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AUTOMATED DETECTION OF ISOLATED REM SLEEP BEHAVIOR DISORDER (IRBD) DURING SINGLE NIGHT IN-LAB VIDEO-POLYSOMNOGRAPHY (PSG) USING COMPUTER VISION

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Introduction: At least 1% of adults aged 45 and above have isolated REM sleep behavior disorder (iRBD), a prodromal stage of a synucleinopathy, however a majority remains undiagnosed until they develop irreversible neuropathology. The gold-standard diagnostic procedure, the in-lab video-polysomnography (PSG), relies on complex rules for sleep staging and electromyography quantification which potentially lead to incorrect diagnoses. We tested a computer vision classifier for RBD versus other sleep conditions based on automated video analysis of body movements during a single-night in-lab PSG.

Methods: Raw PSG video recordings of 60 iRBD patients (mean 67 years, 78% males) and 100 controls (mean 65, 65% males) were selected from the Stanford Sleep Center database. Our pipeline involved three main steps: movement detection, feature extraction, and RBD recognition. The recordings between lights off and lights on were 7 to X hours in duration with some interspersed short movements. For every recording, short video segments that contain movements were first extracted using background subtraction. Additional features, such as sleep-onset time and wake-up time, were used to filter out noisy segments that did not involve patients being asleep. Next, I3D, a state-of-the-art method for action recognition, was used to derive a feature vector of 2048 features from every extracted segment. RBD diagnosis could be considered as an action recognition task in which 'RBD' was the action category to be classified. For every recording, the feature vectors for every segments were averaged, resulting in one feature vector per subject. With 160 PSG video recordings, this resulted in a dataset of 160 feature vectors that were used to train a multi-layer perceptron (MLP) for RBD recognition.

Results: Leave-one-out cross-validation (LOOC) procedure was used for evaluation achieving 91.9% accuracy, with a 78.3% sensitivity and 100% precision.

Conclusion: We tested the feasibility and performance of a new diagnostic paradigm for RBD solely based on single-night video analysis of PSG. Our results suggest that a machine learning model can detect and distinguish the characteristics of movements related to RBD versus other sleep disorders and normal sleep. Larger studies in heterogeneous datasets are needed to validate these findings.

Support (If Any): Google

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CHARACTERIZING ACTIGRAPHY-MEASURED SLEEP DISTURBANCE IN VETERANS AND SERVICE MEMBERS WITH POST-TRAUMATIC HEADACHE FOLLOWING MILD TRAUMATIC BRAIN INJURY

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Introduction: Post-traumatic headache (PTH) frequently occur following traumatic brain injury (TBI) is particularly prevalent in Veterans with deployment-related TBI. PTH is associated with a range of physical and mental health symptoms, including post-traumatic stress disorder (PTSD), depression, anxiety, post-concussive symptoms, and subjective sleep complaints. Subjective sleep disturbance is associated with greater pain severity, and headaches (HA) are associated with poorer sleep. Poor sleep may be a mechanism by which PTH exerts both direct and indirect effects on health outcomes. Despite the high prevalence of sleep problems in individuals with PTH, we know little about sleep disturbance in Veterans and military personnel with PTH. This study sought to characterize the relationship between objective sleep disturbance and HA in Veterans and military personnel with chronic PTH following mild TBI.

Methods: Veterans and active-duty service members (N=39, Mage=49.4, 89.7% male) were included from a larger study evaluating prazosin as prophylactic treatment for persistent PTH. Participants completed baseline measures of PTSD symptoms, insomnia, sleep quality, HA frequency and impairment, as well as 7-day actigraphy, sleep diary, and HA logs. Actigraphy-derived sleep parameters include sleep onset latency (SOL), total sleep time (TST), sleep efficiency (SE), and wake after sleep onset (WASO). Daily HA logs were used to assess HA severity and duration. Analyses were conducted in SPSS 26.0 using multilevel modeling, controlling for the effects of time.

Results: Preliminary results suggest number of HA days at baseline was significantly associated with self-reported sleep quality ($r=-.398$, $p=.016$), but not with subjective SOL, TST, or WASO. Number of HA days was significantly correlated with actigraphy-measured WASO ($r=.178$, $p=.003$). Actigraphy-measured SOL, SE, WASO, and TST were not significantly associated with same-day HA severity and duration.

Conclusion: This preliminary data suggest examination of sleep fragmentation may be important in enhancing our understanding of PTH and related impairment. Findings support the importance of using both subjective and objective measures in the assessment of sleep in Veterans and service members with PTH.

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