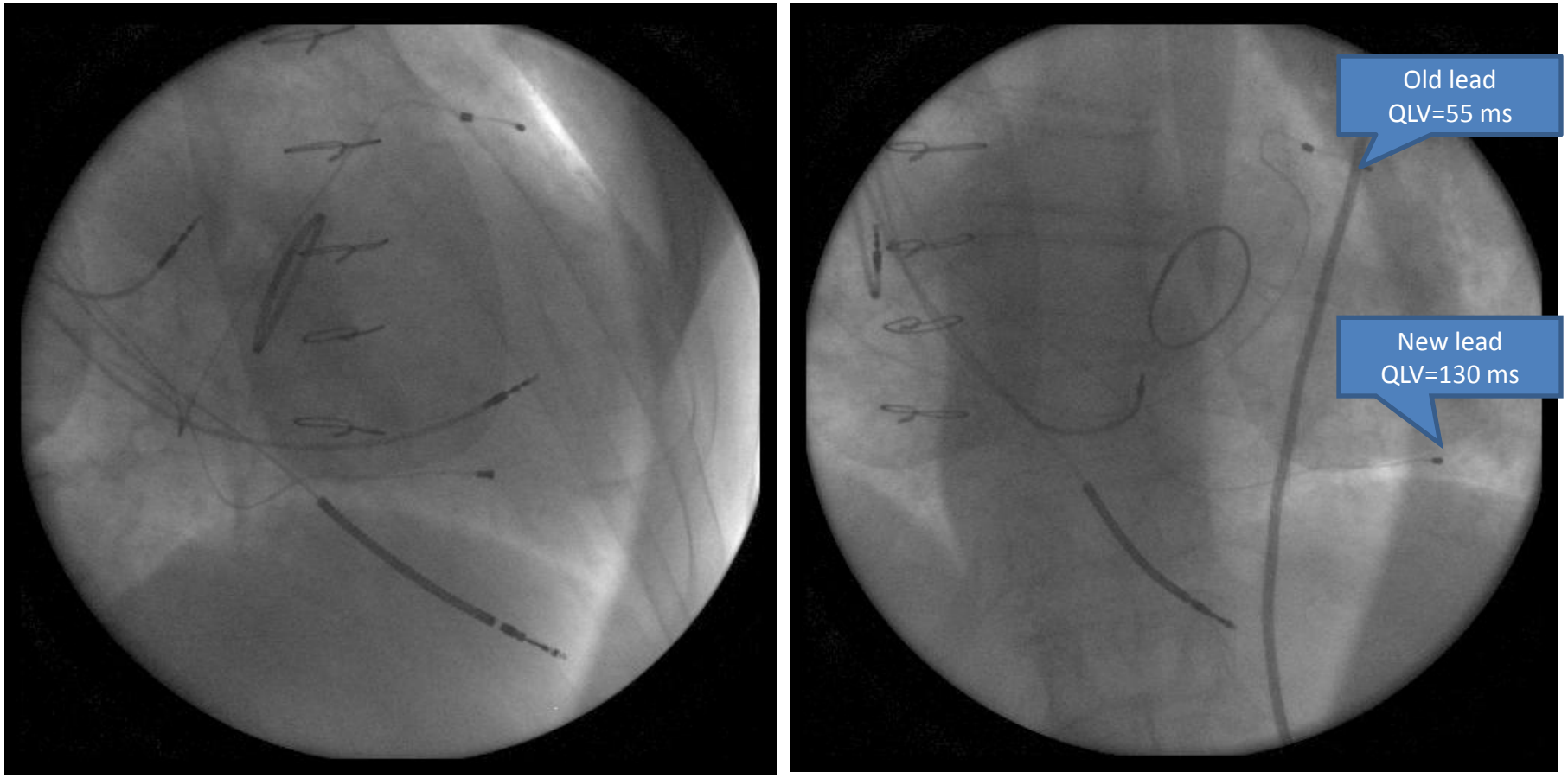
When LV apex is excluded, results from RCT are inconsistent

1.Singh JP et al, Circulation 2011, 2. Thebault C et al, J Heart J 2012, 3. Wilton SB, J Interv Card Electrophysiol 2008, 4. Foley PW et al, *Pacing Clin Electrophysiol* 2011

Empirical evidence

RAO

LAO



Possible explanations

1. LV lead position is not important

2. Inconsistent definition of anatomical location – ant-lat-post / anterolateral-posterolateral

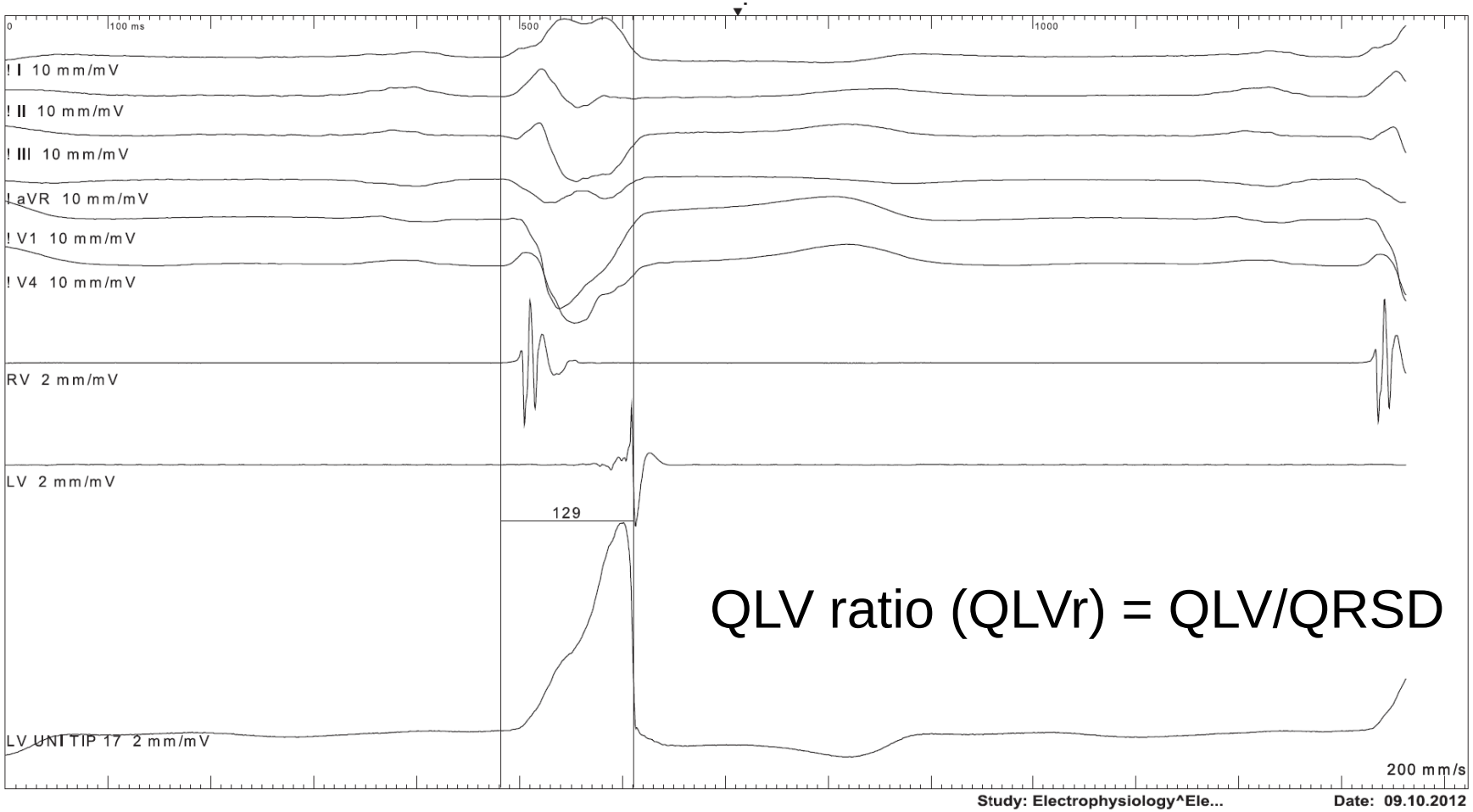
3. Anatomical targeting is not good enough

4. Optimal position is variable

CRT provides a partial compensation of significantly delayed activation of LV free wall by preexcitation of these delayed regions by LV lead.

