Noninvasive ventilation to prevent respiratory failure after extubation in high-risk patients*

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Objective: Compared with standard medical therapy (SMT), noninvasive ventilation (NIV) does not reduce the need for reintubation in unselected patients who develop respiratory failure after extubation. The goal of this study was to assess whether early application of NIV, immediately after extubation, is effective in preventing postextubation respiratory failure in an at-risk population.

Design: Multiple-center, randomized controlled study.

Setting: Multiple hospitals.

Patients: Ninety-seven consecutive patients with similar baseline characteristics, requiring >48 hrs of mechanical ventilation and considered at risk of developing postextubation respiratory failure (i.e., patients who had hypercapnia, congestive heart failure, ineffective cough and excessive tracheobronchial secretions, more than one failure of a weaning trial, more than one comorbid condition, and upper airway obstruction).

Postextubation respiratory failure is a rather common event after discontinuation of mechanical ventilation, reintubation being needed in about 10% of patients (1, 2), with a range between 4% (3) and 24% (4).

Nonrandomized studies (5, 6) suggested that noninvasive mechanical ventilation (NIV) may be successfully used, especially in patients with hypercapnic postextubation respiratory failure (6), as a “curative” therapy to avoid reintubation. However, two subsequent randomized studies doused enthusiasm for this strategy. Keenan et al. (7) reported no difference in mortality and reintubation rate when NIV was compared with standard medical therapy. Later Esteban et al. (8) showed that NIV did not avoid the need for reintubation and indeed that it was associated with a higher intensive care unit (ICU) mortality rate than was standard medical treatment.

The length of time elapsed before reintubation is associated with mortality rate (9), and therefore the treatment of postextubation failure should be started very early.

It has also been shown (2, 9) that there is a clearly identified subset of patients (i.e., those with comorbid conditions, increased work of breathing at the time of failure, and upper airway obstruction) at high risk of requiring reintubation.

We postulated that in comparison with standard medical treatment, the “preventive” use of NIV for the first 48 hrs after extubation would reduce the need for intubation and related complications in these patients at risk. We tested this hypothesis in a randomized, controlled multiple-center study.

Interventions: After a successful weaning trial, the patients were randomized to receive NIV for ≥8 hrs a day in the first 48 hrs or SMT. Primary outcome was the need for reintubation according to standardized criteria. Secondary outcomes were intensive care unit and hospital mortality, as well as time spent in the intensive care unit and in hospital.

Measurements and Main Results: Compared with the SMT group, the NIV group had a lower rate of reintubation (four of 48 vs. 12 of 49; \( p = .027 \)). The need for reintubation was associated with a higher risk of mortality (\( p < .01 \)). The use of NIV resulted in a reduction of risk of intensive care unit mortality (−10%, \( p < .01 \)), mediated by the reduction for the need of reintubation.

Conclusions: NIV was more effective than SMT in preventing postextubation respiratory failure in a population considered at risk of developing this complication. (Crit Care Med 2005; 33:2465–2470)

Key Words: standard medical therapy; noninvasive ventilation; reintubation; respiratory failure

MATERIALS AND METHODS

Patients

Ninety-seven patients admitted to three ICUs who had been ventilated ≥48 hrs and who were considered at risk of developing postextubation respiratory failure were enrolled. The enrolment criteria are shown in Table 1. A weak cough was assessed using the Airway Care Score (10). Chronic heart failure (CHF) was defined according to the New York Heart Association criteria (11). The presence of comorbidities was classified as previously described (12); CHF has been considered a “stand-alone” risk factor of reintubation (2). Weaning from mechanical ventilation was performed according to standardized protocols using gradual daily reduction of pressure support or a single daily T-tube trial (13, 14). A weaning trial was done once the patient had reached a phase of clinical stability and met the following criteria: a) normal sensorium; b) absence of hyperthermia (core temperature >38°) and sepsis; c) PaO\(_2\) ≥60 mm Hg at a FiO\(_2\) ≤40% with an external positive end-expiratory pressure (PEEP\(_{\text{ext}}\) ) <5 cm H\(_2\)O; d) no cardiac ischemia or arrhythmias; e) a cuff leak volume >110 mL (15). The patients able
The fractional concentration of oxygen was the patient's tolerance and with a PEEPext inspiratory pressure was adjusted according to sure support ventilation mode with the ventilators using either a ventilator speaker with a variable block size.

