2011 Adult Non Invasive Ventilation (NIV) audit

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The second BTS national audit of acute NIV provision was even more successful than last year. Patients and hospitals contributing more than doubled to 2187 and 122 respectively. The majority were from England (114 hospitals) but the geographical location and type of institution was otherwise diverse.

The main patient characteristics and outcomes were similar to 2010. The mean age in 2011 was 71yrs with generally poor performance status (70% limited/very limited, 7.5% chair/bed bound). Admissions occurred out of hours in 50%. AECOPD was the indication in most (70%), obesity hypoventilation in 9% and cardio-genic pulmonary oedema in 8.5%. (Figure 1). Patients with probable pneumonia as the precipitant for hospital admission continue to be treated by NIV (38% had consolidation on X-ray) but the audit could not establish if this affected outcome. Trial evidence suggests it does and this was reported in the 2008 NCROP audit (1) in which pneumonia was present in 21% of NIV treated patients with a mortality 30% versus 24% without x-ray changes. As in our previous audit, admission gases indicate that many had chronic hypercapnic respiratory failure with HCO3 >30 in 50% and at least 25% having been treated by NIV in a previous admission. Worryingly, we again found this year that no hospital follow up was recorded in 30% despite the need for NIV indicating a high readmission risk and < 50% 1 year survival.

Oxygen associated hypercapnia (oxygen toxicity) remains common. This was also found in the NCROP audit (1). The fact that 92% of respondents answered the question suggests these clinicians are alert to the problem. In 21% of cases it was thought oxygen toxicity caused or contributed to hypercapnia. This was felt to have occurred less frequently in ambulance transit in 2011 than 2010 (29% v 39%) and as a result the proportion thought to be related to hospital therapy increased (62% v 49%). This is disappointing given the recent strong evidence on the mortality risk of high concentration oxygen (2). The recommendation to employ universal precautions by ambulance services (28% O_2 in acutely unwell COPD patients unless *in extremis*) may have contributed to a fall in occurrence on the way to hospital but more action is required to reduce it happening in hospital is needed. We enquired about the use of oxygen alert cards or other strategies to protect patients this year. Unfortunately no data was recorded in 40% and only 10% of respondents who had identified oxygen toxicity as occurring took action to reduce future recurrence. Clearly more work is needed to reduce oxygen toxicity, particularly in hospital.

The median pCO_2 at the start of NIV was 10.1 and fell to 7.3 kPa at discharge (in the survivors). As in 2010, a few patients appeared to have been treated for a metabolic acidosis with pCO_2 <6 in 5% and < 4.5 in just over 2%. In the NCROP audit, the co-existence of metabolic and respiratory acidosis increased mortality, as did the late development of acidosis. There are a variety of causes for metabolic acidosis complicating AECOPD, such as type B lactic acidosis indicating significant cardiac failure or sepsis and acidosis relating to renal failure or diabetic keto-acidosis. It may also be iatrogenic relating to excessive B2 stimulant use (3) and this, in my experience, is not commonly recognised.

Pressure settings remain modest at best with a median IPAP at 1 hour of 15 (range 8-29) and with less than 20% of cases managed with an IPAP >20. Despite this, overall success, defined as overall improvement, was similar to trial data and 67% of patients treated by NIV being discharged from hospital. Of these 7% were given domiciliary NIV and 33% LTOT. Of the 33% who died during admission this was attributed to respiratory failure in 25% and non respiratory causes in 8%.

Management plans relating to failure of NIV were available in 73% cases - to proceed to intubation in 22%, to view NIV as ceiling therapy in 66% and in 9% to only employ NIV as "palliative" or for symptom control. However, only 83 of the total cohort of 2187 patients were subsequently managed by invasive mechanical ventilation. (Figures 2 and 3). This represents 3.8% of all patients. Is this a significant increase from 2.3% in 2010? One can hope so although the reason(s) for this cannot be determined from the audit. As case discussion with the ICU was only reported in 33%, part of the explanation may be lack of referral. Patients or relatives were more likely to be informed or involved in decision making regarding NIV at 47% (v 39% in 2010) but the use of advance directives remains rare (4%) despite many patients having had previous and, presumably, sometimes frequent admissions. Of concern, care plans appear to have been decided upon by very junior trainees (FY2/ST1/2) in 6% of cases and in discussion with a consultant in only 36% and unfortunately further questions relating to this issue were unanswered in 24%. These findings are similar to the NCROP audit where 11% of "no escalation" plans were made by juniors below ST3 level and 50% by ST3 and above. In our audit, the speciality of doctor making the decisions was respiratory in 41%, acute or general internal medicine in 40% and intensivist in 13%. The audit has again demonstrated that actual treatment provided does not reflect proposed management plans and suggests insufficient involvement of consultants and ICU staff in decision making. The results may also reflect inappropriate placement of the more severe patients eg those with more severe acidosis who because they might be expected to fail NIV should be admitted to ICU to receive NIV. Finally, it may reflect inadequate ICU provision or continued nihilism for aggressive management of patients with acute hypercapnic respiratory failure (4).

