Medical Coverage Policy | Phrenic Nerve Stimulation for Central Sleep Apnea

EFFECTIVE DATE: 07|01|2022
POLICY LAST REVIEWED: 07|15|2026

OVERVIEW
Central sleep apnea (CSA) is characterized by sleep-disordered breathing due to diminished or absent respiratory effort. Central sleep apnea may be idiopathic or secondary (associated with a medical condition, drugs, or high-altitude breathing). The use of positive airway pressure devices is currently the most common form of therapy for CSA. An implantable device that stimulates the phrenic nerve in the chest is a potential alternative treatment. The battery-powered device sends signals to the diaphragm in order to stimulate breathing and normalize sleep-related breathing patterns.

MEDICAL CRITERIA
Not applicable

PRIOR AUTHORIZATION
Not applicable

POLICY STATEMENT
Medicare Advantage Plans
The use of phrenic nerve stimulation for central sleep apnea is not covered as the evidence is insufficient to determine the effects of the technology on health outcomes.

Commercial Products
The use of phrenic nerve stimulation for central sleep apnea is considered not medically necessary as the evidence is insufficient to determine the effects of the technology on health outcomes.

COVERAGE
Benefits may vary between groups and contracts. Please refer to the appropriate section of the Benefit Booklet, Evidence of Coverage or Subscriber Agreement for applicable not medically necessary benefits/coverage.

BACKGROUND
Central Sleep Apnea
Central sleep apnea (CSA) is characterized by repetitive cessation or decrease in both airflow and ventilatory effort during sleep. Central sleep apnea may be idiopathic or secondary (associated with a medical condition such as congestive heart failure, drugs, or high altitude breathing). Apneas associated with Cheyne-Stokes respiration are common among individuals with heart failure (HF) or who have had strokes, and account for about half of the population with CSA. Central sleep apnea is less common than obstructive sleep apnea. Based on analyses of a large community-based cohort of participants 40 years of age and older in the Sleep Heart Health Study, the estimated prevalence of CSA and obstructive sleep apnea are 0.9% and 47.6%, respectively.1, Risk factors for CSA include age (>65 years), male gender, history of HF, history of stroke, other medical conditions (acromegaly, renal failure, atrial fibrillation, low cervical tetraplegia, and primary mitochondrial diseases), and opioid use. Individuals with CSA have difficulty maintaining sleep and therefore experience excessive daytime sleepiness, poor concentration, and morning headaches, and are at higher risk for accidents and injuries.

Treatment
The goal of treatment is to normalize sleep-related breathing patterns. Because most cases of CSA are secondary to an underlying condition, central nervous system pathology, or medication side effects, treatment

of the underlying condition or removal of the medication may improve CSA. Treatment recommendations differ depending on the classification of CSA as either hyperventilation-related (most common, including primary CSA and those relating to HF or high altitude breathing) or hypoventilation-related (less common, relating to central nervous system diseases or use of nervous system suppressing drugs such as opioids).

For individuals with hyperventilation-related CSA, continuous positive airway pressure (CPAP) is considered first-line therapy. Due to CPAP discomfort, individual compliance may become an issue. Supplemental oxygen during sleep may be considered for individuals experiencing hypoxia during sleep or who cannot tolerate CPAP. Individuals with CSA due to HF with an ejection fraction >45%, and who are not responding with CPAP and oxygen therapy, may consider bilevel positive airway pressure or adaptive servo-ventilation (ASV) as second-line therapy. Bilevel positive airway pressure devices have 2 pressure settings, 1 for inhalation and 1 for exhalation. Adaptive servo-ventilation uses both inspiratory and expiratory pressure, and titrates the pressure to maintain adequate air movement. However, a clinical trial reported increased cardiovascular mortality with ASV in individuals with CSA due to HF and with an ejection fraction <45%,2, and therefore, ASV is not recommended for this group.

