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Comparison of Opinions and Practices of Pediatric Intensive Care and Pediatric Emergency Departments in High-flow Nasal Cannula Oxygen Therapy: A National Survey Study

Çocuk Yoğun Bakım ve Çocuk Acil Servislerinin Yüksek Akışlı Nazal Kanül Oksijen Tedavisindeki Görüş ve Uygulamalarının Karşılaştırılması: Bir Ulusal Anket Çalışması

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Abstract

Introduction: The purpose of this study is to compare the practice and opinions of tertiary pediatric intensive care units and pediatric emergency departments on high flow nasal cannula oxygen therapy in Turkey.

Methods: A questionnaire was sent to the clinical chiefs of the tertiary intensive care units or pediatric emergency departments who are members of the Pediatric Emergency and Intensive Care Association via e-mail. In the questionnaire, the features of the unit, the high-flow nasal cannula oxygen therapy practice and their opinions on this treatment were asked. Pathologies using high-flow nasal cannula and the success expected were asked to score between 0 and 10 (0: Completely ineffective; 10: Very effective).

Results: A total of 14 pediatric intensive care units and 17 pediatric emergency departments were included in the study. The most frequently used and the highest success score belonged to bronchiolitis. It is used more frequently for neuromuscular diseases in emergency departments ($p<0.05$). Sepsis, lung contusion, rapid sequential intubation, and non-invasive mechanical ventilation incompatibility were most frequent indications in intensive care units ($p<0.05$). There was no difference in terms of maximum flow rates among intensive care units and emergency departments ($p>0.05$). In the follow-up, intensive care units use the chest radiography and the emergency departments use a respiratory severity score more frequently ($p<0.05$). Complication of air leak syndrome was more common in intensive care units (35.7% vs. 0; $p<0.05$). All units described high-flow nasal cannula oxygen therapy as an easy-to-use method. 94.1% of the emergency departments and all intensive care units stated that the treatment was comfortable for the patient.

Öz

Giriş: Çalışmanın amacı, Türkiye'de üçüncü basamak çocuk yoğun bakım üniteleri ve çocuk acil servislerinin yüksek akışlı nazal kanül oksijen tedavisi pratiklerini ve görüşlerini karşılaştırmaktır.

Yöntemler: Çocuk Acil ve Yoğun Bakım Derneği'ne üye olup bir üçüncü basamak çocuk yoğun bakım ünitesi veya çocuk acil servisi sorumluluğunu yürüten hekimlere dernek e-posta sistemi üzerinden anket gönderildi. Ankette ünitenin özellikleri, yüksek akışlı nazal kanül oksijen tedavisi pratiği ve bu tedavi ile ilgili görüşleri soruldu. Yüksek akışlı nazal kanülün kullanıldığı patolojiler ve beklenen başarıya 0 ile 10 arasında puan verilmesi istendi (0: Tamamen etkisiz; 10: Çok etkili).

Bulgular: Toplam 14 çocuk yoğun bakım ve 17 çocuk acil servis çalışmaya dahil edildi. En sık kullanılan ve en yüksek başarı puanı olan patoloji bronşiyolitti. Nöromusküler hastalıklarda kullanım acil serviste daha sıktı ($p<0,05$). Sepsis, akciğer kontüzyonu, hızlı ardışık entübasyon ve non-invaziv mekanik ventilasyon uyumsuzluğu nedeniyle kullanım yoğun bakımda daha sıktı ($p<0,05$). Maksimum akış hızları açısından yoğun bakım ve acil servisler açısından fark saptanmadı ($p>0,05$). İzlemde, yoğun bakımlar akciğer grafisini ve acil servisler bir solunum şiddet skorunu daha sık kullanıyordu ($p<0,05$). Hava kaçağı sendromu komplikasyonu yoğun bakımlarda daha sıktı (%35,7'ye karşılık 0; $p<0,05$). Tüm üniteler yüksek akışlı nazal kanül oksijen tedavisini uygulaması kolay bir yöntem olarak tanımladı. Acil servislerin %94,1'i ve tüm yoğun bakım üniteleri tedavinin hasta için rahat olduğunu belirtti.

