Intermittent Noninvasive Ventilation at San José Hospital in Chile: Report of a German Donation

Nicht-invasive Beatmung am San José Hospital in Chile: Bericht über eine Spende aus Deutschland

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Abstract

Home mechanical ventilation is currently expanding in Chile, but its application along the country is hindered by financial and geographical reasons. In 2006 the San José Hospital in Santiago de Chile developed a non-invasive ventilation (NIV) center as a strategy to overcome the limitations of ventilator availability from public resources. Since then, this center provides intermittent diurnal sessions of NIV to patients with chronic hypercapnic respiratory failure.

In 2013, a collaboratory work between the Chilean doctors, the German Interdisciplinary Society of Home Mechanical Ventilation (DIGAB= Deutsche Interdisziplinäre Gesellschaft für Außerklinische Beatmung) and the German non-invasive (NIV) home care provider "Heinen und Löwenstein" organized a donation of 100 second-hand ventilators (BiPAP Synchrony; Respironics, USA) including masks and tubing systems, which were provided by Heinen und Löwenstein.

The ventilator devices arrived in Santiago in January 2014. Since then, the following initiatives have been launched: 1) the establishment of a domiciliary mechanical ventilation program independent of governmental founding, 2) NIV setting-titration, 3) renewal of ventilators at the hospital's intermittent NIV unit. Future goals are the establishment of a rehabilitation unit with concomitant NIV therapy and a clinical research program.

Therefore, the German donation of ventilators and equipment has a reported impact on the development of NIV in Chile.

Zusammenfassung

Die außerklinische Beatmung expandiert gegenwärtig in Chile. Ihre flächendeckende Anwendung ist jedoch aufgrund finanzieller und geografischer Hindernisse eingeschränkt. Im Jahre 2006 wurde im San José Krankenhaus in Santiago de Chile ein Zentrum zur nicht-invasiven Beatmung mit dem Ziel gegründet, die eingeschränkte Verfügbarkeit von Ventilatoren zu überwinden. Seitdem besteht die Möglichkeit, intermittierende Phasen von nicht-invasiver Beatmung am Krankenhaus durchzuführen. In enger Zusammenarbeit zwischen chilenischen Ärzten, der Deutschen Interdisziplinären Gesellschaft für Außerklinische Beatmung e.V. (DIGAB) und dem Deutschen Provider Heinen & Löwenstein wurde im Jahre 2013 eine Spende von 100 gebrauchten Ventilatoren (BiPAP Synchrony; Respironics, USA) inklusive der Masken und der Schlauchsysteme organisiert, wobei die Bereitstellung der Hilfsmittel über die Firma Heinen & Löwenstein erfolgte.

Die Ventilatoren sind im Januar 2014 in Santiago eingetroffen, seitdem sind folgende Initiativen gestartet worden: 1) die Einrichtung eines Programms zur außerklinischen Beatmung unabhängig von der Finanzierung über die Regierung, 2) die Möglichkeit zur intermittierenden nicht-invasiven Beatmung am Krankenhaus nach individueller Titration, 3) die Erneuerung der Ventilatoren im Krankenhaus.

Für die Zukunft bestehen weitere Ziele in der Etablierung der nicht-invasiven Beatmung im Rahmen eines Rehabilitationsprogramms sowie in der Etablierung klinisch-wissenschaftlicher Forschung.

Aus diesem Grund kommt der Spende von Beatmungsgeräten aus Deutschland mit entsprechendem Zubehör eine entscheidende Rolle für die Weiterentwicklung der außerklinischen Beatmung in Chile zu.

Introduction

Over the last decade Chile has experienced a robust economical growth that has led to a significant progress in the quality of life of its 17.2 million citizens. Therefore, in 2010 it was the first South American country to join the OECD group (Organization for Economic Co-operation and Development). This enhances its compromise to continue pursuing policy reforms to: improve the social well-being, reduce poverty and lower the still high income inequality. Accordingly, the actual life expectancy at birth in Chile is almost 78 years, only two years lower than the OECD average.
Similarly to other South American countries, health care-planning consists of two independent systems with still very different quality standards. While the private insurance system offers excellent medical care quality and modern technological facilities, it demands monthly payments and copayments by every medical procedure that makes it affordable for only 20% of Chile's population. On the other hand, the public health system counts on still insufficient bed availability and limited medical resources/devices to optimally guarantee patient care.

