Biomarkers in Cardiovascular Diseases: A New Tool to Evaluate Endothelial Function

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Post-ischemic reactive hyperemia is an important index of endothelial function that has often been evaluated with strain-gauge plethysmography (SGP) or Doppler echocardiography. The accuracy and reproducibility of these techniques, however, are often limited by motion artifacts and inter-observer variations. To overcome this problem, we have used near-infrared time-resolved spectroscopy (TRS) as a new tool to evaluate reactive hyperemia. This method allows absolute concentrations of oxygenated-, deoxygenated- and total hemoglobin to be determined, thereby providing a new index for assessment of blood flow (blood flow index, BFI, μM/sec). Thirty healthy volunteers were recruited for comparative simultaneous applications of TRS and SGP to assess reactive hyperemia. During reactive hyperemia, forearm blood flow assessed using SGP was increased from basal levels of 6.58 ± 2.94 mL/min/100 mL to 25.1 ± 7.32 mL/min/100 mL ($p < 0.001$), and BFI was increased from basal levels of 0.95 ± 1.05 μM/sec to 4.29 ± 3.15 μM/sec ($p < 0.001$). BFI values were well correlated with blood flow measured by SGP ($p < 0.0001$, $R=0.646$). Inter-individual difference at baseline condition was significantly greater with TRS (SD/mean: 1.11) than SGP (SD/mean: 0.45). However, reproducibility was better with TRS than with SGP; forearm blood flow measured by SGP showed two-fold increase in day-to-day coefficient of variation ($20 \pm 16\%$) than TRS ($10 \pm 8\%$) ($p < 0.001$). In addition, BFI was significantly less prone to intra-individual variations: the intra-individual coefficient of variation was $14 \pm 8\%$ for BFI and $20 \pm 16\%$ for SGP ($p < 0.01$). TRS thus appears to be a very sensitive, reliable method for non-invasive assessment of reactive hyperemia. This technique should represent a novel, valuable tool for assessment of characteristics of various cardiovascular drugs on endothelial function.

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Education

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