Split Night Protocols for Adult Patients

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SUMMARY

Sleep technologists are team members who work under the direction of a physician practicing sleep disorders medicine. Sleep technologists are trained and must demonstrate competency in patient interaction, age-related competencies, patient education, and the diagnostic and therapeutic modalities used in the management of sleep disorders. One therapeutic process involves the use of a positive airway pressure (PAP) device to correct sleep-related airway obstruction and/or increase airway patency, thereby reducing or eliminating sleep-related breathing disturbances. A comprehensive technical guideline has been developed that summarizes the AASM clinical guidelines for manual titration of positive airway pressure in patients with sleep related breathing disorders (1). This guideline is intended to provide guidance for the technologist performing split-night PAP studies.

A split-night study is most often performed using continuous positive airway pressure (CPAP), which allows the technologist to simultaneously increase both inspiratory and expiratory pressures throughout the polysomnography recording. This process is used to determine the single fixed pressure that will eliminate respiratory disturbances during subsequent nightly usage at home. A bilevel positive airway pressure (BPAP) device may be used when a patient demonstrates difficulty acclimating to high airway pressure (>14 cm H20 according to AASM guidelines) during the expiration phase of breathing, or when inspiratory pressure support is needed to augment ventilation. BPAP allows the sleep technologist to separately increase inspiratory or expiratory pressures during the overnight polysomnogram to arrive at two pressures (IPAP and EPAP) for subsequent use in the home. The pressures between IPAP and EPAP must be a minimum of 4-cm H2O pressure. In general, other non-invasive modalities, including servoventilation devices (SV) are not used for a split-night titration.

The 2008 American Academy of Sleep Medicine (AASM) clinical guidelines indicate that manual titration of PAP pressures during attended polysomnography is the current standard for selection of the optimal patient therapeutic pressure. PAP devices must be administered and titrated by a well-trained sleep technician, preferably a registered sleep technologist (RST, RPSGT) or respiratory therapist (RRT-SDS, CRT-SDS) depending on state regulations and insurance guidelines. All potential PAP titration candidates must have an evaluation, which can also include PAP education, a hands-on equipment demonstration, careful mask fitting, and acclimation to the device prior to beginning the polysomnogram (2).

KEY DEFINITIONS

Apnea-Hypopnea Index (AHI) refers to total apneas and hypopneas per hour of sleep.

Automatic Positive Airway Pressure (APAP) is a device that uses a computer algorithm designed to provide air pressure (continuous or bilevel) automatically adjusting pressure levels to meet each specific person's breathing pattern. This therapy is used to treat obstructive sleep apnea.

Adaptive Servoventilation (ASV) is a non-invasive ventilation PAP device that uses a computer algorithm to deliver airflow and pressure to the patient on a breath-by-breath basis. It measures breathing patterns and customizes the pressure delivered to stabilize breathing. This therapy may be used to treat obstructive sleep apnea, central sleep apnea and/or complex sleep apnea.

Bilevel Positive Airway Pressure (BPAP) is performed using a PAP device that can be set to deliver different pressures for inhalation (IPAP) and exhalation (EPAP). This therapy may be used to treat obstructive sleep apnea, central sleep apnea and/or complex sleep apnea.

Continuous Positive Airway Pressure (CPAP) is performed using a PAP device designed to deliver positive airway pressure at a consistent level. This therapy is used to treat obstructive sleep apnea.

Positive Airway Pressure (PAP) is a standard treatment for patients with sleep disordered breathing. The delivery system consists of a mechanical air pump which compresses room air to a set pressure, tubing to deliver the air to the patient, and a flexible, size-adjusted mask, which completes the circuit from the device to the patient. PAP devices can include CPAP, BPAP, APAP, ASV, and VAPS.

Respiratory Disturbance Index (RDI) refers to the number of apneas, hypopneas and RERAS per hour of sleep.

Respiratory Event Index (REI) is defined for use with home sleep apnea testing (HSAT) refers to the total number of events scored per hour of monitoring time.

Respiratory Effort Related Arousals (RERAS) may be estimated by flattening of the inspiratory airflow profile associated with an arousal when airflow changes do not meet apnea or hypopnea criteria or by changes in the esophageal pressure recording.

Sleep Technologists work under the general supervision of the medical director or designee to provide comprehensive evaluation and treatment of sleep disorders including in center and out of center sleep testing, diagnostic and therapeutic interventions, comprehensive patient care and direct patient education. A sleep technologist is able to perform the duties defined for a sleep technician and is able to provide oversight of other sleep center staff. The sleep technologist is credentialed in sleep technology.

Sleep technicians perform comprehensive sleep testing and analysis, and associated interventions under the general supervision of a sleep technologist and/or the medical director or designee. A sleep technician can provide supervision of a sleep trainee.

Sleep trainees develop competency in and perform basic sleep testing procedures and associated interventions. The sleep trainee works under direct supervision of a sleep technician or a sleep technologist.

Standard precautions make use of risk assessment and common sense practices, like hand hygiene and personal protective equipment, that protect healthcare providers from infection and prevent the spread of infection from patient to patient.

