



High Flow Therapy Research Study Tool

Lübeck, August 2018

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3 7 9 10 108 110

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25 26 110

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Dysart K, Miller TL, Wolfson MR, Shaffer TH.

Respiratory
Medicine
2009;**103**(10):1400–5.
[PUBMED: 19467849]

<https://www.ncbi.nlm.nih.gov/pubmed/19467849>

Summary:

This article provides a **review of the proposed mechanisms behind the efficacy of high flow therapy** via nasal cannula, which include washout of nasopharyngeal dead space, attenuation of the inspiratory resistance associated with the nasopharynx, improvement in conductance and pulmonary compliance, mild distending pressure and reduction in energy expenditure for gas conditioning.

02 Nasal high flow clears anatomical dead space in upper airway models

[Back](#)

Möller W, Celik G, Feng S, et al.

J Appl Physiol
2015;118(12):1525–1532

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4482836/>

Objective:

The hypothesis of this study was to test whether NHF can clear dead space in two different models of the upper nasal airways.

Result:

This study has shown effective clearance of the tracer gas, demonstrating similar dynamic characteristics despite the very different geometries of the upper airway models. The clearance is linearly related to the NHF rate with an anterior portion of the nasal cavities clearing faster than the posterior portion. We conclude **that clearance of the nasal component of the anatomical dead-space with NHF therapy is a rapid process, which may significantly reduce CO₂ rebreathing.**

03 Oxygen delivery through HFNC increase end-expiratory lung volume & reduce respiratory rate in post-cardiac surgical patients

[Back](#)

Corley A, Caruana LR, Barnett AG, Tronstad O, Fraser JF.

British Journal of Anaesthesia
2011;107(6):998–1004.
[DOI: 10.1093/bja/aer265]

<https://www.ncbi.nlm.nih.gov/pubmed/21908497>

Objective:

Primary objectives were to investigate the **effects of HFNC on airway pressure (Paw) and end-expiratory lung volume (EELV)** and to identify any correlation between the two. Secondary objectives were to investigate the effects of HFNC on **respiratory rate, dyspnoea, tidal volume, and oxygenation**; and the interaction between BMI and EELV.

Result:

HFNCs generate statistically and clinically relevant **increases in oropharyngeal airway pressure and increases in EELV and tidal volume** as demonstrated by changes in lung impedance, particularly in patients with higher BMIs. These changes are associated with **reduced respiratory rate, less dyspnoea, and improved oxygenation**. Thus, HFNC may be a useful treatment option for patients experiencing respiratory dysfunction post-cardiac surgery, particularly those patients who cannot tolerate non-invasive ventilation and those with a higher BMI.

04 High flow nasal oxygen generates positive airway pressure in adult volunteers

[Back](#)

Groves N, Tobin A.

*Aust Crit Care. 2007
Nov;20(4):126-31. Epub
2007 Oct 10.*

<https://www.ncbi.nlm.nih.gov/pubmed/17931878>

Conclusion:

This study has demonstrated that high flow nasal therapy is associated with the generation of significant positive airway pressure in volunteers. In conclusion **there is a degree of CPAP generated with the HFN therapy, which is flow dependent and also dependent on whether the person is breathing with mouth open or closed.**

05 Nasal high-flow therapy delivers low level positive airway pressure

[Back](#)

Parke R, McGuinness S, Eccleston M.

Br J Anaesth. 2009 Dec;103(6):886-90. doi: 10.1093/bja/aep280. Epub 2009 Oct 20.

<https://www.ncbi.nlm.nih.gov/pubmed/19846404>

Objective:

The aim of this prospective study was to determine whether **a level of positive airway pressure was generated** in participants receiving nasal high flow (NHF) in a cardiothoracic and vascular intensive care unit (ICU).

Conclusion:

This study demonstrated that a low level of positive pressure was generated with NHF at 35 l/min of gas flow. This is consistent with results obtained in healthy volunteers.

06 Nasal mucociliary transport in healthy subjects is slower when breathing dry air

[Back](#)

Salah B, Dinh Xuan AT, Fouilladieu JL, Lockhart A, Regnard J.

European Respiratory Journal
1988;1(9):852–5. [PUBMED:
3229484]

<https://www.ncbi.nlm.nih.gov/pubmed/3229484>

Objective:

To assess the effect of dry air (DA) nasal breathing on nasal clearance rate in healthy non-smoking subjects.

Result:

Dry air breathing results in excessive water loss by the nasal mucosa, which may in turn reduce nasal mucociliary clearance rate through changes in the rheological properties or adhesiveness of nasal mucus and/or slowing of ciliary beating.

07 Discomfort associated with under humidified high-flow oxygen therapy in critically ill patients

[Back](#)

Chanques G, Constantin JM, Sauter M, Jung B, Sebbane M, Verzilli D, et al.

Intensive Care Med. 2009 Jun;35(6):996-1003. doi: 10.1007/s00134-009-1456-x. Epub 2009 Mar 18.

<https://www.ncbi.nlm.nih.gov/pubmed/19294365>

Objective:

To measure (1) the discomfort in non-intubated patients under high-flow oxygen therapy (HFOT) humidified with bubble (BH) or heated humidifiers (HH), and (2) the hygrometric properties of oxygen with a BH and an HH.

Result:

Compared to bubble humidifiers, the use of a heated-humidifier in patients with high-flow oxygen therapy is associated with a decrease of dryness symptoms mediated by increased humidity delivered to the patient.

Back

Ricard JD.

Minerva Anesthesiol. 2012
Jul;78(7):836-41. Epub 2012
Apr 24.

<https://www.ncbi.nlm.nih.gov/pubmed/22531566>

Summary:

HFNC rapidly alleviates symptoms of respiratory distress and improves oxygenation by several mechanisms, including deadspace washout, reduction in oxygen dilution and in inspiratory nasopharyngeal resistance, a moderate positive airway pressure effect that may generate alveolar recruitment and an overall greater tolerance and comfort with the interface and the heated and humidified inspired gases. Indications of HFNC are broad, encompassing most if not all causes of acute hypoxemic respiratory failure. HFNC can also provide oxygen during invasive procedures, and be used to prevent or treat post-extubation respiratory failure. HFNC may also alleviate respiratory distress in patients at a palliative stage. Although observational studies suggest that HFNC might reduce the need for intubation in acute hypoxemic respiratory failure; such a reduction has not yet been demonstrated. Beyond this potential additional effect on outcome, the evidence already published argues in favor of the large use of HFNC as first line therapy for acute respiratory failure.

09 High Flow Oxygen Therapy in Acute Respiratory Failure

[Back](#)

Roca O, Riera J, Torres F, Masclans JR.

Respir Care. 2010 Apr;55(4):408-13.

<https://www.ncbi.nlm.nih.gov/pubmed/20406507>

Objective:

To compare the comfort of oxygen therapy via high-flow nasal cannula (HFNC) versus via conventional face mask in patients with acute respiratory failure.

Result:

HFNC was **better tolerated** and **more comfortable** than face mask. HFNC was associated with **better oxygenation** and **lower respiratory rate**. HFNC could have an important role in the treatment of patients with acute respiratory failure.

10 Beneficial effects of humidified high flow nasal oxygen in critical care patients: a prospective pilot study

[Back](#)

Sztrymf B, Messika J, Bertrand F, Hurel D, Leon R, Dreyfuss D, et al.

Intensive Care Medicine
2011;37(11):1780–6.
[PUBMED: 21946925]

<https://www.ncbi.nlm.nih.gov/pubmed/21946925>

Objective:

To evaluate the efficiency, safety and outcome of high flow nasal cannula oxygen (HFNC) in ICU patients with acute respiratory failure.

Result:

HFNC has a beneficial effect on clinical signs and oxygenation in ICU patients with acute respiratory failure.

11 Impact of HFNC oxygen therapy on ICU patients with acute respiratory failure: a prospective observational study.

[Back](#)

Sztrymf B, Messika J, Mayot T, Lenglet H, Dreyfuss D, Ricard JD.

J Crit Care. 2012 Jun;27(3):324.e9-13. doi: 10.1016/j.jcrc.2011.07.075. Epub 2011 Sep 29.

<https://www.ncbi.nlm.nih.gov/pubmed/21958974>

Objective:

The purpose of this study was to determine the **impact of high-flow nasal cannula oxygen (HFNC) on patients with acute respiratory failure (ARF) in comparison with conventional oxygen therapy.**

Result:

Use of HFNC in patients with persistent ARF was associated with significant and sustained improvement of both clinical and biologic parameters.

12 High-flow oxygen administration by nasal cannula for adult and perinatal patients

[Back](#)

Ward JJ.

Respir Care. 2013
Jan;58(1):98-122. doi:
10.4187/respcare.01941.

<https://www.ncbi.nlm.nih.gov/pubmed/23271822>

Objective:

This review will identify **proposed mechanisms for therapeutic effectiveness, current delivery equipment, guidelines for rational patient application**, and direction for further research.

13 Current evidence for the effectiveness of HHHFNC supportive therapy in adult patients with respiratory failure

Back

Roca O, Hernández G, Díaz-Lobato S, et al.

Crit Care 2016;20(1):109.

<https://ccforum.biomedcentral.com/track/pdf/10.1186/s13054-016-1263-z?site=ccforum.biomedcentral.com>

Summary:

High flow nasal cannula (HFNC) supportive therapy has emerged as a safe, useful therapy in patients with respiratory failure, improving oxygenation and comfort. Here we review the current knowledge about HFNC therapy, from its mechanisms of action to its effects on outcomes in different clinical situations.

Conclusion:

Delivery of heated and humidified oxygen at high flow rates through nasal cannula is now widely used in adult patients. Its mechanisms of action and potential clinical benefits can **help to improve the management of patients with either acute or chronic respiratory failure**. With the evidence currently available, several questions still remain unanswered; in the absence of any general recommendations, decisions on HFNC treatment should be individualized in each particular situation. However, HFNC therapy is an innovative and powerful technique that is currently changing the management of patients with respiratory failure.

14 Use of high-flow nasal cannula oxygenation in ICU adults: a narrative review

[Back](#)

Papazian L, Corley , Hess , Fraser J, Frat JP, Guitton C, Jaber S, Maggiore SM, Nava S, Rello J, Ricard JD, Stephan F, Trisolini R, Azoulay E.

Intensive Care Med. 2016 Sep;42(9):1336-49. doi: 10.1007/s00134-016-4277-8. Epub 2016 Mar 11

<https://www.ncbi.nlm.nih.gov/pubmed/26969671>

Objective:

The main aim of this review is to **guide clinicians towards evidence-based clinical practice guidelines**. It summarizes current knowledge about HFNCO use in ICU patients and the potential areas of uncertainties.

Back

Nishimura M.

J Intensive Care. 2015 Mar 31;3(1):15. doi: 10.1186/s40560-015-0084-5. eCollection 2015.

<https://jintensivecare.biomedcentral.com/track/pdf/10.1186/s40560-015-0084-5?site=jintensivecare.biomedcentral.com>

Conclusion:

HFNC oxygen delivery is proving to be a valuable aid and has been gaining attention as an alternative means of respiratory support for critically ill patients. Physicians have been using it for patients with a variety of underlying diseases. **It seems to be effective for treating hypercapnic respiratory failure and mild to moderate hypoxemic respiratory failure.** Some important issues remain to be resolved, however, such as the indication of HFNC and criteria for timing the start of HFNC, for stopping HFNC, and for escalating treatment. Since HFNC is non-invasive, the PEEP (CPAP) level is not measured. Despite these issues, a growing body of evidence suggests that HFNC oxygen therapy is an innovative and effective modality for the early treatment of adults with respiratory failure associated with diverse underlying diseases.

16 The effects of flow on airway pressure during nasal high-flow oxygen therapy

[Back](#)

Parke RL, Eccleston ML,
McGuinness SP.

Respir Care. 2011
Aug;56(8):1151-5. doi:
10.4187/respcare.01106.
Epub 2011 Apr 15.

<https://www.ncbi.nlm.nih.gov/pubmed/21496369>

Objective:

To determine the relationship between flow and pressure with a nasal high-flow oxygen therapy system.

Result:

With the mouth closed, the mean \pm SD airway pressures at 30, 40, and 50 L/min were 1.93 ± 1.25 cm H₂O, 2.58 ± 1.54 cm H₂O, and 3.31 ± 1.05 cm H₂O, respectively. There was a positive linear relationship between flow and pressure.

Conclusion:

The mean nasopharyngeal pressure during nasal high-flow oxygen increases as flow increases.

