INTRODUCTION

- Sudden unexpected death in epilepsy (SUDEP) is the sudden, unexpected death of an epilepsy patient who was otherwise healthy.
- It is the most common cause of death in epilepsy patients and is second only to stroke in terms of potential years of life lost among all neurological conditions (Dlouhy, Gelbach, & Richardson, 2015).
- The mechanisms behind SUDEP aren’t understood.
- It has been previously established that vigilance state is associated with seizure mortality, with seizures occurring in rapid eye movement (REM) sleep posing the greatest risk of death and wakefulness posing the least (Hajek & Buchanan, 2016).
- It has been observed that seizures occur most frequently during non-REM (NREM) sleep and that SUDEP most commonly occurs at night.
- In this study, we are interested in observing the impact of amygdala kindling, which is a model of epileptogenesis, by examination of sleep architecture before and after kindling, and directly following a seizure.

METHODS

- Adult male and female C57Bl6J mice were used in this experiment.
- Surgery: Mice were anesthetized with 2% isoflurane and stereotaxically implanted with EEG/EMG electrodes. They were given a 7-10 day post-operative recovery period.
- Protocol: Mice were acclimated to the recording apparatus for 24 hrs. Recordings were then taken throughout the kindling process.
- Kindling: Two stimulations at a predetermined after discharge threshold were delivered each day until the mice had three Racine scale 4 seizures in a row. Trials: Fully kindled mice were placed into a sealed plethysmography chamber. After baseline recordings were completed, mice were given an injection of saline during various sleep states. 30 minutes to an hour after the injection, mice were stimulated.
- Recording apparatus: EEG and EMG data was collected and analyzed using Sirenia Acquisition and Sirenia Sleep.

RESULTS

- Figure 3 (left). This graph is a comparison of percent composition of each sleep state in pre and post kindling. Data is presented as mean and standard deviation.
- Figure 4 (left). This graph shows the percent change in the amount of time spent in each sleep state from pre to post kindling.
- Figure 5 (left). This graph depicts the percent change in sleep state distribution in the acute effects of a seizure before and after its induction.
- Figure 7 (above). This image of EEG and EMG traces depicts a spontaneous seizure occurring during NREM sleep in mouse AMK 18. It depicts a generalized tonic-clonic seizure, followed by postictal generalized electroencephalographic suppression, followed by return to baseline.

SUMMARY/CONCLUSION

- Amygdala kindling in mice was associated with a change in sleep architecture.
- There was an increase in the percentage of time spent in wakefulness and subsequently a decrease in time spent in NREM and REM sleep following kindling.
- There was a decrease in wakefulness and an increase in NREM and REM sleep, with REM showing the greatest growth, in the 24 hours directly after a seizure.
- Spontaneous seizures were observed in three mice following kindling. All of the seizures occurred during NREM sleep; however, most did not occur at night.

FUTURE DIRECTIONS

- Examine long term changes in sleep architecture.
- Analyze how amygdala kindling might alter sleep architecture differently between genders.
- Determine the impact of various antiepileptic drugs, especially selective 5-HT reuptake inhibitors, on sleep architecture.
- Follow up experiments ought to be conducted in order to determine a causal relationship between kindling and sleep architecture.

REFERENCES


RESEARCH OBJECTIVES

- Observe how amygdala kindling alters short and long term sleep architecture and seizure spontaneity in mice.
- We hypothesize that there will be alterations in sleep architecture.
- Additionally, if spontaneous seizures were to occur, we would expect to see them at night during NREM sleep.

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