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KLİNİK ÇALIŞMA
RESEARCH ARTICLE

Approach of pulmonologists in Turkey to noninvasive mechanical ventilation use at home for chronic respiratory failure

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SUMMARY

Approach of pulmonologists in Turkey to noninvasive mechanical ventilation use at home for chronic respiratory failure

Introduction: *To define approach of pulmonologists in Turkey to noninvasive mechanical ventilation (NIV) use for chronic respiratory failure (CRF), the most currently applied technique for home mechanical ventilation.*

Patients and Methods: *A 38-question survey, developed and tested by the authors, was distributed throughout Turkey to 2205 pulmonologists by e-mail.*

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Results: *Twenty-seven percent of the pulmonologists responded (n=596). Domiciliary NIV was reported to be prescribed by 340 physicians [57.1% of all responders and 81% of pulmonologists practicing NIV at clinical practice (n= 420)]. NIV prescription was associated with physician's title, type of hospital, duration of medical license, total number of patients treated with NIV during residency and current number of patients treated with NIV per week (p< 0.05). Main estimated indications were listed as chronic obstructive pulmonary disease (median, 25-75 percentile of the prescriptions: 75%, 60-85), obesity hypoventilation syndrome (10%, 2-15), overlap syndrome (10%, 0-20) and restrictive lung disease (5%, 2-10). For utilization of NIV at home, Bilevel positive airway pressure-spontaneous mode (40%, 0-80) and oronasal mask (90%, 60-100) were stated as the most frequently recommended mode and interface, respectively. Pressure settings were most often titrated based on arterial blood gas findings (79.2%). Humidifier was stated not to be prescribed by approximately half of the physicians recommending domicilliary NIV, and the main reason for this (59.2%) was being un-refundable by social security foundation.*

Conclusion: *There is a wide variation in Turkey for prescription of NIV, which is supposed to improve clinical course of patients with CRF. Further studies are required to determine the possible causes of these differences, frequency of use and patient outcomes in this setting.*

Key words: *Noninvasive ventilation, chronic respiratory failure, survey, chronic obstructive pulmonary disease*

ÖZET

Türkiye'de kronik solunum yetmezliğinde evde noninvaziv mekanik ventilasyon kullanımına göğüs hastalıkları doktorlarının yaklaşımı

Giriş: *Bu çalışmanın amacı Türkiye'deki göğüs hastalıkları doktorlarının kronik solunum yetmezliğinde, evde mekanik ventilasyon uygulaması için son dönemlerde sıklıkla uygulanan tekniklerden noninvaziv mekanik ventilasyon (NIV) kullanımı konusundaki yaklaşımlarını belirlemektir.*

Hastalar ve Metod: *Yazarlar tarafından oluşturulan ve test edilen 38 soruluk anket, Türkiye genelindeki 2205 göğüs hastalıkları doktoruna e-posta yoluyla gönderildi.*

Bulgular: *Göğüs hastalıkları doktorlarının %27'si ankete katıldı (n= 596). Ev tipi NIV cihazının 340 doktor (tüm katılımcıların %57.1'i ve klinik pratikte NIV kullanan 420 doktorun %81'i) tarafından reçetelendiği belirtildi. Eve NIV reçete etmenin doktorun unvanı, çalıştığı hastanenin tipi, göğüs hastalıkları uzmanlık süresi, asistanlık eğitimi esnasında NIV kullanılan hasta sayısı ve haftalık takip edilen NIV hasta sayısı ile ilişkili olduğu saptandı (p< 0.05). En sık endikasyonların sırasıyla kronik obstrüktif akciğer hastalığı (KOAH) [ortanca (çeyrekler arası aralık: IQR): %75 (60-85)], obezite hipoventilasyon sendromu [%10 (2-15], Overlap sendromu [%10 (0-20)] ve restriktif akciğer hastalığı [%5 (2-10)] olduğu tahmin edildi. Bilevel pozitif hava yolu basıncı spontan modu [%40 (0-80)] ile oronazal maske [%90 (60-100)] sırası ile en sık önerilen mod ve maske olarak belirtildi. Basınç ayarlarının çoğunlukla arter kan gazı sonuçlarına (%79.2) göre titre edildiği bildirildi. Eve NIV cihazı veren doktorların yaklaşık yarısı nemlendirici reçete etmediğini ve bunun temel sebebinin (%59.2) sosyal güvenlik kurumunun karşılamaması olduğunu belirtti.*

