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East and West—
a Common Future

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N. Mutz, W. Koller, H. Benzer

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The vasomotor effect of breathing N0 on the arterial pulmonary circulation is well known in many cases of arterial pulmonary hypertension. The aim of this study is to evaluate the respiratory and hemodynamic effects of N0 in patients with chronic obstructive pulmonary disease (COPD) and acute pulmonary failure (APF).

Patients and methods: 9 patients (mean age 62±10 years) with COPD and pulmonary hypertension are studied. They have APF and controlled ventilation. Respiratory and hemodynamic data are collected before N0 inhalation after 15 minutes of N0 inhalation (40 ppm) and 30 minutes after the end of N0 breathing. Statistical analysis used ANDYA.

Results:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before N0</th>
<th>During N0</th>
<th>After N0</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAP (mmHg)</td>
<td>312</td>
<td>257*</td>
<td>317*</td>
</tr>
<tr>
<td>CI (L/min-m2)</td>
<td>4.75</td>
<td>4.87*</td>
<td>4.61*</td>
</tr>
<tr>
<td>PVR (dyn/sec cm-5-m2)</td>
<td>3665 ± 184</td>
<td>2880 ± 115*</td>
<td>3690 ± 142*</td>
</tr>
<tr>
<td>SVR (dyn/sec cm-5-m2)</td>
<td>15672 ± 379</td>
<td>1348 ± 345</td>
<td>1586 ± 368</td>
</tr>
<tr>
<td>DO2/FiO2</td>
<td>342</td>
<td>40<em>10</em></td>
<td>354*</td>
</tr>
<tr>
<td>P_{PEEP} (mmHg)</td>
<td>325.10</td>
<td>241.3*</td>
<td>127*</td>
</tr>
<tr>
<td>P_{QO2} (mmHg)</td>
<td>385.16</td>
<td>441<em>11</em></td>
<td>597.21</td>
</tr>
<tr>
<td>P_{C02} (mmHg)</td>
<td>372.16</td>
<td>345</td>
<td>344</td>
</tr>
<tr>
<td>QO2 (%)</td>
<td>165.10</td>
<td>22.19</td>
<td>187.95</td>
</tr>
</tbody>
</table>

**Conclusion:** Inhalation of 40 ppm of N0 during APF of COPD has a pure arterial pulmonary vasodilator effect with an improvement of right ventricular function. There was a decrease of P_{QO2} and V_{A/Q} mismatching probably due to excessive arterial pulmonary vasodilatation in patients whose previous hypoxemia was corrected by controlled ventilation.

**TREATMENT OF PATIENT-VENTILATOR-DESYNCHRONISATION WITH AUTOMATIC TUBE COMPENSATION (ATC) AND PROPORTIONAL ASSIST VENTILATION (PAV)**

F. Fabry, J. Guttmann, L. Eberhard, G. Wolff

Patient-triggered respiratory pressure support (IPS) is a useful modality for avoiding spontaneous breathing. In weaning patients with respiratory failure using IPS, we found, however, that more than 50% of the patients displayed desynchronisation, i.e. the ventilator did not detect and consequently did not support all the patients’ efforts to breathe. The reasons for desynchronisation are 1) a prolonged ventilator response delay (e.g. due to trigger mechanism), 2) an imperfect trigger for the termination of pressure support, and 3) dynamic hyperventilation (e.g. due to expiratory flow limitation). Reasons 1) and 2) can be rectified with Proportional Assist Ventilation (PAV). Expiratory flow limitation can be reduced with a mode compensating for the flow-dependent resistance of the endotracheal tube. We combined PAV with ATC in a modified demand flow ventilator and applied this mode in a patient displayed desynchronisation. Under IPS the respiratory rate measured at the ventilator was 25/min, however, the patient attempted to breathe 50/min. Under PAV with ATC each breathing effort was supported by the ventilator. The figure shows volume, airway pressure and esophageal pressure of this patient in both modes.