Patients were randomized to either standard material blood gases were repeated, and the patient were ventilated using either a ventilator speaker with a variable block size.

PEEPext was initially set at 5 cm H2O and then increased to the maximum tolerated.

One hour after successful extubation, arterial blood gases were repeated, and arterial blood gases were monitored for 48 hrs and then extubated (13, 14).

Criterions for exclusion from the study were coma, inability to protect the airways defined as a Airway Care Score >12 (10) or a documented swallowing problem, cervical spine injury, neuromuscular diseases, lack of informed consent, agitated or uncooperative state, anatomical abnormalities interfering with the mask fit, uncontrolled cardiac ischemia or arrhythmias, and failure of more than two organs. Patients overweight (i.e., body mass index >30), those with documented or suspected sleep apnea, and those already on home noninvasive mechanical ventilation were excluded from the study to avoid confounding factors. The study was approved by the institutional Ethics Committee, and informed written consent was obtained from patients or their next of kin.

**Protocol**

One hour after successful extubation, arterial blood gases were repeated, and the patients were randomized to either standard medical therapy or NIV. The randomization sequence was generated by a computer program with a variable block size.

**Noninvasive Ventilation.** All the patients were ventilated using either a ventilator specifically designed for NIV (BiPAP Vision, Respinronics) or an ICU ventilator, using a pressure support ventilation mode with the addition of a PEEPext.

For patients who were hypercapnic, the inspiratory pressure was adjusted according to the patient's tolerance and with a PEEPext <6 cm H2O. For the nonhypercapnic patients, the PEEPext was initially set at 5 cm H2O and could be increased until oxygen saturation was constantly >92%, whereas the inspiratory pressure support was initially set at 10 cm H2O and then increased to the maximum tolerated.

In either case, both settings were aimed to achieve respiratory rate <25 breaths/min and satisfactory gas exchange, that is, arterial oxygen saturation (SaO2) >92%, with pH >7.35. The fractional concentration of oxygen was such to achieve an SaO2 >92%.

A full face mask was used in all the patients but five to start NIV and then, in some cases, substituted by a nasal one after the first few hours of ventilation.

NIV was applied following the so-called sequential protocol, modified from the protocol proposed by Hilbert et al. (16). After the first 48 hrs of the protocol, if the patient was clinically stable, NIV was withdrawn; otherwise it was ventilated ad libitum.

**Standard Medical Therapy.** Oxygen therapy was delivered to achieve SaO2 >92%. Patients also received standard medical treatment, decided by the attending physicians.

Both groups received the same care by nurses and respiratory therapists during the ICU stay. In particular one daily session of physiotherapy was provided to all the patients. This included chest clapping, passive and active mobilization, and postural drainage, when indicated.

**Criteria for Intubation.** In both study groups, after patients had undergone the assigned treatment for >1 hr, they were reintubated if they met at least one of the following major criteria usually employed in patients developing postextubation respiratory failure (8, 9): a) respiratory acidosis (pH <7.35 with a PaCO2 >45 mm Hg or in the presence of hypercapnia at the time of extubation, a PaCO2 increase >15%); and b) hypoxemia (i.e., SaO2 <90% for FiO2 >50%). Minor criteria for intubation were a) an increase in respiratory rate >20% from the time of extubation and in any case >35 breaths/min; b) clinical signs of “incipient” respiratory muscle fatigue (use of accessory muscles, inward movements of the abdomen during inspiration); c) severe dyspnea; and c) inability to remove secretions (Airway Care Score >12) (10). Patients had to meet one of the major criteria or at least two of the minor criteria to be intubated. Clearly, endotracheal intubation was also promptly performed in emergency situations such as coma, cardiac or respiratory arrest, or severe hypotension.

