

COMMENTS TO RESEARCH ARTICLES

High-flow nasal cannulas. Do they give value?☆

Cánulas nasales de alto flujo ¿aportan valor?

Comment

Acute respiratory failure (ARF) is a common complication, in many clinics and a highly frequent cause of admittance to an intensive care unit (ICU) with elevated morbidity and mortality. A highly considerable number of these patients require treatments which include the use of mechanical ventilation (invasive or non-invasive) in the ICU and this has become a highly relevant process in clinical practice during continuous assessment. Both invasive ventilation and non-invasive ventilation (NIV) are processes which may involve complications and alternatives are therefore sought so that patients may not have to undergo these procedures.

Furthermore, we now know that patients with ARF on spontaneous ventilation who present with an increase in respiratory effort also run the risk of worsening their lung injury because of the increase in the transpulmonary pressure which may also occur and inadvertently in spontaneous ventilation.¹ As a result, it is possible that the indications for ventilatory support and monitoring of patients on spontaneous ventilation will change shortly so that better assessment of the respiratory function may be assessed and not simply the gaseous exchange and balance.

High flow nasal cannulas (HFNC) is an oxygen, and possibly ventilation, support technique which emerged recently and which has become used in clinical practice in intensive care services and also in emergency hospital departments. This technique is based on the use of devices which are able to administer high flows of oxygen, over 100 lpm, through a system adapted to the patient's nose and air handling, supplying it at an appropriate temperature and successfully humidifying this gas so that it improves both the possibility of gaseous exchange and the tolerance by the patients to this flow of gas.²

Ni YN, Luo J, Yu H, Liu D, Ni Z, Cheng J, et al. Can high-flow nasal cannula reduce the rate of endotracheal intubation in adult patients with acute respiratory failure compared with conventional oxygen therapy and noninvasive positive pressure ventilation? A systematic review and meta-analysis? *Chest*. 2017; 151: 764–75.

Abstract

Background: 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).

Methods: The PubMed, Embase, Medline, and the Cochrane Central Register of Controlled Trials databases, as well as the Information Sciences Institute Web of Science, were searched for all controlled studies that compared HFNC with NIPPV and COT in adult patients with ARF. The primary outcome was the rate of endotracheal intubation; the secondary outcomes were ICU mortality and length of ICU stay.

Results: Eighteen trials with a total of 3881 patients were pooled in our final studies. Except for ICU mortality ($I^2 = 67\%$, $\chi^2 = 12.21$, $P = .02$) and rate of endotracheal intubation ($I^2 = 63\%$, $\chi^2 = 13.51$, $P = .02$) between HFNC and NIPPV, no significant heterogeneity was found in outcome measures. Compared with COT, HFNC was associated with a lower rate of endotracheal intubation ($z = 2.55$, $P = .01$) while no significant difference was found in the comparison with NIPPV ($z = 1.40$, $P = .16$). As for ICU mortality and length of ICU stay, HFNC did not exhibit any advantage over either COT or NIPPV.

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

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The functioning mechanism of the HFNC in the ARF has not been fully clarified and this effect does not appear to solely depend on the amount of oxygen supplied to the patient, but it has been described that the system reduces the dead space (improving ventilation efficiency as a result) and may produce a modest effect of CPAP, which increases the residual functional capacity (opening areas of possible lung collapse) and improve the mechanical conditions of ventilation. This has led to its use being extended to other patients, not only hypoxaemic ones but also hypercapnic, although at present only some isolated cases have been reported and couple of small-sized series. A sufficiently large sample size is pending for the effects on these patients to be proven.³

However, at present there is no consensus regarding the genuine efficacy and efficiency in different indications of the example of HFNC. Ni et al.⁴ have carried out a systematic review aimed at establishing in adult patients with ARF, whether the use of HFNC is associated with an improvement in prognosis. The main objective outcome of the study is the reduction in the rate of intubation, whilst secondary goals would be length of hospital stay or ICU mortality. In the systematic review they do not analyse other factors which could have been related to the use of the technique, such as complications associated with the use of HFNC or NIV and episodes of intolerance to both techniques. I believe these circumstances may interfere and may partly explain the results obtained both in clinical trials and real practice.

They carried out a search of all clinical trials recorded on conventional data bases and also an iterative search in the references of articles published between 1996 and 2016. They identified 776 articles, including 18 in the final meta-analysis, which included or did not include intubation in their results. Of the 18 studies included, 12 were clinical trials and the remainder was retrospective analyses or prospective cohort studies. These studies included 3881 patients out of whom 1893 were treated with HFNC, 934 with VNI and 1054 with conventional oxygen therapy (COT).

What stands out in this meta-analysis is the selection of articles of case series (when there are 11 clinical trials available) and also the inclusion of several articles which actually do not analyse the effect on ARF but the effect on the prevention of the same post-extubation. These two facts may undoubtedly affect the results of this meta-analysis as shown by the extreme heterogeneity referred to in the different results of the studies. Moreover, no articles were eliminated from analysis due to methodological criteria, although the possibility of error was huge in several studies due to the design (not blind).

The main result of the meta-analysis is that treatment with HFNC compared with COT reduces the rate of intubation (OR: 0.47; CI 95%: 0.27–0.84), whilst it does not reduce the rate of intubation compared with VNI (OR: 0.73; CI 95%: 0.43–1.13). No significant differences were found in ICU length of stay or in mortality with regard to the use of HFNC vs COT or VNI.

There is a very interesting post hoc analysis they made with an important subgroup of patients where the reason was the use of post-extubation. In this subgroup of patients the use of HFNC reduced the need for re-intubation compared with the use of COT, but not compared with the use

of VNI and neither was there a change in the remainder of outcomes.

The results of this study are actually disappointing and do not appear to provide a higher level of evidence to support the clinical trials included in them. At present the indications for the use of HFNC are essentially expanding due to it being easy to use in clinical practice, but we should demand a higher level of evidence for its use and a cost-effectiveness analysis.

The analysis published by Mayordomo-Colunga et al.⁵ is therefore useful as it analyses the cost that each intervention on a specific condition could entail, using current data. In the case of an asthmatic episode in children the use of HGNC systems is not justified. The authors put forward different scenarios, depending on the possibility of the superiority or non-superiority of using HFNC and carry out a study of the costs which show us how in the case of avoiding a re-intubation and applying it to the population described there would be an incremental cost of \$1734 (CI 95%: 991–4955).

At this moment in time we could perhaps contemplate a scenario of stratified use of different COT, HFNC, VNI and invasive ventilation systems. These techniques must be used under correct indications and strict monitoring so that complications are reduced, and a delay in intubation we know may lead to poorer prognosis avoided.⁵ It is obvious that HFNC play their role, but we have to also carry out studies in different indications, with the appropriate methodological quality and which include true economic analysis of what that use would entail.

With what we already know and using a Bayesian type of analysis and applying a reference scenario (without enthusiasm or scepticism), we could say that there is a 2.8% probability that VNI would be superior to HFNC, a 97% probability that they are equivalent and only 0% probability that the use of HFNC would be superior to that of VNI⁶). At present we are still finding studies which show the result of equivalence between the different strategies.⁷

The use of HFNC is another alternative in the treatment of ARF in adult patients, but in no case should it delay the correct use of appropriate tracheal intubation and invasive mechanical ventilation. When choosing the technique to be used, above all between HFNC and VNI we should always take into account as many dependent factors of the patient in addition to their illness,⁸ such as the experience and availability of the technique. There is not sufficient evidence to justify a replacement of VNI for HFNC systems and we should very much consider the possible incremental cost which the availability of this equipment entails. It is however true that in the literature greater facility for its use, and good clinical tolerance⁹ has been reported and this may promote its introduction into clinical practice.

References

1. Yoshida T, Roldan R, Beraldo MA, Torsani V, Gomes S, De Santis RR, et al. Spontaneous effort during mechanical ventilation: maximal injury with less positive end-expiratory pressure. *Crit Care Med*. 2016;44:e678–88.
2. Masclans JR, Pérez-Terán P, Roca O. Papel de la oxigenoterapia de alto flujo en la insuficiencia respiratoria aguda. *Med Intens*. 2015;39:505–15.

3. Plotnikow G, Thille AW, Vasquez D, Pratto R, Desmery P. High-flow nasal cannula oxygen for reverting severe acute exacerbation of chronic obstructive pulmonary disease: a case report. *Med Intens.* 2017, <http://dx.doi.org/10.1016/j.medin.2016.11.009>. Ahead of print.
4. Ni YN, Luo J, Yu H, Liu D, Ni Z, Cheng J, et al. Can high-flow nasal cannula reduce the rate of endotracheal intubation in adult patients with acute respiratory failure compared with conventional oxygen therapy and noninvasive positive pressure ventilation? *Chest.* 2017;151:764–75.
5. Esteban A, Frutos-Vivar F, Ferguson N, Arabí Y, Apezteguía C, González M, et al. Noninvasive positive-pressure ventilation for respiratory failure after extubation. *N Engl J Med.* 2004;350:2452–60.
6. Mayordomo-Colunga J, Medina A. High-flow nasal cannula oxygenation for everyone? Not so fast! *Med Intens.* 2017, <http://dx.doi.org/10.1016/j.medin.2017.03.003>. Ahead of print.
7. Fernandez R, Subira C, Frutos-Vivar F, Rialp G, Laborda C, Masclans JR, et al. High-flow nasal cannula to prevent postextubation respiratory failure in high-risk non-hypercapnic patients: a randomized multicenter trial. *Ann Intensive Care.* 2017;7:47.
8. Hernández-Tejedor A, Peñuelas O, Sirgo Rodríguez G, Llompарт-Pou JA, Palencia Herrejón E, Estella A, et al. Recomendaciones para el tratamiento de los pacientes críticos de los Grupos de Trabajo de la Sociedad Española de Medicina Intensiva, Crítica y Unidades Coronarias (SEMICYUC). *Med Intensiva.* 2017;41:285–305.
9. Frat JP, Thille AW, Mercat A, Girault C, Ragot S, Perbet S, et al., FLORALI Study Group, REVA Network. High-flow oxygen through nasal cannula in acute hypoxemic respiratory failure. *N Engl J Med.* 2015;372:2185–96.

F. Gordo Vidal^{a,b}

^a *Servicio de Medicina Intensiva, Hospital Universitario del Henares, Coslada, Madrid, Spain*

^b *Facultad de Ciencias de la Salud, Universidad Francisco de Vitoria (UFV), Pozuelo de Alarcón, Madrid, Spain*
E-mail address: fgordo5@gmail.com