241. Noninvasive ventilation for weaning and acute exacerbation management of airway obstruction

**P2022**

Invasive and noninvasive ventilation in adults hospitalized with asthma in Portugal – Nationwide data from 2000-2010

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**Introduction:** Few studies have addressed the use and outcomes of invasive (IV) and noninvasive positive pressure ventilation (NPPV) in severe asthma exacerbations.

**Objective:** To describe the use of IV and NPPV in patients hospitalized due to asthma in Portugal from 2000 to 2010.

**Methods:** Retrospective study of inpatient records with principal diagnosis of asthma, age ≥18 years, in acute care hospitals of the national healthcare system (N=85) in mainland Portugal, with discharges between 2000 and 2010 (N=17 446). Analysis of all episodes that included IV and NPPV that were identified using ICD-9-CM (codes 93.9x and 96.7x). The Charlson/Deyo index, a comorbidity risk adjustment measurement, was used.

**Results:** In 1 041 episodes (6%) ventilatory support was needed: NPPV 2.3% and IV 3.6%. NPPV use increased from 17 to 79 cases, mainly after 2007, while IV use decreased over the years. Length of stay (days) was similar in both ventilation procedures. Mortality for IV was significantly higher than for NPPV (15% vs. 2.2%).

**Characteristics of adults hospitalized with asthma who needed NPPV or IV**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NPPV (N=407)</th>
<th>IV (N=64)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender Male/Female</td>
<td>115 (28.3%) / 292 (71.7%)</td>
<td>284 (44.8%) / 350 (55.2%)</td>
<td></td>
</tr>
<tr>
<td>Age, Median (P25–75)</td>
<td>64.9 (57.0–80.0)</td>
<td>52.2 (37.0–69.0)</td>
<td></td>
</tr>
<tr>
<td>Comorbidities: Charlson/Deyo index</td>
<td>0.9</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>No comorbidities</td>
<td>169 (41.5%)</td>
<td>427 (67.4%)</td>
<td></td>
</tr>
<tr>
<td>Length of stay (days) Medium (P25–75)</td>
<td>9.0 (6.0–13.0)</td>
<td>8.0 (4.0–16.0)</td>
<td></td>
</tr>
<tr>
<td>In-hospital mortality (N=104, 10%)</td>
<td>9 (2.2%)</td>
<td>95 (15%)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** NPPV is increasingly used in severe asthma exacerbations. Patients treated with NPPV have a lower mortality rate despite of being older and having an increased comorbidity risk index. Prospective studies are strongly needed.

**P2023**

Non invasive proportional assist ventilation in management of severe asthma exacerbation

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**Background:** NIV could be beneficial in selected patients with severe asthma exacerbation (SAE). However, its role is still not well defined.

**Objective:** To evaluate the efficacy of NIV using proportional assist ventilation (PAV) in SAE after failure of conventional medical treatment (CMT).

**Patients&Methods:** Thirty patients with SAE were failed to respond on CMT. NIV was applied via face mask as a last resort before intubation.

**Results:** The mean age was 39.2 ± 9.7 with female predominance (19 females Vs 11 males). The successful outcome was achieved in 23/30 patients (76.6%). Follow up of respiratory distress and gasometric parameters after 1h NIV in successful group was shown in table 1.

**Table 1. Follow up of respiratory distress and gasometric parameters after 1h NIV**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conventional therapy</th>
<th>1h NIV</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate</td>
<td>125.3 ± 69.3</td>
<td>107.4 ± 5.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>38.2 ± 3.3</td>
<td>25.4 ± 2.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>pH</td>
<td>7.28 ± 0.03</td>
<td>7.36 ± 0.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PaCO2</td>
<td>55.3 ± 5.3 mmHg</td>
<td>42.6 ± 2.1 mmHg</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PaO2</td>
<td>58 ± 4.8 mmHg</td>
<td>87 ± 5.9 mmHg</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PEFR % predicted</td>
<td>30 ± 7.4</td>
<td>64 ± 6.1</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

PEFR in successful and failure groups are shown in figure 1.