Sonuç: *Kronik solunum yetmezliği olan hastaların klinik gidişatını iyileştiren evde NIV cihazının reçetelenmesinde Türkiye'de yaygın farklılıklar vardır. Bu farklılıkların temel sebeplerinin, uygun hastalarda kullanım sıklığının ve sonuçlarının tam olarak belirlenmesine yönelik ileri çalışmalara ihtiyaç vardır.*

Anahtar kelimeler: *Noninvaziv mekanik ventilasyon, kronik solunum yetmezliği, anket, kronik obstrüktif akciğer hastalığı*

INTRODUCTION

Noninvasive mechanical ventilation (NIV), the mode of ventilation providing ventilator assistance by a mask without an invasive airway, is a major part of home mechanical ventilation (HMV), and an established treatment for chronic respiratory failure (CRF) (1-5). Restrictive thoracic disorders (RTD) (including thoracic cage deformities and neuromuscular disorders (NMD)), obesity hypoventilation syndrome (OHS) and stable chronic obstructive pulmonary disease (COPD) with severe hypercapnia and nocturnal desaturation can be listed as the appropriate indications for domiciliary NIV use. NIV has been shown to decrease somnolence, fatigue and dyspnea with improved quality of life and survival in selected patients with these disorders (especially for amyotrophic lateral sclerosis (ALS), RTD, OHS) 6; whereas its role in stable COPD still remains controversial (6-8).

Surveys from Europe, Australia, Hong Kong and United States provide some data about HMV use around the world (6-13). The 'Eurovent' study, representing up to 21526 HMV users (13% of whom tracheostomized) in 16 European countries, reported an estimated prevalence of HMV use as 6.6/100.000 people (9). Marked variation was noted between countries in the prevalence and pattern of HMV prescription. A recent study from Australia and New Zealand, showed a minimum prevalence of HMV use 9.9 and 12/100.000, respectively (10). The increased

utilization was similarly observed in other studies from Hong Kong and Sweden (11,12). The most common indications were OHS and NMD, with variations in prescription patterns among participating centers based on center size, location and experience (10). Another reason for this variation was thought to be uneven distribution of highly skilled enthusiasm with special competence and interest in HMV between hospitals (14).

Previous small retrospective studies from Istanbul (23 pediatric NIV users) and Ankara (70 adult NIV users) reported limited regional data about domiciliary NIV use in Turkey however there is no national database or comprehensive data about prescription patterns. Although surveys from Europe, Australia and U.S. highlight their experience, surveys from developing countries such as Turkey are missing (15,16). The aim of this study is to define the approach of pulmonologists in Turkey for NIV use at home for CRF.

PATIENTS and METHODS

After reviewing the previously published surveys about NIV and blending with personal experiences and perceived areas of interest, the authors (AOU and ZK) drafted the questionnaire. The final version of the 38-question, self-administered survey was established after pilot testing done in 10 physicians and all of the authors, based on the feedbacks. The study protocol was approved by the Ethics Committee at Baskent University Faculty of Medicine.

The survey included mainly 3 sections as follows:

1. Eleven questions about the pulmonologist and his/her hospital (demographics, NIV and intensive care unit (ICU) experience, hospital type and region, application of NIV in daily practice),
2. Eighteen questions regarding to NIV use pattern in acute respiratory failure (ARF),
3. Nine questions regarding to NIV use at home for CRF. In this last section, physicians were asked to provide indications and estimated distribution of etiology for the prescriptions, estimated distribution of equipments and settings prescribed, and titration methods.

The indications for NIV use in patients with CRF were divided into five disease categories:

1. COPD,
2. Overlap syndrome (i.e. COPD with obstructive sleep apnea syndrome),
3. RTD (including thoracic cage abnormalities due to kyphoscoliosis, tuberculosis sequela and NMD (such as motor neuron disease (including ALS), muscular dystrophy, etc.),
4. OHS,
5. Other. The results of survey regarding to NIV use in ARF were discussed previously (17).

The e-mail addresses of the target population, 2205 pulmonologists all around in Turkey, were gathered from Turkish Thoracic Society and regional sources. An e-mail asking for participation in survey with attached questionnaire was sent to all of physicians in November 1, 2013. Reminder e-mails were sent every 2 weeks twice, and to further improve the response rate, telephone or face-to-face follow-ups were conducted for non-responders. The deadline for the survey completion was February 28, 2014.

