Indicazione ragionata a CRT: in base alla durata del QRS o alla morfologia del QRS?

Maurizio Lunati MD
Direttore
SC Cardiologia 3 Elettrofisiologia
Dipartimento Cardiologico “De Gasperi”
GOM Niguarda Cà Granda-Milano
maurizio.lunati@ospedaleniguarda.it
Maurizio Lunati MD
2016 Declaration of Interest
(based on information provided to the European Society of Cardiology)

- Institutional research funding:
  Boston Scientific, Biotronik, Medtronic, St. Jude Medical, Sorin
- Speaker fee/Consultancy:
  Bayer, Biotronik, Boehringer-Ingelheim, Boston Scientific, Medtronic, St. Jude Medical, Sorin
CRT is a fantastic treatment

- Improves HF symptoms, QoL
- Haemodynamics and Exercise Capacity
- Remodelling
- HF hospitalizations, Arrhythmias, Mortality

But...

- ¼ of HF patients meet conventional implant criteria
  *Can this proportion be increased?*
- ⅓ non responders
  *Can this proportion be reduced*
The Task Force agrees to merge the recommendations for all pts with symptomatic HF irrespective to NYHA Class (II-IV).

In these pts further research is very unlikely to change our confidence in the estimate of effect.

LBBB morphology is required
* QRS duration ≥ 120 ms
* QS or rS in lead V1
* broad, notched or slurred, R waves in lead I, aVL, V5-V6
* absent Q waves in lead V5-V6

Brignole et al *EHJ* 2013, 34:2281-2329
Pathophysiology of HF relevant to CRT-1

- CRT helps to restore AV, inter and intraventricular synchrony, improving LV function, reducing functional MR and inducing LV reverse remodeling:
  - increases of LV filling time, LVEF,
  - decreases of LVESV and LVEDV, MR, septal dyskinesis
- The dominant benefit varies from one patient to the next and within an individual patient over time
- The mechanism of benefit is so heterogeneous that no single measure will accurately predict the response (and its magnitude) to CRT
True LBBB

A. Initial ECG: QRS duration = 76 ms

B. ECG 1 year later: QRS duration = 148 ms
True LBBB Responder

Before CRT  

After CRT
True LBBB Responder

Before CRT

After CRT
Non LBBB
Non LBBB
Non responder

Before CRT

After CRT
Severely prolonged QRS

<table>
<thead>
<tr>
<th>Study</th>
<th>RR (95% CI)</th>
<th>z Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPANION</td>
<td>0.78 (0.59-1.04)</td>
<td>-1.70</td>
<td>.09</td>
</tr>
<tr>
<td>CARE-HF</td>
<td>0.66 (0.47-0.93)</td>
<td>-2.35</td>
<td>.02</td>
</tr>
<tr>
<td>REVERSE</td>
<td>0.60 (0.46-0.79)</td>
<td>-3.70</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MADIT-CRT</td>
<td>0.48 (0.37-0.63)</td>
<td>-5.41</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>RAFT</td>
<td>0.59 (0.48-0.73)</td>
<td>-4.93</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Meta-analysis</td>
<td>0.60 (0.53-0.67)</td>
<td>-8.67</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Moderately prolonged QRS

<table>
<thead>
<tr>
<th>Study</th>
<th>RR (95% CI)</th>
<th>z Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPANION</td>
<td>1.01 (0.76-1.35)</td>
<td>0.07</td>
<td>.95</td>
</tr>
<tr>
<td>CARE-HF</td>
<td>0.74 (0.54-1.02)</td>
<td>-1.86</td>
<td>.06</td>
</tr>
<tr>
<td>REVERSE</td>
<td>1.05 (0.58-1.89)</td>
<td>0.16</td>
<td>.87</td>
</tr>
<tr>
<td>MADIT-CRT</td>
<td>1.06 (0.74-1.52)</td>
<td>0.32</td>
<td>.75</td>
</tr>
<tr>
<td>RAFT</td>
<td>0.99 (0.77-1.27)</td>
<td>-0.08</td>
<td>.94</td>
</tr>
<tr>
<td>Meta-analysis</td>
<td>0.95 (0.82-1.10)</td>
<td>-0.68</td>
<td>.49</td>
</tr>
</tbody>
</table>
Effect of QRS morphology on clinical event reduction with cardiac resynchronization therapy: Meta-analysis of randomized controlled trials