![PEFR Graph](image)

*After 1h NIV, there were significantly (P < 0.01) higher tidal volume, peak inspiratory pressure and triggered breaths % in successful group Vs failure group.*

**Conclusion:** NIV can relieve respiratory distress and improve gas exchange in majority of patients with severe asthma exacerbation who are candidate for intubation after failure of CMT.

**P2024**

Mixed acid-base disorders, hydroelectrolyte imbalance and lactate production in hypercapnic respiratory failure: The role of noninvasive ventilation

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**Hypercapnic COPD exacerbation in patients with comorbidities is complicated by**
mixed acid-base, hydro-electrolyte and lactate disorders. Aim of this study was to determine the relationships of these disorders with the requirement for and duration of non-invasive ventilation (NIV).

Methods: Sixty-seven consecutive patients who were hospitalized for hypercapnic COPD exacerbation had their clinical condition, respiratory function, blood chemistry, arterial blood gases, blood lactate and volmic state assessed. Heart and respiratory rates, pH, PaO₂, and PaCO₂ and blood lactate were checked at the 1st, 2nd, 3rd and 4th hours after starting NIV.

Results: Nine patients were transferred to the intensive care unit. NIV was performed for a total of 56 (60%) ventilated respiratory acidosis, 10/46 (27.8%) respiratory acidosis and 3/5 (60%) mixed respiratory-metabolic acidosis patients (p=0.026), with durations of 45 ± 9.8 h, 36.2 ± 8.9 h and 53.3 ± 4.1 h, respectively (p=0.016). The duration of ventilation was associated with higher blood lactate (p<0.001), lower pH (p=0.016), lower serum sodium (p=0.014) and lower chloride (p=0.038). Hypoventilation without hypercapnic hypocloremia occurred in 11 respiratory acidosis patients. Hypovolemic hypotension with hypokalemia and hypokalemia occurred in 10 mixed respiratory-acidosis-metabolic alkalosis patients, and euvolemic hypokalemia occurred in the other 7 patients with this mixed acid-base disorder.

Conclusions: Mixed acid-base and lactate disorders during hypercapnic COPD exacerbations predict the need for and longer duration of NIV.

P2025
Noninvasive ventilation (NIV) for acute hypercapnic respiratory failure (AHRF): Is the helmet an effective interface? A pilot RCT

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To date the helmet is rarely used in AHRF, despite being hypoxic respiratory failure, it is employed as a “rotating” strategy when the facial mask is poorly tolerated. In a previous RCT, we compared the clinical efficacy of a new helmet designed to specifically improve the performance in COPD vs a full face mask during an episode of AHRF. 17 COPD patients with AHRF were randomly assigned to receive NIV either with full face mask (Group A, n=9, pH = 7.26±0.07, PaCO₂ = 73.7±10.8mmHg, PaO₂/FiO₂ 97.3±3.5) or the helmet (Group B, n=8, pH = 7.24±0.05, PaCO₂ = 83.3±12.2mmHg, PaO₂/FiO₂ = 100.6±6.4). In the former group the ventilator settings were set to improve the respirator-acidosis-metabolic alkalosis patients, and the helmet was used as a “rotating” strategy when the facial mask was poorly tolerated. All patients were treated for at least 6 hours in the PICU. Vital parameters, discomfort scale, dysnea score and adverse events were recorded.

Baseline characteristics did not differ significantly between the two groups. 2 and 1 patients for groupA and B respectively required intubation. NIV improved gas exchange vs baseline (p<0.05) both with mask and helmet (pH= 7.34±0.08, PaCO₂= 39.7±12.3mmHg, and pH= 7.30±0.06, PaCO₂= 70.4±13.5mmHg, at 1h; and pH= 7.34±0.07, PaCO₂ = 75.2±10.4mmHg, PaO₂/FiO₂ = 58.0±6.0mmHg, at 6h). No differences in vital signs, patients’ comfort and dysnea score were observed between the two groups.