Sonuç: Yüksek akışlı nazal kanül oksijen tedavisi solunum sıkıntısına neden olan çeşitli patolojilerde kullanılmaktadır. Ünitelerin bu

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Conclusion: High flow nasal cannula oxygen therapy is used in various pathologies that cause respiratory distress. The treatment practice of the units partially overlaps. It is considered to be easy to apply, comfortable and effective treatment for patients.

Keywords: High flow nasal cannula oxygen therapy, pediatric intensive care, pediatric emergency department, respiratory distress, bronchiolitis

tedaviyi kullanım pratikleri kısmen örtüşmektedir. Uygulaması kolay, hasta konforunu artıran ve etkin bir yöntem olarak düşünülmektedir.

Anahtar Kelimeler: Yüksek akışlı nazal kanül oksijen tedavisi, çocuk yoğun bakım, çocuk acil servisi, solunum sıkıntısı, bronşiyolit

Introduction

High-flow nasal cannula oxygen therapy (HFNCOT) is a non-invasive respiratory support therapy method that has been used in newborns, infants, children and adults in recent years.[1-3] The device consists of an air/oxygen mixer, an active humidifier, a heated circuit and a nasal cannula. A flow rate above 4 L/minute cannot be used in standard nasal cannula oxygen therapy. At higher currents, the patient cannot tolerate the treatment because there is not enough humidification and airflow is given at lower temperatures than body temperature.[4] When oxygen is given with HFNCOT, airflow at a level close to body temperature is provided to the patient through nasal way, with better humidification. Thus, the respiratory workload decreases, oxygenation increases and some continuous positive pressure is provided.[2] Heated and humidified oxygen reduces irritation in the airway mucosa; the oxygen concentration can be titrated according to the patient's needs, and as a result, the patient tolerates higher flow better.[1,5] Studies have been conducted on respiratory system diseases, especially bronchiolitis.[3,6-8] However, there are a limited number of studies in the literature indicating that it can also be used for diseases of other systems that cause respiratory distress, such as sepsis, heart failure and metabolic diseases. Studies were often conducted in intensive care or emergency room conditions.[2,5-10]

For HFNCOT, which has been used with increasing frequency in the last 10 years, there are no accepted guidelines yet on the indications, contraindications, flow rates, monitoring and administration of drugs by nebulization while under HFNCOT. Each center uses HFNCOT by interpreting the literature with their own experiences.[11-13] In the world, there are few survey studies in which HFNCOT practice is evaluated at the national level.[13-18] No similar study has been found in our country.

The aim of this study is to determine and compare the HFNCOT practices and opinions of tertiary pediatric intensive care units (PICU) and pediatric emergency services (PES) in our country.

Materials and Methods

The study was carried out between 01.08.2018 and 30.09.2018 by means of a questionnaire. Surveys created through the SurveyMonkey® (www.tr.surveymonkey.com) portal were sent to physicians, who were the members of the Pediatric Emergency and Intensive Care Association and carried out the responsibility of a tertiary PICU and PES, via e-mail. The first part of the questionnaire consisted of items about the unit's characteristics, annual patient capacity, and HFNCOT experience. The questions in the second part of the questionnaire were about HFNCOT practice. Pathologies in which high-flow nasal cannula was used and the expected success of HFNCOT in these pathologies were requested to be scored between 0 and 10 (0: Completely ineffective; 10: Very effective). For four different age groups (<12 months; 1-5 years, 5-12 years and >12 years), maximum flow rates that were used, clinical and laboratory parameters used in follow-up, use of drugs for sedation, methods used in nebulized drug administration, and the side effects they experienced were asked.

