Speckle Tracking – Imagerie de Déformation

Erwan DONAL
Cardiologie – CHU Rennes
erwan.donal@chu-rennes.fr
## Déclaration de Relations Professionnelles
### Disclosure Statement of Financial Interest

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- Grant/Research Support
- Consulting Fees/Honoraria
- Major Stock Shareholder/Equity
- Royalty Income
- Ownership/Founder
- Intellectual Property Rights
- Other Financial Benefit

### Company
- Medtronic
- Novartis
- Bristol Myer Squibb
- Daiichi Sankyo
- Astra Zeneca
- General Electric
- Philips
Imagerie de Déformation → SPECKLE TRACKING

- Bonne définition des contours
- Cadence images ±80/s
- Bonne image, bon tracé ECG
C’est quoi ce « SPECKLE TRACKING »?
LAGRANGIAN STRAIN

\[ S = \frac{l - l_0}{l_0} = \frac{\Delta l}{l_0} \]
Normal Values:
• LONG -20%
• Circ -20%
Entrez la durée FVA dans Phases cardiaques.
Déform. l. g. = -25 %
Entrez la durée FVA dans Phases cardiaques.
Déform. c. g. = -26 %
Entrez la durée FVA dans Phases cardiaques.
Déform. I. g. = -25 %
Garder à l’esprit la charge dépendance
Current and Evolving Echocardiographic Techniques for the Quantitative Evaluation of Cardiac Mechanics: ASE/EAE Consensus Statement on Methodology and Indications

Endorsed by the Japanese Society of Echocardiography

Pioneer in cardiac morphology

New quantitative techniques

M-Mode

2-D: descriptive echo

Doppler
Comparison of ≠ GLS

Comparison of to ‘out of the box’ tools for assessing strain on DiCom data

Journal of the American Society of Echocardiography 2012
GLS consistently showed good reproducibility (~6%) while reproducibility was moderate for circumferential strain (~12%) and poor in the radial direction (~20%).

30 frames/sec (on DiCom data) can be reliably performed for longitudinal strain.
Cardiomyopathies

Ischemic heart disease

Aortic stenosis / increase in afterload

Mitral Regurg/ Aortic Regurg

Chemotherapy

Right heart disease cut-off -19%
Atria: reservoir function, functional remodeling
Entrez la durée FVA dans Phases cardiaques.
Déform. I.g. = -17 %

Déformation systolique pic
Temps à pic

FC = 96 bpm
A2C Déform. I. = -18 %
A4C Déform. I. = -20 %
A3C Déform. I. = -17 %
Déform. I.g. (Moy) = -18 %
Ischemic heart
Model of progressive abnormalities in LV diastolic and systolic function underlying heart failure across the LV EF spectrum.

Shah A M, Solomon S D Eur Heart J 2012;33:1716-1717
Independent prognostic value of GLS in HF with LVEF <40%

GLS < -7%

GLS > -7%

RR=7.02, p<0.00001

Mignot A, Donal E, et al. JaSE 2010
Importance of Longitudinal Function in Chronic Heart Failure Patients:
Correlation with Functional Capacity and Prognosis
140 CHF patients
GLS and adverse outcome (death, cardiac assistance or transplant, and recurrent HF)


125 consecutive patients, LV EF 31±10%; 15 deaths; 29 recurrent HF; 4 heart transplants over 266±177 days
Dysynchrony
Prediction of All-Cause Mortality From Global Longitudinal Speckle Strain

Comparison With Ejection Fraction and Wall Motion Scoring

Conclusions—GLS is a superior predictor of outcome to either EF or WMSI and may become the optimal method for assessment of global left ventricular systolic function. (Circ Cardiovasc Imaging. 2009;2:356-364.)

