476. New scientific findings on noninvasive ventilation in the acute setting

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Predicting mortality in patients hospitalised with acute exacerbations of COPD (AECOPD) requiring assisted ventilation

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Background: Prognostic studies in AECOPD requiring assisted ventilation often select patients by place of care and predict failure of non-invasive ventilation (NIV), not mortality. Improved mortality prediction for unselected patients requiring ventilation for AECOPD is needed.

Objective: Identify mortality predictors in patients with AECOPD requiring ventilatory assistance.

Methods: Clinical data were collected on consecutive patients hospitalised with AECOPD requiring assisted ventilation (NIV or invasive ventilation) for acidaemic respiratory failure (ARF) during their hospital stay. Independent predictors of in-hospital mortality were identified.

Results: 199 received ventilatory assistance: mean (SD) age = 73.9 (9.8) years; FEV_1 38.1 (16.1) % predicted and 61.3% were female. 49 (24.6%) patients died in hospital.

Older age, an ineffective cough, and severe stable-state dyspnoea were the strongest

Table 1. Independent predictors of mortality

Variable	Odds ratio (95% CI)	p value
Age, years	1.11 (1.04–1.18)	0.001
Ineffective cough	5.23 (1.74–15.7)	0.003
eMRCD	2.08 (1.25–3.43)	0.005
[HCO3], mmol/L*	0.93 (0.88–0.98)	0.008
Stroke disease	5.54 (1.49–20.6)	0.011
Anxiety/depression	0.21 (0.06–0.70)	0.012
Recent weight loss	3.78 (1.26–11.3)	0.017
Time to recognition of ARF, hours	1.01 (1.00–1.02)	0.020
Neutrophil count, $\times 10^9$/L	1.10 (1.01–1.20)	0.031
Maintenance carbocysteine	4.03 (1.06–15.2)	0.040

*At time of ventilation commencement.

mortality predictors. The regression model (table 1) showed excellent discrimination for mortality (AUROC = 0.92, 0.88 to 0.96).
Conclusion: Mortality in patients hospitalised with AECOPD requiring assisted ventilation is high but can be accurately predicted using simple to measure indices.

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Echocardiographic speckle tracking strain and right ventricular function assessment during non-invasive ventilation in acute respiratory failure patients
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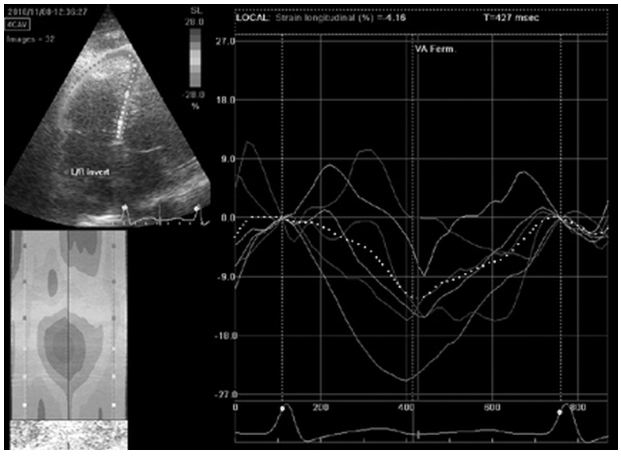
Introduction: During acute respiratory failure (ARF), right ventricular (RV) function can be abnormal due to increased afterload and/or decreased contractility or preload. Speckle tracking strain analysis can diagnose RV dyssynchrony. We aimed to test whether RV dyssynchrony exists during ARF and can be reversed during non-invasive ventilation (NIV).
Methods: Prospective study including 13 patients admitted for ARF. Trans thoracic echocardiography (TTE) was performed during spontaneous breathing (SB) activity and during NIV. Usual echo parameters and speckle tracking strain were measured. The software generated 6 segmental RV strain curves. Time to peak strain from each of 6 time-strain curves was determined with dyssynchrony defined as the difference between earliest and latest segments.
Results: 13 patients aged 69(11) y were included. 11 had chronic respiratory failure. Compared to SB, left ventricular ejection fraction and stroke volume increased during NIV: 59 (6) vs 66 (6) %, 61 (9) vs 65 (11) mL, $p < 0.05$ respectively, and systolic pulmonary arterial pressure (SPAP) decreased 61 (16) mmHg vs 41(16) mmHg, $p = 0.03$. RV dyssynchrony improved significantly: 235(140) vs 182 (149) msec, $p = 0.04$.



Conclusion: RV dyssynchrony measured using speckle tracking strain is observed in our ARF patients. NIV can improve LVEF, RV afterload and RV dyssynchrony.

