Five Year Follow-up of Double Master’s Test, Maximal Treadmill Stress Test, and Resting and Postexercise Apexcardiogram in Asymptomatic Persons

By Wilbert S. Aronow, M.D., and John Cassidy, M.D.

SUMMARY
The double Master’s test, the maximal treadmill stress test, the resting apexcardiogram, and the postexercise apexcardiogram significantly correlated with the development of subsequent coronary heart disease within five years in 100 asymptomatic persons. The maximal treadmill stress test correlated better than the double Master’s test in predicting subsequent coronary heart disease. The presence of both an abnormal maximal treadmill stress test and an abnormal a-wave ratio in the postexercise apexcardiogram had the best value in predicting subsequent coronary heart disease.

WE REPORTED 30 month follow-up data correlating the double Master’s test, the maximal treadmill stress test (MTST), the resting apexcardiogram, and the postexercise apexcardiogram with the development of subsequent coronary heart disease in 100 asymptomatic individuals. An abnormal MTST plus an abnormal postexercise apexcardiogram correlated best with an increased incidence of subsequent coronary heart disease. We are reporting five year follow-up data correlating the double Master’s test, the MTST, the resting apexcardiogram, and the postexercise apexcardiogram with the development of subsequent coronary heart disease in these 100 asymptomatic individuals.

Materials and Methods
The 100 clinically normal subjects who previously had a double Master’s test and a MTST were followed for five years. They included 98 men and two women who were between ages 38 and 64 years, with a mean age of 51 ± 6 years, at the onset of this study. Ninety-eight of these 100 clinically normal subjects had a satisfactory resting and postexercise apexcardiogram.

The 100 asymptomatic subjects were hospital personnel or their friends who were invited by the authors to participate in this study, and were matched for age and sex with 100 patients with angina pectoris due to coronary artery disease. All 100 subjects had a normal 12-lead resting electrocardiogram and blood pressure below 140/90 mm Hg at the time of their initial tests. None of them was on any medication at the time of their tests. None of them had any evidence of valvular disease. All tests were performed at least two hours after a light meal.

The criterion for an abnormal double Master’s test and for an abnormal MTST was ≥1.0 mm of ischemic ST-segment depression below the resting level, with the ST segment either extending horizontally or at least 0.08 sec or sloping downward. The criterion for an abnormal resting apexcardiogram was a resting a-wave ratio of at least 15%. The criterion for an abnormal postexercise apexcardiogram was an a-wave of at least 20% after a double Master’s test.

The data were statistically analyzed by a biostatistical consultant who used a Fisher Exact Probability Test.

Results
Nine of the 100 asymptomatic subjects (9%) developed clinical coronary heart disease within the five year follow-up period. Three persons died of coronary heart disease, four developed transmural myocardial infarction, one had saphenous vein bypass graft surgery for severe angina pectoris, and one person with angina pectoris had a 75% occlusion of his left anterior descending coronary artery visualized by coronary angiography.

Table 1 correlates the double Master’s test, the MTST, the resting apexcardiogram, and the postexercise apexcardiogram with the development of subsequent coronary heart disease within the five year follow-up period. No reasonably narrow limits can be set for a confidence interval for relative risk because the sample size of the persons who developed coronary heart disease is too small.

Asymptomatic individuals with initially an abnormal double Master’s test were 6.8 times more likely to develop coronary heart disease within five years than normal subjects with initially a normal double Master’s test (P = 0.0395). Asymptomatic persons
with initially an abnormal MTST were 13.6 times more likely to develop coronary heart disease within five years than normal subjects with initially a normal MTST \((P = 0.0001)\).

Asymptomatic individuals with initially an abnormal resting apexcardiogram were 12.4 times more likely to develop coronary heart disease within five years than normal persons with initially a normal resting apexcardiogram \((P = 0.0005)\). Asymptomatic persons with initially an abnormal postexercise apexcardiogram were 11.1 times more likely to develop coronary heart disease within five years than normal subjects with initially a normal postexercise apexcardiogram \((P = 0.0003)\).

Table 2 correlates the presence of an abnormal MTST plus an abnormal resting apexcardiogram and also the presence of an abnormal MTST plus an abnormal postexercise apexcardiogram with the development of subsequent coronary heart disease within the five year follow-up period.

