Framingham score and microalbuminuria: Combined future targets for primary prevention?

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Background. Risk assessment is the cornerstone of primary prevention of cardiovascular disease. Our objective was to evaluate the prognostic value of the Framingham score in microalbuminuric subjects without a history of cardiovascular disease and whether this risk score can predict the benefit of treatment with fosinopril or pravastatin.

Methods. Subjects were randomized to fosinopril 20 mg or matching placebo, and to pravastatin 40 mg or matching placebo (mean age 51 ± 12 years, 65% men, N = 830). Prediction of 10-year risk for coronary heart disease by the Framingham score was performed using the risk factor categories with LDL cholesterol.

Results. Albuminuria was correlated with Framingham score at baseline (P < 0.001). In the population with a Framingham risk score <20%, both albuminuria and Framingham risk score were independent predictors of the primary end point. A two-fold increase of albuminuria or the Framingham risk score was associated with a hazard ratio of 1.60 (95% CI 1.10–2.31), P = 0.013 and 3.00 (95% CI 1.40–6.44), P = 0.005, respectively. In contrast to fosinopril, pravastatin showed a significant beneficial effect on Framingham risk score after 4 years of follow-up (P < 0.001). Furthermore, the observed absolute risk reduction in cardiovascular events was greater than calculated by the Framingham risk score.

Conclusion. The Framingham score is useful in microalbuminuric subjects as a prognostic tool. In addition, when considering the risk score as a target of intervention, the beneficial effects of therapies might be underestimated. Combining the Framingham score with the level of urinary albumin excretion is suggested as a primary prevention strategy with higher efficiency.

It has been generally accepted that early detection of cardiovascular risk and subsequent intervention can prevent coronary heart disease (CHD). The traditional cardiovascular risk factors are male gender, age, cigarette smoking, elevated blood pressure, high LDL cholesterol, low HDL cholesterol, and diabetes. All these cardiovascular risk factors are included in the Framingham cardiovascular risk score. This score can help physicians to predict 10-year risk for major cardiovascular events in the individual patient. Studies also show that the higher the risk for developing CHD, the higher the efficacy of the intervention is. However, several primary prevention trials have demonstrated a significant effect of intervention on cardiovascular events in patients with a lower risk score [1, 2]. Limited data are available on the recommended strategy in lower risk populations with a 10-year risk between 10% to 20%. New tools such as noninvasive imaging and novel serum markers are in development to use in clinical practice. These markers may be used after assessment of traditional cardiovascular risk factors to identify the persons whom need aggressive intervention despite their moderate risk. A new relatively inexpensive to be measured risk indicator is microalbuminuria, which has been associated with an increased risk for cardiovascular disease in subjects with hypertension and diabetes, but also in the general population [3]. The Prevention of REnal and Vascular ENdstage Disease Intervention Trial demonstrated that treatment with fosinopril had a significant effect on urinary albumin excretion, and was associated with a trend in reducing cardiovascular events. Treatment with pravastatin did not result in a significant reduction in urinary albumin excretion or a reduction in the primary end point [4]. All these subjects had no indication for primary prevention at inclusion. In this supplementary-analysis of the PREVEND IT, we evaluated the prognostic value of the Framingham risk score in microalbuminuric subjects without a history of cardiovascular disease and whether this risk score can predict the benefit of treatment with fosinopril or pravastatin.

METHODS

The PREVEND IT was an investigator-initiated, single-center, double-blind, randomized, placebo-controlled trial with a 2 × 2 factorial design. Subjects were randomized to fosinopril 20 mg or matching placebo, and to pravastatin 40 mg or matching placebo (N = 864). The key entry criteria were persistent microalbuminuria (once a urinary albumin concentration >10 mg/L in an early morning spot urine, and at least
randomization. Informed consent was obtained from all subjects before dance with the guidelines of the Declaration of Helsinki. Institutional Review Board, and conducted in accord-

performed with SPSS version 11.0.1 software (SPSS, 10 mg/24h, or 10% vs. 5%). All calculations were 

ingham risk score were doubled (e.g., 20 mg/24h vs. 

be interpreted as if values of albuminuria or Fram-

this transformation, the relative risk estimates should 

analysis was used to investigate the prognostic value of 

effect of intervention on reduction in Framingham 

The laboratory and diagnostic methods to measure risk 

infarction, and without the use of lipid-lowering drugs. 