In conclusion, in this pilot RCT we have shown that the helmet may be a valid alternative to the “classical” full face mask during an episode of AHRF, making the former interface possible alternative for “rotating” strategy.

P2026
Effects of non invasive ventilation on left and right hemodynamic parameters during acute respiratory failure secondary to COPD exacerbation

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Non Invasive Ventilation (NIV) is a technique used in different forms of acute respiratory failure that allows the patient to provide a full or partial ventilatory support without intubation. NIV has obvious effects on lung mechanics, but the changes that brings to the pulmonary vascular circulation, and to the right and left ventricle are more less investigated. Based on this assumption, we studied 32 patients (18 men, 14 women, mean age 72.0±7.5 years) with respiratory failure secondary to COPD exacerbation who required NIV and we submitted to transho racic echocardiography at the admission and at the resolution of respiratory failure.

We have therefore shown that NIV not only has positive outcomes on right ventricular function (reduction of Pulmonary Insufficiency, Tricuspid Regurgitation, and four-chambers Right Ventricolar Systolic and Diastolic Areas and short-axis Diameter), but its secondary improving of Tricuspid Anular Plane Systolic Ecurricularion, but it had a statistical positive effect also on left ventricular function (Ejection Fraction increase, p < 0.05). Minimizing the effect of venicular interdependece and deflating the lung, NIV not only has positive results on right hemodynamic parameters, but increasing venous return to the left ventricle and recovering the stroke volume, also improves its performance.
P2030 Nasal non-invasive positive pressure ventilation for moderate exacerbation of chronic obstructive pulmonary disease (COPD) treated in a Tunisian medical ward

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Background: Nasal non-invasive positive pressure ventilation (NPPV) is a soft method with a low burden which can be used in medical ward and may improve the outcome of COPD exacerbation.

Aim: The aim of this study is to evaluate the effectiveness of the addition of NPPV to usual medical care in improving the outcome of patients treated in a medical ward for an exacerbation of COPD with moderate hypercapnia.

Methods: Among 25 patients who were hospitalized for an exacerbation of COPD with moderate hypercapnia, 10 were randomly selected to receive NPPV (NPPV group) and then compared to the 15 patients who received only an optimal medical treatment without ventilation support (control group).

Results: The age of patients who received NPPV did not differ from that of control group (63±10 yrs-old vs 66±9 yrs-old; p = 0.31) and neither did the blood gas on admission (PaO2: 46±9 vs 49±12 mmHg; p=0.56; PaCO2: 58±12 mmHg vs 57±49 mmHg; p=0.80; pH: 7.39±0.1 vs 7.38±0.06; p = 0, 8). None of the patients treated with NPPV died or was transferred to ICU while 2 died and 3 were transferred to ICU among patients of control group. Also, time to improve blood gas parameters was shorter and on day one we recorded a ΔPaO2 = 33.6±14 mmHg in NPPV group vs 17.28±19 mmHg in control group (p=0.02) and a ΔPaCO2 = 4±13 mmHg in NPPV group vs 16±7.5 mmHg in control group (p=0.04).

Results: NPPV in COPD patients treated for an exacerbation with moderate hypercapnia shortens time to improve of blood gas and is likely to reduce mortality and the need of more invasive ventilation methods.

P2033 Noninvasive ventilation as an end-of-life measure in patients with chronic obstructive pulmonary disease

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Background: Noninvasive ventilation (NIV) has been deemed as a useful measure for reducing the role of probability of invasive mechanical ventilation in patients with acute exacerbation of chronic obstructive pulmonary disease (COPD). However, The role of NIV as a palliative measure in dying patients with COPD remains unclear.

Aim: To investigate the usefulness of NIV as an end-of-life measure in patients with COPD.

