Pulmonary hypertension in COPD

The application of "pulsed" NO combined with LTOT may have a role in treating pulmonary hypertension secondary to COPD.

Following the identification of nitric oxide (NO) in 1986 as "endothelium derived relaxing factor", there has been an exponential growth in our understanding of the physiological role of NO culminating in the award of a Nobel Prize, and the naming of NO as "molecule of the decade". Considerable research has subsequently been devoted to understanding the role of this molecule in vascular biology in general, and the pulmonary vascular system in particular.

NO is an unstable radical with a low blood gas partition coefficient. For decades NO was considered an environmental contaminant produced by bacteria and internal combustion engines. Believed to be highly toxic, it appeared an unlikely candidate for a major role as a biological mediator. However, within the last 15 years it has become clear that endogenously produced NO is ubiquitous in mammalian systems, playing an important role in both health and disease; in the regulation of blood pressure and flow, inflammatory responses, and neurotransmission. Insight into these physiological roles has led to its use as a therapeutic agent in a number of clinical settings.

There are ample data to support a major role for NO in the regulation of pulmonary vascular tone, and the deleterious impact on gas exchange is worsened by inactivation of inhaled NO in an oxygen rich environment. This includes the delivery system and monitoring systems necessary to ensure accurate dosing and safety. In addition, long term gas therapies are far from ideal contaminant produced by bacteria and internal combustion engines. Believed to be highly toxic, it appeared an unlikely candidate for a major role as a biological mediator. However, within the last 15 years it has become clear that endogenously produced NO is ubiquitous in mammalian systems, playing an important role in both health and disease; in the regulation of blood pressure and flow, inflammatory responses, and neurotransmission. Insight into these physiological roles has led to its use as a therapeutic agent in a number of clinical settings.

There are ample data to support a major role for NO in the regulation of pulmonary vascular tone, and the deleterious impact on gas exchange is worsened by inactivation of inhaled NO in an oxygen rich environment. This includes the delivery system and monitoring systems necessary to ensure accurate dosing and safety. In addition, long term gas therapies are far from ideal.
from convenient for the patient. NO reduces pulmonary vascular resistance by increasing cyclic GMP levels in vascular smooth muscle cells. This effect can also be achieved by inhibition of the enzymes that metabolise cyclic GMP. Inhibitors of the type 5 cyclic GMP phosphodiesterase such as sildenafil may have some selectivity for the pulmonary circulation, and it remains to be seen whether these drugs administered orally may have an effect equivalent to inhaled NO.

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Childhood asthma

Second line treatment for severe acute childhood asthma

M South

The choice of treatment for a child with severe acute asthma unresponsive to high dose inhaled bronchodilators and oral or intravenous corticosteroids is still the subject of debate. Although both salbutamol and aminophylline have been around for a long time and have been the subject of many studies, it is still not possible unrestrainedly to recommend one of these agents over the other as second line treatment.

Most physicians would agree that first line treatment for an acute exacerbation of childhood asthma should be the administration of high dose inhaled bronchodilators and corticosteroids administered either orally or intravenously, but when a child with severe acute asthma is unresponsive to such treatment—what should come next? This is an important question that is faced by doctors every day in emergency departments, paediatric wards, and intensive care units the world over. Most commonly, physicians will reach next for intravenous salbutamol or intravenous aminophylline, although some will consider other treatments. Salbutamol and aminophylline have been shown to be individually better than placebo in severe acute asthma. Although a recent Cochrane systematic review appeared to cast doubt on this statement for salbutamol, many suspect that this is a flaw caused by the inclusion of several very weak early studies of salbutamol in the analysis. A large study of aminophylline and another Cochrane systematic review have confirmed its efficacy in improving a number of important outcomes including the need for, and duration of, mechanical ventilation in acute childhood asthma.

