



Review

Complementary Home Mechanical Ventilation Techniques: SEPAR Year 2014[☆]Eusebi Chiner,^{*} Jose N. Sancho-Chust, Pedro Landete, Cristina Senent, Elia Gómez-Merino

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ABSTRACT

This is a review of the different complementary techniques that are useful for optimizing home mechanical ventilation (HMV).

Airway clearance is very important in patients with HMV and many patients, particularly those with reduced peak cough flow, require airway clearance (manual or assisted) or assisted cough techniques (manual or mechanical) and suctioning procedures, in addition to ventilation.

In the case of invasive HMV, good tracheostomy cannula management is essential for success.

HMV patients may have sleep disturbances that must be taken into account. Sleep studies including complete polysomnography or respiratory polygraphy are helpful for identifying patient-ventilator asynchrony.

Other techniques, such as bronchoscopy or nutritional support, may be required in patients on HMV, particularly if percutaneous gastrostomy is required.

Information on treatment efficacy can be obtained from HMV monitoring, using methods such as pulse oximetry, capnography or the internal programs of the ventilators themselves.

Finally, the importance of the patient's subjective perception is reviewed, as this may potentially affect the success of the HMV.

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Técnicas complementarias a la ventilación mecánica domiciliaria. Año SEPAR 2014

RESUMEN

La ventilación mecánica domiciliaria (VMD) precisa técnicas complementarias para optimizar el tratamiento, que son revisadas en el presente trabajo.

El manejo de las secreciones respiratorias es muy importante, ya que muchos pacientes, particularmente cuando descienden los flujos de tos, precisan la aplicación de técnicas manuales o asistidas para el manejo de secreciones, técnicas de tos asistida (manual o mecánica) y aspiración mecánica de secreciones.

Si se aplica la VMD de forma invasiva, el buen manejo de la cánula de traqueostomía es esencial para su éxito.

Las alteraciones durante el sueño pueden estar presentes en estos pacientes, siendo un aspecto a valorar, estudiadas mediante polisomnografía o poligrafía respiratoria, que además ayudan a identificar las asincronías entre el paciente y el ventilador.

Otras técnicas que pueden ser requeridas en pacientes con VMD son la fibrobroncoscopia o el soporte nutricional (especialmente si se requiere la colocación de una sonda de gastrostomía).

Palabras clave:

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Ventilación mecánica domiciliaria

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La monitorización de la VMD aporta información sobre la efectividad del tratamiento aplicado. Existen varios métodos para ello, como pueden ser la pulsioximetría, la capnografía o los programas internos de los ventiladores.

Finalmente, se revisa la importancia de la percepción subjetiva del paciente, ya que puede tener potencial influencia en el éxito de la VMD.

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Introduction

Invasive and non-invasive home mechanical ventilation (HMV) is administered in a wide range of diseases (Tables 1 and 2), with significant differences in prevalence and patterns of use.^{1,2} In highly dependent patients, in particular, complementary techniques are needed for HMV to be fully effective, and the aim of this article is to review those techniques.

Airway Secretion Clearance

HMV patients themselves, if capable, or family members and caregivers may need to be educated and trained in airway

clearance methods, including manual and instrumental techniques for assisted coughing and secretion suctioning (Table 3).

Manual Airway Clearance Techniques

There are several methods, such as slow expiration, auto-genic drainage or forced expiration techniques aimed at improving mucociliary transport.³ These should only be applied in patients with preserved expiratory muscle function. Other manual techniques, such as percussion or clapping, manual vibration and postural drainage,^{4–6} have been widely studied in patients with other respiratory diseases, such as cystic fibrosis. Their utility in patients with compromised expiratory capacity has not been proven.

Instrumental Airway Clearance Techniques

Oscillating and non-oscillating positive expiratory pressure (PEP) devices increase alveolar recruitment and collateral ventilation and reduce hyperinflation by increasing airflow resistance in the device outlet.^{3–6} Thus, positive pressure proportional to the degree of resistance of the device is generated, preventing premature closure of the airways during expiration. Moreover, they act mechanically on the rheological properties of mucus.^{7,8} Other systems, such as intrapulmonary percussive ventilation^{9,10} or external high-frequency chest-wall oscillation/compression devices, have been used in airway clearance, helping to mobilize secretions and acting on mucus viscoelasticity.¹¹

Although these techniques have few adverse effects, gas exchange alterations and respiratory failure have been described in both healthy subjects and in subjects with chronic obstructive pulmonary disease (COPD) exacerbations.¹² Similarly, expiratory muscle function must be normal.

Manual Assisted Cough Techniques

These techniques are indicated in patients with neuromuscular diseases (NMD) and spontaneous peak cough flow (PCF) of less than 270 l/min, and in patients with other diseases involving muscle weakness and ineffective cough.^{13–17}

Table 1
Medical Disorders That Can Be Treated With Home Mechanical Ventilation in Adult Patients.

Central nervous system disorders	Arnold–Chiari malformation Central nervous system injuries Cerebrovascular diseases Congenital and acquired respiratory control disorders Myelomeningocele Spinal cord injuries Amyotrophic lateral sclerosis Guillain-Barré syndrome Phrenic nerve paralysis Poliomyelitis and post-polio syndrome Spinal atrophy
Neuromuscular diseases	Duchenne muscular dystrophy Steinert myotonic dystrophy Other muscular dystrophies Myasthenia gravis
Thoracic cage deformities	Thoracoplasty Kyphoscoliosis Secondary musculoskeletal disorders Obesity-hypoventilation syndrome Bronchopulmonary dysplasia
Lower airway obstructive diseases	COPD Cystic fibrosis
Other	Upper airways disorders Pierre-Robin syndrome Tracheomalacia Vocal cord paralysis

Table 2
Medical Disorders That Can Be Treated With Home Mechanical Ventilation in Pediatric Patients.

Bronchopulmonary dysplasia
Restrictive pulmonary parenchymal disorders
Thoracic cage disorders
Motor neuron diseases
Primary myopathies (e.g., Duchenne disease)
Spinal cord disorders
Congenital alveolar hypoventilation syndrome
Acquired alveolar hypoventilation syndrome (e.g., tumors or brain stem bleeding)
Myelomeningocele
Respiratory center development or neurological control disorders (e.g., apnea of prematurity)

Table 3
Levels of Evidence in Airway Secretion Clearance in the Diseases Most Frequently Treated With These Techniques.

Disease	Level of evidence
Amyotrophic lateral sclerosis	1C
Spinal injuries	1C
Duchenne disease	1C
Other myopathies	1C
Myotonic dystrophia	1C
Kyphoscoliosis	1C
Post-polio sequelae	1C

1C: strong recommendation from low quality studies or low quality evidence (observational studies or case series).

Adapted from Make et al.²⁴

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