In the last part, they were asked to answer as Yes/No to the standard sentences prepared about HFNCOT. The last question was an open-ended question and the participants expressed their views on HFNCOT in a few sentences. Then, the answers given by the authors to this question were categorized.

Ethics committee approval was obtained for the survey. Participation in the survey was on a voluntary basis. Physicians who wanted to participate in the study filled out the questionnaire sent to their e-mails.

Statistical Analysis

Categorical data were expressed as numbers (n) and percentage (%). The scores given by the units regarding the effectiveness of HFNCOT were shown with the median and interquartile range (IQR). The non-parametric numerical data of two independent groups were compared with the Mann-Whitney U test. The chi-square or Fischer's Exact test was used in the comparison of categorical data in two independent groups. IBM SPSS 20.0 Statistics (IBM Corporation, New York, USA) software was used for statistical analysis. The value of $p<0.05$ was considered as statistically significant.

Results

General Characteristics of Units

A questionnaire was sent to 25 PICU and 33 PES charge physicians in 15 provinces. Sixteen PICU and 25 PES charge

physicians in 14 different provinces responded to the survey. Two PICUs and 9 PESs were excluded because they did not use HFNCOT. A total of 14 PICUs and 17 PESs were included in the study. The median annual number of patients followed in the PICUs participating in the study was 581 (IQR: 400-910); The median annual number of pediatric patients admitted to PESs was 112 951 (IQR: 66 175-161 000) (Table 1).

Indications

Those responsible ones for the emergency and intensive care units were asked to rate the pathological conditions in which they used HFNCOT and their views on the success of HFNCOT treatment in these pathologies. The pathology in which HFNCOT was used most frequently in both PICUs and PESs was bronchiolitis, and the highest expected success score belonged to bronchiolitis. HFNCOT for oxygen support in neuromuscular diseases was preferred more frequently in PESs compared to PICUs (p=0.028). Sepsis, lung contusion, preoxygenation of rapid successive intubation, and mask incompatibility in non-invasive mechanical ventilation (NIV) were the most preferred indications in PICUs (p<0.05), and the expected success of HFNCOT was higher (p<0.05) (Table 2).

Flow Rates

The physicians responsible for the units who participated in the survey were asked about the maximum flow rates they

Table 1. Characteristics of PICU and PES participating in the survey and using HFNCOT

No	Institution	Unit	Minor education	Patient number (n/year)	HFNCOT number (n/year)	HFNCOT experience (year)	HFNCOT protocol
1.	University	PICU	No	230	150	3	No
2.	University	PICU	Yes	587	300	3	No
3.	TRH	PICU	Yes	900	150	3.5	Yes
4.	TRH	PICU	No	720	397	4	No
5.	University	PICU	Yes	500	100	2	No
6.	University	PICU	Yes	575	70	3	No
7.	TRH	PICU	No	1200	25	1	No
8.	TRH	PICU	No	1247	250	2	No
9.	TRH	PICU	No	400	200	4	No
10.	TRH	PICU	Yes	400	220	5	Yes
11.	University	PICU	Yes	166	50	2	No
12.	University	PICU	Yes	524	42	2	No
13.	TRH	PICU	No	750	300	4	Yes
14.	University	PICU	Yes	940	48	3	Yes
15.	TRH	PES	Yes	167000	250	4	Yes
16.	University	PES	Yes	76000	200	4	Yes
17.	TRH	PES	No	155000	200	2	Yes
18.	University	PES	Yes	99286	10	2	No
19.	TRH	PES	No	140000	30	4	No
20.	TRH	PES	No	-	70	1.5	No
21.	University	PES	Yes	45300	60	2	Yes
22.	University	PES	Yes	112951	70	2.5	No
23.	University	PES	Yes	40000	50	2	Yes
24.	TRH	PES	No	321000	450	2	Yes
25.	TRH	PES	No	113660	41	1	Yes
26.	TRH	PES	No	135568	50	1.5	Yes
27.	TRH	PES	No	229000	50	1.5	No
28.	University	PES	Yes	87474	90	3	Yes
29.	TRH	PES	No	350000	20	1.5	No
30.	University	PES	Yes	62350	200	1	Yes
31.	University	PES	Yes	70000	100	4	Yes