Electrical position of LV lead

QLV



QLV ratio (QLVr) = QLV/QRSD

LV depolarization wavefront

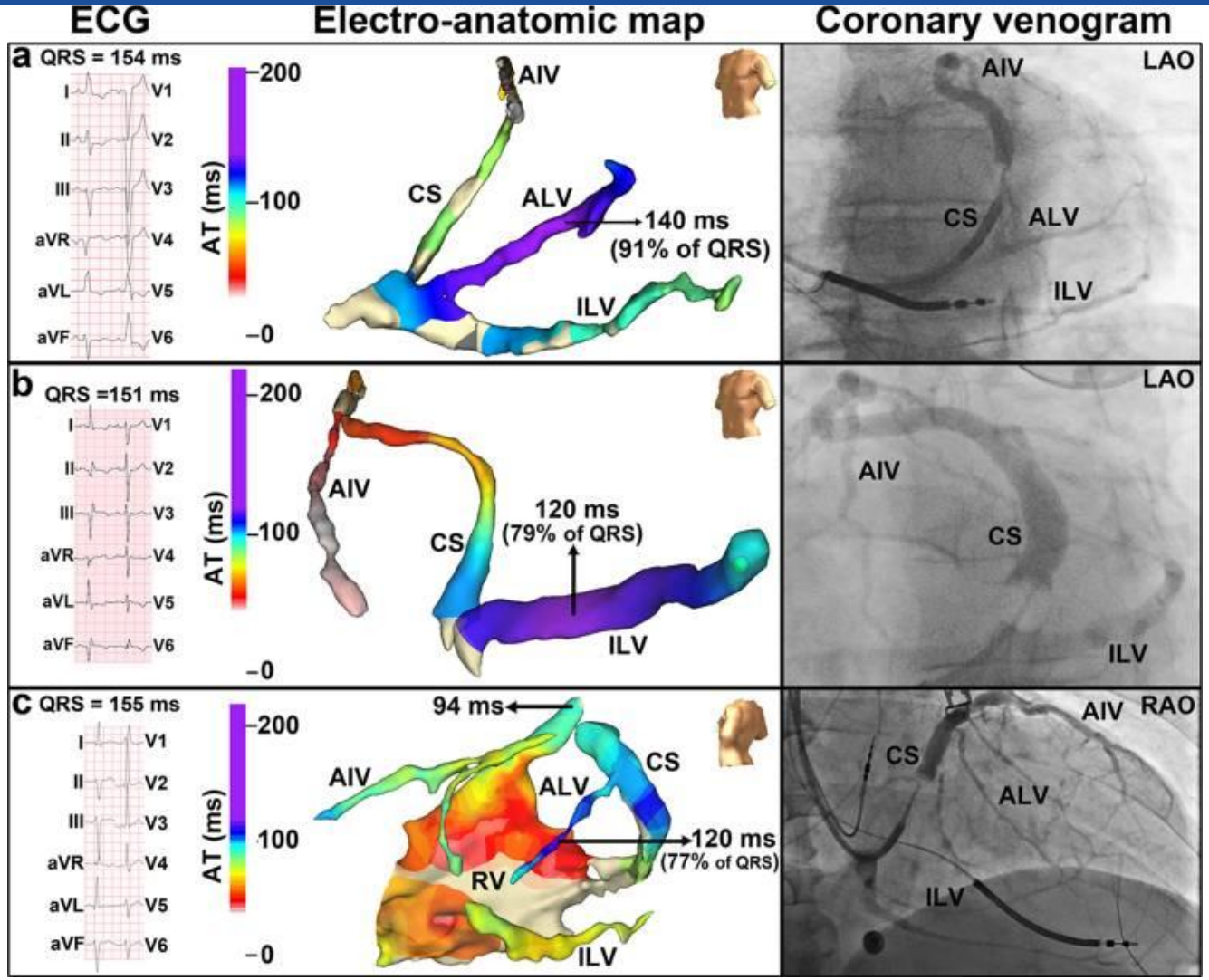
Experimental

- dog models
- RFA of proximal LBB
- Homogenous activation
- Targetting the lateral wall

Clinical

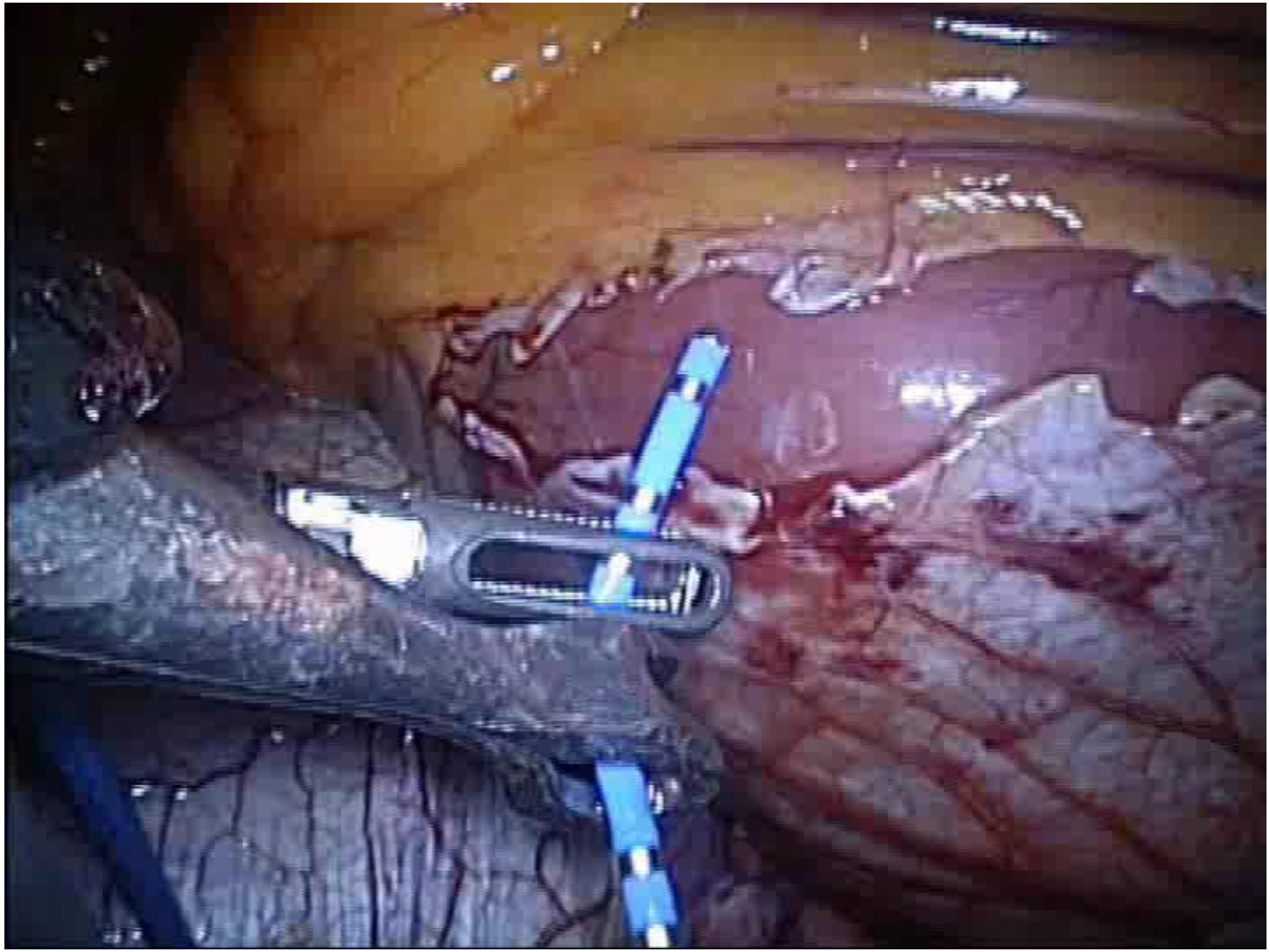
- More variable
- Especialy CAD – scars, blocks
- Variable ventricular septum transition

Coronary venous electro-anatomical mapping



van Stipdonk AM, Prinzen FW et al, , coronary venous electroanatomical mapping. Netherlands Heart Journal. 2016;24(1)

