

Feasibility Of Modulating Pilocarpine-Induced Status Epilepticus In Rats Via Concentric Ring Electrode Transcutaneous Electrical Stimulation

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Rationale:

We sought to evaluate the effect of transcutaneous electrical stimulation (TcES) via concentric ring electrodes on ictal electrographic and behavioral activity and mortality in rats with pilocarpine-induced status epilepticus (SE).

Methods:

Male Sprague-Dawley rats (290-330 g) were briefly anesthetized and 3 concentric ring electrodes were affixed to their scalps one day before the experiment. Scopolamine methylnitrate (2 mg/kg i.p.) was given 30 minutes prior to pilocarpine. Pilocarpine HCl (310mg/kg i.p) was given to cause long lasting SE. Laplacian EEG was recorded from tri-polar concentric electrodes on the scalp. TcES was applied 5 minutes after the onset of SE. Time-frequency analysis was performed on the Laplacian EEG signals to compare the electrographic activity before and after the application of TcES. Behavior was monitored by inspection. Survival was assayed at 24 h after administration of pilocarpine.

Results:

Control rats (n=8) followed the classic electrographic stages of pilocarpine-induced status epilepticus described by Treimen (1987) and expired on average 15 hours after the pilocarpine injection. TcES-treated rats (n=8) lived significantly longer ($p=0.013$, Two-Sample t-Test), which were euthanized on average at 48 hours. Twenty-four hours after the pilocarpine injection, six (75%) TcES-treated rats versus one (12.5%) control rat were alive ($p=0.041$, Mann-Whitney U test). Both electrographic and behavioral manifestations of seizure activity were reduced or abolished after the application of TcES. All surviving TcES-treated rats recovered to baseline activity, including eating and drinking. By contrast, none of the control rats ate or drank after they entered SE. The time-frequency analysis showed evident differences before and after TcES.

Conclusions:

The application of TcES increased survival of rats with pilocarpine-induced SE. Positive TcES effects on electrographic and behavioral manifestations of seizure activity were significant and persistent. TcES may represent a novel and effective early treatment for SE.

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