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Original Research Article

Relations between digital thermal monitoring of vascular function, the Framingham risk score, and coronary artery calcium score

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KEYWORDS:
Coronary artery calcium score;
Coronary artery disease;
Digital thermal monitoring;
Framingham risk score

BACKGROUND: Digital thermal monitoring (DTM) of vascular function was shown to correlate with the presence of known coronary artery disease (CAD).

OBJECTIVE: We evaluated whether DTM can identify at-risk, asymptomatic patients with significant coronary artery calcium (CAC) or increased Framingham risk score (FRS).

METHODS: Two hundred thirty-three consecutive asymptomatic subjects (58 ± 11 years; 62% men) without known CAD underwent DTM, CAC, and FRS calculation. DTM measurements were obtained during and after a 5-minute suprasystolic arm-cuff occlusion. After cuff-deflation temperature rebound (TR) and area under the temperature curve (AUC) were measured and correlated with FRS and CAC.

RESULTS: TR was lower in patients with FRS $>$ 20% and CAC $\geq$ 100 as compared with FRS $<$ 10% and CAC $<$ 10, respectively ($P < 0.05$). After adjustment for age, sex, and traditional cardiac risk factors, the odds ratio of the lowest compared with the upper 2 tertiles of TR was 3.96 for FRS $\geq$ 20% and 2.37 for CAC $\geq$ 100 compared with low-risk cohorts. The area under the receiver operating characteristic (ROC) curve to predict CAC $\geq$ 100 increased significantly from 0.66 for FRS to 0.79 for TR to 0.89 for TR + FRS.

CONCLUSIONS: Vascular dysfunction measured by DTM strongly correlates with FRS and CAC independent of age, sex, and traditional cardiac risk factors and was superior to FRS for the prediction of significant CAC.

Introduction

Peripheral vascular dysfunction, assessed noninvasively through reactive hyperemia procedures, is an independent predictor of cardiovascular events.[1–4] Fingertip digital vascular function during cuff-occlusive reactive hyperemia is a

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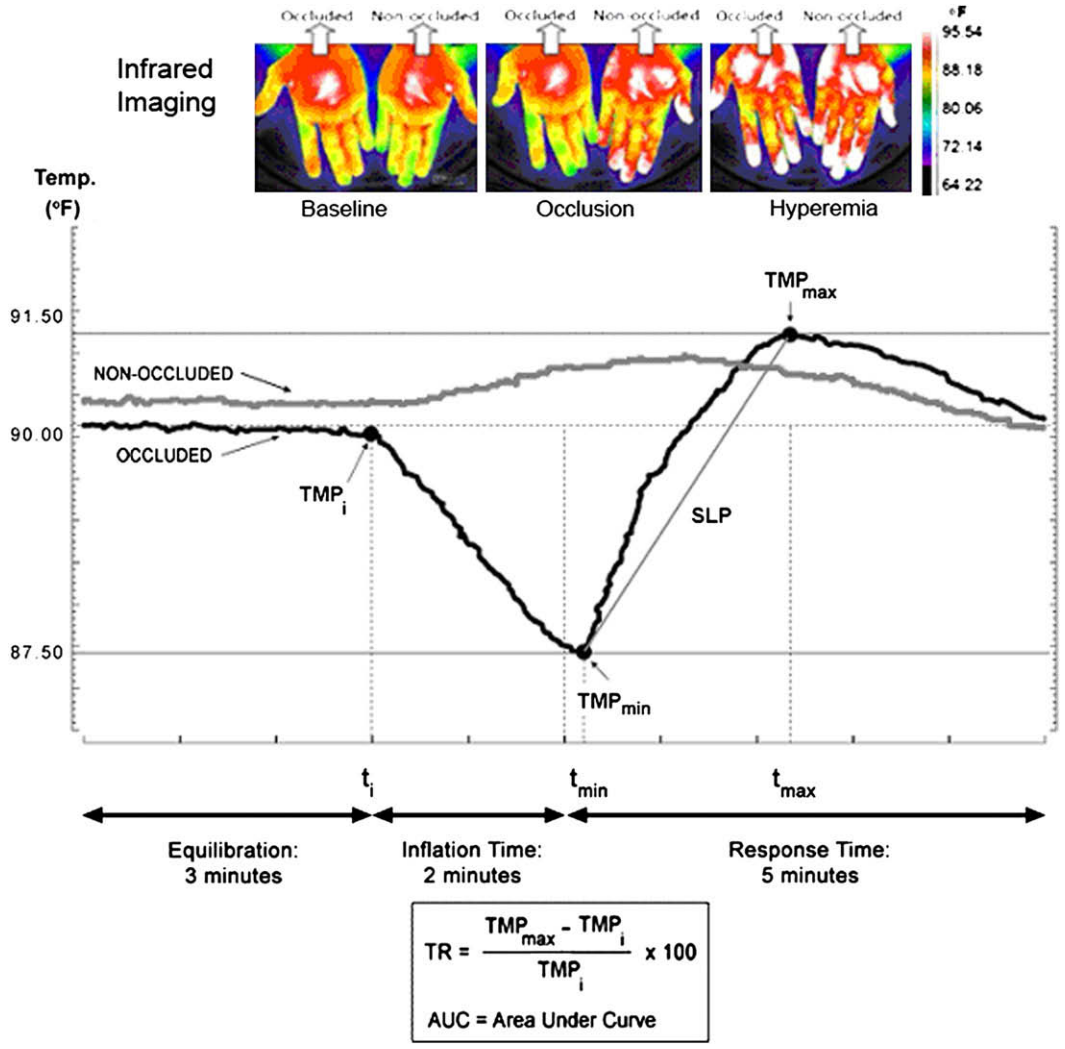

Figure 1 Fingertip skin temperature changes before and during postocclusive reactive hyperemia as shown by infrared imaging and DTM.

new noninvasive and operator-independent test that was previously shown to predict the extent of coronary artery disease (CAD).[5,6] Coronary artery calcification (CAC) is an anatomic disease marker that was correlated with the presence and extent of CAD.[7] The present study was designed to determine the correlation of vascular dysfunction measured by digital thermal monitoring (DTM) with the Framingham risk score (FRS) for 10-year CAD and the extent of subclinical atherosclerosis measured by CAC in asymptomatic adults.

Methods

Subjects and study design

The study population consisted of 233 consecutive asymptomatic patients (age > 35 y) who underwent CAC scanning and DTM. Subjects with established cardiovascular disease, stroke, diabetic retinopathy, end-stage renal disease, Raynaud syndrome, infection, cancer, immunosuppression, systemic inflammation status, or end-stage liver disease were excluded. Body mass index, hip circumference, blood pressure, fasting blood glucose, and lipid profile were obtained by standard techniques. DTM of vascular function was performed at the same visit. Risk factors were determined, and FRS was calculated to assess the risk of developing total coronary disease events (angina, myocardial infarction, or cardiovascular death) over the next 10 years.[8]

CAC scanning

CAC was detected using an E-Speed electron beam scanner (GE-Imatron, South San Francisco, CA). The coronary arteries were imaged with 30–40 contiguous 3-mm slices during end-diastole using electrocardiographic (ECG) triggering during a 35-sec breathhold. CAC was considered present in a coronary artery when a density of >130 Hounsfield units (HU) was detected in ≥3