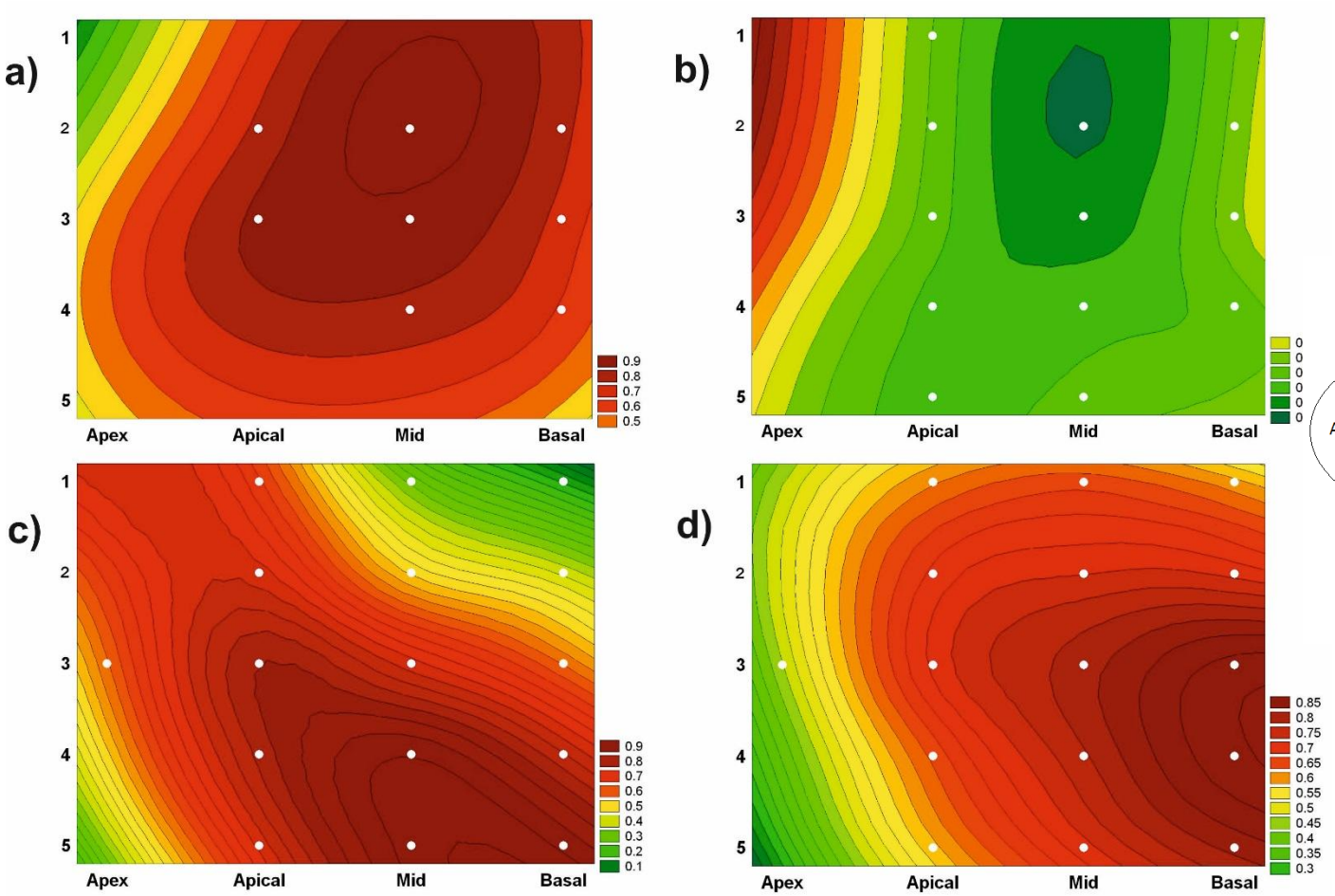
Epicardial mapping during thoracoscopic LV lead implantation



Polasek R. et al, JCE, 2014

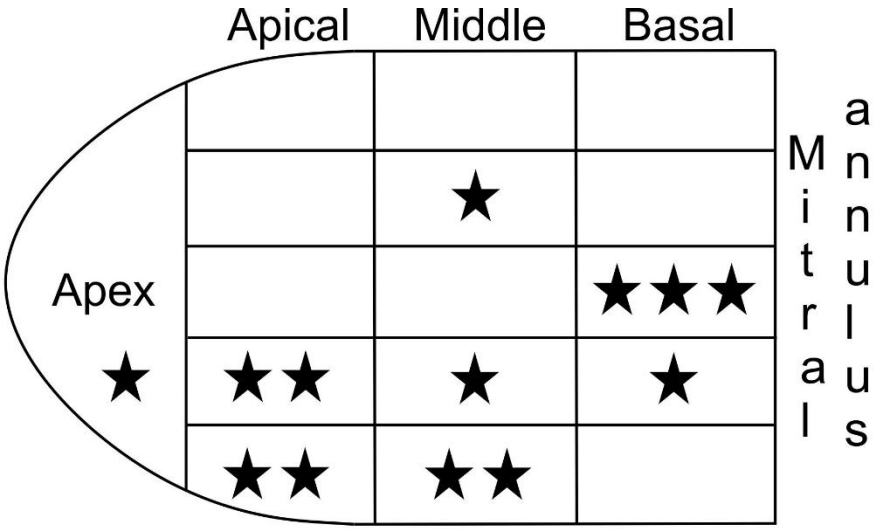
Epicardial mapping during surgical LV placement

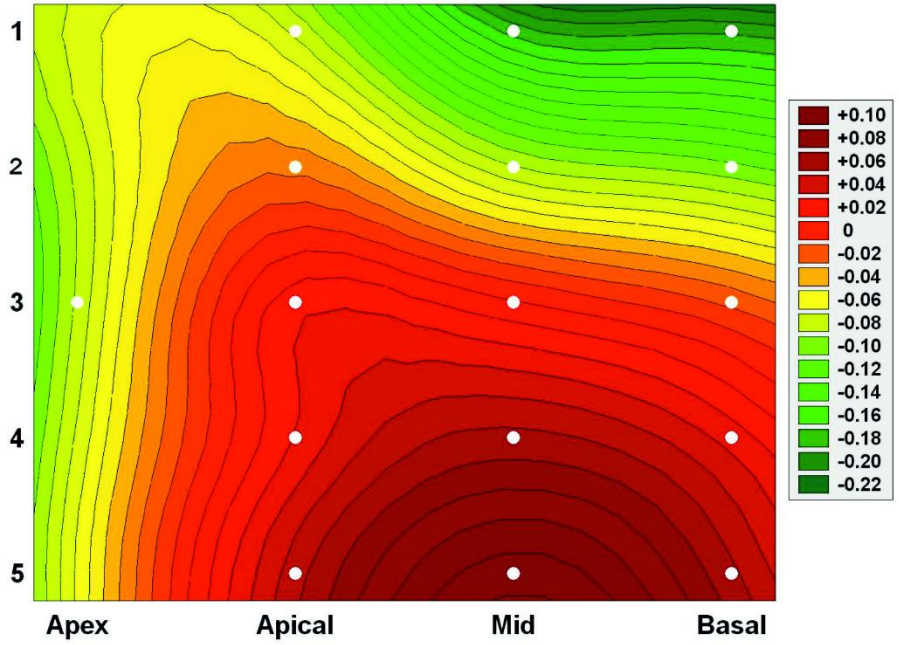
LV activation pattern is variable (LBBB/IVCD patients)



