THE ROLE OF THE TECHNICIAN IN POLYPHYSIOLOGY: FROM LITERATURE REVIEW TO CASE STUDY

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ABSTRACT

Objective: To present in detail the results of polysomnography in a patient with severe obstructive sleep apnea, thereby highlighting the central role of the polysomnographer.

Method: Case study.

Results: The polysomnography was performed successfully thanks to the adherence to standard procedures and the professional skills of the polysomnographer. The results provided clear quantitative evidence of the severity of OSA and hypoxemia. These results are a direct product of the technician's accurate data collection and processing, demonstrating their essential and irreplaceable role in the effective diagnosis of sleep disorders using polysomnography.

Conclusion: The technician is responsible for preparing and connecting the electrodes and sensors to the patient correctly, ensuring the quality of the collected data. Emphasizing the indispensable role of nursing in patient classification.

Keywords: Technician role, polysomnography, sleep apnea syndrome.

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1. Overview

Sleep is an important aspect of human health, however, sleep disorders are becoming increasingly common in modern society. Among them, Obstructive Sleep Apnea (OSA) is estimated to affect tens of millions of adults [1]. Given the high prevalence of the disease, the diagnosis and management of OSA is extremely necessary. Polysomnography (PSG) is considered the gold standard in the diagnosis of sleep disorders [2], including OSA [2]. This technique simultaneously monitors multiple physiological parameters of the patient during sleep [2], providing detailed information on sleep structure, respiration, heart rate, muscle movements and other events occurring during the night [2]. Due to the rapid development of the field of sleep medicine [3], the implementation of PSG requires specialized techniques and well-trained staff [3]. In the entire polysomnography process, the polysomnographer plays an indispensable role [1]. They are responsible for preparing the patient [2], performing the application of electrodes and sensors that measure brain waves (EEG), eye movements (EOG), muscle tone (EMG), electrocardiogram (ECG), respiration (including airflow and respiratory effort), oxygen saturation, body position, and snoring [2]. Correct application of electrodes and sensors is the most important factor to ensure the quality and accuracy of the recorded data [2]. The technician also performs bio-calibration to check the system's operation before starting the recording [2], monitors the measurement process during the night [2], records abnormal events [2], and processes, scores, or automatically edits the raw data [1]. They need to be properly trained in patient interaction, patient education about the procedure and the importance of treatment [1], ensuring low failure rates, and adherence to infection control protocols [1].

The aim of this case report is to present in detail the results of polysomnography in a patient with severe obstructive sleep apnea, thereby highlighting the central role of the polysomnographer in performing this complex technique, collecting high-quality data [2], and performing the initial scoring [1, 2],

which is crucial for accurate diagnosis and treatment planning for the patient [2]. The report also aims to share practical experience in the application of PSG in the diagnosis of OSA and to raise awareness of the importance of the PSG technician in the care of patients with sleep disorders.

2. Case introduction

Patient Nguyen Thi T, born in 1968, female, residing in Hanoi, was assigned to perform PSG at the ENT Hospital. The appointment was made on 22/05/2025 by an ENT specialist, with the purpose of monitoring Sleep Apnea Syndrome, specifically suspected OSA. PSG data collection was performed by a polysomnography technician, starting at 21:00 on 22/05/2025 and ending at 06:00 on 23/05/2025. The patient's total time in bed (TIB) was 509.3 minutes, of which the Total Sleep Time (TST) was 374 minutes. The entire study did not record any adverse events.

The analysis of physiological parameters recorded in the PSG study showed that Sleep Efficiency (as measured by TST/TIB) was 73.3%. Regarding respiratory signs, a total of 229 Obstructive Apneas and 31 Obstructive Hypopneas were recorded. Based on these events, the total Apnea-Hypopnea Index (AHI) was 38.4, indicating a significant degree of sleep-disordered breathing. The duration of respiratory events was also analyzed: the longest Obstructive Apnea was 52.1 seconds and the mean was 27.1 seconds, while the longest Obstructive Hypopnea was 23.1 seconds and the mean was 23.1 seconds. In addition, blood oxygenation during sleep was also monitored through blood oxygen saturation. The lowest recorded blood oxygen saturation (SpO2) was 69.0%.

Sleep Architecture analysis showed that the time distribution in sleep stages had changed. The time in stage N3 (deep sleep) was 143.0 minutes, accounting for 38.3% of total sleep time, which was recorded as an increase. Meanwhile, the time in stage N1 was 16.5 minutes (4.4% of TST) and stage N2 was 116.5 minutes (31.2% of TST) both showing a decrease. Based on a comprehensive analysis of PSG data, including AHI index and other physiological parameters, the doctor who read the Polysomnography results made a diagnosis. The patient was diagnosed with severe obstructive sleep apnea (OSA), which was clearly confirmed by

the AHI index of 38.4. The patient also had mild oxygen desaturation with a minimum SpO2 of 69%. In addition, the doctor also noted changes in the patient's sleep structure, especially an increase in the time spent in stage N3 sleep and a decrease in the time spent in stages N1 and N2.