TRH: Training and research hospital, PICU: Pediatric intensive care unit, PES: Pediatric emergency service, HFNCOT: High flow nasal cannula oxygen therapy

used in HFNCOT according to their age groups. There was no statistical difference between PICUs and PESs in terms of maximum flow rates used in those younger than one year (p=0.812), 1-5 years old (p=0.906), 5-12 years old (p=0.531), and older than 12 years (p=0.865) (Figure 1).

Monitoring

All units participating in the survey had determined respiration and pulse rate as routine monitoring parameters. 50% of intensive care units used chest X-ray (p=0.001) and 50% of PESs used a standard respiratory severity score (p=0.009) in their routine monitoring (Table 3).

Frequency of Using Sedative Drugs and Administration Methods for Nebulization Therapy

When asked about the frequency of using drugs for sedation during HFNCOT, 13 (92.9%) PICUs and 11 (64.7%) PESs stated that they used sedative drugs when necessary (p=0.094). When drug administrations with nebulization were questioned, the units stated that they used various nebulization techniques at different times. Accordingly, giving the patient nebulization therapy with a mask during HFNCOT [PICU: 5 (35.7%); PES: 12 (70.6%)]; Administering nebulization therapy by connecting a conventional jet nebulizer to the circuit with a spacer during HFNCOT [PICU: 5 (35.7%); PES: 7 (50%]; applying nebulization therapy by connecting the vibrating mesh nebulizer to the circuit with a spacer during HFNCOT [PICU: 3 (21.4%); PES: 4 (23.5%)]; interrupting HFNCOT and giving nebulization therapy via jet nebulizer and mask [PICU: 6 (42.9%); PES: 3 (17.6%)] were the preferred methods, but there was no statistically significant difference between PICU and PES in terms of the frequency of using these methods (p=0.341).

Complications

Five (35.7%) PICUs participating in the study stated that they had air leak syndrome due to HFNCOT; however, none of the PESs reported this complication (p=0.012). When asked about minor complications, all 14 (100%) PICUs stated that they encountered at least one side effect (2 gastric distention, 3 dermatitis, 4 agitation, 4 cannula removal, 1 condensation in circuit). Only 1 (5.9%) PES reported that they encountered with nasal irritation (p<0.001).

Opinions of Units About High Flow Nasal Cannula Oxygen Therapy

All PESs and PICUs participating in the survey see HFNCOT as an easy method to implement. Sixteen (94.1%) of the emergency departments and 14 (100%) of the PICUs think that the treatment is comfortable for the patient (Table 4).

Discussion

In this study, the use of HFNCOT in PICUs and PESs was evaluated for the first time with a national survey. HFNCT is used in many pathologies that cause respiratory distress. The using practice of intensive care and emergency services

