Treatment of acute exacerbations with Non-Invasive Mechanical Ventilation (NIMV) in chronic hypercapnic COPD patients with pulmonary hypertension

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Introduction: COPD is a slowly progressive airways disorder, often presenting exacerbations of respiratory symptoms requiring hospitalization. This leads to greater use of medical resources and increases direct and indirect costs. Non-Invasive Mechanical Ventilation (NIMV) has been shown to be an effective adjunct to medical therapy in the treatment of hypercapnic respiratory failure. Pulmonary hypertension is a common complication of COPD. The increase in pulmonary artery pressures is often present with a progressively downhill clinical course because of right-sided heart failure added to ventilatory handicap. The cause of pH in COPD is generally due to hypoxic pulmonary vasoconstriction leading to permanent medial hypertrophy.

Aim: the aim of the study was to evaluate the effect of NIMV in acute exacerbation of patients with COPD characterized by chronic hypercapnic respiratory failure, and partitioned on arterial blood gas pH in compensate and uncompenstate respiratory acidosis (pH>7.35 and <7.35).

Materials and Methods: We enrolled 61 consecutive COPD patients (41 M, 20 F) with hypercapnic respiratory failure admitted to our Respiratory Unit for acute exacerbation. Patients were divided into two groups: Group A (26) with uncompensated hypercapnic respiratory acidosis (pH<7.35) and Group B (35) with compensated respiratory acidosis (pH>7.35). A measurement of six-minute walking test (6mWT) and pulmonary arterial pressure (by transthoracic echocardiography) was evaluated: mean Pulmonary Pressure in group A= 46.2mmHg, group B= 50.7mmHg. All patients were treated with medical therapy and NIMV. Main outcomes were pH, PaCO2, PaO2, duration of NIMV, 6mWT, and pulmonary pressure.

Results: Total regression of uncompensated acidosis was observed in group A (mean pH from 7.29 to 7.42) (Fig.1). Both groups reported significant reduction of PaCO2 (group A from 77.1 to 45.1mmHg, and group B from 70.1 to 40mmHg) (Fig.2), and increase of PaO2 (group A from 51.2 to 84.2mmHg, and group B from 55.9 to 87mmHg) (Fig.3).

Mean duration of NIMV was longer in group A (81.1 hours) than B (55.8hours) (Fig.4).

In addition we observed an improvement in 6mWT in both groups (from 118.4 to 175.1 meters), p < 0.05 (Fig.5). Analysing data in patients with severe Pulmonary Hypertension (PAPS >55mmHg) they reported a lower response to NIMV treatment on PaCO2, (p < 0.05) (PaCO2 in PAPS >55mmHg pre-NIMV 69.5, post-NIMV 69.4, PAPS <55mmHg pre-NIMV 69.4, post-NIMV 43.7) (Fig.6).

Conclusion: this study showed as treatment with NIMV is particularly useful in patients with compensated and uncompenstate respiratory acidosis during acute exacerbations. NIMV efficiently improved blood gas parameters, walking autonomy, and symptoms. As seen from graph 6 the patients with severe Pulmonary Hypertension showed a poorer response to NIMV treatment. Therefore, it is important to consider the presence of a state of Pulmonary Hypertension in COPD patients who undergo NIMV during an exacerbation in order to predict ventilatory response.

References:

Table 1:
<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-NIMV</th>
<th>Post-NIMV</th>
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<tbody>
<tr>
<td>pH</td>
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<td>7.42</td>
</tr>
<tr>
<td>PaCO2</td>
<td>77.1</td>
<td>45.1</td>
</tr>
<tr>
<td>PaO2</td>
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<td>84.2</td>
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</tbody>
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Figure 1. pH variation PRE and POST NIMV

Figure 2. PaCO2 variation PRE and POST NIMV

Figure 3. PaO2 variation PRE and POST NIMV

Figure 4. Duration of NIMV

Figure 5. 6MWT PRE and POST NIMV

Figure 6. PaCO2 variation related to PAPS

* p < 0.05