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Wavelet assessment of cerebrospinal compensatory reserve and cerebrovascular pressure reactivity M. LATKA, M. TURALSKA, Wroclaw University of Technology, W. KOLODZIEJ, D. LATKA, Opole Regional Medical Center, B. WEST, Army Research Office — We employ complex continuous wavelet transforms to develop a consistent mathematical framework capable of quantifying both cerebrospinal compensatory reserve and cerebrovascular pressure–reactivity. The wavelet gain, defined as the frequency dependent ratio of time averaged wavelet coefficients of intracranial (ICP) and arterial blood pressure (ABP) fluctuations, characterizes the dampening of spontaneous arterial blood oscillations. This gain is introduced as a novel measure of cerebrospinal compensatory reserve. For a group of 10 patients who died as a result of head trauma (Glasgow Outcome Scale GOS =1) the average gain is 0.45 calculated at 0.05 Hz significantly exceeds that of 16 patients with favorable outcome (GOS=2): with gain of 0.24 with $p = 4 \times 10^{-5}$. We also study the dynamics of instantaneous phase difference between the fluctuations of the ABP and ICP time series. The time-averaged synchronization index, which depends upon frequency, yields the information about the stability of the phase difference and is used as a cerebrovascular pressure–reactivity index. The average phase difference for GOS=1 is close to zero in sharp contrast to the mean value of 30^o for patients with GOS=2. We hypothesize that in patients who died the impairment of cerebral autoregulation is followed by the break down of residual pressure reactivity.

Bruce West
Army Research Office

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