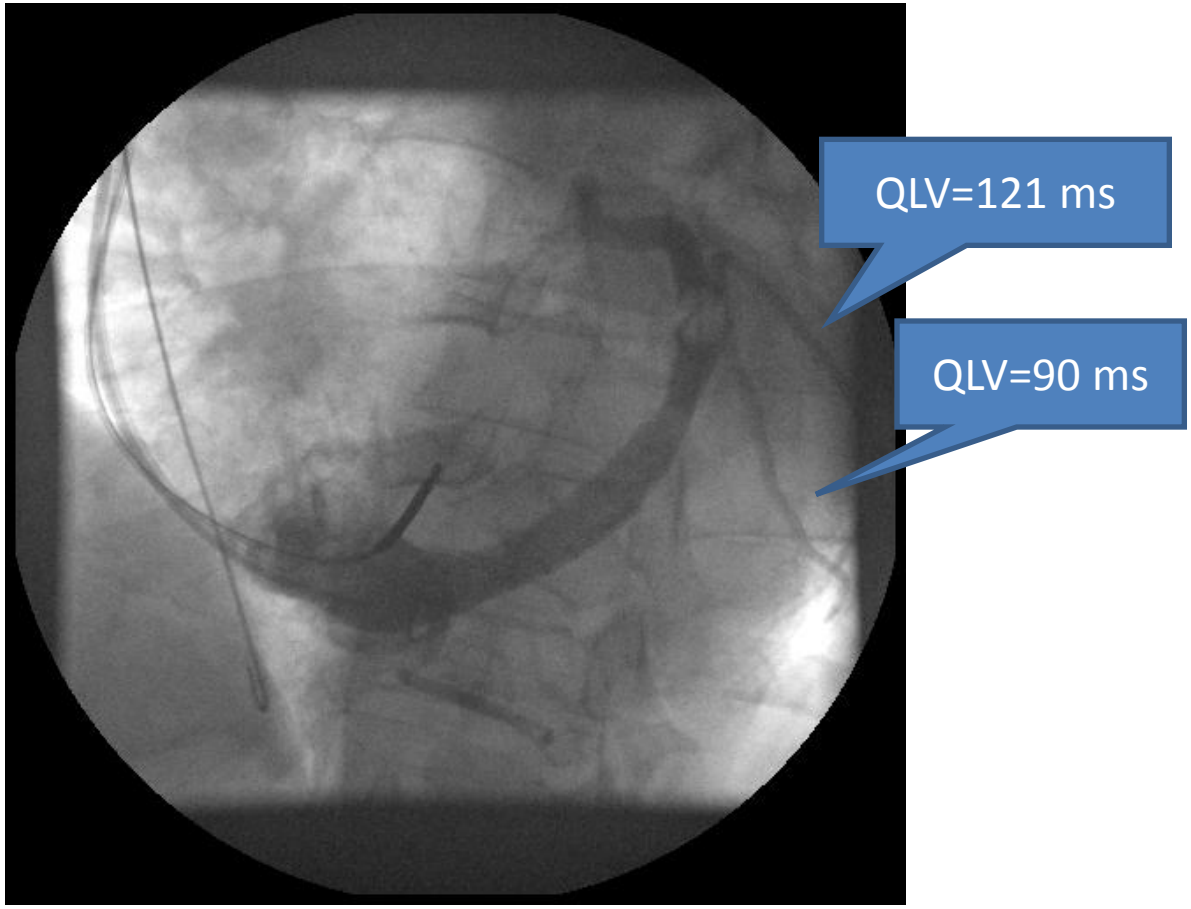
Polasek R. et al, JCE, 2014

Distribution of the optimal spot, Average map





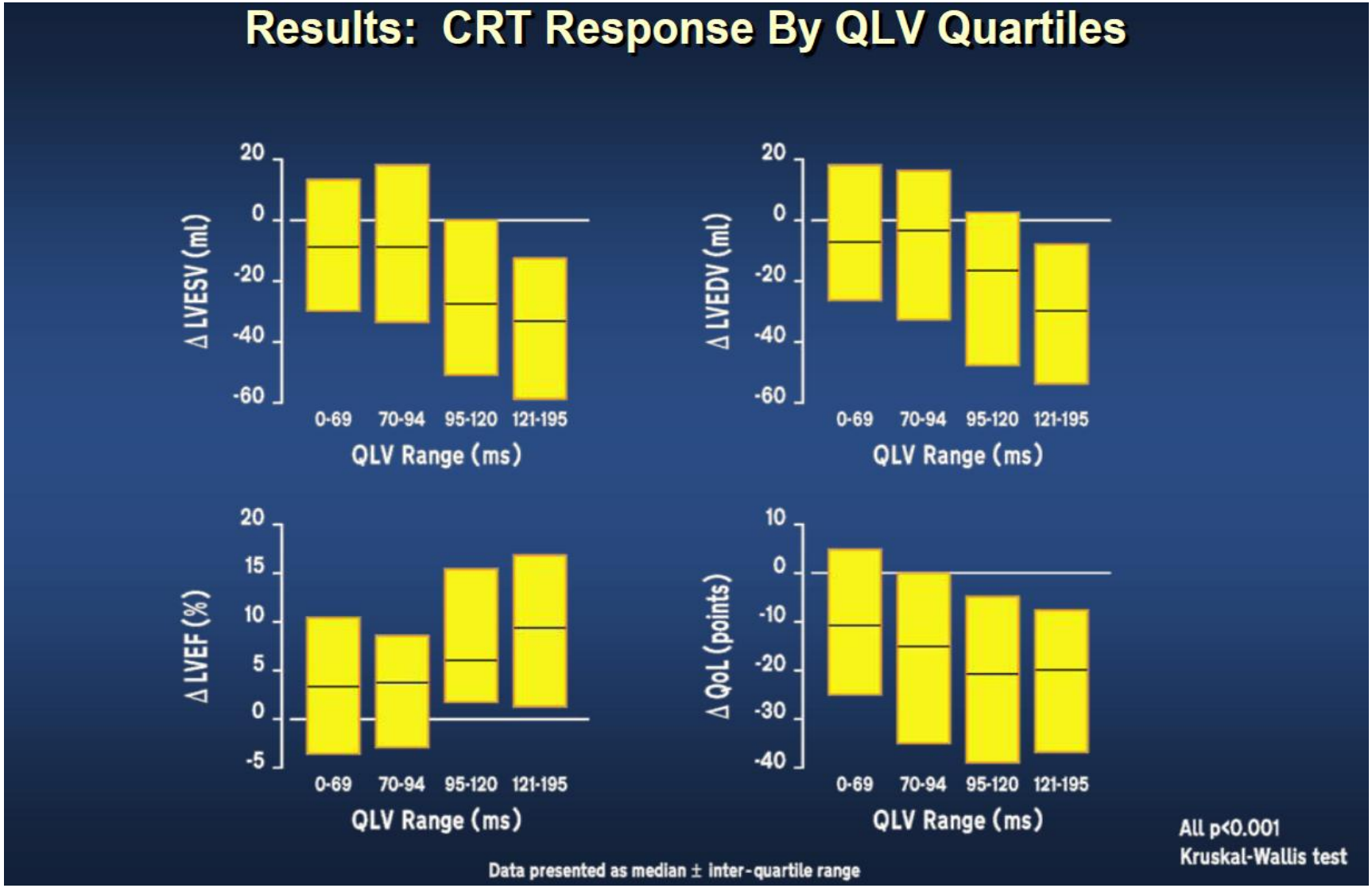
Anatomy **X** QLV



A small anatomical difference could lead to large QLV changes

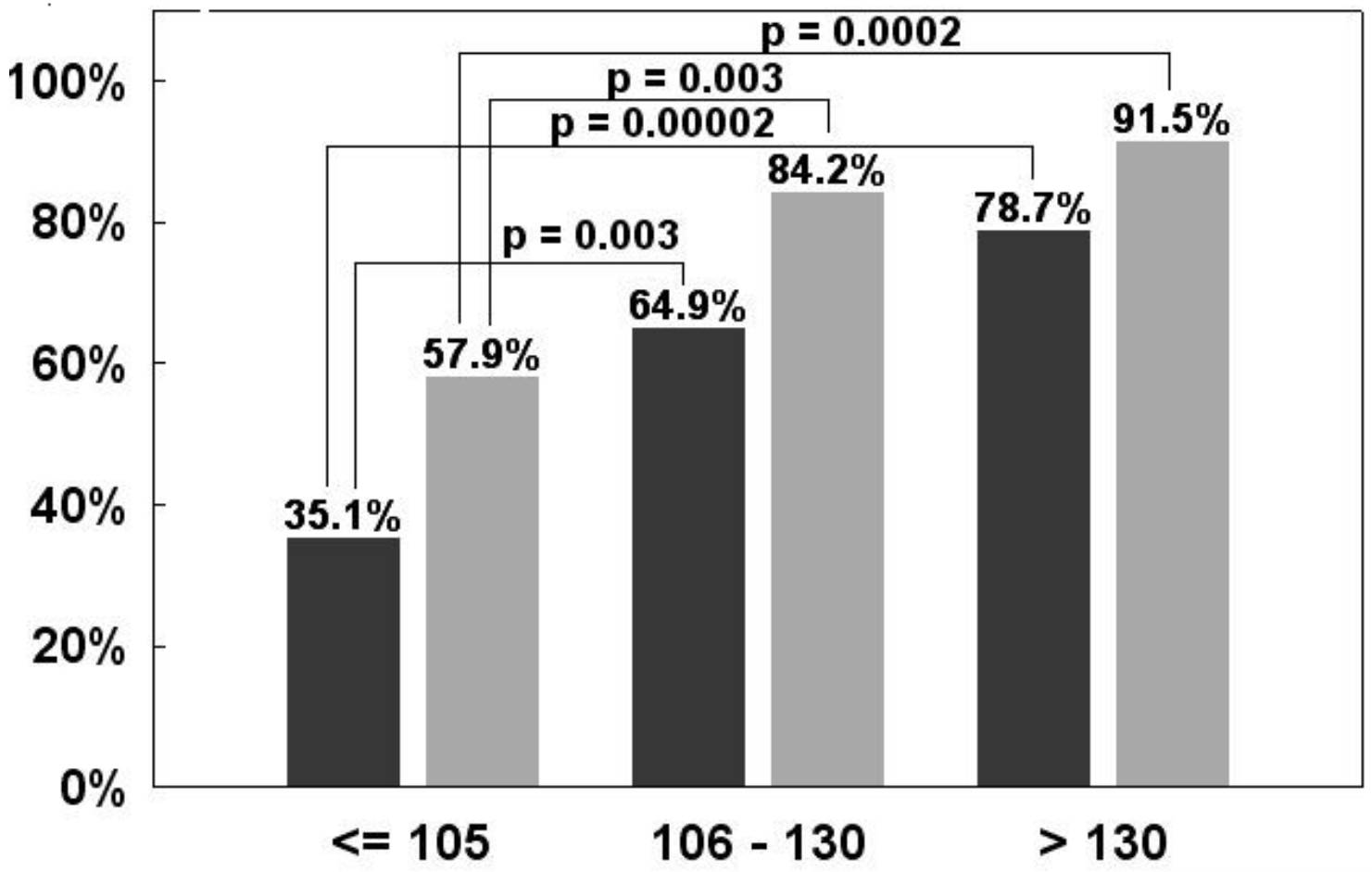
SMART AV QLV substudy

(LBBB/IVCD/RBBB)



