I. .......................... 1

II. .......................... 10

1. .......................... 10

2. .......................... 10

3. .......................... 10

4. .......................... 10

5. .......................... 11

6. PESDA .......................... 11

7. .......................... 11

8. .......................... 12

9. .......................... 14

10. .......................... 14

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Table 1. Baseline characteristics of 101 study patients

Table 2. Accuracy in the diagnosis of coronary artery stenosis

Table 3. Accuracy in the diagnosis of left anterior descending artery stenosis

Table 4. Accuracy in the diagnosis of left circumflex artery stenosis

Table 5. Accuracy in the diagnosis of right coronary artery stenosis

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Table 7. Accuracy in the prediction of cardiac events
Table 8. Predictors of cardiac events by univariate analysis

Table 9. Predictors of cardiac events by multivariate analysis
Figure 1. Examples of normal myocardial contrast enhancement and contrast defect detected by real time myocardial contrast echocardiography using low mechanical index
perfluorocarbon-exposed sonicated dextrose albumin (PESDA)
Univariate analysis showed that the presence of 21 years, 34 years, and 14 years was associated with 57.8%, 83.8%, 86.0%, 53.4%, 81.1%, 73.4%, 81.1%, 63.8%, respectively. 14 years, 21 years, 34 years was associated with 79.1%, 58.6%, 76.7%, 75.9%, 70.1%.

Multivariate analysis showed that the presence of 21 years, 34 years, and 14 years was associated with 57.8%, 83.8%, 86.0%, 53.4%, 81.1%, 73.4%, 81.1%, 63.8%, respectively. 14 years, 21 years, 34 years was associated with 79.1%, 58.6%, 76.7%, 75.9%, 70.1%.

( p<0.05 )
,...
I. Topic

...
fluorocarbon gas, albumin, surfactant, lipid, polymer shell 7.

2. 3 second harmonic imaging (oscillation)

2. 4 second harmonic imaging (non-linear oscillation) 8.

second harmonic imaging
mechanical index (MI))

inversion Doppler pulse

power modulation 11,12.

13. 14,15 12
perfluorocarbon-exposed sonicated dextrose albumin (PESDA)
II. 1. 

2001年 11月 2002年 9月 101例 ST段压低 ≥0.1mV 12-lead ECG 0.2mV T波 压低 0.1mV ST段压低 ≥0.1mV

2. 

. 1. 

. 12-lead ECG 2-lead ECG lead TnT > 0.1ng/ml, CK-MB > 5ng/ml
. PESDA

Perfluorocarbon (188g/mol) 8ml 5% dextrose 12ml, 5% human albumin 4ml

80 (electromechanical sonication ; Heat System Inc. LA, California, USA)

(550W) 124 ± 15W (maximal output) 25 ± 3% (mean ± SD)

124 ± 15W 98 ± 11W/cm²

4.7 ± 0.2 µm, 1.3 ± 0.1 × 10⁹ microbubbles/ml

.
60ml PESDA 40ml (1ml/min) (refilling) S-VHS.

(Figure 1) digital ultrasound system (Sonos 5500, Agilent, Messachusets, USA) low mechanical index Power Modulation imaging (MI 0.1 gain) How much is the cell.
Figure 1. Examples of normal myocardial contrast enhancement and contrast defect detected by real time myocardial contrast echocardiography using low mechanical index. (A) A normal subject; The first endsystolic frame after microbubble destruction with high mechanical index ultrasound. LV wall is visualized as black due to absence of signals from the microbubbles(left). Note even enhancement of LV wall with the replenished microbubbles at the 10th endsystolic frame(right). (B) A patient with the left anterior descending artery and the left circumflex artery stenoses; The first endsystolic frame after the microbubble destruction(left). Non-enhancement at the apex and the lateral wall of the LV(arrows) is prominent at the 10th endsystolic frame due to the perfusion abnormality(right).
48歳の男性で、脳梗塞の既往がなく、 leben アイストラクトを行った。がん性の間違いないもので、＜セルドナー＞＜ジェダイキン＞＜A-com projector＞のような方法で、治療を進める。成功率は 70%で、経験が豊富な医師が行う。
. .