A study by Roberts et al6 in this edition of Thorax is the first to compare the two agents using a good trial design. The authors have attempted to study these second line treatments in a randomised controlled trial to compare an intravenous bolus of salbutamol with a loading dose of aminophylline followed by an intravenous infusion. They have inevitably come across two of the major obstacles faced by anyone studying acute asthma episodes in children: (1) how to study such very sick children and (2) what outcomes are both measurable and important in this context? Improvement in severity score and reduced length of hospital stay are clearly of interest but it is not the main goals of treatment. Unfortunately, despite the inclusion of five hospitals in the study, their sample size is still relatively small with only 44 subjects. Although this was the required number from the calculations, it is too small to address important outcomes such as the need for intensive care admission or mechanical ventilation, and much too small to examine an impact on long term morbidity or mortality from severe asthma exacerbations. In their salbutamol group 11% of patients required intubation and ventilation, while only 4% in the aminophylline
Improving the care for patients with acute severe respiratory disease

M W Elliott

Services to improve the care of patients with acute severe medical conditions in general, and respiratory disease in particular, need to be improved. This includes access to a non-invasive ventilation service, available 24 hours per day, in all hospitals admitting patients with acute medical conditions.

In the early 1960s the first coronary care units (CCU) were established and are now a “given” in every hospital admitting patients with acute cardiac disease. For patients admitted to hospital with physiological disturbance due to non-acute cardiac medical conditions, the only options are usually either admission to an intensive care unit (ICU) or to a general medical ward. Inevitably, given the differences in staffing and facilities with one nurse looking after one patient with comprehensive physiological monitoring on the ICU compared with perhaps only two or three nurses looking after 30 patients at night with minimal continuous monitoring on a general medical ward, some patients will be admitted to the ICU who could be managed elsewhere. This is economically disadvantageous. Alternatively, patients may be looked after in an area in which proper care is not possible. This is an issue of standards of care and clinical governance. In the UK there are a number of drivers towards improving the acute care for medical patients including two recent reports—one from the Royal College of Physicians of London and the other from the NHS Modernisation Agency. Patients with respiratory failure constitute a significant proportion of medical admissions and the development of appropriate services for these patients is important from both the clinical governance and the economic perspectives. The provision of an ICU to patients with acute severe respiratory disease is not just an issue in the UK.1

Critical care

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hours of the cardiac arrest. Common findings included failure of the nurse to notify a physician of a deterioration in the patient’s mental status or failure of the physician to obtain or interpret an arterial blood gas measurement in the setting of respiratory distress. Cardiac arrests were more common in patients discharged from the ICU. Schein et al reported a similar picture with 84% of inpatient cardiac arrests having documented deterioration within 8 hours of the event. There is therefore a clear need to improve the quality of care afforded to patients with acute non-cardiac medical conditions.

There are a number of solutions, including better education of medical and nursing staff and more senior input into the assessment of patients at an early stage in the admission. ICU outreach teams are strongly recommended to avert admissions by identifying patients who are deteriorating and either helping to prevent admission or ensuring that admission to a critical care bed happens in a timely manner to ensure best outcome. This presupposes that such patients are brought to the attention of the team and this can be helped by the use of early warning scores. The team needs to be available 24 hours per day. The RCP Working Party recommended that appropriate facilities for provision of level 2 care (see box 1) to medical patients be available. Ideally this should be in close proximity to the level 3 facility and suggests the need for a unit for medical patients, of whom a significant proportion will be those with respiratory disease.

NON-INVASIVE VENTILATION

There is now a robust evidence base for the use of non-invasive ventilation (NIV) in patients with mild (pH 7.31–7.35), moderate (pH 7.25–7.30), and severe (pH <7.25) acidotic exacerbations of chronic obstructive pulmonary disease (COPD). It is best instituted early before ventilatory support is definitely needed but, even when the patient appears to warrant intubation and mechanical ventilation, there is much to be gained and little to be lost by a trial of NIV. NIV has also been used in patients with hypoxaemic respiratory failure resulting from a variety of different conditions. It has been shown to be both more effective and cheaper than intubation and ventilation on the ICU and conventional treatment on general wards. It is certainly feasible outside the ICU.

A review of adult critical care services in the UK published by the Department of Health recognised that NIV was one of a number of clinical areas impacting upon the level of critical care provision that required additional evaluation. In response the NHS Modernisation Agency Critical Care Team assembled a multiprofessional working group to discuss the issues relating to current practice and the resources needed to deliver a service. Their report and an Executive Summary were published in April 2002 and are available at www.criticalcare.nhs.uk. A key recommendation was that “an NIV service be established in each acute trust for the management of patients with acute respiratory failure...”. A number of further recommendations were made including that NIV should be available continuously, appropriately supported by nursing and allied health professional staff, equipped to standards specified by the British Thoracic Society with data collection and audit facilities and a training facility for all junior medical, nursing, and allied health professional staff.