Statistics

The data was expressed as the median (Interquartile range [IQR]) unless otherwise specified. Chi-square test was used for categorical data, whereas Mann-Whitney U test was used for continuous data when appropriate. A p value of < 0.05 was considered significant. Statistical analysis was performed using SPSS statistical analysis software, version 12.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

Characteristics of Pulmonologists Using NIV for CRF

Out of 2205 pulmonologists receiving the survey, 27.1% (n= 596) responded. NIV was reported to be prescribed for home use by 340 physicians [57.1% of all responders and 81.0% of pulmonologists practicing NIV at clinical practice (n= 420)].

Among all responders, "home NIV prescribers" (i.e. NIV prescribers for CRF) (n= 340) had an approximately close distribution in terms of title and were mainly from teaching hospitals, whereas non-prescribers (n= 256) were mainly specialists and from non-teaching hospitals (Table 1). The prescribers were younger with shorter duration of work in the pulmonary field, but more experienced for NIV use and ICU care. The median number of patients with ARF treated at hospital by NIV was 4 (IQR 2-7) for 'home NIV prescribers', as it was 2 (2-5) for non-prescribers (p= 0.001).

Table 1. The characteristics of 'home NIV prescribers' in comparison with non-prescribers (all and ones utilizing NIV only for ARF)

	Home NIV Prescribers (n= 340)	NIV Non-Prescribers (n= 256)	P[1]	NIV for ARF(+), CRF(–) (n= 80)	P[2]
Title, n (%)			< 0.001		0.024
- Academician	102 (30)	42 (16.4)		25 (31.3)	
- Specialist	134 (39.4)	198 (77.3)		42 (52.5)	
- Resident	104 (30.6)	16 (6.3)		13 (16.3)	
Hospital type, n (%)			< 0.001		0.007
- Teaching	266 (78.2)	119 (46.5)		51 (63.8)	
- Non-teaching	74 (21.8)	137 (53.5)		29 (36.3)	
Region, n (%)			< 0.001		0.08
- Aegean	68 (20)	39 (15.2)		18 (22.5)	
- Black Sea	35 (10.3)	35 (10.3)		4 (5)	
- Central Anatolia	53 (15.6)	33 (12.9)		10 (12.5)	
- Eastern Anatolia	29 (8.5)	31 (12.1)		12 (15)	
- Marmara	110 (32.4)	74 (28.9)		18 (22.5)	
- Mediterranean	36 (10.6)	44 (17.2)		14 (17.5)	
- Southeastern Anatolia	9 (2.6)	27 (10.5)		4 (5)	
Age, years	36 (30-42)	40 (34-7)	< 0.001	38 (32-44)	0.11
Duration of work in the pulmonary field, years	10 (4-15)	13 (8-20)	< 0.001	11.5 (7-19.25)	0.019
Daily outpatient number, n	30 (20-50)	40 (30-50)	< 0.001	35 (20-50)	0.30
NIV experience during training, n (%)	263 (77.4)	138 (53.9)	< 0.001	51 (63.8)	0.012
Number of patients treated with NIV during training, n	100 (7-300)	20 (0-120)	< 0.001	50 (0-172.5)	0.006
Duration of NIV experience, years	6 (3-10)	5 (0-8)	< 0.001	6.5 (3.25-10)	0.81
ICU experience, n (%)	219 (65)	103 (40.4)	< 0.001	46 (57.5)	0.21
Duration of ICU experience, mo's	3 (0-36)	0 (0-6)	< 0.001	2 (0-18)	0.27

ARF: Acute respiratory failure, CRF: Chronic respiratory failure, ICU: Intensive care unit, Mo's: Months, NIV: Noninvasive ventilation. p^1 comparison between first 2 groups, p^2 comparison between first and last group. Categorical variables were shown as n (%), whereas continuous variables as median (interquartile range).

All of the home NIV prescribers were also practicing NIV at clinical practice for ARF. Pulmonologists using NIV for ARF, but not for CRF were mainly specialists and from teaching hospitals (Table 1). They were working in the pulmonary field longer than home NIV prescribers, however the duration of experience in NIV use and ICU care was similar.

Indications of Domiciliary NIV Use

Chronic obstructive pulmonary disorder was the main indication for NIV use in CRF, as almost the entire home NIV prescribers (96.2%) were prescribing it for COPD. Restrictive thoracic disorders (74.4% of prescribers) and OHS (73.2%) were similarly preferred by the physicians, as followed by overlap syndrome (64.4%) and other disorders (7.4%). The estimated distribution of etiology for the prescriptions was as shown in Table 2.