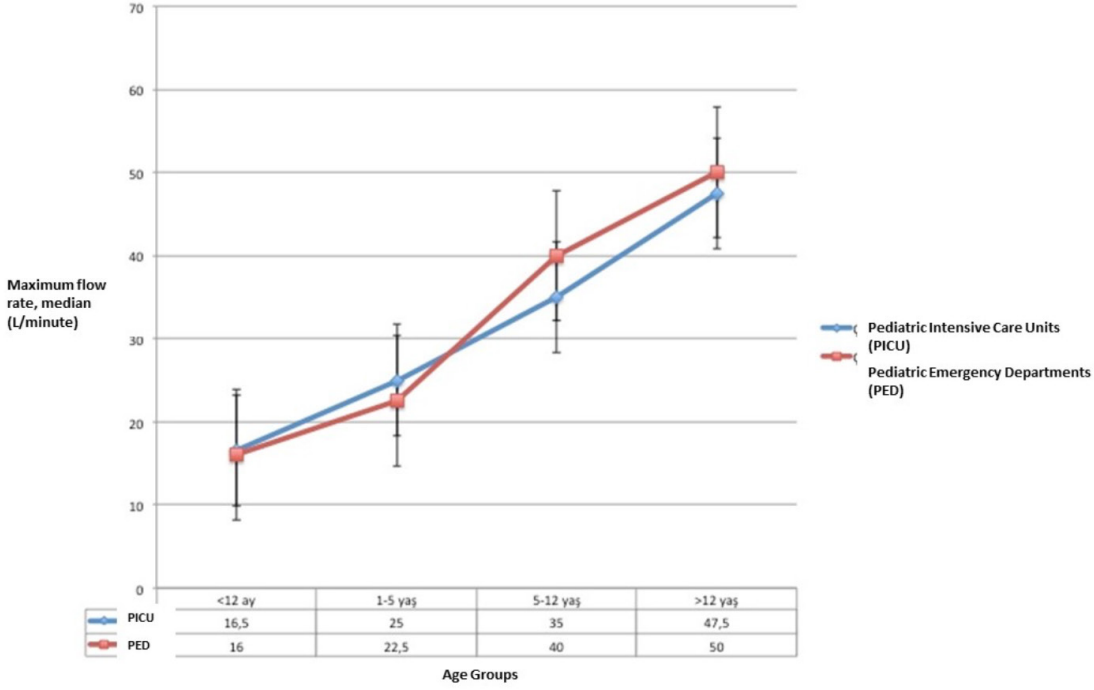

Figure 1. Comparison of maximum flow rates by age groups in patients receiving high-flow nasal cannula oxygen therapy (HFNCOT) in the pediatric intensive care unit (PICU) and pediatric emergency service (PES)

Table 2. Indications for HFNCOT and expected success score (0: Unsuccessful; 10: Very successful) in the PICU and PES

Diseases (%)	Indication for PE (n=17) n (%)	Indication for PICU (n=14) n (%)	p	PES score, median (IQR)	PICU score, median (IQR)	p[1]
Bronchiolitis	17 (100)	14 (100)	>0.999*	9 (8-10)	10 (8-10)	0.131
Pneumonia	17 (100)	13 (92.9)	0.452*	8 (7-9)	8 (8-9)	0.746
Neuromuscular diseases	16 (94.1)	8 (57.1)	**0.028***	6 (1-8)	6 (4-7)	0.934
Asthma	15 (88.2)	13 (92.9)	>0.999*	8 (7-9)	8 (7-9)	0.625
Sepsis	7 (41.8)	11 (78.6)	**0.036****	0 (0-7)	7 (6-8)	**0.017**
Upper airway obstruction	6 (35.3)	9 (64.3)	0.108**	1 (0-8)	8 (7-9)	0.016
ARDS	5 (29.4)	7 (50)	0.242**	0 (0-3)	5 (2-6)	**0.032**
Pulmonary edema	4 (23.5)	8 (57.1)	0.056**	0 (0-0)	6 (0-8)	**0.006**
Lung contusion	2 (11.8)	8 (57.1)	**0.018***	0 (0-0)	7 (0-8)	**0.001**
Preoxygenation in RSI	2 (11.8)	8 (57.1)	**0.018***	0 (0-0)	9 (0-10)	**0.015**
Respiratory distress in a patient with tracheostomy	1 (5.9)	4 (28.6)	0.148*	0 (0-0)	5 (0-7)	0.114
Mask incompatibility in NIV	5 (29.4)	13 (92.9)	**<0.001****	0 (0-7)	8 (7-9)	**0.001**
Postextubation	-	14 (100)	-	-	9 (8-10)	-

ARDS: Acute respiratory distress syndrome, RSI: Rapid successive intubation, NIV: Non-invasive ventilation, [1]: Mann-Whitney U test, *Fischer's Exact test, **: Chi-square test, HFNCOT: High flow nasal cannula oxygen therapy, PICU: Pediatric intensive care unit, PES: Pediatric emergency service

