Diffuse fibrosis in the right and left ventricle of patients with transposition of the great arteries late after atrial switch operation

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Background

In adult patients with transposition of the great arteries (TGA) late after atrial switch operation (Mustard or Senning procedure), the subaortic morphologic right ventricle (RV) is hypertrophic, while the subpulmonary morphologic left ventricle (LV), is usually unloaded and hypotrophic. The extent of diffuse fibrosis in the RV and LV in these patients remains unclear. The aim of this study was to determine the myocardial extracellular volume (ECV) by cardiac magnetic resonance (CMR) in both ventricles.

Methods

We determined ECV by CMR in 10 patients (age 33.4±4.7 yrs), without pulmonary stenosis, late after atrial switch. Modified Look-Locker Inversion recovery sequences (MOLLI) for T1-mapping was used to calculate ECV. We measured T1 values in the lateral and inferior wall of the left ventricle, in the septum and in the right ventricle before and 10 minutes after injection of Gadolinium-based contrast agent. Due to the technical challenge to correctly trace the thin structures of the hypotrophic LV, the T1 measurements were confirmed by two CMR experts.

ECV was calculated by the following Formula:

\[
ECV = \frac{1}{\frac{1}{T1\ post\ myo} - \frac{1}{T1\ post\ blood} - \frac{1}{T1\ myo}}
\]

Results

ECV of the lateral and inferior wall of the LV were significantly increased compared to the RV (p < 0.0001).

<table>
<thead>
<tr>
<th>Ventricle segments</th>
<th>ECV [%]</th>
<th>Native T1 map [ms]</th>
<th>T1 map after contrast [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV</td>
<td>27 (25 – 29)</td>
<td>921 (907 - 967)</td>
<td>452 (418 - 492)</td>
</tr>
<tr>
<td>LV-lateral wall</td>
<td>37 (35 - 39) *</td>
<td>990 (926 - 1063) §</td>
<td>387 (364 - 439) *</td>
</tr>
<tr>
<td>LV-Inferior wall</td>
<td>36 (33 - 41) *</td>
<td>1030 (945 - 1083) *</td>
<td>403 (375 - 444) *</td>
</tr>
<tr>
<td>Septum</td>
<td>28 (24 - 30) §</td>
<td>956 (933 - 983) §</td>
<td>460 (419 - 496) §</td>
</tr>
</tbody>
</table>

[Median; 25th-75th percentile] * = compared to RV p < 0.05 § = compared to RV p > 0.05

Conclusions

ECV is markedly increased in the unloaded LV in patients late after atrial switch operation for TGA. This may be due to diffuse fibrosis, induced by long time unloading of the LV. This hypothesis is supported by previously reported histological results. The ECV of the systemic RV is in the upper normal range.

References


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