Method and patients: We retrospectively reviewed the medical records of COPD patients who died of respiratory failure and had been receiving NIV at the end of life in a university-affiliated medical center.

Results: In 683 COPD patients who died, only 47 (7%) was under NIV support as a palliative measure before death. Most patients (70%) died in general ward, while the minority of patients had a preexisting “do-not-intubate” (DNI) will, 76% placed a DNI documentation after initiation of NIV. There was no significant increase of respiratory rate or worsening of other vital signs 24 hours after starting NIV, suggesting the usefulness of NIV to prevent progression of distress. The consciousness significantly deteriorated (p=0.001) after the starting of NIV, which prevented the use of opioids or sedative agents. The mean length of NIV was 8.7±6.7 days and most of the patients (79%) were maintaining the NIV until they died, suggesting the tolerability.

Conclusions: Our study results suggest that NIV might be useful for dying COPD patients, who might experience a comfortable dying process. For relieving distress caused by respiratory failure, NIV may be a useful alternative measure to alleviate the dyspnea or discomfort. Further prospective study might be required.
Acidotic hypercapnia as a determinant of the length of non-invasive ventilation (NIV) in COPD patients with acute hypercapnic respiratory failure (AHRF)

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Introduction: Factors related to length of stay are complex and related to many non-medical factors, however length (duration) of NIV treatment is not. Although the associations of mortality of patients requiring NIV are well documented (Thomas A et al. Thorax 2010; 65: A3.), the determinants of the length of NIV have not been clearly elucidated, which we decided to investigate.

Methods: A retrospective analysis of the initial arterial blood gas bicarbonate (HCO3mmol/L) values on 115 consecutive episodes of NIV for a dedicated respiratory NIV unit from 01 Jan to 31 Oct 2011 was carried out. Analysis of blood gases and duration of use of NIV (in days) was documented and analyzed.

Results: There were 115 patients admitted with AHRF with COPD. Plotting a graph with HCO3 and length of NIV we see that it has a linear relationship.

The p-value for HCO3 as a determinant of length of NIV is 0.00084, which suggests that it is significant.

Conclusion: This scientific survey indicates that the length of NIV therapy in patients in AHRF increases with a higher HCO3. Though outcome and mortality is closely linked to the pH, length of NIV is more closely linked to the HCO3. This is explained by the fact that people with higher HCO3 are likely to have had chronic respiratory failure for longer and are likely to take longer to recover from the respiratory failure.

Acidotic hypercapnia: Beyond type 1 and type 2 respiratory failure

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Introduction: The indications of non-invasive ventilation (NIV) have widened in the recent years, which is now used in treating hypercapnia with acidosis in a variety of patients. However, in many of the patients treated with NIV, the acidosis may have preceded the hypercapnia. The current case series from our 11-bedded ward based NIV unit describes such acidotic hypercapnia: hypercapnic respiratory failure following metabolic acidosis.

Methods: Time series of Arterial Blood Gas (ABG) findings in 4 patients with acidotic hypercapnia with a background of COPD confirmed with spirometry.

Results: The ABGs for cases 1 and 2 showed a rising CO2 following the onset of a metabolic acidosis; a mixed metabolic and respiratory acidosis in patients 3 & 4 - with the acidosis preceding hypercapnia (Case 3) or being out of proportion to CO2 rise (Case 4). All four patients improved with initiation of NIV combined with active fluid/electrolyte management. A sample ABG time series (Case 3) showing initial eucapnia with acidosis leading to hypercapnia is shown:

