



MASSACHUSETTS

Blue Cross Blue Shield of Massachusetts is an Independent Licensee of the Blue Cross and Blue Shield Association

Medical Policy Inhaled Nitric Oxide

Table of Contents

- [Policy: Commercial](#)
- [Policy: Medicare](#)
- [Authorization Information](#)
- [Coding Information](#)
- [Description](#)
- [Policy History](#)
- [Information Pertaining to All Policies](#)
- [References](#)

Policy Number: 100

BCBSA Reference Number: 8.01.37

NCD/LCD: N/A

Related Policies

None

Policy

Commercial Members: Managed Care (HMO and POS), PPO, and Indemnity Medicare HMO BlueSM and Medicare PPO BlueSM Members

Inhaled nitric oxide may be **MEDICALLY NECESSARY** as a component of treatment of hypoxic respiratory failure in neonates born at 34 or more weeks of gestation.

Other indications for inhaled nitric oxide are **INVESTIGATIONAL** including, but not limited to:

- Treatment of premature neonates born at less than or equal to 34 weeks of gestation with hypoxic respiratory failure
- Treatment of adults and children with acute hypoxemic respiratory failure
- Postoperative use in adults and children with congenital heart disease
- In lung transplantation, during and/or after graft reperfusion.

Prior Authorization Information

Inpatient

- For services described in this policy, precertification/preauthorization **IS REQUIRED** for all products if the procedure is performed **inpatient**.

Outpatient

- For services described in this policy, see below for products where prior authorization **might be required** if the procedure is performed **outpatient**.

	Outpatient
Commercial Managed Care (HMO and POS)	Prior authorization is not required .
Commercial PPO and Indemnity	Prior authorization is not required .
Medicare HMO Blue SM	Prior authorization is not required .

CPT Codes / HCPCS Codes / ICD Codes

Inclusion or exclusion of a code does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage as it applies to an individual member.

Providers should report all services using the most up-to-date industry-standard procedure, revenue, and diagnosis codes, including modifiers where applicable.

CPT Codes

There is no specific CPT code for this service.

Description

HYPOXIC RESPIRATORY FAILURE

Hypoxic respiratory failure may result from respiratory distress syndrome, persistent pulmonary hypertension, meconium aspiration, pneumonia, or sepsis.

Treatment

Treatment typically includes oxygen support, mechanical ventilation, induction of alkalosis, neuromuscular blockade, or sedation.

Extracorporeal membrane oxygenation is an invasive technique that may be considered in neonates when other therapies fail. Inhaled nitric oxide (INO) is both a vasodilator and a mediator in many physiologic and pathologic processes. INO has also been proposed for use in preterm infants less than 34 weeks of gestation and in adults.

Also, there are several potential uses in surgery. One is the proposed use of INO to manage pulmonary hypertension after cardiac surgery in infants and children with congenital heart disease. In congenital heart disease patients, increased pulmonary blood flow can cause pulmonary hypertension. Cardiac surgery can restore the pulmonary vasculature to normal, but there is the potential for complications, including postoperative pulmonary hypertension, which can prevent weaning from ventilation and is associated with substantial morbidity and mortality. Another potential surgical application is the use of INO in lung transplantation to prevent or reduce reperfusion injury.

Summary

For individuals who are neonates, are term or late preterm at birth, and have hypoxic respiratory failure who receive INO, the evidence includes RCTs and a systematic review. Relevant outcomes are overall survival, hospitalizations, resource utilization, and treatment-related morbidity. Evidence from RCTs and a meta-analysis have supported the use of INO in term or late preterm infants. Pooled analyses of RCT data have found that use of INO significantly reduced the need for extracorporeal membrane oxygenation and the combined outcome of extracorporeal membrane oxygenation or death. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who are neonates, are premature at birth, and have hypoxic respiratory failure who receive INO, the evidence includes RCTs and systematic reviews. Relevant outcomes are overall survival, hospitalizations, resource utilization, and treatment-related morbidity. A large number of RCTs have evaluated INO for premature neonates, and most trials have reported no significant difference for primary end points such as mortality and bronchopulmonary dysplasia. Meta-analyses of these RCTs have not found better survival rates in patients who received INO compared with a control intervention. Most meta-analyses also did not report improvements in other outcomes with INO (eg, bronchopulmonary dysplasia, intracranial hemorrhage). The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who are adults and children in acute hypoxemic respiratory failure who receive INO, the evidence includes RCTs and systematic reviews. Relevant outcomes are overall survival,