For individuals with hypoventilation-related CSA, first-line therapy is bilevel positive airway pressure.

Pharmacologic therapy with a respiratory stimulant may be recommended to individuals with hyper- or hypoventilation CSA who do not benefit from positive airway pressure devices, though close monitoring is necessary due to the potential for adverse effects such as rapid heart rate, high blood pressure, and panic attacks.

Phrenic Nerve Stimulation

Several phrenic nerve stimulation systems are available for individuals who are ventilator dependent. These systems stimulate the phrenic nerve in the chest, which sends signals to the diaphragm to restore a normal breathing pattern. Currently, there is 1 phrenic nerve stimulation device approved by the U.S. Food and Drug Administration (FDA) for CSA, the remede System (Respicardia, Inc.). A cardiologist implants the battery powered device under the skin in the right or left pectoral region using local anesthesia. The device has 2 leads, 1 to stimulate a phrenic nerve (either the left pericardiophrenic or right brachiocephalic vein) and 1 to sense breathing. The device runs on an algorithm that activates automatically at night when the individual is in a sleeping position, and suspends therapy when the individual sits up. Individual-specific changes in programming can be conducted externally by a programmer.

Regulatory Status

In October 2017, the FDA approved the remede System (Respicardia, Inc; Minnetonka, MN) through the premarket approval application process. The approved indication is for treatment of moderate to severe CSA in adults. Follow-up will continue for 5 years in the post-approval study.

For individuals with CSA who receive phrenic nerve stimulation, the evidence includes a systematic review, 1 randomized controlled trial (RCT), and observational studies. Relevant outcomes are change in disease status, functional outcomes, and quality of life. The RCT compared the use of phrenic nerve stimulation to no treatment among patients with CSA of various etiologies. All patients received implantation of the phrenic nerve stimulation system, with activation of the system after 1 month in the intervention group and activation after 6 months in the control group. Activation is delayed 1 month after implantation to allow for lead healing. At 6 months follow-up, the patients with the activated device experienced significant improvements in several sleep metrics and quality of life measures. At 12 months follow-up, patients in the activated device arm showed sustained significant improvements from baseline in sleep metrics and quality of life. A subgroup analysis of patients with heart failure combined 6- and 12-month data from patients in the intervention group and 12- and 18-month data from the control group. Results from this subgroup analysis showed significant improvements in sleep metrics and quality of life at 12 months compared with baseline. Results from observational studies supported the results of the RCT. An invasive procedure would typically be considered only if non-surgical treatments had failed, but there is limited data in which phrenic nerve stimulation was evaluated in patients who had failed the current standard of care, positive airway pressure, or respiratory

stimulant medication. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

CODING

Medicare Advantage Plans and Commercial Products

The following code(s) are not covered for Medicare Advantage Plans and not medically necessary for Commercial Products:

33276 Insertion of phrenic nerve stimulator system (pulse generator and stimulating lead[s]), including vessel catheterization, all imaging guidance, and pulse generator initial analysis with diagnostic mode activation, when performed

33277 Insertion of phrenic nerve stimulator transvenous sensing lead (List separately in addition to code for primary procedure)

33281 Repositioning of phrenic nerve stimulator transvenous lead(s)

93150 Therapy activation of implanted phrenic nerve stimulator system, including all interrogation and programming

93151 Interrogation and programming (minimum one parameter) of implanted phrenic nerve stimulator system

93152 Interrogation and programming of implanted phrenic nerve stimulator system during polysomnography

93153 Interrogation without programming of implanted phrenic nerve stimulator system

RELATED POLICIES

Removal of Implantable Devices

PUBLISHED

Provider Update, September 2026
Provider Update, August 2025
Provider Update, September 2024
Provider Update, August 2023
Provider Update, May 2022

