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Analysis of three statistical methods to predict the presence of carotid atheromatous plaques

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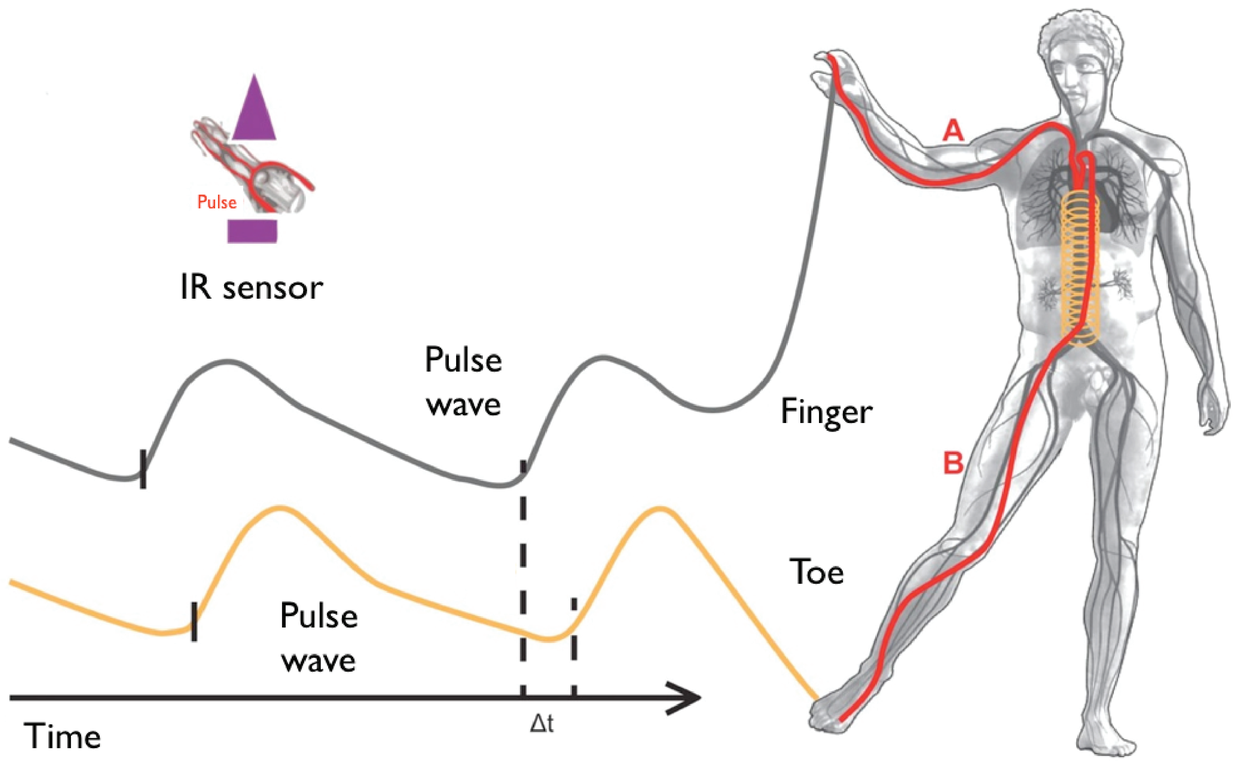
Introduction

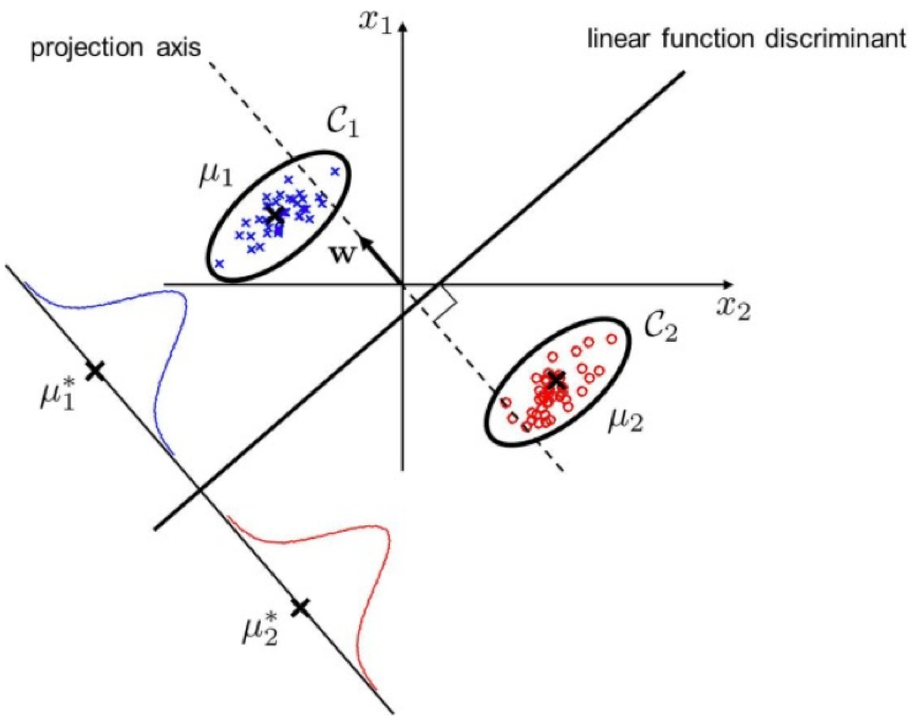
Atherosclerosis is a diffuse, degenerative disease of the arteries resulting in plaques that consist of necrotic cells, lipids, and cholesterol crystals. At least 15–20% of all ischemic strokes are attributable to atherosclerosis (1). The challenge to detect earlier and simply this disease remains to be clarified (2). In this study, we attempted to analyze from 11 traditional risk factors (age, sex, weight, systolic blood pressure (SBP), diastolic blood pressure (DBP), systolic pressure index (SPI), body mass index (BMI), pulse wave velocity by popmeter (PWVpop), difference in transit time of the pulse wave (DOD), aortic stiffness by bioelectrical impedance technique (AoStiff)) three statistical methods in order to predict the presence of carotid atherosclerotic plaques.

Materials and methods

This study was carried out on 48 patients (27 men, mean age 52 ± 10.9) recruited on the occasion of a vascular screening for atherosclerosis in a retrospective analysis. A subgroup of 14 patients presented carotid atheromatous plaques and confirmed by a trained operator using an ultrasound system (Aloka, Alpha 10, Japan). The sensitivity and specificity of the combination of the stiffness indices with other risk factors were considered using multiple linear regressions (MLR), support vector machines (SVM) and discriminant analysis. The best combinations of variables were kept for each learning machine.

The time difference (DOD) between the finger and the toe was calculated by the popmeter. Based on height charts, the toe to finger PWV (PWVpop = height * k / DOD) was calculated. The local aortic stiffness (AoStiff) was measured by a bioelectrical impedance system (Eorta, Manatec Biomedical).





Results

The best sensibility and specificity were obtained using a discriminant analysis. This method reached a sensitivity of 87% ± 30 and a specificity of 77% ± 10 with an area under the ROC curve equal to 0.82 ± 0.2. The predictive variables retained were: Age, SPI, Height, BMI.

MLR method showed a sensitivity of 80% ± 27 with a specificity of 56% ± 21 and the ROC curve equal to 0.62 ± 0.13. The predictive variables were: Sex, Age, SPI and DBP. Finally, the SVM method showed a sensitivity of 50% ± 15 with a specificity of 97% ± 5 and the area under the ROC curve equal to 0.74 ± 0.8 The predictive variables were: Sex, Weight, SPI, DOD and PWVpop.

Conclusion

This preliminary study shows that carotid atherosclerotic plaques could be reliably predicted using a discriminant analysis method. The AoStiff index does not appear as a predictive value of the presence of carotid plaques which would lead to the conclusion that local aortic PWV cannot be considered as a surrogate value for regional PWV (3). Additional studies are needed to confirm the statistical differences observed of this method compared to others.

GROUPE ESEO

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