... (cardiac event) ... , ... ... .

... ... t-... , ... ... ... ... ...

... ... ... ... ... ... . ... SPSS for
windows version 11.0... p<0.05 ... ... ...

... ... ... ... ... ... .
Table 1. Baseline characteristics of 101 study patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>61 ± 10</td>
</tr>
<tr>
<td>Male</td>
<td>57 (56.4%)</td>
</tr>
<tr>
<td>Ejection fraction (%)</td>
<td>61 ± 9</td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>18 (17.8%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>57 (56.4%)</td>
</tr>
<tr>
<td>Smoking</td>
<td>44 (43.6%)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>53 (52.5%)</td>
</tr>
<tr>
<td>Coronary angiography</td>
<td></td>
</tr>
<tr>
<td>Normal/minimal</td>
<td>37 (36.6%)</td>
</tr>
<tr>
<td>1 VD</td>
<td>27 (26.7%)</td>
</tr>
<tr>
<td>2 VD</td>
<td>20 (19.8%)</td>
</tr>
<tr>
<td>3 VD</td>
<td>17 (16.8%)</td>
</tr>
</tbody>
</table>
1 dyslipidemia – total cholesterol > 200 mg/dl or LDL > 130 mg/dl or HDL < 40 mg/dl

2. 

<table>
<thead>
<tr>
<th>T</th>
<th>ST</th>
<th>70%</th>
<th>64%</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>21</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>34</td>
<td>44</td>
<td>37</td>
<td>18</td>
</tr>
<tr>
<td>50</td>
<td>50%~70%</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

57.8%, 83.8% |

86.0%, 53.4% |

73.4%, 81.1%
Table 2. Accuracy in the diagnosis of coronary artery stenosis

<table>
<thead>
<tr>
<th></th>
<th>EKG</th>
<th>Cardiac Enzyme</th>
<th>RWMA by 2DE¹</th>
<th>Perfusion Defect by MCE²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity(%)</td>
<td>46.9</td>
<td>28.1</td>
<td>57.8</td>
<td>73.4</td>
</tr>
<tr>
<td>Specificity(%)</td>
<td>75.7</td>
<td>91.9</td>
<td>83.8</td>
<td>81.1</td>
</tr>
<tr>
<td>Positive predictive value (%)</td>
<td>76.9</td>
<td>85.7</td>
<td>86.0</td>
<td>87.0</td>
</tr>
<tr>
<td>Negative predictive value (%)</td>
<td>45.2</td>
<td>42.5</td>
<td>53.4</td>
<td>63.8</td>
</tr>
</tbody>
</table>

¹RWMA by 2DE: regional wall motion abnormality by two-dimensional echocardiography
²Perfusion Defect by MCE: perfusion defect by myocardial contrast echocardiography

(Table 3 – Table 5)
Table 3. Accuracy in the diagnosis of left anterior descending artery stenosis

<table>
<thead>
<tr>
<th></th>
<th>RWMA by 2DE¹</th>
<th>Perfusion Defect by MCE²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity(%)</td>
<td>43.6</td>
<td>74.5</td>
</tr>
<tr>
<td>Specificity(%)</td>
<td>93.5</td>
<td>82.6</td>
</tr>
</tbody>
</table>

¹RWMA by 2DE : regional wall motion abnormality by two-dimensional echocardiography
²Perfusion Defect by MCE : perfusion defect by myocardial contrast echocardiography

Table 4. Accuracy in the diagnosis of left circumflex artery stenosis

<table>
<thead>
<tr>
<th></th>
<th>RWMA by 2DE¹</th>
<th>Perfusion Defect by MCE²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity(%)</td>
<td>23.7</td>
<td>52.6</td>
</tr>
<tr>
<td>Specificity(%)</td>
<td>95.2</td>
<td>90.5</td>
</tr>
</tbody>
</table>

