

OPINION ARTICLE

Non invasive mechanical ventilation at home Ventilación mecánica no invasiva a domicilio



Gilberto Lázaro Betancourt Reyes¹

Abstract

In this article is exposed a topic very useful, frequent and broadly used in numerous countries around the world. It achieves a theoretical reflection of a topic which is still not within reach of our health system. Used in patient with chronic illnesses and during terminal state of their illnesses where instead of demurrages prolonged in hospital, these patients could cohabit with their irreversible ailment in a worthier and more comfortable way in their own homes, surrounded by their relatives and the psychological support that the family toasts together with the basic health team of the community. The scientific society has noticed of the achievements of this ventilation variety at homes, being vastly accepted in all the latitudes, and our country doesn't escape from this reality.

Keywords: non-invasive mechanical ventilation; indications at home; taking cares at home

Gilberto Lázaro Betancourt Reyes. "Manuel Asuncion Domenech" Teaching Hospital. Intensive Care Unit. Camagüey City, Cuba
E-mail: bbgilbert.cmw@infomed.sld.cu

Resumen

En el presente artículo se expone una temática útil, frecuente y ampliamente utilizada en numerosos países del mundo. Se realiza una reflexión teórica del tema, todavía no al alcance de nuestro sistema de salud. Utilizada en pacientes con enfermedades crónicas y en estadio terminal de su enfermedad, en donde en vez de estar estadias prolongadas en entidades hospitalarias, estos pacientes podrían convivir con su dolencia irreversible de una manera más digna y cómoda en su propio hogar, rodeado de sus familiares y del apoyo psicológico que la familia brinda junto con el equipo básico de salud de la comunidad. La sociedad científica se ha percatado de los logros de esta variedad de ventilación en los hogares, siendo inmensamente aceptada en todas las latitudes, y nuestro país no escapa de esta realidad.

Palabras claves: ventilación mecánica no invasiva; indicaciones a domicilio; cuidados domiciliarios

Introduction

Non-invasive mechanical ventilation at home is simply the intermittent or continuous use of a ventilation system administered through a nasal or facial interface or a mouthpiece in non-invasive ventilation. The aim of this treatment in chronic respiratory failure due to the cause or in patients who are carrying a terminal illness is to reduce the work of the respiratory muscles and to correct hypoxemia and/or respiratory acidosis, through increased alveolar ventilation, thus improving the gaseous exchange. Non invasive mechanical ventilation (NIMV) at home is a well-established treatment of chronic respiratory failure in patients with ventilatory failure. It improves the survival of patients with neuromuscular and thoracic cage diseases^{1,2} and improves anomalies in gas exchange and quality of life in patients with obesity hypoventilation syndrome (OHSS).^{3,4} Its effects on other different components, such as those exerted on

mechanic ventilation, dyspnea or quality of life are constantly under investigation, constituting one of the areas of the greatest development in pneumology and in general of intensive medicine in the recent years.

With respect to the rate of use, it has increased considerably in the last years. A recent study in the Valencian Community showed a prevalence of 29 / 100,000,⁵ figures very similar to those reported by the Observatory of TRD in Catalonia.⁶

With the objective of realizing a theoretical reflection that allows us to know more about this reality so accepted in the world and it has taken interest from the point of view of the modern medicine nowadays that offers us so many benefits when using it by following the precise indications and taking into account principles and ethical standards where the main beneficiary is the patient.

Development

The observatory carried out in Castilla-La Mancha⁷ shows how the application of non-invasive mechanical ventilation at home has taken an acceptance and a preponderant boom in modern medicine nowadays, with increasingly encouraging and beneficial results for mourners. In France, 60,000 patients were with NIMV at home in 2011, which would mean a use rate of 90 / 100,000.⁸ The absence of a national registry prevents us from knowing updated data, but the implementation of efficiency programs in different autonomous communities, allows us to consider that the overall figures are very similar to those of France in Spain.

In fact, in health departments where NIMV at home has been traditionally developed, it is reported in 2014, figures of 82 / 100,000.⁹

The scarcity of controlled clinical trials leaves a number of unanswered questions, such as which type of ventilator is most appropriate for pathology, which may be optimal ventilator configuration, and especially when NIMV at home should be initiated. Because of NIMV at home is the goal treatment in these patients, a prospective controlled study would not be feasible. However, an alternative to minimizing potential bias might be to consider a prospective observational study that would include

all patients receiving NIMV at home according to current indications.¹⁰ The type of patient ventilated at home has changed, and NIMV at home is increasingly being considered in elderly patients and in patients with non-intubation order or associated severe comorbidity, as well as for palliative purposes.¹¹⁻¹³

It is important to take into account here the respect to the capacity and right of decision that the patient has; where the informed consent becomes essential. In Spain there is a legal support which is expressed by Law 41/2002 regulating the autonomy of the patient who argues that patients can always exercise their moral autonomy and make the decisions they deem appropriate regarding their body or their health.¹⁴

Once the patient is assigned to apply non-invasive ventilation at home, the health service is obliged to provide the necessary care activity required by the patient.¹⁵

This activity includes transport, installation, commissioning and training in the use of equipment, such as the carrying out of patient checks and maintenance of equipment.