Table 3. Parameters routinely used in the monitoring of patients receiving HFNCOT in 14 PICU and 17 PES

Monitoring parameters	PES (n=17)	PICU (n=14)	p
Respiratory rate	17 (100)	14 (100)	-
Heart rate	17 (100)	14 (100)	-
Withdrawal	16 (94.1)	14 (100)	>0.999*
SpO_2	16 (94.1)	14 (100)	>0.999*
Patient comfort/compliance with treatment	15 (88.2)	13 (92.9)	>0.999*
Consciousness level	14 (82.3)	11 (78.6)	>0.999*
FiO_2	14 (82.3)	13 (92.9)	0.607*
SpO_2/FiO_2	10 (58.8)	7 (50)	0.623**
Blood gas before HFNCOT	13 (76.4)	7 (50)	0.153*
Follow-up blood gas analysis	11 (64.7)	9 (64.3)	>0.999*
Blood pressure	10 (58.8)	10 (71.4)	0.707*
Capillary filling time	9 (52.9)	8 (57.1)	0.815**
Standard respiratory score	7 (41.8)	0	**0.009***
Lung X-ray	0	7 (50)	**0.001***

SpO_2: Oxygen saturation, FiO_2: The fraction of inspired oxygen, *Fisher's Exact test, **: Chi-square test, HFNCOT: High flow nasal cannula oxygen therapy, PICU: Pediatric intensive care unit, PES: Pediatric emergency service

Table 4. Opinions of PICU and PES participating in the study on HFNCOT

Opinions on HFNCOT n (%)	PES (n=17)	PICU (n=14)	p
A comfortable method for the patient	16 (94.1)	14 (100)	>0.999*
An easy method	17 (100)	14 (100)	-
An expensive method compared to its effectiveness	4 (23.5)	0	0.107**
It has similar efficacy with simple oxygen delivery methods.	0	0	-
Between simple oxygen delivery methods and NIV in terms of efficacy	10 (58.8)	11 (78.6)	0.280*
An NIV method	7 (41.8)	3 (21.4)	**0.016****
It may delay intubation and be harmful to the patient.	3 (17.7)	0	0.232*
It decreases the need for intubation	15 (88.2)	11 (78.6)	0.636*
It reduces hospitalization in PICU	15 (88.2)	11 (78.6)	0.636*
It reduces admissions to pediatric services apart from the PICU	7 (41.8)	-	-
It shortens the monitoring time in the emergency department	9 (52.9)	-	-

HFNCOT: High flow nasal cannula oxygen therapy, PICU: Pediatric intensive care unit, PES: Pediatric emergency service, NIV: Non-invasive mechanical ventilation, *: Fisher's Exact test, **: Chi-square test

partially overlaps. The differences are usually due to the unique conditions of intensive care and emergency services and the lack of an accepted standard guideline. Tertiary units serving critically ill patients generally accept HFNCOT as an easy-to-use, comfortable and effective method.