17 Domiciliary humidification improves lung mucociliary clearance in patients with bronchiectasis

[Back](#)

Hasani A, Chapman TH,
McCool D, Smith RE,
Dilworth JP, Agnew JE.

Chron Respir Dis.
2008;5(2):81-6. doi:
10.1177/1479972307087190

<https://www.ncbi.nlm.nih.gov/pubmed/18539721>

Objective:

Inspired air humidification has been reported to show some benefit in bronchiectasis patients. We have investigated the possibility that one effect might be to enhance mucociliary clearance.

Result:

Following humidification, lung mucociliary clearance significantly improved, the area under the tracheobronchial retention curve decreased from 319 +/- 50 to 271 +/- 46%h ($p < 0.07$). **Warm air humidification treatment improved lung mucociliary clearance in our bronchiectasis patients.**

Lenglet H, Sztrymf B, Leroy C, Brun P, Dreyfuss D, Ricard JD....

Respir Care. 2012 Nov;57(11):1873-8. doi: 10.4187/respcare.01575. Epub 2012 Mar 13.

<https://www.ncbi.nlm.nih.gov/pubmed/22417844>

Objective:

Heated and humidified high flow nasal cannula oxygen therapy (HFNC) represents a new alternative to conventional oxygen therapy that has not been evaluated in the **emergency department** (ED). We aimed to study its feasibility and efficacy in patients exhibiting acute respiratory failure presenting to the ED.

Result:

HFNC is possible in the ED, and it **alleviated dyspnea and improved respiratory parameters** in subjects with **acute hypoxemic respiratory failure**.

19 High-flow nasal oxygen vs high-flow face mask: a randomized crossover trial in extubated patients

Back

Tiruvoipati R, Lewis D, Haji K, Botha J

J Crit Care. 2010 Sep;25(3):463-8. doi: 10.1016/j.jcrc.2009.06.050. Epub 2009 Sep 24.

<https://www.ncbi.nlm.nih.gov/pubmed/19781896>

Objective:

Oxygen delivery after extubation is critical to maintain adequate oxygenation and to avoid reintubation. The delivery of oxygen in such situations is usually by high-flow face mask (HFFM). Yet, this may be uncomfortable for some patients. A recent advance in oxygen delivery technology is high-flow nasal prongs (HFNP). There are no randomized trials comparing these 2 modes.

Result:

High-flow nasal prongs are as effective as HFFM in delivering oxygen to extubated patients who require high-flow oxygen. The tolerance of HFNP was significantly better than in HFFM.

20 High-flow nasal cannula: impact on oxygenation and ventilation in an acute lung injury model.

[Back](#)

Frizzola M, Miller TL, Rodriguez ME, Zhu Y, Rojas J, Heseck A, Stump A, Shaffer TH, Dysart K.

Pediatr Pulmonol. 2011 Jan;46(1):67-74. doi: 10.1002/ppul.21326. Epub 2010 Nov 23

<https://www.ncbi.nlm.nih.gov/pubmed/21171186>

Objective:

The aim of this study was to demonstrate the flow dependence of CO₂ reduction and improved oxygenation during HFNC and the dependence on leak around the nasal prongs.

Result:

With HFNC, CO₂ trended downward in a flow-dependent manner independent of leak. Oxygenation and tracheal pressures increased in a flow-dependent manner with the greatest effect during double prong. At 8 L/min, tracheal pressures did not exceed 6 ± 1 cmH₂O.

HFNC improves gas exchange in a flow-dependent manner; double prong had greater impact on O₂; single prong had greater impact on CO₂ elimination.

21 Evaluation of a humidified nasal high-flow oxygen system, using oxygraphy, capnography & measurement of upper airway pressures

[Back](#)

Ritchie JE, Williams AB,
Gerard C, Hockey H.

Anaesth Intensive Care.
2011;39:1103–10

<https://www.ncbi.nlm.nih.gov/pubmed/22165366>

Objective:

In this study, we evaluated the performance of a humidified nasal high-flow system (Optiflow, Fisher and Paykel Healthcare) by measuring delivered FiO₂ and airway pressures. Oxygraphy, capnography and measurement of airway pressures were performed through a hypopharyngeal catheter in healthy volunteers receiving Optiflow humidified nasal high flow therapy at rest and with exercise. The study was conducted in a non-clinical experimental setting. Ten healthy volunteers completed the study after giving informed written consent.

Result:

We believe that the high gas flow rates delivered by this system enable an accurate inspired oxygen fraction to be delivered. The positive mean airway pressure created by the high flow increases the efficacy of this system and may serve as a bridge to formal positive pressure systems.

22 Effect of high-flow nasal cannula & body position on end-expiratory lung volume

[Back](#)

Riera J, Pérez P, Cortés J, Roca O, Masclans JR, Rello J.

Respir Care. 2013;58:589–96.

<https://www.ncbi.nlm.nih.gov/pubmed/23050520>

Objective:

Electrical impedance tomography measures changes in lung impedance, which are mainly related to changes in lung volume. We used electrical impedance tomography to investigate the effects of high-flow nasal cannula (HFNC) and body position on global and regional end-expiratory lung impedance variation (Δ EELI).

Result:

HFNC increased global EELI in our population, regardless of body position, suggesting an increase in functional residual capacity. Prone positioning was related to a more homogeneous distribution of Δ EELI, while in supine position Δ EELI was higher in the ventral lung regions.

High-flow nasal therapy in adults with severe acute respiratory infection. A cohort study in patients with 2009 influenza A/H1N1v.

[Back](#)

Rello J, Pérez M, Roca O, Poulakou G, Souto J, Laborda C, et al

A/H1N1v. J Crit Care. 2012;27:434–9

<https://www.ncbi.nlm.nih.gov/pubmed/22762937>

Objective:

The experience with high-flow nasal cannula (HFNC) oxygen therapy in severe acute respiratory infection (SARI) is limited. The objective was to assess the effectiveness of HFNC oxygen therapy in adult patients with SARI by confirmed 2009 influenza A/H1N1v infection (by real-time reverse transcription polymerase chain reaction testing).

Result:

High-flow nasal cannula O₂ therapy appears to be an innovative and effective modality for early treatment of adults with SARI.

24 Use of High-Flow Nasal Cannula Oxygen Therapy in Subjects With ARDS: A 1-Year Observational Study.

[Back](#)

Messika J, Ahmed KB, Gaudry S, Miguel-Montanes R, Rafat C, Sztrymf B, et al

Respir Care, 2015
Feb;60(2):162-9. doi:
10.4187/respcare.03423.
Epub 2014 Nov 4

<https://www.ncbi.nlm.nih.gov/pubmed/25371400>

Objective:

Beneficial effects of high-flow nasal cannula (HFNC) oxygen on oxygenation and respiratory parameters have been reported in a small number of subjects with acute respiratory failure (ARF). We aimed to evaluate its effect in subjects with ARDS.

Result:

In daily care, over one fourth of subjects requiring noninvasive ventilatory support were treated via HFNC, with a high success rate in subjects with severe ARDS. We conclude that HFNC may be considered as first-line therapy in ARF, including patients with ARDS.

25 High-flow oxygen through nasal cannula in acute hypoxemic respiratory failure.

[Back](#)

Frat JP, Thille AW, Mercat A, Girault C, Ragot S, Perbet S, Prat G, Boulain T, Morawiec E, Cottreau A, Devaquet J, Nseir S, Razazi K, Mira JP, et al

N Engl J Med. 2015 Jun 4;372(23):2185-96. doi: 10.1056/NEJMoa1503326. Epub 2015 May 17.

<https://www.ncbi.nlm.nih.gov/pubmed/25981908>

Objective:

Whether noninvasive ventilation should be administered in patients with acute hypoxemic respiratory failure is debated. Therapy with high-flow oxygen through a nasal cannula may offer an alternative in patients with hypoxemia.

Result:

In patients with nonhypercapnic acute hypoxemic respiratory failure, treatment with high-flow oxygen, standard oxygen, or noninvasive ventilation did not result in significantly different intubation rates. There was a significant difference in favor of high-flow oxygen in 90-day mortality.

Jian Zhang, Ling Lin,
Konghan Pan, Jiancang,
Zhou, Xiaoyin Huang

J Int Med Res. 2016 Dec;
44(6): 1200–1211.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5536739/>

Objective:

Recently, the use of HFNC in treating adult critical illness patients has significantly increased, and it is now being used in many patients with a range of different disease conditions. However, there are no established guidelines to direct the safe and effective use of HFNC for these patients. This review article summarizes the available published literature on the positive physiological effects, mechanisms of action, and the clinical applications of HFNC, compared with traditional oxygen therapy devices.

Result:

High-flow nasal cannula oxygen therapy has been proven to be a valuable clinical application alternative to conventional oxygen therapy for critically ill patients. It would seem to be effective for treating patients with respiratory failure, respiratory infection, and obstructive airways disease, either during the post-extubation period or pre-intubation.

27 A Systematic Review of the High-flow Nasal Cannula for Adult Patients.

[Back](#)

Helviz Y., Einav S.

Crit Care. 2018 Mar
20;22(1):71. doi:
10.1186/s13054-018-1990-4

<https://www.ncbi.nlm.nih.gov/pubmed/29558988>

Objective:

Over the last 10 years, HFNCs have had widespread uptake in the adult population. The idea that one may provide NIV with little discomfort to the patient is conceptually attractive. However, there is still much debate regarding the role of the HFNC in the management of critically ill patients and only recently has some better quality research emerged on the topic. This review covers the potential beneficial and deleterious effects of the HFNC and the latest evidence regarding its use in some of the more common clinical settings.

Result:

Rabbat et al. summarized the evidence regarding HFNC post-extubation nicely, and this summary holds true for the use of the HFNC in almost every clinical scenario. Difficulties in blinding of the treatment arm constitute a major source of bias in all of the comparative studies on the HFNC; only one study attempted blinding. The HFNC is consistently better tolerated by patients than NIV. The HFNC seems more effective than conventional oxygen therapy and non-inferior to NIV in most studies. The quality of data on the HFNC is slightly better regarding patients post-extubation, but there is need for more studies even in this clinical setting to generate a clearer signal.

28 Cochrane Review - High-flow nasal cannulae for respiratory support in adult intensive care patients.

[Back](#)

Corley A, Rickard CM, Aitken LM, Johnston A, Barnett A, Fraser JF, Lewis SR, Smith AF

Cochrane Database Syst Rev. 2017 May 30;5:CD010172. doi: 10.1002/14651858.CD010172.pub2.

<https://www.ncbi.nlm.nih.gov/pubmed/28555461>

Objective:

We evaluated studies that included participants 16 years of age and older who were admitted to the ICU and required treatment with HFNC. We assessed the safety and efficacy of HFNC compared with comparator interventions in terms of treatment failure, mortality, adverse events, duration of respiratory support, hospital and ICU length of stay, respiratory effects, patient-reported outcomes, and costs of treatment.

Result:

We were unable to demonstrate whether HFNC was a more effective or safe oxygen delivery device compared with other oxygenation devices in adult ICU patients. Meta-analysis could be performed for few studies for each outcome, and data for comparisons with CPAP or BiPAP were very limited. In addition, we identified some risks of bias among included studies, differences in patient groups, and high levels of statistical heterogeneity for some outcomes, leading to uncertainty regarding the results of our analysis.

29 High-flow nasal cannula therapy in do-not-intubate patients with hypoxemic respiratory distress

[Back](#)

Peters SG, Holets SR, Gay PC.

Respir Care. 2013 Apr;58(4):597-600. doi: 10.4187/respcare.01887.

<https://www.ncbi.nlm.nih.gov/pubmed/22781059>

Objective:

Patients with do-not-intubate (DNI) status and respiratory failure are commonly treated with noninvasive ventilation (NIV). High-flow nasal cannula (HFNC) therapy supplies a high flow of heated and humidified oxygen that may provide an effective alternative to NIV. We assessed the efficacy of HFNC in DNI patients with hypoxemic respiratory distress.

Result:

HFNC can provide adequate oxygenation for many patients with hypoxemic respiratory failure and may be an alternative to NIV for DNI patients.

Diab, S; Fraser, JF

Case Rep Crit Care. 2014;
2014: 198262.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4247916/>

Objective:

The advent of high flow nasal cannula allows the clinician to have a “middle man” that allows high flow oxygen delivery as well as a degree of respiratory support, which in some cases has been noted to be between 3 and 4 cm of continuous positive airway pressure-like effect. There are minimal data analyzing the use of high flow nasal cannula during anesthesia for bronchoscopy. We present a **case report** of orthotropic lung transplant recipient undergoing diagnostic bronchoscopy whilst being **supported with high flow nasal oxygen** in the intensive care unit.