There are no precise guidelines on what should be considered satisfactory in terms of nocturnal oxygenation during home ventilation, which represents an important pillar because of the risk and fear that the patient during nighttime hypoventilate. A reasonable goal is to adjust the ventilator to obtain an average SpO₂ > 90% at night, with <10% of the time with SpO₂ <90% after leak correction.¹⁶ The importance of monitoring patients with neuromuscular diseases through transcutaneous PaCO₂ (PtcCO₂) together with nocturnal SpO₂, to adjust the NIMV at

home and thus be sure that there is no hypoventilation, since the continuous measurement of PtcCO₂ shows good agreement with PaCO₂,¹⁷⁻²⁰ discouraging the use of portable CO₂ monitoring systems (PETCO₂), since the relationship between PaCO₂ and PETCO₂ depends on the physiological dead space, the current volume and the ventilatory mode, and also on the type and extent of the disorder underlying parenchyma.

The world of medicine and its relationship with technology is advancing at a high speed and is becoming easier to control the NIMV of a patient at a distance.²¹⁻²³

The most modern respirator software allows the alarms or the regulation of a respirator in the patient's home to be controlled from the hospital. It is also necessary to have the basic health equipment prepared and trained in this type of situations.

Non invasive home ventilation indications include Arnold-Chiari malformation, trauma of the CNS (Central Nervous System) and spinal cord injuries, cerebrovascular diseases, amyotrophic lateral sclerosis, Werdnig-Hoffman's disease, Guillain-Barré syndrome, poliomyelitis, spinal atrophy, Duchenne muscular dystrophy, Becker muscular dystrophy, Steinert myotonic dystrophy, Thomsen myotonic dystrophy, other dystrophies, Charcot-Marie-Tooth disease, Dejèrine-Sottas disease, myasthenia gravis, kyphoscoliosis, obesity hypoventilation syndrome, bronchopulmonary dysplasia, chronic obstructive pulmonary disease, cystic fibrosis, tracheomalacia, vocal cord paralysis, Pierre-Robin syndrome, among others.

What once encouraged the empowerment of the NIMV at home was the possibility that patients could leave the hospital maintaining the quality of life in their own home. The emergence of the necessary technology made it feasible and undoubtedly also contributed to the reduction of the high costs of such care facilitated in the hospital environment. Therefore, the fundamental objective of this discipline is to ensure the continuous care at home of patients who are spared from maintaining an exhausting staying, as well as endless in the hospital, focusing on getting quality of life and not so much on reducing costs.

Through the use of a mask made of silicone and the attachment of the head through harnesses. The masks can be nasal or nasobuccal, being the first one the most used. This type of access to the airway is not free of some complications, such as nasal erosions, gastric distension, vomiting, drooping sensation and claustrophobia, as well as ophthalmologic problems.

Non invasive access has as main advantages that it does not require surgical intervention, facilitates manipu-

lation by the patient, decreases the need

of nursing support and allows talking oral fluids or foods and it lets the patient expectorates. Both nasal pads and mouthpieces were created to provide greater comfort. Non invasive ventilation through either BIPAP or CPAP has been the most used ventilatory-mode. The monitoring is in relation to patient stability and the dependence of the respirator, and it can be weekly or even daily. Patients with NIMV at home may have total ventilator dependence, in which monitoring should be close, or a partial dependency of the ventilator where the following can be performed at intervals of time, although the aspects which are taken into account are basically the same.

It is really important not to underestimate the possible existence of technical failures or to perform calibrations in equipment routinely in order to avoid complications in an uncontrolled environment such as the patient's home; moreover in cases where patients require ventilation as a life support or for prolonged periods.