Acute NIV has grown out of home ventilation and the technology necessary to deliver it is easily portable. It could therefore be argued that it is easy to take the equipment to the patient and there is no need to have a specialist unit with NIV being possible for all patients in any clinical area. However, the evidence does not support this approach for the generality of patients needing NIV. In a study by Plant et al, while it was clear that NIV was feasible on a standard general ward with the usual staffing complement, subgroup analysis suggested that the outcome for those with a pH of <7.30 using a simple ventilator according to protocol was not as good as the results seen in patients with similar illness severity managed in a higher dependency setting. There is much more to NIV than the provision of the necessary hardware and there are many advantages to concentrating the NIV service in one location. Foremost among these is the development of the appropriate expertise, particularly among the
nursing staff. Whether nurses are the primary deliverers of NIV or another professional group such as physiotherapists or technicians take the main role, the nurses must be familiar with it because they are the only healthcare professionals who are with the patient 24 hours per day. They must be both confident about the technique and recognize when there are problems, particularly of a technical nature. Continued use of skills once learnt is important in maintaining them, and this will be facilitated by comprehensive critical care—namely, of a service rather than a place—but it is difficult and expensive to provide such a service 24 hours per day throughout the year. Because the nurse primarily responsible for the bedside care of the patient is unlikely to be familiar with NIV or to gain much experience of it over time, a lot of “hands on” support will be required on a “one to one” basis. It may be difficult for the team if there are a number of patients receiving NIV dispersed around the hospital. In practice most of the time is needed at initiation of NIV, and, once patients are established, they will just need a watching brief and regular review, but help should be readily available if there are problems. The exact model will vary from hospital to hospital, but there is now a clear requirement to provide an acute NIV service in all hospitals admitting emergency medical patients and to improve the standard of care for patients with acute severe medical conditions generally.1 These requirements may be best met by a general medical or multi-specialty high dependency unit (HDU). However, in a recent survey only 26% of 190 general hospitals with an ICU had an HDU;2 the proportion of beds allocated for medical patients was not stated. Anecdotal evidence suggests that there has been a considerable expansion in HDU facilities in the last 2–3 years, but there are no firm data on this. Most of the extra provision has been for surgical patients, driven by cancelled operations because of the lack of ICU bed and waiting list targets. Physicians as a group would certainly be pressing for more level 2 facilities for their patients. However, if these are not forthcoming, the need to improve the standard of care for patients with acute respiratory disease and to provide an NIV service could be achieved in respiratory medicine at a relatively small extra cost compared with many other critical care initiatives. The experience of NIV in Continental European and North American ICUs suggests that a nurse to patient ratio of 1:3 or 4 is satisfactory, which compares favourably in economic terms with a classical UK HDU in which one nurse is recommended for two patients. Designating part—say, one bay—of a larger specialist ward as a mixed sex “acute respiratory care unit” would provide a focus for NIV, as well as the care of level 1 and 2 patients with acute severe respiratory disease. In such a unit a staff can be used flexibly and there is no need for major and expensive building works. It is largely an administrative change, with some extra staffing resource and improved monitoring. The patients are already being cared for within the medical (usually) bed base; instead of being dispersed they are now in one location. The beds must be considered in the light as coronary care and other higher dependency beds in terms of bed management to ensure that the patients who need acute respiratory care are managed in the right environment. It should no longer be acceptable—even at times of great pressure when medicine extends outside its bed base—for acute admissions with physiological compromise due to respiratory or any other organ failure to be managed at the end of a non-acute general ward. A further advantage of such units is that they can allow earlier discharge of some patients with respiratory disease from level 3 beds. Training and education are vital,3,20 and junior medical staff should spend some time in critical care areas as part of their general professional training.1 3-5 Respiratory physicians must ensure that all junior medical and nursing staff are adequately trained in the management of acute severe respiratory disease. Some consultants who were appointed before NIV became available may need training in this specific area. In the future the training of more physicians with dual accreditation in respiratory medicine and critical care is desirable.6 7 The requirement to provide an acute 24 hour per day NIV service is a major driver to improve the standard of care for all patients with acute severe respiratory disease. The development of acute respiratory care units, either integrated into a more general HDU or as part of an existing respiratory ward, is a logical way forward. Such units should not function in isolation and clear protocols and coordination with intensive care units are vital.


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