Result:

NIV strategies and their use during endoscopy have widely been investigated as a safe option for respiratory support. Utilizing HFNC during bronchoscopy in this case report demonstrated an efficient intervention for maintaining oxygenation safely in an already compromised patient undergoing invasive procedure. **HFNC during bronchoscopy could potentially reduce the need for general anesthetic** in some patient groups. HFNC during bronchoscopy on sedated patients may serve as a worthy topic for future research.

31 The use of high-flow nasal oxygen therapy in the management of hypercarbic respiratory failure.

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Millar J, Lutton S, O'Connor P.

Ther Adv Respir Dis. 2014 Apr;8(2):63-4. doi: 10.1177/1753465814521890

<https://www.ncbi.nlm.nih.gov/pubmed/24670392>

Objective:

A recent innovation in adult critical care is the use of high-flow nasal oxygen (HFNO) devices. These systems are capable of delivering high gas flows via nasal cannulae, with the ability to blend air and oxygen to give a controlled FiO₂. Few clinical studies have been conducted in adults, although several are planned. To date the majority of available evidence addresses the use of HFNO in hypoxemic respiratory failure. Here we present a case in which a **HFNO system was used to successfully manage hypercarbic respiratory failure** in a patient unable to tolerate conventional NIV.

Nilius G, Franke KJ,
Domanski U, Rühle KH,
Kirkness JP, Schneider H.

Adv Exp Med Biol.
2013;755:27-34.

<https://www.ncbi.nlm.nih.gov/pubmed/22826046>

Objective:

High flow nasal insufflations (NI) can improve gas exchange and alleviate dyspnea in patients with acute respiratory failure.

Result:

In conclusion, high flow (20 L/min) nasal insufflations of warm and humidified air during wakefulness for 45 min reduced respiratory rate without deterioration of hypercapnia. Our data indicate that high flow NI improved efficiency of breathing and may be used as an adjunct to low flow oxygen for preventing hypercapnic respiratory failure in severely ill COPD patients.

33 The effects of high-flow vs low-flow oxygen on exercise in advanced obstructive airways disease

[Back](#)

Chatila W, Nugent T, Vance G, Gaughan J, Criner GJ.

Chest. 2004
Oct;126(4):1108-15.

<https://www.ncbi.nlm.nih.gov/pubmed/15486371>

Objective:

Current options to enhance exercise performance in patients with COPD are limited. This study **compared the effects of high flows of humidified oxygen to conventional low-flow oxygen** (LFO) delivery at rest and during exercise in patients with COPD.

Result:

High flows of humidified oxygen **improved exercise performance** in patients with COPD and severe oxygen dependency, in part by enhancing oxygenation.

Adamzik, M.; Bauer, A.;
Bein, T.; Benk, C.; Bock, E.;
Boeken, U.; Brückner, U.;
Buchwald, D.; Chaberny, I.;
Deja, M.; Delis, S.;
Dembinski, R.; et al

AWMF Leitlinien-Register
Nr. 001/021, 12/2017

https://www.awmf.org/.../tx_sleitlinien/001-021/S3_Invasive_Beatmung_2017-12.pdf

Objective:

Die Leitlinie verfolgt das Ziel, eine evidenzbasierte Informationsquelle und Entscheidungshilfe für die Versorgung von Patienten mit akuter respiratorischer Insuffizienz sowie zu den mit invasiver Beatmung und extrakorporalen Verfahren assoziierten klinischen Fragestellungen zu bieten.

Die zugrundeliegende Methodik der Literaturrecherche und -bewertung dieser S3-Leitlinie sowie der Ansatz zur Ableitung und Graduierung der Empfehlungen orientieren sich an der Methodik der internationalen GRADE-Arbeitsgruppe. Dabei erfolgt die Bewertung einer therapeutischen Intervention bzw. Maßnahme mit Blick auf die für unsere Patienten relevanten Effekte (Outcome-Parameter); daraus werden Handlungsempfehlungen für die klinische Entscheidungssituation hergeleitet.

Back

Bateman NT, Leach RM

BMJ. 1998 Sep
19;317(7161):798-801

<https://www.ncbi.nlm.nih.gov/pubmed/9740573>

Objective:

Oxygen is widely available and commonly prescribed by medical and paramedical staff. When administered correctly it may be life saving, but oxygen is often given without careful evaluation of its potential benefits and side effects. Like any drug there are clear indications for treatment with oxygen and appropriate methods of delivery. Inappropriate dose and failure to monitor treatment can have serious consequences. Vigilant monitoring to detect and correct adverse effects swiftly is essential.

Result:

Oxygen should be treated like any other drug; it should be prescribed in writing, with the required flow rate and the method of delivery clearly specified. Failure to correct hypoxaemia ($P_{aO_2} > 8$ kPa) for fear of causing hypo-ventilation and carbon dioxide retention is unacceptable clinical practice. Careful monitoring of treatment is essential and will detect those patients at risk of carbon dioxide retention.

36 High-Flow therapy via nasal cannula in acute heart failure.

[Back](#)

Carratalá Perales JM, Llorens P, Brouzet B, Albert Jiménez AR, Fernández-Cañadas JM, Carbajosa Dalmau J, Martínez Beloqui E, Ramos Forner S.

Rev Esp Cardiol. 2011 Aug;64(8):723-5. doi: 10.1016/j.recesp.2010.10.034. Epub 2011 Apr 16.

<https://www.ncbi.nlm.nih.gov/pubmed/21497974>

Objective:

Various oxygenization methods are used in the treatment of respiratory failure in acute heart failure. Occasionally, after patients are stabilized by these ventilation methods, some maintain a degree of dyspnea or hypoxemia which does not improve and is unrelated to deterioration in the functional class or the need to optimize pharmacological treatment. High-flow oxygen systems administered via nasal cannula that are connected to heated humidifiers (HFT) are a good alternative for oxygenation, given that they are easy to use and have few complications. We studied a series of 5 patients with acute heart failure due to acute pulmonary edema with stable dyspnea or hypoxemia following noninvasive ventilation.

Result:

All the patients were successfully treated with HFT, showing clinical and gasometric improvement and no complications or technical failures. We report our experience and discuss different aspects related to this oxygenation system..

37 High-flow nasal cannulae for respiratory support in adult intensive care patients.

[Back](#)

Corley A, Rickard CM, Aitken LM, Johnston A, Barnett A, Fraser JF, Lewis SR, Smith AF

Cochrane Database Syst Rev. 2017 May 30;5:CD010172. doi: 10.1002/14651858.CD010172.pub2.

<https://www.ncbi.nlm.nih.gov/pubmed/28555461>

Objective:

We evaluated studies that included participants 16 years of age and older who were admitted to the ICU and required treatment with HFNC. We assessed the safety and efficacy of HFNC compared with comparator interventions in terms of treatment failure, mortality, adverse events, duration of respiratory support, hospital and ICU length of stay, respiratory effects, patient-reported outcomes, and costs of treatment.

Result:

We were unable to demonstrate whether HFNC was a more effective or safe oxygen delivery device compared with other oxygenation devices in adult ICU patients. Meta-analysis could be performed for few studies for each outcome, and data for comparisons with CPAP or BiPAP were very limited. In addition, we identified some risks of bias among included studies, differences in patient groups, and high levels of statistical heterogeneity for some outcomes, leading to uncertainty regarding the results of our analysis. Consequently, evidence is insufficient to show whether HFNC provides safe and efficacious respiratory support for adult ICU patients.

38 Oxygen delivery through high-flow nasal cannulae increase end-expiratory lung volume & reduce respiratory rate in post-cardiac surgical patients.

Back

Corley A, Caruana LR, Barnett AG, Tronstad O, Fraser JF.

Br J Anaesth. 2011 Dec;107(6):998-1004. doi: 10.1093/bja/aer265. Epub 2011 Sep 9.

<https://www.ncbi.nlm.nih.gov/pubmed/21908497>

Objective:

High-flow nasal cannulae (HFNCs) create positive oropharyngeal airway pressure, but it is unclear how their use affects lung volume. Electrical impedance tomography allows the assessment of changes in lung volume by measuring changes in lung impedance. Primary objectives were to investigate the effects of HFNC on airway pressure (P_{aw}) and end-expiratory lung volume (EELV) and to identify any correlation between the two. Secondary objectives were to investigate the effects of HFNC on respiratory rate, dyspnoea, tidal volume, and oxygenation; and the interaction between BMI and EELV.

Result:

This study suggests that HFNCs reduce respiratory rate and improve oxygenation by increasing both EELV and tidal volume and are most beneficial in patients with higher BMIs.

Back

Dysart K, Miller TL, Wolfson MR, Shaffer TH.

Respir Med. 2009 Oct;103(10):1400-5. doi: 10.1016/j.rmed.2009.04.007. Epub 2009 May 21.

[Research in high flow therapy: Mechanisms of action - Respiratory Medicine](#)

Objective:

Recently, heater/humidifier devices that use novel methods to condition breathing gases from an external source have been introduced. The addition of sufficient warmth and high levels of humidification to breathing gas has allowed for higher flow rates from nasal cannula devices to be applied to patients (i.e., high flow therapy). This article provides a review of the proposed mechanisms.

Result:

HFT through nasal cannula is now a viable option because of devices that completely warm and humidify inspiratory gases to body temperature and 100% saturation. Properly conditioned gas provides for patient comfort and minimizes deterioration of nasopharyngeal structures.

40 Clinical evidence on high flow oxygen therapy and active humidification in adults.

[Back](#)

Gotera C, Díaz Lobato S,
Pinto T, Winck JC.

Rev Port Pneumol. 2013
Sep-Oct;19(5):217-27. doi:
10.1016/j.rppneu.2013.03.00
5. Epub 2013 Jul 8.

[https://www.ncbi.nlm.nih.gov
/pubmed/23845744](https://www.ncbi.nlm.nih.gov/pubmed/23845744)

Objective:

Recently there has been growing interest in an alternative to conventional oxygen therapy: the heated, humidified high flow nasal cannula oxygen therapy (HFNC). However here are no established guidelines or decision-making pathways to guide use of the HFNC therapy for adults. In this article we review the existing evidence of HFNC oxygen therapy in adult patients, its advantages, limitations and the current literature on clinical applications.

Result:

HFNC has been used for years in neonates with good results, but there is little information about treating ARF adults with these devices. We think that the HFNC could be used as an intermediate therapy to improve oxygenation in adult critical care patients, respiratory care units and also for palliative care. However, we believe that further research is required to determine the long-term effect of this therapy and identify the adult patients population to whom it is most beneficial.

41 High flow nasal oxygen generates positive airway pressure in adult volunteers.

[Back](#)

Groves N, Tobin A

Aust Crit Care. 2007
Nov;20(4):126-31. Epub
2007 Oct 10

<https://www.ncbi.nlm.nih.gov/pubmed/17931878>

Objective:

The use of non-invasive ventilation (NIV) as an alternative to intubation in respiratory failure is associated with better outcomes in certain conditions. NIV is often poorly tolerated by patients hence precipitating the need for invasive ventilation. High flow nasal (HFN) oxygen delivery is a potential alternative to NIV as it delivers air and oxygen via a humidified circuit at flows greater than those traditionally used with a nasal interface.

Result:

This study has demonstrated that high flow nasal therapy is associated with the generation of significant positive airway pressure in volunteers. In conclusion there is a degree of CPAP generated with the HFN therapy, which is flow dependent and also dependent on whether the person is breathing with mouth open or closed.

42 Domiciliary humidification improves lung mucociliary clearance in patients with bronchiectasis.

[Back](#)

Hasani A, Chapman TH,
McCool D, Smith RE,
Dilworth JP, Agnew JE

Chron Respir Dis.
2008;5(2):81-6. doi:
10.1177/1479972307087190

<https://www.ncbi.nlm.nih.gov/pubmed/18539721>

Objective:

Inspired air humidification has been reported to show some benefit in bronchiectatic patients. We have investigated the possibility that one effect might be to enhance mucociliary clearance. Such enhancement might, if it occurs, help to lessen the risks of recurrent infective episodes.

Result:

Following humidification, lung mucociliary clearance significantly improved, the area under the tracheobronchial retention curve decreased from 319 +/- 50 to 271 +/- 46%h ($p < 0.07$). Warm air humidification treatment improved lung mucociliary clearance in our bronchiectatic patients. Given this finding plus increasing laboratory and clinical interest in humidification mechanisms and effects, we believe further clinical trials of humidification therapy are desirable, coupled with analysis of humidification effects on mucus properties and transport.

43 Humidified high flow nasal oxygen during respiratory failure in the emergency department: feasibility and efficacy.

Back

Lenglet H, Sztrymf B, Leroy C, Brun P, Dreyfuss D, Ricard JD.