**Measurements.** The following variables were recorded at enrollment: age, gender, number and types of comorbidities, Simplified Acute Physiology Score II (17), and reasons for mechanical ventilation. Respiratory rate and SaO2 were recorded continuously on the monitors, whereas arterial blood gases were analyzed once a day at 8 am and a) in the case of any change either in the ventilatory settings or in the FiO2; b) at the time of reintubation; and c) at discharge from the ICU. Airway Care Score was routinely monitored every 6 hrs. We also recorded the effective hours/day on NIV, the total days on mechanical ventilation before extubation, the total days of ICU and hospital stay, and the causes of intubation (9) and death.

**Outcomes.** The primary end point was the need for reintubation in the ICU. Secondary end points were ICU and hospital mortality and length of stay in the ICU and in hospital.

**Statistical Analysis**

The trial was designed to enter a maximum number of patients in each treatment group of 97 to detect a decrement in reintubation frequency of 15% in the NIV group vs. the postulated 25% frequency of intubation in the conventionally treated group (i.e., chronic obstructive pulmonary disease [COPD], acute respiratory failure (18, 19), and congestive heart failure) (20) with a power of 80% at two-sided p = .05 (21). Two-stage ad-interim analysis was planned after having recruited half of the scheduled patients (22) using the equal-alpha stopping rule of Pocock (23). This rule was based on risk differences of primary outcome (i.e., reintubation in this study) between the two treatment groups, where the fixed nominal p value needed to stop the trial at stage 1 should be <.0296. In the interim analysis, the observed risk difference for intubation in the NIV group was lower than that in the standard therapy group and the p value was less than the cutoff value of .03 (p = .027), and the trial was therefore stopped.

Results are presented as mean ± sd and frequencies (percentages). Significance tests of the patients’ differences at enrollment and at the time of randomization were computed by Student's t-test and chi-square test, when appropriate. Univariate analysis was performed to assess the association between NIV and reintubation, NIV and ICU mortality, and reintubation and ICU mortality. Subsequently, a multivariate analysis was performed. The associations between the variables, reintubation, ICU mortality, and NIV were fitted by generalized linear models with binomial distribution and identity link, performed on an intention-to-treat basis.

To assess the interaction between the so-called direct or indirect NIV effect on ICU mortality (NIV on ICU mortality = direct effect; NIV on ICU mortality mediated by the NIV effect on reintubation = indirect effect), we applied a Mendelian randomization model (24).

**RESULTS**

As shown in Figure 1, 122 patients were considered to be at risk of postextu-
bation respiratory failure and therefore eligible for the study. Twenty-five were excluded so that 97 patients were randomly assigned to receive standard medical therapy or NIV. The groups did not differ significantly at the time of intubation (Table 2) and at the time of randomization, which occurred 1–2 hrs after the weaning trial (Table 3). In the NIV group, the ventilator was set with the following pressures: 13.18 ± 4.54 for the inspiratory support and 5.29 ± 1.61 for PEEPext. Of the 48 patients randomized to receive NIV, only one did not tolerate the procedure, whereas two did not achieve the minimal hours of daily NIV, required by the protocol (8 hrs/day). Fourteen patients enrolled for NIV developed nose-skin redness or abrasion, two eye irritation, one oral dryness, and two nasal congestion.

The primary diagnosis of admission, the reasons for reintubation, and the time it was done are illustrated for the two groups in Table 4. In the univariate model (Table 5), we found that the use of NIV determined a statistically significant reduction in risk of ICU mortality (−10%) as shown by this equation: direct effect + indirect effect = 0.01 + 0.16·0.59 = 0.10 (p = .01).

Finally, hospital mortality (12% vs. 18% for NIV and standard treatment, respectively) and time spent in the ICU (8.9 ± 5.7 days vs. 11.6 ± 14.9) or hospital (23.3 ± 16.4 vs. 25.5 ± 21.4) were not different between the two groups.

**DISCUSSION**

The main finding of this study is that preventive application of NIV in a cohort of patients at risk of postextubation failure after having passed a spontaneous breathing trial may reduce the need for reintubation. The need for reintubation was associated with a higher risk of ICU mortality, and the use of NIV resulted in a reduction of risk of ICU mortality, mediated by the reduction for the need of reintubation.