LBBB

RBBB

Or

IVCD

Advanced HF

Mild to moderate HF

Advanced HF

Mild to moderate HF
Importance of conduction disorders
superior outcome. This morphology finding from MADIT-CRT led the U.S. Food and Drug Administration to restrict device labeling for NYHA functional class I and II HF patients with LBBB and influenced reconfiguration of the U.S. and European guidelines to emphasize QRS morphology beyond QRSd.
Pathophysiology of HF relevant to CRT-2
2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

Table A. Cardiac resynchronization therapy in the primary prevention of sudden death in patients in sinus rhythm and New York Heart Association functional class III/IV ambulatory class IV

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class*</th>
<th>Level§</th>
<th>Ref*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT is recommended to reduce all-cause mortality in patients with an LVEF ≤ 35% and LBBB despite at least 3 months of optimal pharmacological therapy who are expected to survive at least 1 year with good functional status:</td>
<td>IIA</td>
<td>B</td>
<td>313, 314, 329, 320</td>
</tr>
<tr>
<td>- With a QRS duration &gt; 150 ms</td>
<td>313, 314, 329, 320</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRT should or may be considered to reduce all-cause mortality in patients with an LVEF ≤ 35% without LBBB despite at least 3 months of optimal pharmacological therapy who are expected to survive at least 1 year with good functional status:</td>
<td>III</td>
<td>B</td>
<td>313, 314, 329, 320</td>
</tr>
<tr>
<td>- With a QRS duration &gt; 150 ms</td>
<td>313, 314, 329, 320</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Patient in NYHA Class III-IV
Sinus rhythm

No change from 2013 ESC Pacing GL
2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

**Patient in NYHA Class II Sinus rhythm**

Upper part is similar to ESC HF GL 2012, but lower part was IIa-A and is now IIb-A recommendation
Patients in SR

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5) CRT in patients with chronic HF with QRS duration &lt;120 ms is not recommended</td>
<td>III</td>
<td>B</td>
<td>65, 66</td>
</tr>
</tbody>
</table>

Conclusive evidence against CRT

Brignole M et al *EHJ* 2013, 34:2281-2329
809 Patients
- CHF, NYHA III-IV, under OPT
- EF ≤35 %, LVEDD ≥ 55 mm
- QRS <130 ms
- Echo dyssynchrony

ICD 405
CRT-D 404
Mean FU: 19.4 mon

Composite Endpoint: Hospitalization for worsening HF or all-cause mortality

Ruschitzka et al. NEJM 2013
Echo Measures

Inclusion Criteria

- Tissue doppler imaging (TDI) in 4-chamber or long axis view peak systolic velocity $\geq 80$ ms or
- Speckle-tracking radial strain septal-posterior wall delay $\geq 130$ ms
  (Bax index)

(Tanaka index)

Outcome Measures

Primary Endpoint

- Composite of hospitalization for worsening heart failure and all-cause mortality

Secondary Endpoints

- Hospitalization for worsening heart failure
- All-cause mortality
Endpoint Results

Graphs showing the comparison of HF Hospitalization/Mortality between CRT and Control groups. The graphs indicate a trend over years since randomization, with percentages of patients with events and mortality rates at different time points. The right side of the image presents bar charts comparing percentages for different groups: ICD (n=405), CRT-D (n=404). The results are divided into primary and secondary endpoints with statistical significance indicated (p = 0.02 for one of the groups).
The impact of CRT on survival time is nonlinearly dependent on the time window over which it is calculated, growing approximately with the square of time. In patients with underlying LBBB, this impact is a benefit, but in those without underlying LBBB, this nonlinearly expanding impact on survival duration is adverse. The time course fits a progressive adverse physiological effect of pacing rather than implant complications. This suggests an opportunity for...
CONCLUSIONS The nonlinear growth of life span gained when a CRT device is implanted in patients with LBBB broad QRS is unfortunately mirrored by a similarly progressive loss in life span in narrow QRS heart failure. This suggests the culprit is a progressive physiological effect of pacing rather than implant complications. If these data are not sufficient, a randomized controlled trial of deactivating CRT in patients with narrow QRS may now be needed, with a primary endpoint of increasing survival. (J Am Coll Cardiol HF 2015;3:327-36) © 2015 by the American College of Cardiology Foundation.
ever, a meta-analysis of individual patient data from CRT trials has shown that LBBB morphology is not an independent predictor of outcome (68). Notwithstanding, current guidelines adopt LBBB as the primary substrate for CRT.

