Assessing LV Dyssynchrony

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Left Bundle Branch Block

intra-ventricular asynchrony

Left Bundle Branch Block

haemodynamic consequences

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Left Bundle Branch Block

haemodynamic consequences

septal contraction stops filling
slow pressure rise
long IVCT, short ejection,
asynchronous relaxation
long IVRT

impaired LV function
even without cardiomyopathy!

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CRT Principle

bi-ventricular stimulation

„Left ventricular pre-excitation to restore physiological AV timing and contraction synchrony."

Leplang & Kass, JACC 2002

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CRT Patient Selection

Patient Selection
According to Guidelines

clinical criteria:
symptomatic congestion NYHA III-IV*
ischaemic or non-ischaemic cardiomyopathy*

ECG criteria:
QRS ≥ 130ms*
sinus rhythm
LBBB

echo criteria:
LV end-diastolic diameter ≥ 55mm
LV EF ≤ 35%
mechanical criteria of LV asynchrony


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CRT Patient Selection

electrical
asynchrony

mechanical
asynchrony

ventricular dyssynchrony

patient selection
lead position
optimization
follow up

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MIRACLE - study: CRT response vs. QRS width

Selection by QRS Width?

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The New Guidelines

new selection criteria

Assessing Mechanical Asynchrony

Tissue Velocity Imaging

synchronous velocity patterns

Tissue Velocity Imaging

onset QRS – peak velocity

Asynchrony by TVI

Asynchrony by TVI
PROSPECT Study

added predictive value of echo parameters

"... no single echocardiographic measure of dyssynchrony may be recommended to improve patient selection for CRT beyond current guidelines."

Assessing Asynchrony

Does peak systolic velocity tell us about contraction?

When does the wall move fastest? When does the wall contract?

CRT Patient Selection

Assessing Mechanical Asynchrony
Deformation Imaging

Strain Rate Imaging

\[ v = \frac{N}{c} \]

\[ \text{Strain Rate} = \frac{v_1 - v_2}{d} \]

Typical LBBB

Synchronous Velocity Peaks
Asynchronous Deformation!

High Scar Burden

velocity based parameters

- Septal Lat delay: 56 ms
- Septal Post delay: 143 ms
- Basal max delay: 166 ms
- Basal std dev: 76 ms
- All seg. max delay: 201 ms
- All segments std dev: 64 ms

Selection by QRS Width?

- LSB, QRS 154 ms
- LSB, QRS 162 ms

Pat.1: H₅ myocarditis, no CAD
- IVC ET IVR F
- Septal lateral
- 5% strain ECG: 150 ms, 154 ms

Pat.2: CAD, H₅ anterior infarction
- IVC ET IVR E A
- Septal lateral
- 5% strain ECG: 60 ms, 162 ms

Selection by QRS Width?

High Scar Burden
deflection measurement
Deformation Imaging in CRT

CRT off
CRT on

Deformation Analysis for CRT

CRT on
CRT off

CRT Patient Selection

Assessing Mechanical Asynchrony

Other Approaches

Septal Flash

short septal bounce in early systole

Study:

52 patients

septal flash at rest
sensitivity 82%
specificity 88%

septal flash LD Dobu
sensitivity 97%
specificity 88%

Parsai / Sutherland et al, Eur Heart J 2009

Apical Rocking

characteristic motion pattern in LBBB

- reduced LV function
- early short septal motion
- lateral motion during ejection

Brzenczek

Apical Rocking

4 chamber view: septal - lateral motion

Voigt et al., Eur Heart J 2009
Apical Rocking

Visual Assessment of Apical Rocking

baseline

follow up

Visual Assessment of Apical Rocking

preliminary results (n = 201)

prediction of response

survival

Summary

Echocardiography can analyze regional myocardial function in patients eligible for CRT.

Optimal parameters for patient selection are still subject to debate.

Dyssynchrony may be measured by tissue velocity based parameters which do not always mirror the true contraction sequence.

Preliminary study results indicate, that septal flash, apical rocking or deformation based parameters may be helpful alternative approaches.

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