The incidence of reintubation is relatively high, being about 10–15% (1, 2), among patients undergoing mechanical ventilation for >48 hrs, so it is important to identify those patients at risk.

Some important information was provided by Epstein and Ciubotaru (9), who demonstrated how the etiology of extubation failure and the time to reintubation are both strong predictors of outcome. These authors postulated that if the need of reintubation was the primary explanation for mortality, then the latter should not vary according to the different causes of extubation failure. They also concluded that the “timely reinstitution of ventilatory support has the potential to reduce the increased mortality” and that the need to “test accuracy of predictors of early reintubation may be less important if NIV proves to be an effective therapy for extubation respiratory failure.”

Two randomized controlled studies were therefore recently performed in a nonselected population of patients to assess the hypothesis that NIV may be an effective curative strategy for postextubation respiratory failure.

In a single-center study, Keenan et al. (7) showed in a heterogeneous group of 81 patients who developed respiratory distress during the first 48 hrs after extubation that treatment with NIV did not improve the outcome, compared with standard medical therapy. The criteria for defining postextubation failure were not based on deterioration of arterial blood gases but mainly on clinical signs such as an increased respiratory rate or the presence of accessory muscle recruitment and abdominal paradox.

To expand the clinical meaning of this relatively small study, a larger international multiple-center randomized study was performed in 221 patients. Esteban and coworkers (8) found that the curative application of NIV to treat an episode of postextubation respiratory failure did not reduce mortality or the need for reintubation, but quite the contrary, that the

![Figure 1. Trial profile. Seven patients were not recruited because of an omission by the attending physician. NIV, noninvasive ventilation.](image-url)
The etiology of extubation failure is an independent factor influencing the need for reintubation (2), patients considered at risk, consisting mainly of those with chronic diseases (i.e., mainly COPD or CHF), and increased work of breathing at the time of extubation (9). In these sub-sets of patients, NIV has been shown to be of benefit even to shorten the duration of intubation compared with the standard weaning procedure (25–27) and to fully mimic, when properly set, the physiologic changes observed during endotracheal mechanical ventilation.

In contrast to the previous studies, assessing the curative treatment with NIV, once postextubation respiratory failure was overt, the present investigation was designed to assess the preventive effects of NIV in avoiding reintubation.

Years ago, Jiang et al. (28) evaluated the effects of preventive NIV immediately after extubation, in a randomized study comparing this strategy with standard medical therapy. They were unable to show any statistical difference in the patients’ outcome, but again the population was unselected, so that their results may theoretically have underestimated the effect of NIV in a more specific subset of patients.

Contrary to the previous and other investigations (7, 8), most of the high-risk patients enrolled in our study were affected by persistent hypercapnia (i.e., COPD), CHF, or other comorbidities. The benefits of NIV in preventing reintubation in COPD patients have been already described, compared with standard medical treatment, in a nonrandomized study by Hilbert et al. (6). Patients with CHF are also likely to benefit from the application of continuous expiratory pressure and inspiratory support delivered noninvasively (29), especially during the first phase of unsupported breathing when the “cardiopulmonary pump” is under stress (30).

Our study also involved few high-risk postoperative patients. Most of the previous studies assessing the specific use of NIV as a preventive treatment in these patients demonstrate an improvement in physiologic variables, but no benefits on the clinical outcome were reported (31–33). This was likely to be due to the relatively small sample size of the studies. To support the findings of our study, it was very recently demonstrated that the application of noninvasive continuous positive pressure was more effective compared with standard treatment in pre-