Cleland JG et al Eur Heart J 2013,34,547
CRT: QRS duration and reverse remodeling

Gold MR et al Circulation 2012, 126, 822
Cardiac resynchronisation therapy is not associated with a reduction in mortality or heart failure hospitalisation in patients with non-left bundle branch block QRS morphology: meta-analysis of randomised controlled trials

Colin Cunnington,1 Chun Shing Kwok,2 Duvvurakan K Satchitharananda,3 Ashish Patowala,4 Muhammad A Khan,1 Amir Zaid,1 Fozia Z Ahmed,1,2 Mamas A Mamas1,2,4

Table 1: Study design, participants and inclusion criteria for patients with non-LBBB QRS morphology who did or did not receive CRT

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Date</th>
<th>Country</th>
<th>Sample size</th>
<th>Age</th>
<th>Sex</th>
<th>Participant inclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>MADIT-CRT5,15,20</td>
<td>Randomised controlled trial</td>
<td>December 2004 to September 2013</td>
<td>88 centres in USA, Canada and Europe</td>
<td>1820 total: 1281 LBBB, 536 non-LBBB, 3 unknown</td>
<td>Total mean; 64 years; non-LBBB mean; 64% male</td>
<td>Total 75% male</td>
<td>Age ≥ 21 years with ischaemic (NYHA I–II) or non-ischaemic (NYHA II) cardiomyopathy, sinus rhythm, QRS ≥ 130 msec and LVEF ≤ 30%</td>
</tr>
<tr>
<td>CARE-HF1,18</td>
<td>Randomised controlled trial</td>
<td>January 2001 to March 2003</td>
<td>82 European centres</td>
<td>775 total: 730 LBBB, 45 non-LBBB</td>
<td>Total mean; 67 years</td>
<td>Total 73% male</td>
<td>Age ≥ 18 years with NYHA III–IV, LVEF &lt; 35%, height-adjusted LVEDD ≥ 30 mm, QRS &gt; 120 msec and sinus rhythm (additional dyssynchrony criteria required for QRS 120–149 msec)</td>
</tr>
<tr>
<td>COMPANION2</td>
<td>Randomised controlled trial</td>
<td>January 2000 to November 2002</td>
<td>128 US centres</td>
<td>1520 total: 1075 LBBB, 444 non-LBBB</td>
<td>Total mean; 67 years</td>
<td>Total 67% male</td>
<td>NYHA class III–IV ischaemic or non-ischaemic cardiomyopathy, sinus rhythm, QRS ≥ 120 msec, LVEF ≤ 35% and HF hospitalisation within preceding 12 months</td>
</tr>
<tr>
<td>RAFT4,52</td>
<td>Randomised controlled trial</td>
<td>January 2003 to February 2009</td>
<td>34 centres in Canada, Europe, Turkey and Australia</td>
<td>1798: 1295 LBBB, 503 non-LBBB</td>
<td>Total mean; 66 years</td>
<td>Total 83% male</td>
<td>NYHA II–III ischaemic or non-ischaemic cardiomyopathy, LVEF ≤ 30%, QRS duration &gt; 120 msec (or paced QRS &gt; 200 msec)</td>
</tr>
<tr>
<td>REVERSE6,34</td>
<td>Randomised controlled trial</td>
<td>September 2004 to September 2006</td>
<td>73 centres in USA, Canada and Europe</td>
<td>610: 369 LBBB, 238 non-LBBB, 3 unknown</td>
<td>Total mean; 63 years; Non-LBBB, 63% male</td>
<td>Total 79% Non-LBBB, 88% male</td>
<td>NYHA I–II, sinus rhythm, QRS &gt; 120 msec, LVEF ≤ 40%, LVEDD ≥ 55 mm</td>
</tr>
</tbody>
</table>

6MWT: 6-min walk test; CRT, cardiac resynchronisation therapy; HF, heart failure; LBBB, left bundle branch block; LVEDD, left ventricular end-diastolic dimension; NYHA, New York Heart Association.