Gold et al, Eur Heart J Aug 29; 2011

QLV and NYHA + ECHO response



n = 161, LBBB/IVCD

Polasek R, BMC Cardiovasc Dis, 2012

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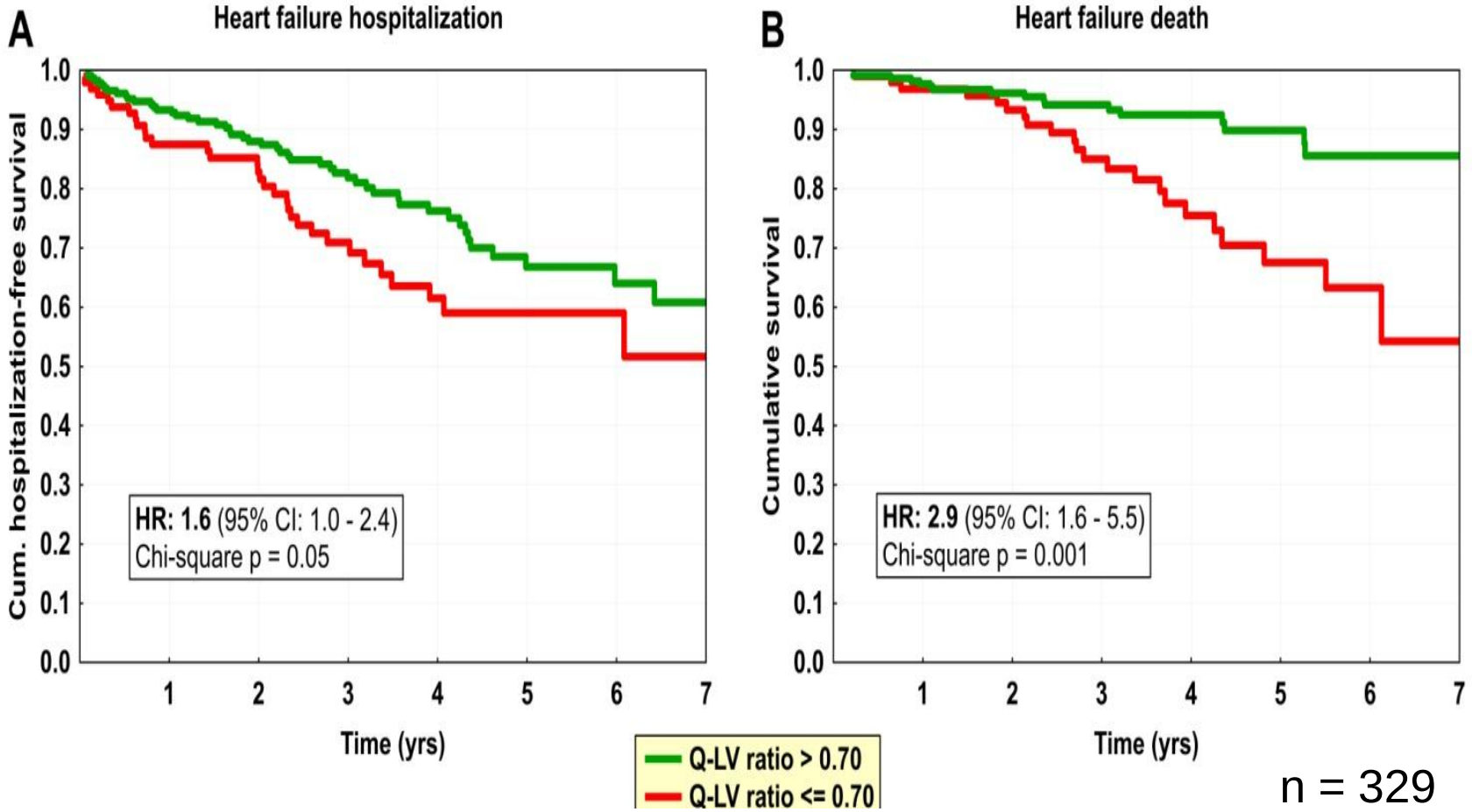
ElectroCRT trial

- RCT, n = 122
- QLV / ECHO targeted LV lead placement
- Δ EF/6m 11 ± 10% vs. 7 ± 11%, *P* = 0.03

Stephansen C, EHRA 2019

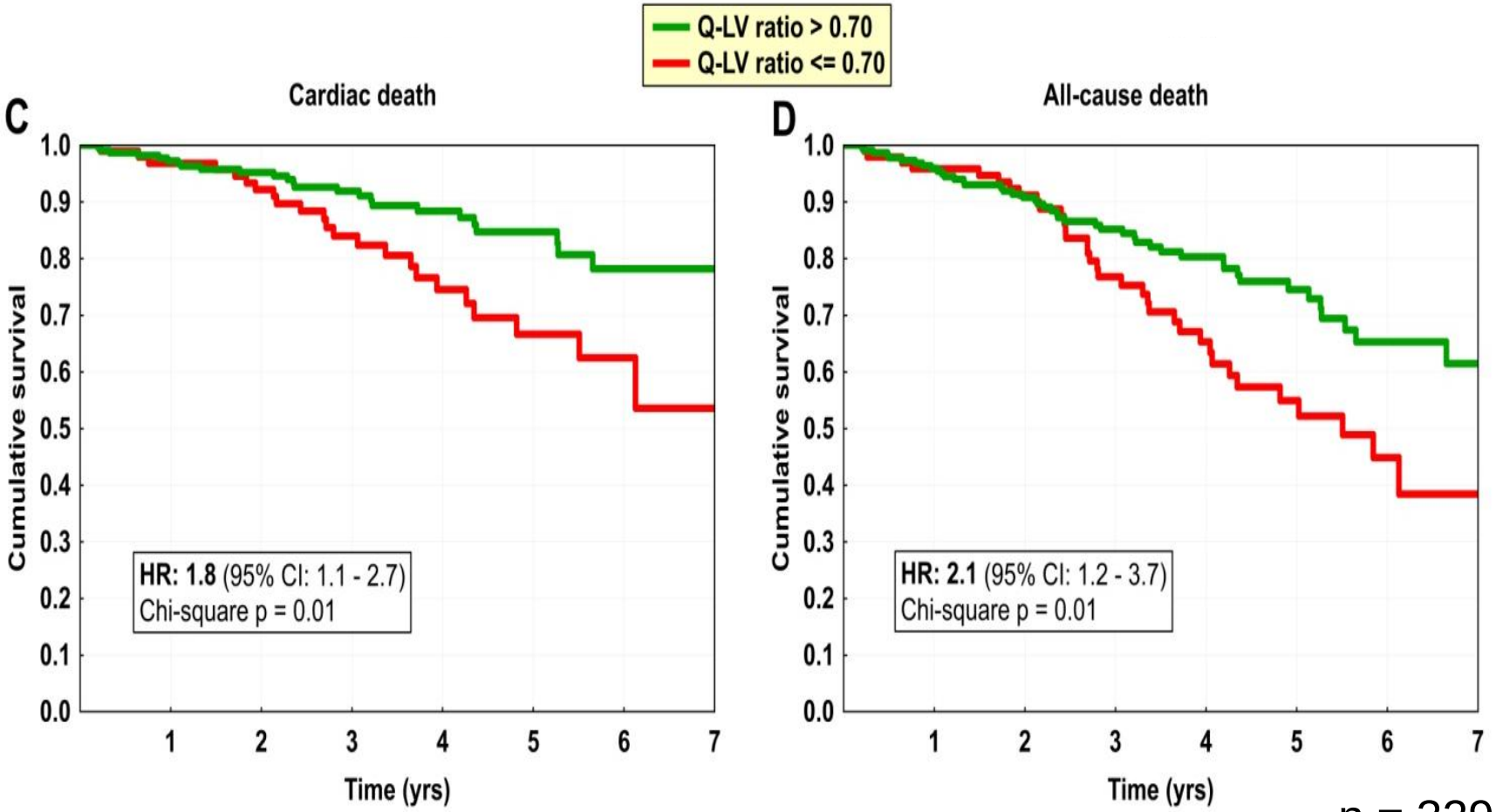
Q-LV ratio: Heart failure morbidity and mortality