REFERENCES

1. Centers for Medicare and Medicaid Services. Local Coverage Determination: Transvenous Phrenic Nerve Stimulation in the Treatment of Central Sleep Apnea (A57548). 2019 (retired 2022). https://localcoverage.cms.gov/mcd_archive/view/article.aspx?articleInfo=57548:10. Last Accessed April 11, 2025.
2. Donovan LM, Kapur VK. Prevalence and Characteristics of Central Compared to Obstructive Sleep Apnea: Analyses from the Sleep Heart Health Study Cohort. Sleep. Jul 01 2016; 39(7): 1353-9. PMID 27166235
3. Cowie MR, Woehrle H, Wegscheider K, et al. Adaptive Servo-Ventilation for Central Sleep Apnea in Systolic Heart Failure. N Engl J Med. Sep 17 2015; 373(12): 1095-105. PMID 26323938
4. Wang Y, Huang Y, Xia M, et al. Effect of phrenic nerve stimulation on patients with central sleep apnea: A meta-analysis. Sleep Med Rev. Aug 2023; 70: 101819. PMID 37467524
5. Costanzo MR, Javaheri S, Ponikowski P, et al. Transvenous Phrenic Nerve Stimulation for Treatment of Central Sleep Apnea: Five-Year Safety and Efficacy Outcomes. Nat Sci Sleep. 2021; 13: 515-526. PMID 33953626
6. Oldenburg O, Costanzo MR, Germany R, et al. Improving Nocturnal Hypoxemic Burden with Transvenous Phrenic Nerve Stimulation for the Treatment of Central Sleep Apnea. J Cardiovasc Transl Res. Apr 2021; 14(2): 377-385. PMID 32789619
7. Costanzo MR, Goldberg LR, Ponikowski P, Augostini R, Stellbrink C, Abraham W. Phrenic nerve simulation for central sleep apnea is effective and safe in the presence of concomitant cardiac devices. J Card Fail; Aug 2018; 24(8):S17-8.
8. Zhang X, Ding N, Ni B, et al. Safety and feasibility of chronic transvenous phrenic nerve stimulation for treatment of central sleep apnea in heart failure patients. Clin Respir J. Mar 2017; 11(2): 176-184. PMID 26072733

