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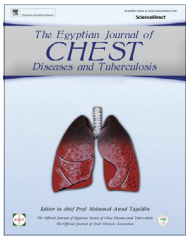

ORIGINAL ARTICLE

Effect of respiratory muscles training in weaning of mechanically ventilated COPD patients

Mohammed S. Elbouhy [a], **Hesham A. AbdelHalim** [b,*], **Ahmed M.A. Hashem** [c]

[a] *Faculty of Medicine, Ain Shams University, Egypt*
[b] *Faculty of Medicine, Ain Shams University, Egypt*
[c] *Abbassia Chest Hospital, Egypt*

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KEYWORDS

COPD;
Mechanical ventilation;
Difficult weaning;
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Abstract *Background:* Inspiratory muscle weakness is common in patients receiving mechanical ventilation, especially COPD patients with prolonged duration of mechanical ventilation. Inspiratory muscle training could limit or reverse these unhelpful sequelae and facilitate more rapid and successful weaning.

Objective: Assessment of the effect of respiratory muscle training in weaning of mechanically ventilated COPD patients admitted in respiratory ICU in the Abbassia chest hospital.

Patients and methods: The study was conducted on 40 COPD patients admitted to the respiratory intensive care unit in the Abbassia chest hospital in the period between October-2011 and March-2013. All patients were diagnosed as having acute exacerbation of COPD with acute respiratory failure necessitating mechanical ventilatory support and difficult weaning; patients were subdivided into 2 groups: GROUP (A): (20 patients) include patients who received respiratory muscle training and GROUP (B): (20 patients) include patients who did not receive inspiratory muscle training.

Results: There was a significant difference between the 2 groups as regards the primary outcomes including weaning success rate, duration of mechanical ventilation, length of stay in ICU, length of stay in hospital. Also there was a significant improvement of secondary outcomes in group (A) including PO_2, O_2 saturation, TV, RR, MIP over the 5 days of IMT; while there was a significant difference between the 2 groups regarding the above secondary outcomes in favor to group (A).

Conclusion: Inspiratory muscle training increases muscle strength and endurance as well as it assists in weaning from mechanical ventilation in COPD patients with difficult weaning.

* Corresponding author. Mobile: +20 1224474750.
E-mail address: heshamatef71@yahoo.com (H.A. AbdelHalim).

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Introduction

In intensive care, weaning is the term used for the process of withdrawal of mechanical ventilation to enable spontaneous breathing to be re-established. Inspiratory muscle weakness and reconditioning are common in patients receiving

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mechanical ventilation, especially that of prolonged duration and chronic obstructive pulmonary disease (COPD) patients. Inspiratory muscle training could limit or reverse these unhelpful sequelae and facilitate more rapid and successful weaning [1].

Failure to wean from mechanical ventilation is a significant clinical and economic problem; weaning failure resulting in prolonged ventilation is detrimental to the individual as it is associated with increased risk of respiratory muscle weakness, critical illness myopathy, nosocomial infection and airway trauma. Prolonged mechanical ventilation is also associated with an increase in mortality, morbidity and intensive care unit (ICU) length of stay, as well as reduced functional status and quality of life. In addition prolonged mechanical ventilation is expensive, consuming a large fraction of hospital resources, with a healthcare burden that may continue after hospital discharge [2]. Weakness or fatigue of the diaphragm and accessory muscles of inspiration is widely recognized as a cause of failure to wean from mechanical ventilation. Fatigue may be due to excessive load on the inspiratory muscles, which may result from increased airway resistance and/or reduced lung compliance. A reduction in the capacity of the respiratory muscle pump may also occur due to phrenic nerve injury, corticosteroids, endocrine or nutritional factors. There is increasing evidence to show mechanical ventilation itself may adversely affect the diaphragm's structure and function, which has been termed ventilator-induced diaphragmatic dysfunction. The combination of positive pressure ventilation and positive end-expiratory pressure may unload the diaphragm therefore subjecting it to changes in myofibril length, which may account for its rapid atrophy. In addition, patients who undergo prolonged periods of ventilation demonstrate a decrease in respiratory muscle endurance and are at risk of respiratory muscle fatigue [3].