Volume Assured Pressure Support (VAPS) refers to hybrid modes of ventilation that aim to provide a minimum level of ventilation by automatically varying the level of pressure support provided by the device.

1.0 SCOPE

This guideline addresses split-night PAP titration and is based on the current AASM Clinical Guidelines (2, 3). The scope of this guideline is restricted to adult (≥12 years) patients with obstructive sleep apnea. PAP titration should be performed in an AASM accredited sleep facility by a properly credentialed sleep technologist (see Summary) and reviewed by a board certified sleep specialist.

1.1 INDICATIONS FOR A SPLIT-NIGHT PAP TITRATION

A split-night PAP titration is indicated for patients who are suspected to have the diagnosis of severe OSA, which is defined as an AHI of at least 40 documented during a minimum of two (2) hours of diagnostic PSG. A split-night study may be considered in a patient with an AHI of 20 to 40, based on clinical judgment and lab/center policy (2, 3, 4).

1.2 PATIENT REFERRAL

Patients may be referred for a split-night PAP titration when there is a strong clinical suspicion of severe OSA after an initial clinical evaluation. A split-night study may also be undertaken if severe OSA is seen during the PSG and is accompanied by significant oxygen desaturation and/or cardiac arrhythmias (3,4), including:

- frequent premature ventricular complexes (PVC's), more than 10 per minute,
- bigeminy, more than 10 per minute,
- couplets, more than 5 per minute,
- runs of ventricular tachycardia,
- heart block of any degree,
- atrial tachy-arrhythmias, atrial fibrillation, atrial flutter,
- paroxysmal atrial tachycardia, or multi-focal atrial tachycardia.

2.0 RECORDING TECHNIQUES

A split-night PAP titration should be performed using Type 1 attended polysomnography in an accredited sleep facility using the sensors and data collection parameters reflected in the AASM Clinical Practice Guideline (5) and the Manual for the Scoring of Sleep and Associated Events standards (6). The results should be validated, interpreted, and reported by a board certified sleep physician (7).

2.1 PHYSIOLOGICAL AND RECORDING PARAMETERS

EEG electrodes should be placed at F3, C3, O1, M1, F4, C4, O2, and M2 according to the International 10-20 System for Electrode Placement (8). The recommended EEG derivation is F4-M1, C4-M1, and O2-M1 recorded at a minimum sampling rate of 200 Hz with impedances of 5 KΩ or less. The recommended sampling rate is 500 Hz with a sensitivity setting of 7 µV/mm. Filter settings for this parameter are LFF 0.3 Hz and HFF 35 Hz.

EOG electrodes should be placed at E1 and E2 according to AASM Manual for the Scoring of Sleep and Associated Events standards. The recommended EOG derivation is E1-M2, E2-M2 recorded at a minimum sampling rate of 200 Hz with impedances of 5 KΩ or less. The recommended sampling rate is 500 Hz with a sensitivity setting of 7 µV/mm. Filter settings for this parameter are LFF 0.3 Hz and HFF 35 Hz.

Chin EMG electrodes should be placed above and below the mandible on the mental and submental muscles of the chin as specified in the AASM Manual for the Scoring of Sleep and Associated Events standards. The derivation for recording chin EMG consists of a submental electrode referred to the electrode placed above the mandible on the mental muscle. The minimum sampling rate is 200 Hz. The recommended sampling rate is 500 Hz with a sensitivity setting of 7 µV/mm (which may be adjusted to better visualize muscle tone). Filter settings for this parameter are LFF 10 Hz and HFF 100 Hz.

The recommended airflow sensor for use during PAP titration is the airflow signal generated by the PAP device. Use of an oronasal thermal sensor under the PAP interface is not recommended. The recommended respiratory effort sensor is either calibrated or uncalibrated respiratory inductance plethysmography (RIP). The minimum acceptable sampling rate for the collection of respiratory data is 25 Hz with a sensitivity setting of 7 µV/mm (which may be adjusted to better visualize ventilation). The preferred sampling rate is 100 Hz, which improves the ability to assess artifacts and visualize cardiogenic oscillations. Filter settings for the respiratory data parameters are LFF 0.1 Hz, HFF 15 Hz.

The recommended blood oxygen sensor is a pulse oximeter (Sp02) with an averaging time of < 3 seconds. Finger probe placement is recommended. The minimum recommended sampling rate is 10 Hz. The preferred sampling rate is 25 Hz, which improves the ability to recognize artifacts.

A pulse rate is generally obtained from the pulse oximeter. The minimum acceptable sampling rate is 10 Hz. The preferred sampling rate is 25 Hz, which improves the ability to recognize artifacts. When it is used in conjunction with the oximetry signal, the pulse rate signal may assist with oximeter artifact detection.

The minimum acceptable sampling rate for recording body position is 1 Hz.