9. Fox H, Bitter T, Horstkotte D, et al. Long-Term Experience with First-Generation Implantable Neurostimulation Device in Central Sleep Apnea Treatment. Pacing Clin Electrophysiol. May 2017; 40(5): 498-503. PMID 28211952
10. Jagielski D, Ponikowski P, Augostini R, et al. Transvenous stimulation of the phrenic nerve for the treatment of central sleep apnoea: 12 months' experience with the remedē ® System. Eur J Heart Fail. Nov 2016; 18(11): 1386-1393. PMID 27373452
11. Costanzo MR, Ponikowski P, Javaheri S, et al. Transvenous neurostimulation for central sleep apnoea: a randomised controlled trial. Lancet. Sep 03 2016; 388(10048): 974-82. PMID 27598679
12. Abraham WT, Jagielski D, Oldenburg O, et al. Phrenic nerve stimulation for the treatment of central sleep apnea. JACC Heart Fail. May 2015; 3(5): 360-369. PMID 25770408
13. Ponikowski P, Javaheri S, Michalkiewicz D, et al. Transvenous phrenic nerve stimulation for the treatment of central sleep apnoea in heart failure. Eur Heart J. Apr 2012; 33(7): 889-94. PMID 21856678
14. Zhang XL, Ding N, Wang H, et al. Transvenous phrenic nerve stimulation in patients with Cheyne-Stokes respiration and congestive heart failure: a safety and proof-of-concept study. Chest. Oct 2012; 142(4): 927-934. PMID 22302299
15. Costanzo MR, Augostini R, Goldberg LR, et al. Design of the remedē System Pivotal Trial: A Prospective, Randomized Study in the Use of Respiratory Rhythm Management to Treat Central Sleep Apnea. J Card Fail. Nov 2015; 21(11): 892-902. PMID 26432647
16. Costanzo MR, Ponikowski P, Javaheri S, et al. Sustained 12 Month Benefit of Phrenic Nerve Stimulation for Central Sleep Apnea. Am J Cardiol. Jun 01 2018; 121(11): 1400-1408. PMID 29735217
17. Fox H, Oldenburg O, Javaheri S, et al. Long-term efficacy and safety of phrenic nerve stimulation for the treatment of central sleep apnea. Sleep. Oct 21 2019; 42(11). PMID 31634407
18. Baumert M, Immanuel S, McKane S, et al. Transvenous phrenic nerve stimulation for the treatment of central sleep apnea reduces episodic hypoxemic burden. Int J Cardiol. May 01 2023; 378: 89-95. PMID 36841294
19. Baumert M, Linz D, McKane S, et al. Transvenous phrenic nerve stimulation is associated with normalization of nocturnal heart rate perturbations in patients with central sleep apnea. Sleep. Sep 08 2023; 46(9). PMID 37284759
20. Hartmann S, Immanuel S, McKane S, et al. Transvenous phrenic nerve stimulation for treating central sleep apnea may regulate sleep microstructure. Sleep Med. Jan 2024; 113: 70-75. PMID 37988861
21. Samii S, McKane S, Meyer TE, et al. Analysis by sex of safety and effectiveness of transvenous phrenic nerve stimulation. Sleep Breath. Mar 2024; 28(1): 165-171. PMID 37436669
22. Abraham WT, Oldenburg O, Lainscak M, et al. Win ratio analysis of transvenous phrenic nerve stimulation to treat central sleep apnoea in heart failure. ESC Heart Fail. Feb 2025; 12(1): 80-86. PMID 39422417
23. Javaheri S, McKane SW, Germany RE. Changes in quality of life in patients with atrial fibrillation and central sleep apnea treated with transvenous phrenic nerve stimulation. Sleep Med. May 2026; 141: 108824. PMID 41643229
24. Costanzo MR, Ponikowski P, Coats A, et al. Phrenic nerve stimulation to treat patients with central sleep apnoea and heart failure. Eur J Heart Fail. Dec 2018; 20(12): 1746-1754. PMID 30303611
25. Hill L, Meyer T, McKane S, et al. Transvenous phrenic nerve stimulation to treat central sleep apnoea in patients with heart failure may improve sleep, quality of life, and symptoms. Eur J Cardiovasc Nurs. Jul 19 2023; 22(5): 489-497. PMID 36125322
26. Wang Y, Schoebel J, Han J, et al. Phrenic nerve stimulation for the treatment of central sleep apnea in patients with heart failure. Sleep Breath. Jun 2023; 27(3): 1027-1032. PMID 35978055
27. Badr MS, Khayat RN, Allam JS, et al. Treatment of central sleep apnea in adults: an American Academy of Sleep Medicine clinical practice guideline. J Clin Sleep Med. Dec 01 2025; 21(12): 2181-2191. PMID 40820608

CLICK THE ENVELOPE ICON BELOW TO SUBMIT COMMENTS

This medical policy is made available to you for informational purposes only. It is not a guarantee of payment or a substitute for your medical judgment in the treatment of your individuals. Benefits and eligibility are determined by the member's subscriber agreement or member certificate and/or the employer agreement, and those documents will supersede the provisions of this medical policy. For information on member-specific benefits, call the provider call center. If you provide services to a member which are determined to not be medically necessary (or in some cases medically necessary services which are non-covered benefits), you may not charge the member for the services unless you have informed the member and they have agreed in writing in advance to continue with the treatment at their own expense. Please refer to your participation agreement(s) for the applicable provisions. This policy is current at the time of publication; however, medical practices, technology, and knowledge are constantly changing. BCBSRI reserves the right to review and revise this policy for any reason and at any time, with or without notice. Blue Cross & Blue Shield of Rhode Island is an independent licensee of the Blue Cross and Blue Shield Association.