¹RWMA by 2DE : regional wall motion abnormality by two-dimensional echocardiography
²Perfusion Defect by MCE : perfusion defect by myocardial contrast echocardiography

Table 5. Accuracy in the diagnosis of right coronary artery stenosis

<table>
<thead>
<tr>
<th></th>
<th>RWMA by 2DE¹</th>
<th>Perfusion Defect by MCE²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity(%)</td>
<td>23.8</td>
<td>9.5</td>
</tr>
<tr>
<td>Specificity(%)</td>
<td>91.3</td>
<td>95.0</td>
</tr>
</tbody>
</table>

¹RWMA by 2DE : regional wall motion abnormality by two-dimensional
Perfusion Defect by MCE: perfusion defect by myocardial contrast echocardiography

3.

<table>
<thead>
<tr>
<th></th>
<th>Without Cardiac Events</th>
<th>With Cardiac Events</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>60 ± 11</td>
<td>61 ± 9</td>
<td>0.420</td>
</tr>
<tr>
<td>Male</td>
<td>17 (16.8%)</td>
<td>40 (39.6%)</td>
<td>0.003</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>152 ± 34</td>
<td>146 ± 26</td>
<td>0.309</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>87 ± 18</td>
<td>85 ± 12</td>
<td>0.463</td>
</tr>
<tr>
<td>Diabetes</td>
<td>5 (5.0%)</td>
<td>13 (12.9%)</td>
<td>0.161</td>
</tr>
<tr>
<td>Hypertension</td>
<td>23 (22.8%)</td>
<td>34 (33.7%)</td>
<td>0.607</td>
</tr>
<tr>
<td>Smoking</td>
<td>11 (10.9%)</td>
<td>33 (32.7%)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

(\(p<0.05\)) (Table 6)
<table>
<thead>
<tr>
<th>Dyslipidemia¹</th>
<th>18 (17.8%)</th>
<th>35 (34.7%)</th>
<th>0.054</th>
</tr>
</thead>
</table>

¹ dyslipidemia – total cholesterol > 200 mg/dl or LDL > 130 mg/dl or HDL < 40 mg/dl

<table>
<thead>
<tr>
<th>Table 7. Accuracy in the prediction of cardiac events</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWMA by 2DE¹</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Sensitivity (%)</td>
</tr>
<tr>
<td>Specificity (%)</td>
</tr>
<tr>
<td>Positive predictive value (%)</td>
</tr>
<tr>
<td>Negative predictive value (%)</td>
</tr>
</tbody>
</table>

¹RWMA by 2DE : regional wall motion abnormality by two-dimensional echocardiography
²Perfusion Defect by MCE : perfusion defect by myocardial contrast echocardiography
Table 8. Predictors of cardiac events by univariate analysis

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio (95%CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>3.84(1.62~9.07)</td>
<td>0.002</td>
</tr>
<tr>
<td>Ejection fraction</td>
<td>0.93(0.88~0.97)</td>
<td>0.003</td>
</tr>
<tr>
<td>Abnormal ECG</td>
<td>2.72(1.15~6.40)</td>
<td>0.022</td>
</tr>
<tr>
<td>RWMA by 2DE(^1)</td>
<td>5.35(2.17~13.18)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Perfusion Defect by MCE(^2)</td>
<td>10.37(4.10~26.20)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

\(^1\)RWMA by 2DE: regional wall motion abnormality by two-dimensional echocardiography

\(^2\)Perfusion Defect by MCE: perfusion defect by myocardial contrast echocardiography

Table 9. Predictors of cardiac events by multivariate analysis

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>1.27 (0.36~4.48)</td>
<td>0.710</td>
</tr>
<tr>
<td>Ejection fraction</td>
<td>0.97 (0.90~1.04)</td>
<td>0.384</td>
</tr>
<tr>
<td>Abnormal ECG</td>
<td>2.81 (0.94~8.45)</td>
<td>0.066</td>
</tr>
<tr>
<td>RWMA by 2DE(^1)</td>
<td>1.03 (0.26~4.17)</td>
<td>0.965</td>
</tr>
<tr>
<td>Perfusion Defect by MCE&lt;sup&gt;2&lt;/sup&gt;</td>
<td>8.37 (2.59~27.01)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------</td>
<td>--------</td>
</tr>
</tbody>
</table>