### Table 2. Baseline characteristics at the time of institution of mechanical ventilation

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>NIV (n = 48)</th>
<th>Standard Treatment (n = 49)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yrs</td>
<td>56.0 ± 19.3</td>
<td>53.2 ± 19.5</td>
<td>.47</td>
</tr>
<tr>
<td>Gender, female/male</td>
<td>17/31</td>
<td>19/30</td>
<td>.65</td>
</tr>
<tr>
<td>SAPS II</td>
<td>31.4 ± 0.3</td>
<td>32.5 ± 2.6</td>
<td>.60</td>
</tr>
<tr>
<td>Reason for initiation of mechanical ventilation, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>8 (17)</td>
<td>9 (18)</td>
<td>.87</td>
</tr>
<tr>
<td>ARDS</td>
<td>6 (13)</td>
<td>5 (10)</td>
<td>.76</td>
</tr>
<tr>
<td>Postsurgical respiratory failure</td>
<td>4 (8)</td>
<td>4 (8)</td>
<td>.81</td>
</tr>
<tr>
<td>Trauma</td>
<td>4 (8)</td>
<td>4 (8)</td>
<td>.81</td>
</tr>
<tr>
<td>CHF</td>
<td>4 (8)</td>
<td>6 (12)</td>
<td>.49</td>
</tr>
<tr>
<td>NYHA II (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NYHA III (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NYHA IV (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPD exacerbation</td>
<td>17 (36)</td>
<td>15 (31)</td>
<td>.36</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>3 (6)</td>
<td>5 (11)</td>
<td>.44</td>
</tr>
<tr>
<td>Others</td>
<td>2 (4)</td>
<td>1 (2)</td>
<td>.55</td>
</tr>
</tbody>
</table>

NIV, noninvasive ventilation; SAPS, Simplified Acute Physiology Score; ARDS, acute respiratory distress syndrome; CHF, congestive heart failure; NYHA, New York Heart Association classification (no. of patients); COPD, chronic obstructive pulmonary disease.

The p values were obtained by χ² test or t-test, when appropriate.

### Table 3. Characteristics of the patients at the time of randomization and the number of reintubation for each risk group

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>NIV (n = 48)</th>
<th>Standard Treatment (n = 49)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of endotracheal mechanical ventilation, days</td>
<td>6.14 ± 7</td>
<td>7.46 ± 6</td>
<td>.24</td>
</tr>
<tr>
<td>Respiratory rate, breaths/min</td>
<td>21.5 ± 12.3</td>
<td>23.2 ± 11.0</td>
<td>.65</td>
</tr>
<tr>
<td>Heart rate, beats/min</td>
<td>89.5 ± 3.5</td>
<td>92.6 ± 28.8</td>
<td>.52</td>
</tr>
<tr>
<td>pH</td>
<td>7.44 ± 0.06</td>
<td>7.44 ± 0.05</td>
<td>.95</td>
</tr>
<tr>
<td>PaO₂, mm Hg</td>
<td>13.9 ± 4.3</td>
<td>13.9 ± 4.6</td>
<td>.09</td>
</tr>
<tr>
<td>PaO₂/FI₂O₂</td>
<td>246.9 ± 59.8</td>
<td>269.9 ± 73.0</td>
<td>.11</td>
</tr>
<tr>
<td>Bicarbonates, mmol/L</td>
<td>28.7 ± 5.97</td>
<td>27.2 ± 5.44</td>
<td>.19</td>
</tr>
</tbody>
</table>

The etiology of extubation failure is an independent factor influencing the need for reintubation (2), patients considered at risk, consisting mainly of those with chronic diseases (i.e., mainly COPD or CHF), and increased work of breathing at the time of extubation (9). In these sub-sets of patients, NIV has been shown to be of benefit even to shorten the duration of intubation compared with the standard weaning procedure (25–27) and to fully mimic, when properly set, the physiologic changes observed during endotracheal mechanical ventilation.

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Incapacity to remove secretions (Ns) 141 (Ns) 2
Upper airway obstruction
High ventilatory demand 1 (COPD) 16
Emergency surgery 1 (Post-s) 40
Cardiac arrest 1 (ARDS) 26 1 (CHF) 5
Refractory hypoxia 1 (ARDS) 18
Changes in mental status 1 (Tr) 31 1 (COPD) 38