3. Discussion

The case of patient Nguyen Thi T, 57 years old, was diagnosed with sleep apnea syndrome. Therefore, the indication for PSG is reasonable and necessary to determine whether OSA exists or not, the severity, and other characteristics of the sleep disorder [3].

The process of performing polysomnography on patient Nguyen Thi T is an overnight study (overnight PSG), lasting from 9:00 pm the previous night to 6:00 am the next morning. This is the period of physiological signal recording in a controlled bedroom environment at the sleep unit [2]. The polysomnographer is the person primarily responsible for the entire process of collecting this data, ensuring the quality and reliability of the results [2]. The steps include:

- Pre-measurement preparation: Although the case report does not detail the patient preparation steps, according to the standard PSG procedure, patients are usually instructed to prepare (e.g., avoid caffeine/alcohol, do not take naps, wash hair) [2]. The technician will welcome the patient, introduce the measurement room environment, and explain the procedure to be performed to reassure and cooperate the patient [2]. The technician also collects initial information and checks the doctor's instructions [2].

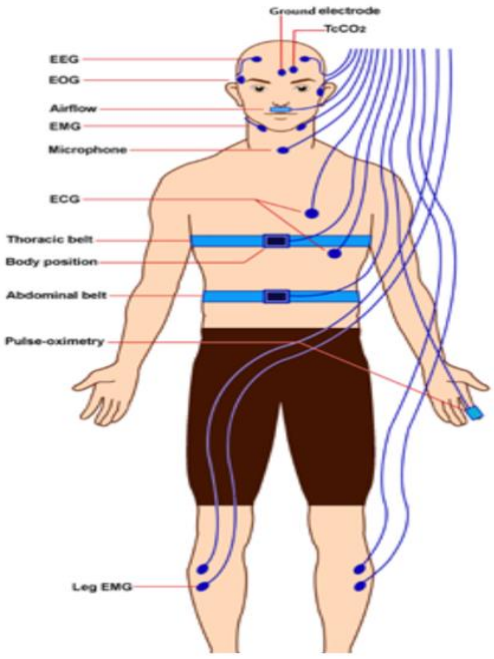

Figure 1. *Illustration of the locations of various electrodes and sensors used for sleep monitoring. Including EEG, EOG, electromyography (chin EMG), airflow (nasal and/or oral), ECG, pulse oximetry, respiratory effort (chest/abdomen), snoring microphone, and body position sensor* [2]

- Electrode and sensor placement: This is the most important step to ensure data quality [2]. The technician connects the electrodes and sensors to specific locations on the patient's body according to standard regulations (usually according to AASM) [2, 3]. The recorded signals include:

+ Brain waves (EEG): To determine sleep stages (N1, N2, N3, REM) [2]. Electrodes are placed systematically [2].

+ Eye movements (EOG): To determine REM sleep stages and sleep onset [2].

+ Muscle tone (EMG): Record chin muscle activity (important to determine REM) and leg muscles (to detect periodic limb movements) [2].

+ Electrocardiogram (ECG): Monitor heart rate and detect sleep-related arrhythmias [2].

+ Respiration: Record airflow (through the nose/mouth with a temperature or pressure sensor) [2], respiratory effort (chest and abdominal movements with a sensor belt) [2], and snoring [2]. These signals are essential for detecting and classifying apnea and hypopnea events [2].

+ Blood oxygen saturation (SpO2): Continuously measured with a finger-clip sensor (or other location) [2]. This index reflects the state of hypoxia in the blood [2].

+ Body position: Record the patient's lying position (supine, lateral, prone) [2]. This is important because OSA is often more severe in the supine position [2].

+ Audio and video: Record patient behavior, snoring, and other unusual events [2]. The technician needs to carefully prepare the skin area where the electrodes are applied (clean, gently rub) to reduce impedance and ensure a clean, noise-free signal [2]. Correctly applying electrodes and sensors is certainly the core responsibility of the technician, directly affecting the ability to accurately score later [2]. The technician also explains the function of each sensor to the patient to make them feel more comfortable [2].