Asymptomatic individuals with initially an abnormal MTST plus an abnormal resting apexcardiogram were 18.9 times more likely to develop coronary heart disease within five years than normal subjects without both tests abnormal \((P = 0.00003)\). Asymptomatic persons with initially an abnormal MTST plus an abnormal postexercise apexcardiogram were 26.0 times more likely to develop coronary heart disease within five years than normal individuals without both tests abnormal \((P = 0.000005)\).

### Discussion

Ischemic ST-segment depression in asymptomatic persons following a double Master's test,\(^1\) 6-10 a submaximal treadmill stress test,\(^11\) a near-maximal treadmill stress test,\(^12\) and a MTST\(^13\), \(^13\), \(^14\) has been correlated with an increased probability of developing subsequent coronary heart disease. The MTST in asymptomatic individuals was found at five years by Bruce and McDonough,\(^13\) at 6.3 years by Froelicher and associates,\(^14\) at 2.5 years by us,\(^1\) and at five years in the present study to correlate better than the double Master's test in predicting subsequent coronary heart disease.

We demonstrated that at 2.5 years, the presence of an abnormal MTST plus an abnormal postexercise apexcardiogram in asymptomatic persons correlated best with the development of subsequent coronary heart disease.\(^2\) The present study shows that at five years, the presence of an abnormal MTST plus an abnormal postexercise apexcardiogram in asymptomatic individuals correlated best with the development of subsequent coronary heart disease.

In conclusion, our data show that an abnormal

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**Table 1**

*Correlation of Double Master's Test, MTST, and Resting and Postexercise Apexcardiogram with Subsequent Coronary Heart Disease*

<table>
<thead>
<tr>
<th>Test</th>
<th>Incidence of coronary disease within 5 years</th>
<th>Risk ratio of positive to negative test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal double Master's test (N = 4)</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Normal double Master's test (N = 96)</td>
<td>7</td>
<td>7.3</td>
</tr>
<tr>
<td>Abnormal MTST (N = 13)</td>
<td>6</td>
<td>46.2</td>
</tr>
<tr>
<td>Normal MTST (N = 87)</td>
<td>3</td>
<td>3.4</td>
</tr>
<tr>
<td>Abnormal resting apexcardiogram (N = 6)</td>
<td>4</td>
<td>60.7</td>
</tr>
<tr>
<td>Normal resting apexcardiogram (N = 92)</td>
<td>3</td>
<td>5.4</td>
</tr>
<tr>
<td>Abnormal postexercise apexcardiogram (N = 15)</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Normal postexercise apexcardiogram (N = 83)</td>
<td>3</td>
<td>3.6</td>
</tr>
</tbody>
</table>

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**Table 2**

*Correlation of Abnormal MTST plus Abnormal Resting Apexcardiogram and of Abnormal MTST plus Abnormal Postexercise Apexcardiogram with Subsequent Coronary Heart Disease*

<table>
<thead>
<tr>
<th>Test</th>
<th>Incidence of coronary disease within 5 years</th>
<th>Risk ratio of positive to negative test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal MTST plus abnormal resting apexcardiogram (N = 4)</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>MTST and resting apexcardiogram are not both abnormal (N = 94)</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Abnormal MTST plus abnormal postexercise apexcardiogram (N = 7)</td>
<td>6</td>
<td>85.7</td>
</tr>
<tr>
<td>MTST and postexercise apexcardiogram are not both abnormal (N = 91)</td>
<td>3</td>
<td>3.3</td>
</tr>
</tbody>
</table>
double Master's test, an abnormal MTST, an abnormal a-wave ratio in the resting apexcardiogram, and an abnormal a-wave ratio in the postexercise apexcardiogram in asymptomatic persons may reflect clinically silent myocardial ischemia and significantly correlate with an increased incidence of subsequent coronary heart disease. The MTST correlates better than the double Master's test in predicting subsequent coronary heart disease. The presence of both an abnormal MTST plus an abnormal a-wave ratio in the postexercise apexcardiogram has the best value in predicting subsequent coronary heart disease.

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References

Five year follow-up of double Master's test, maximal treadmill stress test, and resting and postexercise apexcardiogram in asymptomatic persons.

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