Cardiac resynchronisation therapy is not associated with a reduction in mortality or heart failure hospitalisation in patients with non-left bundle branch block QRS morphology: meta-analysis of randomised controlled trials

Colin Cunnington,1 Chun Shing Kwok,2 Duwanakan K Satchithananda,3 Ashish Patwala,3 Muhammad A Khan,1 Amir Zaidi,1 Feza Z Ahmed,1,2 Mamas A Mamas1,2,4

**Sample size:** 6523 pts

**Risk of adverse outcomes among patients with non-LBBB QRS morphology who did or did not receive CRT**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Risk Ratio IV, Random, 95% CI</th>
<th>Heterogeneity: Tau²</th>
<th>Heterogeneity: Chi², df=1 (P)</th>
<th>Test for overall effect: Z, P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Death</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MADIT-CRT (non-LBBB)</td>
<td>1.57 [1.03, 2.39]</td>
<td>0.16</td>
<td>4.02, df=1 (P=0.04)</td>
<td>0.42 (P=0.67)</td>
</tr>
<tr>
<td>RAFT (non-LBBB)</td>
<td>0.82 [0.51, 1.32]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>1.15 [0.61, 2.16]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Heart failure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MADIT-CRT (non-LBBB)</td>
<td>1.13 [0.80, 1.60]</td>
<td>0.00</td>
<td>0.02, df=1 (P=0.89)</td>
<td>0.80 (P=0.42)</td>
</tr>
<tr>
<td>RAFT (non-LBBB)</td>
<td>1.09 [0.73, 1.62]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>1.11 [0.86, 1.45]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Death or heart failure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARE-HF (RBBB)</td>
<td>0.81 [0.52, 1.28]</td>
<td>0.01</td>
<td>4.95, df=4 (P=0.29)</td>
<td>0.09 (P=0.92)</td>
</tr>
<tr>
<td>COMPANION (non-LBBB)</td>
<td>0.86 [0.63, 1.17]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MADIT-CRT (non-LBBB)</td>
<td>1.27 [0.94, 1.73]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAFT (non-LBBB)</td>
<td>1.03 [0.75, 1.42]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REVERSE (non-LBBB)</td>
<td>0.50 [0.11, 2.29]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>0.99 [0.62, 1.50]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cardiac resynchronisation therapy is not associated with a reduction in mortality or heart failure hospitalisation in patients with non-left bundle branch block QRS morphology: meta-analysis of randomised controlled trials

Colin Cunnington,1 Chun Shing Kwok,2 Duwarakan K Satchithananda,3 Ashish Patwala,4 Muhammad A Khan,1 Amir Zaidi,1 Foizia Z Ahmed,1,2 Mamas A Mamas1,2,4

Key messages

What is already known on this subject?
Cardiac resynchronisation therapy (CRT) is recommended for patients with severe LV systolic dysfunction and QRS duration ≥120 msec.
Previous analyses have suggested a lack of benefit in patients with non-left bundle branch block (LBBB) QRS morphology.

What might this study add?
This is the largest CRT meta-analysis to date.
CRT is not associated with a reduction in death or heart failure hospitalisation in patients with non-LBBB QRS morphology.

How might this impact on clinical practice?
Clinicians need to reconsider the risk versus benefit of CRT in patients with non-LBBB QRS morphology as recommended in contemporary CRT guidelines.