Respir Care. 2012 Nov;57(11):1873-8. doi: 10.4187/respcare.01575. Epub 2012 Mar 13.

<https://www.ncbi.nlm.nih.gov/pubmed/22417844>

Objective:

Heated and humidified high flow nasal cannula oxygen therapy (HFNC) represents a new alternative to conventional oxygen therapy that has not been evaluated in the emergency department (ED). We aimed to study its feasibility and efficacy in patients exhibiting acute respiratory failure presenting to the ED.

Result:

HFNC is possible in the ED, and it alleviated dyspnea and improved respiratory parameters in subjects with acute hypoxemic respiratory failure.

44 High-flow nasal interface improves oxygenation in patients undergoing bronchoscopy.

[Back](#)

Lucangelo U, Vassallo FG, Marras E, Ferluga M, Beziza E, Comuzzi L, Berlot G, Zin WA.

Crit Care Res Pract. 2012;2012:506382. doi: 10.1155/2012/506382. Epub 2012 May 20.

<https://www.ncbi.nlm.nih.gov/pubmed/22666567>

Objective:

During bronchoscopy hypoxemia is commonly found and oxygen supply can be delivered by interfaces fed with high gas flows. Recently, the high-flow nasal cannula (HFNC) has been introduced for oxygen therapy in adults, but they have not been used so far during bronchoscopy in adults. Forty-five patients were randomly assigned to 3 groups receiving oxygen: 40 L/min through a Venturi mask (V40, N = 15), nasal cannula (N40, N = 15), and 60 L/min through a nasal cannula (N60, N = 15) during bronchoscopy.

Result:

Under a flow rate of 40 L/min both the Venturi mask and HFNC behaved similarly, but nasal cannula associated with a 60 L/min flow produced the better results, thus indicating its use in mild respiratory dysfunctions.

45 Prospective Randomized trial comparing oxygen administration during FOB: conventional nasal cannula versus HFNC (Optiflow)

Back

Pinto T, Vaz M , Goncalves M, Magalhães A, Winck J

Objective:

No abstract available.

Researchgate.net, Rev Port Pneumol. 18, (Jan 2012)

https://www.researchgate.net/publication/284814777_Prospective_Randomized_trial_comparing_oxygen_administration_during_FOB_conventional_nasal_cannula_versus_HFNC_Optiflow

46 The effects of flow on airway pressure during nasal high-flow oxygen therapy.

[Back](#)

Parke RL, Eccleston ML,
McGuinness SP.

Respir Care. 2011
Aug;56(8):1151-5. doi:
10.4187/respcare.01106.
Epub 2011 Apr 15.

<https://www.ncbi.nlm.nih.gov/pubmed/21496369>

Objective:

To determine the relationship between flow and pressure with the Optiflow nasal high-flow oxygen therapy system.

Result:

With the mouth closed, the mean \pm SD airway pressures at 30, 40, and 50 L/min were 1.93 ± 1.25 cm H₂O, 2.58 ± 1.54 cm H₂O, and 3.31 ± 1.05 cm H₂O, respectively. There was a positive linear relationship between flow and pressure.

47 A preliminary randomized controlled trial to assess effectiveness of nasal high-flow oxygen in intensive care patients.

Back

Parke RL, McGuinness SP,
Eccleston ML.

Respir Care. 2011
Mar;56(3):265-70. doi:
10.4187/respcare.00801.
Epub 2011 Jan 21.

<https://www.ncbi.nlm.nih.gov/pubmed/21255498>

Objective:

In a cardiothoracic and vascular intensive care unit, to compare nasal high-flow (NHF) oxygen therapy and standard high-flow face mask (HFFM) oxygen therapy in patients with mild to moderate hypoxemic respiratory failure.

Result:

NHF oxygen therapy may be more effective than HFFM in treating mild to moderate hypoxemic respiratory failure.

48 Nasal high-flow therapy delivers low level positive airway pressure.

[Back](#)

Parke R, McGuinness S,
Eccleston M.

Br J Anaesth. 2009
Dec;103(6):886-90. doi:
10.1093/bja/aep280. Epub
2009 Oct 20.

<https://www.ncbi.nlm.nih.gov/pubmed/19846404>

Objective:

The aim of this prospective study was to determine whether a level of positive airway pressure was generated in participants receiving nasal high flow (NHF) delivered by the Optiflow system (Fisher and Paykel Healthcare Ltd, Auckland, New Zealand) in a cardiothoracic and vascular intensive care unit (ICU).

Result:

This study demonstrated that a low level of positive pressure was generated with NHF at 35 litre min⁻¹ of gas flow. This is consistent with results obtained in healthy volunteers. Australian Clinical Trials Registry www.actr.org.au ACTRN012606000139572.

49 The clinical utility of long-term humidification therapy in chronic airway disease.

[Back](#)

Rea H, McAuley S, Jayaram L, Garrett J, Hockey H, Storey L, O'Donnell G, Haru L, Payton M, O'Donnell K.

Respir Med. 2010 Apr;104(4):525-33. doi: 10.1016/j.rmed.2009.12.016. Epub 2010 Feb 9.

<https://www.ncbi.nlm.nih.gov/pubmed/20144858>

Objective:

Persistent airway inflammation with mucus retention in patients with chronic airway disorders such as COPD and bronchiectasis may lead to frequent exacerbations, reduced lung function and poor quality of life. This study investigates if long-term humidification therapy with high flow fully humidified air at 37 degrees C through nasal cannulae can improve these clinical outcomes in this group of patients.

Result:

Long-term humidification therapy significantly reduced exacerbation days, increased time to first exacerbation, improved lung function and quality of life in patients with COPD and bronchiectasis.

Back

Ricard JD

Minerva Anesthesiol. 2012
Jul;78(7):836-41. Epub 2012
Apr 24.

<https://www.ncbi.nlm.nih.gov/pubmed/22531566>

Objective:

HFNC rapidly alleviates symptoms of respiratory distress and improves oxygenation by several mechanisms, including deadspace washout, reduction in oxygen dilution and in inspiratory nasopharyngeal resistance, a moderate positive airway pressure effect that may generate alveolar recruitment and an overall greater tolerance and comfort with the interface and the heated and humidified inspired gases. Indications of HFNC are broad, encompassing most if not all causes of acute hypoxemic respiratory failure.

Result:

Although observational studies suggest that HFNC might reduce the need for intubation in acute hypoxemic respiratory failure; such a reduction has not yet been demonstrated. Beyond this potential additional effect on outcome, the evidence already published argues in favor of the large use of HFNC as first line therapy for acute respiratory failure.

Back

Roca O, Riera J, Torres F, Masclans JR.

Respir Care. 2010 Apr;55(4):408-13.

<https://www.ncbi.nlm.nih.gov/pubmed/20406507>

Objective:

To compare the comfort of oxygen therapy via high-flow nasal cannula (HFNC) versus via conventional face mask in patients with acute respiratory failure. Acute respiratory failure was defined as blood oxygen saturation < 96% while receiving a fraction of inspired oxygen > or = 0.50 via face mask.

Result:

HFNC was better tolerated and more comfortable than face mask. HFNC was associated with better oxygenation and lower respiratory rate. HFNC could have an important role in the treatment of patients with acute respiratory failure.

52 Beneficial effects of humidified high flow nasal oxygen in critical care patients: a prospective pilot study.

[Back](#)

Sztrymf B, Messika J, Bertrand F, Hurel D, Leon R, Dreyfuss D, Ricard JD.

Intensive Care Med. 2011 Nov;37(11):1780-6. doi: 10.1007/s00134-011-2354-6. Epub 2011 Sep 27.

<https://www.ncbi.nlm.nih.gov/pubmed/21946925>

Objective:

To evaluate the efficiency, safety and outcome of high flow nasal cannula oxygen (HFNC) in ICU patients with acute respiratory failure.

Result:

HFNC has a beneficial effect on clinical signs and oxygenation in ICU patients with acute respiratory failure. These favorable results constitute a prerequisite to launching a randomized controlled study to investigate whether HFNC reduces intubation in these patients.

53 Impact of high-flow nasal cannula oxygen therapy on intensive care unit patients with acute respiratory failure: a prospective observational study.

Back

Sztrymf B, Messika J, Mayot T, Lenglet H, Dreyfuss D, Ricard JD.

J Crit Care. 2012 Jun;27(3):324.e9-13. doi: 10.1016/j.jcrc.2011.07.075. Epub 2011 Sep 29.

<https://www.ncbi.nlm.nih.gov/pubmed/21958974>

Objective:

The purpose of this study was to determine the impact of high-flow nasal cannula oxygen (HFNC) on patients with acute respiratory failure (ARF) in comparison with conventional oxygen therapy.

Result:

Use of HFNC in patients with persistent ARF was associated with significant and sustained improvement of both clinical and biologic parameters.

54 Performance of oxygen delivery devices when the breathing pattern of respiratory failure is simulated.

[Back](#)

Sim MA, Dean P, Kinsella J, Black R, Carter R, Hughes M.

Anaesthesia. 2008 Sep;63(9):938-40. doi: 10.1111/j.1365-2044.2008.05536.x. Epub 2008 Jun 6.

<https://www.ncbi.nlm.nih.gov/pubmed/18540928>

Objective:

Oxygen is the commonest drug prescribed in hospitals. The inhaled concentration is altered by the administered oxygen flow rate, the characteristics of the delivery device and the patient's respiratory pattern. Using healthy volunteers we measured the inspired oxygen concentration achieved with different devices both at rest and when the breathing pattern of respiratory failure was simulated by binding the subjects' chests until the forced expiratory volume in 1 s was reduced by > 50% and the respiratory rate was > 25 breaths.min⁻¹.

Result:

We conclude that the F_IO₂ delivered by high flow devices is unaffected when the breathing pattern of respiratory failure is simulated. The F_IO₂ achieved at rest by a non-rebreathing mask (0.68) is less than that often quoted in the literature.

55 High-flow oxygen administration by nasal cannula for adult and perinatal patients.

[Back](#)

Ward JJ

Respir Care. 2013
Jan;58(1):98-122. doi:
10.4187/respcare.01941

<https://www.ncbi.nlm.nih.gov/pubmed/23271822>

Objective:

Traditionally, the nasal cannula has been categorized as a low-flow device and capable of delivering a 0.4 F(IO₂) with flows up to 6 L/min to adults with normal minute ventilation. However, there is considerable performance variability among patients and design, which results in an exponential decline in delivered F(IO₂) as breathing frequencies increase.

Result:

Clinical observations report greater patient acceptance and comfort versus oxygen masks. HFNC therapy has also been considered valuable in perinatal care in treating the respiratory distress syndrome or supporting patients after extubation similar to nasal CPAP. At present, research-based evidence for the role of HFNC for its perinatal applications remains unclear. This review will identify proposed mechanisms for therapeutic effectiveness, current delivery equipment, guidelines for rational patient application, and direction for further research.

Frat JP, Ragot S, Girault C, Perbet S, Prat G, Boulain T, Demoule A, Ricard JD, Coudroy R, Robert R, Mercat A, Brochard L, Thille AW; REVA network.

Lancet Respir Med. 2016 Aug;4(8):646-652. doi: 10.1016/S2213-2600(16)30093-5. Epub 2016 May 27.

<https://www.ncbi.nlm.nih.gov/pubmed/27245914>

Objective:

The use of non-invasive ventilation is controversial in immunocompromised patients with acute respiratory failure, whereas the use of high-flow nasal cannula oxygen therapy is growing as an alternative to standard oxygen. We aimed to compare outcomes of immunocompromised patients with acute respiratory failure treated with standard oxygen with those treated with high-flow nasal cannula oxygen alone or high-flow nasal cannula oxygen associated with non-invasive ventilation.

Result:

Non-invasive ventilation might be associated with an increased risk of intubation and mortality and should be used cautiously in immunocompromised patients with acute hypoxaemic respiratory failure.

57 Effect of Postextubation High-Flow Nasal Cannula vs Conventional Oxygen Therapy on Reintubation in Low-Risk Patients: A Randomized Clinical Trial.

Back

Hernández G, Vaquero C, González P, Subira C, Frutos-Vivar F, Rialp G, Laborda C, Colinas L, Cuenca R, Fernández R

JAMA. 2016 Apr 5;315(13):1354-61. doi: 10.1001/jama.2016.2711.

<https://www.ncbi.nlm.nih.gov/pubmed/26975498>

Objective:

To determine whether high-flow nasal cannula oxygen therapy is superior to conventional oxygen therapy for preventing reintubation in mechanically ventilated patients at low risk for reintubation.

