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ASSESSING THE DIAGNOSTIC BENEFIT OF POLYSOMNOGRAPHY WITH ROUTINE CARBON DIOXIDE MEASUREMENTS IN ADOLESCENT AND ADULT OBESE PATIENTS

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Introduction: The diagnosis of obstructive sleep apnea (OSA) and obesity hypoventilation syndrome (OHS) has increased with the increasing prevalence of obesity. Adding routine transcutaneous carbon dioxide (TcCO2) or end-tidal carbon dioxide sensors (EtCO2) to a polysomnogram (PSG) may expand the analytic capabilities of the study. Our study looks at the utility of using CO2 monitoring in obese adolescent (age 13-18 years) and obese adults in increasing the diagnostic yield of the polysomnogram.
Methods: A retrospective chart review was conducted on obese adolescents (13-18 years) and obese adults (body mass index [BMI] > 95 percentile and >30 kg/m2 respectively) undergoing a PSG with EtCO2 monitoring. The CO2 values were documented while supine (awake) and while sleeping. The EtCO2 value was correlated with the BMI but the adults were also compared between Group 1 (BMI 30-40 kg/m2) and Group 2 (BMI >40 kg/m2). Patients with known hypoventilation syndromes or studies that had poor EtCO2 waveforms were excluded.
Results: 72 patients were identified between December 2019 and November 2020 at the Memorial Hermann Sleep Disorders Center. Amongst the adults, 52% were men, with an average age of 55 years (range 26-77) and an average BMI 40.5 kg/m2 (SD +/- 8.8). The average AHI on the diagnostic study (CMS criteria) was 31 events/hour (SD +/- 34.1) and the average oxygen saturation nadir was 80%. Twenty patients (28%) met the diagnostic criteria for OHS based on the baseline awake EtCO2. The mean EtCO2 was 40.1 mmHg in patients with a BMI between 30 and 40 kg/m2 (Group 1) versus 45.1 mmHg in patients with BMI >40 kg/m2 (Group 2) with a statistically significant p-value of 0.0002. Additionally, we identified 18 patients between the ages of 13-18 years with obesity amongst which, 4 patients also had a baseline EtCO2 of >45 torr (22%) with a potential diagnosis of OHS.
Conclusion: Patients diagnosed with OHS are reported to have a higher overall greater mortality. Our study suggests a higher diagnostic yield of OHS in adults and adolescents with the use of CO2 monitoring especially in the morbidly obese. This evidence would advocate for the routine use of CO2 monitoring in the obese patient population.
Support (If Any):

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VALIDATION STUDIES FOR SCORING POLYSOMNOGRAMS AND HOME SLEEP APNEA TESTS WITH ARTIFICIAL INTELLIGENCE: SLEEP STAGE PROBABILITIES (HYPNODENSITY) DERIVED FROM NEUROLOGICAL OR CARDIORESPIRATORY SIGNALS

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Introduction: There have been significant advances in machine learning in recent years. This means that powerful methods are now available for classification problems, such as scoring sleep stages from neurological or cardiorespiratory signals. In the present work, validation studies for both applications are presented.
Methods: To determine the 5 sleep stages from the neurological signals, 54 sleep-wake-related features were calculated and classified by a bidirectional long short-term memory (LSTM) network which had been trained on 1956 manual scorings of 588 PSGs from 294 subjects (supervised deep learning). To determine the 4 stages (wake, light sleep, deep sleep, REM) from cardiorespiratory signals, a convolutional neural network combined with LSTM layers was used for feature extraction and classification. This network had been trained on 685 PSGs from 391 subjects (Bakker et al. JCSM 2021). The networks obtained were validated in 428 PSGs with one and 10 PSGs with 12 manual scorings (neurological staging) as well as in 2 two datasets, each containing 296 ambulatory recordings (cardiorespiratory staging).
Results: Cohen's kappa between autoscoring based on neurological signals and manual scoring was 0.74 (95%-confidence interval: 0.74-0.74) for the 428 PSGs. The intraclass correlation coefficient (ICC) for absolute agreement between autoscoring and manual scoring was for the AHI 0.97 (0.96-0.98), for the arousal index 0.79 (0.67-0.86) and for the PLMSI 0.91 (0.88-0.93). The ICC between the sleep stage probabilities derived from the 12 manual scorings and the artificial intelligence (AI) derived hypnodensity was 0.91 (0.91-0.91). Cohen's kappa values for the cardiorespiratory sleep staging were 0.68 (0.68-0.68) and 0.64 (0.63-0.64) for the 2 datasets with 296 ambulatory recordings each.
Conclusion: All metrics from the PSG validation studies show substantial (Cohen's kappa > 0.6) as well as good to excellent agreement (ICC > 0.75 or > 0.90) compared to manual scorings. As an added value of the AI-supported PSG evaluation, the probabilities of the sleep stages per epoch are determined (hypnodensity graph). The valid estimation of the sleep stages from cardiorespiratory signals by means of AI may result in improved clinical interpretation of home sleep apnea tests, which are increasingly used in the sleep-disordered breathing diagnostic pathway.
Support (If Any):

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WHAT IS HSAT MISSING? A COMPARISON OF RESPIRATORY EVENTS AND OSA DIAGNOSIS ACROSS TYPE 2 AND TYPE 3 STUDIES

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Introduction: The need for having in-home sleep testing has grown due to the COVID-19 pandemic. While Type 3 Home Sleep Apnea Tests (HSAT) are frequently used, their accuracy remains questionable. This study aimed to compare respiratory events and diagnosis of obstructive sleep apnea between Type 2 and Type 3 studies.
Methods: 550 participants completed overnight Type 2 sleep studies using the Cerebra Sleep System. Files were autoscored as a type 2 acquisition and were manually edited by a RPSGT. On a second auto-score, mapped file channels were reduced to nasal cannula, chest belt, SpO2, position, heart rate, and audio channels to simulate a Type 3 study. The respiratory disturbance index (RDI) in the Type 2 tests was compared to the apnea-hypopnea