Peripheral Perfusion Index as an Early Predictor for Central Hypovolemia in Awake Healthy Volunteers.

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Background

In healthy volunteers, we investigated the ability of the pulse oximeter-derived peripheral perfusion index (PPI) to detect progressive reductions in central blood volume.

Methods

Twenty-five awake, spontaneously breathing, healthy male volunteers were subjected to progressive reductions in central blood volume by inducing stepwise lower body negative pressure (LBNP) with 20 mm Hg for 5 minutes per step, from 0 to -20, -40, -60, and back to 0 mm Hg. Throughout the procedure, stroke volume (SV), heart rate (HR), and mean arterial blood pressure were recorded using volume-clamp finger plethysmography. Assessment of the PPI was done by pulse oximetry. Additionally, the forearm-to-fingertip skin-temperature gradient was measured. Data are presented as mean ± SE. PPI underwent log transformation and is presented as median (25th-75th).

Results

Of the 25 subjects, one did not complete the study because of cardiovascular collapse. After the first LBNP step (-20 mm Hg), PPI decreased from 2.2 (1.6-3.3) to 1.2 (0.8-1.6) ($P = 0.007$) and SV decreased from 116 ± 3.0 mL to 104 ± 2.6 mL ($P = 0.02$). The magnitude of the PPI decrease (41% ± 6.0%) was statistically different from that observed for SV (9% ± 1.3%) and HR (3% ± 1.9%). During progression of LBNP, SV decreased and HR increased progressively with the increased applied negative pressure, whereas the PPI remained low throughout the remainder of the protocol and returned to baseline values when LBNP was released. At -60 mm Hg LBNP, SV decreased and HR increased by 36% ± 0.9 % and 33% ± 2.4% from baseline, respectively. Mean arterial blood pressure remained in the same range throughout the experiment.

Conclusions

These results indicate that the pulse oximeter-derived PPI may be a valuable adjunct diagnostic tool to detect early clinically significant central hypovolemia, before the onset of cardiovascular decompensation in healthy volunteer