

Abstracts

Heart Rate Variability to Hypercapnia Is Altered in Tonic-clonic and Absence Seizure Rat Models

Abstract number: 3.284

Submission category: 3. 3. Neurophysiology / 3F. Animal Studies

Year: 2024

Submission ID: 535

Source: www.aesnet.org

Presentation date: 12/9/2024 12:00:00 AM

Published date:

Authors:

Presenting Author: Ayse Dereli, PhD – Leuven Catholic University

Auriane Apace, BS – Catholic University of Leuven

Abigail Nibiyizi, BS – Catholic University of Leuven

Elena Acedo Reina, Msc – Catholic University of Leuven

Elise Collard, PhD – Leuven Catholic University

Enrique Germany, PhD – Catholic University of Leuven

Antoine Nonclercq, PhD – Free University of Brussels

Riim El Tahry, MD, PhD – UC Leuven

RationaleRationale: Tonic-clonic seizures significantly elevate the risk for Sudden Unexpected Death in Epilepsy (SUDEP). Our previous observations indicated that rats experiencing tonic-clonic seizures exhibited cardiorespiratory responses to hypercapnia, in contrast to those with absence suggest, dysfunction within the central chemoreception network. This study aims to assess autonomic balance with respect to central chemoreception by appalling heart rate variability (HRV) in two different animal models; a focal temporal lobe epilepsy (TLE) model and a genetic absence epilepsy model.

Methods: For the TLE, Wistar rats were injected with kainic acid (KA) intraperitoneally to induce a status epilepticus leading to spontaneous severe tonic-clonic seizures for 5 months post-injection. For the genetic absence model, we use Genetic Absence Epilepsy Rat from Strasbourg (GAERS), and we also had a group of healthy Wistar control rats. Baseline HRV was analyzed using raw photoplethysmography to identify interictal heartbeats and derive time domain and frequency domain metrics. Following baseline, rats were exposed to a 1-hour, 10% CO₂ challenge followed by 1-hour room air to evaluate their autonomic response to hypercapnia.

Results: Both KA and GAERS rats exhibited increased baseline low-frequency HRV power compared to healthy controls (p- 0.001 for KA, p-05 for GAERS). This indicates that epileptic rats have an overall increase in baseline sympathetic tone that was pronounced more in the KA rats. Upon exposure to hypercapnia, healthy rats displayed significant increases in HRV (RMSSD: p 0.01), low-frequency HCl power (p 0.001), and high-frequency HRV power (p . 0.01), measured autonomic outflow (both sympathetic and parasympathetic) under hypercapnic conditions. These autonomic responses to hypercapnia were ablated in both KA and GAERS rats.

ConclusionsConclusions: In conclusion, these findings suggest a disruption in autonomic balance in epileptic rats. Under baseline conditions, epileptic rats present persist sympathetic dominance with a more pronounced dysregulation in KA rats. The autonomic response to hypercapnia is significantly impaired in both models of epilepsy. These results complement previously described dysfunctions within the central chemoreception network and underscore the impact of tonic-clonic seizures on cardiorespiratory function, elucidating their association with an increased risk of SUDEP.

FundingFunding: Special Research Fund (FSR), Universite Catholique de Louvain *Walloon Excellence in Life Sciences and Biotechnology (WELBIO) department, WEL Research Institute, Belgium*

Neurophysiology

