

# Respiration therapy

PROFESSOR JEAN-DAMIEN RICARD

A new high flow nasal cannula system is being investigated as an effective treatment for acute respiratory failure. **Professor Jean-Damien Ricard** elaborates on how the therapy works, its advantages over conventional treatments and his goals for its widespread use



**Can you introduce your research and highlight your main objectives?**

Acute respiratory failure (ARF) is one of the main causes of admission to the intensive care unit

(ICU). Contrary to acute on chronic respiratory failure – where non-invasive ventilation is undisputedly the first action to take – data are conflicting on the benefits of this technique in patients with hypoxemic respiratory failure, or *de novo* respiratory failure. With nasal high flow cannula oxygen, we saw an opportunity to test a device that could be better tolerated than non-invasive ventilation. Our aims were to see if nasal high flow was able to alleviate patients' respiratory distress, improve their oxygenation and ultimately avoid intubation.

**Why did you decide to study ARF, specifically the effects of nasal high flow cannula oxygen therapy as a treatment?**

I trained as a pneumologist and specialised in intensive care medicine, so I have always had a special interest in the respiratory aspects of intensive care. Additionally, very early in my career I was alerted to the risks of intubation and

mechanical ventilation and the means to avoid them, because I completed my experimental research and PhD thesis with Drs Didier Dreyfuss and Georges Saumon, who are recognised for their work on ventilator-induced lung injury worldwide. When Fisher&Paykel Healthcare representatives showed us their nasal high flow device called 'Optiflow', we were eager to try it.

**What methods and methodologies did you employ over the course of this study?**

For ethical reasons, we decided against performing a randomised control trial, the reason being that all the data available on oxygenation at the time of the study were in favour of the nasal high flow device when compared to conventional oxygen. In addition, we were already using nasal high flow oxygen in our most hypoxemic patients with satisfactory results. Therefore, the question we wished to answer was: should we extend its use to all

## The breath of life

Acute respiratory failure is a common cause of intensive care unit admission and is associated with significant mortality. Specialists at the **Louis Mourier Hospital** are investigating the use of a nasal high flow cannula in the treatment of the condition

**ACUTE RESPIRATORY FAILURE** (ARF) is considered to be one of the most distressing organ failures and is a common occurrence in the critically ill. As a consequence, alleviating the discomfort and risks associated with ARF is a matter of importance to those working in intensive care. While there are several methods already in place to treat the condition, they are not universally successful and often induce further complications. A study of a new technology, devised by Fisher&Paykel Healthcare, led by Professor Jean-Damien Ricard of the Department of Intensive Care at Paris Diderot University and termed 'Optiflow', has produced promising results from the first use.

### PROBLEMS WITH CURRENT PROCEDURES

Current treatments for ARF vary depending on the diagnosis of the failure and its severity. Many patients can be treated with existing nasal cannula systems; however, there is a significant chance of dilution with air from the room. In mild cases this is unimportant, but in

the case of extreme failure, such dilution can be detrimental.

Traditionally in these severe cases, patients are treated with intubation: the process of inserting a tube into the patient's respiratory system to allow oxygenation. Often, people cannot tolerate this procedure and may experience pulmonary damage. In addition, depending on the underlying illness, there can be an array of fatal complications. "One of the main hazards associated with intubation of critically ill patients is profound desaturation during intubation, which can lead to death. Moreover, intubation increases the chance of patients developing infectious diseases, such as ventilator-associated pneumonia," states Ricard, who is an intensive care specialist at Louis Mourier Hospital.

### SOLUTION-ORIENTATED SCIENCE

In light of this, Ricard has spent a large portion of his career looking for alternatives to invasive procedures. The nasal high flow cannula

system or 'Optiflow' – which is currently been trialled in several intensive care units – is the product of such an investigation. This surge in its prevalence occurred after it was delivered to an intensive care unit in France, where a patient undergoing ARF gave her consent for her medical team to use the system as an alternative to intubation. Following its introduction, the patient's care team noted significant improvements in her respiratory state, and in only two hours the majority of the failure was alleviated. Moreover, the increased oxygenation and a high tolerance of the therapy allowed time for the treatment of her underlying illness.