Modified Lead II is the recommended placement for recording the electrocardiogram (ECG). The minimum acceptable sampling rate is 200 Hz. The recommended sampling rate of 500 Hz improves waveform definition. A sensitivity setting of 20 µV/mm (which may be adjusted to better visualize waveforms) is generally adequate. Filter settings for ECG are LFF 0.3 (which minimizes waveform distortion), HFF 70 Hz.

Snoring sound or vibration data must be recorded and the minimum acceptable sampling rate for the collection is 200 Hz. The preferred sampling rate of 500 Hz improves waveform definition with a starting sensitivity setting of 7 µV/mm (which may be adjusted to better visualize snoring). Filter settings are LFF 10 Hz, HFF 100 Hz.

2.2.1 SUPPLEMENTAL OXYGEN

Supplemental oxygen (O_2) should be administered based on center/lab protocols (and with a physician order) and the clinical judgment of the technologist. AASM Clinical Practice Guidelines recommend the use of supplemental O_2 during PAP titration when the awake supine oxygen saturation by pulse oximeter

(SpO_2) on room air is less than 88% for 5 minutes or longer (2). Supplemental O_2 should be introduced into the PAP device at the tubing connection using a T connector, not at the PAP mask. The recommended minimum starting rate for adult patients is 1 L/min. Titrate O_2 in 1 L/min increments with an interval of no less than 15 minutes until SpO_2 is between 88% and 94% or according to center/lab protocols. In some circumstances, PAP therapy can decrease the need for supplemental O_2. BPAP therapy may be utilized to improve oxygenation in patients when IPAP level is increased.

2.2.2 REPEAT TITRATION STUDIES

A repeat PAP titration is indicated when a split-night study does not meet standard criteria of greater than 3 hours of titration time and PAP has not been documented to eliminate or nearly eliminate respiratory events during REM and NREM sleep including during supine REM sleep (2).

3.0 DOCUMENTATION

As per the PSG protocol, the sleep technologist is responsible for ensuring that all required documentation (history, physical exam, previous test results, referral and insurance information, consent, etc.) is available prior to the split-night PAP titration.

3.1 TECHNICAL DOCUMENTATION

Technical documentation includes the PSG-generated report with PAP pressures either recorded manually on the record or automatically collected by a signal from the PAP device. Technical documentation includes a technologist-generated log of all events, observations and interventions that occurred during the split-night PAP titration.

The sleep technologist should document the following information:

- Beginning and ending pressures
- Pressure or delivery mode changes and rationale (ex. hypopneas noted)
- Body position
- Sleep stage
- Patient behavior (restless, complaints)
- Snoring
- SpO_2
- Mask used (brand and type)
- Leak of mask at regular intervals along with progress notes (ex. every 30 minutes)
- The reason for changing from one mask or device to another

3.2 RECORDING SUMMARY

The scoring technologist should stage and score events on the split-night PAP titration recording according to the AASM Manual for the Scoring of Sleep and Associated Events standards (6). A report should be generated outlining the preliminary findings for the board certified sleep physician to review.

4.0 RESULTS REPORTING

The sleep physician is responsible for reviewing the raw scored data from the split-night PAP titration and the preliminary report. The sleep physician generates the final report with recommendations for PAP pressures during home use.

5.0 STANDARDS OF PRACTICE

5.1 RESPONSIBILITIES OF SLEEP TECHNOLOGISTS

Sleep technologists performing split-night PAP titration studies should demonstrate knowledge of the application and limitations of PAP devices, mask interfaces, and the PSG recording instruments. The sleep technologist should educate and instruct patients and caregivers in the use of PAP equipment. The sleep technologist must be able to accurately assess and summarize both PAP and PSG recordings to arrive at the optimal therapeutic PAP pressure settings for the patient studied.

5.2 SLEEP FACILITY ORGANIZATION AND RECORD KEEPING

Sleep technologists performing split-night PAP titration studies should follow the sleep facility departmental policy and procedure manual guidelines. Patient charts, in either print or electronic format, should be organized and available for use in the sleep facility (9). HIPAA guidelines should be followed to meet documentation and confidentiality requirements. Records and recordings should be secure and retrievable and stored in accordance with state guidelines for the length of time designated by the statutes (generally a seven year minimum for adults, 7 years past their 18th birthday for minors).

5.3 EQUIPMENT SAFETY

Equipment and sensor use and maintenance should meet manufacturer standards. All electronic equipment used for diagnostic and therapeutic sleep testing must be inspected and maintained by a trained biomedical technician, and those actions must be documented (9).

5.4 INFECTION CONTROL

Sleep technologists must use standard precautions to prevent the spread of infectious disease. Frequent hand washing is essential for protection of both patient and technologist, and should be performed before and after all patient contact, after glove removal, and when visibly soiled. The technologist must wear gloves when handling contaminated equipment (10).

5.4.1 EQUIPMENT DECONTAMINATION

All equipment and sensors, masks and belts coming into contact with the patient will be handled as contaminated per sleep facility policy and procedure. Clean and dirty equipment must be kept in distinct areas designated as clean or dirty. All dirty equipment must be cleaned and disinfected after each use according to manufacturer guidelines. Single use items are encouraged and are to be discarded after each use (10).

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