

important aspects, such as the response of chemokines or adhesion molecules, as well as angiogenesis-related factors to resistive breathing. More research is needed to study not only the factors driving the expression of an angiogenic programme within the respiratory muscles, but also the actual process of angiogenesis, as well as its clinical relevance.

**T. Vassilakopoulos, S. Zakynthinos and C. Roussos**

Dept of Critical Care and Pulmonary Services, University of Athens Medical School, Evangelismos Hospital, Athens, Greece.

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DOI: 10.1183/09031936.05.00029505

# Technical practices are important to consider when assessing noninvasive ventilation failure

To the Editors:

In their recent publication in the *European Respiratory Journal*, CONFALONIERI *et al.* [1] nicely describe relevant clinical predictive factors of noninvasive ventilation (NIV) failure in chronic obstructive pulmonary disease patients hospitalised for acute hypercapnic respiratory failure. The authors provide an interesting tool that could help to quantify this risk better and, thus, shorten the delay of a possible intubation.

NIV failures are linked to the clinical severity at admission and to the location where it was performed, as confirmed by the authors, who focused their work on clinical determinants of immediate NIV failure. However, technical factors, which are more difficult to assess, may modify the results of such prognostic studies, even if they are performed by experienced personnel. Recommendations and experts' opinions concerning NIV in the acute setting [2–4] mention the fact that a proportion of patients fail NIV because of technical problems related to humidification, interfaces, ventilatory modes and patient–ventilator interactions [4].

Humidification of inspired air is a critical factor, since heat and moisture exchangers increase the work of breathing and may lead to NIV failure [5, 6]. NIV failure may also be linked to a poor adaptation to nasal/ facial masks, leading to asynchrony and/or unintentional leaks. In real world studies, most teams change the interface during the ventilatory course, using facial

masks to reduce leaks and, as soon as possible, nasal masks to improve tolerance [7]. Finally, it would be interesting to know if the pressure support mode was modified or shifted during NIV courses in this study. A shift from pressure support to assist–control ventilation is mentioned by some authors in the literature [8], and this could help to resolve some situations, avoiding endotracheal intubation.

In addition to clinical parameters at admission, technical practices obviously need to be taken into account when assessing noninvasive ventilation success or failure during an acute hypercapnic respiratory failure episode. It is, of course, extremely difficult to design clinical studies that would control all technical factors, and we do not know to what extent such control would have modified the final message from CONFALONIERI *et al.* [1]. However, since a non-negligible percentage of patients with chronic obstructive pulmonary disease and acute hypercapnic respiratory failure still fail to be successfully treated by noninvasive ventilation, the important results from CONFALONIERI *et al.* [1] would need to be extended in a prospective study assessing the role of technical factors in the outcome of acute hypercapnic respiratory failure.

**A. Cuvelier and J-F. Muir**

Pulmonary and Respiratory Intensive Care Unit, Hopital de Bois-Guillaume, Rouen University, Rouen, France.

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DOI: 10.1183/09031936.05.00020205

### From the authors:

We would like to thank A. Cuvelier and J-F. Muir for their interesting comment on our article [1]. They have highlighted the importance of technical factors to determine the rate of success of noninvasive ventilation (NIV) in patients with exacerbation of chronic obstructive pulmonary disorder (COPD).

From a theoretical point of view, we agree that problems related to humidification, interfaces, ventilator modes and patient–ventilator interaction may be crucial to ensure the best results of NIV in single patients, but we believe that experience, skills and the level of assistance of the personnel may be even more important than any particular technical aspect itself in determining the success of NIV in patients with similar clinical characteristics [2]. The Italian units participating in our study are all recognised as trained and experienced in the field of NIV for a long period of time (some units for >6 yrs). We designed a “real world” study that allowed all the personnel to manage the patients according to their experience, thus using the best-fitting mask for each patient, changing

interface when needed, adjusting ventilator settings appropriately, and tailoring any technical aspects of NIV to the patients’ needs and clinical evolution. It is well known that inexperienced management of equipment or ventilation mode may be responsible for the failure of NIV and that there is a learning curve in this ventilatory technique, as with other medical or surgical techniques. Nevertheless, the only comparable way to assess progressive training and familiarity with NIV should be by calculating the unit’s years of experience in NIV application. In fact, some investigators who have published several papers on NIV reported initial negative results in COPD patients [3], but the same group later revealed opposite results [4, 5]. CARLUCCI *et al.* [6] recently reported that, over 8 yrs, their increased experience with NIV progressively allowed more severely ill COPD patients to be treated without changing the rate of success.

The letter to the Editors from A. Cuvelier and J-F. Muir correctly recognises the difficulty of designing clinical studies that are able to control all technical factors. Moreover, the familiarity and ability of the medical and paramedical staff with noninvasive ventilation cannot be measured, but only presumed by comparing the success rate within the same unit over time. Bearing all this in mind, we are confident that our validated chart of risk for noninvasive ventilation failure may be used by all the trained units having more than 3 yrs’ experience with noninvasive ventilation application in patients with acute exacerbation of chronic obstructive pulmonary disease.

**M. Confalonieri and M. Kodric**

University Hospital of Cattinara, Trieste, Italy.

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DOI: 10.1183/09031936.05.00029805