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Confirmatory analysis of the impact of case-volume on ICU management of severe COPD exacerbations (1998-2010)
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Objective: To study the relationship between case volume and management and mortality of acute exacerbations of chronic obstructive pulmonary disease (AECOPD) in intensive care units (ICU).
Design setting: A 12-year multicenter French retrospective cohort study (CUB-Réa database).
Patients and methods: Patients with AECOPD were identified and demographic characteristics, SAPS II, mechanical ventilation (MV) (invasive (IV) or non-invasive (NIV)) and vital status were analyzed. Participating units were categorized into volume tertiles of the running mean annual volume of admissions. Prognostic factors were analyzed by a conditional multivariate logistic model after matching on a propensity score of being admitted to a high-volume unit and on the year of admission.
Results: 14,440 AECOPD were identified. SAPS II and ICU mortality gradually increased between 1998 and 2010 (36 to 41 and 12% to 14%, respectively). The proportion of patients receiving any MV increased (64% to 86%), with a marked increase in the use of NIV (from 47% to 78%) and a decrease in the use of IV alone (53 to 22%). There was a significant association between case volume and NIV use with an odds ratio for the highest versus lowest + intermediate tertiles of case volume of 1.43 [95% CI: 1.23 - 1.66]. The association between case volume and mortality was not significant.
Conclusion: During the last 12 years, the severity and mortality rate of AECOPD admitted in CUB-REA ICUs increased. There was a growing use of NIV and a decreased use of IV. NIV use was related to case volume, suggesting that increasing experience favours the use of NIV.

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Is non-invasive ventilation (NIV) utilised appropriately outside of respiratory specialist areas?
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Background: The British Thoracic Society (BTS) recommends regular audit of NIV practice (BTS, NIV in acute respiratory failure, Thorax 2002, 57, p192-211) and states inappropriate use of NIV is undesirable.
Aims and objectives: The aim of this study was to establish if inappropriate NIV could be correlated with location of set up. Proving this hypothesis would enable us to target locations to provide additional support to reduce and prevent the inappropriate use of NIV.
Methods: Data were collected prospectively from 255 consecutive patients requiring NIV from May 2009 to April 2011 using an adapted version of the BTS NIV data tool. The establishment of NIV was deemed appropriate or not as per the BTS guidelines.
Results: The impact of appropriate use of NIV on mortality is summarised.

Table 1. Impact of appropriate use of NIV on mortality

	Appropriate use of NIV (n) %	Inappropriate use of NIV (n) %	p value (Chi squared)
Mortality	34% (n=68)	52% (n=29)	0.022

The impact of location on appropriate use of NIV is summarised.

Table 2. Impact of location on appropriate use of NIV

Location	Appropriately commenced on NIV	Inappropriately commenced on NIV	p value (Chi squared)
Accident & Emergency	71% (n=66)	29% (n=27)	0.030
Medical Assessment Unit	50% (n=9)	50% (n=9)	0.002
Respiratory specialist areas (Respiratory ward and Medical High Dependancy Unit)	87% (n=121)	13% (n=18)	0.014

Conclusion: Patients commenced on NIV outside of respiratory speciality areas are more likely to receive inappropriate NIV with subsequent higher mortality rates.This may be due to the lack of expertise in non-respiratory areas. We therefore conclude that NIV should only be initiated in respiratory specialist areas within our hospital.

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Effect of continuous and bilevel noninvasive ventilation for acute asthma exacerbation – A randomized controlled trial
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Guidelines for management of acute asthma exacerbation (AAE) centre on pharmacological interventions and invasive mechanical ventilation. The role of non-invasive positive pressure ventilation (NPPV) in AAE remains unanswered.
Aims: We hypothesized that adding continuous positive airway pressure (CPAP) or bilevel positive pressure ventilation (BPPV) to standard therapy (ST) would improve lung function and clinical signs faster than ST alone.
Methods: Thirty patients with severe AAE [peak expiratory flow rate percentage (PEFR%) predicted < 60%] presenting at an emergency unit were randomized to either ST, ST and CPAP or ST and BPPV.
Results: Groups presented similar baseline characteristics. Mean baseline PEFR% predicted was 35.2 (10.7) % [ST], 30.5 (11.7) % [CPAP] and 33.5 (13.8) % [BPPV]. PEFR significantly improved in the CPAP group from the first 30 minutes of treatment (PEFR $p = 0.00$; PEFR% predicted $p = 0.00$) compared to the BPPV and ST groups. Improvement in respiratory rate (RR) ($p = 0.05$) and sensation of breathlessness (SB) ($p = 0.00$) was significantly better in the BPPV group from the first 30 minutes.
Discussion: The significant improvement in PEFR in the CPAP group could be related to its intrinsic effect on the airway smooth muscle and/or its load. The positive effect of BPPV on RR and SB could be related to the inspiratory assistance provided.

Conclusion: The addition NPPV to ST in acute severe asthma exacerbation, improved lung function and clinical signs faster than ST, yet CPAP was faster and more effective in reducing bronchospasm than BPPV.