Conclusions

The benefits derived from this therapeutic measure reflect clearly, such as individually, with a decrease in symptoms, a better quality of life and an increase in their life expectancy, as well as collective, with a decrease in health costs, since these patients require a smaller number of admissions to health institutions. The main objectives to be achieved with this modality of home ventilation are the lengthening of the patient's life; to try

to improve the quality of life; the provision of an environment that can favor individual, family and work development of the patient; thus reducing morbidity, improving physical and psychic function, and reducing costs. Where the doctor should go beyond the basic diagnosis and focus on the prognosis so reserved that these types of diseases have, to assess the severity of it, their own evolution, for which the patient with his or her own

psychosocial conditions is very important in assessing the success of this therapeutic measure. It is

necessary to know the mental state, cultural level, and the family environment where life is unfolding.

Bibliographic references

- 1- King AC. Long-term home mechanical ventilation in the United States. *Respir Care*. 2012; 57:921-30. (Citado 23 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/22663967>
- 2- McKim DA, Road J, Avendano M, Abdool S, Cote F, Duguid N, et al.; Canadian Thoracic Society Home Mechanical Ventilation Committee. Home Mechanical Ventilation: a Canadian Thoracic Society clinical practice guideline. *Can Respir J*. 2011; 18:197-215. (Citado 23 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/22059178>
- 3- Hannan LM, Dominelli GS, Chen JW, Darlene Ride W, Road J. Systematic review on non - invasive positive pressure ventilation for chronic respiratory failure. *Respir Med*. 2014; 108:229 - 43. (Citado 23 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/24315469>
- 4- Ojeda Castillejo E, De Lucas Ramos P, López Martín S, Resano Barrios P, Rodríguez Rodríguez P, Morán Caicedo L, et al. Non invasive Mechanical Ventilation in Patients with Obesity Hypoventilation Syndrome. Long-term Outcome and Prognostic Factors. *Arch Bronconeumol*. 2015, 51:61 - 8. (Citado 23 de abril del 2017). Disponible en: <https://pdfs.semanticscholar.org/c061/4b5d6868a25ed99da31ad55159a1799426c0.pdf>
- 5- Chiner E, Llombart M, Martínez-García MA, Fernández-Fabrellas E, Navarro R, Cervera A. Ventilación mecánica no invasiva en la Comunidad Valenciana: de la teoría a la práctica. *Arch Bronconeumol*. 2009, 45:118-22. (Citado 23 de abril del 2017). Disponible en: <http://www.archbronconeumol.org/es/ventilacion-mecanica-no-invasiva-comunidad/articulo/S030028960900060X/>
- 6- Observatori de Teràpies Respiratòries domiciliàries de Catalunya. (Citado 24 de abril del 2017). Disponible en: http://www.gencat.cat/salut/depsan/units/aatrm/pdf/observatorio_trd_es_p.pdf.
- 7- Hidalgo Carvajal R, Ortega González A, López Gabaldón E. Ventilación mecánica domiciliaria en Castilla La Mancha. Libro de resúmenes del XIX Congreso de Neumomadrid. Abril de 2014. (Citado 24 de abril del 2017). Disponible en: <http://www.neumomadrid.org/>.
- 8- Datos Antadir 2010. (Citado 24 de abril del 2017). Disponible en: http://www.observatoritrd.weebly.com/uploads/5/1/4/2/5142345/antadir_2010.pdf.
- 9- Grupo de Trabajo de la Comisión y Seguimiento de la prestación de Oxigenoterapia y Terapias Respiratorias domiciliarias del Departamento 17 de la Agència Valenciana de Salut.

