Eur Respir J 2010; 35: 463–466
DOI: 10.1183/09031936.00002410

EDITORIAL: RESPIRATORY INTENSIVE CARE ASSEMBLY

Pulmonologists and intensivists: ''two hearts are better than one''

Respiratory Intensive Care Assembly contribution to the celebration of 20 years of the ERS

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The Respiratory Intensive Care Assembly at the European Respiratory Society (ERS) is composed of two areas of interest: noninvasive ventilation and acute critical care. Both of them are mainly focused on respiratory issues related to critically ill patients, aiming to promote the exchange of information between pneumonologists and intensivists, and to foster and encourage education, research and scientific progress.

NONINVASIVE VENTILATION

When the Respiratory Intensive Care Assembly became part of the ERS, one of the groups was named ''noninvasive ventilatory support'' making it a unique feature within the society, since the name of a technique was chosen as representative of a group. Why did this happen?

The spread of innovation in medicine has a typical behaviour, in which the so-called innovators propose new technologies, diagnostic strategies or other elements of care, which are not necessarily followed by an immediate clinical application, despite the excellent results [1]. The time lag encompassing the dissemination of innovation and its spread in ''real life'' varies largely.

At the beginning of the 1990s, a group of enthusiastic people, mainly based in Europe [2–4] or in a specific area of the USA [5], ''re-discovered'' a technique that was first employed in the 1930s by a genuine pioneer, EMERSON [6], and then was abandoned for decades. This technique is called noninvasive positive pressure ventilation (NIV), and few individuals though that, less than 20 yrs later, NIV would have became a first-line intervention for certain forms of acute respiratory failure (ARF), such as chronic obstructive pulmonary disease (COPD) exacerbations [7, 8].

Nowadays the real life use of NIV has increased so much in the intensive care unit (ICU), respiratory ICU (RICU), emergency room, or even medical ward, that at least in certain countries, such as France, >50% of patients starting mechanical ventilation in the ICU are treated directly with NIV [9].

There are, however, still substantial differences between different geographical locations, environments (*i.e.* ICU *versus* non-ICU) and type of hospitals (academic *versus* nonacademic), so that overall use in real life, at least in Europe, is estimated to be ~30% of the patients ventilated for ARF [10]. There is therefore still ''room'' for a further increase for the future, when also the ''laggards'' for disseminating innovations will be convinced about the efficacy of this technique, which, as a matter of fact, was the first form of mechanical ventilation, having preceded the practice of intubation.

The European pulmonologists involved in the practice of critical care can be considered, together with some intensivists, the fathers of NIV in the past 20 yrs. Altogether we thought that this technique would change the practice of medicine, so that for the first time within the ERS a specific group was dedicated to a technique, rather than a disease or a specific branch of respiratory medicine.

Clearly with time, we have learnt several other ''lessons'' from the application of NIV. The fields of interventions have been enlarged, from its use only in COPD exacerbation, to the treatment of various forms of ARF due to cardiogenic pulmonary oedema, to pulmonary infection in immunocompromised patients, and finally in the facilitation of weaning from invasive ventilation and prevention of post-extubation failure [7, 8]. Indeed several ''emerging'' indications have given very promising clinical and scientific results, despite the fact they have not thus far reached the level A of evidence as assessed using the criteria of evidence-based medicine.

The increasing use of NIV, supported by solid clinical evidences, was made possible by the huge efforts that the ''pioneers'' of this technique and their co-workers have made, together with the help of the scientific societies, to improve not only the knowledge, but also the skill and the training of the personnel, which is critical in determining the success of NIV, *via* organising *ad hoc* courses, lectures and, in recent years, web-based activities.

All this has resulted in the evolution of the technology, which now allows us to work with more advanced ventilators, monitoring systems, NIV specific ventilatory modes and software, and more sophisticated material (*i.e.* interfaces and humidification systems) than in the early days [11].

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''Two hearts are better than one'' from B. Springsteen, ''Two Hearts'', *The River*, Columbia Records, 1980.

Since the first goal of medicine is ''*primum non nocere*'' it is important to recognise not only the positive side of the technique, but also its limitations and potential dangers that may harm our patients. For example in these years we have understood that NIV should be applied with extreme caution, if not avoided if the team lack experience, in certain specific conditions, such as acute respiratory distress syndrome (ARDS), severe pneumonia and basically in the most severely ill patients with multiple organ failure, in whom it has been shown that ''only'' <20% of the patients using NIV may avoid intubation [12].