n = 329

Roubicek T, Circulation AE, 2015

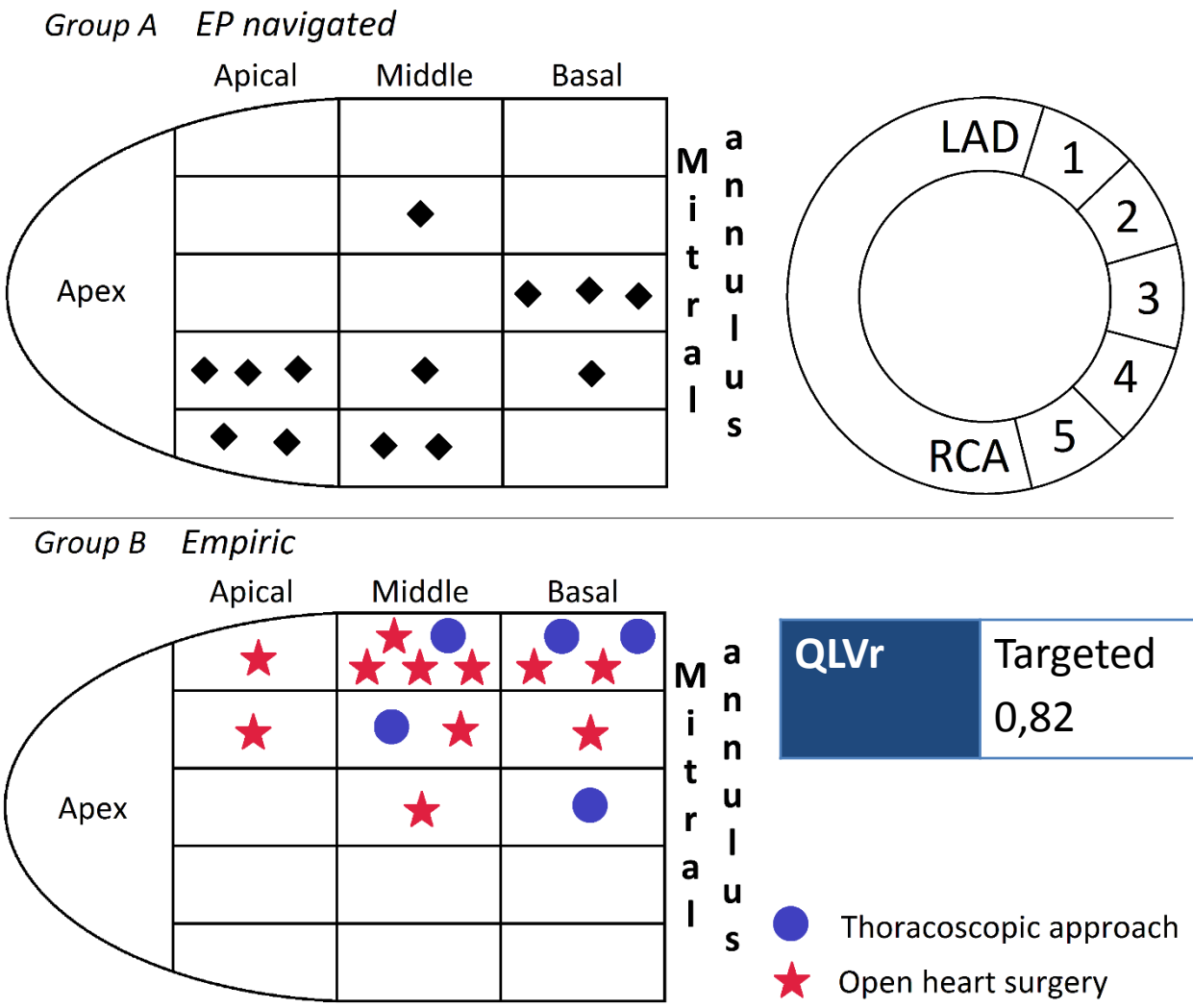
Q-LV ratio: cardiac and all-cause mortality



n = 329

Roubicek T, Circulation AE, 2015

Comparison of empirical and targeted LV lead position (surgical)



No patient with QLVr < 0,70

QLVr	Targeted	Empirical	
	0,82	0,60	P=0,0006

Polasek R, Hanuliakova, Skalsky, HRS Denver 2015 abstract

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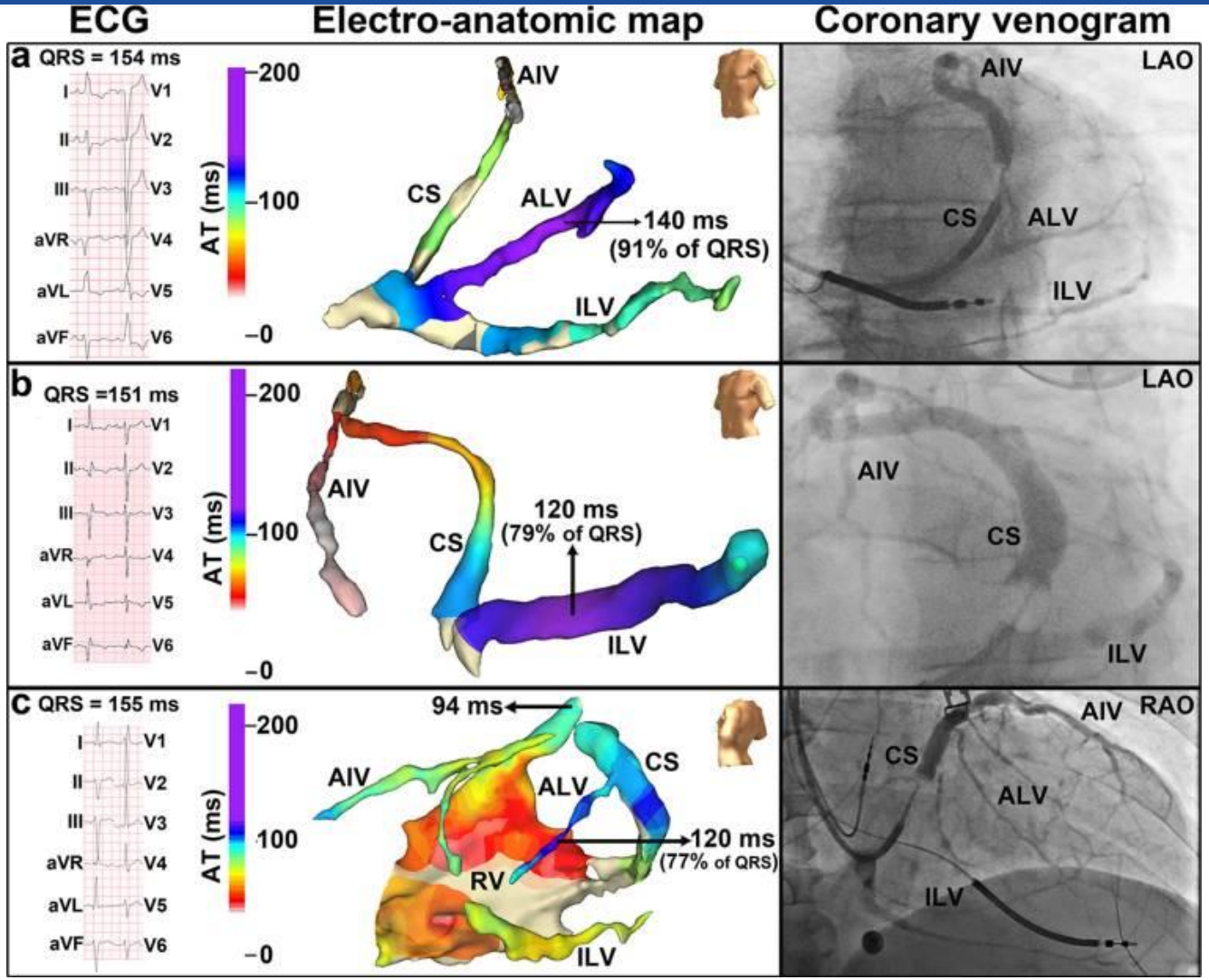
The limitations and opposition of QLV

F.W.Prinzen Maastricht

Short electrical delay in the targeted region (LV lateral) could be not only because of the suboptimal lead position, but also short LV activation time (not suitable for CRT).

Coronary venous electro-anatomical mapping



Delayd LV activation
- **LBBB 100%**
- IVCD 50%
- RBBB 10%

van Stipdonk AM, Prinzen FW et al, , coronary venous electroanatomical mapping. Netherlands Heart Journal. 2016;24(1)

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The limitations and opposition of QLV

No RCT

(2024 – DANISH-CRT, n = 1000)

Or negative RCT?

ENHANCE CRT Pilot trial (non LBBB)

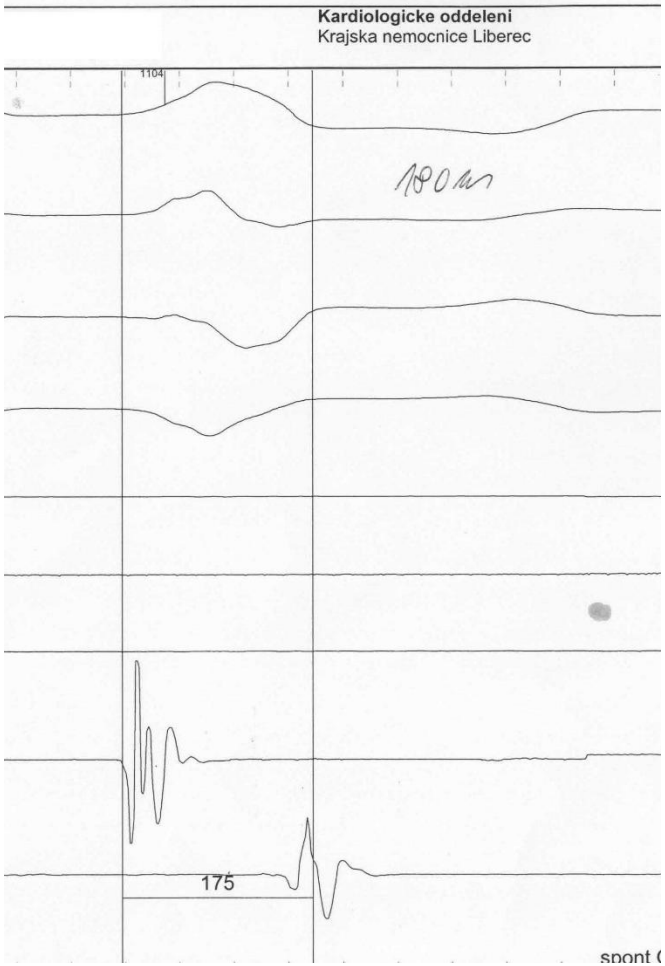
- QLV targeted/standard LV lead placement
- Randomized double blind trial 2:1, N=242
- RBBB 61% and IVCD 39%
- QRS durations 120 to 149 ms in 45.8%
- NYHA III/IV
- Composite endpoint (NYHA, EF, QOL) p = 0,51