The pathology in which HFNCOT is most commonly used, except in the neonatal period, is bronchiolitis.[1-3,6,8-11] There are limited studies on its less frequently use in pneumonia,[1,2,10,11] asthma attack,[2,10,11,16] sepsis,[2,11] upper airway obstruction,[2,11] neuromuscular diseases, acute respiratory distress syndrome (ARDS),[2,16] rapid successive intubation,[13] and postextubation[2]. Two survey studies about the use of HFNCOT in pediatric patients are available in the literature. In the survey conducted in PICUs in Germany, the most common indications were reported as bronchiolitis, pneumonia, rapid successive intubation, postextubation, and NIV incompatibility.[13] In the survey conducted among respiratory therapists in the United States, the most common indications were found to be bronchiolitis, asthma attack, pneumonia, postoperative respiratory support and ARDS. No questionnaire including PESs was found in the literature. In our study, in accordance with the literature, bronchiolitis, pneumonia and asthma attacks came to the fore as the most preferred indications in intensive care and emergency services. However, PICUs stated that they used HFNCOT more frequently in sepsis, rapid successive intubation, NIV incompatibility, and lung contusion, compared to PESs. Additionally, PICUs had higher expected benefit from HFNCOT in sepsis, upper airway obstruction, ARDS, pulmonary edema, rapid successive intubation, NIV incompatibility, and lung contusion. On the other hand, PESs preferred HFNCOT more frequently in neuromuscular diseases. However, in these patients, there was no difference in terms of the expected success of HFNCOT between intensive care and emergency services. Since there is no similar study in the literature, a comparison could not be made. However, we can interpret these results in the light of our experience. We think that indications for HFNCOT reported by pediatric intensive care and emergency services reflect the differences in intensive care and emergency medicine practice. Patients with pathologies frequently used by the PICU are not followed up in the emergency and general pediatric services, and their treatment is carried out under intensive care conditions. In addition, NIV support is generally given in intensive care conditions. Respiratory problems in neuromuscular diseases are type 2 respiratory failures, in which the partial carbon dioxide level is usually high, unless there is an additional disease. The success of HFNCOT in type 2 respiratory failure is quite low. These patients benefit more from NIV or invasive mechanical ventilation.[19] Because emergency departments follow these patients for a shorter time and then hospitalize them in the PICU, they use HFNCOT for a short time at the admission. The fact that both units have similar expectations from HFNCOT in these patients supports our opinion.

There is no accepted standard protocol for HFNCOT in the world yet.[16,19,20] One-third of PICUs in the United States use a protocol based on age and body weight, established by each institution.[16] In a Finnish study investigating oxygen supplementation in bronchiolitis, it was reported that 60% of centers had a standard HFNCOT initiation protocol and 40% had a HFNCOT outcome protocol.[15] Even in neonatal units where body weight does not change much, there are differences in practice.[17,18] In Germany, there are significant differences among PICUs in terms of preferred maximum flow values.[13] Compared to PICUs in our country, PESs have created a standard HFNCOT protocol within themselves. Considering the age groups, there was no difference between institutions in terms of maximum flow rates. Common parameters used in patient follow-up reflected the typical clinical monitoring of a patient with respiratory distress. However, parameters such as SpO_2/FiO_2, blood gas analysis, chest X-ray or capillary refill time were not common monitoring tools used by all units. In particular, the fact that some of the emergency services created a standard HFNCOT protocol and preferred respiratory severity scoring more frequently in the follow-up was interpreted as the standardization efforts of busy emergency services within themselves. We think that this anonymity has been resulted from the partial overlap in indications, expectations and maximum flow rates; the fact that all the institutions where the survey was conducted are tertiary units; the fact that the questionnaire was filled by the members of the pediatric emergency and intensive care associations; and the fact that HFNCOT has been emphasized frequently in the scientific programs of the national congresses held in our country in recent years.

In order to reduce hypoxemia due to the patient's agitation during non-invasive mechanical ventilation, administration of sedation to the patient in certain clinical situations increases the success of the treatment. However, there is a risk of respiratory depression due to pharmacological sedation. A standard sedation protocol has not yet been determined for both NIV and HFNCOT.[21] In our survey, almost all of the PICUs and more than half of the PESs stated that they used sedative drugs when necessary during HFNCOT.

