Abstract: **3078**

Usefulness of a semi-quantitative and layer-specific assessment of the relative apical sparing pattern of longitudinal strain for the identification of cardiac amyloidosis

**Authors:**
M Saito¹, M Imai¹, D Wake¹, R Higaki¹, T Sumimoto¹, S Inaba¹, ¹Kitaishikai Hospital - Ozu - Japan,

**Topic(s):**
Tissue Doppler, Speckle Tracking and Strain Imaging

**Citation:**

Background: The relative apical sparing pattern (RASP) of left ventricular longitudinal strain (LS) is determined using a strain polar map, while global longitudinal strain is measured using speckle-tracking echocardiography, and it is frequently associated with cardiac amyloidosis (CA). However, the definition of visual RASP is ambiguous, and this leads to insufficient reproducibility, whereas quantitative RASP takes time and leads to difficulty in the clinical application. Generally, amyloid predominantly accumulates in the endo-myocardial layer. As such, layer-specific analysis of RASP may more accurately identify CA. Therefore, the aims of this study were to explore the reproducible and easy definition of RASP for identifying CA and investigate the effect of layer-specific analysis on the assessment.

Methods: A total of 40 patients with CA diagnosed by biopsy and technetium pyrophosphate scintigraphy were compared with 120 control patients matched for mean left ventricular wall thickness (40 aortic stenosis, 40 hypertrophic cardiomyopathy, and 40 hypertensive heart disease). We compared the discriminative abilities of three definitions of RASP (visual, quantitative, and semi-quantitative). According to a previous paper, visual RASP was defined as visual reduction of LS in the basal and middle LS segments (light red or blue) relative to the apical LS (red). Quantitative RASP was calculated using the following formula: average apical LS/(average basal LS + average mid-ventricle LS), then binarized by the optimal cut-off value for predicting CA. Semi-quantitative RASP was defined as reduction of LS (−10%) in five or more segments out of the basal six segments, relative to apical LS (−15%). Sample cases are shown in Figure (left). Visual and semi-quantitative RASP were independently assessed by two blinded sonographers. The RASP at the endo-myocardial and all layers was evaluated using customized software. The concordance was assessed using the kappa statistic, whereas the discriminative ability was assessed using receiver operating characteristic curve analysis.

Results: The concordance of visual RASP was modest but its semi-quantitative RASP was perfect (Table right). The discriminative ability of semi-quantitative RASP at each layer was significantly better than that of visual RASP and close to that of the binary quantitative RASP. Additionally, the discriminative abilities of visual (p = 0.10) and semi-quantitative (p = 0.11) RASP at the endo-myocardial layer appeared to be better than those at all layers. Conclusions: The assessment method of semi-quantitative RASP is easy and highly reproducible. Furthermore, it accurately discriminates CA. In addition, assessment at the endo-myocardial layer potentially improves the discriminative ability.
Abstract:
Usefulness of a semi-quantitative and layer-specific assessment of the relative apical sparing pattern of longitudinal strain for the identification of cardiac amyloidosis

Authors:
M Saito 1, M Imai 1, D Wake 1, R Higaki 1, T Sumimoto 1, S Inaba 1

1 Kitaishikai Hospital - Ozu - Japan

Topic(s):
Tissue Doppler, Speckle Tracking and Strain Imaging

Citation:

Background: The relative apical sparing pattern (RASP) of left ventricular longitudinal strain (LS) is determined using a strain polar map, while global longitudinal strain is measured using speckle-tracking echocardiography, and it is frequently associated with cardiac amyloidosis (CA). However, the definition of visual RASP is ambiguous, and this leads to insufficient reproducibility, whereas quantitative RASP takes time and leads to difficulty in the clinical application. Generally, amyloid predominantly accumulates in the endo-myocardial layer. As such, layer-specific analysis of RASP may more accurately identify CA. Therefore, the aims of this study were to explore the reproducible and easy definition of RASP for identifying CA and investigate the effect of layer-specific analysis on the assessment.

Methods: A total of 40 patients with CA diagnosed by biopsy and technetium pyrophosphate scintigraphy were compared with 120 control patients matched for mean left ventricular wall thickness (40 aortic stenosis, 40 hypertrophic cardiomyopathy, and 40 hypertensive heart disease). We compared the discriminative abilities of three definitions of RASP (visual, quantitative, and semi-quantitative). According to a previous paper, visual RASP was defined as visual reduction of LS in the basal and middle LS segments (light red or blue) relative to the apical LS (red). Quantitative RASP was calculated using the following formula: average apical LS/(average basal LS + average mid-ventricle LS), then binarized by the optimal cut-off value for predicting CA. Semi-quantitative RASP was defined as reduction of LS (= -10%) in five or more segments out of the basal six segments, relative to apical LS (= -15%). Sample cases are shown in Figure (left). Visual and semi-quantitative RASP were independently assessed by two blinded sonographers. The RASP at the endo-myocardial and all layers was evaluated using customized software. The concordance was assessed using the kappa statistic, whereas the discriminative ability was assessed using receiver operating characteristic curve analysis.

Results: The concordance of visual RASP was modest but its semi-quantitative RASP was perfect (Table right). The discriminative ability of semi-quantitative RASP at each layer was significantly better than that of visual RASP and close to that of the binary quantitative RASP. Additionally, the discriminative abilities of visual (p = 0.10) and semi-quantitative (p = 0.11) RASP at the endo-myocardial layer appeared to be better than those at all layers.

Conclusions: The assessment method of semi-quantitative RASP is easy and highly reproducible. Furthermore, it accurately discriminates CA. In addition, assessment at the endo-myocardial layer potentially improves the discriminative ability.

Reproducibility and Discriminative ability for identifying cardiac amyloidosis

<table>
<thead>
<tr>
<th>Layer</th>
<th>Variables</th>
<th>Kappa</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Visual RASP</td>
<td>0.63</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Semi-quantitative RASP</td>
<td>1.00</td>
<td>0.73*</td>
</tr>
<tr>
<td></td>
<td>Binary quantitative RASP</td>
<td>-</td>
<td>0.78*</td>
</tr>
<tr>
<td>Endo-myocardial</td>
<td>Visual RASP</td>
<td>0.68</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Semi-quantitative RASP</td>
<td>1.00</td>
<td>0.78*</td>
</tr>
<tr>
<td></td>
<td>Binary quantitative RASP</td>
<td>-</td>
<td>0.75*</td>
</tr>
</tbody>
</table>

*p<0.01 vs Visual RASP at each layer

AUC, area under the curve; LS, longitudinal strain; RASP, relative apical sparing pattern.