Prediction of stroke diagnosis through a classification model on cerebral autoregulation: a preliminary study

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Introduction: Ischemic stroke has been shown to affect the human's cerebral autoregulation (CA). This paper aims to evaluate the feasibility of employing K-nearest neighbor (KNN) technique to automatically predict stroke outcomes, based on transfer function method.

Methods: In this study 50 control and 60 stroke subjects were enrolled. For each subject, bilateral cerebral blood flow velocity (CBFv) and non-invasive arterial blood pressure (ABP) were collected (5 min, Fs: 100 Hz), low-pass filtered (cutoff:20 Hz, Butterworth, 3rd order), beat-to-beat mean value interval extracted and the surrogated signal upsampled (5 Hz, cubic slipe interpolation). Transfer function is estimated through the relation between auto-spectrum of ABP and the cross-spectrum of ABP with CBFv, based on the discrete Fourier transform combined with Welch's method applied to ABP and CBFv (Hanning window, 100 s and 50% overlap). Then, gain, phase and coherence are calculated in three different frequency bands, 0.02-0.07 Hz (very low Frequency, VLF), 0.07-0.2 Hz (low frequency, LF) and 0.2-0.5 Hz (high frequency, HF).

Classification: Firstly, patients were ranked by a stroke scale (NIHSS: mild ≤4, moderate 5-15, and severe ≥16) by clinical specialists. Then, KNN was applied on the data (i.e VLF/LF and HF of each subject vs. stroke scale) randomly divided into 75% training and 25% testing. The model's results were evaluated through accuracy (ACC) and ROC area under the curve (AUC).

Results: Stroke groups presented higher mRS, ABP and heart rate. Initial analysis showed that ACC from gain (68% and 62% for VLF and LF, respectively); and phase 62% (LF) did perform better.

Conclusion: A large percentage of false outcomes still present, for the most popular method for assessing CA (i.e TFA). Currently, other machine learning methods in under analysis and outcomes will be present by the conference, to highlight more accurate and reliable diagnostic for stroke patients.