Home mechanical ventilation in Chile: development and limitations

In the last decade, many countries worldwide have experienced a significant increase in the interest and use of long-term NIV labeled home mechanical ventilation (HMV) as the standard care for patients with chronic hypercapnic respiratory failure that results from different etiologies such as chronic obstructive pulmonary disease (COPD), restrictive thoracic disorders, neuromuscular diseases and obesity hypoventilation syndrome (OHS) [1,2]. Even though data for most of the South American countries are not published so far, the number of patients receiving HMV in Chile is steadily increasing (personal communication). Importantly, HMV was initially available in Santiago de Chile only, but it is currently being expanded to other cities. Nevertheless, developmental differences across its long geography hamper nationwide coverage.
The principal indications for HMV, in the adult population, in Chile in order of frequency are: COPD, OHS and restrictive thoracic disorders. The neuromuscular diseases are, however, the prevailing indication for HMV in Chilean children [3].
The financial restrictions of the public health system hinder the access to home ventilators to patients who meet the indication criteria established by international recommendations [4–6]. As a matter of fact, these patients are put on a waiting list, typically for over six months.
The San José Hospital is the main public hospital in the northern area of Santiago de Chile, and serves the health needs of a large poor economic resource population. In 2006 the NIV center at San José Hospital was founded as a strategy to overcome the limitations of ventilator availability from public resources. This NIV center counts also on financial support from the Order of Malta. Today, seven bi-level ventilators are placed in a single room to provide NIV sessions during working days to patients who attend the NIV center, while they are on the waiting-list to receive a home ventilator. The sessions take place three times a week for three hours (**Fig. 1**). Therefore, two shifts of patients are treated every day.

Fig. 1 The San José Hospital in Santiago de Chile with the specifically dedicated NIV center.

This NIV approach was initiated based on two important scientific study settings: Firstly, daytime mechanical ventilation in awake patients was reported to be equally effective at reversing chronic respiratory insufficiency when compared to nocturnal mechanical ventilation [7]. Secondly, Chilean researchers have nicely shown that intermittent diurnal NIV five times a week for three hours a day was capable of improving respiratory function including a reduction of lung hyperinflation [8,9].
A further contribution of the diurnal intermittent NIV center is that it provides the attending patients the opportunity to exchange experiences and fears, and to build friendships between them. This parallel contribution cannot be underestimated, because such chronic respiratory patients usually cope with physical and social restrictions.

German donation of ventilators to Chile

In 2013, as a member of the San José NIV center team, Dr. Maria Paola Arellano Maric spent a 3-month period in the ventilation center of the department of Pneumology at Cologne Merheim Hospital, Witten/Herdecke University. The goal of her visit was to learn the specific *high-intensity NIV technique*, which has shown a favorable clinical impact chronic hypercapnic COPD patients [10–12].
The afore mentioned limitations of NIV availability in Chile was communicated to the German Interdisciplinary Society of Home Mechanical Ventilation (DIGAB=Deutsche Interdisziplinäre Gesellschaft für Außerklinische Beatmung: www.digab.de). In the following days, a discussion forum was held and industry representatives were involved. As a result, a generous donation of 100 second-hand ventilators (BiPAP Synchrony; Respironics, USA) plus 200 masks and tubing systems for the San José NIV center was organized. The Heinen und Löwenstein company provided all the equipment including a technical check-up of each machine. Subsequently, the DIGAB organization conducted the donation shipment to Santiago de Chile per aircraft. All import formalities and procedures were carried out by the Order of Malta agents in Cologne and Santiago de Chile. A symbolic ventilator-handover was performed at the Cologne Merheim Hospital in Germany with local press coverage. **Fig. 2** illustrates the Chilean NIV center at San José Hospital with one of the donated ventilators.

Fig. 2 Chilean NIV center at San José Hospital with Dr. Maria Paola Arellano Maric holding a donated ventilator, the director Dr. Rosa Roldán Toledo (right extreme) and staff (nurses and respiratory therapists).

Use of donated ventilators in Chile

The ventilator devices arrived in Santiago in January 2014. Since then, the following initiatives have been launched:

- **Home mechanical ventilation.** The ventilator donation enabled the San José Hospital in Santiago de Chile to start its own HMV program independently from governmental funding. Candidate patients to receive a home ventilator are referred to the NIV center from pulmonologists or other specialties. A complete and careful patient evaluation determines the indication for starting HMV (according to international guidelines). In addition, a social assistant is sent to patient's home to confirm that the necessary preconditions are met (for eg. social network, electricity). To date, forty two ventilators have already been delivered for HMV (thirty four patients with COPD, four with OHS, two with idiopathic kyphoscoliosis, one patient with Myotonic Dystrophy Curschmann-Steinert, and one with amyotrophic lateral sclerosis).
- **NIV titration.** An experienced team of respiratory therapists is in charge of NIV titration, which is performed ambulatory at the NIV unit in 2-hour NIV sessions, three times a week. Usually, the spontaneous-timed mode (ST) is used with ventilatory pressures being steadily increased during each session. The titration process is carried out on a personified fashion considering patient's tolerance and the target of significant CO_2 reduction. Typically, optimal ventilator settings are reached after eight to twelve sessions. Afterwards, the patient receives a ventilator to continue NIV therapy at home. Currently, nocturnal NIV application and measurements are not provided at the NIV center. Nevertheless, patients are advised to use NIV overnight in the home environment.
- **Renewed NIV center's ventilators.** The previous set of ventilators for the intermittent NIV application has been replaced by the donated ones (seven available spots). Patients who are judged as not optimal HMV candidates (for example, no relatives to help with ventilator's installation, no home electricity), continue to attend to intermittent NIV sessions on a permanent basis as described above. The Order of Malta provides ambulances to transport these fragile patients.