ACUTE CRITICAL CARE

Acute lung injury (ALI) and ARDS play a prominent role among the areas of interest of the acute critical care group. In fact, the mortality from ALI/ARDS is high and not decreasing with time [13]. Here, we will briefly discuss what we believe changed the diagnostic and therapeutic management of ALI/ARDS in the past 20 yrs.

Lung imaging

Lung imaging not only provides new insights on the pathophysiology of ALI/ARDS but optimises ventilatory treatment. Computed tomography (CT) demonstrated an inhomogeneous distribution of the affected areas in the lung parenchyma with increased lung oedema [14]. The use of CT scan may play a relevant role: 1) to improve the definition of ALI/ARDS (*i.e.* lung oedema, as assessed by CT scan, should be included in the definition); 2) to provide a firm rationale for tailoring tidal volume during mechanical ventilation (ideally, tidal volume should be proportional to the portion of the lung open to ventilation, rather than to the body weight); 3) to optimise the setting of positive end-expiratory pressure (PEEP), according to CT assessment of lung recruitability; 4) to detect occult complications, when a sudden and unexplained deterioration of the clinical status or the lack of expected improvement occur; and 5) to follow the evolution with time of ALI/ARDS.

The use of bedside lung ultrasound has been recently proposed to accurately estimate lung aeration and consolidation in patients with ALI/ARDS, as well as pneumothoraces and pleural effusions, and the detection of ventilator-associated pneumonia [15, 16]. The learning curve is brief, so most intensive care physicians will be able to use it after a few weeks of training, although some limitations, like the accuracy and the precision of the technique, must be addressed.

Invasive mechanical ventilation

Mechanical ventilation strategies have been demonstrated to have an impact on the outcomes of patients with ALI/ARDS. Available evidence from a limited number of randomised controlled studies shows better outcomes with routine use of low tidal volume (6 mL per kg ideal body weight) and plateau pressure of the respiratory system ($P_{plat,rs}$) <30 cmH_2O but not high PEEP ventilation in unselected patients with ALI/ARDS. Higher PEEP might provide survival benefit by helping to prevent life-threatening hypoxaemia in a subgroup of more severe patients as compared with lower PEEP [17]. To individualise PEEP, the expiratory phase has to be considered, and the oesophageal pressure measurement to compute the transpulmonary pressure should be progressively introduced in clinical practice [18]. Recruitment manoeuvres are often used to treat patients with ALI or ARDS [19] but the effect of this treatment on clinical outcomes has not been well established [20]. However, tidal hyperinflation may occur in even patients with ALI/ARDS who are ventilated with a protective tidal volume and $P_{plat,rs}$. In these patients ventilation with tidal volume <6 $mL \cdot kg^{-1}$ enhances lung protection, and resulting respiratory acidosis may be safely and efficiently managed by extracorporeal carbon dioxide removal [21]. Finally, it has been recommended that adult patients with severe but potentially reversible ARDS, whose Murray score exceeds 3.0 or who have a pH of <7.20 on optimum conventional management, should be transferred to a centre with an extracorporeal membrane oxygenation-based management protocol, in order to significantly improve survival without severe disability [22].

Weaning

Liberation from mechanical ventilation is a vital treatment goal in the management of critically ill patients. The duration of mechanical ventilation is affected by strategies for ventilator weaning and sedation [23] and the weaning process has been classified as simple, difficult or prolonged [24]. Patient outcomes are significantly influenced by the choice of sedative and analgesic agents, the presence of over- or undersedation, poor pain control and delirium. Individualised sedation management using sedation assessment tools, sedation protocols and daily sedative interruption can improve clinical outcomes. Surveys of clinicians' self-reported practice and prospective practice audits characterise sedation and analgesia practices and provide directions for education and future research. Current guidelines organised by the ERS recommend the use of spontaneous breathing trials and spontaneous awakening trials [25].

