Assessment of sudden cardiac death by myocardial strain imaging

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Conflicts of interest

• None
Team 2010: Integrated Cardiovascular Function, Oslo University Hospital, Oslo, Norway
Long QT Syndrome

Ion channel dysfunction

Prolongation of action potential duration

Dispersion of electrical repolarization

Torsade de pointes ventricular arrhythmia

Effect of Calcium Channel Block on the Wall Motion Abnormality of the Idiopathic Long QT Syndrome.
Gaetano M. De Ferrari, MD; Filippo Nador, MD; Gabriella Beria, MD; Sergio Sala, MD; Antonio Lotto, MD; Peter J. Schwartz, MD
Circulation. 1994;89.2126-2132.

"Echocardiographic Analysis All LQTS patients had a marked abnormality in baseline conditions and, specifically, a prolonged plateau"
Figure 2: M-mode from a patient with LQTS. *White arrows* indicate the double peak pattern in septal contraction.
Mechanical dispersion
Standard deviation of time to peak longitudinal strain in 16 LV segments
Mechanical Dispersion
Standard deviation of time to peak strain in 16 LV segments

K. Haugaa et al., Circulation 2010; 122: 1355-63.
ROC curves of cardiac events in 101 LQTS mutation carriers.

K. Haugaa et al., Circulation 2010; 122: 1355-63.
Myocardial mechanical dispersion by tissue Doppler imaging.

Mechanical dispersion predicted appropriate ICD therapy in 85 patients after myocardial infarction over 2 years of follow up.

AUC 0.84 (95% CI 0.75 - 0.92)

Ability of mechanical dispersion to identify patients with ventricular arrhythmias.
The majority of patients who die suddenly after myocardial infarction do not fulfill current ICD indications (EF<35%).

AF Buxton et al., JACC 2007
Mechanical dispersion predicted ventricular arrhythmias in patients with non-ischemic cardiomyopathy independently of EF.
Mechanical dispersion in 569 patients 40 days after myocardial infarction

- Prospective multi center study
- Mechanical dispersion was a marker of ventricular arrhythmias during 2 years of follow up

K Haugaa et al. JACC Cardiovasc Imaging 2013
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<th>Table 2. Echocardiographic and ECG Findings in 569 Patients After MI</th>
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<td>Post-MI Patients Without Arrhythmias (n = 554)</td>
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Values are mean ± SD or n. The p values are from Student unpaired t tests, Fisher exact tests, and Mann-Whitney U tests.

ECG = electrocardiographic; GLS = global longitudinal strain; LVEDV = left ventricular end-diastolic volume; LVEF = left ventricular ejection fraction; LVESV = left ventricular end-systolic volume; NSTEMI = non-ST-segment elevation myocardial infarction; PSSI = post-systolic strain index; QTc = corrected QT; other abbreviations as in Table 1.
Log rank p<0.001

Mechanical dispersion

Cumulative freedom of arrhythmias

Time (months)

No. at risk

< 75 ms  533  529  528  520  446  322

≥ 75 ms  24  22  21  18  14  9
Even when excluding patients with LVEFs <35% \( (n = 28) \), mechanical dispersion remained an excellent and independent predictor of arrhythmic events \( (p < 0.01) \), indicating that mechanical dispersion may serve as a risk marker in the vast majority of post-MI patients currently not fulfilling primary ICD indications. Mechanical dispersion was increased in those with arrhythmic events compared with those without also when excluding all patients with QRS durations >120 ms \( (n = 17) \) \( (60 \pm 21 \text{ ms} \text{ vs. } 41 \pm 17 \text{ ms}, p < 0.001) \).
Conclusions

- Myocardial mechanical dispersion by strain imaging is a promising marker of risk in patients with normal or mildly impaired LV function.

- Further testing in larger prospective trials are needed.