Name of Policy: **Adaptive Servo ventilation (ASV) Titration Procedure** **Policy Number**: 3364-171-07-01 **Approving Officer**: Chief Executive Officer Chief Operating Officer Medical Director **Responsible Agent**: Director, Respiratory Care **Scope**: The University of Toledo Medical Center Pulmonary Services Department	UTOLEDO HEALTH **Effective date:** **Original effective date**: March 17, 2023
Key words: CSA, Servo ventilation, AASM, Cheyne-Stokes, Ventilation	

	New policy proposal		Minor/technical revision of existing policy
X	Major revision of existing policy		Reaffirmation of existing policy

(A) Policy statement

All qualified and trained polysomnographic technologists will be able to set up and titrate patients using adaptive servo ventilation (ASV).

(B) Purpose of policy

To effectively treat non-hypercapnic and/or hyperventilating patients with Central Sleep Apnea Syndrome (CSA), including Cheyne-Stokes Breathing, Treatment-Emergent Central Sleep Apnea (previously known as Complex Sleep Apnea), and opiate-induced CSA.

(C) Overview

Adaptive servo ventilation (ASV) is a form of bilevel positive airway pressure (BPAP) therapy used to treat central sleep apnea. Furthermore, ASV is a form of closed-loop mechanical (“servo”) ventilation, pressure preset, and volume or flow cycled. All ASVs provide fixed or automatic expiratory airway support, adjustable minimal and maximal pressure support, and different options for backup rates (user specified, device algorithm estimated, or none). Volume and flow targets are used, and the sampling-averaging window extends over 3 to 4 minutes. Thus, ASV devices track long-range respiratory patterns and make adjustments in the parameters to maintain the target within a prespecified range.

ASV alleviates central sleep apnea due to Cheyne Stokes breathing pattern by providing dynamic (breath-by-breath) adjustment of inspiratory pressure support with a back-up rate to normalize breathing patterns relative to a predetermined target. The difference between minimal and maximal allowable pressure support is the "adaptive space." Specifically, ASV mitigates hyperventilation and associated hypocapnia by delivering preset minute ventilation. Meanwhile, detection of apneic obstructive events results in expiratory pressure increases.

The ResMed ASV uses a three-minute moving average to monitor and determine an appropriate target minute ventilation, set to 90% of their most recent minute ventilation. This target threshold prevents under and over ventilation by dynamically increasing (for hypopneas) or decreasing (for hyperpnea's) inspiratory pressure support (IPS) as needed. Together with a back-up respiratory rate (set dynamically at 15 breaths/min), when a patient's minute ventilation falls below the set target, ResMed's ASV automatically adjusts the inspiratory pressure support to provide the ventilation needed. As breathing stabilizes, the pressure delivered is rapidly reduced back towards the minimum required.

The Philips Respironics ASV targets the average peak flow, which is calculated over a 4-minute moving window. Like ResMed ASV, the EPAP serves to stabilize upper airway obstruction, while the IPAP max increases when the flow signal is below the target peak flow. If the flow target is reached, the device does not offer any additional pressure support or a minimum level of support if the IPAP minimum is slightly above EPAP. The Philips Respironics ASV device has two methods of setting a backup rate: a fixed rate determined by the operator, or an auto mode that synchronizes with the patient's intrinsic rate.

(D) Procedure

(1) Upon receiving an order for ASV with a qualifying diagnosis, the Sleep Lab will call and schedule the patient for an in-lab titration.

Note: It is recommended to have an entire night to accurately titrate a patient on ASV. If a patient fails CPAP and BPAP during a routine titration the sleep technologist will document findings and recommendations for the physician during his/her review. Additionally, all servo ventilation orders must be written by a sleep physician and patients must have a Left Ventricular Ejection Fraction (LVEF) > 45% charted.

(2) American Academy of Sleep Medicine (AASM) definitions for optimal, good, adequate, and unacceptable titration:

(a) Optimal titration reduces the Apnea Hypopnea Index (AHI) < 5 for at least 15 minutes' duration and should include supine Rapid Eye Movement (REM) sleep at the selected pressure that is not continually interrupted by spontaneous arousals or awakenings.

(b) A good titration reduces the AHI<10 or by 50% if the baseline AHI is <15 and should include supine REM that is not continually interrupted by spontaneous arousals or awakenings at the selected pressure.

(c) An adequate titration does not reduce the AHI ≤ 10 but reduces the AHI by 75% from baseline (especially in severe OSA patients) or one in which the titration grading criteria for optimal or good are met with the exception that Supine REM did not occur at the selected pressure.

(d) An unacceptable titration is one that does not meet any of the above definitions.

(3) Training.

If the patient has been on CPAP or BPAP, then it is up to the technician to assess whether ASV training is necessary, although generally it is recommended. Patients with poor prior experience will typically benefit from training. Patient education and ASV training shall be performed in the same manner as specified by the **CPAP Titration Procedure**. During training (to be conducted on bilevel), the EPAP setting shall be maintained at its lowest level (i.e., 4 cm H_2O), while IPAP pressure shall begin at 8 cm H_2O, and be gradually increased to 10 cm H_2O at the end of the training session.

(a) Explain test/expectations to the patient.
(b) Set-up and inspect for minimalization of leak.
(c) Add heated humidification using sterile water.
(d) Fit the patient with an interface and headgear.
(e) Allow patient to test/feel pressure prior to starting hook-up.
(f) Select ASV.
(g) Initial settings per ASV protocol (see attached).
    (i) EPAP 5 cm H2O.
    (ii) Minimum Pressure Support (Min PS) 3 cm H2O.
    (iii) Maximum Pressure Support (Max PS) 15 cm H2O.
(h) Follow the ASV flow chart (refer to the attached algorithm). If EPAP reaches maximum, increase the Max EPAP for obstructive events 1 cm H2O until obstructive events are resolved.
(i) Chart all settings and patient tolerance.

(4) Components
(a) Patient education
(b) Patient hook-up
    (i) International 10-20 hook-up.
    (ii) Chin Electromyograph (EMG).
    (iii) Eye Electrooculogram (EOG).
    (iv) Anterior Tibialis leads right and left.

(v) Chest Respiratory Inductance Plethysmography (RIP) belts.
(vi) Abdomen RIP belt.
(vii) Oximeter.
(viii) Snore microphone.

(c) Patient to bed
(d) Lights out
(e) Impedance check
(f) Machine calibration
(g) Patient calibration
(h) Machine calibration
(i) Lights on
(j) Disassemble PAP device, remove all electrodes, and process each for disinfection or disposal per policy.

(E) Reference.

See Procedure Adaptive Servo Ventilation Titration

Approved by:	**Policies Superseded by this Policy:**
	• *None*
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