Acidosis preceding hypercapnia on ABG Time series

<table>
<thead>
<tr>
<th>Time</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 2</th>
<th>Day 2</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.336</td>
<td>7.143</td>
<td>7.567</td>
<td>7.462</td>
<td></td>
</tr>
<tr>
<td>pCO2</td>
<td>11.2</td>
<td>8.76</td>
<td>6.55</td>
<td>7.91</td>
<td></td>
</tr>
<tr>
<td>pCO2</td>
<td>5.56</td>
<td>11.8</td>
<td>7.51</td>
<td>3.73</td>
<td>5.7</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>21.6</td>
<td>N/A</td>
<td>29.4</td>
<td>29.8</td>
<td></td>
</tr>
<tr>
<td>Base Excess</td>
<td>-5.2</td>
<td>-4.0</td>
<td>+3.0</td>
<td>+6.2</td>
<td></td>
</tr>
</tbody>
</table>

Discussion: Acidotic hypercapnia could be a further subtype of respiratory failure (akin to previously described Type 4 or shock-muscle hyperperfusion related respiratory failure) for which larger confirmatory studies and prospective trials to establish the efficacy and timing of NIV are required.

P2037

A cohort study for improvement of asthma attack by noninvasive positive pressure ventilation (NPPV)

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Objective: A few study of efficacy of NPPV therapy in asthmatic patients have been reported. We studied efficacy and incidence rate of NPPV therapy.

Method: This prospective cohort study was performed in two hospitals in Okayama prefecture, Japan. All of the patients admitted because of asthma attack between January 2005 and June 2010 had to fulfill the following criteria before hospitalization: 1. The patients’ peak flow is less than 200 L/min or 30% of his or her best peak flow 2. Borg scale is nine or ten. Hospitalization patients had to fulfill the following criteria for NPPV therapy. 1. Patients received PaCO2 >45 mmHg and pH <7.35. 2. His or her Borg scale is ten.

Results: 94 patients were included in the study. Fourteen patients were received NPPV therapy. All patients avoided receiving mechanical ventilation.

Figure 1 shows profile of pH in the patients receiving NPPV. Figure 2 shows profile of Borg scale in the patients receiving NPPV.

Conclusion: The proportion of patients need NPPV therapy is 15%. In asthmatic patients NPPV therapy appears highly effective in correcting gas exchange abnormalities and severe dyspnea.
P2038
Should teaching about non-invasive ventilation be mandatory to all grades of general medical doctors? An audit of junior doctor knowledge regarding the management of patients on NIV before and after teaching sessions
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Introduction: On non-invasive ventilation (NIV) are usually looked after by normal working hours by general medical doctors.

Aims and objectives: We sought to determine the level of knowledge about NIV amongst general medical foundation (F1) doctors, core medical trainees (CMT) and specialist registrars (SPRs) before and after teaching.

Methods: Junior doctors were asked to complete a questionnaire covering knowl-edge about the criteria for commencing NIV, initial settings and appropriate manipulation of NIV machines according to patient response before and after mandatory teaching for F1 and CMT trainees and a voluntary attendance session for SPRs.

Results: Forty-nine doctors completed the questionnaire pre-teaching and all F1 and CMT doctors attended training but only 5/16 SPRs attended teaching. Some of the most concerning findings were that all grades were poor at defining type II respiratory failure pre- and post-teaching. Knowledge about initial ventilator settings, alteration of pressure settings and target oxygen saturations on NIV were poor before teaching (although better in SPR group than more junior doctors). Majority would have aimed for pressure settings too low to be effective. However, knowledge improved substantially after teaching amongst those who attended.

Conclusion: Baseline knowledge of all grades of junior doctors about practical NIV care is poor risking ineffective treatment but this can be improved by teaching. However, sessions need to be mandatory to ensure attendance.

P2039
Short and long-term outcomes after the first episode of non-invasive ventilation (NIV) for an acute exacerbation of COPD (AECOPD) on a general ward
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Background: NIV is an evidence based treatment for acute respiratory acidosis due to AECOPD. However, less data exist on long-term prognosis after the first episode of NIV.

Aim: To investigate the short and long-term outcomes after the first episode of NIV for AECOPD.

Method: A retrospective, observational, cohort study of 183 patients admitted to the hospital between 2008-2011 for an acute respiratory acidosis due to AECOPD treated with NIV on a general ward. Potential prognostic factors were recorded.