Result:

Among extubated patients at low risk for reintubation, the use of high-flow nasal cannula oxygen compared with conventional oxygen therapy reduced the risk of reintubation within 72 hours.

Coudroy R, Jamet A, Petua P, Robert R, Frat JP, Thille AW

Ann Intensive Care. 2016 Dec;6(1):45. doi: 10.1186/s13613-016-0151-7. Epub 2016 May 20.

<https://www.ncbi.nlm.nih.gov/pubmed/27207177>

Objective:

High-flow nasal cannula oxygen therapy (HFNC) is an alternative to standard oxygen or NIV, and its use in hypoxemic patients has been growing. Therefore, we aimed to compare outcomes of immunocompromised patients treated using HFNC alone or NIV as a first-line therapy for acute respiratory failure in an observational cohort study over an 8-year period. Patients with acute-on-chronic respiratory failure, those treated with standard oxygen alone or needing immediate intubation, and those with a do-not-intubate order were excluded.

Result:

Based on this observational cohort study including immunocompromised patients admitted to intensive care unit for acute respiratory failure, intubation and mortality rates could be lower in patients treated with HFNC alone than with NIV. The use of NIV remained independently associated with poor outcomes.

59 Effect of Very-High-Flow Nasal Therapy on Airway Pressure and End-Expiratory Lung Impedance in Healthy Volunteers

[Back](#)

Parke RL, Bloch A,
McGuinness SP

Respir Care. 2015
Oct;60(10):1397-403. doi:
10.4187/respcare.04028.
Epub 2015 Sep 1.

<https://www.ncbi.nlm.nih.gov/pubmed/26329355>

Objective:

Assess the relationship between flows of up to 100 l/min and changes in lung physiology.

Result:

Measured airway pressure and lung impedance increased linearly with increased gas flow. Observed airway pressures were in the range used clinically with face-mask noninvasive ventilation. Developments in delivery systems may result in this therapy being an acceptable alternative to face-mask noninvasive ventilation.

60 Efficacy of High-Flow Nasal Cannula Therapy in Acute Hypoxemic Respiratory Failure: Decreased Use of Mechanical Ventilation.

Back

Nagata K, Morimoto T, Fujimoto D, Otoshi T, Nakagawa A, Otsuka K, Seo R, Atsumi T, Tomii K

Respir Care. 2015 Oct;60(10):1390-6. doi: 10.4187/respcare.04026. Epub 2015 Jun 23.

<https://www.ncbi.nlm.nih.gov/pubmed/26106206>

Objective:

Evaluate the efficacy of high-flow oxygen as a support method for acute hypoxemic respiratory failure.

Result:

In the post-HFNC period, significantly fewer subjects required mechanical ventilation (NIV or invasive ventilation). There were significantly fewer ventilator days and more ventilator-free days.

High flow decreased mechanical ventilation requirement in patients with respiratory failure.

61 Pressures delivered by nasal high flow oxygen during all phases of the respiratory cycle

[Back](#)

Parke RL, McGuinness SP

Respir Care. 2013
Oct;58(10):1621-4. doi:
10.4187/respcare.02358.
Epub 2013 Mar 19.

<https://www.ncbi.nlm.nih.gov/pubmed/23513246>

Objective:

Nasal high flow (NHF) oxygen therapy and CPAP are modes of noninvasive respiratory support used to improve respiratory function in multiple patient groups. Both therapies provide positive pressure, although this varies during the respiratory cycle. The purpose of this study was to measure and compare the airway pressure generated during different phases of the respiratory cycle in patients receiving NHF at various gas flows.

Result:

The expiratory pressure during NHF was higher than the mean pressure previously reported for NHF. This may account in part for the disproportional clinical effects seen with NHF.

62 Predicting success of high-flow nasal cannula in pneumonia patients with hypoxemic respiratory failure: The utility of the ROX index.

Back

Roca O, Messika J, Caralt B, García-de-Acilu M, Sztrymf B, Ricard JD, Masclans JR

J Crit Care. 2016 Oct;35:200-5. doi: 10.1016/j.jcrc.2016.05.022. Epub 2016 May 31.

<https://www.ncbi.nlm.nih.gov/pubmed/27481760>

Objective:

The purpose of the study is to describe early predictors and to develop a prediction tool that accurately identifies the need for mechanical ventilation (MV) in pneumonia patients with hypoxemic acute respiratory failure (ARF) treated with high-flow nasal cannula (HFNC).

Result:

In patients with ARF and pneumonia, the ROX index can identify patients at low risk for HFNC failure in whom therapy can be continued after 12 hours.

63 Physiologic Effects of High-Flow Nasal Cannula Oxygen in Critical Care Subjects

[Back](#)

Vargas F, Saint-Leger M,
Boyer A, Bui NH, Hilbert G

Respir Care. 2015
Oct;60(10):1369-76. doi:
10.4187/respcare.03814.
Epub 2015 May 5.

<https://www.ncbi.nlm.nih.gov/pubmed/25944940>

Objective:

High-flow nasal cannula (HFNC) can deliver heated and humidified gas (up to 100% oxygen) at a maximum flow of 60 L/min via nasal prongs or cannula. The aim of this study was to assess the short-term physiologic effects of HFNC. Inspiratory muscle effort, gas exchange, dyspnea score, and comfort were evaluated.

Result:

Compared with conventional oxygen therapy, HFNC improved inspiratory effort and oxygenation. In subjects with acute hypoxemic respiratory failure, HFNC is an alternative to conventional oxygen therapy.

Brotfain E, Zlotnik A,
Schwartz A, Frenkel A,
Koyfman L, Gruenbaum SE,
Klein M.

Isr Med Assoc J. 2014
Nov;16(11):718-22.

<https://www.ncbi.nlm.nih.gov/pubmed/25558703>

Objective:

To assess the clinical effects of high flow nasal cannula (HFNC) compared with standard oxygen face masks in Intensive Care Unit (ICU) patients after extubation.

Result:

This study demonstrated better oxygenation for patients treated with HFNC compared with NRB after extubation. HFNC may be more effective than standard oxygen supply devices for oxygenation in the post-extubation period.

65 Effect of high-flow nasal cannula on thoraco-abdominal synchrony in adult critically ill patients

[Back](#)

Itagaki T, Okuda N, Tsunano Y, Kohata H, Nakataki E, Onodera M, Imanaka H, Nishimura M.

Respir Care. 2014 Jan;59(1):70-4. doi: 10.4187/respcare.02480. Epub 2013 Jun 4.

<https://www.ncbi.nlm.nih.gov/pubmed/23737548>

Objective:

High-flow nasal cannula (HFNC) creates positive oropharyngeal airway pressure and improves oxygenation. It remains unclear, however, whether HFNC improves thoraco-abdominal synchrony in patients with mild to moderate respiratory failure. Using respiratory inductive plethysmography, we investigated the effects of HFNC on thoraco-abdominal synchrony.

Result:

HFNC improved thoraco-abdominal synchrony in adult subjects with mild to moderate respiratory failure.

66 Oxygen delivery through high-flow nasal cannulae increase end-expiratory lung volume & reduce respiratory rate in post-cardiac surgical patients.

Back

Corley A, Caruana LR,
Barnett AG, Tronstad O,
Fraser JF.

Br J Anaesth. 2011
Dec;107(6):998-1004. doi:
10.1093/bja/aer265. Epub
2011 Sep 9.

<https://www.ncbi.nlm.nih.gov/pubmed/21908497>

Objective:

Investigate the effects of HFNC on Paw (airway pressure) and end-expiratory lung volume(EELV).

Result:

HFNC reduced RR and improved oxygenation by increasing both EELV and tidal volume, and are most beneficial in patients with higher BMI.

67 A preliminary randomized controlled trial to assess effectiveness of nasal high-flow oxygen in intensive care patients.

Back

Parke RL, McGuinness SP,
Eccleston ML.

Respir Care. 2011
Mar;56(3):265-70. doi:
10.4187/respcare.00801.
Epub 2011 Jan 21.

<https://www.ncbi.nlm.nih.gov/pubmed/21255498>

Objective:

In a cardiothoracic and vascular intensive care unit, to compare nasal high-flow (NHF) oxygen therapy and standard high-flow face mask (HFFM) oxygen therapy in patients with mild to moderate hypoxemic respiratory failure.

Result:

NHF oxygen therapy may be more effective than HFFM in treating mild to moderate hypoxemic respiratory failure.

68 High-flow nasal cannula versus conventional oxygen therapy after endotracheal extubation: a randomized crossover physiologic study.

Back

Rittayamai N, Tscheikuna J, Rujiwit P.

Respir Care. 2014 Apr;59(4):485-90. doi: 10.4187/respcare.02397. Epub 2013 Sep 17.

<https://www.ncbi.nlm.nih.gov/pubmed/24046462>

Objective:

Compare the short-term benefit of high-flow nasal cannula (HFNC) with non-rebreathing mask in terms of change in dyspnea, physiologic variables, and patient comfort in subjects after endotracheal extubation.

Result:

HFNC can improve dyspnea and physiologic parameters, including breathing frequency and heart rate, in extubated subjects compared with conventional oxygen therapy. This device may have a potential role for use after endotracheal extubation.

69 Nasal high-flow oxygen therapy in ICU: A before-and-after study.

Back

Fealy N, Osborne C,
Eastwood GM, Glassford N,
Hart G, Bellomo R

Aust Crit Care. 2016
Feb;29(1):17-22. doi:
10.1016/j.aucc.2015.05.003.
Epub 2015 Jun 16.

<https://www.ncbi.nlm.nih.gov/pubmed/26092213>

Objective:

Assess the feasibility, safety and cost-effectiveness of introducing a protocol in which HFNP was the primary oxygen delivery device for non-intubated intensive care patients.

Result:

Using HFNP as the primary oxygen delivery method for non-intubated intensive care patients was feasible, appeared safe, and the oxygen device costs were reduced. The findings of our single-centre study support further multi-centre evaluations of HFNP therapy protocols in non-ventilated intensive care patients.

70 The effects of a 2-h trial of high-flow oxygen by nasal cannula versus Venturi mask in immunocompromised patients with hypoxemic acute respiratory failure: a multicenter randomized trial

Back

Lemiale V, Mokart D, Mayaux J, Lambert J, Rabbat A, Demoule A, Azoulay E

Crit Care. 2015 Nov 2;19:380. doi: 10.1186/s13054-015-1097-0.

<https://www.ncbi.nlm.nih.gov/pubmed/26521922>

Objective:

Compare HFNC and Venturi mask oxygen to avoid mechanical ventilation during a 2-hour period.

Result:

In immunocompromised patients with hypoxemic ARF, a 2-h trial with HFNO improved neither mechanical ventilatory assistance nor patient comfort compared with oxygen delivered via a Venturi mask. However, the study was underpowered because of the low event rate and the one-sided hypothesis.

Back

Gaunt KA, Spilman SK,
Halub ME, Jackson JA,
Lamb KD, Sahr SM

Respir Care. 2015
Oct;60(10):1383-9. doi:
10.4187/respcare.04016.
Epub 2015 Jun 9.

<https://www.ncbi.nlm.nih.gov/pubmed/26060320>

Objective:

Humidified, high-flow nasal cannula (HFNC) enables mucociliary clearance, accurate oxygen measurement, precise control of flow, and low-level positive airway pressure. There is sparse information concerning the timing of HFNC on patient outcomes such as incidence of adverse events during hospitalization, ICU stay, and post-ICU stay.

Result:

Study results provide preliminary evidence that early use of HFNC is beneficial in a medical and trauma ICU population, as it was associated with decreased ICU and post-ICU lengths of stay and reduced incidence of adverse events. This suggests that HFNC should be considered early in the ICU as first-line oxygen therapy.

72 Failure of high-flow nasal cannula therapy may delay intubation and increase mortality

[Back](#)

Kang BJ, Koh Y, Lim CM, Huh JW, Baek S, Han M, Seo HS, Suh HJ, Seo GJ, Kim EY, Hong SB

Intensive Care Med. 2015 Apr;41(4):623-32. doi: 10.1007/s00134-015-3693-5. Epub 2015 Feb 18.

<https://www.ncbi.nlm.nih.gov/pubmed/25691263>

Objective:

Intubation in patients with respiratory failure can be avoided by high-flow nasal cannula (HFNC) use. However, it is unclear whether waiting until HFNC fails, which would delay intubation, has adverse effects. The present retrospective observational study assessed overall ICU mortality and other hospital outcomes of patients who received HFNC therapy that failed.