This success is attributed to several design points incorporated in the system: contrary to traditional nasal cannula systems, the nasal high flow system has an enlarged nasal tube that carries pre-heated and pre-humidified air prior to inspiration. These features help to reduce dilution of pure oxygen during inhalation.



the patients who require intubation? We then designed a before-and-after study in which we evaluated our usual practice using conventional oxygenation for preoxygenation and the new strategy using nasal high flow.

### Did you have specific criteria for selecting patients to participate?

As we were already convinced that the most hypoxemic patients benefited from the device, we did not include patients already under nasal high flow nor those under non-invasive ventilation, since this technique has already been shown to be superior to conventional oxygen for preoxygenation. Moreover, we did not include those who required awake intubation with fiberoptic bronchoscopy, or those undergoing cardiopulmonary resuscitation. Otherwise, all the patients that required intubation in the ICU were eligible.

### How have you affirmed the effectiveness of this form of treatment?

As a matter of fact, this study – called FLORALI – has recently completed, and its preliminary results were presented at the European Society of Intensive Care Medicine Congress in Barcelona last September by Dr Jean-Pierre Frat, its lead investigator. It was designed as a multicentre, randomised trial that compared three groups of patients with ARF: one receiving conventional

oxygen, one receiving nasal high flow oxygen and the third receiving non-invasive ventilation that could be associated with nasal high flow oxygen. The primary outcome measure was the intubation rate in the three groups. Results showed a trend toward lower intubation rates with the use of nasal high flow but importantly, a statistically significant reduction in mortality in patients treated with nasal high flow alongside a significantly lower intubation rate in the more hypoxemic patients treated with nasal high flow, in comparison with the two other groups (conventional oxygen and non-invasive ventilation).

### Will this research have direct impact on patient care?

Nasal high flow is becoming increasingly popular in the ICU because of its simplicity of use, remarkable tolerance and suspected – though not yet proven – superiority over conventional oxygen. Our results, along with those from the FLORALI study, provide the necessary evidence that administering heated and humidified nasal high flow of oxygen via nasal cannula has become the new standard for oxygen therapy in ARF, and that it can be used as soon as the patient enters the ICU. It should be used as a means to preoxygenate and secure the intubation procedure if intubation is necessary, and also to provide oxygen during the post-extubation phase.

## BUILDING A BODY OF EVIDENCE

This initial success has triggered a stream of studies examining the potential uses of the new technology, which have yielded further positive results. For example, an early-stage study investigated simple physical responses to the treatment, including the patient's respiratory rate, the use of accessory muscles and thoracoabdominal asynchrony. The results showed there was less profound desaturation in almost all patients.

More developed studies have monitored the use of the nasal high flow system in a variety of situations. These studies have shown that though the major advantage of the therapy is its ability to avoid intubation, in some cases it is still unavoidable. However, in this situation, the scientists have found that nasal high flow systems are still partially beneficial via assisting with preoxygenation prior to and during intubation as the device remains in place throughout.

## NASAL HIGH FLOW FOR EVERYONE

In addition to the benefits for adult patients, Ricard and his fellow medical practitioners and scientists have shown that the nasal high flow system is effective for a diverse pool of

subjects, including infants, children and the elderly. The main advantage of the therapy for these groups is the balance between comfort and clinical effectiveness. Comfort is achieved through the lack in invasive procedures while clinical effectiveness is reflected in the conclusions of the initial study. This indicates that the patient was retaining a safe level of oxygenation during the failure. Ricard puts concisely why these results are so important: "Because intubation of critically ill patients is a high risk procedure, and because patient safety must be our constant objective, we believe everything should be done to lower the risk. Using nasal high flow should be used in that prospect".

## MAJOR BENEFITS AND FEW RISKS

While studies have shown that the new technology is not beneficial in specific cases, there is no sign that it poses any risk of worsening a critically ill patient. Moreover, it has proven itself effective for a wide range of patients suffering from a vast number of conditions. Consequently, the next stage of Ricard's work is to integrate this new technology in other centres globally, so that this progressive treatment can do what it was designed to do: save lives and improve the quality of care for patients.

## INTELLIGENCE

# ACUTE RESPIRATORY FAILURE

## OBJECTIVE

To compare pre- and during intubation oxygenation with either a conventional high FiO<sub>2</sub> oxygen bag reservoir facemask – the current standard practice – or nasal high flow cannula oxygen therapy.

## KEY COLLABORATORS

Based at the Louis Mourier Hospital, France:

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## PARTNERS

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