Patient and methods

This study was conducted on 40 COPD patients admitted to the respiratory intensive care unit in the Abbassia chest hospital in the period between October-2011 and March-2013. All patients were diagnosed (by clinical and arterial blood gas findings) as having acute exacerbation of COPD with acute respiratory failure (ARF) necessitating mechanical ventilatory support and difficult weaning.

Difficult weaning is defined as: The need for more than three spontaneous breathing trials or more than one week to achieve successful weaning [2].

The patients were subdivided into 2 groups:

Group (A): (20 patients) Include patients who received respiratory muscle training.

Group (B): (20 patients) Include patients who did not receive inspiratory muscle training.

The patients were connected to a mechanical ventilator.

Two types of ventilators will be used:

1- Servo I maquet model no 6449701 Sweden used in the Abbassia chest hospital respiratory ICU.
2- Servo 300 model no 30207 Sweden used in the Abbassia chest hospital respiratory ICU with all varieties of modalities and data auto-analysis.

Study design

Patients were subjected to the following: full history taking from the patient or his relatives, general and local chest examination, laboratory investigations in the form of: arterial blood gases (using BAYER RAPIDLAB 248 blood gas analyzer), serum electrolytes, liver and kidney functions, blood glucose, complete blood picture, ECG, chest radiography (Antro-posterior view).

All patients enrolled in the study received standard medical treatment in the form of: antibiotics: parenteral, broad-spectrum, empirical then guided by sputum culture and sensitivity, bronchodilators in the form of intravenous theophylline infusion, inhaled b2-agonists, inhaled ipratropium bromide (dosage of them titrated according to body weight), corticosteroids (intravenous then shifted to oral), expectorants, prophylactic anticoagulant, oral sucralfate, physiotherapy (chest percussion). All patients underwent continuous cardiac and arterial oxygen saturation monitoring.

Ventilator setup

Both groups were trained and weaned on pressure support mode, with FiO_2 0.4 and positive end expiratory pressure (PEEP) was titrated to 5 cm/H_2O [4].

Inclusion criteria

Criteria of a weanable patient: (1) Criteria of weaning from mechanical ventilation: Respiratory rate less than 38 breaths/min., tidal volume 4–6 ml/kg., minute ventilation 10–15 L/min., maximal inspiratory pressure −15 to −30 cm H_2O, rapid shallow breathing index (RSBI) 60–105, PaO_2/FiO_2 ratio > 150–200, improving or normal appearing chest radiogram, homodynamic stability without need for vasoactive drugs, consciousness and normal orientation (Glasgow coma score > 11), ability to initiate spontaneous breaths, PH > 7.25, arterial oxygen saturation > 90% [5]; (2) patient is afebrile; (3) minimal secretions; (4) within normal lab investigations [6].

Patients were subdivided into 2 groups:

Group (A): (20 patients) Include patients who were received respiratory muscle training.

1. Pressure support ventilation was titrated at a level sufficient to achieve a respiratory rate of 20–30 breath/min and tidal volume 4–6 ml/kg.
2. Pressure support was reduced by 2 cm H_2O every hour to reach pressure support 8 cm H_2O.
3. Two exercise sessions were performed, at 9 AM and 5 PM.
4. Training will be based on decreasing the trigger sensitivity gradually in order to increase muscle endurance.
5. The trigger sensitivity was adjusted to 20% of the first recorded MIP at the start of training (In the first session), inspiratory muscle training (IMT) was limited to 5 min; afterwards the duration was increased by 5 min at every session until it reached 30 min. If a patient tolerated 30 min of IMT, The next session would be performed with increasing trigger sensitivity by 10% of the initial MIP.