Brief report

High-Flow Therapy via Nasal Cannula in Acute Heart Failure

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INTRODUCTION

Acute heart failure (AHF) is one of the main causes of acute respiratory failure (ARF) and is generally treated with conventional oxygenation systems (nasal cannula, Venturi mask); however, newer means of ventilation are now available that are more effective and easier to use. New respiratory devices make it possible to heat and humidify air flows administered through a nasal cannula, enabling use of higher flows of up to 60 l/min. These high-flow nasal systems with a built-in heated humidifier provide an alternative and effective means of oxygenation. They have been widely used in the home treatment of chronic respiratory failure patients, in post-surgical ARF, in intensive care of children and adult patients with ARF, but above all in cases of hypoxemia and dyspnea that do not respond to treatment with traditional Venturi masks. These systems provide a higher and more constant oxygen fraction, reduce respiratory dead space, generate positive airway pressure, and offer improved comfort and tolerance.

METHODS

The clinical profile of 5 patients with AHF due to acute pulmonary edema (APE) treated with a high-flow system via nasal cannula is described. 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.

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Clinical and Gasometric Parameters Before Administering High-Flow Oxygen and After 24 h

<table>
<thead>
<tr>
<th></th>
<th>Before high-flow oxygen; FiO2 100%</th>
<th>After 24 h of high-flow oxygen</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaO2 (mmHg)</td>
<td>73.4 ± 4.3</td>
<td>98.8 ± 4.76</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>PaCO2 (mmHg)</td>
<td>53.2 ± 13</td>
<td>47.4 ± 8</td>
<td>.109</td>
</tr>
<tr>
<td>pH</td>
<td>7.33</td>
<td>7.39</td>
<td>.047</td>
</tr>
<tr>
<td>SaO2 (%)</td>
<td>85.4 ± 2.41</td>
<td>99.4 ± 0.89</td>
<td>.042*</td>
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<tr>
<td>HCO3</td>
<td>38.5 ± 7.59</td>
<td>40 ± 4.69</td>
<td>.188</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>103 ± 7</td>
<td>91 ± 3</td>
<td>.024</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>154 ± 21</td>
<td>149.6 ± 15</td>
<td>.379</td>
</tr>
<tr>
<td>RR (bpm)</td>
<td>35 ± 2</td>
<td>24 ± 3</td>
<td>.002</td>
</tr>
<tr>
<td>Degree of dyspnea, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>0</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>80</td>
<td>0</td>
<td></td>
</tr>
</tbody>
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bpm, breaths per minute; bpm, beats per minute; FiO2, fraction of inspired oxygen; HR, heart rate; PaCO2, partial pressure of CO2 in arterial blood; PaO2, partial pressure of O2 in arterial blood; RR, respiratory rate; SaO2, Saturation level of O2 by pulse oximeter; SBP, systolic blood pressure.

* Wilcoxon T test.

b In accordance with Borg's modified scale.

DISCUSSION

It is common to find patients with AHF who, after being stabilized, maintain a level of dyspnea or hypoxemia which does not improve with conventional oxygenation systems and cannot be attributed to deterioration in functional level or a need to optimize medical treatment. In our case, the HFT system was effective with all the patients and improvement was observed in the evolution of the disease: significant reduction in the intensity of the dyspnea, improved respiratory effort and tachypnea, and the disappearance of hypoxemia.

Active HFT systems have been used for years to treat chronic respiratory failure in adults (sleep apnea syndrome and neuromuscular diseases), as they offer dyspnea control and efficient oxygenation with good tolerance.11
There is little evidence of treating ARF adults with HFT systems. In 2010, Roca et al. compared the comfort and efficacy of an HFT system with a conventional Venturi mask in 20 ARF patients of diverse etiology who were treated in an intensive care unit. They obtained statistically significant results in favor of the HFT system, which produced few side effects. These data are in agreement with those from our patients, although ours remained on high-flow treatment longer (62 h compared to 30 min) and all were admitted due to APE.

The improvements in clinical and gasometric parameters with this system have two main causes: first, HFT systems provide a more constant FiO₂, and second, the use of a nasal cannula as the interface reduces the amount of respiratory dead space and generates a constant positive pressure directly proportional to the flow used and to the resistance created during expiration, which contributes to increased oxygenation.

Other beneficial characteristics of note are that the active humidification and heating of the gas facilitates bronchial secretion clearance, improves the sensation of dyspnea and bronchial hyperreactivity, reduces the likelihood of atelectasis due to mucous accumulation, and increases patient tolerance when used for long periods.

Even in elderly patients with functional dependence, like those in our series, the degree of comfort is significant because the use of a cannula as the interface enables patients to speak, eat, and take medication without interrupting oxygenation. It is important to highlight two aspects of this system: that it is easy to learn and use, and that it can be used in conventional hospital rooms without the need for constant monitoring.

As in the study by Roca et al., the reduction in respiratory rate (a sign of clinical improvement) was at no time associated with changes in arterial CO₂ pressure or pH.

The most commonly described side effects in the literature with respect to the use of HFT systems are: cervical and tracheal discomfort, feeling hot, and nasal mucosal lesions. The first 2 are mild and disappear in most cases after the adaptation period, as was the case in 2 of our patients. Mucosal lesions are reported less often and are related to the misuse of the technique.

In short, the use of HFT systems is a good alternative to traditional oxygenation systems for the treatment of patients with ARF secondary to AHF due to APE that have dyspnea and refractory hypoxemia. The system is well tolerated and produces significant improvements in clinical and gasometric parameters after 24 h.

CONFLICTS OF INTEREST

None declared.

REFERENCES