The laboratory and diagnostic methods to measure risk 

<

mmol/L or 

antihypertensive medication, and total cholesterol <8.0 

momol/L or <5.0 momol/L in case of previous myocardial 

section, and without the use of lipid-lowering drugs. 

The laboratory and diagnostic methods to measure risk 

<

mm Hg 

Systolic blood pressure mm Hg 

Diastolic blood pressure mm Hg 

LDL-cholesterol mmol/L 

HDL-cholesterol mmol/L 

Current smoking 29.8% 48.2% 47.4% 39.8% 

Diabetes 0.3% 1.1% 1.0% 0.3% 3.7 

Albuminuria mg/24h 

Framingham risk score % 5.2 (3.0–7.2) 13.8 (11.6–16.8) 29.9 (24.3–39.5) 11.1 (5.6–21.2) 

Data are given as mean ± standard deviation, except for albuminuria and Framingham risk score, which are presented as median (interquartile range).

once 15 to 300 mg/24 hours in 2 × 24-hour urine samples), 

blood pressure <160/100 mm Hg without the use of antihypertensive medication, and total cholesterol <8.0 

mmol/L or <5.0 mmol/L in case of previous myocardial 

infrared, and without the use of lipid-lowering drugs. 

The laboratory and diagnostic methods to measure risk 

<

mg/24h Albuminuria 

Diabetes 

Albuminuria mg/24h 

Framingham risk score % 

Table 1. Baseline characteristics

<table>
<thead>
<tr>
<th>Framingham risk score</th>
<th>&lt;10%</th>
<th>10% to 20%</th>
<th>&gt;20%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age years</td>
<td>43 ± 9</td>
<td>52 ± 9</td>
<td>62 ± 9</td>
<td>51 ± 12</td>
</tr>
<tr>
<td>Male gender</td>
<td>44.6%</td>
<td>74.1%</td>
<td>88.7%</td>
<td>64.9%</td>
</tr>
<tr>
<td>Systolic blood pressure mm Hg</td>
<td>122 ± 14</td>
<td>131 ± 16</td>
<td>141 ± 17</td>
<td>130 ± 18</td>
</tr>
<tr>
<td>Diastolic blood pressure mm Hg</td>
<td>71 ± 8</td>
<td>78 ± 9</td>
<td>82 ± 9</td>
<td>76 ± 10</td>
</tr>
<tr>
<td>LDL-cholesterol mmol/L</td>
<td>3.7 ± 0.8</td>
<td>4.2 ± 0.9</td>
<td>4.5 ± 1.0</td>
<td>4.1 ± 1.0</td>
</tr>
<tr>
<td>HDL-cholesterol mmol/L</td>
<td>1.1 ± 0.3</td>
<td>1.0 ± 0.3</td>
<td>0.9 ± 0.2</td>
<td>1.0 ± 0.3</td>
</tr>
<tr>
<td>Current smoking</td>
<td>29.8%</td>
<td>48.2%</td>
<td>47.4%</td>
<td>39.8%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.3%</td>
<td>3.1%</td>
<td>5.7%</td>
<td>2.5%</td>
</tr>
<tr>
<td>%</td>
<td>55.2 (3.0–16.8)</td>
<td>22.6 (16.0–38.9)</td>
<td>28.6 (18.2–50.6)</td>
<td>22.6 (15.6–40.8)</td>
</tr>
</tbody>
</table>

Fig. 1. Kaplan-Meier analysis illustrating the prognostic value of Framingham risk score in microalbuminuric subjects. The population is di-

vided in three groups according to 10-year risk on cardiovascular dis-

case. Hazard ratios (95% CIs) are given for the groups with a score 

between 10% to 20% and >20%.