<sup>1</sup>RWMA by 2DE: regional wall motion abnormality by two-dimensional echocardiography

<sup>2</sup>Perfusion Defect by MCE: perfusion defect by myocardial contrast echocardiography

### IV. 4.4

Gramiak 17, 18, 19

PESDA 20
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¹ÌÅäÄܵ帮¾Æ¿¡

²4. ²1. ²2. ²22. ²23. ²24. ²7. ²10. 

MCE ²99mTc-sestamibi SPECT ²99mTc-sestamibi SPECT ²¹³¹ß°ú³ª. ²¹³¹ß°ú³ª. Kaul ²3® ²2® dipyridamole ²4®

µî ²10® harmonic power Doppler imaging ²¹³¹ß°ú³ª. ²7®

Heinle

¹¹³¹ß°ú³ª. ²¹³¹ß°ú³ª. ²¹³¹ß°ú³ª. ²¹³¹ß°ú³ª.
Porter 25 25 25 perfluorocarbon intermittent harmonic imaging intermittent imaging Cwajg 26 26 45 45 accelerated intermittent imaging Optison, PESDA 12 low MI Pulse inversion Doppler imaging.
99mTc-sestamibi SPECT

70% 70%

(stunning myocardium),  (hibernating myocardium) 70%

64% 54% 12%

ischemic cascade,
univariate analysis

and multivariate analysis
V. ipment

ST(300) equipment is used for the low MI power modulation

(PESDA) equipment is used for the low MI power modulation

The equipment is used for the low MI power modulation

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Abstract

The role of myocardial contrast echocardiography

in acute chest pain without ST elevation

Pil-Ki Min

Department of Medicine

The Graduate School, Yonsei University

( Directed by Professor Namsik Chung )

Background: Two-dimensional echocardiography (2DE) plays an important role in the diagnosis of acute coronary syndrome in patients presenting with non-diagnostic ECG. We hypothesized that simultaneous assessment of myocardial perfusion and regional wall motion abnormality using real-time myocardial contrast echocardiography (MCE) provides more useful information than
routine 2DE in this clinical setting.

**Methods:** We prospectively enrolled 101 patients (age: 61±10 years, 57 men) who presented to the emergency room with acute chest pain. Within 12 hours of episodes of chest pain, two-dimensional echocardiography (2DE) was performed to evaluate regional wall motion abnormality and non-stress MCE was performed to assess perfusion defect using real-time low mechanical-index power modulation imaging while infusing PESDA continuously. Coronary angiography was performed in all patients. Cardiac events (myocardial infarction, revascularization, death) were analyzed.

**Results:** Of the 101 patients studied, 64 had significant coronary artery disease (diameter stenosis > 70%). Cardiac events occurred in 58 patients; 21 myocardial infarction, 34 percutaneous transluminal coronary angioplasty, and 14 coronary artery bypass graft. The sensitivity of 2DE and MCE for significant coronary artery stenosis were 57.8% and 73.4%, and the specificity were 83.8% and 81.1%, respectively. Among 58 patients with cardiac events, regional wall motion abnormality was observed in 34 (59%) patients, and perfusion defect was observed in 44 (76%) patients. The specificity of 2DE and
MCE for cardiac events were 79% and 77%, respectively. There were no significant differences in history of hypertension or diabetes, but male gender, smoking, and abnormal ECG (T inversion>0.2mV or ST depression>0.1mV) were more frequent in patients with cardiac events (p<0.05). With multivariate logistic regression analysis, only perfusion defect independently predicted cardiac events (p<0.001, odds ratio=8.37).

**Conclusion:** Real time MCE in patients with acute chest pain fairly predicts significant coronary artery stenosis, and identifies those who will have cardiac events.

Key words: chest pain, myocardial ischemia, echocardiography, contrast media,