This year, information on mode of ventilation, reasons for failure and use of sedation was requested. Pressure support (PS) with a back-up rate (BUR) <16 was the most commonly employed mode (64%), PS BUR>16 was used in 8% and pressure control in 14% (with no data in 14%). Of 640 records responding to a question on cause of NIV failure, "general intolerance" was thought causative in 33% and patient deterioration despite NIV in 54%. This suggests a problem of failing to take appropriate action when NIV is failing rather than insurmountable issues as excessive secretions, inability to control leak or specific mask intolerance were regarded as rarely of importance. The audit did not provide evidence on what action was taken by staff providing NIV when it failed as this question was only answered by 111 respondents. Of these, 97 indicated sedation was given, 10 changed to the pressure control mode and in 7 cases a helmet or total facemask was employed. Whether such a limited response to these questions indicates a lack of knowledge of the options available, inadequate information being provided in local guidelines or both is unknown.

On a more positive note, the 2010 audit of acute NIV appears to be of value to respiratory physicians. It had been discussed with clinical colleagues by 55% of respondents , with managers in 64% and 70% claimed a change in service provision had been made as a result. Examples included two cases of the establishment of an acute NIV unit and in one of instigating a 24/7 nurse led service. Other benefits included increased teaching and funding, review of NIV performance and creation of care bundles, completion of incidents forms for oxygen toxicity, establishing a named on call respiratory consultant for NIV and, finally, of more aggressive ramping up of IPAP.

The NCROP audit published in 2011 provides additional evidence of a failure or delay in delivery NIV to hypercapnic COPD patients. It also found that persisting and, even more significantly, developing acidosis increases the risk of death. It raised concerns that mortality of NIV treated patients during the period of the audit (2008-9) was not lower than those apparently equally severe patients managed without NIV. The cause of this unexpected outcome is unknown but may relate to the quality of service provision and together these audits issue a challenge to the respiratory community to improve the delivery of NIV in our hospitals. It is now time for a continuous review of performance in NIV feeding into cycles of improvement in service delivery. In the writer's opinion this should be a commissioned performance measure in COPD patient care. The introduction of mandatory reporting of NIV outcome, as is required of patients intubated for respiratory failure in the ICU, would be in the interest of patients and respiratory teams trying to provide a quality service. The 2011 audit tool remains available on the BTS website for units to bench mark their performance. Let us get ready to make the 2012 audit even more comprehensive in terms of hospital coverage and may we hope to demonstrate improved service delivery?

(1) Roberts CM et al Acidosis, non –invasive ventilation and mortality in hospitalised COPD exacerbations. Thorax 2011; 66: 43-48

(2) Austin MA et al Effect of high flow oxygen on mortality in COPD in pre-hospital setting : an RCT. BMJ 2010; 341:c5462

(3) Manthous CA Lactic acidosis in status asthmaticus : 3 cases and review of the literature. Chest 2001; 119: 1599-1602.

(4) Wildman MJ, Sanderson MJ, Groves J et al. Implications of prognostic pessimism in patients with COPD or asthma admitted to intensive care in the UK : multi-centre observational COHORT study. BMJ 2007; 335: 1132-34.

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Figure 1: Respiratory diagnoses

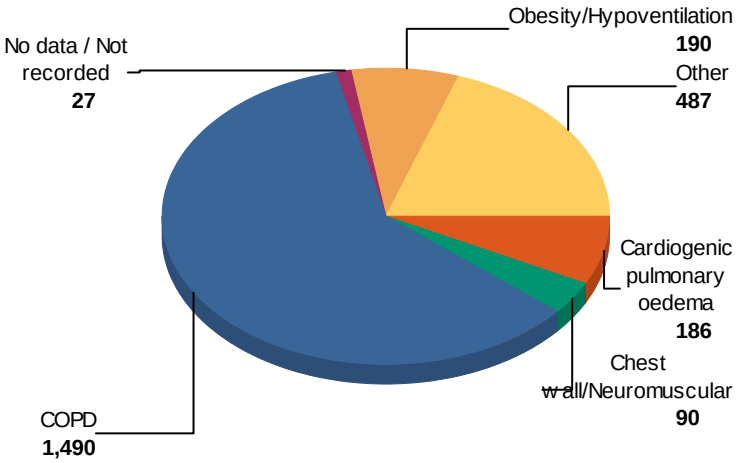
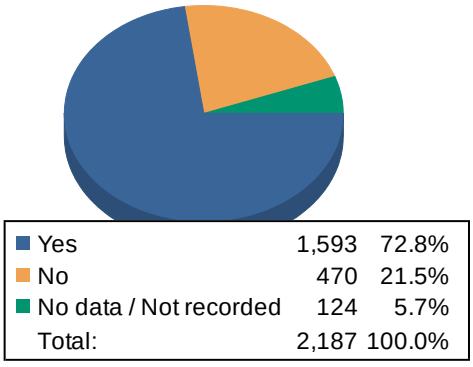
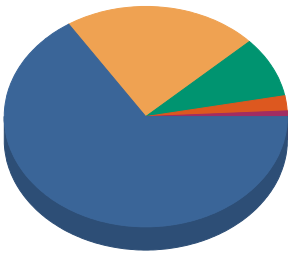


Figure 2: Do the medical records document a plan if NIV fails?



Yes	1,593	72.8%
No	470	21.5%
No data / Not recorded	124	5.7%
Total:	2,187	100.0%

Figure 3: If yes – what plan was made



Plan NIV as ceiling to treatment	1,047	65.7%
Plan to proceed to intubation	357	22.4%
Plan to remove NIV if no benefit (ie palliative approach)	141	8.9%
Other	33	2.1%
No Data / Not Recorded	15	0.9%
Total:	1,593	100.0%