Future perspectives

The donation of the ventilators has stimulated the development of future initiatives:

- **Rehabilitation unit.** Currently, a pulmonary rehabilitation program offers to chronic respiratory patients, supervised regular exercise training with supplemental oxygen therapy in a gym provided with static bicycles and treadmills. In the future, it is also intended to provide NIV-aided exercise given the physiological benefit of this approach [13].
- **Clinical research.** Importantly, the faculty of the San José Hospital in Santiago de Chile is very keen on starting a research program within the NIV center. For that purpose, a collaborative agreement with the "Pontificia Universidad Católica de Chile" University has been settled. Consequently, Dr. Maria Paola Arellano Maric has started an 18-month research training period in long-term NIV and sleep medicine at department of Pneumology at the Cologne Merheim Hospital, Witten/Herdecke University.

Conflict of interest

SE Huttmann, JH Storre and W Windisch received speaking fees, travel funding and open research grants from companies dealing with home mechanical ventilation. MP Arellano and R Roldán Toledo have no conflicts of interest.

References

1 *Lloyd-Owen SJ*, *Donaldson GC*, *Ambrosino N* et al. Patterns of home mechanical ventilation use in Europe: results from the Eurovent survey. Eur Respir J 2005; 25: 1025 – 1031
2 *Garner DJ*, *Berlowitz DJ*, *Douglas J* et al. Home mechanical ventilation in Australia and New Zealand. Eur Respir J 2013; 41: 39 – 45
3 *Bertrand P1*, *Fehlmann E*, *Lizama M* et al. Home ventilatory assistance in Chilean children: 12 years' experience. Arch Bronconeumol 2006; 42: 165 – 170
4 Anonymous clinical indications for noninvasive positive pressure ventilation in chronic respiratory failure due to restrictive lung disease, COPD, and nocturnal hypoventilation – a consensus conference report. Chest 1999; 116: 521 – 534
5 *Windisch W*, *Walterspacher S*, *Siemon K* et al. Guidelines for non-invasive and invasive mechanical ventilation for treatment of chronic respiratory failure. Published by the German Society for Pneumology (DGP). Pneumologie 2010; 64: 640 – 652
6 *McKim DA*, *Road J*, *Avendano M* et al. Home mechanical ventilation: a Canadian Thoracic Society clinical practice guideline. Can Respir J 2011; 18: 197 – 215
7 *Schönhofer B*, *Geibel M*, *Sonneborn M* et al. Daytime mechanical ventilation in chronic respiratory insufficiency. Eur Respir J 1997; 10: 2840 – 2846
8 *Díaz O*, *Bégin P*, *Andresen M* et al. Physiological and clinical effects of diurnal noninvasive ventilation in hypercapnic COPD. Eur Respir J 2005; 26: 1016 – 1023
9 *Díaz O*, *Bégin P*, *Torrealba B* et al. Effects of noninvasive ventilation on lung hyperinflation in stable hypercapnic COPD. Eur Respir J 2002; 20: 1490 – 1498
10 *Windisch W*. Noninvasive positive pressure ventilation in COPD. Breathe 2011; 8: 114 – 123
11 *Köhnlein T*, *Windisch W*, *Köhler D* et al. Non-invasive positive pressure ventilation for the treatment of severe stable chronic obstructive pulmonary disease: a prospective, multicentre, randomised, controlled clinical trial. Lancet Respir Med 2014; 2: 698 – 705
12 *Dreher M*, *Storre JH*, *Schmoor C* et al. High-intensity versus low-intensity non-invasive ventilation in patients with stable hypercapnic COPD: a randomised crossover trial. Thorax 2010; 65: 303 – 308
13 *Dreher M*, *Storre JH*, *Windisch W*. Non-invasive ventilation during walking in patients with severe COPD: A randomised cross-over trial. Eur Respir J 2007; 29: 930 – 936