Noninvasive Ventilation Strategies in Neonates

Review Article

Volume 62, Pages 451-460, June 2025

Jogender Kumar[1] · Praveen Kumar[1] · Vineet Bhandari[2]

[1]Neonatal Unit, Department of Pediatrics Post Graduate Institute of Medical Education and Research, Chandigarh 160012, India; [2]Division of Neonatology, Department of Pediatrics, Cooper Medical School of Rowan University, The Children's Regional Hospital at Cooper, One Cooper Plaza , Camden, NJ 08103, USA.

Correspondence to: Vineet Bhandari, bhandari-vineet@cooperhealth.edu

Received: 31 January 2025 / Accepted: 24 March 2025 / Published online: 29 April 2025

https://doi.org/10.1007/s13312-025-00077-7

ABSTRACT

We provide recommendations on neonatal noninvasive ventilation (NIV) strategies used in the delivery room (DR) and neonatal intensive care unit (NICU). A systematic search was performed in the PubMed, Embase, and CENTRAL databases to identify relevant literature from the past 5 years. A critical review of the available literature was conducted to provide context-specific recommendations. In the DR, we recommend using nasal continuous positive airway pressure (NCPAP) or nasal intermittent positive pressure ventilation (NIPPV) with a T-piece resuscitator (TPR). Surfactant replacement therapy should be administered early (< 2 h of life) in infants requiring NCPAP of 6–7 cm H_2O and FiO_2 >0.3, using less invasive surfactant administration techniques. Infants should be transported to the NICU on positive pressure support using NCPAP or TPR. In extremely preterm infants with severe respiratory distress requiring intubation in the DR, surfactant should be considered during the intubation. If equipment and expertise are available in the NICU, NIPPV is the preferred mode of NIV. Nasal masks or short binasal prongs are the preferred nasal interfaces. A heated, humidified, high flow nasal cannula is not recommended as the primary mode of NIV. Additional clinical trials are needed for nasal high frequency ventilation and noninvasive ventilation neurally adjusted ventilatory assist modes of NIV. Guidelines for the recommended initial and maximal settings for primary, post-extubation, and weaning off NIV in neonates are provided in this article. NIPPV and NCPAP are the preferred modes of NIV in neonates with respiratory distress.

Keywords: Preterm · RDS · NCPAP · NIPPV · HHHFNC · NIV-NAVA · NHFV · NIV

REFERENCES

1. De Luca D, Tingay DG, van Kaam AH, et al. Epidemiology of neonatal acute respiratory distress syndrome: prospective, multicenter, international cohort study. Pediatr Crit Care Med. 2022;23:524–34.
2. Tribolet S, Hennuy N, Rigo V. Ventilation devices for neonatal resuscitation at birth: a systematic review and meta-analysis. Resuscitation. 2023;183:109681.
3. Guideline 13.4. Airway management and mask ventilation of the newborn [Internet]. ANZCOR Guidel. Accessed on Mar 12, 2025. Available from: https://www.anzcor.org/home/neonatal-resuscitation/guideline-13-4-airway-management-and-mask-ventilation-ofthe-newborn/ .

