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Detection of generalized tonic-clonic seizures from ear-EEG based on EMG analysis.

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Abstract

PURPOSE: Sudden unexpected death in epilepsy (SUDEP) is associated with generalized tonic-clonic seizures (GTCS) with most deaths occurring during sleep. Seizure detection devices have been suggested as a SUDEP prevention strategy. EMG-based GTCS detection can take advantage of the GTCS characteristic of sustained high-amplitude, high-frequency activity in the time-domain.

METHOD: We present a GTCS-detection method based on median-filtered variance estimates on surface EMG measurements and describe its performance in a small exploratory proof-of-concept setting involving a group of 15 patients with 3 GTCS recorded with ear-EEG and another group of 6 patients with 11 GTCS recorded with scalp-EEG.

RESULTS: GTCS intervals were detected within 4.2-12.9 s of onset with 100% sensitivity (CI 29.2-100%) without false positives in 820.7 h of ear-EEG. The same detection method worked for the 11 GTCS from scalp EEG data with 100% sensitivity (CI 71.5-100%) and no false positives.

CONCLUSIONS: Ear-EEG contains enough GTCS-specific EMG activity for GTCS detection to be feasible. Ear-EEG could be considered for nocturnal GTCS monitoring as a supplement to SUDEP preventive interventions.

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KEYWORDS: Ear-EEG; Epilepsy; GTCS; Neurophysiological monitoring; SUDEP prevention; Seizure detection

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