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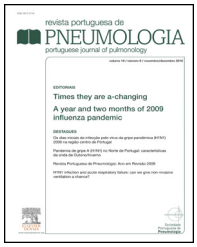

REVIEW

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

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Abstract Recently there has been growing interest in an alternative to conventional oxygen therapy: the heated, humidified high flow nasal cannula oxygen therapy (HFNC). A number of physiological effects have been described with HFNC: pharyngeal dead space washout, reduction of nasopharyngeal resistance, a positive expiratory pressure effect, an alveolar recruitment, greater humidification, more comfort and better tolerance by the patient, better control of FiO_2 and mucociliary clearance. There is limited experience of HFNC in adults. There 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. Further research is required to determine the long-term effect of this therapy and identify the adult patient population to whom it is most beneficial.

PALAVRAS-CHAVE
Oxigenoterapia humidificada de alto débito com cânulas nasais;
Ventilação não-invasiva;
Trocas gasosas;
Insuficiência respiratória

Evidência clínica acerca da oxigenoterapia de baixo débito e humidificação ativa em adultos

Resumo Recentemente, uma alternativa à oxigenoterapia convencional tem recebido atenção crescente: trata-se da oxigenoterapia humidificada de alto débito com cânulas nasais (HFNC). Um número de efeitos fisiológicos têm sido descritos: «lavagem» do espaço morto farín-geo, redução da resistência da nasofarige, efeito tipo «CPAP», recrutamento alveolar, maior humidificação, maior conforto e melhor tolerância do doente, melhor controle do FiO2 e do «clearance» mucociliar. A experiência com HFNC em adultos ainda é limitada e de momento não há «guidelines» para o seu uso. Neste artigo revemos a evidência existente do uso da HFNC em adultos, as suas vantagens, limitações e a literatura mais recente sobre as suas aplicações

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clínicas. Mais investigação será necessária para determinar os efeitos a longo prazo desta terapêutica e identificar quais as populações em que é mais benéfica.

Introduction

For years supplemental oxygen administration provided by different devices (such as nasal prongs, nose masks and face masks), has been the first line treatment for hypoxemic respiratory failure. However the oxygen provided by these conventional systems has several limitations. These limitations do not usually have clinical consequences because the delivered oxygen flow is sufficient to correct the hypoxemia. However, in some patients there can be serious problems. For example, poor tolerance because of insufficient humidification and heating of the oxygen flow or the fact that the oxygen flow supplied by these devices generally is no more than 15 L/min (the maximum flow delivered by facemasks). Another drawback of conventional oxygen devices is the difference between the oxygen flow delivered and that the exact amount of the patient's inspiratory flow is not precise; it can vary between 30 and 120 L/min during respiratory failure.[1–3] This means that the proportion of humidified and oxygenated inspired gas can be very small (below 10%) depending on the extent of oxygen dilution with room air.[2] One direct consequence is that the fraction of inspired oxygen (FiO_2) is not constant during conventional oxygen therapy and it is also unknown.

Recently growing attention has been paid to an alternative to conventional oxygen therapy. We refer to the heated, humidified high flow nasal cannula oxygen therapy (HFNC). This system basically works with an air oxygen blender allowing from 21% to 100% FiO_2 and generates up to 60 L/min flow rates. The gas is heated and humidified through an active heated humidifier and delivered via a single limb heated inspiratory circuit (to avoid heat loss and condensation) to the patient through nasal cannula of large diameter (Figs. 1 and 2), the ''high flow nasal cannulas''.[3] This therapeutic alternative is mainly characterized by the fact that

Figure 1 Vapotherm and Flowrest devices.

Figure 2 Optiflow and AIRVO devices.

the patient is given a heated, humidified high flow above its maximum inspiratory flow and we can have increased confidence about the real FiO_2 being delivered to the patient. HFNC has been widely studied in pediatric patients where it is increasingly used, however, the evidence in adults is limited.[4] There 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.

How does HFNC work?

HFNC has a number of physiological effects that could be used to illustrate its benefits. Several studies have shown that HFNC generates a low level of positive airway pressure,[2,5,6] improves oxygenation, increases the end-inspiratory lung volume, reduces airway resistance, increases functional residual capacity[2,7] and flushes nasopharyngeal dead space,[2,8] thus helping to manage breathing reduction in acute respiratory failure from all causes. It also better tolerated and more comfortable for the patient. Finally, pulmonary defence mechanisms are restored. The main physiological effects of HFNC are shown in Table 1.

Table 1 Physiological effects of HFNC.

- Pharyngeal dead space washout
- Reduction of nasopharyngeal resistance
- Positive expiratory pressure (PEEP effect)
- Alveolar recruitment
- Humidification, great comfort and better tolerance
- Better control of FiO_2 and better mucociliary clearance