hospitalizations, resource utilization, and treatment-related morbidity. A large number of RCTs have evaluated INO for treatment of acute hypoxemic respiratory failure. Meta-analyses of these RCTs have not found that INO significantly reduced mortality or shortened the duration of mechanical ventilation. Some evidence from a meta-analysis of 4 RCTs and a cohort study has suggested that INO may be associated with an increased risk of renal impairment in patients with acute respiratory distress syndrome. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who are adults and children with congenital heart disease who have had heart surgery who receive INO, the evidence includes RCTs and a systematic review. Relevant outcomes are overall survival, hospitalizations, resource utilization, and treatment-related morbidity. Evidence from a number of small RCTs and a systematic review of these trials did not find a significant benefit for INO on mortality and other health outcomes in the postoperative management of children with congenital heart disease. There is less evidence on INO for adults with congenital heart disease. One RCT found that treatment with INO did not improve the postoperative outcomes of adults with congestive heart failure. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have lung transplant who receive INO, the evidence includes RCTs and a systematic review. Relevant outcomes are overall survival, hospitalizations, resource utilization, and treatment-related morbidity. Several small RCTs have evaluated INO after lung transplantation; none found statistically significant improvements in health outcomes with INO. A systematic review of RCTs and observational studies concluded that available evidence did not support the routine use of INO after lung transplant. The evidence is insufficient to determine the effects of the technology on health outcomes.

Policy History

Date	Action
6/2018	New references added from BCBSA National medical policy. Background and summary clarified.
6/2017	New references added from BCBSA National medical policy.
10/2016	BCBSA National medical policy review. Investigational statement reformatted for clarity. Added investigational bullet points: Postoperative use in adults and children with congenital heart disease and in lung transplantation during and/or after graft reperfusion. Effective 10/1/2016.
12/2014	New references added from BCBSA National medical policy.
1/2014	New references added from BCBSA National medical policy.
4/2013	BCBSA National medical policy review. Changes to policy statement. Effective 4/2013.
11/2011-4/2012	Medical policy ICD 10 remediation: Formatting, editing and coding updates. No changes to policy statements.
5/2011	Reviewed - Medical Policy Group - Pediatrics and Endocrinology. No changes to policy statements.
4/2011	Reviewed - Medical Policy Group - Cardiology and Pulmonology. No changes to policy statements.
5/2010	Reviewed - Medical Policy Group - Pediatrics and Endocrinology. No changes to policy statements.
3/2010	Reviewed - Medical Policy Group - Allergy and ENT/Otolaryngology. No changes to policy statements.
6/2009	Medical policy #100, effective 6/2009, describing covered and non-covered indications.

Information Pertaining to All Blue Cross Blue Shield Medical Policies

Click on any of the following terms to access the relevant information:

[Medical Policy Terms of Use](#)

[Managed Care Guidelines](#)

[Indemnity/PPO Guidelines](#)

[Clinical Exception Process](#)