Ventilator Settings and Interface

Bi-level positive airway pressure ventilators with spontaneous and spontaneous/timed modes (BİPAP/S and BİPAP/ST), were the most preferred ventilators by 66.5 and 84.4% of the prescribers, respectively. Fewer physicians were claiming that they prescribe continuous positive airway pressure (CPAP) (37.1% of prescribers), average volume assured pressure support (AVAPS) (20.9%) and adaptive servoventilation (7.1%) for management of CRF. In terms of interface, most of the physicians were recommending oronasal mask (95.3% of prescribers), followed by nasal (60%), total face (11.5%) and helmet (0.3%) masks. The estimated distribution of ventilator and interface types among the prescriptions was as shown in Table 2.

Table 2. Estimated distribution of the prescriptions

	% of prescriptions
Indication for NIV	
Chronic obstructive pulmonary disease	75 (60-85)
Obesity hypoventilation syndrome	10 (2-15)
Overlap syndrome	10 (0-20)
Restrictive lung disorders	5 (2-10)
Other	0 (0)
Ventilator mode	
Bipap S	40 (0-80)
Bipap ST	30 (10-85)
AVAPS	0 (0-0)
ASV	0 (0-0)
CPAP	0 (0-16.25)
Other	0 (0-0)
Interface	
Oronasal mask	90 (60-100)
Nasal mask	10 (0-40)
Total face mask	0 (0-0)
Helmet	0 (0-0)

ASV: Adaptive servosentilation, AVAPS: Average volume assured pressure support, Bipap: Bilevel positive airway pressure, CPAP: Continuous positive airway pressure, S: Spontaneous; ST: Spontaneous/timed Continuous variables were shown as median (interquartile range).

Most of the home NIV prescribers stated that they determined ventilator pressure settings based on arterial blood gas results (79.2% of prescribers), while some decided according to the results of sleep studies (22.9%) or amount of tidal volume/number of apnea detected on the ventilator during titration at the hospital (21.8%). Only 3.8% of the physicians mentioned that they were prescribing NIV for CFR without any titration.

Estimated settings for COPD, the most common etiology for prescription, were as median inspiratory and expiratory positive airway pressures of 15 (12-16) cmH_2O and 5 (5-6) cmH_2O, respectively, with a median back-up rate of 14 (12-15) per min and volume of 450 (413-500) mL. Eleven prescribers claimed that they prescribe CPAP ventilator for COPD with a median CPAP of 7 (6-11) cmH_2O.

Nearly two thirds of the prescribers were providing education to the patient and/or caretakers about use and hygiene of ventilator and the accessories (i.e. interface and tubings) (65.9%), as more than a quarter (27.6%) was not providing any.

Humidifier Use

Humidifiers were stated to be prescribed by only half of the home NIV prescribers (50.9%). The main reason for not prescribing the humidifier for NIV use during CRF was claimed as being un-refundable by social security foundations (59.2% of physicians prescribing NIV without humidifier). The other causes were 'not considering it necessary' (27.6%) and 'not thinking that patient could use that in appropriate conditions' (34.8%).

DISCUSSION

The present study showed that domiciliary NIV was estimated to be prescribed by nearly two thirds of responders of our national survey done among pulmonologists all over Turkey. There was a variation in home-NIV prescription behavior associated with

physicians" and hospitals" characteristics. The most common indication was mentioned as COPD. BİPAP/S and oronasal mask were reported to be the most commonly used mode and interface, respectively; whereas humidifier was reported to be prescribed by only half of the "home NIV prescribers", mainly due to reimbursement policies.

Home mechanical ventilation is an effective and growing long-term treatment for individuals with CRF secondary to a number of heterogeneous conditions. Rapid expansion of use in the last three decades could probably be due to higher number of physicians and medical staff experienced and skilled in NIV field with increased awareness of domiciliary NIV use, increasing numbers of patients surviving critical illness with appropriate indications for HMV and the ongoing technologic advances in NIV ventilators and equipments.

The overall response rate for our survey was quite low (27%), however it was a challenge to identify pulmonologists and ask them to complete the questionnaire. Although only HMV centers (defined as any hospital or outpatient unit initiating, prescribing or coordinating HMV use) were selected to be surveyed in Eurovent study, the largest trial about HMV performed in 16 European countries, the response rate was 62%9. Therefore our low response rate can be due to reluctance or low/no interest of some of the pulmonary physicians in NIV use CRF.