A significant rate of patients receiving HFNCOT require nebulized drug therapy. The ideal way of drug administration by nebulization in this patient group is not yet known. Nebulized drug therapy is recommended to be administered with a vibrating mesh nebulizer, which is connected to the circuit with a spacer by reducing the flow rate to 2-4 L/min while the patient is under HFNCOT support.[12,22,23] In a survey conducted in the United States, more than 70% of

respiratory therapists stated that they administered nebulized medication with a vibrating mesh nebulizer during HFNCOT. However, few people specified that they reduced the flow rate while applying the drug.[16] In our survey, participants used various methods of nebulization and there was no standard. Connecting the mesh nebulizer to the HFNCOT circuit with the spacer, which is suggested in the literature, was one of the least used methods. In our opinion, it is the least effective method to apply nebulized medication with a face mask to the patient at the same time while taking HFNCOT. We think that the patient's nostrils being partially closed with HFNCOT cannulas and the high-speed oxygen intake from the cannulas at this time will prevent the nebulized drug from reaching the lower airways. However, one-third of PICUs and approximately 70% of PESs sometimes preferred this method.

The most serious complication associated with HFNCOT is air leak syndrome. However, very few cases have been reported in the literature. Apart from this, few and less clinically important complications such as nasal cannula damage to the nasal mucosa and gastric distension can be seen. High-flow nasal cannula oxygen support is generally considered to be a reliable treatment method in pediatric patients.[2-4,13,19,24,25] In our study, approximately one third of PICUs stated that they had air leak syndrome due to HFNCOT. In addition, all of these units encountered at least one minor complication. On the other hand, no air leak syndrome due to HFNCOT was reported in any of the emergency services. Minor complications were very few. The main reason for this difference may be longer follow-up of critically ill patients in PICUs compared to PESs. As the follow-up period increases, the incidence of complications will also increase.

Although there are limited data on HFNCOT, onset time, flow rate, and weaning patients from treatment in PESs, HFNCOT is used especially in patients with a diagnosis of bronchiolitis and is thought to be effective.[26] In a survey study conducted in PICUs in Germany, it has been revealed that HFNCOT is preferred in many cases with respiratory distress, although there are limited data in the literature, except for bronchiolitis.[13] In a survey study investigating NIV methods applied in children with bronchiolitis in England, it has been revealed that HFNCOT is preferred in many hospitals because it is very easy to apply.[14] In our study, HFNCOT is seen as a reliable and easy-to-apply method in tertiary pediatric intensive care and emergency services in our country. The common view of all participants is that HFNCOT is a higher-level method than simple oxygen delivery methods. In fact, some of the physicians responsible for PESs accept HFNCOT as an NIV method. In general, HFNCOT is thought to reduce intubation and hospitalization. Unlike intensive care units, pediatric emergency personnel are concerned that it may cause loss of time in critically ill patients who need intubation, since it is an easy method to apply. As it can be understood from the annual patient capacities of the centers participating in the study, PESs serve under a serious patient load. We think that the fear that a possible deterioration or lack of improvement in a patient due to HFNCOT may not be noticed under such a patient density may be the reason for this statement.

Study Limitations

Our survey study is the first in Turkey in terms of reflecting the use and views of tertiary pediatric intensive care and emergency services about HFNCOT. This type of research is limited in the world. However, the most important limitation is that the data on the HFNCOT practice are based on the statements of the responsible physicians. At this point, the medical records of the hospitals were not used.

Conclusion

As a result, the majority of senior pediatric intensive care and emergency services in our country use HFNCOT in many pathologies that cause respiratory distress, although there are not enough data in the literature. It is accepted as an effective method that is easy to apply, increasing patient comfort. The HFNCOT practices of the units partially overlap. The differences are due to the lack of standards and the specific operating conditions of the units. These results highlight the necessity of establishing a standardized guideline for HFNCOT in critically ill children.

Ethics

Ethics Committee Approval: Approval for the survey was obtained from the İzmir Katip Çelebi University Ethics Committee (date: 02.04.2018, number: 140).

Informed Consent: Participation in the survey was on a voluntary basis. Physicians who wanted to participate in the study filled out the questionnaire sent to their e-mails.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Concept: M.A., A.B.A., Design: M.A., Data Collection or Processing: M.A., A.B.A., F.K., Analysis or Interpretation: M.A., A.B.A., F.K., Literature Search: M.A., A.B.A., F.K., Writing: M.A.

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