Result:

Failure of HFNC might cause delayed intubation and worse clinical outcomes in patients with respiratory failure. Large prospective and randomized controlled studies on HFNC failure are needed to draw a definitive conclusion.

73 Nasal high-flow oxygen therapy in patients with hypoxic resp. failure: effect on functional and subjective resp. parameters comp. to conventional oxygen therapy and non-invasive ventilation

Back

Schwabbauer N, Berg B, Blumenstock G, Haap M, Hetzel J, Riessen R

BMC Anesthesiol. 2014 Aug 7;14:66. doi: 10.1186/1471-2253-14-66. eCollection 2014.

<https://www.ncbi.nlm.nih.gov/pubmed/25110463>

Objective:

Aim of the study was to compare the short-term effects of oxygen therapy via a high-flow nasal cannula (HFNC) on functional and subjective respiratory parameters in patients with acute hypoxic respiratory failure in comparison to non-invasive ventilation (NIV) and standard treatment via a Venturi mask.

Result:

In hypoxic respiratory failure HFNC offers a good balance between oxygenation and comfort compared to NIV and Venturi mask and seems to be well tolerated by patients.

74 Open-label, phase II study of routine high-flow nasal oxygen therapy in cardiac surgical patients

[Back](#)

Parke R, McGuinness S,
Dixon R, Jull A.

Br J Anaesth. 2013
Dec;111(6):925-31. doi:
10.1093/bja/aet262. Epub
2013 Aug 6.

<https://www.ncbi.nlm.nih.gov/pubmed/23921199>

Objective:

Respiratory complications after cardiac surgery increase morbidity, mortality, and length of stay. Studies suggest that routine delivery of positive airway pressure after extubation may be beneficial. We sought to determine whether the routine administration of nasal high-flow oxygen therapy (NHF) improves pulmonary function after cardiac surgery.

Result:

Routine use of NHF did not increase / ratio on Day 3 but did reduce the requirement for escalation of respiratory support.

Roca O, Pérez-Terán P, Masclans JR, Pérez L, Galve E, Evangelista A, Rello J.

J Crit Care. 2013 Oct;28(5):741-6. doi: 10.1016/j.jcrc.2013.02.007. Epub 2013 Apr 16.

<https://www.ncbi.nlm.nih.gov/pubmed/23602035>

Objective:

High flow nasal cannula (HFNC) may decrease preload being associated with beneficial hemodynamic and respiratory effects in adults with heart failure.

Result:

These findings suggest that patients with NYHA class III heart failure may benefit with HFNC supportive therapy.

Maitra S, Som A,
Bhattacharjee S, Arora MK,
Baidya DK

J Crit Care. 2016
Oct;35:138-44. doi:
10.1016/j.jcrc.2016.05.013.
Epub 2016 May 25.

<https://www.ncbi.nlm.nih.gov/pubmed/27481749>

Objective:

The role of high-flow nasal oxygen (HFNO) therapy in adult patients with acute hypoxemic respiratory failure is controversial.

Result:

High-flow nasal oxygen does not offer any benefit over NIV or conventional oxygen therapy in terms of requirement of higher respiratory support.

77 High-Flow Nasal Cannula Oxygen Therapy in Adults: Physiological Benefits, Indication, Clinical Benefits, and Adverse Effects

[Back](#)

Nishimura M

Respir Care. 2016
Apr;61(4):529-41. doi:
10.4187/respcare.04577.

<https://www.ncbi.nlm.nih.gov/pubmed/27016353>

Objective:

High-flow nasal cannula (HFNC) oxygen therapy is carried out using an air/oxygen blender, active humidifier, single heated tube, and nasal cannula. Able to deliver adequately heated and humidified medical gas at flows up to 60 L/min, it is considered to have a number of physiological advantages compared with other standard oxygen therapies, including reduced anatomical dead space, PEEP, constant F(IO₂), and good humidification.

Result:

Many published reports suggest that HFNC decreases breathing frequency and work of breathing and reduces the need for respiratory support escalation. Some issues remain to be resolved, such as definitive indications for HFNC and criteria for timing the starting and stopping of HFNC and for escalating treatment. Despite these issues, HFNC has emerged as an innovative and effective modality for early treatment of adults with respiratory failure with diverse underlying diseases.

Roca O, Hernández G, Díaz-Lobato S, Carratalá JM, Gutiérrez RM, Masclans JR; Spanish Multidisciplinary Group of High Flow Supportive Therapy in Adults (HiSpaFlow).

Crit Care. 2016 Apr 28;20(1):109. doi: 10.1186/s13054-016-1263-z.

<https://www.ncbi.nlm.nih.gov/pubmed/27121707>

Objective:

Recently several clinical trials have analyzed the effectiveness of HFNC therapy in different clinical situations and have reported promising results. Here we review the current knowledge about HFNC therapy, from its mechanisms of action to its effects on outcomes in different clinical situations.

Result:

Delivery of heated and humidified oxygen at high flow rates through nasal cannula is now widely used in adult patients. Its mechanisms of action and potential clinical benefits can help to improve the management of patients with either acute or chronic respiratory failure. With the evidence currently available, several questions still remain unanswered; in the absence of any general recommendations, decisions on HFNC treatment should be individualized in each particular situation. However, HFNC therapy is an innovative and powerful technique that is currently changing the management of patients with respiratory failure.

79 Discomfort associated with under humidified high-flow oxygen therapy in critically ill patients

[Back](#)

Chanques G, Constantin JM, Sauter M, Jung B, Sebbane M, Verzilli D, Lefrant JY, Jaber S

Intensive Care Med. 2009 Jun;35(6):996-1003. doi: 10.1007/s00134-009-1456-x. Epub 2009 Mar 18.

<https://www.ncbi.nlm.nih.gov/pubmed/19294365>

Objective:

To measure (1) the discomfort in non-intubated patients under high-flow oxygen therapy (HFOT) humidified with bubble (BH) or heated humidifiers (HH), and (2) the hygrometric properties of oxygen with a BH and an HH.

Result:

Compared to bubble humidifiers, the use of a heated-humidifier in patients with high-flow oxygen therapy is associated with a decrease of dryness symptoms mediated by increased humidity delivered to the patient.

80 Use of High-Flow Nasal Cannula for Acute Dyspnea and Hypoxemia in the Emergency Department.

[Back](#)

Rittayamai N, Tscheikuna J,
Praphruetkit N, Kijpinyochai
S

Respir Care. 2015
Oct;60(10):1377-82. doi:
10.4187/respcare.03837.
Epub 2015 Jun 9.

<https://www.ncbi.nlm.nih.gov/pubmed/26060321>

Objective:

Acute dyspnea and hypoxemia are 2 of the most common problems in the emergency room. Oxygen therapy is an essential supportive treatment to correct these issues. In this study, we investigated the physiologic effects of high-flow nasal oxygen cannula (HFNC) compared with conventional oxygen therapy (COT) in subjects with acute dyspnea and hypoxemia in the emergency room.

Result:

HFNC improved dyspnea and comfort in subjects presenting with acute dyspnea and hypoxemia in the emergency department. HFNC may benefit patients requiring oxygen therapy in the emergency room.

81 Comparison of three high flow oxygen therapy delivery devices: a clinical physiological cross-over study

[Back](#)

Chanques G, Riboulet F, Molinari N, Carr J, Jung B, Prades A, Galia F, Futier E, Constantin JM, Jaber S

Minerva Anesthesiol. 2013 Dec;79(12):1344-55. Epub 2013 Jul 15.

<https://www.ncbi.nlm.nih.gov/pubmed/23857440>

Objective:

High-flow-oxygen-therapy is provided by various techniques and patient interfaces, resulting in various inspired-fraction of oxygen (FiO₂) and airway-pressure levels. However, tracheal measurements have never been performed.

Result:

On one hand, Boussignac (TM) is the only device that generates a relevant positive-airway-pressure during both inspiration-and-expiration, independently of mouth-position. Optiflow (TM) provides a low positive-airway-pressure (<4 cmH₂O), highly dependent of mouth-closing. The reservoir-bag-facemask provides no positive-airway-pressure. On the other hand, FiO₂ are slightly but significantly higher for Optiflow (TM) and reservoir-bag-facemask than for Boussignac (TM). Discomfort was lesser for Optiflow (TM) and reservoir-bag-facemask.

Corley A, Bull T, Spooner AJ, Barnett AG, Fraser JF

Intensive Care Med. 2015 May;41(5):887-94. doi: 10.1007/s00134-015-3765-6. Epub 2015 Apr 8.

<https://www.ncbi.nlm.nih.gov/pubmed/25851385>

Objective:

Patients with a body mass index (BMI) ≥ 30 kg/m² experience more severe atelectasis following cardiac surgery than those with normal BMI and its resolution is slower. This study aimed to compare extubation of patients post-cardiac surgery with a BMI ≥ 30 kg/m² onto high-flow nasal cannulae (HFNC) with standard care to determine whether HFNC could assist in minimising post-operative atelectasis and improve respiratory function.

Result:

In this study, prophylactic extubation onto HFNC post-cardiac surgery in patients with a BMI ≥ 30 kg/m² did not lead to improvements in respiratory function. Larger studies assessing the role of HFNC in preventing worsening of respiratory function and intubation are required.

83 Heated and humidified high-flow oxygen therapy reduces discomfort during hypoxemic respiratory failure.

[Back](#)

Cuquemelle E, Pham T, Papon JF, Louis B, Danin PE, Brochard L.

Respir Care. 2012 Oct;57(10):1571-7. Epub 2012 Mar 12.

<https://www.ncbi.nlm.nih.gov/pubmed/22417569>

Objective:

Non-intubated critically ill patients are often treated by high-flow oxygen for acute respiratory failure. There is no current recommendation for humidification of oxygen devices.

Result:

Upper airway caliber was not significantly modified by HHFO₂, compared to standard oxygen therapy, but HHFO₂ significantly reduced discomfort in critically ill patients with respiratory failure. The system is usually preferred over standard oxygen therapy.

84 A preliminary randomized controlled trial to assess effectiveness of nasal high-flow oxygen in intensive care patients.

Back

Parke RL, McGuinness SP, Eccleston ML

Respir Care. 2011 Mar;56(3):265-70. doi: 10.4187/respcare.00801. Epub 2011 Jan 21

<https://www.ncbi.nlm.nih.gov/pubmed/21255498>

Objective:

In a cardiothoracic and vascular intensive care unit, to compare nasal high-flow (NHF) oxygen therapy and standard high-flow face mask (HFFM) oxygen therapy in patients with mild to moderate hypoxemic respiratory failure.

Result:

NHF oxygen therapy may be more effective than HFFM in treating mild to moderate hypoxemic respiratory failure.

85 Bilevel positive airway pressure versus OPTIFLOW in hypoxemic patients after cardiothoracic surgery (the BiPOP study).

Back

Stéphan F, Barrucand B, Petit P, Rézaiguia-Delclaux S, Médard A, Delannoy B, Cosserant B, Flicoteaux G, Imbert A, Pilorge C, Bérard L; BiPOP Study Group.

JAMA. 2015 Jun 16;313(23):2331-9. doi: 10.1001/jama.2015.5213.

<https://search.proquest.com/openview/881bfb8cdbfb13d761bd2fe72c76b8b/1.pdf?pq-origsite=gscholar&cbl=40575>

Objective:

Occurrence of hypoxemic acute respiratory failure is frequent after cardiothoracic surgery. Noninvasive ventilation delivered as bilevel positive airway pressure (BiPAP) is an effective preventive and therapeutic tool to treat acute respiratory failure. Nasal high flow oxygen therapy (OPTIFLOW) is an increasingly popular method to improve oxygenation. However, no clinical trials have confirmed that the improvement of gas exchange with OPTIFLOW is similar to that obtained under BiPAP. We conducted a multicenter, randomized, non inferiority, open trial to compare the efficacy of OPTIFLOW with BiPAP in the treatment of postoperative hypoxemia after cardiothoracic surgery.

Result:

The efficiency of Optiflow was similar to that of BiBAP as respiratory support for patients with or at risk of acute respiratory failure after cardio thoracic surgery.

86 Randomized Trial of Apneic Oxygenation during Endotracheal Intubation of the Critically Ill.

[Back](#)

Semler MW, Janz DR, Lentz RJ, Matthews DT, Norman BC, Assad TR, Keriwala RD, Ferrell BA, Noto MJ, McKown AC, Kocurek EG, Warren MA, Huerta LE, Rice TW; Fellow Investigators; PCC Research Group.

Am J Respir Crit Care Med. 2016 Feb 1;193(3):273-80. doi: 10.1164/rccm.201507-1294OC.

