

Thermography in Assessing Cardiovascular Risk

Short Communication

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Abstract — The recognition of arterial atherosclerosis in all its stages is critical for the prevention of cardiovascular future events, including death. Recently, the measurement of endothelial function through the microcirculation in patients emerged as a useful tool to evaluate the presence of atherosclerotic plaque in different vascular beds. The classic risk factors are associated with impaired endothelial function and lead at least in part, to a loss of control of the homeostasis of the vascular endothelium. However, despite the recognition of these risk factors studies have shown that a significant number of individuals with low risk of cardiovascular events presented. Two studies evaluating endothelial function through the thermography and correlated with risk of cardiovascular events by established methods. From these results we concluded that the study of endothelial function by thermography can be used as a surrogate marker to improve stratification of cardiovascular risk and might also be useful for the evaluation of therapeutic strategies.

keywords: thermography, cardiovascular risk, Framingham risk score for stroke, carotid atherosclerosis

Resumo — O reconhecimento de aterosclerose arterial em todas as suas fases é crítica para a prevenção de futuros eventos cardiovasculares, incluindo a morte. Recentemente, a medida da função endotelial por meio da microcirculação em pacientes surgiu como uma ferramenta útil para avaliar a presença de placa aterosclerótica em diferentes leitos vasculares. Os fatores de risco clássicos estão associados com a função endotelial alterada e levar, pelo menos, em parte, a uma perda de controle da homeostase do endotélio vascular. No entanto, apesar do reconhecimento destes fatores de risco estudos mostraram que um número significativo de indivíduos com baixo risco de eventos cardiovasculares apresentada. Dois estudos que avaliam a função endotelial por meio da termografia e correlacionados com o risco de eventos cardiovasculares por métodos estabelecidos. A partir destes resultados concluiu-se que o estudo da função endotelial por termografia pode ser utilizado como um marcador substituto para melhorar a estratificação do risco cardiovascular e pode também ser útil para a avaliação das estratégias terapêuticas.

Palavras-chave: termografia, risco cardiovascular, escore de risco de Framingham para AVC, aterosclerose carotídea

1. INTRODUCTION

Cardiovascular disease is the leading cause of death worldwide and prevention strategies by risk stratification has failed. Endothelial dysfunction participates in all stages of the development of atherosclerosis and its existence has been correlated with the development of future cardiovascular events.

Despite this fact known the assessment of endothelial function has not been incorporated into clinical practice due to several factors: cost, difficulty of measurement, lack of standardization and technical difficulties. In this scenario is that the infrared thermography appears as a useful tool, inexpensive, reproducible, and independent operator can measure changes in microcirculation through standard maneuvers and thus evaluate the vascular endothelial function and reactivity.

Two studies in order to assess ability of thermography to assess cardiovascular risk. In the first compare thermographic changes hands after maneuvers of ischemia and reperfusion arm with the Framingham risk score for stroke (1) and the second with the presence of atherosclerosis measured by high-resolution ultrasonography of the carotid arteries (2).

2. FRAMINGHAM RISK SCORE FOR STROKE AND THERMOGRAPHY

The ischemic cerebrovascular disease can be based on pathophysiological endothelial dysfunction, characterized by abnormalities in the production of autacoids, with loss of their duties. This, in turn, can be evaluated using methods that examine the vascular tone in the face of maneuvers that induce ischemia and reperfusion. The thermoregulation is mediated by the autonomic nervous system whose sympathetic motor fibers produce vasodilation or vasoconstriction dependent on the microcirculation of the degree of activation.

Objectives: To evaluate the skin by infrared thermography the correlation with stroke risk stratification predicted by the Framingham score (FRS).

Materials and Methods: Cohort of 55 patients, in an analytical cross-sectional design. High sensitivity thermal imager was used with infrared sensor resolution 160 x 120 (19,200 pixels) in the spectral range (8 to 14 microns) for dynamic study (60 Hz) and thermal sensitivity of 0.1 ° C. The following thermographic variables were

assessed: average temperature in the distal phalanges of the right hand and left hand - basal temperature on the right hand least the minimum temperature, obtained after 5 minutes of examination (maximum ischemia Rate) - Maximum temperature obtained between 6 and 15 minutes in right hand about the maximum ischemia temperature (Tar) - Maximum temperature on the right hand minus the basal temperature of the same hand (rebound temperature) - Tar divided by the minimum temperature at 5 minutes in his right hand - Resulting from the Tar divided by the basal temperature of the right hand - Proceeds from the basal temperature of the right hand divided by the Tar – Neuro-reactivity (3).

Statistical analysis: It is estimated that the test of power is above 80% (type II error <0.20), assuming simple random sampling and absence of confounding factors (type I error = 0.05). Relationship between the score obtained by FRS to stroke according to each independent variable measured by the simple linear regression method.

Outcomes: All variables of vascular reactivity test were associated significantly with the FRS for the risk of stroke, ischemia and the maximum rate (0.622 or 62.2%) and the Tar (0.585 or 58.5%) the variables most associated FRS score. The Framingham risk score for stroke increased 1.14% to each point in ischemia rate and 1.18% for each point in Tar.

Conclusion: Skin with infrared thermography showed good correlation with FRS. This result suggests that the method can be used for prediction of risk stratification.

III. CAROTID ATHEROSCLEROSIS AND THERMOGRAPHY

Atherosclerosis is a systemic disease characterized by the formation of atherogenic plaques along the cardiovascular system is fundamental condition for the occurrence of acute ischemic events and death (eg, myocardial infarction and stroke)

The ARIC study (2) showed that the thickening of the intimal medium complex (IMT) and the existence of plaque in the carotid arteries measured by high-resolution ultrasound should be understood as ischemic equivalent. This study revealed a strong correlation of these structural changes of the carotid walls with the existence of disease in the coronary arteries and future events.

Materials and Methods: A cross-sectional study, using measures from the thermography study, a cohort of patients of both genders that were allocated sequentially. Although the design adopted not allow inferring causality for statistical analysis purposes and alignment issues with this manuscript, Skin variables measured by thermography were treated as independent variables and thickening of the intima-media complex (IMT), as well as the presence of atheromatous plaques in the carotid arteries, as variables dependents.

Use of multivariate regression tests for the identification of risk probabilities [Odds Ratio; (95%)], to verify the association of thermographic variables with the presence of atherosclerotic plaques as assessed by ultrasound method. This assessment was performed by an independent investigator who was unaware of the clinical characteristics of patients.

Population: Cohort including 92 individuals of both genders (40% men.), Median age of 58y; having 70% of hypertensive patients, 9% had diabetes mellitus and 3% of smokers.

Outcomes: Among the evaluated thermal variables that presented better performance in increasing the IMT was the rebound temperature with linear behavior (the lower the rebound temperature, the greater the intima-media thickness) for both genders. In the multivariate regression model, the Cox test, with adjustment for age, we obtained: [OR; 95% CI 6.54 (1.59 to 26.95), $p = 0.009$] associating the presence of atherosclerotic plaque in neuro-reactivity deficient patients.

Conclusions: The presence of sympathetic hyperactivity assessed by thermography was able to discriminate patients with atherosclerosis. The vascular reactivity test for skin with infrared thermography showed good association with the presence of carotid atherosclerosis.

IV. CONCLUSIONS

In both studies analyzed found a strong correlation of thermographic findings (neuro-reactivity, tar, rebound temperature and maximum temperature ischemia) and cardiovascular risk.

The involved pathophysiological reasoning, previous studies with contact thermography associated with these new findings we conclude that thermography can be useful in assessing cardiovascular risk patients

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