GLS = global longitudinal strain, EF = ejection fraction, WMSI = wall motion score index

DCM

546 patients; 5.2 year follow-up
Hypertrophic cardiomyopathy

Prognostic cut-off -12.9%

%LGE = 11.9 %
%LGE = 0 %

GLS = -9.4 %
GLS = -16.4 %

When the HCM patients were stratified based on the median level of GLS (-12.9%), All events were observed in the worse GLS group (P = 0.018)
Longitudinal LV Function for Prediction of Survival in Systemic Light-Chain Amyloidosis
Incremental Value Compared With Clinical and Biochemical Markers

GLS : valeur indépendante et additive au score de Karnovsky

### Table A

<table>
<thead>
<tr>
<th>Group</th>
<th>Number at risk</th>
<th>Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; -10.7</td>
<td>95 94 89 86 80 76 67 40 18</td>
<td>0 250 500 750 1000 1250 1500 1750 2000 2250</td>
</tr>
<tr>
<td>&gt; -10.7</td>
<td>110 56 45 36 31 24 19 13 6</td>
<td>0 250 500 750 1000 1250 1500 1750 2000 2250</td>
</tr>
</tbody>
</table>

### Table B

<table>
<thead>
<tr>
<th>Group</th>
<th>Number at risk</th>
<th>Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; -11.8</td>
<td>113 109 104 101 95 88 78 48 22</td>
<td>0 250 500 750 1000 1250 1500 1750 2000 2250</td>
</tr>
<tr>
<td>&gt; -11.8</td>
<td>92 41 30 21 16 12 8 5 2</td>
<td>0 250 500 750 1000 1250 1500 1750 2000 2250</td>
</tr>
</tbody>
</table>

### Table C

<table>
<thead>
<tr>
<th>NT-proBNP</th>
<th>Survival probability (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3085 pg/ml</td>
<td>p&lt;0.0001, X²=84.2</td>
</tr>
<tr>
<td>&gt; 3085 pg/ml</td>
<td>p&lt;0.0001, X²=84.2</td>
</tr>
</tbody>
</table>

### Table D

<table>
<thead>
<tr>
<th>Cardiac Troponin-T</th>
<th>Survival probability (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.01 µg/l</td>
<td>p&lt;0.0001, X²=72.3</td>
</tr>
<tr>
<td>≥ 0.01 µg/l</td>
<td>p&lt;0.0001, X²=72.3</td>
</tr>
</tbody>
</table>

Sebastian J. Buss et al.
Journal of the American College of Cardiology 2012; 60 : 1067 - 1076
Interesting value in Asymptomatic AoS

Adjustment for gender, systemic arterial compliance, E-wave, E/A ratio and response to exercise (abnormal vs. normal)

- Peak aortic velocity $\geq 4.4 \text{ m.s}^{-1}$
- $Zva \geq 4.9 \text{ mmHg.ml}^{-1}.\text{m}^{-2}$
- GLS $\leq 15.9 \%$
- Ind. LA area $\geq 12.2 \text{ cm}^2/\text{m}^2$

Hazard ratio:
- HR = 1.7, $p=0.027$
- HR = 1.9, $p=0.013$
- HR = 2.2, $p=0.003$
- HR = 2.8, $p=0.001$
Global longitudinal strain is a strong independent predictor of all-cause mortality in patients with aortic stenosis.


N=146
Kaplan–Meier plot illustrating survival free from major adverse cardiac events in patients with aortic stenosis.

low (GLS $\geq$15%)
ROC of preoperative LV GLS for LV dysfunction at long-term follow-up (>12 months).

Witkowski T G et al. Eur Heart J Cardiovasc Imaging 2012;ehjci.jes155
Postoperative outcome for mortality according to GLS and LVEF.

Ternacle J et al. Eur Heart J Cardiovasc Imaging 2012;ehjci.jes156

425 patients

- CABG 155
- aortic valve surgery 174
- mitral surgery 96
2D Longitudinal Strain: Powerful modality for the assessment of subclinical cardiac dysfunction

Spethmann S et al. Eur Heart J Cardiovasc Imaging 2012;ehjci.jes047
Conclusions—In patients with breast cancer treated with anthracyclines, taxanes, and trastuzumab, systolic longitudinal myocardial strain and ultrasensitive troponin I measured at the completion of anthracyclines therapy are useful in the prediction of subsequent cardiotoxicity and may help guide treatment to avoid cardiac side-effects. (Circ Cardiovasc Imaging. 2012;5:596–603.)
Echo / speckle tracking/ deformation imaging

LONGITUDINAL STRAIN in addition to the current practice

Increase number of demonstrations of its real clinical value

Best for follow-up than EF, still few technical issues and necessity in recognizing a necessary learning curve
Inscrivez vous !