<https://www.ncbi.nlm.nih.gov/pubmed/26426458>

Objective:

To determine if apneic oxygenation increases the lowest arterial oxygen saturation experienced by patients undergoing endotracheal intubation in the intensive care unit.

Result:

Apneic oxygenation does not seem to increase lowest arterial oxygen saturation during endotracheal intubation of critically ill patients compared with usual care. These findings do not support routine use of apneic oxygenation during endotracheal intubation of critically ill adults.

87 Can HFNC Reduce the Rate of Endotracheal Intubation in Adult Patients With Acute Resp. Failure Compared With Convent. Oxygen Therapy and Noninvasive Positive Pressure Ventilation?

Back

Ni YN, Luo J, Yu H, Liu D, Ni Z, Cheng J, Liang BM, Liang ZA

Chest. 2017 Apr;151(4):764-775. doi: 10.1016/j.chest.2017.01.004 . Epub 2017 Jan 13.

<https://www.ncbi.nlm.nih.gov/pubmed/28089816>

Objective:

The effects of high-flow nasal cannula (HFNC) on adult patients with acute respiratory failure (ARF) are controversial. We aimed to further determine the effectiveness of HFNC in reducing the rate of endotracheal intubation in adult patients with ARF by comparison to noninvasive positive pressure ventilation (NIPPV) and conventional oxygen therapy (COT).

Result:

In patients with ARF, HFNC is a more reliable alternative than NIPPV to reduce the rate of endotracheal intubation than COT.

88 Effect of high-flow nasal cannula oxygen therapy in adults with acute hypoxemic respiratory failure: a meta-analysis of randomized controlled trials.

Back

Ou X, Hua Y, Liu J, Gong C, Zhao W

CMAJ. 2017 Feb 21;189(7):E260-E267. doi: 10.1503/cmaj.160570.

<https://www.ncbi.nlm.nih.gov/pubmed/28246239>

Objective:

Conflicting recommendations exist on whether high-flow nasal cannula (HFNC) oxygen therapy should be administered to adult patients in critical care with acute hypoxemic respiratory failure. We performed a meta-analysis of randomized controlled trials (RCTs) to evaluate its effect on intubation rates.

Result:

The intubation rate with HFNC oxygen therapy was lower than the rate with conventional oxygen therapy and similar to the rate with noninvasive ventilation among patients with acute hypoxemic respiratory failure. Larger, high-quality RCTs are needed to confirm these findings.

Monro-Somerville T, Sim M,
Ruddy J, Vilas M, Gillies MA.

Crit Care Med. 2017
Apr;45(4):e449-e456. doi:
10.1097/CCM.000000000000
02091

[https://www.ncbi.nlm.nih.gov
/pubmed/27611978](https://www.ncbi.nlm.nih.gov/pubmed/27611978)

Objective:

High-flow nasal cannulae are used in adults with or at risk of acute respiratory failure. We conducted a systematic review and meta-analysis to evaluate the evidence for their use in this setting.

Result:

No difference in mortality or intubation was detected in patients with acute respiratory failure treated with high-flow nasal cannulae compared with usual care. High-flow nasal cannulae seem well tolerated by patients. Further large randomized controlled trials are required to evaluate their utility in this setting.

Humidified high flow nasal cannula supportive therapy improves outcomes in lung transplant recipients readmitted to the intensive care unit because of acute respiratory failure

Back

Roca O, de Acilu MG, Caralt B, Sacanell J, Masclans JR; ICU collaborators

Transplantation. 2015 May;99(5):1092-8. doi: 10.1097/TP.0000000000000460

<https://www.ncbi.nlm.nih.gov/pubmed/25340596>

Objective:

The effectiveness of humidified high flow nasal cannula (HFNC) in lung transplant (LTx) recipients readmitted to intensive care unit (ICU) because of acute respiratory failure (ARF) has not been determined to date.

Result:

HFNC O2 therapy is feasible and safe and may decrease the need for MV in LTx recipients readmitted to the ICU because of ARF.

92 High-Flow Nasal Cannula Therapy for Acute Hypoxemic Respiratory Failure in Adults: A Retrospective Analysis

[Back](#)

Hyun Cho W, Ju Yeo H,
Hoon Yoon S, Lee S,
SooJeon D, Seong Kim Y,
Uk Kim K, Lee K, Kyung
Park H, Ki Lee M

Intern Med.
2015;54(18):2307-13. doi:
10.2169/internalmedicine.54
.4266. Epub 2015 Sep 15.

[https://www.ncbi.nlm.nih.gov
/pubmed/26370853](https://www.ncbi.nlm.nih.gov/pubmed/26370853)

Objective:

High-flow nasal cannula (HFNC) therapy is an oxygen delivery system. However, evidence regarding the clinical applications of HFNC is still emerging. We herein evaluated the clinical predictors of HFNC therapy success for adult patients with acute hypoxemic respiratory failure.

Result:

HFNC therapy showed a good compliance and the improvement of the physiologic parameters in an adult population. The failure to improve oxygenation within 24 hours was a useful predictor of intubation. Among the failure group, the vasopressor use and failed oxygenation improvement were associated with ICU mortality.

Back

Gaunt KA, Spilman SK,
Halub ME, Jackson JA,
Lamb KD, Sahr SM

Respir Care. 2015
Oct;60(10):1383-9. doi:
10.4187/respcare.04016.
Epub 2015 Jun 9.

<https://www.ncbi.nlm.nih.gov/pubmed/26060320>

Objective:

Humidified, high-flow nasal cannula (HFNC) enables mucociliary clearance, accurate oxygen measurement, precise control of flow, and low-level positive airway pressure. There is sparse information concerning the timing of HFNC on patient outcomes such as incidence of adverse events during hospitalization, ICU stay, and post-ICU stay.

Result:

Study results provide preliminary evidence that early use of HFNC is beneficial in a medical and trauma ICU population, as it was associated with decreased ICU and post-ICU lengths of stay and reduced incidence of adverse events. This suggests that HFNC should be considered early in the ICU as first-line oxygen therapy.

Jones PG, Kamona S,
Doran O, Sawtell F, Wilsher
M

Respir Care. 2016
Mar;61(3):291-9. doi:
10.4187/respcare.04252.
Epub 2015 Nov 17.

<https://www.ncbi.nlm.nih.gov/pubmed/26577199>

Objective:

Humidified high-flow nasal cannula (HFNC) is a novel method of oxygen delivery with increasing use in emergency departments and intensive care settings despite little evidence showing benefit over standard oxygen delivery methods (standard O₂). The aim of this study was to determine whether HFNC compared with standard O₂ given to subjects in acute respiratory distress would reduce the need for non-invasive ventilation or invasive ventilation.

Result:

HFNC was not shown to reduce the need for mechanical ventilation in the emergency department for subjects with acute respiratory distress compared with standard O₂, although it was safe and may reduce the need for escalation of oxygen therapy within the first 24 h of admission.

95 High-flow nasal cannula oxygen versus non-invasive ventilation in patients with acute hypoxaemic respiratory failure undergoing flexible bronchoscopy – a prospective randomised trial.

Back

Simon M, Braune S, Frings D, Wiontzek AK, Klose H, Kluge S

Crit Care. 2014 Dec 22;18(6):712. doi: 10.1186/s13054-014-0712-9.

<https://www.ncbi.nlm.nih.gov/pubmed/25529351>

Objective:

Critically ill patients with respiratory failure undergoing bronchoscopy have an increased risk of hypoxaemia-related complications. Previous studies have shown that in awake, hypoxaemic patients non-invasive ventilation (NIV) is helpful in preventing gas exchange deterioration during bronchoscopy. An alternative and increasingly used means of oxygen delivery is its application via high-flow nasal cannula (HFNC). This study was conducted to compare HFNC with NIV in patients with acute hypoxaemic respiratory failure undergoing flexible bronchoscopy.

Result:

The application of NIV was superior to HFNC with regard to oxygenation before, during and after bronchoscopy in patients with moderate to severe hypoxaemia. In patients with stable oxygenation under HFNC, subsequent bronchoscopy was well tolerated.

96 Effect of Postextubation High-Flow Nasal Cannula vs Conventional Oxygen Therapy on Reintubation in Low-Risk Patients: A Randomized Clinical Trial.

Back

Hernández G, Vaquero C, González P, Subira C, Frutos-Vivar F, Rialp G, Laborda C, Colinas L, Cuenca R, Fernández R

JAMA. 2016 Apr 5;315(13):1354-61. doi: 10.1001/jama.2016.2711.

<https://www.ncbi.nlm.nih.gov/pubmed/26975498>

Objective:

To determine whether high-flow nasal cannula oxygen therapy is superior to conventional oxygen therapy for preventing reintubation in mechanically ventilated patients at low risk for reintubation.

Result:

Among extubated patients at low risk for reintubation, the use of high-flow nasal cannula oxygen compared with conventional oxygen therapy reduced the risk of reintubation within 72 hours.

97 Humidified high flow nasal oxygen during respiratory failure in the emergency department: feasibility and efficacy.

Back

Lenglet H, Sztrymf B, Leroy C, Brun P, Dreyfuss D, Ricard JD

Respir Care. 2012 Nov;57(11):1873-8. doi: 10.4187/respcare.01575. Epub 2012 Mar 13.

<https://www.ncbi.nlm.nih.gov/pubmed/22417844>

Objective:

Heated and humidified high flow nasal cannula oxygen therapy (HFNC) represents a new alternative to conventional oxygen therapy that has not been evaluated in the emergency department (ED). We aimed to study its feasibility and efficacy in patients exhibiting acute respiratory failure presenting to the ED.

Result:

HFNC is possible in the ED, and it alleviated dyspnea and improved respiratory parameters in subjects with acute hypoxemic respiratory failure.

Millar J, Lutton S, O'Connor P.

Ther Adv Respir Dis. 2014 Apr;8(2):63-4. doi: 10.1177/1753465814521890

<https://www.ncbi.nlm.nih.gov/pubmed/24670392>

Objective:

Hypercarbic respiratory failure, occurring secondary to chronic lung disease, is a frequently encountered problem. These patients present a significant challenge to respiratory and critical care services, as many are unsuitable for mechanical ventilation and most have multiple comorbidities. Recently, noninvasive ventilation (NIV) has become established as the primary modality for respiratory support in this group of patients. Several factors limit patient compliance with NIV, not least comfort and tolerability. A recent innovation in adult critical care is the use of high-flow nasal oxygen (HFNO) devices.

Result:

Here we present a case in which a HFNO system was used to successfully manage hypercarbic respiratory failure in a patient unable to tolerate conventional NIV.

99 Effects of nasal high flow on ventilation in volunteers, COPD and idiopathic pulmonary fibrosis patients.

Back

Bräunlich J, Beyer D, Mai D, Hammerschmidt S, Seyfarth HJ, Wirtz H

Respiration. 2013;85(4):319-25. doi: 10.1159/000342027. Epub 2012 Nov 1.

<https://www.ncbi.nlm.nih.gov/pubmed/23128844>

Objective:

The aim of this study was to describe changes in respiratory parameters.

Result:

nHF resulted in significant effects on respiratory parameters in patients with obstructive and restrictive pulmonary diseases. The rise in pressure amplitude and mean pressure and the decrease in breathing rate and minute volume will support inspiratory efforts, helps to increase effectiveness of ventilation and will contribute to a reduction in the work of breathing. A CO₂ wash-out effect in the upper airway part of the anatomical dead space may contribute to the beneficial effects of the nHF instrument.

Nilius G, Franke KJ,
Domanski U, Rühle KH,
Kirkness JP, Schneider H.

Adv Exp Med Biol.
2013;755:27-34.

<https://www.ncbi.nlm.nih.gov/pubmed/22826046>

Objective:

High flow nasal insufflations (NI) can improve gas exchange and alleviate dyspnea in patients with acute respiratory failure. In the present study we investigated the effects of high flow nasal insufflations in COPD patients with chronic hypercapnic respiratory failure (HRF).

Result:

In conclusion, high flow (20 L/min) nasal insufflations of warm and humidified air during wakefulness for 45 min reduced respiratory rate without deterioration of hypercapnia. Our data indicate that high flow NI improved efficiency of breathing and may be used as an adjunct to low flow oxygen for preventing hypercapnic respiratory failure in severely ill COPD patients.

101 The effects of high-flow vs low-flow oxygen on exercise in advanced obstructive airways disease.

Back

Chatila W, Nugent T, Vance G, Gaughan J, Criner GJ.

Chest. 2004
Oct;126(4):1108-15.

<https://www.ncbi.nlm.nih.gov/pubmed/15486371>

Objective:

Current options to enhance exercise performance in patients with COPD are limited. This study compared the effects of high flows of humidified oxygen to conventional low-flow oxygen (LFO) delivery at rest and during exercise in patients with COPD.