Table 4. Clinical outcome (reintubation) of patients

<table>
<thead>
<tr>
<th>Reasons for Reintubation</th>
<th>NIV</th>
<th>Standard Medical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Patients (n = 4)</td>
<td>Time from Randomization, Hrs</td>
</tr>
<tr>
<td>Incapacity to remove secretions</td>
<td>1 (Ns)</td>
<td>14</td>
</tr>
<tr>
<td>1 (COPD)</td>
<td>26</td>
<td>1 (Ns)</td>
</tr>
<tr>
<td>Changes in mental status</td>
<td>1 (Tr)</td>
<td>31</td>
</tr>
<tr>
<td>Refractory hypoxia</td>
<td>1 (ARDS)</td>
<td>26</td>
</tr>
<tr>
<td>1 (Pne)</td>
<td>27</td>
<td>1 (CHF)</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>1 (ARDS)</td>
<td>26</td>
</tr>
<tr>
<td>Emergency surgery</td>
<td>1 (Pne)</td>
<td>8</td>
</tr>
<tr>
<td>High ventilatory demand</td>
<td>1 (ARDS)</td>
<td>3</td>
</tr>
<tr>
<td>Upper airway obstructiona</td>
<td></td>
<td>24.2 ± 7.2</td>
</tr>
</tbody>
</table>

NIV, noninvasive ventilation; Ns, neurosurgery patient; COPD, chronic obstructive pulmonary disease; Tr, trauma; ARDS, acute respiratory distress syndrome; Pne, pneumonia; CHF, chronic heart failure; Post-s, postsurgical respiratory failure.
a Stridor with resolution on reintubation (Ref. 2). Values are number of patients (primary diagnosis on admission).

ventilating the need for intubation in patients who developed initial hypoxemia after elective major abdominal surgery (34).

The criteria of reintubation adopted in the study, although they were similar to those reported in the literature (8, 9), may have been too strict, especially for COPD patients. We should note, however, that a pH < 7.35 should have been also accompanied with a PaCO2 increase > 15% from that recorded at the time of extubation. For this reason, the highest pH of COPD patients needing intubation was 7.31 (one patient), whereas in the remaining COPD patients the pH values ranged from 7.27 to 7.30.

Last, we are well aware of the possible problem of tolerance and complications when applying NIV to critically ill patients. The tolerance to NIV was quite high in our study, in keeping with our previous experiences (25, 35) and the rate of complications, rather similar to those described in the literature (36).

CONCLUSIONS

In this study, performed in patients considered at risk of developing postextubation respiratory failure, we demonstrated that the preventive application of NIV immediately after extubation is associated with a lower need for endotracheal intubation than in patients treated with standard medical therapy. The use of NIV itself was independently associated with a reduced risk of developing postextubation failure, whereas the act of reintubation per se was a strong predictor of mortality.

This study demonstrates that despite the recent negative studies about the use of NIV to treat postextubation respiratory failure, preventive application of NIV may be of clinical benefit in a very selected population of patients at high risk of developing postextubation respiratory distress.

REFERENCES


Table 5. Risk difference of univariate and multivariate equations calculated with the generalized linear models

<table>
<thead>
<tr>
<th>Response Variable Y</th>
<th>Predictor Variable X, n (%)</th>
<th>Risk Difference, %</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univariate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reintubation</td>
<td>NIV 4/48 (8)</td>
<td>No NIV 12/49 (24)</td>
<td>−16</td>
<td>(−2, −31)</td>
</tr>
<tr>
<td>ICU mortality</td>
<td>NIV 3/48 (6)</td>
<td>No NIV 9/49 (18)</td>
<td>−12</td>
<td>(−25, +0.7)</td>
</tr>
<tr>
<td>ICU mortality</td>
<td>Reintubation 1/16 (63)</td>
<td>No reintubation 2/81 (3)</td>
<td>+60</td>
<td>(+36, +84)</td>
</tr>
<tr>
<td>Multivariate</td>
<td>NIV 4/48 (8)</td>
<td>No NIV 12/49 (24)</td>
<td>−16</td>
<td>(−2, −31)</td>
</tr>
<tr>
<td>ICU mortality</td>
<td>NIV 6/48 (12)</td>
<td>No NIV 6/49 (12)</td>
<td>−1</td>
<td>(−8, +6)</td>
</tr>
<tr>
<td>ICU mortality</td>
<td>Reintubation 10/16 (62)</td>
<td>No reintubation 2/81 (3)</td>
<td>+60</td>
<td>(+37, +83)</td>
</tr>
</tbody>
</table>

CI, confidence interval; NIV, noninvasive ventilation; ICU, intensive care unit.


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