Tracheostomy

Currently, tracheostomy represents an established procedure for airway management in critically ill patients who require long-term respiratory support, and it is one of the most frequently performed surgical procedures in critically ill patients [26, 27]. It offers a number of practical and theoretical advantages when compared to conventional translaryngeal oro- or nasotracheal intubation, but is also associated with a number of serious complications. Due to increased experience and advanced techniques, percutaneous tracheostomy has become a popular, relatively safe procedure in the ICU. The decision of when and how to perform a tracheostomy is often subjective, but must be individualised to the patient. Surprisingly, few data are available on the current practice of tracheostomy in the ICU setting. The following recommendations might be made on a low level of evidence: on day 2 or 3 after onset of mechanical ventilation (>48 h of mechanical ventilation or need for an artificial airway) tracheostomy should be seriously considered. Different issues must be taken into consideration when deciding to perform a tracheostomy, such as the most likely course of the underlying respiratory insufficiency, the likelihood of need of invasive mechanical ventilation for more than 1 week, either because of an ongoing impairment of oxygenation, weaning failure, upper airway obstruction, coma or a swallowing disorder, and the presence of relevant contraindications for the performance of a

tracheostomy. Most reports, however, favour the performance of tracheostomy within 10 days of respiratory failure.

Fluid strategy

Optimal fluid management in patients with ALI/ARDS is unknown. Diuresis or fluid restriction may improve lung function but could jeopardise extrapulmonary organ perfusion. Evidence suggests that a conservative strategy of fluid management improves lung function and shortens the duration of mechanical ventilation and intensive care without increasing nonpulmonary organ failures. These results support the use of a conservative strategy of fluid management in patients with ALI/ARDS [28]. Furthermore, pulmonary artery catheter (PAC)-guided therapy does not improve survival or organ function but is associated with more complications than central venous catheter-guided therapy. These results, when considered with those of previous studies, suggest that PAC should not be routinely used for the management of ALI/ARDS [29].

Corticosteroids

The use of corticosteroids in sepsis and septic shock is matter of debate. Despite their potential benefits, corticosteroids have adverse affects and the benefits and risks, *e.g.* superinfections and critical illness polyneuromyopathy, must be balanced in order to determine whether they should be used or not [30]. Conversely, experimental and clinical studies have demonstrated a strong cause and effect relationship between persistence *versus* reduction in systemic inflammation and progression of ALI/ARDS. Recent evidence from eight controlled studies suggests that low-dose corticosteroids given early after ALI/ARDS onset may significantly reduce markers of systemic inflammation, pulmonary and extrapulmonary organ dysfunction scores, duration of mechanical ventilation and ICU length of stay [31]. However, further large randomised studies are warranted to define the role of corticosteroids in ALI/ARDS.

Blood glucose control

Hyperglycaemia is associated with increased mortality in critically ill patients; however, the optimal target range for blood glucose remains unclear. Intensive glucose control may increase mortality among adults in the ICU: a blood glucose target of $\leqslant 180$ mg·dL^{-1} resulted in lower mortality than a target of 81–108 mg·dL^{-1} [32]. There is no evidence to support the use of intensive insulin therapy in general medical/surgical ICU patients who are fed according to current guidelines. Tight glycaemic control is associated with a high incidence of hypoglycaemia and an increased risk of death in patients not receiving parenteral nutrition [33]. However, this therapy may be beneficial to patients admitted to a surgical ICU [34].

Ethics

End-of-life medical decisions can take place in any setting in which patients die, that is in hospital, nursing homes, hospices and at home.

The problems of dying with end-stage disease and the limits of medical care have became one of the consuming interests of intensivists and the subset of pulmonologists who are dealing with chronic obstructive or restrictive pulmonary disorders. Most European legislation has not specifically addressed this issue, but interestingly, the European Commission has ruled that the patient has the right of self determination, including the right to refuse unwanted therapies. Two recent multinational European surveys have assessed end-of-life decision-making. In particular, the main conclusions of the Ethicus study [35] were that limiting life-sustaining treatment in European ICU is common but varies according to patient's age, diagnosis and geographic and religious factors. Southern European countries were, for example, less likely to practice withdrawing life-support. The ERS task force on end-of-life decision-making in RICUs [36] was the first study performed in a specific ''respiratory environment'' and showed that end-of-life decision is taken in 21.5% of the patients admitted. Witholding, do-not-intubate/do-not-resuscitate orders and NIV as a ceiling treatment for palliation are the most common procedures. Patients and families are often involved, together with nurses.

CONCLUSIONS

In the past 20 yrs, the advances in critical care medicine have been enormous. This has been achieved thanks to our intensivist colleagues, but also through the dedication of the subset of pulmonologists involved in critical care practice. This field is a typical example in which the collaboration, rather than the antagonism, of two different specialities may lead to a common final task, which is the improvement of care of our patients.

STATEMENT OF INTEREST

A statement of interest for S. Nava can be found at www.erj.ersjournals.com/misc/statements.dtl

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