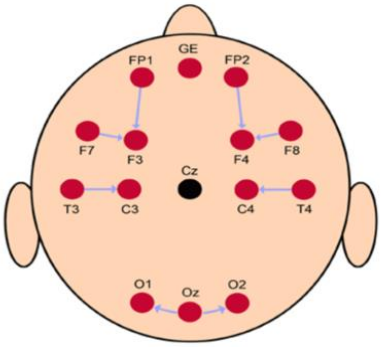

Figure 2. *Illustration of the location of EEG electrodes on the scalp according to the 10–20 electrode placement system[1]*

- Bio-calibration: Before starting to officially record signals while the patient is asleep, the technician performs a series of requests to check the function of each sensor and the quality of the signal [2]. The patient is asked to perform movements such as opening/closing the eyes, moving the eyes side to side, clenching the jaw, breathing deeply, holding the breath, moving the legs [2]. The technician observes the signals on the screen to ensure that they are correctly recording these activities [2]. Bio-calibration is an essential step to help the technician and the later scorer accurately recognize the types of signals and abnormal events [2]. The technician also checks the electrode impedance (<5kΩ ideal, <10kΩ acceptable) and replaces it if necessary [2]. - Night monitoring: During the measurement, the technician is always present in the control room to monitor the patient's physiological signals, ensuring that the device is operating stably and without technical problems [2]. They also record events observed through the camera or through patient communication (e.g., patient waking up, device complaints) [2]. Technicians need to promptly correct signal problems (noise, signal loss) so that the recorded data is as complete and accurate as possible [1, 2]. The technician-to-patient ratio is usually 1:2 or 1:3 to ensure effective care and data collection [3].

- End of measurement and removal of the device: In the morning, the technician will wake the patient, remove the electrodes and sensors [2]. The patient may be asked to complete a post-measurement questionnaire [2]. The technician ensures that the device is properly handled (e.g., disinfected, cleaned) before use on another patient [1, 2].

The role of the Polysomnographer does not stop at collecting data during the night. After the recording process is completed, the scoring technologist continues to process and score the huge amount of raw data collected [1]. This is a step that requires in-depth knowledge of sleep physiology, scoring standards (e.g. according to AASM), and skills in identifying physiological signals as well as artifacts [1, 2].

Main tasks include:

- Data loading: Loading raw data from the measuring device into the analysis software [1].

- Manual scoring/Automatic result checking and editing: Although there is software to support automatic scoring, manual scoring or automatic result checking and editing by a technician is mandatory and cannot be replaced because automatic algorithms are not accurate enough, especially in classifying respiratory events, determining sleep stages, and eliminating noise [1, 3]. Experienced technicians from scoring full-night PSG are needed to accurately distinguish between wakefulness, movement, mouth breathing, and sleep-disordered breathing events [1].

- Identifying and marking abnormal signs: The technician determines sleep stages (N1, N2, N3, REM, Wake) based on EEG, EOG, EMG [2]. They mark respiratory events (obstructive/central/mixed apnea, hypopnea), oxygen desaturation, arousal episodes, limb movements, and other abnormal events based on the corresponding signals [2]. Correctly identifying and marking each event according to the standard is the foundation for calculating important indicators such as AHI [1, 3].

- Recognition and removal of artifacts: Technicians need to be skilled in identifying noise signals (artifacts) caused by patient movement, technical problems, or the electromagnetic environment, and removing them to ensure that only clean data is scored [1, 2].

- Initial report synthesis: Technicians compile the scoring results into a detailed report, including indicators of sleep structure, respiratory events, SpO2, heart rate, etc., and note any technical limitations of the measurement session [1]. This report, together with the raw data, will be forwarded to the sleep specialist for final interpretation [1].

This case is a clear demonstration that the diagnostic results (severe OSA, low SpO2, altered sleep architecture) are built entirely on accurate and reliable data collected, processed, and initially scored meticulously by the technician, following professional procedures and standards [1-3]. From the careful preparation for the measurement session, performing bio-calibration, monitoring overnight, to the challenging

scoring of the raw data, the technician is the one who creates the high-quality "raw product" that the sleep specialist relies on to make the final diagnosis and decide on the most effective treatment for the patient. Without the technician's skill and care, the PSG results can be misleading, leading to incorrect diagnosis and treatment.

The polysomnography was successfully performed thanks to the adherence to standard procedures and the professional skills of the polysomnographer. The results provided clear quantitative evidence of the severity of OSA and hypoxemia. These results are a direct product of the technician’s accurate data collection and processing, demonstrating their essential and irreplaceable role in the effective diagnosis of sleep disorders using polysomnography.

4. Conclusions

The role of the polysomnographer in this case is extremely important. The technician is the person who directly performs the measurement process from start to finish. They are responsible for preparing and connecting the electrodes and sensors to the patient correctly, ensuring the quality of the collected data. The accurate diagnosis results from the case allow the doctor to choose the optimal treatment regimen for the patient and adjust the treatment parameters based on the severity of the disease and the state of hypoxemia.

References

1. *Home Sleep Apnea Testing (HSAT) December 2020 , AAST Technical Guideline*
2. Pandi-Perumal, S., *Polysomnography I: procedure and technology*, in *Synopsis of Sleep Medicine*. 2016, Apple Academic Press. p. 467-480.
3. George, C., *Standards for polysomnography in Canada. The standards committees of the Canadian Sleep Society and the Canadian Thoracic Society.* CMAJ: Canadian Medical Association Journal, 1996. **155**(12): p. 1673.