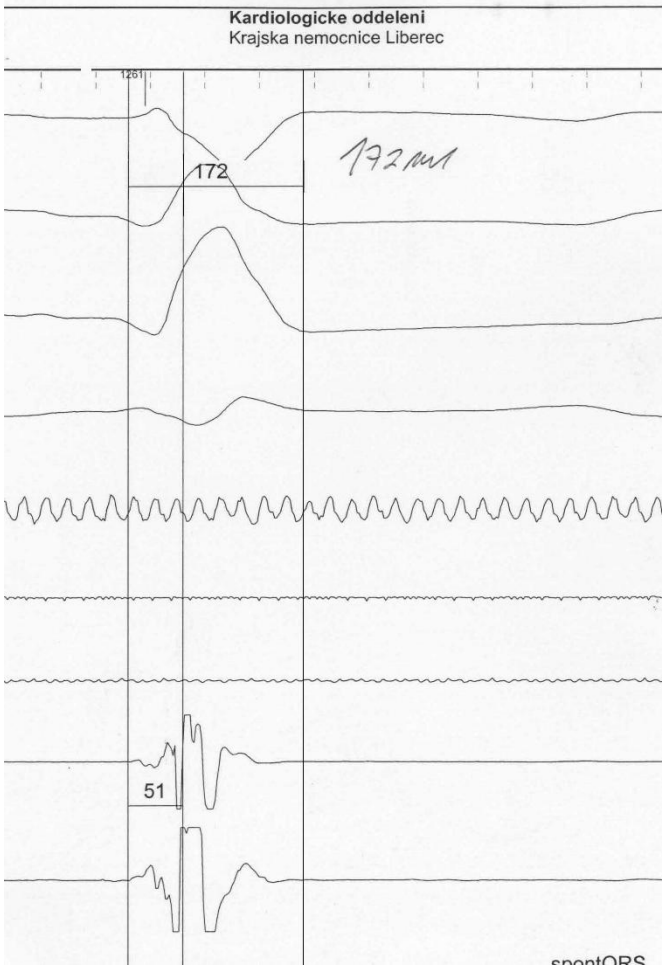
Singh, HRS 2018

LBBB X RBBB

RV

LV





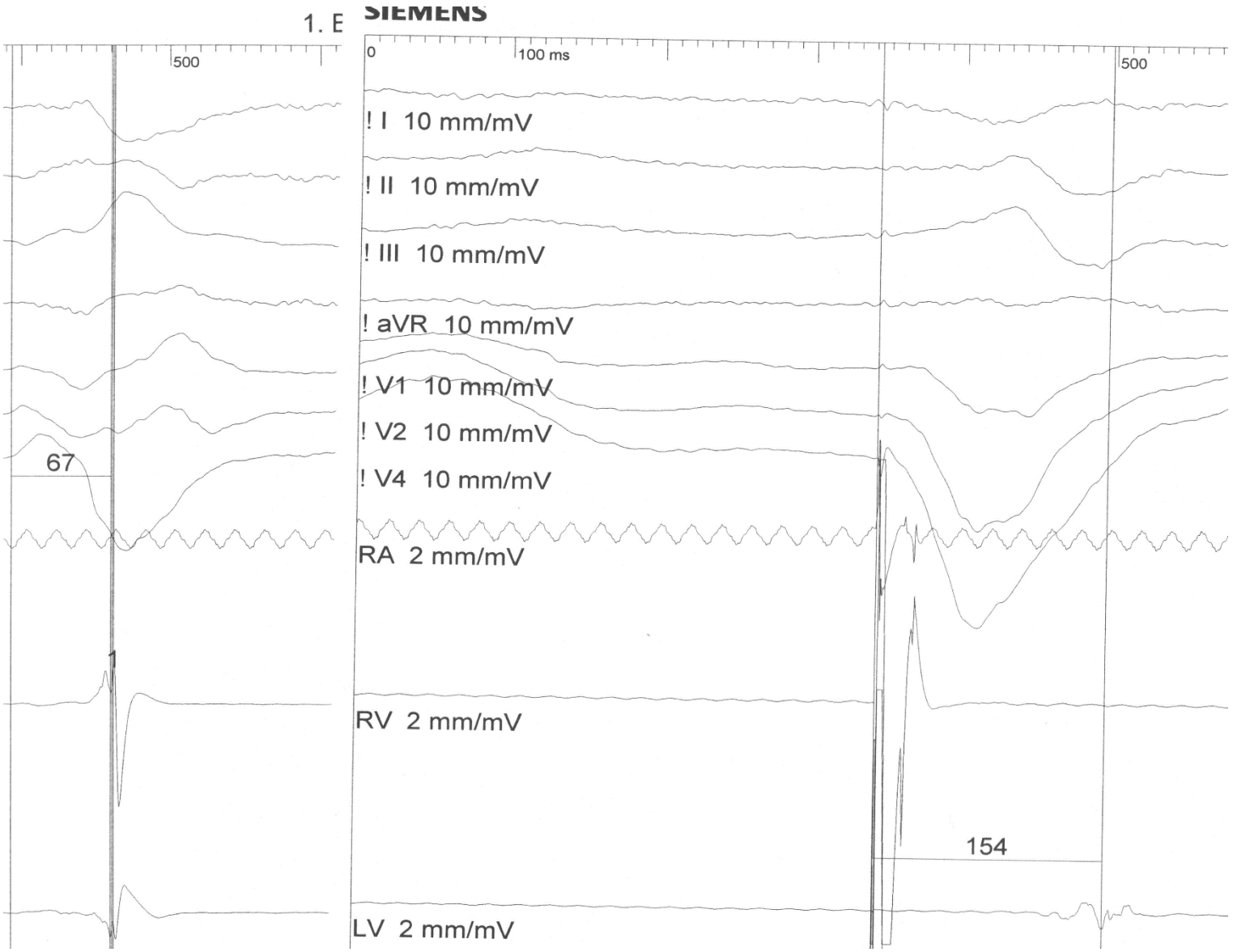
ENHANCE CRT Pilot trial (non LBBB)

My comment

- QLV in nonLBBB is probably more of a marker of LV activation type, rather than optimal target of LV lead

- The question today is if an individual nonLBBB patient is indicated for CRT = if LV activation is delayed (developement of non-ivasive LV activation mapping)

QLV X RVstim-LV



The limitations and opposition of QLV

No RCT

We have only indirect evidence from RCT assesing echocardiographically targeted LV lead (most delayed contraction)