Result:

High flows of humidified oxygen improved exercise performance in patients with COPD and severe oxygen dependency, in part by enhancing oxygenation.

102 Death and other complications of emergency airway management in critically ill adults. A prospective investigation of 297 tracheal intubations.

Back

Schwartz DE, Matthay MA, Cohen NH.

Anesthesiology. 1995 Feb;82(2): 367-76.

<https://www.ncbi.nlm.nih.gov/pubmed/7856895>

Objective:

This study investigates complications of emergency airway management in critically ill adults, including: (1) the incidence of difficult and failed intubation; (2) the frequency of esophageal intubation; (3) the incidence of pneumothorax and pulmonary aspiration; (4) the hemodynamic consequences of emergent intubation, including death, during and immediately following intubation; and (5) the relationship, if any, between the occurrence of complications and supervision of the intubation by an attending physician.

Result:

In critically ill patients, emergency tracheal intubation is associated with a significant frequency of major complications. In this study, complications were not increased when intubations were accomplished without the supervision of an attending physician as long as the intubation was carried out or supervised by an individual skilled in airway management. Mortality associated with emergent tracheal intubation is highest in patients who are hemodynamically unstable and receiving vasopressor therapy before intubation.

103 Non-invasive ventilation improves preoxygenation before intubation of hypoxic patients.

Back

Baillard C, Fosse JP, Sebbane M, Chanques G, Vincent F, Courouble P, Cohen Y, Eledjam JJ, Adnet F, Jaber S.

Am J Respir Crit Care Med. 2006 Jul 15;174(2):171-7. Epub 2006 Apr 20.

<https://www.ncbi.nlm.nih.gov/pubmed/16627862>

Objective:

To find out whether noninvasive ventilation (NIV), as a preoxygenation method, is more effective at reducing arterial oxyhemoglobin desaturation than usual preoxygenation during orotracheal intubation in hypoxemic, critically ill patients.

Result:

For the intubation of hypoxemic patients, preoxygenation using NIV is more effective at reducing arterial oxyhemoglobin desaturation than the usual method.

104 Use of high-flow nasal cannula oxygen therapy to prevent desaturation during tracheal intubation of intensive care patients with mild-to-moderate hypoxemia.

Back

Miguel-Montanes R, Hajage D, Messika J, Bertrand F, Gaudry S, Rafat C, Labbé V, Dufour N, Jean-Baptiste S, Bedet A, Dreyfuss D, Ricard JD

Crit Care Med. 2015 Mar;43(3):574-83. doi: 10.1097/CCM.0000000000000743.

<https://www.ncbi.nlm.nih.gov/pubmed/25479117>

Objective:

Tracheal intubation of ICU patients is frequently associated with severe hypoxemia. Although noninvasive ventilation reduces desaturation during intubation of severely hypoxemic patients, it does not allow for per-procedure oxygenation and has not been evaluated in mild-to-moderate hypoxemic patients for whom high-flow nasal cannula oxygen may be an alternative. We sought to compare pre- and per-procedure oxygenation with either a nonrebreathing bag reservoir facemask or a high-flow nasal cannula oxygen during tracheal intubation of ICU patients.

Result:

High-flow nasal cannula oxygen significantly improved preoxygenation and reduced prevalence of severe hypoxemia compared with nonrebreathing bag reservoir facemask. Its use could improve patient safety during intubation.

105 High-flow nasal cannula oxygen during endotracheal intubation in hypoxemic patients: a randomized controlled clinical trial.

Back

Vourc'h M, Asfar P, Volteau C, Bachoumas K, Clavieras N, Egreteau PY, Asehnoune K, Mercat A, Reignier J, Jaber S, Prat G, Roquilly A, Brule N, Villers D, Bretonniere C, Guitton C.

Intensive Care Med. 2015 Sep;41(9):1538-48. doi: 10.1007/s00134-015-3796-z. Epub 2015 Apr 14.

<https://www.ncbi.nlm.nih.gov/pubmed/25869405>

Objective:

Intubation of hypoxemic patients is associated with life-threatening adverse events. High-flow therapy by nasal cannula (HFNC) for preoxygenation before intubation has never been assessed by randomized study. Our objective was to evaluate the efficiency of HFNC for preoxygenation, compared to high fraction-inspired oxygen facial mask (HFFM).

Result:

Compared to HFFM, HFNC as a preoxygenation device did not reduce the lowest level of desaturation.

Jaber S, Monnin M, Girard M, Conseil M, Cisse M, Carr J, Mahul M, Delay JM, Belafia F, Chanques G, Molinari N, De Jong A

Intensive Care Med. 2016 Dec;42(12):1877-1887. doi: 10.1007/s00134-016-4588-9. Epub 2016 Oct 11.

<https://www.ncbi.nlm.nih.gov/pubmed/27730283>

Objective:

High-flow nasal cannula oxygen (HFNC) has the potential to provide apnoeic oxygenation. We decided to assess in a proof-of-concept study whether the addition of HFNC to non-invasive ventilation (NIV) could reduce oxygen desaturation during intubation, compared with NIV alone for preoxygenation, in severely hypoxaemic intensive care unit (ICU) patients with respiratory failure.

Result:

A novel strategy for preoxygenation in hypoxaemic patients, adding HFNC for apnoeic oxygenation to NIV prior to orotracheal intubation, may be more effective in reducing the severity of oxygen desaturation than the reference method using NIV alone.

Back

Simon M, Wachs C, Braune S, de Heer G, Frings D, Kluge S

Respir Care. 2016 Sep;61(9):1160-7. doi: 10.4187/respcare.04413. Epub 2016 Jun 7.

<https://www.ncbi.nlm.nih.gov/pubmed/27274092>

Objective:

Critically ill patients with respiratory failure undergoing intubation have an increased risk of hypoxemia-related complications. Delivering oxygen via a high-flow nasal cannula (HFNC) has theoretical advantages and is increasingly used. This study was conducted to compare HFNC with bag-valve-mask (BVM) for preoxygenation and to assess oxygenation during intubation in subjects with hypoxemic respiratory failure.

Result:

There was no significant difference in the mean lowest SpO2 during intubation between the HFNC and the BVM group. There was also no significant difference in SpO2 between the 2 groups at any of the predefined time points. However, on continuous monitoring, there was a significant decrease in SpO2 during the apnea phase before intubation in the BVM group, which was not seen in the HFNC group.

Stéphan F, Barrucand B, Petit P, Rézaiguia-Delclaux S, Médard A, Delannoy B, Cosserant B, Flicoteaux G, Imbert A, Pilorge C, Bérard L; BiPOP Study Group.

JAMA. 2015 Jun
16;313(23):2331-9. doi:
10.1001/jama.2015.5213.

<https://www.ncbi.nlm.nih.gov/pubmed/25980660>

Objective:

To determine whether high-flow nasal oxygen therapy was not inferior to BiPAP for preventing or resolving acute respiratory failure after cardiothoracic surgery.

Result:

Among cardiothoracic surgery patients with or at risk for respiratory failure, the use of high-flow nasal oxygen therapy compared with intermittent BiPAP did not result in a worse rate of treatment failure. The findings support the use of high-flow nasal oxygen therapy in similar patients.

Futier E, Paugam-Burtz C, Godet T, Khoy-Ear L, Rozenchwajg S, Delay JM, Verzilli D, Dupuis J, Chanques G, Bazin JE, Constantin JM, Pereira B, Jaber S; OPERA study investigators.

Intensive Care Med. 2016 Dec;42(12):1888-1898. doi: 10.1007/s00134-016-4594-y. Epub 2016 Oct 22.

<https://www.ncbi.nlm.nih.gov/pubmed/27771739>

Objective:

High-flow nasal cannula (HFNC) oxygen therapy is attracting increasing interest in acute medicine as an alternative to standard oxygen therapy; however, its use to prevent hypoxaemia after major abdominal surgery has not been evaluated. Our trial was designed to close this evidence gap.

Result:

Among patients undergoing major abdominal surgery, early preventive application of high-flow nasal cannula oxygen therapy after extubation did not result in improved pulmonary outcomes compared with standard oxygen therapy.

Maggiore SM, Idone FA,
Vaschetto R, Festa R,
Cataldo A, Antonicelli F,
Montini L, De Gaetano A,
Navalesi P, Antonelli M.

Am J Respir Crit Care Med.
2014 Aug 1;190(3):282-8.
doi: 10.1164/rccm.201402-
0364OC.

[https://www.ncbi.nlm.nih.gov/
pubmed/25003980](https://www.ncbi.nlm.nih.gov/pubmed/25003980)

Objective:

To compare the effects of the Venturi mask and the nasal high-flow (NHF) therapy on PaO₂/FiO₂SET ratio after extubation. Secondary endpoints were to assess effects on patient discomfort, adverse events, and clinical outcomes.

Result:

Compared with the Venturi mask, NHF results in better oxygenation for the same set FiO₂ after extubation. Use of NHF is associated with better comfort, fewer desaturations and interface displacements, and a lower reintubation rate.

111 Open-label, phase II study of routine high-flow nasal oxygen therapy in cardiac surgical patients.

Back

Parke R, McGuinness S,
Dixon R,
Jull A.

Br J Anaesth. 2013
Dec;111(6):925-31. doi:
10.1093/bja/aet262. Epub
2013 Aug 6.

<https://www.ncbi.nlm.nih.gov/pubmed/23921199>

Objective:

Respiratory complications after cardiac surgery increase morbidity, mortality, and length of stay. Studies suggest that routine delivery of positive airway pressure after extubation may be beneficial. We sought to determine whether the routine administration of nasal high-flow oxygen therapy (NHF) improves pulmonary function after cardiac surgery.

Result:

Routine use of NHF did not increase / ratio on Day 3 but did reduce the requirement for escalation of respiratory support.

112 Physiologic Effects of High-Flow Nasal Cannula in Acute Hypoxemic Respiratory Failure

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Mauri T, Turrini C, Eronia N,
Grasselli G, Volta CA,
Bellani G, Pesenti A

doi: 10.1164/rccm.201605-
0916OC Epub 2016 Dec 20.

[https://www.atsjournals.org/
doi/full/10.1164/rccm.201605-
0916OC](https://www.atsjournals.org/doi/full/10.1164/rccm.201605-0916OC)

Objective:

High-flow nasal cannula (HFNC) improves the clinical outcomes of nonintubated patients with acute hypoxemic respiratory failure (AHRF).

Result:

In patients with AHRF, HFNC exerts multiple physiologic effects including less inspiratory effort and improved lung volume and compliance. These benefits might underlie the clinical efficacy of HFNC.

113 High flow nasal cannulae oxygen therapy in acute-moderate hypercapnic respiratory failure

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Lee MK, Choi J, Park B, Kim B, Lee SJ, Kim SH, Young SJ, Choi EH, Lee WY

Clin Respir J 2018
Jun;12(6):2046-2056. doi:
10.1111/crj.12772. Epub
2018 Mar 5

<https://www.ncbi.nlm.nih.gov/pubmed/29392846>

Objective:

We evaluated the effectiveness of the high flow nasal cannulae (HFNC) therapy in severe AECOPD with moderate hypercapnic acute respiratory failure (ARF) compared to non-invasive ventilation (NIV).

Result:

There was no difference of the 30-day mortality and intubation rate between HFNC and NIV groups.

114 Optimum support by high-flow nasal cannula in acute hypoxemic respiratory failure: effects of increasing flow rates

[Back](#)

Mauri T, Alban L, Turrini C, Cambiaghi B, Carlesso E, Taccone P, Bottino N, Lissoni A, Spadaro S, Volta CA, Gattinoni L, Pesenti A, Grasselli G

Intensive Care Med 2017 Oct;43(10):1453-1463. doi: 10.1007/s00134-017-4890-1. Epub 2017 Jul 31.

<https://www.ncbi.nlm.nih.gov/pubmed/28762180>

Objective:

Limited data exist on the correlation between higher flow rates of high-flow nasal cannula (HFNC) and its physiologic effects in patients with acute hypoxemic respiratory failure (AHRF). We assessed the effects of HFNC delivered at increasing flow rate on inspiratory effort, work of breathing, minute ventilation, lung volumes, dynamic compliance and oxygenation in AHRF patients

Result:

In this cohort of patients with AHRF, an increasing HFNC flow rate progressively decreased inspiratory effort and improved lung aeration, dynamic compliance and oxygenation. Most of the effect on inspiratory workload and CO₂ clearance was already obtained at the lowest flow rate.

**Thank you for
your attention.**

Forename surname

Position

Contact details