Results: During a 3-year period 278 admissions involving 183 patients were analysed. Included were 72 (39%) men and 111 (61%) women, with a mean age of 70 years (range 45-93y) and a mean FEV1 of 33% (range 12-74%). 34 (19%) patients were readmitted for NIV with an average of 3 admissions (range 1-9). Success rate of NIV was 76% (211 of 275 episodes). In 24% (64 episodes) NIV failed: 32 patients died during NIV (all prior Do-Not-Intubate patients), 7 did not tolerate NIV and died (all prior DNI patients), 16 needed invasive ventilation at the ICU (2 died), 9 died because of a non-respiratory cause. In-hospital mortality during the first admission was 21%. The mortality rate at 1 month was 34%, mortality rate observed was high, as expected in this subset of patients.

Discussion: The presence of hypercapnia RF had better prognosis, as opposed to hypoxemic RF. Greater NIV dependence was correlated with higher mortality. The mortality rate observed was high, as expected in this subset of patients.

P2040
Outcome of respiratory critical care patients treated with noninvasive ventilation as a maximal intervention strategy
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Background: End-of-life decisions are an important part of day-to-day medical practice in Respiratory Intensive Care Units (RICU), reflecting the need to prevent unreasonable therapeutic interventions. Noninvasive ventilation (NIV) can be used in the do-not-intubate patient and in palliative care setting.

Aim: To determine the outcome of patients with respiratory failure (RF) in whom NIV was performed as a maximal intervention strategy.

Methods: Prospective study of 369 patients admitted to our RICU for 18 months. Age, gender, APACHE II, diagnosis,comorbidities, inpatient days, NIV duration, type of respiratory failure, PaCO₂ on admission, NIV dependence (quantified in hours/day as follows: ≤15, 16-23 and 24) and RICU mortality were evaluated. Patients were divided in 2 groups based on outcome (alive/dead) and variables were compared between groups.

Results: Among patients in need of ventilatory assistance (n=242), 60 had a decision to forego tracheal intubation (24.8%). Age (y): 70±18. Males: 60%. APACHE

P2041
Elective early noninvasive ventilation as a weaning method of COPD patients
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Patients with acute exacerbations of COPD represent a large portion of critically ill patients that mechanically ventilated. The rate of weaning failure is high in these patients. Prolonged mechanical ventilation (MV) increases intubation associated complications.

Objective: To determine the efficacy of early non-invasive mechanical ventilation as a weaning method in COPD patients with acute hypercapnic respiratory failure compared with the conventional-weaning approach.

Methods: Study was conducted on a 30 mechanically ventilated COPD patients who had infective exacerbations. Patients were randomly extubated, receiving non-invasive ventilation (n=15), or weaned following a conventional-weaning approach (n=15).

Results: Compared with the conventional-weaning group, the noninvasive-ventilation group had shorter periods of invasive MV, total ventilator support, ICU stay, less incidence of ventilator associated pneumonia and less mortality.

Outcome parameters in both studied groups

<table>
<thead>
<tr>
<th>Character</th>
<th>Noninvasive ventilation Group</th>
<th>Standard Group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Duration of invasive MV (days)</td>
<td>6.8±3.1</td>
<td>18.9±6.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Duration of total MV (days)</td>
<td>14.3±6.1</td>
<td>18.9±6.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Duration of ICU stay (days)</td>
<td>14.6±4.2</td>
<td>24.5±12.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Incidence of VAP</td>
<td>1</td>
<td>5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Weaning failure</td>
<td>2</td>
<td>4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of death in the hospital</td>
<td>1</td>
<td>3</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

P value less than 0.001 was considered significant.

Conclusion: Patients with chronic obstructive pulmonary disease who had respiratory failure and were starting to breathe spontaneously, showed that noninvasive ventilation could decrease pneumonia, length of stay in the intensive care and the duration of ventilatory support.

Reference: