

## **Joint Analysis of Cardiovascular Control and Shear Wave Elastography to Assess the Vulnerability of Carotid Artery Plaque**

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Noninvasive characterization of the carotid plaque is important in asymptomatic carotid artery stenosis patients because plaque's vulnerability contributes to the risk of stroke. This study proposes the joint evaluation of elastographic and cardiovascular control markers for a deeper characterization of plaque vulnerability.

Autonomic and baroreflex time and frequency domain markers were derived from heart period (HP) and systolic arterial pressure (SAP) time series in 78 patients scheduled for carotid endarterectomy (age: 74.2±7.7 yrs, 27 females) evaluated in supine position (REST) and during active standing (STAND). Plaque's Young modulus (YM) was derived in the same patients via shear wave elastography. Thirty-six patients featured vulnerable (VULN) and 42 stable (STABLE) plaque according to post-surgery evaluation.

Results showed that the baroreflex response to the STAND was impaired in STABLE patients and preserved in VULN ones. Remarkably, baroreflex sensitivity as estimated from the transfer function gain from SAP to HP in high frequency (HF: 0.15-0.4 Hz) band ( $TFG_{HP-SAP}(HF)$ ), at REST was higher in VULN patients than STABLE ones ( $6.16 \pm 6.19$  vs  $4.01 \pm 4.12$  ms/mmHg), significantly decreasing to  $3.81 \pm 3.66$  ms/mmHg in STAND only in VULN patients. STABLE patients had a higher YM ( $24.22 \pm 26.31$  vs  $48.71 \pm 48.13$  kPa).

A multivariate logistic regression model was built using YM and  $TFG_{HP-SAP}(HF)$  at REST to predict plaque vulnerability. Compared to the sole YM the addition of  $TFG_{HP-SAP}(HF)$  at REST increased the area under the receiver operating characteristic curve from 0.625 to 0.649.

Markers of elastography and baroreflex markers could be fruitfully combined to assess carotid plaque vulnerability and to improve risk stratification for stroke in asymptomatic CAS patients.

Acknowledgement: The study was funded by the Italian Ministry of Health under the grant GR-2018-1236686 to D.M.