4. Perlman JM, Wyllie J, Kattwinkel J, et al. Part 7: neonatal resuscitation: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. Circulation. 2015;132:S204-241.
5. Sotiropoulos JX, Oei JL, Schmölzer GM, et al. Initial oxygen concentration for the resuscitation of infants born at less than 32 weeks' gestation: a systematic review and individual participant data network meta-analysis. JAMA Pediatr. 2024;178:774–83.
6. Schmölzer GM, Kumar M, Pichler G, Aziz K, O'Reilly M, Cheung P-Y. Non-invasive versus invasive respiratory support in preterm infants at birth: systematic review and meta-analysis. BMJ. 2013;347:f5980.
7. Sweet DG, Carnielli VP, Greisen G, et al. European consensus guidelines on the management of respiratory distress syndrome: 2022 update. Neonatology. 2023;120:3–23.
8. National Neonatology Forum India. Guidelines on non-invasive respiratory support for neonates [Internet]. National Neonatology Forum. India. Accessed on Dec 30, 2024. Available from: https://www.nnfiorg/assests/upload/cpg-pdf/CPAP-Guidelines-draft--deid.pdf
9. Bhandari V, Black R, Gandhi B, et al. RDS-NExT workshop: consensus statements for the use of surfactant in preterm neonates with RDS. J Perinatol. 2023;43:982–90.
10. Ramaswamy VV, Bandyopadhyay T, Abiramalatha T, et al. Clinical decision thresholds for surfactant administration in preterm infants: a systematic review and network meta-analysis. EClinicalMedicine. 2023;62:102097.
11. Silveira RC, Panceri C, Munõz NP, Carvalho MB, Fraga AC, Procianoy RS. Less invasive surfactant administration versus intubation-surfactant-extubation in the treatment of neonatal respiratory distress syndrome: a systematic review and meta-analyses. J Pediatr (Rio J). 2024;100:8–24.
12. Pawale D, Anne RP, Oleti T, Murki S, Fursule A. A survey of less invasive surfactant administration usage in India. Indian J Pediatr. 2023;90(2):181–3.
13. KarlinskiVizentin V, de Madeira Sá Pacheco I, Fahel Vilas BôasAzevêdo T, de FlorêncioMesquita C, Alvim Pereira R. Early versus late caffeine therapy administration in preterm neonates: an updated systematic review and meta-analysis. Neonatology. 2024;121:7–16.
14. Dumpa V, Avulakunta I, Bhandari V. Respiratory management in the premature neonate. Expert Rev Respir Med. 2023;17:155–70.
15. Bharadwaj SK, Alonazi A, Banfi eld L, Dutta S, Mukerji A. Bubble versus other continuous positive airway pressure forms: a systematic review and meta-analysis. Arch Dis Child Fetal Neonatal Ed. 2020;105:526–31.
16. Kumar J, Yadav B, Meena J, Sundaram V, Dutta S, Kumar P. Periodic rotation versus continuous application of same nasal interface for non-invasive respiratory support in preterm neonates: a systematic review and meta-analysis. Indian J Pediatr. 2024;91:1250–61.
17. Prakash R, De Paoli AG, Oddie SJ, Davis PG, McGuire W. Masks versus prongs as interfaces for nasal continuous positive airway pressure in preterm infants. Cochrane Database Syst Rev. 2022;11:CD015129.
18. Kumar J, Meena J, Debata P, Sundaram V, Dutta S, Kumar P. RAM cannula versus short binasal prongs for non-invasive ventilation in preterm infants: an updated systematic review and metaanalysis. Indian J Pediatr. 2024 Aug 1; Online ahead of print.
19. Sharma D, Murki S, Maram S, et al. Comparison of delivered distending pressures in the oropharynx in preterm infant on bubble CPAP and on three different nasal interfaces. Pediatr Pulmonol. 2020;55:1631–9.
20. Ho JJ, Kidman AM, Chua B, Chang G, Fiander M, Davis PG. Nasal continuous positive airway pressure immediately after extubation for preventing morbidity in preterm infants. Cochrane Database Syst Rev. 2024;10:CD000143.
21. Kidman AM, Manley BJ, Boland RA, et al. Higher versus lower nasal continuous positive airway pressure for extubation of extremely preterm infants in Australia (ÉCLAT): a multicentre, randomised, superiority trial. Lancet Child Adolesc Health. 2023;7:844–51.
22. Moresco L, Romantsik O, Calevo MG, Bruschettini M. Non-invasive respiratory support for the management of transient tachypnea of the newborn. Cochrane Database Syst Rev. 2020;4:CD013231.
23. Mustaqeem A, Yadav A, Kumar J, Debata P. Continuous positive airway pressure versus conventional oxygen therapy in meconium aspiration syndrome: a randomized controlled trial. J Trop Pediatr. 2025;71:002.
24. Pandita A, Murki S, Oleti TP, et al. Effect of nasal continuous positive airway pressure on infants with meconium aspiration syndrome: a randomized clinical trial. JAMA Pediatr. 2018;172:161–5.
25. Lemyre B, Deguise M-O, Benson P, Kirpalani H, Ekhaguere OA, Davis PG. Early nasal intermittent positive pressure ventilation (NIPPV) versus early nasal continuous positive airway pressure (NCPAP) for preterm infants. Cochrane Database Syst Rev. 2023;7:CD005384.
26. Rüegger CM, Owen LS, Davis PG. Nasal intermittent positive pressure ventilation for neonatal respiratory distress syndrome. Clin Perinatol. 2021;48:725–44.
27. Kuitunen I, Räsänen K. Non-invasive neurally adjusted ventilatory assist (NIV-NAVA) reduces extubation failures in preterm neonates: a systematic review and meta-analysis. Acta Paediatr. 2024;113:2003–10.
28. John SC, Garg M, Muttineni M, et al. Safety of bubble nasal intermittent positive pressure ventilation (NIPPV) versus bubble nasal continuous positive airway pressure (NCPAP) in preterm infants with respiratory distress. J Perinatol. 2024;44:1252–7.
29. Hodgson KA, Wilkinson D, De Paoli AG, Manley BJ. Nasal high flow therapy for primary respiratory support in preterm infants. Cochrane Database Syst Rev. 2023;5:CD006405.

30. Martins C, Pissarra R, Costa S, Soares H, Guimarães H. Comparison between continuous positive airway pressure and high-flow nasal cannula as postextubation respiratory support in neonates: a systematic review and meta-analysis. Turk Arch Pediatr. 2022;57:581–90.
31 Abdel-Latif ME, Tan O, Fiander M, Osborn DA. Non-invasive high-frequency ventilation in newborn infants with respiratory distress. Cochrane Database Syst Rev. 2024;5:CD012712.
32. van Delft B, Van Ginderdeuren F, Lefevere J, van Delft C, Cools F. Weaning strategies for the withdrawal of non-invasive respiratory support applying continuous positive airway pressure in preterm infants: a systematic review and meta-analysis. BMJ Paediatr, Open. 2020;4:e000858.
33. Balhareth Y, Razak A. High flow nasal cannula for weaning nasal continuous positive airway pressure in preterm infants: a systematic review and meta-analysis. Neonatology. 2024;121:359–69.
34. Murki S, Kandraju H, Oleti T, Saikiran, Gaddam P. Predictors of CPAP failure–10 years' data of multiple trials from a single center: a retrospective observational study. Indian J Pediatr. 2020;87:891–6.
35 Lemyre B, Deguise M-O, Benson P, Kirpalani H, De Paoli AG, Davis PG. Nasal intermittent positive pressure ventilation (NIPPV) versus nasal continuous positive airway pressure(NCPAP) for preterm neonates after extubation. Cochrane Database Syst Rev. 2023;7:CD003212.