The purpose of this European Heart Rhythm Association (EHRA) EP wires survey was to evaluate the implementation of the current guidelines for cardiac pacing and cardiac resynchronization therapy (CRT) in Europe. A total of 48 centres replied to the survey, 34 of them (71%) were university hospitals. All responding centres implement CRT in patients with classical indications, i.e. sinus rhythm, New York Heart Association (NYHA) functional class II, III, or ambulatory IV, left ventricular ejection fraction (LVEF) 35%, and left bundle-branch block (LBBB) with QRS duration > 150 ms, while 31 centres (67%) would implant a CRT device in patients with the same characteristics but with a non-LBBB pattern. Forty-one centres (89%) would also implant CRT in patients with sinus rhythm, NYHA Class II, III, or ambulatory IV, LVEF < 35%, and LBBB with QRS duration between 120 and 150 ms, while only eight centres (17%) would implant the device in patients with the same characteristics but with a non-LBBB pattern. In patients with LVEF < 35% and QRS duration below 120 ms, the majority of the centres (80%) would implant a single- or dual-chamber implantable cardioverter-defibrillator, but in nine cases (20%) no device was considered to be indicated. The results of this survey
Do cardiologists follow the European guidelines for cardiac pacing and resynchronization therapy? Results of the European Heart Rhythm Association survey

Elena Sciaraffia1, Nikolaus Dagres2, Antonio Hernandez-Madrid3, Alessandro Proclemer4, Derick Todd5, and Carina Blomström-Lundqvist1

1Department of Cardiology, Institute of Medical Sciences, Uppsala University, Uppsala 751 85, Sweden; 2Cardiovascular Department, African University Hospital, University of Athens, Athens, Greece; 3Division of Cardiology, Department of Cardiovascular Medicine, Vall d’Hebron University Hospital, Barcelona, Spain; 4Division of Cardiology, Department of Cardiovascular Science, University Hospital San Maria, Milan, Italy; and 5Division of Cardiovascular Medicine and Science, Liverpool Heart and Chest Hospitals, Liverpool L12 2AP, UK.

Europe (2015) 17, 148–151
doi:10.1093/europe/ euu395

**Figure 1** Actions taken to manage patients that do not respond to CRT. On the X-axis priority given to the listed actions, on the Y-axis number of centres. (A) Re-evaluation and possibly optimization of medical therapy; (B) Echo-guided optimization of atrio-ventricular and inter-ventricular delay; (C) Evaluation of ventricular capture during ergometric tests; (D) Surgical correction of the left ventricular lead position; (E) Multisite left ventricular pacing.
Identification of Typical Left Bundle Branch Block Contraction by Strain Echocardiography Is Additive to Electrocardiography in Prediction of Long-Term Outcome After Cardiac Resynchronization Therapy

Niels Riksen, MD, PhD; (Hoppe-Seyler's Clinic, MD); Thomas E. Hansen, MD; Niels E. Braun, MD, DMRc; Magnus T. Jensen, MD, PhD; Thibe K. Lauridsen, MD; Sølve Suhre, MD; Joseph Kode, MD; John Grevlian HS, MD; Peter Sogaard, MD, DMRc

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC.

http://dx.doi.org/10.1016/j.jacc.2015.06.020
Identification of Typical Left Bundle Branch Block Contraction by Strain Echocardiography Is Additive to Electrocardiography in Prediction of Long-Term Outcome After Cardiac Resynchronization Therapy

Niels Rønne, MD, PhD,1; Henning Towi, MD,2; Thomas D. Hansen, MD,3; Niels E. Brunn, MD, DMSc,4; Magnus T. Jensen, MD, PhD;5; Thibe K. Lauridsen, MD,6; Søren Saba, MD; Joseph Eisen, MD, F, John G. Sahn, MD;7; Peter Søgaard, MD, DMSc.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC.

VOL. 64, NO. 6, 2015
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.06.020

FIGURE 1. Kaplan-Meier curves showing freedom from death, LVAD, or heart transplant after CRT.

These curves are in relation to the presence or absence of a typical LBBB contraction pattern. CRT = cardiac resynchronization therapy; LVAD = left ventricular assist device; other abbreviations as in Figure 1.
In the PROSPECT and ECHO CRT trials, the mechanical delays in contraction were addressed by methods that rely on the time-to-peak principle.
Will the Real Left Bundle Branch Block Please Stand Up?*

Edward A. Gill, MD; Jeanne E. Poole, MD;

The study by Risum et al. (13) emphasizes the limitations of conventional ECG-defined LBBB in detection of true mechanical dyssynchrony and provides initial evidence that a combination of electrical dyssynchrony by ECG and echocardiography-defined LBBB to detect mechanical dyssynchrony could enhance the selection process for CRT.
CRT response

