Time structure of physiological hind-limb movements during sleep in rats and mice: toward rodent models of periodic limb movements (PLM) and restless legs syndrome (RLS)

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Objectives: Understanding the physiology of tibialis anterior muscle (TA) activity during sleep in rodents is necessary to develop rodent models of periodic limb movements (PLM) and the restless legs syndrome (RLS). We aimed to develop a common methodological approach for recording rodent TA activity and describe its time structure.

Methods: Eight wild-type rats and eight wild-type mice were implanted with electrodes for recording the electroencephalogram and electromyogram (EMG) of postural (neck) and bilateral TA muscles. Recordings were performed for >24 hours on undisturbed and freely behaving animals. An algorithm for computer detection of TA-EMG bursts was developed and validated against visual scoring by consensus between two investigators (A. Silvani and M. Manconi) of a total of 1883 TA-EMG bursts during non-REM sleep in the light period.

Results: The incidence of visually-scored TA-EMG bursts was similar for the left and right hind limbs and was higher for mice than for rats. The burst duration and inter-movement intervals were similar for mice and rats and had modes < 1 s and 4-5 s, respectively. The algorithm for TA-EMG burst detection had a sensitivity of 91% and 87% and a false positive rate of 34% and 34% for mice and rats, respectively.

Conclusions: The methodological approach we developed resulted was found to be feasible and reliable for monitoring and detecting (computer-assisted detection) limb movements during sleep in rats and mice.

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