Successful reperfusion therapy for acute myocardial infarction (AMI) increases the ratio of subendocardial infarction to transmural infarction. Consequently, reperfusion therapy reduces left ventricular remodeling. Therefore, evaluation of transmural myocardial perfusion, as well as horizontal perfusion, becomes important for estimating the long-term prognosis of patients with AMI. Scintigraphy is of limited value in the evaluation of transmural myocardial perfusion because of its relatively poor resolution in time and space. However, the superior resolution in time (0.08–0.16 s) and space (0.4 mm) of newly developed multi-detector computed tomography (MDCT) has provided a powerful modality with which to evaluate transmural myocardial microcirculation. The aim of the present study was to determine whether the evaluation of transmural myocardial microcirculation by newly developed 4-slice computed tomography (CT) can estimate the recovery of left ventricular function.

Methods and Results Seventeen consecutive patients who had anterior AMI with a total occlusion in the proximal left anterior descending artery (LAD) and who had undergone successful balloon reperfusion therapy within 24 h of the onset of AMI were examined. Four-slice CT was performed 10–14 days after AMI onset. The median of the epicardial perfusion ratio (infarcted anterior epicardial CT number/intact lateral epicardial CT number ratio = 92%) was used to categorize the cases into 2 groups: the transmural infarction group (n=8) and the subendocardial infarction group (n=9). Although no significant difference was observed between myocardial enhancement by CT in the acute phase and anterior wall motion or ejection fraction in the acute phase, the transmural infarction group showed poor recovery of anterior wall motion at 6 months after AMI onset, whereas the subendocardial infarction group exhibited good recovery of regional and global left ventricular function. The diagnostic resting first-pass perfusion imaging scan (arterial image) was automatically begun when the contrast enhancement reached the aortic root. The injection speed was set at 4 ml/s for the first 100 ml followed by 3 ml/s for the remaining 40 ml. All patients received 10 mg propranolol orally at 1 h before the scan if their first episode of anterior AMI (maximal creatine kinase level (max CK) 2,509±2,003, mean±SD) with a total occlusion (TIMI 0) in the proximal left anterior descending artery (LAD) and who had undergone successful primary balloon reperfusion therapy (TIMI 3) within 24 h of the onset of AMI were examined. Coronary arteriography showed that none of the patients had collateral flow to the distal LAD. Stents were implanted in 15 of the 17 patients because of unsatisfactory angioplasty. These 17 cases were considered to have almost the same horizontal extent of infarction. Left ventriculography was performed at 30 min after reperfusion and 6 months after the onset of AMI. The centerline method (SD/cord) was used to determine whether evaluating the transmural myocardial microcirculation by MDCT can estimate the recovery of left ventricular function.

Conclusions Transmural myocardial microcirculation imaged by 4-slice CT can predict wall motion recovery after AMI. (Circ J 2004; 68: 512–514)

Key Words: Acute myocardial infarction; Multi-detector computed tomography; Transmural perfusion

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the heart rate was more than 70 beats/min. A region of interest (ROI) was placed over the epicardial and endocardial halves of the infarcted mid-septum to apex and the intact mid-lateral wall. Representative cases show good enhancement in the epicardium but poor enhancement in the endocardium (a) and poor perfusion in both the endocardial and epicardial halves (b) as assessed by multidetector computed tomography (MDCT). The arrowhead indicates a horizontal infarct lesion. The subtracted CT values of the infarct lesions were calibrated using subtracted CT values of the intact mid-lateral wall. (c) Evaluation of perfusion ratio in the epicardial and endocardial walls by MDCT. The median CT ratio in the epicardial half (92%) is shown as a dotted line. Cases above the dotted median line were classified as transmural infarction (n=8), whereas those below were classified as subendocardial infarction (n=9).

Table 1 Regional Anterior Wall Motion (SD/cord) by Left Ventriculography in Patients With Anterior AMI

<table>
<thead>
<tr>
<th></th>
<th>Transmural infarction group (n=8)</th>
<th>Subendocardial infarction group (n=9)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute phase</td>
<td>−2.69±1.06</td>
<td>−2.77±0.97</td>
<td>0.87</td>
</tr>
<tr>
<td>6 months after onset</td>
<td>−2.35±1.37</td>
<td>−1.14±0.84</td>
<td>0.04</td>
</tr>
<tr>
<td>∆SD/chord</td>
<td>+0.33±0.87</td>
<td>+1.65±0.97</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Data represent mean±SD.

Table 2 Left Ventricular Ejection Fraction (EF) by Left Ventriculography in Patients With Anterior AMI

<table>
<thead>
<tr>
<th></th>
<th>Transmural infarction group (n=8)</th>
<th>Subendocardial infarction group (n=9)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute phase</td>
<td>54±16</td>
<td>51±13</td>
<td>0.68</td>
</tr>
<tr>
<td>6 months after AMI</td>
<td>55±10</td>
<td>64±11</td>
<td>0.13</td>
</tr>
<tr>
<td>∆EF</td>
<td>1±10</td>
<td>13±8</td>
<td>0.03</td>
</tr>
</tbody>
</table>

EF, ejection fraction.
months after AMI onset. Patients in the subendocardial infarction group showed contractile recovery at 6 months after the onset. Recent studies have shown that delayed-enhanced images by MRI correspond to irreversible contractile function of the infarcted wall. Unfortunately, delayed MDCT images were not performed in the present study in order to avoid additional radiation exposure.

In summary, the transmural myocardial microcirculation was clearly imaged by 4-slice MDCT in 17 patients experiencing a first episode of anterior AMI. Transmural perfusion, particular epicardial perfusion during the acute phase, may be a key predictor of wall motion recovery after AMI.

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References