

The importance of measuring autonomic data in new epilepsy treatments

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We provide an overview of recent findings examining autonomic data, measured from a comfortable wristband, in patients with epilepsy.

The novel data collected by the wristband in these studies is electrodermal activity (EDA), a sensitive measure of sympathetic nervous system activation. EDA is strongly elicited by stimulation of brain regions such as the amygdala, hippocampus, and anterior cingulate [1], and is measured non-invasively on the surface of the skin. Studies in children with treatment-resistant epilepsy, who were monitored with Video-EEG, showed that 12 out of 12 generalized tonic-clonic seizures (GTCS) and 19 of 22 (86%) complex partial seizures (CPS) were accompanied by significant increases in EDA, more than 2 standard deviations above the pre-ictal baseline [2]. While responses for GTCS are usually higher than for CPS, the size of the EDA response was not associated with the length of the seizure, nor was it associated with the duration of the motor component in GTCS [2]. Combining EDA data with motion data improved the accuracy of automated GTCS detection [3].

We have examined the relationship between EDA response during GTCS and post-ictal generalized EEG suppression (PGES). The duration of PGES is a potential biomarker of SUDEP. PGES was found in all monitored cases of SUDEP in the MORTEMUS study [4]. Our studies in a pediatric treatment-resistant population showed that longer PGES correlates with larger EDA response during GTCS [2]. This finding was replicated in a larger cohort, including children and adults, at another hospital [5]. Thus, EDA on the wrist provides a strong correlate to PGES duration.

Altered autonomic function is considered by many to be among the mechanisms that lead to SUDEP [6]. In addition to the EDA findings, our studies showed decreased heart-rate variability associated with longer-duration PGES, which is also consistent with autonomic disruption. Respiratory arrest is inducible in humans by electrical stimulation of the amygdala during the expiratory phase of the respiratory cycle [7]. Stimulation of the amygdala in epilepsy patients can produce a very strong ipsilateral EDA response [1]. We encourage more clinical studies to collect and examine autonomic data in epilepsy, especially since it can now be easily collected.

References

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