Peripheral Muscle Stimulation Increases Coronary Blood Flow  
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Abstract

Background: Improving myocardial blood supply in patients with coronary artery disease (CAD) may improve angina. The geko™ device is a small transcutaneous nerve stimulator that is applied non-invasively to the skin over the common peroneal nerve and stimulates peripheral blood flow. The purpose of this study was to investigate the effect of the geko™ device on coronary blood flow.

Methods: We enrolled ten patients with symptomatic obstructive CAD undergoing PCI. A Doppler guide wire was used to assess coronary average peak velocity and CFR in the obstructed coronary artery and in a control vessel without obstructive disease at baseline and after five minutes of peripheral muscle stimulation.

Results: Ten male patients, age 59.4±10.8 were included. The culprit vessel was LAD in 6, LCx in 3 and RCA in 1. Compared to baseline, there was a significant increase in APV in the control vessel with muscle stimulation (20.3±7.7 to 23.5±10 cm/s; p=0.03; Figure a) but no significant increase in the obstructed vessel (21.9±12 to 23.9±12.9 cm/s; p=0.23; Figure b). CFR in the control vessel was 2.2±0.6 at baseline and 2.4±0.6 with muscle stimulation (p=0.4). CFR in the culprit vessel was 2.2±0.9 at baseline and 1.9±0.3 (p=0.4) with stimulation.

Conclusions: A few minutes of peripheral muscle stimulation may improve coronary blood flow. This effect is more prominent in non-obstructed vessels. The effect of longer duration of stimulation on coronary flow and angina should be further studied.

Introduction

• Angina pectoris is related to imbalance between myocardial blood supply and oxygen demand
• In patients that are not candidates for mechanical revascularization, alternate methods are considered
• The geko™ device is a small transcutaneous nerve stimulator that is applied to the skin over the common peroneal nerve in the lower limb and can stimulate blood flow in the venous system
• By improving venous return, geko™ has the potential to have a therapeutic effect in the management of coronary artery disease by augmenting coronary blood flow
• Peripheral motor neuropathy
• Contraindication to adenosine

Inclusion criteria:
• 18-80 years old
• Patient undergoing elective PCI

Exclusion criteria:
• Significant valvular disease
• Heart failure
• Contraindication to adenosine
• Peripheral motor neuropathy

Confounders:
• No confounders were identified

Study Design:
A pilot study assessing the effect of the geko™ device on coronary artery blood flow. Patients acted as their own controls.

Inclusion criteria:
• 18-80 years old
• Patient undergoing elective PCI

Exclusion criteria:
• Significant valvular disease
• Heart failure
• Contraindication to adenosine
• Peripheral motor neuropathy

Coronary Flow Assessment:
• Baseline, with muscle stimulation at low setting and at maximal setting
• Average peak velocity (APV)
• Coronary flow reserve (CFR)
• Measurements of APV and CFR were performed first in a control artery (no stenosis beyond 30 %) and then the artery planned for PCI (prior to PCI). The LAD was used as a control unless it was the culprit vessel

Baseline characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>10</td>
</tr>
<tr>
<td>Age (mean±SD in years)</td>
<td>59.4±10.8</td>
</tr>
<tr>
<td>Gender (% male)</td>
<td>100</td>
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<tr>
<td>Creatinine (mean±SD in umol/l)</td>
<td>74.6±13.9</td>
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<tr>
<td>Previous AMI (%)</td>
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</tr>
<tr>
<td>Previous PCI (%)</td>
<td>50</td>
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<tr>
<td>Risk factors (%)</td>
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<td>Previous or current smoker</td>
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<tr>
<td>Hypertension</td>
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<tr>
<td>Dyslipidemia</td>
<td>100</td>
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<tr>
<td>Family History of CAD</td>
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<tr>
<td>Diabetes mellitus</td>
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<td>Medications (%)</td>
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<td>ACE-I or ARB</td>
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<td>Statin</td>
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<tr>
<td>Culprit vessel (%)</td>
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</tr>
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<td>LAD</td>
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<tr>
<td>Diagonal</td>
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<tr>
<td>LCX</td>
<td>30</td>
</tr>
<tr>
<td>RCA</td>
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</tr>
</tbody>
</table>

Results

Compared to baseline, there was a significant increase in APV in the control vessel with muscle stimulation (20.3±7.7 to 23.5±10 cm/s; p=0.03; Figure a) but no significant increase in the obstructed vessel (21.9±12 to 23.9±12.9 cm/s; p=0.23; Figure b). CFR in the control vessel was 2.2±0.6 at baseline and 2.4±0.6 with muscle stimulation (p=0.4). CFR in the culprit vessel was 2.2±0.9 at baseline and 1.9±0.3 (p=0.4) with stimulation.

Conclusions

• A few minutes of peripheral muscle stimulation may improve coronary blood flow.
• This effect is more prominent in non-obstructed vessels.
• The effect of longer duration of stimulation on coronary flow and angina should be further studied.

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Co-authors—nothing to disclose