Stochastic model (trialist’s view)

- Standard treatment for all eligible patients
- Outcome statistically determined, individual response cannot be predicted

Deterministic model (clinician’s view)

- If we know enough about the patient (clinical, electrical, imaging etc) we can predict: response, degree of response, how to obtain maximal response

Truth is probably a mixture

- We can predict a lot but there are known unknowns (and probably unknown unknowns...)
- We should strive to improve predictability and individualize treatment
Identification of Typical Left Bundle Branch Block Contraction by Strain Echocardiography Is Additive to Electrocardiography in Prediction of Long-Term Outcome After Cardiac Resynchronization Therapy

Niels Ringaard, MD, PhD; Hippolytus van der H, MD; Thomas E. Hansen, MD; Niels E. Bruun, MD, DMSc; Magnus C. Jensen, MD, PhD; Thomas E. Lauridsen, MD; Sølve Saba, MD; Joseph Kilde, MD; John Grovum, MD; Peter Sogaard, MD, DMSc

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC.

CLINICAL PERSPECTIVES. Identification of typical LBBB contraction was found to be beneficial, independent of QRS duration and morphology, but assessment of contraction patterns may be particularly useful in pre-implantation evaluation of patients in the intermediate QRS duration range of 120 to 150 ms. Patients with a wide QRS duration of >150 ms have a higher prior likelihood of response, whereas the role for CRT in the intermediate QRS duration group is not entirely clear, as reflected by guidelines (3).

In the present study, a majority of patients in the intermediate QRS group did not have evidence of LBBB contraction. This was associated with a poor outcome, with more than a 3-fold increase in risk of death, LVAD implantation, or heart transplant. In particular, only a minority of patients with a QRS duration of between 120 and 140 ms showed mechanical evidence of true LBBB. These findings...
PHYSIOLOGY MAKES A DIFFERENCE. Distinguishing mechanical dyssynchrony induced by an electrical activation delay (likely to benefit from CRT) from mechanical dyssynchrony from other causes (unlikely to benefit from CRT) may be quite difficult. The present study suggests that more attention should be paid to the complex interplay between walls, which reflects the physiology of activation delay-induced heart failure. In fact, any method, whether by echocardiography or ECG, should reliably reflect this substrate. Strict ECG criteria for complete LBBB were
The data imply that mechanical contraction patterns using echocardiography-based strain inherently hold useful information beyond the activation delay for prediction of outcome after CRT. Computer simulations have shown that LBBB deformation patterns are primarily determined by wall contractility and the degree of activation delay in the LV (33). Absence of typical LBBB mechanical contraction despite LBBB by ECG indicates that the patient either does not have a true LBBB or that contractility is decreased to such a degree that patterns are abolished (6). Either scenario or a combination of both scenarios is associated with a poor prognosis and is critical to identify. LBBB
Considerazioni (personali)

- E’ opportuno che si cerchi di “sincronizzare” competenza ed expertise dei molti sanitari (Cardiologi clinici, HF specialists, ELF etc.) che si occupano dei pz con SC.

- La fisiopatologia fa la differenza. La differenziazione tra dissincronia meccanica indotta da ritardo elettrico di attivazione (elevata probabilità di beneficio con la CRT) e assenza di dissincronia o da dissincronia secondaria ad altre cause, scar-assenza di contrattilità-ecc., (scarsissima probabilità di beneficio con la CRT) deve meritare un’attenzione maggiore (imaging, elaborazioni a computer).

- Con tutta probabilità nuovi sistemi di erogazione della CRT (MPP) giocheranno un ruolo importante soprattutto nei casi dubbi.
Possible patterns of wavefront propagation with conventional LV pacing vs MPP in scarred heart
Key messages ( molto personali )

- Pz con “true LBBB” e QRSD > 150 ms → CRT
  ( probabilità di responder/superresponder molto alta )
- Pz con “true LBBB” e QRSD 120-150 ms → CRT
  ( ma probabilità di responder intermedia )
- Pz con “non-LBBB” → CRT solo in casi selezionati e dopo imaging IVCD
  ( probabilità di responder bassa )
- BBD
  ( probabilità di responder bassa/assente )