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Outcome of acidotic COPD-patients on hospital admission

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Background: Acidosis is a marker of acute respiratory failure in COPD.Non invasive ventilation (NIV) is the first choice of ventilation for such patients to avoid intubated mechanical ventilation (IMV) and associated complications. The ERS COPD Audit evaluated the clinical practice of treatment standards in acute exacerbation of COPD(AECOPD) in 422 hospitals of 13 European countries.We present the analysis of treatment standards for acidotic AECOPD patients and associated outcomes.
Methods: Data collection of clinical treatment of all hospital admitted AECOPD for 8 weeks and follow up until 90 days after discharge.
Results: Of 12893 patients 18,8% (2429/66% male) presented with respiratory acidosis on admission(14,8%(n=1902) with moderate acidosis: ph 7,35≥7,25, 4,1%(n=526) with severe acidosis: ph ≤7,25).Acidotic patients were significantly sicker than non acidotic.

Table 1

	FEV1 % pred	% current smoker	% diabetes	% renal failure	% congestive heart failure
Non acidotic patients (n=10464)	43,8	30,4	19,2	5,2	19,3
Acidotic patients (n=2429)	37,1 p=0,001	36,3 p=0,001	23,0 p=0,001	6.9 p=0,001	21,3 p=0,016

Outcomes were related to severity of acidosis.

Table 2

	Non acidotic patients	Moderate acidotic patients	Severe acidotic patients	p≤0,01
Length of stay (d)	9±8	10,7±8	14±20	p=0,001
% hospital mortality	3,8	8,8	17,1	p=0,001
% 90 d-readmission	35,1	37,8	42,9	p=0,001

43% of the acidotic patients received NIV and 5% IMV. 89,6% of hospitals offered NIV in their unit but only 66,7% always had the capacity for all eligible patients.
Summary: Our data revealed a severe comorbid condition of acidotic COPD patients,a subgroup of AECOPD- patients with worse outcome.A high proportion received NIV, units accepting these patients should offer NIV.

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Assessment of two methods to withdraw non-invasive ventilation in acute hypercapnic respiratory failure

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Introduction: No studies are available assessing the best method for withdrawing non-invasive ventilation (NIV) after an episode of acute hypercapnic respiratory failure (AHRF). We assessed if the prolongation of nocturnal ventilation after an AHFR could prevent new episodes of respiratory failure after NIV withdrawal compared to a strategy of direct discontinuation of NIV without additional nocturnal support.
Methods: A randomized controlled study was performed in 128 patients who presented an AHRF at admission and initiate NIV. When the AHRF was resolved and patients tolerate spontaneous breathing during 4 hours, they were randomly allocated to receive 3 additional nights of NIV (n=64) or conventional oxygen therapy (control group, n= 64). The primary outcome was avoidance of respiratory failure after NIV withdrawal.
Results: Patients of both groups presented similar baseline characteristics, being COPD the main chronic respiratory disorder (74%). Patients from nocturnal NIV group received NIV longer than the control group (5±2 vs 3±4; p<0.001). No differences between groups were observed in terms of respiratory failure after NIV withdrawal, hospital stay, readmission or mortality.
Conclusions: The prolongation of NIV during 3 nights after an episode of AHRF does not seem to improve prognostic outcomes, and consequently NIV could be directly withdrawn when the acute episode is resolved and patients tolerate spontaneous breathing in AHRF.
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Arterial blood gas analysis after 120 minutes of noninvasive positive pressure ventilation can predict outcome in acute cardiogenic pulmonary oedema

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Background: Noninvasive positive pressure ventilation (NIPPV) is first line intervention in Acute Cardiogenic Pulmonary Oedema (ACPO). Arterial Blood Gas Analysys (ABG) is largely available in clinical practice in the Emergency Department (ED)
Aims: To assess the role of ABG to predict outcome in patients with ACPO treated by NIPPV
Materials and methods: Treatment failure defined as hospital mortality or need for invasive mechanical ventilation. Observational clinical study in the ED of a University teaching Hospital during 5 months, including every patient emergently admitted for ACPO and treated with first-line NIPPV, referring to an institutional protocol.
Results: 214 patients included. Failure rate 14.5%.

Table 1. ABG at presentation

	Failure	Success
PaO2 mmHg	57.6 (53.7)	61.8 (56.0)
pH	7.330 (7.317)	7.323 (7.329)
PaCO2 mmHg	50.6 (39.4)	51.8 (47.8)
HCO3 mmol/l	25.0 (23.0)	25.6 (25.1)

Media (median).

Table 2. ABG delta (Δ) at 120 minutes

	Failure	Success
ΔPaO2	12.6 (22.1)	15.3 (13.7)
ΔpH	–0.030 (–0.021)	0.074 (0.061)
ΔPaCO2	1.1 (1.0)	–8.2 (–6.9)
ΔHCO3	–3.0 (–0.1)	1.2 (0.2)
ΔPaO2/FIO2	–5 (–14)	12 (31)

Media (median).

Conclusions: In patients with ACPO treated with NIPPV, ABG at presentation is not able to carefully predict outcome. After 60' of NIPPV both groups (success versus failure) improved without any significant difference. The improvement of ABG after 120' is associated with success; these patients will likely benefit from continuation of NIPPV. The inability to improve gas exchange after 120' of NIPPV in ACPO is predictor of failure; these patients should be closely monitored with a low threshold for endotracheal intubation.