References

1. Barrington KJ, Finer N, Pennaforte T, et al. Nitric oxide for respiratory failure in infants born at or near term. *Cochrane Database Syst Rev*. Jan 05 2017;1:Cd000399. PMID 28056166
2. Barrington KJ, Finer N, Pennaforte T. Inhaled nitric oxide for respiratory failure in preterm infants. *Cochrane Database Syst Rev*. Jan 03 2017;1:Cd000509. PMID 28045472
3. Yang Y, Feng Y, Zhou XG, et al. Inhaled nitric oxide in preterm infants: An updated meta-analysis. *J Res Med Sci*. Dec 2016;21:41. PMID 27904587
4. Donohue PK, Gilmore MM, Cristofalo E, et al. Inhaled nitric oxide in preterm infants: a systematic review. *Pediatrics*. Feb 2011;127(2):e414-422. PMID 21220391
5. Mercier JC, Hummler H, Durrmeyer X, et al. Inhaled nitric oxide for prevention of bronchopulmonary dysplasia in premature babies (EUNO): a randomised controlled trial. *Lancet*. Jul 31 2010;376(9738):346-354. PMID 20655106
6. Durrmeyer X, Hummler H, Sanchez-Luna M, et al. Two-year outcomes of a randomized controlled trial of inhaled nitric oxide in premature infants. *Pediatrics*. Aug 12 2013;132(3):e695-703. PMID 23940237
7. Gebistorf F, Karam O, Wetterslev J, et al. Inhaled nitric oxide for acute respiratory distress syndrome (ARDS) in children and adults. *Cochrane Database Syst Rev*. Jun 27 2016(6):Cd002787. PMID 27347773
8. Adhikari NK, Dellinger RP, Lundin S, et al. Inhaled nitric oxide does not reduce mortality in patients with acute respiratory distress syndrome regardless of severity: systematic review and meta-analysis. *Crit Care Med*. Feb 2014;42(2):404-412. PMID 24132038
9. Afshari A, Brok J, Moller AM, et al. Inhaled nitric oxide for acute respiratory distress syndrome and acute lung injury in adults and children: a systematic review with meta-analysis and trial sequential analysis. *Anesth Analg*. Jun 2011;112(6):1411-1421. PMID 21372277
10. Ruan SY, Wu HY, Lin HH, et al. Inhaled nitric oxide and the risk of renal dysfunction in patients with acute respiratory distress syndrome: a propensity-matched cohort study. *Crit Care*. Nov 30 2016;20(1):389. PMID 27903300
11. Potapov E, Meyer D, Swaminathan M, et al. Inhaled nitric oxide after left ventricular assist device implantation: a prospective, randomized, double-blind, multicenter, placebo-controlled trial. *J Heart Lung Transplant*. Aug 2011;30(8):870-878. PMID 21530317
12. Bizzarro M, Gross I, Barbosa FT. Inhaled nitric oxide for the postoperative management of pulmonary hypertension in infants and children with congenital heart disease. *Cochrane Database Syst Rev*. Jul 3 2014;7(7):CD005055. PMID 24991723
13. Miller OI, Tang SF, Keech A, et al. Inhaled nitric oxide and prevention of pulmonary hypertension after congenital heart surgery: a randomised double-blind study. *Lancet*. Oct 28 2000;356(9240):1464-1469. PMID 11081528
14. Tavare AN, Tsakok T. Does prophylactic inhaled nitric oxide reduce morbidity and mortality after lung transplantation? *Interact Cardiovasc Thorac Surg*. Nov 2011;13(5):516-520. PMID 21791520
15. Meade MO, Granton JT, Matte-Martyn A, et al. A randomized trial of inhaled nitric oxide to prevent ischemia-reperfusion injury after lung transplantation. *Am J Respir Crit Care Med*. Jun 1 2003;167(11):1483-1489. PMID 12770854
16. Perrin G, Roch A, Michelet P, et al. Inhaled nitric oxide does not prevent pulmonary edema after lung transplantation measured by lung water content: a randomized clinical study. *Chest*. Apr 2006;129(4):1024-1030. PMID 16608953
17. Botha P, Jeyakanthan M, Rao JN, et al. Inhaled nitric oxide for modulation of ischemia-reperfusion injury in lung transplantation. *J Heart Lung Transplant*. Nov 2007;26(11):1199-1205. PMID 18022088
18. Kinsella JP, Steinhorn RH, Krishnan US, et al. Recommendations for the use of inhaled nitric oxide therapy in premature newborns with severe pulmonary hypertension. *J Pediatr*. Mar 2016;170:312-314. PMID 26703869
19. Cole FS, Alleyne C, Barks JD, et al. NIH Consensus Development Conference statement: inhaled nitric-oxide therapy for premature infants. *Pediatrics*. Feb 2011;127(2):363-369. PMID 21220405
20. American Academy of Pediatrics, Committee on Fetus and Newborn. Use of inhaled nitric oxide. *Pediatrics*. Aug 2000;106(2 Pt 1):344-345. PMID 10920164
21. Kumar P, Committee on F, Newborn, et al. Use of inhaled nitric oxide in preterm infants. *Pediatrics*. Jan 2014;133(1):164-170. PMID 24379225