**ADDITIONAL AND REDUCED WORK OF BREATHING UNDER AUTOMATIC TUBE COMPENSATION (ATC) WITH PROPORTIONAL ASSIST VENTILATION (PAV)**

B. Fabry, J. Guttmann, L. Eberhard, G. Wolff

**Background:** In weaning patients from mechanical ventilation, patient-triggered Inspiratory Pressure-Support-Ventilation (IPS) is commonly used. Several methods have been described on how to find the optimal level of inspiratory pressure support. **Problem:** The flow-dependent resistance of the endotracheal tube (ETT) can seriously hinder inspiration and expiration. The pressure drop across the ETT (APAP) can be larger than the PIP causing additional inspiratory work.

**Methods:** To compensate for the resistance of the endotracheal tube during inspiration and expiration we modified a demand-flow-ventilator as follows: 1) Tracheal pressure (P_{PeaP}) was calculated at a rate of 600 Hz by measurement of flow and pressure at the outer end of the ETT and using coefficients describing the flow-dependent ETT resistance. 2) The calculated tracheal pressure was then fed into the ventilator which then controlled tracheal pressure at a target tracheal pressure.

With our modified ventilator we were able to apply a volume Proportional Assist Ventilation (PAV) of the tracheal pressure (ATC with PAV).

**Results:** In 10 intubated patients breathing spontaneously under IPS and ATC with PAV, we determined additional and reduced work of breathing from pressure difference between measured P_{PeaP} and PEEP. Additional work arises if P_{PeaP}>PEEP: W_{add}=\int (P_{PeaP}-PEEP)dV, and the patient’s work of breathing is reduced if P_{PeaP}<PEEP: W_{red}=\int (PEEP-P_{PeaP})dV. Results: During IPS, enormous additional work can arise, depending on the breathing effort of the patient. Unfortunately, reduced work decreases with increasing breathing effort. During ATC with PAV, reduced work increases with increasing breathing effort. Additional work remains negligible. The figure gives an example of a patient (intubated with an ETT of 7.5 mmID) who displayed variable breathing effort. Conclusion: ATC with PAV is a suitable mode for avoiding additional work of breathing, especially in patients with variable or high breathing effort.

**EFFECT OF ATOMIC PRESSURE EMBOLISM ON EXTRAVASCULAR LUNG WATER**

F. Fernandez Monreal, J. Vázquez Mui, F. Cárdenas, R. Rivera, F. Navarrete Navarro, A. Aranz, J. Guerrero

Ventriculation with high peak airway pressures (Peak-AP) can produce severe respiratory deterioration, with an increase in extravascular lung water (EVLW). It is therefore possible that mechanical ventilation with high pressures can contribute to lung damage in patients with Adult Respiratory Distress Syndrome (ARDS). This deterioration will often not be recognised, due to the severe pulmonary injuries that these patients already have.

**OBJECTIVE:** To determine if a reduction of over 20% in peak airway pressure (Peak-AP) can affect the volume of EVLW.

**MATERIAL AND METHODS:** 11 patients on mechanical ventilation and who met the usual criteria for Adult Respiratory Distress Syndrome (ARDS). The study was performed within the first 72 hours after the diagnosis of ARDS. The patients’ EVLW was determined in two situations, 1) during controlled mechanical ventilation with positive end expiratory pressure (PEEP=5 cmH2O), and 2) 6 hours after reducing the Peak-AP by at least 20% using inverse 1/3 ratio of 2/1 (10-1/2). EVLW was determined by double dilution method.

**RESULTS:** The study was abandoned in 1 patient for various reasons. In the 10 patients who completed the procedure, the Peak-AP fell from 44.4±9 cmH2O during OH-PEEP to 36.1±9 cmH2O during IH-PEEP (p<0.001), while the EVLW was similar in both situations, 17.3±4.5 ml/kg during OH-PEEP, and 16.3±4.5 ml/kg during IH-PEEP. Cardiac output, pulmonary artery pressure, systemic artery pressure and PAo2/PAO2 ratio showed no variations on changing the ventilation pattern.

**CONCLUSION:** The reduction of Peak-AP over 6 hours in patients with ARDS produced no significant changes in EVLW.
TREATMENT OF PATIENT-VENTILATOR-DESYNCHRONISATION WITH AUTOMATIC TUBE COMPENSATION (ATC) AND PROPORTIONAL ASSIST VENTILATION (PAV)
B. Fabry, J. Guttmann, L. Eberhard, G. Wolff

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Clinical Physiology, University Clinics Basel, 4031 Basel, Switzerland