ECHO targeted LV lead– TARGET trial

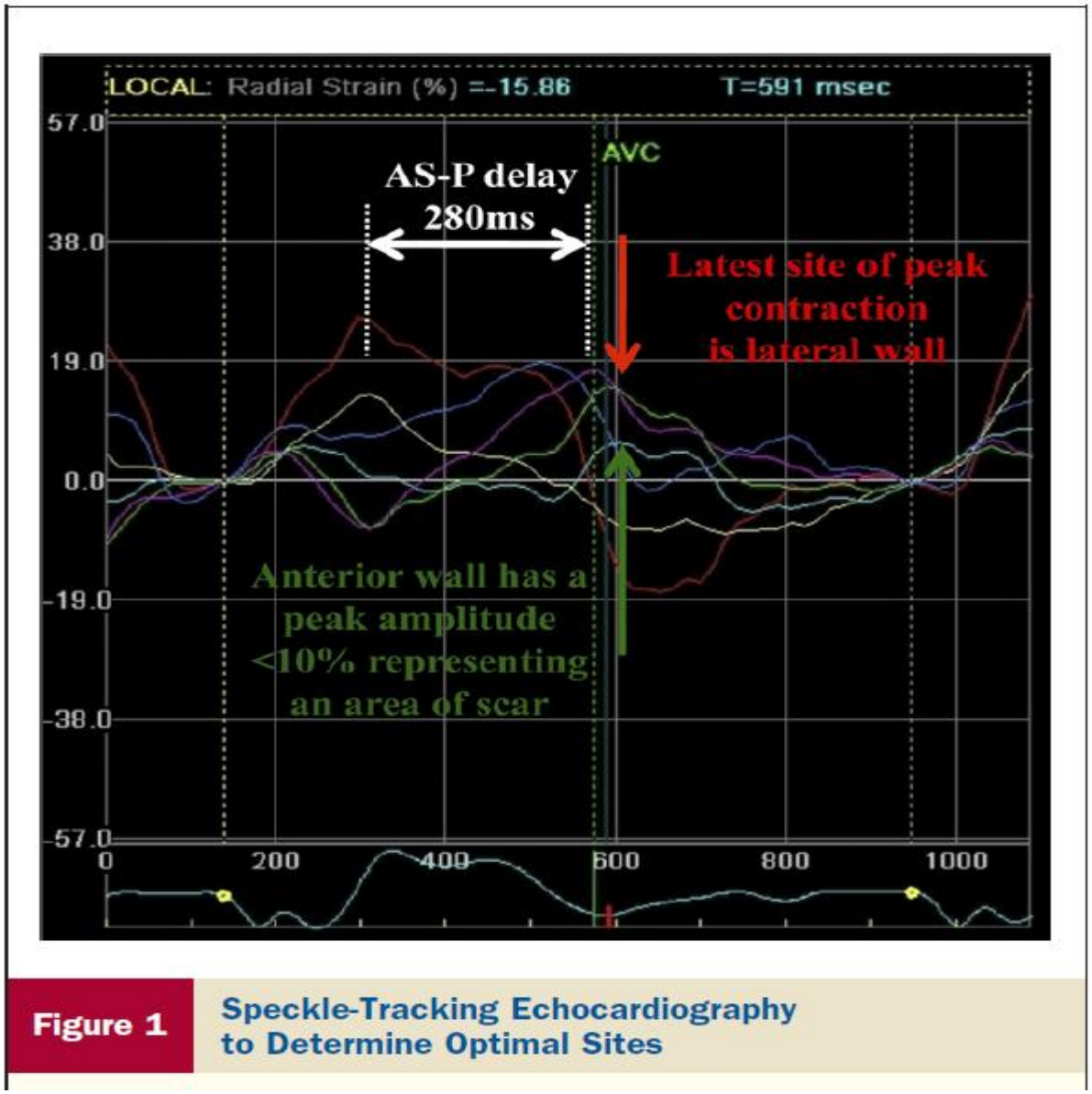
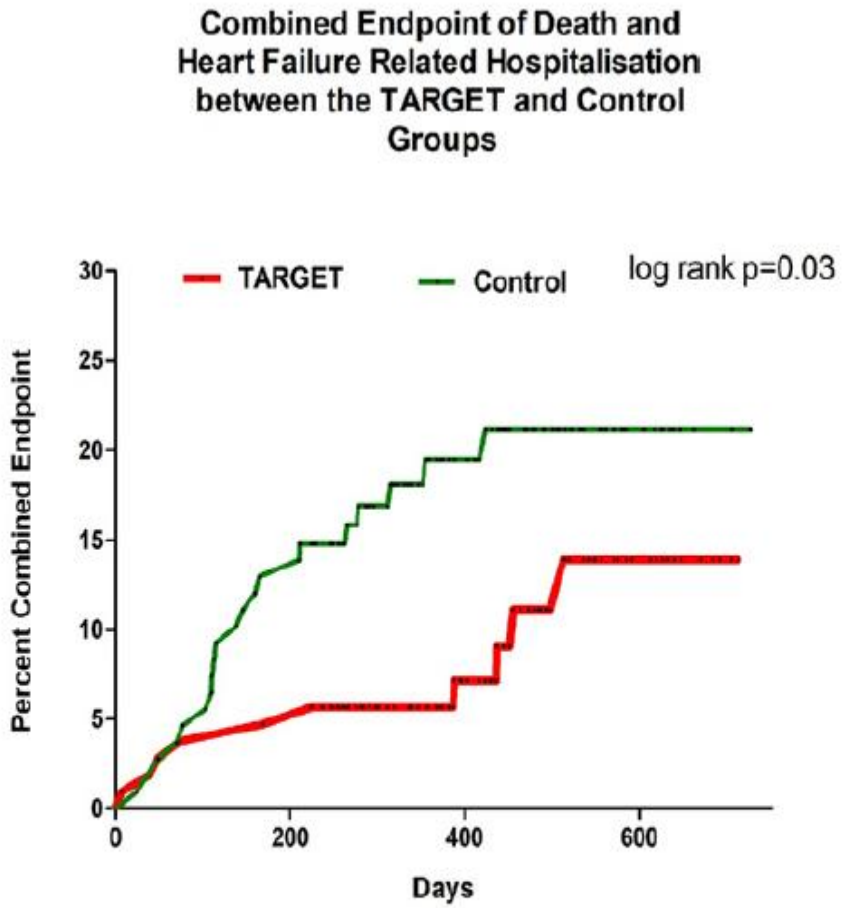


Figure 1 Speckle-Tracking Echocardiography to Determine Optimal Sites

Khan FZ et all, JACC 2012

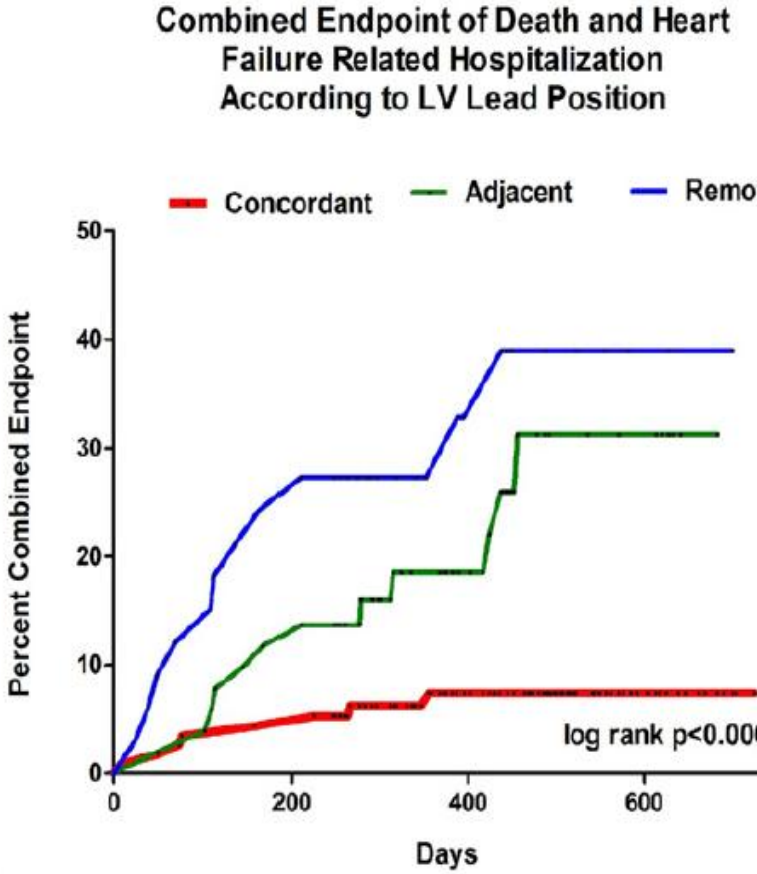
TARGET

ECHO optimized LV lead



No. At Risk				
TARGET	110	102	59	18
CONTROL	110	101	61	17

Figure 4 Kaplan-Meier Curves Comparing Both Randomized Groups



No. At Risk				
Concordant	124	109	69	21
Adjacent	58	46	31	12
Remote	29	25	13	5

Figure 5 Kaplan-Meier Curves Comparing Groups According to LV Lead Position

Choice of pacing mode (and CRT optimization)

Recommendations	Class	Level
1) The goal of should be to achieve biventricular pacing as close to 100% as possible since the survival benefit and reduction in hospitalization are strongly associated with an increasing percentage of biventricular pacing.	IIa	B
2) Apical position of the LV lead should be avoided when possible.	IIa	B
3) LV lead placement may be targeted at the latest activated LV segment.	IIb	B

Clinical perspectives

- The usual (standard) modality of CRT pacing consists of simultaneous biventricular pacing (RV and LV) with a fixed 100-120 ms AV delay with LV lead located in a posterolateral vein, if possible. …Current evidence does not strongly support the performance of AV and VV optimization routinely in all patients receiving CRT.
- LV pacing alone… seems to be non-inferior to biventricular pacing for improving soft end-points (quality of life, exercise capacity and LV reverse remodelling) and might be considered to lower the costs and complexity of the procedure and to increase the longevity of the device. LV pacing alone seems particularly appealing in children and young adults.

www.escardio.org/guidelines

European Heart Journal 2013;34:2281-2329
Europace 2013;15:1070–1118

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Conclusions

- QLV targeted LV lead implantation seems to be reasonable in LBBB
- QLVr > 0,70 (evidence from observational studies)
  - Better clinical and echo response
  - Better clinical outcome – lower mortality
- Results of RCT are needed

Conclusions

- QLV is not suitable for RBBB (and IVCD?), where it is more of a marker of different LV activation pattern rather than optimal lead position

- RVstim-LV could be considered instead

Unresolved questions

- What to do when QLVr is short
  - alternative CS branch?
  - surgical LV lead implantation?
  - HB pacing?

- Non responder with short QLVr
  - Is reintervention indicated? Safe?

Děkuji za pozornost

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