RESULTS

The baseline characteristics for the total population and the three Framingham risk strata are summarized in Table 1. Almost half of our population (44.8%) has a Framingham risk score <10%, 27.5% has a risk score between 10% to 20%, and 27.7% has a risk score >20%. The level of albuminuria itself was significantly corre-

lated with the Framingham score at baseline (P = linear trend <0.001). As illustrated in Figure 1, the Framing-

harm risk score has prognostic value in microalbuminuric subjects. In the population with a Framingham risk score <20%, albuminuria and Framingham risk score itself were independent predictors of the primary end point. A two-fold increase of albuminuria or Framingham risk score was associated with a hazard ratio of 1.60 (95% CI 1.10–2.31), P = 0.013, and 3.00 (1.40–6.44), P = 0.005, respectively.

In four years of follow-up, 41 primary end points oc-

occurred, 1.3% of the subjects with a Framingham <10%
had an end point, 5.3% in the group between 10% to 20%, and 10.4% in the group with a Framingham >20%. These incidences were comparable with the predicted incidence of cardiovascular events over the four-year period: 2.1%, 5.5%, and 11.9%, respectively. As shown in Figure 2, fosinopril and pravastatin both decreased the event rate over four years calculated by Framingham risk score by 1.1% and 0.8%, respectively. Interestingly, the observed reduction during the four-year follow-up was greater than the calculated reduction (3.1% and 1.3%, respectively).

Despite a significant reduction of fosinopril in cardiovascular events, no beneficial effect could be demonstrated on Framingham risk score after four years of follow-up. Median (interquartile range) delta Framingham risk score was 6.01% in the fosinopril group versus 6.42% in the placebo group. In contrast to fosinopril, pravastatin did show a positive and long-term effect on Framingham risk score. In the pravastatin group a median (interquartile range) delta Framingham risk score of 3.74% was observed in comparison to 8.53% in the placebo group ($P < 0.001$).

**DISCUSSION**

In a microalbuminuric population, a strong prognostic value of the Framingham risk score was observed. Microalbuminuria itself, as indicator of increased cardiovascular risk, is correlated with this Framingham risk score, and was an independent predictor of primary end points in subjects with a Framingham risk score <20%. In contrast to fosinopril, pravastatin showed a significant beneficial effect on Framingham risk score after four years’ follow-up ($P < 0.001$). Furthermore, the observed absolute risk reduction in cardiovascular events was greater than calculated by the Framingham risk score.

In our main report on the results of the PREVEND IT study, we already observed that fosinopril, but not pravastatin, had an effect on microalbuminuria. Many studies have shown that the presence and magnitude of risk factors is associated with the level of microalbuminuria. The fact that the calculated effect of pravastatin on the risk score is lower than the calculated effect for fosinopril is in line with the observed difference in their effect on microalbuminuria. Furthermore, the predicted difference in incidence of cardiovascular events between the pravastatin and fosinopril group is in line with the observed incidence. However, it is also evident that for both groups the Framingham score is underestimating the beneficial effect of treatment substantially. This suggests that including microalbuminuria in the algorithm for the Framingham score could improve the prediction for those treatments, which have an effect on the level of urinary albumin excretion. Especially microalbuminuria could improve the predictive value of the Framingham risk score in subjects with a risk score below 20%.

**CONCLUSION**

The Framingham risk score predicts also in microalbuminuric subjects the incidence of cardiovascular events. However, the beneficial effects of therapies reducing albumin excretion are underestimated. Combining the Framingham score with the level of urinary albumin excretion is suggested as a primary prevention strategy with high efficiency.

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**REFERENCES**


