LOUISIANA TECH UNIVERSITY

Novel Biomarkers of Susceptibility to SUDEP

(ROI 2014-10)

Description

- A quantitative biomarker to assess the susceptibility of epilepsy patients to SUDEP (Sudden Unexpected Death in Epilepsy).
- SUDEP refers to the death of a seemingly healthy patient with epilepsy, excluding toxicological, accidental, or anatomical causes. It is possibly the most common cause of death as a result of complications from epilepsy, accounting for between 7.5 to 17% of all epilepsy-related deaths. SUDEP accounts for 34% of all sudden deaths in children with epilepsy. The risk of sudden death in young adults with epilepsy is increased 24-fold compared to the general population. Epilepsy affects 1% to 2% of the general population.
- Through mathematical analysis of the recorded electroencephalogram (EEG) and electrocardiograms (ECG) in rodents with epilepsy, we developed a novel quantitative biomarker for SUDEP. It is based on the discovery of disassociation of EEG and ECG activity in rodents that die from SUDEP.
- Unsuccessful approaches by other groups use first the EEG to detect an increase of epileptiform activity (spikes, seizures) and, during those periods, search for abnormalities in the ECG / respiratory signals, or the other way around. Our approach does not depend on detecting abnormalities in each of those signals, but it is based on the association / disassociation of different characteristics between those signals. In one sense, each of the EEG and ECG signals may appear normal or abnormal, but it is their disassociation that increases the risk to SUDEP.
- The developed biomarker can be incorporated into the software of brain monitoring devices, or in a standalone device that records and processes EEG and ECG signals, to provide warnings about susceptibility of an epilepsy patient to SUDEP.
- The developed biomarker could also be useful in the diagnosis of other paroxysmal conditions of a neurological and cardiovascular basis.

Advantages

- There is currently no reliable biomarker for SUDEP
- The biosignals (EEG and ECG) needed to be analyzed for estimation of the biomarker are readily available at hospitals and/or physicians' offices, as well as via existing portable recording devices at the home environment of a patient
- Short, relatively inexpensive procedure
- Safe test for the patient

Areas of Application

- Assessment of SUDEP risk. The biomarker could assist with the diagnosis of an epilepsy patient being SUDEP susceptible in a hospital or home environment

OFFICE OF INTELLECTUAL PROPERTY AND COMMERCIALIZATION
PO BOX 3043 · RUSTON, LA 71272 · TEL (318) 257-2484 · FAX (318) 257-4703

- Evaluation of epilepsy treatment. The biomarker could be useful in evaluating anti-epilepsy treatment over time by monitoring increase/decrease of SUDEP susceptibility.
- Diagnosis and treatment of other brain\heart disorders.

Patent Status

Provisional Patent.

Publications

- Karumuri B.K., Liu R., Gautier N., Vlachos I., Glasscock E., Iasemidis L., "Association of EEG with ECG in a Digenic Mouse Model of SUDEP". Proceedings of the 36th Annual International IEEE Engineering in Medicine & Biology Conference, 2014
- Jeppesen J. et al., "Heart rate variability analysis indicates preictal parasympathetic overdrive preceding seizure-induced cardiac dysrhythmias leading to sudden unexpected death in a patient with epilepsy," Epilepsia, pp. 3–5, Apr. 2014.
- Glasscock E. et al., "Kv1.1 potassium channel deficiency reveals brain-driven cardiac dysfunction as a candidate mechanism for sudden unexplained death in epilepsy," J Neurosci, pp 5167-75, Apr 2010.