- Departamento de Salud Alicante - Sant Joan d'Alacant. Enero 2014.
- 10- Barbé F, Escarrabill J. Hacer correctamente lo que es correcto. Arch Bronconeumol. 2014; 50:563-4. (Citado 23 de abril del 2017). Disponible en: <http://www.archbronconeumol.org/en/do-right-what-is-right/articulo/S1579212914002869/>
- 11- Azevedo LC, Caruso P, Silva UV, Torelly AP, Silva E, Rezende E, et al. Outcomes for Patients with Cancer Admitted to the ICU Requiring Ventilatory Support: Results from a Prospective Multicenter Study. Chest. 2014; 146:257-66. (Citado 23 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/24480886>
- 12- Nava S, Ferrer M, Esquinas A, Scala R, Groff P, Cosentini R, et al. Palliative use of non invasive ventilation in end-of-life patients with solid tumours: a randomised feasibility trial. Lancet Oncol. 2013; 14:219-27. (Citado 23 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/23406914>
- 13- Khan N, Munday D. It is getting harder to breath: non invasive ventilation (NIV) in advanced chronic obstructive pulmonary Disease (COPD). BMJ Support Palliat Care. 2012; 2:7. (Citado 23 de abril del 2017). Disponible en: <http://spcare.bmj.com/content/bmjspcare/2/2/7.1.full.pdf>
- 14- Ley 41/2002, de 14 de noviembre, básica reguladora de la autonomía del paciente y de derechos y obligaciones en materia de información y documentación clínica. (Citado 27 de abril del 2017). Disponible en: <http://www.boe.es/boe/días/2002/11/15/pdfs/A40126-40132.pdf>
- 15- Plataforma de Contratación de la Comunidad Autónoma de las Illes Balears. Prestación del servicio de terapias respiratorias domiciliarias y otras técnicas de ventilación asistida (Citado 27 de abril del 2017). Disponible en: <http://www.plataformadecontractacio.caib.es/Licitacion.jsp?=&pagina=&idi=es&idTipoContrato=SERVICIO>
- 16- Langevin B, Leger P, Gerard M, Sukkar F, Guez A, Robert D, Monitoring nasal ventilation. Eur Respir Rev. 1993; 3:260-5. (Citado 27 de abril del 2017). Disponible en: <http://www.google.com/url?sa=t&rc=j&q=&esrc=s&source=web&cd=2&ad=rja&uact=8&ved=0ahUKEwibsOSnuobUAhUI5oMKHS7FB74QFggoMAE&url=http%3A%2F%2Fwww.archbronconeumol.org%2Fes%2Fpdf%2FS0300289604755829%2FS300%2F&usq=AFQjCNGO9awDhZXMp-JH5zPxGz6sw6Pag>
- 17- Janssens JP, Borel JC, Pépin JL; SomnoNIV Group. Nocturnal monitoring of home non-invasive ventilation: the contribution of simple tools such as pulse oximetry, capnography, built in ventilator software and autonomic markers of sleeps fragmentation. Thorax. 2011; 66:438-45. (Citado 27 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/20971980>
- 18- Fernández R, Rubinos G, Cabrera C, Galindo R, Fumero S, Sosa A, et al. Nocturnal home pulse oximetry: variability and clinical implications in home mechanical ventilation.

- Respiration. 2011; 82:142-7. (Citado 27 de abril del 2017). Disponible en: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjg_NXJuYbUAhUsw4MKHQUjB_MQFggrMAE&url=http%3A%2F%2Fwww.archbronconeumol.org%2Fes%2Fpdf%2FS0300289614002671%2FS300%2F&usq=AFOjCNFVwayjamQ12EC9prXJW0nyVuYc6w
- 19- Chiner E, Sancho-Chust IN, Landete P, Senent C, Gómez Merino E. Complementary home mechanical ventilation techniques. SEPAR Year 2014. Arch Bronconeumol. 2014; 50:546-53. (Citado 27 de abril del 2017). Disponible en: <http://www.archbronconeumol.org/en/complementary-home-mechanical-ventilation-techniques/articulo/S1579212914002948/>
- 20- Nardi J, Prigent H, Adala A, Bohic M, Lebargy F, Quera-Salva MA, et al. Nocturnal oximetry and transcutaneous carbón dioxide in home-ventilated neuromuscular patients. Respir Care. 2012; 57:1425-30. (Citado 27 de abril del 2017). Disponible en: <http://www.tandfonline.com/doi/abs/10.3109/21678421.2013.837932?journalCode=iafd20>
- 21- Crescimanno G, Greco F, Marrone O. Monitoring noninvasive ventilation in neuromuscular patients: feasibility of unattended home polysomnography and reliability of sleep diaries. Sleep Med. 2014; 15:336-41. (Citado 27 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/24513436>
- 22- Janssens JP, Borel JC, Pépin JL; groupe Somno VNI. Nocturnal monitoring of home non-invasive ventilation: Contribution of simple tools such as pulse-oximetry, capnography, built in ventilator software and autonomic markers of sleep fragmentation. Rev Mal Respir. 2014; 31:107-18. (Citado 27 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/20971980>
- 23- Pinto A, Almeida JP, Pinto S, Pereira J, Oliveira AG, De Carvalho M. Home telemonitoring of non-invasive ventilation decreases healthcare utilisation in a prospective controlled trial of patients with amyotrophic lateral sclerosis. J Neurol Neurosurg Psychiatry. 2010; 81:1238-42. (Citado 27 de abril del 2017). Disponible en: <https://www.ncbi.nlm.nih.gov/pubmed/20826878>

¹ Intensive Critical Care Unit, Manuel Ascunce Domenech 's Teaching Hospital, Camagüey City, Cuba.

There is not any potential conflict of interest

Received: April, 30th of 2017
Accepted: May, 23rd of 2017

Gilberto Lázaro Betancourt Reyes. E-mail: bbgilbert.cmw@infomed.sld.cu