



Comparison of Actual Performance in the Flow and Fraction of Inspired O₂ among Different High-Flow Nasal Cannula Devices: A Bench Study

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Objectives

High-flow nasal cannula (HFNC) oxygen therapy has been recommended for use in patients with acute respiratory failure and many other clinical conditions. HFNC devices produced by different manufacturers may have varied performance. Whether there is a difference in these devices and the extent of the differences in performance remain unknown. This study sought to compare flow and FiO₂ at the cannula among different HFNC systems.

Study methods

This was a bench study comparing four HFNC devices (AIRVO 2, TNI softFlow 50, HUMID-BH, and OH-70C) and one ventilator with a HFNC module (bellavista 1000). A gas flow analyzer was used to measure actual flow rate of gas delivered. An oxygen analyzer measured FiO₂. High flow oxygen was provided by the hospital intensive care unit systems. Each device was measured at flow rates ranging from 20 to 80 L/min at FiO₂ ranging from 21% to 90%. Testing was performed on heated and humidified air.

Results

There were significant differences between the actual flow and the set flow in all five devices ($p<0.001$). The AIRVO 2 had the lowest differences followed by the bellavista 1000. TNI softFlow compensated the best when one of the two prongs of the nasal cannula was obstructed. There were significant differences in actual FiO₂ compared to set FiO₂ in all devices. The AIRVO 2 showed the least difference, followed by the bellavista™ 1000. In devices other than the bellavista™ 1000, increasing the set FiO₂ resulted in larger differences between set and measured FiO₂.

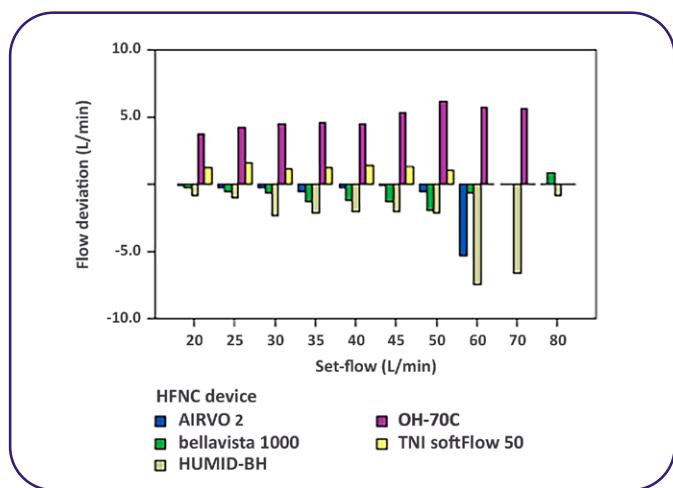


Figure 1 Flow deviation at different set-flow levels in five devices

Why use the bellavista™ for HFNC therapy?

HFNC oxygen therapy offers significant physiologic benefits for patients requiring respiratory support without ventilation. HFNC-therapy has multiple physiological advantages, including generating positive end-expiratory pressure (PEEP), washing out dead space, decreasing inspiratory effort, improving alveolar recruitment, and increasing lung volume and compliance. Using a HFNC system allows the consistent delivery of warmed, humidified oxygen therapy to the patient who is struggling to breathe. Wall oxygen is dry and cold and far less consistent in flow and FiO₂ delivered. The systems tested in this study offer distinct therapeutic benefits compared to conventional oxygen therapy.

Not every patient succeeds with HFNC, with some requiring invasive or noninvasive ventilation. Being able to provide HFNC therapy using a ventilator is a potential game-changer for physicians. If a patient requires additional support such as invasive or noninvasive ventilation, the life-saving machine is already at the patient's bedside. The bellavista 1000

ventilator can provide high quality and predictable HFNC therapy without requiring the capital outlay of a stand-alone machine.



Figure 2 The bellavista™ 1000 ventilator

Take home message

According to this bench study, the bellavista™ 1000 ventilator with the HFNC module delivers high flow nasal cannula oxygen therapy at a level comparable to the best dedicated free-standing products on the market. Flow rates and FiO₂ are consistent and predictable even in cases of accidental compression or blocking of the cannulas. The bellavista has the additional advantage of being able to be used for higher levels of ventilatory support should the patient require it.

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