



Split Night Protocols for Adult Patients - Updated July 2012

SUMMARY: Sleep technologists are team members who work under the direction of a physician practicing sleep disorders medicine. Sleep technologists are trained in patient interaction, age related competencies, facilitating patient education and the diagnostic and therapeutic modalities used in sleep technology. 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 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 during the expiration phase of breathing. BPAP allows the sleep technologist to separately increase inspiratory or expiratory pressures during the polysomnography to arrive at two pressures for subsequent use in the home. Other modalities, including servoventilation devices (SV) should not be 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 technologist, preferably a registered sleep technologist (RST, RPSGT) or respiratory therapist (RRT-SDS, CRT-SDS). All potential PAP titration candidates must have an initial physician evaluation, PAP education, a hands-on equipment demonstration, careful mask fitting and acclimation to the device prior to titration (2).

KEY DEFINITIONS

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

Bilevel Positive Airway Pressure (BPAP) is performed using a PAP device with two adjustments; one adjustment for inspiratory and one for expiratory pressure.

Continuous Positive Airway Pressure (CPAP) is performed using a PAP device with one adjustment for both inspiratory and expiratory pressures.

Positive Airway Pressure (PAP) is a standard treatment for patients with obstructive sleep apnea. The PAP delivery system consists of a mechanical air pump which compresses room air to a prescribed level, tubing to deliver the air to the patient, and a flexible, size adjusted mask, which completes the circuit from the device to the patient.

Respiratory Disturbance Index (RDI) (defined for use with Type I studies) refers to the total of apneas, hypopneas and RERAs per hour of sleep.

Servoventilation (SV) is performed using a PAP device that uses a computer controlled valve to deliver airflow and pressure to the patient on a breath by breath basis.

1.0 SCOPE

This guideline addresses split-night PAP titration and is based on 2008 AASM Clinical Guidelines. 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 registered sleep technologist 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 diagnosed with 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 (3).

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, or a split-night study may be undertaken due to severe OSA seen during the PSG that is accompanied by significant oxygen desaturation and/or cardiac arrhythmias 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 AASM accredited sleep facility using the sensors and data collection parameters reflected in the *AASM Manual for the Scoring of Sleep and Associated Events* standards. The results should be validated, interpreted and reported by a board certified sleep physician.

2.1 PHYSIOLOGICAL AND RECORDING PARAMETERS (4)

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 (5, 6). 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 K Ω or less. The recommended sampling rate is 500 Hz. 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 K Ω or less. The recommended sampling rate is 500 Hz. 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. 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 calibrated or un-calibrated respiratory inductance plethysmography (RIP). The minimum acceptable sampling rate for the collection of respiratory data is 25 Hz. The preferred sampling rate is 100 Hz, which improves the ability to assess artifact 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 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 artifact.

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

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 artifact. When it is used in conjunction with the oximetry signal, the pulse rate signal may assist with oximeter artifact detection.

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. Filter settings for ECG are LFF 0.3 (which minimizes waveform distortion), HFF 70 Hz.

The minimum acceptable sampling rate for the collection of snoring sound or vibration data is 200 Hz. The preferred sampling rate is 500 Hz, which improves waveform definition. Filter settings are LFF 10 Hz, HFF 100 Hz.

2.2 DESCRIPTION AND METHODOLOGY FOR SPLIT-NIGHT PAP TITRATION

Split-night CPAP and BPAP titration studies must be performed using titration algorithms that are identical to those used for full night CPAP or BPAP studies (2). These algorithms are detailed in the *AAST Technical Guideline – Summary of AASM Clinical Guidelines for Manual Titration of Positive Airway Pressure in Patients with Sleep Related Breathing Disorders*.

Split-night studies should not be performed in children less than 12 years old. Due to the reduced titration time available during split-night studies, increase PAP pressures by a minimum of 2 cm H₂O with an interval of no less than 5 minutes.

2.2.1 SUPPLEMENTAL OXYGEN

Supplemental oxygen should be administered based on laboratory protocols and the clinical judgment of the technologist to attain an appropriate titration for each individual patient. AASM Clinical Practice Guidelines recommend the use of supplemental O₂ during PAP titration when awake supine SpO₂ on room air is less than 88% for 5 minutes or longer (2). Supplemental oxygen should be introduced into the PAP device at the device tubing connection using a T connector, not at the PAP mask. The recommended minimum starting rate for adult and pediatric patients is 1 L/min. Titrate O₂ in 1 L/min increments with an interval of no less than 15 minutes

until SpO₂ is between 88% and 94%. Supplemental O₂ levels can sometimes be reduced in patients on BPAP 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, etc.) is available prior to the split-night PAP titration.

3.1 TECHNICAL DOCUMENTATION

Technical documentation includes the PSG generated recording report with PAP pressures either recorded manually on the record or automatically recorded 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 records the following information:

- Beginning and ending pressures
- Pressure or delivery mode changes and rationale
- Body position
- Sleep stage
- Patient behavior (restless, complaints)
- Snoring
- SpO₂
- The reason for changing from one mask or device to another

3.2 RECORDING SUMMARY

The scoring technologist stages and event scores the split-night PAP titration recording and generates a preliminary findings report 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 QUALIFICATIONS 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 educates and instructs 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 (7). HIPPA 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 statues (generally a seven year minimum).

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. (7).

5.4 INFECTION CONTROL

Sleep technologists must use universal 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 and after glove removal. The technologist must wear gloves when handling contaminated equipment.

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 to be discarded after each use (8).

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