A substantial variation between countries in the prevalence and pattern of HMV prescription was revealed by Eurovent study, but the provision of HMV can also vary within each country (9,14). Half of the HMV prescribers were from non-universities; however universities (40% of prescribers) were reported to have more users, with longstanding HMV service serving as referral centers. A recent study from Australia and New Zealand also showed that prescribing centers were mainly tertiary (78%) hospitals. Likewise, we found that "home NIV prescribers" were mainly from teaching hospitals. Although skills and experience of the medical staff as well as the teaching status of the hospital can be associated with this variation in the prescriber profile; it can also be due to differences in individual attitudes, such as younger physicians with higher enthusiasm and special interest in domiciliary NIV use as found in our study. One fifth of the physicians applying NIV for ARF during their clinical practice were not prescribing NIV for home use. The proportion of non-teaching hospitals and specialists were higher among these physicians compared to home NIV prescribers. We can only speculate that those physicians had no or lower interest and/or available resources to follow-up patients with CRF on HMV.

In our study, COPD was estimated as the main indication of domiciliary NIV, as almost all of the prescribers were prescribing NIV for this indication. COPD was nearly three fourths of all the home NIV prescriptions. This is in concordance with data from Eurovent and Hong Kong studies, with higher rates of COPD prescriptions (34-49%) (9,12). However COPD was reported as an uncommon indication (8%) by Garner et al. This difference could be due to higher rates of smoking and easier access to NIV for COPD in Turkey compared to Australia and New Zealand (10). It may also be due to our survey population, consisting of only pulmonologists. Obesity hypoventilation syndrome, commonest indication (31%) reported by Garner et al, was estimated to be the indication for one tenth of the prescriptions in Turkey as much as overlap syndrome (10). Although home NIV was claimed to be prescribed for RTD by nearly 75% of the physicians, it was guessed as an indication only 5% of home NIV prescriptions. This might also be due to surveying only pulmonologists; since anesthesiologists in Turkey might prescribe more for RTD after an acute onset of respiratory failure treated in intensive care unit.

Although a significant proportion of our caregivers declared that they preferred bi-level modes, few of them reported CPAP prescription for COPD patients. It must be emphasized that CPAP is not a ventilatory mode and should better not be routinely used to treat hypoventilation; however, it can be prescribed for only a subset of patients with OHS or sleep related disorders (3). Additionally, BİPAP with back-up rate (BİPAP/ST), recommended usually in patients with ALS or Duchenne muscular dystrophy and reimbursed in Turkey in case of high inspiratory positive airway pressure levels or in presence apneas observed during stay in intensive care unit, was claimed to be nearly 30% (reaching up to 85% for some physicians) of NIV prescriptions. Since appropriate indications were not reported in accordance with this rate, either BİPAP/ST is over-prescribed for inappropriate conditions or the rate for related conditions was under-estimated (3,18). In either case, continuing education may help the physicians to improve the knowledge and skill on appropriate domiciliary NIV application.

Domiciliary NIV was reported to be implemented by utilizing mainly arterial blood gas analyses (96%), followed by polysomnography (77%) and transcutaneous CO_2 monitoring (62%) (10). Our results, as most determine settings based on arterial blood gas results, are compatible with these findings. However, it should be noted that few physicians reported prescribing it without any form of titration, which is very improper.

Dry gas inhalation during NIV application can provoke some detrimental effects on airway mucosa (19). Currently, active humidification is suggested for NIV by American Association of Respiratory Care (20). In accordance with that, humidifier use was reported as 87% by Garner et al. Unfortunately, in our study, nearly half of the caregivers reported not prescribing humidifier with NIV, mainly due to reimbursement issues (10). Its use in symptomatic patients (such as nasal congestion or thick or tenacious secretions) with risk factors (mouth air leaks, high FiO_2, high IPAP) may be helpful to prevent deleterious effects of NIV and improve compliance and adherence. Therefore, health policies regarding to this issue might better be changed in favor of refunding humidifier in selected group of patients with CRF using NIV.

Limitations of this study were summarized in our prior report (17). A survey by e-mail requesting detailed information on practices is never completely accurate (recall bias) and there might be a selection bias, favoring NIV prescribing physicians to respond. Our response rate of 27% can be due to including only pulmonologists.

In conclusion, this study showed that there is wide variation in Turkey for domiciliary NIV prescription pattern. The causal differences of this variation are still mysterious; however differences in individual attitudes for domiciliary NIV application can be a possible explanation. COPD was claimed to be the most common indication, and bi-level ventilators with oronasal mask were reported to be the most commonly prescribed equipments. With an expanding list of medical indications, resulting in HMV population to become more and more heterogeneous; national data registries and further research providing prevalence of domiciliary NIV use and its outcomes are needed. Continuing education and increased availability of resources with development of home care companies and evidence-based clinical practice standards (including refundable humidification) on NIV use for CRF are required to ensure best practice policies for this group of patients.

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